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LOUISIANA BLUE CRAB
Fishery Management Plan

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Office of Fisheries

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Contents

Contents

List of Tables & Figures

TABLES

FIGURES

Executive Summary

Louisiana's blue crab (*Callinectes sapidus*) resource supports one of the largest and most valuable commercial fisheries in the state. Blue crab has been harvested commercially in Louisiana since at least the 1800s and continues to be one of the state's most important seafood industries. Louisiana's blue crab fishery is the largest blue crab fishery in the United States. It accounts for more than half of the total blue crab harvested in the Gulf, and Louisiana has led the United States in blue crab harvest for most years since 2000. The recreational fishery for blue crabs is popular as well. Blue crabs are also an important part of the estuarine food web as both predator and prey.

Blue crab populations in the Gulf of Mexico are highly resilient. They are considered an annual stock - they are short-lived, grow fast, mature rapidly, and are highly productive. Productivity is a function of fecundity, growth rates, natural mortality, age at maturity, and longevity and can be a reasonable proxy for resilience.

This fishery management plan creates a centralized document that summarizes current information about the biology and status of Louisiana blue crab; Louisiana's commercial and recreational fisheries for blue crab; ecosystem considerations and environmental factors; management approaches within the state and regional framework; issues and options to address these issues; and future research needs.

Introduction

DEFINITION OF MANAGEMENT UNIT

The management unit includes the blue crab and its fisheries in the coastal waters of Louisiana.

MANAGEMENT AUTHORITY AND PROCESS

The Louisiana Department of Wildlife and Fisheries (LDWF), the Louisiana Wildlife and Fisheries Commission (Commission), and the Louisiana State Legislature (Legislature) are responsible for managing the blue crab fishery in Louisiana's state waters, which extend seaward from the shoreline to 9 nautical miles. (Note that federal authorities claim waters 3 nautical miles seaward of the Louisiana coastline. Implications of this are further discussed in the Fishery Management Program section of this document.)

Title 56 of Louisiana's Revised Statutes provides 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 of the United Nations' Code of Conduct for Responsible Fisheries.

Responsible fisheries management requires an ongoing process of continual improvement, with active monitoring of fisheries resources and fisheries and timely response to any observed changes. Fishery management plans are flexible and can be improved with collection and analyses of relevant data. Plan work groups will continuously review new research and monitoring information, document progress toward fishery management goals and objectives, and fully review and revise management plans as managers and stakeholders prioritize issues and identify and refine management options.

MANAGEMENT GOALS AND OBJECTIVES

The goal of the Louisiana's Blue Crab Fishery Management Plan is to ensure long-term conservation and sustainable use of the blue crab resource for the maximum environmental, social, and economic benefit to the State and her citizens and visitors.

We will use the following objectives to achieve this goal:

1. Prevent overfishing and ensure crabs 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 profitable fishery while addressing other potentially related issues at the same time.
3. Minimize conflicts among user groups.
4. Minimize fishery impacts on undersized blue crabs and other non-targeted species.
5. Continue to collect fishery dependent and independent data to support blue crab stock assessments, especially with regard to estimating total mortality.
6. Promote research to better understand impact of environmental factors on blue crab populations as well as the blue crab fishery's impacts on the ecosystem.
7. Promote research to improve knowledge of the commercial and recreational fisheries for blue crab, including harvest data and socioeconomic information, and enhance social and economic benefits derived from the use of the resource.

Description of the Stock

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

Blue crabs in the Gulf of Mexico are considered an annual stock - they are short-lived, grow fast, and mature rapidly. They are highly productive, and therefore highly resilient.

BIOLOGICAL PROFILE

PHYSICAL DESCRIPTION

Blue crabs are crustaceans with a hard upper shell, typically grey, blue, or brownish green in color. The blue crab's carapace (shell) can grow up to 231 millimeters, or about 9 inches, wide (Rathbun 1884). The shell is about 2.5 times as wide as it is long. Blue crabs have two large claws, six thin walking legs, and two paddle-like swimming legs. They have four frontal teeth which distinguish them from similar species.

Mature males can be distinguished from females by their claw color and apron, or abdomen, shape. Males' claws are blue on the inner and outer surfaces and tipped with red; the fingers of the females' claws are orange tipped with purple. The mature male's abdomen has a long, narrow, inverted "T" shape, similar to the Washington Monument. Mature females have a broader, rounded "U" or bell-shaped abdomen, like the dome of the U.S. Capitol building. Immature females have an inverted "V" shape abdomen (MD DNR 2007).

DISTRIBUTION

In the Americas, blue crab range from Nova Scotia, Canada, through the Gulf of Mexico, and southward to northern Argentina, including Bermuda and the Antilles (Williams 1984). Blue crab has also been introduced into Europe, Africa and Asia, as well as California and Hawaii (Williams 2007).

There are likely two different blue crab stocks in the Gulf: a Florida or Eastern Gulf stock along the Florida coast (centered around Tampa Bay) and a Western Gulf stock from central Texas to Apalachicola Bay (centered in Louisiana). This separation is based on the study of Darden (2004) who examined molecular variance and phylogenetic analyses in multiple locations around the Gulf of Mexico (Perry and VanderKooy 2015). In Louisiana, blue crab are common throughout the coastal parishes but have been documented as far north as Simmesport, Louisiana via the Mississippi River (Gunter 1938).

HABITAT

Female blue crabs release their eggs in high salinity waters of the lower estuary and offshore shelf (Costlow and Bookhout 1959, Sulkin and Epifanio 1975, Bookhout et al. 1976, Sulkin et al. 1976). After hatching, blue crab larvae, or zoea, go through seven (sometimes eight) zoeal stages and then metamorphose into a megalopal stage, which resembles the adult form. Winds and currents transport the megalopae into shallow, lower salinity estuaries. Megalopae settle into northern Gulf of Mexico estuaries year-round (Perry 1975, Morgan et al. 1996), with peak settlement from July to mid-October in Mobile Bay (Morgan et al. 1996) and from late-summer to early fall and again in February in Mississippi Sound (Perry 1975).

When megalopae move into the upper and middle estuaries, they metamorphose into the first juvenile blue crab stage. Juveniles remain in the upper and middle estuaries where they grow, mature, and then mate. Perry (1975) and Perry and Stuck (1982) documented blue crabs in this first juvenile stage year-round in Mississippi Sound. Adkins (1972) also reported catching juvenile blue crabs in 6-foot otter trawls in Louisiana year-round, but juveniles were more abundant from November to May, with a peak in February. Darnell (1959) found that juvenile crab abundance peaked in late spring/early summer in Lake Pontchartrain, Louisiana (Lyncker 2008).

Early juveniles seek refuge in a variety of habitats. The extensive salt and brackish marshes in Louisiana provide ideal habitat for them. Baltz and Gibson (1990) and Zimmerman et al. (1990) documented the areas where marsh and water meet in shallow ponds and embayments as important habitat for early stage juvenile crabs. Other important juvenile blue crab habitat includes oyster reefs, submerged aquatic vegetation, and soft bottoms (Glancy et al. 2003, Shervette and Gelwick 2008, Stunz et al. 2010, Shervette et al. 2011). Juvenile blue crabs occur over a wide range of salinities but are most abundant in lower salinities like those found in the upper estuaries.

Adult blue crabs are found in a variety of habitats, including submerged vegetation, unvegetated sediments, and marsh grass in fresh, estuarine, and shallow oceanic waters throughout the Gulf. Adult blue crabs are most abundant during the summer months; Adkins (1972) showed a peak catch of adult blue crabs in June and July.

Adult males and females often select different habitats according to season and salinity. While both sexes are found in the middle estuary when they mate, females move toward higher salinity waters of the lower estuary to spawn and may remain there for the rest of their lives. In fact, Gelpi et al. (2009) found a large population of females in the offshore waters of Louisiana in the Ship Shoals, Tiger Shoals, and Trinity Shoals areas. The bottom in these areas is composed of mostly fine grain sand on the shoals and mud surrounding the shoals. These areas are habitat for an important component of the spawning stock of blue crabs for Louisiana and perhaps the entire Gulf of Mexico. Males typically remain in the lower salinity waters of the upper and middle estuaries for the rest of their lives.

REPRODUCTION

Blue crabs can sexually mature within one year in the Gulf of Mexico (Perry 1975, Tatum 1980). Crowley et al. (2012) found that females can sexually mature between 8 and 10 months in Florida ponds. Guillory and Hein (1996) found that half of male and female blue crabs were sexually mature at a carapace width (CW) of 110 and 125 millimeters (4.3 and 4.9 inches), respectively. All male blue crabs were sexually mature at 130 millimeters (5.1 inches) CW; all females were sexually mature 160 millimeters (6.3 inches) CW.

Typically, within two months of mating, female blue crabs move to higher salinity waters to spawn, usually in the spring and summer. Hines et al. (2003) showed that blue crabs from Indian River Lagoon, Florida could have from four to seven broods of eggs in one spawning season, potentially yielding 18 broods in a female's lifetime. The number of eggs per brood varies - recent literature suggests a range from 2.8 million (Graham et al. 2012) to 3.5 million (Ealy 2001).

AGE AND GROWTH

Blue crabs in the Gulf of Mexico are considered an annual stock - they are short-lived, grow fast, and mature quickly. The blue crab's hard exoskeleton restricts growth so they must shed it (molt) to increase in size. They grow incrementally through a series of molts and intermolts, each of which is termed a "crab stage" (Van Den Avyle and Fowler 1984). The first crab stage is usually 2.5 millimeters (0.1 inches) CW. Young blue crabs molt every few days, but they molt less often as they grow - crabs 5 millimeters (0.2 inches) CW molt every three to five days; crabs 12 millimeters (0.47 inches) through 100 millimeters (3.9 inches) CW molt every 10 to 15 days. Crabs larger than 100 millimeters molt every 20 to 50 days. Blue crabs usually become sexually mature after they have molted 18 to 20 times (Van Engel 1958).

Water temperature is the main environmental factor that affects blue crab growth; the optimal water temperature for growth ranges from 13 to 27°C, or about 55 to 81°F (Leffler 1972). The blue crab's growth rate increases directly with temperature, given adequate food and optimal salinity (Holland et al. 1971, Cadman and Weinstein 1988). In Louisiana, Adkins (1972) found that juvenile blue crabs grew 14 millimeters (0.5 inches) per month, and crabs larger than 85 millimeters (3 inches) grew 15 to 20 millimeters (0.6 to 0.8 inches) per month. Darnell (1959) estimated blue crab growth to be 16.7 millimeters (0.66 inches) per month in Lake Pontchartrain, Louisiana.

Fischler (1965) estimated that blue crabs can live to an average age of 3 years (assuming natural mortality) and a maximum age of five years.

PREDATOR-PREY RELATIONSHIPS

Blue crabs are opportunistic feeders, eating whatever food is readily available, and are an important part of the estuarine food web. According to Stoner and Buchanan (1990), blue crabs most commonly feed on fish, detritus, crabs, and bivalves. Blue crabs also feed on amphipods, polychaetes, shrimp, and gastropods. Stoner and Buchanan (1990) divided blue crabs into four size groups and defined their diet as follows:

- 10-20 millimeter (0.4 to 0.8 inch) CW blue crabs mainly feed on amphipods and detritus
- 21-30 millimeter (0.8 to 1.2 inch) CW blue crabs mainly feed on foraminiferans and detritus
- 31-80 millimeter (1.2 to 3.15 inch) CW blue crabs mainly feed on fish and crabs, and sometimes bivalves
- 81-150 millimeter (3.2 to 6 inch) CW blue crabs mainly feed on fish, crabs, and bivalves.

Predation has a significant impact on the abundance of early stage blue crabs. A large and diverse number of predators prey on blue crab due to the species' different life stages, abundance, and distribution over a wide range of habitats, as well as the lack of true seasonality and the variety of predators in the Gulf of Mexico (Heck and Coen 1995). Guillory and Elliot (2001) conducted an extensive literature search on the food habits of estuarine and marine vertebrates and invertebrates in the Gulf of Mexico (GOM) and compiled a comprehensive list identifying 93 species, including invertebrates, fish, reptiles, birds, and mammals, that prey on blue crab at different life stages. Finfish species were the top blue crab predator among these groups. Many different fish, including red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), sheepshead (*Archosargus probatocephalus*), spotted seatrout (*Cynoscion nebulosus*), southern flounder (*Paralichthys lethostigma*), alligator gar (*Atractosteus spatula*), largemouth bass (*Micropterus salmoides*), and blue catfish (*Ictalurus furcatus*), prey on blue crabs (Darnell 1958, Lambou 1961, Fox and White 1969). Red drum ranked as the top blue crab predator among estuarine predators. In a food habit study conducted in the Terrebonne estuary in Louisiana, Guillory and Prejean (2001) reported that blue crab was the most frequently encountered species in the diet of red drum. They found blue crabs in 31% of the stomachs of the approximately 1,200 red drum they collected. Blue crabs comprised 31% and 37% of red drum's total diet by number and weight, respectively. Blue crabs are also cannibalistic and likely target other crabs when they are most vulnerable, just after they have molted.

RELATIVE PRODUCTIVITY/RESILIENCE

Productivity is a function of fecundity, growth rates, natural mortality, age of maturity, and longevity and can be a reasonable proxy for resilience. Relative productivity of GOM blue crab is characterized based on life-history characteristics 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 1*). Each life history characteristics (von Bertalanffy growth rate, age at maturity, longevity, and natural mortality rate) were assigned a rank (low=1, medium=2, and high=3) and then averaged to compute an overall productivity score. In this case, the overall productivity score for GOM blue crab is 3.0 indicating high productivity and resilience.

STOCK STATUS AND ASSESSMENT METHODOLOGY

STOCK UNIT DEFINITION

The blue crab unit stock is defined as those crabs occurring in Louisiana waters, consistent with a non-regional, statewide management strategy. Adult male blue crabs in the northern Gulf of Mexico generally remain within the same estuary for life whereas females migrate to higher salinity nearshore waters to spawn. Once larvae hatch, tides disperse them throughout coastal waters (Guillory et al. 2001). Wind and tides assist post-larvae in moving and settling into lower salinity estuaries of the northern Gulf of Mexico (Perry et al. 1995). These factors make it very probable that blue crab stocks mix between estuaries and state waters. Nonetheless, blue crab landings from the northern Gulf of Mexico primarily originate in Louisiana waters and are landed in Louisiana.

CURRENT STOCK STATUS

LDWF most recently assessed the blue crab stock in Louisiana waters in 2019 (West et al. 2019). Exploitable biomass is defined in the assessment as crabs 125 millimeters (4.9 inches) or larger (the regulatory size limit is 5 inches) and uses exploitable biomass as a measure of spawning stock biomass in the development of management reference points. The precautionary targets and explicit limits of fishing were defined and proposed in an earlier LDWF stock assessment (West et al 2011) as conservation standards to ensure future sustainability of the Louisiana blue crab stock.

Overfishing Status

Fishing mortality rate (F) estimates exceeding Flimit indicate overfishing. The blue crab stock in Louisiana waters is currently not experiencing overfishing and the fishery is currently operating below its fishing mortality target (Ftarget) where the three most recent 2015-2017 fishing mortality estimates (2015-2018) are below Ftarget.

Overfished Status

Spawning stock biomass (SSB) estimates below SSBlimit would indicate an overfished stock. The blue crab stock in Louisiana waters is currently not overfished and the stock is current-

TABLE 1. FAO proposed guideline for indices of productivity for exploited aquatic species. Parameter values are taken from West et al. (2011) and GDAR (2013).

PARAMETER	PRODUCTIVITY			SPECIES	
	Low	Medium	High	Blue Crab	Score
Natural mortality rate (M)	<0.2	0.2 - 0.5	>0.5	1.0	3
von Bertalanffy growth rate (K)	<0.15	0.15 - 0.33	>0.33	1.9	3
Maximum age (tmax)	>8	3.3 - 8	<3.3	1	3
Maximum age (tmax)	>25	14 - 25	<14	3	3
Examples	Orange Roughy, many sharks	Cod, Hake	Sardine, Anchovy	Blue Crab Productivity Score = 3	

ly above its target (SSBtarget) where the 2018 SSB estimate is above SSBtarget. However, assessment results indicate the stock was considered overfished in 1995, 1996, and 2015. In 2012 and 2013, the estimates of exploitable biomass are below SSBtarget.

Control Rules and Assessment Frequency

The Commission adopted a resolution on Feb. 6, 2014 establishing the following policy based on the proposed reference points for overfishing and overfished limits: "Should the fishing mortality or exploitable biomass exceed the overfished or overfishing limits, or exceed the targets for three consecutive years, as defined in the most current Louisiana blue crab stock assessment, LDWF shall come before the Commission with an updated assessment and a series of management options for the Commission to review and act upon, intended to keep the fishery from becoming overfished, and that management options for review and action shall include provisions for emergency closures, time based closures, and spatial closures" (Louisiana Wildlife and Fisheries Commission 2014).

ASSESSMENT METHODOLOGY

LDWF's 2019 blue crab assessment used a two-stage modeling approach (catch-survey or Collie and Sissenwine (1983) analysis) to estimate annual exploitable biomass, recruitment, and fishing mortality rates of blue crabs in Louisiana waters. This model balances the number of individuals from one life stage to the next (i.e. recruits to exploitable sizes), given constant natural mortality, while scaling these values to harvest. This modeling approach is intended for data poor situations where a full size/age structure is lacking and has been used extensively in other recent blue crab stock assessments (Florida, Chesapeake Bay, and Gulf of Mexico). Data requirements are a time-series of observed landings and corresponding abundance indices for juvenile and adult life stages and an estimate of the natural mortality rate.

Indices of abundance are derived from the LDWF fishery-independent marine inshore trawl survey. Landings are taken from National Marine Fisheries Service (NMFS) statistical records, 1968-1998, and the LDWF Trip Ticket Program, 1999-2018. Natural mortality is estimated based on longevity estimates in past literature. To account for recreational harvest in the assessment, commercial harvests are expanded by 5%, based on a recreational survey conducted in Terrebonne Parish in the late 1990s (Guillory 1998b).

The precautionary limits and targets in the assessment are based upon the history of the stock and fishery by requiring that biomass not fall below the lowest observed levels earlier in the fishery (1968-2009) where sustainability was demonstrated (i.e., recruitment overfishing not occurring). The spawning potential ratio (SPR) and fishing mortality rate that correspond with the biomass limit are also estimated. SPR is based on the principle that certain levels of fish have to survive in order to spawn and replenish the stock at a sustainable level and is equivalent to a limit SSB (SPR; Goodyear 1993). These limit reference points are considered suitable proxies for Maximum Sustainable Yield (MSY)-based reference points.

See the full stock assessment report (West et al. 2019) in *Appendix I* for complete details of current stock status and methodology.

REGIONAL ASSESSMENT EFFORTS

The Gulf States Marine Fisheries Commission (GSMFC) recently gathered available data from the Gulf states' commercial and recreational crab fisheries and their independent sampling programs for blue crab and completed the Stock Assessment Report for Gulf of Mexico Blue Crab (2013). This regional assessment provides quantitative analyses on the status of the Western and Eastern blue crab stocks through 2011. Each of the five state marine resource agencies provided blue crab experts and analysts to develop indices of abundance for use in the assessment models. Much of this work was influenced by assessments already completed in Louisiana, Florida, Texas, and the Chesapeake Bay.

This assessment employed two separate modeling approaches to assess the Gulf of Mexico stocks. The primary, or base, model was a modified catch-survey analysis similar in structure to those used in previous blue crab stock assessments (Chesapeake, Louisiana, Florida, Delaware), while the supporting model was a surplus production model. Surplus production models describe the dynamics of exploited populations and do not distinguish among recruitment, individual growth, and mortality patterns as contributing factors to changes in abundance. Instead, the aggregate effects of these factors are modeled as a single function of the population size.

Population growth is a function of stock size - it is zero when the stock is at maximum biomass and is maximized at an intermediate level of biomass. The assessment used the surplus production model analysis for blue crab to provide an alternative/validation approach to the results of the base model. Surplus production models of blue crab have been used previously for this purpose, notably for the Chesapeake stock. In that assessment the authors used a production model to provide support for the reference point MSY.

According to the base model, the Western stock experienced overfishing in 1999 and 2002, while the Eastern stock experienced overfishing in 1996 and 1998. The base model found that both stocks are currently neither overfished nor undergoing overfishing, although the Western stock is in a depressed state and approaching the overfished limit. Assessment results differed from Louisiana's most recent assessment as the GSMFC model integrated the stock recruitment relationship and estimated MSY. Louisiana's straightforward model estimated recruitment and biomass but did not estimate a relationship, assuming equilibrium was the average.

For complete details of the regional stock assessment results and methodology, see the full assessment report (GDAR 2013) online at *www.gsmfc.org/publications/GSMFC Number 215.pdf.*

Description of the Fishery

Fishery Monitoring

LDWF monitors commercial landings and fishing effort through a trip ticket program. Through this program, LDWF collects information about commercial fishermen's catch - for example, what it is, where it was caught, how it was caught, and how much was caught - from seafood dealers, crab shedders and commercial fishermen holding fresh products licenses. LDWF also conducts economic research pertaining to Louisiana and Gulf region fisheries resources using information from the trip ticket program and surveys.

Comprehensive descriptions of the Louisiana commercial and recreational blue crab fisheries prior to 2000, including development and history of exploitation, effort and harvest, economics, markets, value, and processing are available through numerous publications (Gowanloch 1952; Adkins 1972; Jaworski 1971; Jaworski 1972; Jaworski 1982; Moss 1982; Roberts and Thompson 1982; Perry et al. 1984; Horst 1985; Keithly et al. 1988; Steele and Perry 1990; Guillory et al. 1996; Guillory 1998a and 1998b; Guillory et al. 1998; Guillory and Perret 1998; and Guillory et al. 2001).

COMMERCIAL FISHERY

All dockside values have been adjusted for inflation using the U.S. Bureau of Economic Analysis base year of 2012 and are shown as real dockside value. Blue crab supports the third largest and third most valuable commercial fishery in Louisiana (behind shrimp and menhaden), accounting for landings of 45.1 million pounds with a dockside value of $57.7 million in 2018 (*Table 2*). Louisiana has historically accounted for the majority of Gulf of Mexico blue crab harvests (Guillory et al. 2001) with landings averaging more than half (about 64%) of annual Gulf blue crab landings since 1968 (*Figure 1*). Additionally, Louisiana has led the United States in blue crab landings every year since 2000, except in 2010 and 2011 following the 2010 *Deepwater Horizon* oil spill (*Table 3*).

DATA COLLECTION AND ANALYSES

In Louisiana, fishermen have been harvesting blue crabs commercially since the 1800s, with the earliest documented landings reported in 1880 (Guillory et al. 1996). However, landings statistics are discontinuous through 1947 (Guillory et al. 2001). LDWF implemented a trip ticket program in 1999 to monitor commercial landings and fishing effort. Through this program, LDWF collects commercial landings data on a trip basis from wholesale/retail seafood dealers, crab shedders, and commercial fishermen holding fresh products licenses. LDWF requires that dealers purchasing blue crab from commercial fishermen submit trip tickets to capture information about their catch - for example, what it is, where it was caught, how it was caught, and how much was

TABLE 2. Louisiana blue crab commercial landings: 2000-2018.

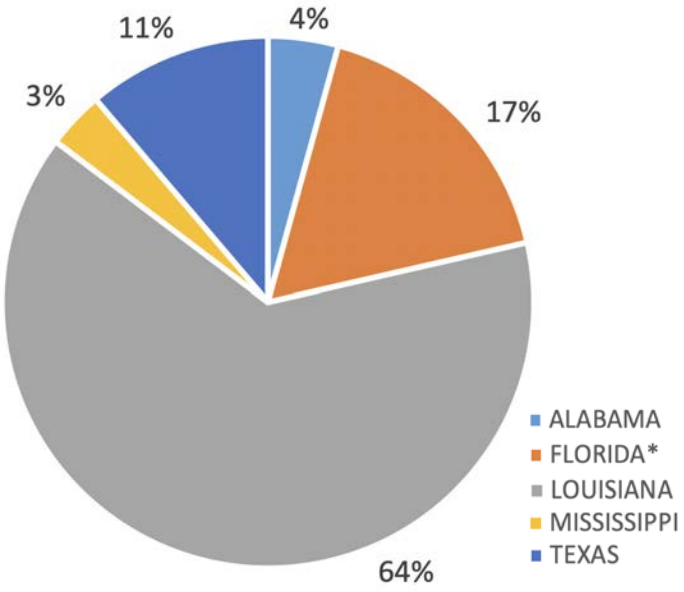
YEAR	VOLUME	REAL DOCKSIDE VALUE	REAL DOCKSIDE PRICE PER POUND
2000	52,042,994	$44,059,427	$0.85
2001	41,865,816	$40,167,199	$0.96
2002	50,084,064	$37,860,100	$0.76
2003	48,089,332	$40,730,364	$0.85
2004	44,411,299	$35,034,769	$0.79
2005	38,118,294	$31,349,126	$0.82
2006	53,291,203	$35,874,403	$0.67
2007	46,199,766	$38,679,372	$0.84
2008	44,662,853	$36,707,548	$0.82
2009	54,986,691	$40,449,900	$0.74
2010	30,898,691	$31,738,652	$1.03
2011	43,970,796	$37,614,942	$0.86
2012	46,379,483	$44,155,281	$0.95
2013	39,223,969	$50,760,818	$1.29
2014	43,307,504	$64,787,252	$1.50
2015	41,470,121	$55,758,646	$1.34
2016	40,792,845	$47,370,894	$1.16
2017	44,372,770	$51,072,189	$1.15
2018	45,143,082	$57,687,189	$1.28

TABLE 3. Blue crab landings (pounds) and value (dollars), hard, soft, and peeler crabs combined, from major blue crab producing U.S. states: 2000-2017.

State	YEAR								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Alabama	4,783,861	2,457,532	2,574,892	2,958,121	3,328,653	1,024,295	2,384,281	2,556,594	1,798,218
Delaware	4,092,195	4,084,568	3,061,924	1,791,677	2,275,706	2,923,213	2,856,148	3,799,488	3,507,868
Florida*	9,496,834	5,344,302	4,466,874	3,975,494	7,071,316	8,090,876	6,259,662	10,375,314	6,185,270
Georgia	3,296,255	2,771,377	1,988,950	1,713,197	2,916,880	4,248,852	4,091,201	4,398,812	4,227,747
Louisiana	52,047,449	41,799,397	50,123,164	48,089,280	40,644,038	38,078,642	52,899,936	45,457,050	44,191,169
Maryland	22,847,019	25,933,144	26,480,553	27,816,215	35,627,324	34,914,410	29,445,503	30,783,649	34,871,781
Mississippi	1,680,486	867,312	1,433,256	1,753,042	1,623,604	857,851	2,253,624	737,668	450,188
New Jersey	5,092,764	4,724,352	6,229,082	4,011,694	4,350,041	6,309,319	5,981,411		
New York	1,481,728	1,245,544	6,229,082	963,407	885,318	748,725	870,670	714,628	535,998
North Carolina	40,639,200	32,180,314	6,229,082	42,769,856	34,130,638	25,430,151	25,343,216	21,424,961	32,916,691
South Carolina	5,817,508	5,566,261	6,229,082	4,410,545	4,667,544	4,439,462	4,214,689	4,137,767	4,479,785
Texas	4,653,306	5,163,132	6,229,082	4,811,275	3,960,838	3,119,000	1,965,694	3,453,692	2,635,100
Virginia	28,846,173	25,057,395	6,229,082	21,464,379	27,628,731	26,054,450	22,707,953	25,141,417	23,243,440

State	YEAR								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
Alabama	1,458,542	926,834	1,617,351	1,325,257	1,026,512	1,160,568	1,300,587	1,917,700	1,425,383
Delaware	3,413,801	4,109,648	3,501,969	4,570,508	2,488,186	1,999,716	2,123,651	4,555,178	3,788,248
Florida*	5,071,923	8,481,802	10,518,465	8,182,483	7,258,006	6,122,015	6,656,770	5,769,010	6,795,694
Georgia	3,597,687	2,329,414	3,427,161	4,265,341	3,216,465	2,667,476	2,933,730	3,319,117	3,838,685
Louisiana	54,139,551	30,553,821	43,890,680	44,322,807	39,063,983	43,218,562	41,307,838	40,099,248	43,874,273
Maryland	38,800,823	66,261,696	51,162,683	43,741,302	24,797,479	24,690,009	28,758,709	36,734,433	30,655,095
Mississippi	545,626	367,189	370,195	782,114	359,254	542,795	798,305	780,047	625,683
New Jersey	2,416	9,458,438	9,610,554	7,395,778		3,232,627	7,247,304	6,815,847	6,410,060
New York	868,910	963,847	493,446	122,694	122,819	285,397	222,686	248,282	388,981
North Carolina	29,707,232	30,683,012	30,035,232	26,786,574	22,202,946	26,231,454	32,123,853	25,645,294	19,273,156
South Carolina	4,001,171	3,274,105	5,438,773	5,900,079	5,133,695	3,832,621	3,744,871	4,381,835	4,390,021
Texas	2,844,263	3,433,612	2,886,204	2,853,533	1,902,380	2,237,955	4,330,568	5,321,764	4,131,522
Virginia	32,756,165	38,489,668	39,656,372	33,143,498	24,258,072	24,205,354	21,377,682	26,298,039	22,011,061

FIGURE 1. Average contribution to Gulf of Mexico blue crab landings by state, 1968-2017.



caught. Commercial fishermen who sell their catch directly to consumers are also required to submit trip tickets. As of 2000, dealers could submit trip tickets through a computerized electronic trip ticket program; to date, about 401 dealers are signed up to use electronic trip tickets to submit their data.

LDWF's Socioeconomic Research and Development Section conducts economic research pertaining to Louisiana and Gulf region fisheries resources using information from Louisiana's trip ticket program 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 to LDWF and other agencies to support scientific research and resource management.

Unless otherwise noted, the data presented throughout this section is sourced from LDWF's trip ticket program. Data is presented from 2000 (when the electronic trip ticket system was implemented) through 2018 (the most recent data year available). Value is presented in constant 2012 dollars; volume is presented in pounds.

VOLUME AND VALUE OF LANDINGS

Average commercial blue crab landings in Louisiana between 2000 and 2018 were 44.7 million pounds (*Table 2*). Landings dropped to 38.1 million pounds in 2005, the year of hurricanes Katrina and Rita, and rose to 53.3 million pounds in 2006. Landings dropped again to 44.7 million pounds in 2008 (the year of hurricanes Gustav and Ike), and then rose to 55.0 million pounds in 2009. It is important to note that the two highest landings years immediately followed years with major hurricanes. Blue crab commercial landings declined to a period low of 30.9 million pounds in 2010 following the *Deepwater Horizon* oil spill. To more accurately view trends within the commercial blue crab fishery, annual landings should be viewed in a smaller time series. The five-year (2014-2108) annual average shows that 43.0 million pounds are landed, while commercial landings in 2018 was 45.1 million pounds, an increase by 5%.

Annual real dockside value of commercial blue crabs landings between 2000 and 2018 averaged approximately $43.3 million (*Table 2*). Annual real dockside value climbed to a series high of $64.8 million in 2014 and dropped to a series low of $31.3 million in 2005. The five-year (2014-2108) annual real dockside value is approximately $55.3 million, which is $12 million higher than the 19-year time series.

Real dockside price per pound for blue crabs (annual real dockside value divided by annual commercial landings) averaged $0.98 per pound during the 2000 to 2018 time period (*Table 2*). Dockside price per pound dropped to a series low of $0.67 per pound in 2006 and climbed to a period maximum of $1.50 per pound in 2014. Similar to landings and annual real dockside value, real dockside price per pound has seen an increase over the five-year average when compared to the 19-year time series.

LANDINGS BY TYPE AND SEASON

Commercial fishermen harvest hard-shell, soft-shell, and peeler blue crabs. Peelers are hard-shell crabs that are in the pre-molt stage, i.e. no further from molting than having a white line on the back paddle fin. Commercial fishermen harvest hard-shell crabs for sale to:

- Wholesale/retail seafood dealers who grade, pack and ship crabs to live markets or crab processors
- Retail seafood dealers
- Consumers (direct sales).

Hard-shell blue crab landings accounted for 99% of the cumulative volume and 98% of the cumulative real dockside value of blue crabs landed in Louisiana from 2000 to 2018 (*Table 4*). Hard-shell crabs destined for live shipment to both in state and out of state markets are generally graded by size. Crabbers grade crabs onboard the vessel or at the dock. Graded sizes may vary based upon crab abundance and market demands. Grades include:

- Number 1 males: greater than 6 inches carapace width (CW)
- Number 2 males: 5.5 to 6 inches CW
- Number 3 females: greater than 5.5 inches CW
- Factory crabs (smaller crabs destined for processing).

Hard-shell crab fishermen also cull and shed peeler crabs in their own shedding facilities or sell them directly to other shedding facilities.

Harvest of soft-shell and peeler crabs is a minor but economically important portion of the total crab harvest as these crabs tend to fetch a higher market price. Soft-shell crabs are almost exclusively produced from shedding operations. Peeler crabs are introduced into open or closed recirculating tank systems and carefully separated according to molt stage. Once crabs shed, they are very vulnerable to predation from other crabs and must be removed within a few hours or so of molting; otherwise their new shell may harden to a point which makes them unmarketable.

Soft-shell blue crabs comprised less than 0.5% of the cumulative volume and cumulative real dockside value of blue crab landings from 2000 to 2018 (*Table 4*). Average soft-shell crab landings from this period were approximately 24,000 pounds.

TABLE 4. Landings and real dockside price per pound of Louisiana blue crab by type: 2000-2018.

YEAR	BUSTER/PEELER		HARDSHELL*		SOFTSHELL	
2000	544,573	$1,160,568	42,929,959	$35,935,005	56,915	$328,789
2001	344,177	$985,569	34,327,216	$32,751,634	57,665	$356,685
2002	327,234	$863,043	42,437,820	$31,864,808	44,885	$275,162
2003	337,501	$929,743	41,639,180	$35,365,532	46,850	$314,654
2004	293,214	$803,128	38,046,138	$30,249,168	34,951	$220,168
2005	186,467	$507,353	33,515,737	$27,551,936	33,698	$153,305
2006	118,398	$301,663	48,127,091	$32,146,621	22,405	$137,905
2007	192,282	$525,270	41,520,564	$34,286,898	12,402	$74,267
2008	96,977	$265,710	40,040,687	$32,673,067	7,083	$46,630
2009	172,026	$460,266	51,420,908	$37,132,170	37,304	$110,300
2010	120,154	$331,260	28,456,766	$29,101,280	14,474	$83,056
2011	166,614	$455,062	39,102,096	$33,532,013	20,345	$141,129
2012	152,435	$466,742	41,025,552	$39,325,922	8,873	$46,613
2013	132,138	$350,878	35,722,397	$46,801,937	8,143	$56,931
2014	162,927	$425,589	39,982,964	$60,542,341	7,805	$57,129
2015	176,002	$449,848	39,763,975	$53,346,836	9,669	$71,097
2016	146,980	$365,340	39,112,358	$45,380,742	11,245	$81,035
2017	114,030	$281,268	42,504,689	$48,713,265	10,171	$83,046
2018	95,591	$240,089	43,146,388	$55,356,332	14,466	$103,447

**The Hard-shell category includes blue crabs for which the market condition descriptions on trip tickets were listed as number 1, number 2 or number 3 crabs; factory grade crabs; small, medium, or large crabs; or crab claws as well as blue crabs for which the market condition was unidentified or unavailable.*

TABLE 5. Average monthly blue crab landings, dockside value and dockside price per pound: 2000-2018.

MONTH	AVG. LANDINGS	AVG. REAL DOCKSIDE VALUE	AVG. REAL DOCKSIDE PRICE PER POUND
January	2,124,377	$2,216,501	$1.04
February	1,684,169	$2,019,119	$1.20
March	1,585,865	$2,123,167	$1.34
April	2,765,068	$3,359,156	$1.21
May	4,333,587	$4,976,214	$1.15
June	5,650,427	$5,684,691	$1.01
July	6,528,375	$5,698,189	$0.87
August	5,309,738	$4,755,520	$0.90
September	3,850,621	$3,675,590	$0.95
October	4,099,719	$3,300,442	$0.81
November	3,650,628	$2,786,429	$0.76
December	3,117,921	$2,659,828	$0.85

Volume fell from approximately 57,000 pounds in 2000 and 2001 to a period low of 7,000 pounds in 2008. Volume then spiked to 37,000 pounds in 2009 but has since remained below average. Soft-shell crab landings were below 10,000 pounds from 2012-2015, but have surpassed that amount during the past three years. The real dockside price for soft-shell crabs averaged $5.97 between 2000 and 2018, just over six times the price per pound of hard-shell blue crabs during the same period. Price per pound of soft-shell crab has average $7.44 over the past five years, while the previous blue crab management plan (2000-2013) showed an average price per pound of $5.88.

Peeler crabs represented 0.5% of the cumulative volume and approximately 1.4% of the cumulative real dockside value of blue crab landings from 2000 to 2018 (*Table 4*). During this period, average peeler crab landings were 204,000 pounds. Peeler crab landings dropped from a period high of more than 544,500 pounds in 2000 to nearly 95,600 pounds in 2018. From 2000 to 2018, the real dockside price per pound for peeler crabs averaged $2.62 per pound, approximately three times the average real dockside price per pound for hard-shell blue crabs during the same period. Price per pound has remained fairly stable over the 19-year time series.

Commercial blue crab landings in Louisiana vary by season. Landings are lowest in January, February and March, averaging approximately 1.8 million pounds and $2.1 million monthly (from 2000 to 2018; *Table 5*). Average monthly landings are highest in the summer months: 5.7 million pounds and $5.7 million in June, 6.5 million pounds and $5.7 million in July, and 5.3 million pounds and $4.7 million in August.

Average real dockside price per pound also fluctuates seasonally (*Table 5*). From 2000 to 2018, average real price per pound was highest during February-April with prices over $1.20, while March reached the highest price per pound at $1.34. Price per pound decreased below $1.00 per pound in July and remained until January.

LANDINGS BY GEAR TYPE AND VESSEL LENGTH

Early blue crab fishermen used baited trotlines to harvest hardshell crabs in Louisiana (Rathbun 1884). In the mid-1960s, crab traps became the most popular gear used in the fishery due to their efficiency (Guillory et al. 1996). While a number of fishing gears are currently approved for the blue crab fishery in Louisiana, most crabbers use crab traps, generally baited with menhaden, shad, or freshwater catfish remains. Since 1999, more than 99% of the total volume and real dockside value of blue crab landings in Louisiana has been harvested with traps.

Landings from other gear types account for less than 0.5% of the total volume of annual blue crab landings in Louisiana. Approximate annual average (2000-2018) landings from other gear types are: skimmer nets (77,000 pounds), wire nets (30,500 pounds), otter trawls (39,000 pounds), butterfly nets (23,100 pounds), and trotlines (23,000 pounds). Blue crabs caught in skimmers, trawls, and butterfly nets are seldom targeted and are considered incidental catch in shrimp fisheries. These crab also are deemed non-sustainable, since the Louisiana blue crab trap fishery is the only sustainable commercial blue crab fishery; this requires dealers/processors to track the chain of custody on all blue crab purchased.

Overall, the majority of crab landings in Louisiana is harvested by vessels measuring 40 feet long or less, approximately 89%. Between 2000 and 2003, the majority of crab landings in Louisiana was harvested nearly equitably among vessels ranging from 11 to 20 feet and 21 to 30 feet, about 43%. A slight shift in landings by vessel size was noticed between 2004-2010, where vessels ranging from 11 to 20 feet and 21-30 feet averaged approximately 34% and 56%, respectively. Since 2010, the average percentage of crab landings harvested in vessels ranging from 11 to 20 feet dwindled to about 22%; the percentage harvested in vessels ranging from 21 to 30 feet grew to almost 58%. Vessel size was unspecified for about 10% of the crab landings between 2000 and 2018.

LANDINGS BY AREA

When commercial fishermen land blue crabs in Louisiana, they are required to identify on their trip tickets the area in which they caught the majority of the crabs during each trip. Eighty-eight percent of the total Louisiana crab landings between 2000 and 2018 were harvested from four of the state's major estuarine basins: Terrebonne, Pontchartrain, Barataria, and Atchafalaya/Vermilion/Teche Rivers (*Table 6*). During this time series, average real dockside price per pound was highest in Lake Pontchartrain, followed by Calcasieu River and Atchafalaya/Vermilion/Teche River basins.

Terrebonne Basin

From 2000-2015, Terrebonne Basin led all basins in crab landings, averaging more than 12 million pounds annually. Landings averaged 13.6 million pounds annually from 2000-2009, but

TABLE 6. Blue crab landings (millions of pounds) and average real dockside price per pound by basin: 2000-2018.

YEAR	ATCHAFALAYA / VERMILION-TECH		BARATARIA		CALCASIEU / SABINE / MERMENTAU RIVERS		PONTCHARTRAIN		MS. RIVER		TERREBONNE		STATEWIDE	
2000	13.90	11.68	7.24	6.15	2.11	5.30	8.36	7.76	5.38	3.97	14.87	12.51	51.85	47.38
2001	8.10	7.81	6.52	6.21	1.62	3.14	6.37	7.11	2.62	2.13	16.59	15.32	41.82	41.72
2002	8.59	6.07	10.63	7.94	2.10	2.56	10.15	8.84	2.07	1.24	16.50	11.93	50.05	38.59
2003	8.37	6.81	8.66	7.21	1.84	2.36	11.96	11.81	2.02	1.29	15.22	12.02	48.08	41.50
2004	7.24	5.65	9.88	7.41	2.02	2.40	11.23	9.95	2.19	1.25	11.83	9.08	44.38	35.74
2005	7.96	5.72	8.61	7.40	1.65	1.95	7.0	7.0	1.51	.93	11.35	8.82	38.09	31.82
2006	11.47	7.54	10.89	8.04	4.01	2.80	12.25	8.70	2.79	1.40	11.81	7.29	53.22	35.77
2007	6.83	5.86	9.03	7.99	5.09	3.42	12.61	10.99	1.56	.88	11.08	8.48	46.19	37.62
2008	6.29	5.46	8.55	6.86	4.20	2.73	12.22	10.60	1.07	.65	12.30	9.38	44.62	35.67
2009	7.57	6.27	9.65	6.65	4.90	2.87	17.08	13.36	1.22	.63	14.54	9.54	54.95	39.31
2010	4.48	4.75	4.94	4.86	3.08	2.59	10.91	12.38	.71	.51	6.76	5.98	30.89	31.07
2011	6.88	6.76	6.89	5.48	3.12	3.24	15.83	14.37	2.03	1.15	9.19	6.52	43.94	37.53
2012	7.67	7.99	7.22	6.72	3.51	4.70	15.64	15.91	2.83	2.0	9.50	7.70	46.37	45.03
2013	5.40	7.67	6.68	8.45	2.58	5.26	12.95	17.59	2.58	3.05	9.05	10.70	39.22	52.72
2014	6.01	9.55	6.60	9.61	3.13	7.18	14.26	23.08	3.11	4.05	10.08	13.62	43.19	67.10
2015	5.36	7.92	5.85	7.42	3.32	6.59	16.51	23.31	2.82	3.10	7.54	9.13	41.40	57.47
2016	5.07	6.22	6.18	6.76	3.62	5.89	14.31	18.28	2.95	2.80	8.56	8.44	40.69	48.38
2017	5.45	6.57	6.65	7.26	3.07	6.0	15.95	20.42	3.34	3.25	9.86	9.81	44.31	53.31
2018	4.65	6.43	7.20	8.84	2.61	6.48	16.72	23.21	3.70	3.96	10.21	11.82	45.09	60.73

annual landings have averaged less than 9 million pounds from 2010-2018. Over the 19-year time series, the Terrebonne Basin has ranked second in average annual landings.

Pontchartrain Basin
Blue crab landings from Pontchartrain Basin ranked first among all basins, averaging 12.75 million pounds annually from 2000-2018. Landings peaked at 17.08 million pounds in 2009, the year following hurricanes Gustav and Ike. Lowest landings were reported in 2001 (6.37 million pounds) and 2005 (7 million pounds). The Pontchartrain Basin showed average annual landings of approximately 10 million pounds from 2000-2008, but have since averaged 15 million pounds.

Barataria Basin
Blue crab landings from Barataria Basin averaged 7.78 million pounds annually from 2000-2018 and ranged from a high of 10.89 million pounds in 2006 to a low of 4.94 million pounds in 2010, the year of the *Deepwater Horizon* oil spill. Average annual landings have been approximately 6.5 million pounds over the past five years.

Atchafalaya/Vermilion/Teche River Basins
Blue crab landings from a combination of the Atchafalaya, Vermilion, and Teche River basins ranked fourth among basins in commercial blue crab landings, closely trailing levels reported in Barataria Basin. Landings have averaged 7.23 million pounds annually from 2000-2018 and ranged from a high of 13.9 million pounds in 2000 to a low of 4.5 million pounds in 2010. Blue crab landings have average just over 5 million pounds for the past five years.

Calcasieu/Sabine/Mermentau River Basins
Commercial blue crab landings from a combination of the Calcasieu, Sabine, and Mermentau River basins were some of the lowest of all basins, ranging from a high of more than 5 million pounds reported in 2007 to a low of 1.62 million pounds in 2001. The 19-year annual blue crab landings average is 3 million pounds, which is consistent with annual landings since 2010.

Mississippi River Basin
Crab landings from the Mississippi River Basin ranked last among all basins, averaging approximately 2.45 million pounds annually from 2000-2018. Lowest levels were reported from 2005-2010, with the exception of 2006. Since 2010, landings have averaged between 2-3 million pounds annually.

COMMERCIAL CRABBERS

Any licensed commercial fishermen carrying crab gear on a commercial fishing vessel in Louisiana must have a commercial crab gear license appropriate to their gear type and residency status. The majority of commercial crab gear licenses issued in Louisiana are resident licenses (*Table 7*). From 2000 to 2014 (years prior to the required professionalism training), the number of resident licenses varied from a period low of 2,996 in 2005 to a period high of 3,632 in 2011. The number of non-resident commercial crab gear licenses during this period varied from a low of 40 in 2000 to a high of 85 in 2011. Very few commercial fishermen use drop nets; resident commercial crab drop net license sales remained low throughout the period and numbered no more than 22 in any year. Since the inception of the blue crab professionalism program (2015), resident commercial crab trap gear licenses have averaged approximately 2,600. From 2015- 2018, these license sales have slowly reduced by about 100 licenses per year. During this time period, non-resident commercial crab trap gear license has remained around 50. Resident commercial crab trap drop net sales have shown a slight increase in 2017 and 2018 compared to all previous years (*Table 7*).

The number of commercial fishermen annually reporting at least one sale of blue crabs for the years 2000 through 2018 declined from approximately 2,200 in 2000 and 2001 to a low of 1,351 in 2006. Years prior to the professionalism program showed a difference between total crab license sales and the number of fishermen reporting sales averaging approximately 1,600, but this number has dropped to nearly 1,180 between 2015-2018. In contrast, sales of commercial crab trap gear licenses do not reflect such wide variation. The disparity between the number of gear licenses sold and the number of fishermen reporting blue crab sales may be due to a number of reasons. Many recreational crab fishermen may choose to purchase commercial trap licenses to fish more traps than allowed under the recreational 10 trap limit. Some fishermen may hold licenses for speculative reasons in anticipation of future trap gear license moratoriums. Additionally, many shrimp fishermen purchase trap gear licenses as large numbers of abandoned traps as well as actively fished traps are incidentally captured in shrimp gear. (This allows them to keep any incidentally captured traps on board, eliminating the chance of catching those traps again and reducing associated impacts to their gear and catch.) Finally, some crab buyers may simply remain noncompliant and fail to report crab purchases from fishermen, and fishermen may fail to report retail sales made directly to the public.

Most commercial fishermen who hold crab trap gear licenses reside in southeast Louisiana. In every year from 2000 to 2018, the majority of commercial fishermen reporting blue crab landings resided in one of the following parishes: Jefferson, Lafourche, Plaquemines, St. Bernard, St. Mary, St. Tammany and Terrebonne.

FISHING EFFORT

LDWF analyzed 2000 to 2018 trip ticket information to generate volume and dockside value per trip as a measure of catch per unit of effort (*Table 8*). Average volume per trip reached a low of 315 pounds in 2001 and a high of 556 pounds in 2006, the year following hurricanes Katrina and Rita. The 2000-2018 annual volume per trip average was 410, which is consistent with the past five-year average. Real dockside value per trip average $398 from 2000-2018, but has not been below $400 per trip since 2011. The dockside value per trip reached a period low of $272 per trip in 2004 and a high of $574 per trip in 2018.

As part of NOAA Fisheries and GSMFC's "Fisheries Information Network" (FIN), LDWF conducted dockside surveys of commercial crab fishermen to test the validity of using trip tickets to collect trip level effort data. From October 2006 to September 2007, they collected trip level data including the number and type of gear used, soak times, crew size, trip length, and bait

TABLE 7. Number of LDWF commercial crab gear license sales compared to number of commercial fishermen reporting blue crab sales: 2000-2018.

YEAR	RESIDENT COMMERCIAL CRAB TRAP	NON-RESIDENT COMMERCIAL CRAB TRAP	RESIDENT COMMERCIAL CRAB DROP NET	TOTAL CRAB GEAR LICENSES	COMMERCIAL FISHERMEN REPORTING BLUE CRAB SALES
2000	3,561	40	-	3,601	2,232
2001	3,228	58	5	3,291	2,214
2002	3,342	63	10	3,415	2,034
2003	3,386	51	16	3,453	2,017
2004	3,421	57	11	3,489	1,826
2005	2,996	32	9	3,037	1,500
2006	3,230	60	10	3,300	1,351
2007	3,125	52	13	3,190	1,411
2008	3,006	52	13	3,071	1,425
2009	3,107	51	11	3,169	1,497
2010	3,523	78	11	3,612	1,714
2011	3,632	85	22	3,739	1,837
2012	3,396	63	20	3,479	1,691
2013	3,222	55	18	3,295	1,586
2014	3,301	78	18	3,397	1,712
2015	2,743	47	25	2,815	1,594
2016	2,659	50	28	2,737	1,528
2017	2,548	55	41	2,644	1,463
2018	2,475	46	45	2,566	1,437
Average	3,153	56	18	3,226	1,688

TABLE 8. Number of trips reporting blue crab landings, average landings per trip, and average real dockside value per trip, 2000-2018.

YEAR	TRIPS	VOLUME PER TRIP	REAL DOCKSIDE VALUE PER TRIP
2000	140,285	371	$314
2001	132,748	315	$303
2002	134,609	372	$281
2003	140,520	342	$290
2004	128,988	344	$272
2005	91,506	417	$343
2006	95,851	556	$374
2007	108,521	426	$356
2008	92,232	484	$398
2009	111,260	494	$364
2010	74,854	413	$424
2011	99,552	442	$378
2012	107,795	430	$410
2013	106,034	370	$479
2014	116,499	372	$556
2015	113,110	367	$493
2016	104,379	391	$454
2017	100,273	443	$509
2018	100,565	449	$574

used. They merged the survey data with LDWF trip ticket data to provide the catch and dockside value associated with each surveyed trip. Results are as follows:

- Trip length varied among basins but averaged 7.2 hours coastwide.
- The number of traps set per trip ranged from just over 200 traps in the Calcasieu River basin to just over 500 traps in the Vermilion/Teche River basin. (Setting refers to placing a trap.)
- Coastwide, the average number of traps set per trip was 319.
- Average trap soak time measured 63.5 hours coastwide.
- Average crab catch per trap was 1.34 pounds. Crab catch per trap was greatest in the Mississippi River basin (3.25 pounds per trap) and lowest in the Vermilion/Teche River basin (1.15 pounds per trap).
- Average landings per trip ranged from 340 pounds per trip in Terrebonne basin to 717 pounds per trip in the Mississippi River basin.
- Dockside value per trip was highest in the Lake Pontchartrain basin ($474 per trip) and lowest in the Terrebonne basin ($243 per trip).

LDWF's trip ticket data provides information on the number of vessels landing blue crabs caught with crab traps, which can be used to estimate the number of vessels active in the trap fishery from year to year (*Table 9*). The total number of vessels annually landing blue crabs caught with traps ranged from a high of 4,687 in 2000 to a low 1,514 reported in 2018. Vessels active in the trap fishery declined abruptly in 2002 (N = 2,276)

TABLE 9. Number of vessels landing blue crabs caught with crab traps reporting purchases or sales of blue crabs: 2000-2018.

YEAR	0 - 1,000 POUNDS	1,001 - 5,000 POUNDS	5,001 - 10,000 POUNDS	10,001 - 20,000 POUNDS	20,001 - 50,000 POUNDS	50,001 - 100,000 POUNDS	>100,000 POUNDS	TOTAL
2000	2,138	1,136	403	321	400	211	78	4,687
2001	1,682	1,036	354	355	410	188	32	4,057
2002	538	452	237	286	416	277	70	2,276
2003	544	491	232	252	427	250	72	2,268
2004	466	418	218	272	374	228	64	2,040
2005	322	351	209	243	309	198	58	1,690
2006	247	267	183	178	303	217	136	1,531
2007	330	289	156	185	315	245	94	1,614
2008	322	286	156	193	297	223	94	1,571
2009	286	234	160	207	298	276	132	1,593
2010	438	461	278	306	309	113	43	1,948
2011	657	524	238	270	392	195	76	2,352
2012	761	597	272	287	357	230	72	2,576
2013	388	342	203	225	372	188	52	1,770
2014	419	350	193	247	392	211	61	1,873
2015	365	317	200	222	390	195	71	1,760
2016	362	308	185	216	353	193	73	1,690
2017	283	311	162	200	328	199	87	1,570
2018	263	263	159	197	338	197	97	1,514
Average	569	444	221	245	357	212	77	2,125

and again in 2005 and 2006 following hurricanes Katrina and Rita. However, these numbers rapidly increased from 2010 to 2012, but from 2013-2018 fell to levels approximately 27% below the 2000 to 2013 average. It is important to note that the greatest level of vessel activity in the trap fishery is from vessels reporting landing less than 5,000 pounds of blue crab annually.

The number of vessels reporting landing less than 1,000 pounds of crabs annually remained fairly consistent from 2002 to 2004 and 2005 to 2009. The number of vessels within these two periods respectively averaged 516 and 301 vessels annually. Beginning in 2010, the number of active vessels with annual blue crab landings less than 1,000 pounds suddenly increased, and by 2012 more than doubled the numbers reported in 2009. In 2013, the number of active vessels reporting blue crab landings less than 1,000 pounds annually dropped to 388 and has continued to decline to 263 in 2018..

The number of vessels that landed 1,001 to 5,000 pounds of crabs annually displayed somewhat similar trends to vessels landing less than 1,000 pounds of crabs annually. Since 2000-2001, the number of vessels reporting this range of pounds significantly declined. During 2002-2004, approximately 450 vessels reported these landings, but this declined to an average of 285 from 2005-2009. An increase in vessels landing between 1,001-5,000 pounds was seen between 2010-2012 (the year of the *Deepwater Horizon* spill and the two preceding). Since 2013, the number of vessels reporting pounds of blue crab in this range have continued to decline to an average of 315; this is a decrease of 20% when compared to the 2002-2012 average.

Wide variation in the number of vessels landing less than 5,000 pounds of crabs annually, particularly before the 2015 professionalism program, indicates a high level of transience in the trap fishery. Licensed trap fishermen and vessels that harvest crabs at these relatively low levels enter and leave the fishery at very high rates, which suggests that they are likely temporary or part-time commercial crab fishermen and vessels. Since 2015, the numbers of vessels landing less than 5,000 pounds has stabilized, only showing slight shifts in the numbers.

In contrast, the number of vessels that average landings more than 5,001 pounds of crabs annually has remained far more consistent between 2000 and 2018. This consistency better characterizes the number of vessels active in the trap fishery from year to year.

SEAFOOD DEALERS

Seafood dealers include any person or entity that purchases seafood from commercial fishermen for resale to any other business or individual. Seafood dealers must hold some form of dealer license depending on their residency status and other characteristics. LDWF analyzed 2000 to 2018 licensing and trip ticket information to measure purchasing activity (*Table 10*). The number of seafood dealers that purchased crabs directly from commercial fishermen averaged 370 between 2000-2018. These numbers have fluctuated from a low of 327 in 2014 to a high of 433 in 2004. Since 2000, 67% of the dealers that purchased crabs directly from commercial fishermen held resident wholesale/retail seafood dealer business licenses.

TABLE 10. Number of licensed dealers reporting purchases or sales of blue crabs: 2000-2018.

YEAR	RESIDENT WHOLE-SALE/RETAIL DEALER BUSINESS LICENSE HOLDERS	RESIDENT WHOLE-SALE/RETAIL DEALER VEHICLE LICENSE HOLDERS	FRESH PRODUCTS LICENSE HOLDERS	OTHER DEALER LICENSE HOLDERS	TOTAL
2000	274	35	68	40	417
2001	254	29	40	22	345
2002	266	33	56	22	377
2003	289	37	66	18	410
2004	300	44	64	25	433
2005	256	31	56	18	361
2006	233	36	101	16	386
2007	236	41	64	4	345
2008	232	37	66	6	341
2009	233	50	90	4	377
2010	237	47	98	4	386
2011	236	40	104	4	384
2012	252	43	85	3	383
2013	247	35	49	2	333
2014	234	36	54	3	327
2015	243	42	77	1	363
2016	232	45	78	2	357
2017	234	47	80	2	363
2018	224	47	71	-	342
Average	248	40	72	11	370

TABLE 11. Total volume of blue crab purchases or sales by license type: 2000-2018.

YEAR	Resident		
	WHOLESALE/ RETAIL DEALER BUSINESS	WHOLESALE/ RETAIL DEALER VEHICLE	FRESH PRODUCTS DEALER
2000	49,186,226	1,881,034	213,656
2001	37,593,990	3,276,363	94,982
2002	46,176,395	2,696,122	201,324
2003	44,842,550	2,127,395	157,965
2004	41,315,514	2,061,097	174,463
2005	34,995,248	1,596,389	181,109
2006	47,342,333	3,352,075	536,012
2007	42,016,789	2,390,245	227,672
2008	40,845,564	2,463,083	189,893
2009	49,571,992	3,846,011	370,815
2010	28,229,186	1,623,976	505,553
2011	39,802,975	2,005,192	393,699
2012	43,965,614	1,642,784	339,977
2013	37,028,900	1,355,112	387,639
2014	41,332,940	1,551,798	195,391
2015	39,897,939	1,319,541	249,062
2016	38,828,075	1,431,937	493,171
2017	39,739,686	3,552,229	1,064,910
2018	40,561,670	3,929,144	652,268

Wholesale/retail seafood dealer vehicle license holders are individuals or businesses licensed to sell seafood from their vehicles. The number of resident wholesale/retail seafood dealer vehicle license holders purchasing crabs directly from commercial fishermen between 2000 and 2018 averaged 40 per year and ranged from 29 in 2001 to 50 in 2009 (*Table 10*).

Fresh products license holders are licensed commercial fishermen who are also licensed to retail seafood directly to consumer. The number of fresh products license holders retailing crabs averaged 72 per year between 2000 and 2018, ranging from 40 in 2001 to 104 in 2011.

"Other dealer license holders" include those who hold non-resident wholesale/retail seafood dealer licenses, non-resident wholesale/retail seafood dealer vehicle licenses, and fresh products spouse licenses. The number of license holders in these categories reporting crab purchases or sales averaged 11 during the 2000 to 2018 period with a low of one in 2015 to a high of 40 in 2000 (*Table 10*). The numbers of these license holders has drastically declined since 2006 and have currently been at or below three individuals for seven years (2012-2018).

In every year between 2000 and 2018, resident wholesale/retail seafood dealer business license holders purchased 90% or more of the total volume of crabs sold by Louisiana commercial fishermen (*Table 11*). The volume of crabs purchased by resident wholesale/retail seafood dealer business license holders ranged from a low of 28.2 million pounds in 2010 to 49.6 million pounds in 2009. The 2000-2018 average volume of crabs

TABLE 12. Volume and real value of blue crab products reported as processed in Louisiana: 2000-2018.

YEAR	RESPONDENTS REPORTING BLUE CRAB PRODUCT OUTPUT	VOLUME OF BLUE CRAB PRODUCTS	REAL VALUE OF BLUE CRAB PRODUCTS	VOLUME PER PROCESSOR RESPONDENT	REAL VALUE PER PROCESSOR RESPONDENT
2000	25	943,736	$10,371,195	37,749	$414,848
2001	22	630,211	$7,506,951	28,646	$341,225
2002	20	828,019	$8,895,112	41,401	$444,756
2003	17	624,368	$6,694,802	36,728	$393,812
2004	10	438,736	$5,205,057	43,874	$520,506
2005	9	542,572	$6,270,300	60,286	$696,700
2006	9	719,015	$7,027,729	79,891	$780,859
2007	9	365,555	$3,463,426	40,617	$384,825
2008	8	399,091	$3,363,453	49,886	$420,432
2009	6	398,331	$3,870,517	66,389	$645,086
2010	6	278,349	$2,769,992	46,392	$461,665
2011	5	372,409	$3,662,574	74,482	$732,515
2012	5	319,225	$3,019,546	63,845	$603,909
2013	5	335,424	$3,425,204	67,085	$685,041
2014	4	297,247	$3,632,313	74,312	$908,078
2015	3	229,681	$2,785,882	76,560	$928,627
2016	3	315,688	$3,737,683	105,229	$1,245,894
2017	4	319,743	$3,954,292	79,936	$988,573
2018	4	297,021	$3,741,295	74,255	$935,324
Average	9.6	455,495.8	$4,915,648.5	60,614.4	$659,614.4

purchased by resident wholesale/retail seafood dealer vehicle license holders is 2.3 million pounds with a low of 1.3 million pounds in 2015 and a high of 3.9 million pounds in 2018. The volume of crabs retailed by fresh products license holders averaged approximately 349,000 pounds per year between 2000 and 2018, about 0.80% of total Louisiana crab landings during this period.

CRAB PROCESSORS

NOAA Fisheries annually surveys seafood processors to measure seafood processing activity in Louisiana. Participation in the survey is optional, and all individual data are strictly confidential.

The number of survey respondents reporting processing blue crabs in Louisiana decreased from 25 in 2000 to three in 2009 through 2018 (*Table 12*). The volume and real value of blue crab products dropped from 944,000 pounds and $10.4 million in 2000 to 297,000 pounds and $3.7 million in 2018. In most years, survey respondents reported 93-98% of the volume of blue crab products as cooked blue crab meat.

The volume of blue crab products per dealer fluctuated between 28,646 pounds per processor to 105,229 pounds per processor during the time period measured (*Table 12*). The real value of blue crab products per processor ranged from $341,000 per processor to $1,245,000 per processor during the time period examined.

SWIMMING CRAB IMPORTS

The United States imports two types of "swimming crabs" related to blue crab: Portudinae (the family that includes blue crabs) and Callinectes (the blue crab genus). According to NOAA Fisheries U.S. Foreign Trade database, total U.S. imports of swimming crab have averaged 43.9 million pounds and $357 million per year between 2000 and 2018. Imports bearing the broader Portudinae label averaged 39.4% of the total volume and 34.9% of the total real value of swimming crab imports during the period. Imports under the Callinectes label averaged 60.6% of total volume and 65.1% of the total real value of swimming crab imports from 2000 to 2018.

The United States imports swimming crab in two forms, frozen and in air tight containers. Imports of frozen crab averaged 3.8 million pounds and $20 million per year from 2000 to 2018; imports of crab in air tight containers averaged 40.1 million pounds and $336 million per year during the same period.

Between 2000 and 2018, the United States imported swimming crab products from as few as 14 to as many as 22 different countries, but the majority of swimming crab products come from a relatively small number of countries. Indonesia has been the number one source of swimming crab product imports in every year from 2000 to 2018. The total value of swimming crab product imports from Indonesia comprised nearly 39% of the total value of all swimming crab product imports from 2000 to 2018 (NOAA Fisheries 2014).

RECREATIONAL FISHERY

Recreational fishermen harvest blue crab for personal enjoyment and consumption. Stern and Schafer (1966), Adkins (1972), the U.S. Department of Commerce (1977), Davidson and Chabreck (1983), Titre et al. (1988), and Guillory (1998b) have completed surveys of recreational blue crab harvesters; however, long-term recreational harvest data for blue crabs in Louisiana are lacking. In a survey of the blue crab fishery in Terrebonne Parish, Louisiana, Guillory (1998b) estimated the recreational harvest rate as 4.1% of the reported commercial harvest.

Recreational fishermen harvesting blue crab in Louisiana are not required to hold any license unless crabbing on a wildlife management area (WMA) or state wildlife refuge or using crab traps to harvest crabs. The most common methods used by recreational fishermen to harvest blue crabs include dip nets, drop nets, hand lines, trot lines, bait seines and crab traps; preferred baits consist of fish carcasses and poultry and beef parts.

Any person harvesting crabs on WMAs or refuges must have a basic fishing license or a Wild Louisiana stamp; however, use of traps on these areas is prohibited. Fishermen using recreational crab traps must have a basic fishing license in addition to a recreational crab trap license. Recreational trap fishermen may use no more than 10 crab traps at a time and must abide by the same trap tagging and escape ring requirements as the commercial fishery.

Although the use of most gear does not require licenses, the number of recreational crab trap licenses issued each year may indicate trends in the number of fishermen participating in recreational crabbing. However, it is important to note that recreational activities authorized under the Louisiana Sportsman's Paradise license include use of recreational crab traps along with other recreational gear. The recreational crab trap license is the most common recreational gear license issued by LDWF. Between 2002 and 2018, the number of resident recreational crab trap licenses issued in Louisiana ranged from 4,173 to 6,731 and annual sales have averaged 5,473 (*Table 13*). According to LDWF licensing data, sales of the Louisiana Sportsman's Paradise license, which includes Basic and Saltwater Fishing, Basic Season and Big Game Hunting, Bow, Primitive Firearms, Turkey, LA Duck, WMA Hunting Permit and all Recreational Gear licenses (EXCEPT recreational trawls greater than 16 feet in length - additional license required), reflect similar trends and have increased from 1,158 in 2002 to over 8,000 in recent years.

Louisiana residents who hold lifetime saltwater recreational fishing licenses must also obtain a crab trap license (either lifetime or annual) to deploy crab traps in Louisiana waters. Between 2002 and 2018, sales of crab trap lifetime licenses ranged from one to 79.

Anglers who wish to fish for blue crab using crab traps, but are not Louisiana residents must hold a license that grants them recreational fishing privileges in Louisiana as well as a non-resident recreational crab trap license that allows them to deploy up to 10 crab traps at a time in Louisiana waters. Sales of such licenses has generally been fairly small, ranging from 10 to 98 between 2002 and 2018; non-resident license sales have remained low compared to resident license sales, but they have more than doubled in sales since 2014 when compared to the 2002-2013 average. Since 2014, non-resident recreational crab trap licenses have rose to a period high of 98 in 2018.

TABLE 13. Number of recreational crab trap gear licenses issued by LDWF: license years 2002-2018.

LICENSE YEAR	RESIDENT RECREATIONAL CRAB TRAP LICENSES	NON-RESIDENT RECREATIONAL CRAB TRAP LICENSES	CRAB TRAP LICENSE FOR LIFETIME LICENSE HOLDERS	TOTAL
2002	4,337	20	.	4,357
2003	4,528	18	.	4,546
2004	4,450	19	1	4,470
2005	4,173	22	12	4,207
2006	4,809	17	26	4,852
2007	4,934	30	20	4,984
2008	5,222	36	22	5,280
2009	5,489	48	39	5,576
2010	5,802	44	25	5,871
2011	4,957	37	36	5,030
2012	5,976	10	38	6,024
2013	6,081	47	54	6,182
2014	6,050	65	50	6,165
2015	6,438	73	64	6,575
2016	6,731	74	63	6,868
2017	6,655	92	45	6,792
2018	6,415	98	79	6,592

Most recreational effort using gear other than traps is centered near areas accessible by road. Although fishermen have recreationally harvested crabs with dip nets, drop nets, hand lines, trot lines, and bait seines for many years, sales of recreational crab trap licenses, together with Louisiana Sportsman's Paradise licenses, demonstrates increased use of traps by recreational fishermen. Many recreational fishermen prefer to use traps because they can be passively fished and allowed to soak for extended periods to enhance crab catch. Since traps are difficult to transport in small boats during short day trips, most recreational trap fishermen set traps from fishing camps where traps can be more easily stored and transported.

In addition, license sales increases may be due to local crab availabilities and market conditions resulting in high retail prices experienced over the last several years.

INTERACTIONS WITH OTHER FISHERIES OR USES

In a symposium sponsored by GSMFC, Matherne (1995) cited examples of conflicts between commercial crab trap fishermen and other user groups. In Louisiana, these conflicts include those between commercial crab trap fishermen and other commercial fishermen, recreational crab trap fishermen, saltwater anglers, property owners, hunters, recreational and commercial boaters, and the marine transportation industry. Guillory et al. (2001) identified interactions between commercial crab trap fishermen and commercial shrimp fishermen as one of the most volatile user group conflicts.

Conflicts arise in areas that are highly productive for both crabbing and shrimping. Crab trap fishermen have seen increased numbers of traps lost, damaged, or misplaced due to shrimping activities. Conversely, crab traps caught in shrimping gear can cause damage and loss of catch for both fishermen. Louisiana's Blue Crab and Shrimp Task Forces continue to work to resolve issues of common interest, especially on potential changes to laws regulating possession of crab traps on shrimp vessels.

Guillory et al. (2001) also identified theft of crab traps and their contents as a persistent issue in the crab fishery. This problem escalated when the fishery expanded during the mid-1980s and resulted in conflicts and additional economic loss to the fishermen at a time when net profits were declining. Trap and/or crab theft violations are difficult to enforce because visual verification is needed, often requiring a substantial investment of time by enforcement agents. During the 2019 Regular Legislative Session, a bill (House Bill 355 or HB 355) was promulgated that altered the penalties for a crab or crab trap theft violation. Prior to HB 355, a citation for the theft of a crab trap would warrant a class 4 violation, which is the highest monetary class violation not requiring a judicial hearing. After the promulgation of HB 355, all violations for the theft of crab traps or crabs will receive a class 4 violation and a three tiered additional penalty as described below:

- For the first violation the violator will have their crab trap gear license revoked for one year from the date of the violation and shall be sentenced to no less than 40 hours of community service. In addition, the violator may only be present on a vessel commercially harvesting or processing blue crab if equipped with a vessel monitoring device (VMS).
- For the second violation the violator will have their crab trap gear license revoked for three years from the date of the violation and shall be sentenced to no less than 90 hours of community service. In addition, the violator may only be present on a vessel harvesting or possessing blue crab if equipped with a vessel monitoring device (VMS).
- For the third violation the violator will have their crab trap gear license revoked for 10 years from the date of the violation and shall be sentenced to no less than 120 hours of community service. In addition, the violator may not be present on a vessel harvesting or possessing blue crab.

Ecosystem Considerations & Environmental Factors

Addressing Potential Impacts

LDWF actively monitors the impact of blue crab fishery on the ecosystem, for example, conducting research on bycatch in active and derelict crab traps. LDWF has implemented a number of measures to mitigate the fishery's potential impacts on other species, including requiring specific gear configurations and sponsoring an annual derelict trap removal program.

ECOSYSTEMS CONSIDERATIONS

HABITAT

Impacts of Louisiana's blue crab fishery on habitat are low. To harvest crabs, fishermen set crab traps over oyster reefs and sand and mud bottoms, which are less affected by traps than sensitive bottom habitats such as corals or grass beds. Although wigeon grass (*Ruppia maritima*) is common all along coastal Louisiana, true seagrass meadows containing turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), and star grass (*Halophila englemannii*) currently occur only east of the Mississippi River near the Chandeleur Islands (Poirrier and Handley 1940).Gear and other restrictions vary in state wildlife management areas, refuges, and other areas to protect important habitat. Commercial fishing including commercial crabbing is prohibited in coastal State and National Wildlife Refuges.

BYCATCH AND DISCARDS

LDWF has conducted a number of studies to measure bycatch in the blue crab fishery. For example, short-term projects have provided information on harvest and bycatch in the blue crab fishery within the Lake Pontchartrain Basin (University of New Orleans contract study) and statewide (ongoing LDWF in-house study). LDWF also has a history of such studies on fishery-related topics going back at least 50 years and maintains a wide range of contacts within management, academic, and fishing communities, so that issues of concern can be brought to LDWF's attention and addressed.

A 2.5-year statewide bycatch study was conducted in December 2012 in order to characterize incidental catch. This study was conducted to assist the Louisiana blue crab commercial fishery with its' sustainability assessment. More than 18,000 individuals were collected during the study with 90% being blue crab. The most common bycatch species collected were hardhead catfish (6%), all other species combined made up 4%. Diamondback terrapins comprised approximately 0.05% of all species landed and 0.7% of bycatch species collected during this study.

Undersized Crabs

Crab traps can incidentally catch undersized blue crabs. To reduce this bycatch, crab traps must currently have at least two escape rings, 2-5/16 inches in inside diameter or larger, to allow undersized crabs the opportunity to leave the traps but retain most legal sized crabs. Escape rings are not currently required in Lake Pontchartrain due to the large market for soft-shell crabs in that region or if the trap is constructed of square wire mesh 2-5/16 inches or larger, which makes use of escape rings unnecessary. However, in 2014, the Legislature enacted revised escape ring requirements that mandate a minimum of three escape rings, with a minimum size of 2-3/8 inches in inside diameter, per trap, with two rings placed in the trap's upper chamber. The revised requirements remove escape ring exemptions for crab traps placed in Lake Pontchartrain; crab traps constructed of square wire mesh of 2-5/16 inches or greater are still exempt. These new requirements were industry-driven; they are intended to reduce incidental capture of undersized blue crabs but will potentially reduce other bycatch as well. They became effective on Nov. 15, 2017.

During a bait study in 2014 and 2015 (Clowes 2016), LSU AgCenter researchers documented discards including undersize crabs in fishery dependent and fishery independent crab trap sampling. Most of these traps would still have had the two escape rings. The fishery independent tests found an average of 0.27 undersize crab were caught per trap per day. The fishery dependent tests did not separate by reason for discard (undersize, sponge crab, dead, etc.) but had a rate of 1.12 discarded crab per trap per day.

During the 2019 Regular Legislative Session, SB 65 was promulgated to give clarification on escape ring location and placement, while also allowing this law to meet current fisheries practices. This bill defined that two escape rings must be placed on the vertical walls of the upper chamber flush with the baffle. One ring is required in the lower chamber, placed on the vertical wall, and must be no more than one mesh off the bottom of the trap. This rule also has a phase-in period that requires all escape rings to be no more than one mesh from a corner of the trap by July 1, 2022.

Other Species

Finfish

Crab traps can catch non-targeted finfish. Guillory (1993) documented bycatch of 11 different finfish species totaling 190 individuals in a study conducted in the Timbalier Bay estuary. In a field survey of 36 Lake Pontchartrain commercial crab fishing trips conducted from April 2008 to June 2010, approximately 34 finfish representing 10 different species were observed in traps (LDWF unpublished data). The most common bycatch in crab traps includes small volumes of stone crabs (*Menippe adina*) and finfish including black drum (*Pogonias cromis*), Atlantic croaker (*Micropogonias undulates*), southern flounder (*Paralichthys lethostigma*), spotted seatrout (*Cynoscion nebulosus*), and occasionally gag grouper (*Mycteroperca microlepis*). The crab trap fishery does not significantly affect any of these species—volumes of retained species make up less than 5% in weight of the total catch, and the low quantities of bycatch species pose no serious threat to the status of these species.

In the previously mentioned LSU AgCenter bait study, sea catfish were the dominant finfish bycatch with a total of 9 different species caught in 386 traps fished for 48 hours (Clowes 2016).

The LDWF coastwide crab trap bycatch survey sampled1,732 individuals comprising 55 different vertebrate and invertebrate species incidentally captured within approximately 8,496 traps. Blue crab accounted for 16,293 of the 18,025 individuals reported. Per protocol, soak times varied by season and averaged 36.5 hours in warmer months and 54.7 hours in cooler months. Bycatch varied among estuarine basins. Hardhead Sea catfish (*Ariopsis felis*) comprised the largest bycatch component, making up approximately 59% of all bycatch; no other species accounted for more than 10%, while diamondback terrapin (a species of concern) accounted for less than 1% of incidental catch. Researchers documented the condition of bycatch; over 95% of all incidental catch was alive.

Legislation supported by the Louisiana Crab Task Force allows crab fishermen to retain most bycatch for both personal consumption and sale, as long as it is within compliance with applicable regulations. Commercially licensed crab trap fishermen may retain as bycatch, an aggregate of up to 25 finfish per vessel per day for personal consumption; however, no freshwater gamefish, spotted seatrout or red drum may be kept as part of this aggregate. In addition to any fish retained as by-catch, any licensed commercial fisherman holding a gear license which allows him to take finfish for commercial purposes may possess any finfish caught under that gear license up to the commercial possession limit allowable for such finfish and such finfish shall not be required to be segregated from the by-catch. LDWF monitors landings and sales of these species through the state's trip ticket reporting system. The species most often retained by crab fishermen, using crab traps or pots, are black drum, southern flounder, and stone crab; these species are a very minimal part of the overall landings from commercial crabbers. From 2000-2018, commercial crab fishermen have averaged approximately 12,000 pounds of black drum annually, while stone crab and southern flounder account for nearly 6,300 and 2,300 pounds, respectively. All other retained finfish species combined average is around 5,500 pounds annually.

Diamondback Terrapins

Diamondback terrapins (*Malaclemys terrapin*) share some habitat with blue crab. While diamondback terrapins may not be legally taken by traps of any kind and may not be taken between April 15 and June 15 in Louisiana, crab traps (generally derelict - discarded, lost, or abandoned - traps) can incidentally catch diamondback terrapins.

The distribution and significance of this incidental catch is unknown. Drowning of diamondback terrapins incidentally caught in crab traps has been identified as a concern in studies conducted in other states (Bishop 1983 and Seigel and Gibbons 1995). Bishop (1983) documented large numbers of dead diamondback terrapins in individual ghost traps in South Carolina. Similarly, LDWF personnel conducting derelict crab trap cleanups have observed dead diamondback terrapins in derelict traps (Anderson and Alford 2014).

Guillory and Prejean (1998) evaluated the effects of the use of 5 by 10 centimeter (1.97 by 3.94 inch) rectangular terrapin excluder devices in crab traps on blue crab catches in three locations within the Timbalier/Terrebonne estuary in south-central Louisiana. The authors noted that catch per trap per day of both legal and undersized blue crabs was greater in traps with terrapin excluder devices than standard traps, and no diamondback terrapins were captured in their study. No diamondback terrapins were caught during other previous trap studies (Guillory 1989, 1993; Arcement and Guillory 1993; Guillory and Merrell 1993; Guillory and Prejean 1997; Guillory and Hein 1998a; and Prejean and Guillory 1998) in the Terrebonne/Timbalier estuary. However, Guillory and Prejean (1998) still assumed that the use of terrapin excluder devices in crab traps would reduce catches of diamondback terrapins in crab traps in Louisiana estuaries as documented in other studies.

A recent Florida study (Gandy and Turner 2014) found that habitat is likely the largest contributing factor for potential interactions with terrapins in the crab trap fishery - there was a significant catch rate of terrapins in the intertidal zone but otherwise minimal interaction. While the presence of fishing pressure and high numbers of terrapins are good indicators of potential interactions, they do not necessarily guarantee a high level of interaction with submerged traps. Further study is needed to determine the factors that contribute to terrapins entering submerged traps in habitats where interaction between terrapins and traps are most likely to occur.

Diamondback terrapin has been designated as a Species of Greatest Conservation Need (SGCN) in Louisiana's Wildlife Action Plan with a state rarity ranking of S3 (primarily due to reductions in abundance in other parts of its range). LDWF biologists are currently researching the diamondback terrapin's distribution and abundance throughout coastal Louisiana. The current study incorporates: (1) trapping adult and sub-adult terrapin in small bayous and appropriate shoreline habitats and (2) surveying and monitoring terrapin nesting efforts (including reproductive productivity) along coastal beaches. LDWF will use the information gathered in this study to enhance existing resource management and conservation strategies for diamondback terrapins within coastal Louisiana.

Marine Mammals

Under Section 118 of the Marine Mammal Protection Act (MMPA), the National Marine Fisheries Service (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. The Gulf of Mexico blue crab trap/pot fishery is listed as a Category III fishery, meaning there is remote likelihood of/no known incidental mortality or serious injury of marine mammals. Owners of vessels or gear engaged in a Category III fishery are not required to register with NMFS or obtain a marine mammal authorization certificate to lawfully take non-endangered and non-threatened marine mammals incidental to commercial fishing operations. However, they 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 which the death or serious injury occurred. Any incidental take will not be authorized unless it is reported. "Injury" is defined as a wound or other physical harm. 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.

DERELICT TRAPS AND GHOST FISHING

Derelict traps are those that have been discarded, lost, or abandoned. Traps can be accidentally lost if they are separated from their buoys by storms, passing boats, or other reasons. Derelict traps can "ghost fish" and continue to capture blue crabs and other species. The widespread use of vinyl coated wire traps in the Louisiana blue crab fishery and subsequently lower trap deterioration rates, increases in the number of traps used in the fishery, and the large numbers of traps lost by fishermen make derelict traps and ghost fishing a significant issue for the Louisiana crab fishery. The significance of potential impacts is largely unknown.

An accurate count of derelict traps is currently unavailable as estimates of trap loss vary widely. According to Roberts and Thompson (1982), crabbers each used an average of 218 traps (range between 65 to 600) and had to replace about 77% of their traps annually due to loss. Guillory and Merrell (1993) estimated that commercial crab trap fishermen each used an average of 268 traps per year and lost an average of 257 traps per year. Guillory and Perret (1998) conservatively estimated that more than 450,000 commercial and recreational crab traps were used in Louisiana and approximately 45,000 or 10% of the total used were lost annually. In a 2012 study in Lake Pontchartrain, Buckner and Lavergne (2012) estimated that for every 188.7 traps run, one was lost; however, the data in this study were limited.

Guillory (1993) evaluated the impacts of ghost fishing on blue crabs in the Timbalier Bay estuary in Louisiana. He reported that an average of 25 blue crabs died in each ghost trap during the year-long study. The number of blue crabs per trap varied seasonally and was a function of the comparative rates of ingress, mortality, and escapement. Small blue crabs (less than 4.7 inches carapace width) were more likely to escape, whereas large individuals (greater than 5.5 inches) were more likely to remain in the traps and eventually die. Additionally, body deterioration and injuries sustained while in confinement may result in higher rates of delays in mortality in crustaceans escaping ghost traps (High and Worlund 1979).

Anderson and Alford (2014) quantified ghost fishing activity in derelict crab traps in coastal Louisiana. Volunteers removed 3,607 derelict traps during these events, and more than 65% of traps analyzed by citizen scientists were actively ghost fishing. Additionally, volunteers identified 19 species enmeshed in derelict traps, including a combination of fresh and saltwater species. Authors also detected a significant difference in the number of blue crab in actively ghost fishing derelict traps across removal locations with estimated catches varying between 2.4 and 3.5 crabs/trap. The study's instantaneous estimates of ghost fishing activity are greater than those previously estimated in Louisiana.

TABLE 14. Annual Derelict Trap Removal Program data: 2004-2019.

YEAR	AREA(S)	TRAPS
2004	2	6,894
2005	4	4,623
2006	1	2,935
2007	2	1,495
2008	1	1,234
2009	1	788
2010	1	477
2011	1	1,100
2012	2	2,798
2013	2	969
2014	1	1,051
2015	1	422
2016	3	2,580
2017	6	5,674
2018	5	4,061
2019	5	4,041
Total	38	41,142

Between 2016 and 2017, the LDWF was contracted by the National Oceanographic and Atmospheric Administration Marine Debris Program to remove derelict or abandoned traps from the Baratraia, Pontchartrain, and Terrebonne Basins. During this period 7,196 traps were removed, a total of 5,208 traps were removed from the Pontchartrain Basin, while 1,407 and 581 traps were removed from the Barataria and Terrebonne Basins, respectively. Of the 7,196 traps removed, bycatch data was collected on approximately 55% of these traps, or 3,968, and of those, 1,615 contained bycatch. More than 4,400 individual organisms representing 30 different species were recorded with blue crab representing about 90% of this total. Approximately 92% of blue crab removed during this period were alive. The remaining 10% of recorded bycatch was largely made up of sheepshead (n=181) followed by mud crab, stone crab, and redspotted sunfish (n=32, n=31, n=25).

Louisiana has implemented several management measures to minimize trap loss as well as the impact of derelict traps, including requiring proper disposal of unserviceable crab traps, mandating the use of solid floats with non-floating lines, requiring trap placement that allows vessels to safely navigate waters, requiring traps to have multiple escape rings, and sponsoring an annual derelict trap removal program. This program includes an educational element designed to reduce the number of traps lost annually and lessen the impacts of traps in the environment and also collects data on the number and types of animals found in the recovered traps. In addition, as of Nov. 15, 2014, to obtain a commercial crab trap gear license, a fisherman must either possess a valid commercial crab trap license during any two license years between 2011 and 2014 or enroll in and complete a professionalism program established by the Commission. Among other elements, the program will include education on the proper placement, tending, and maintenance of crab traps. As such, this program may also help reduce the number of derelict traps.

ENVIRONMENTAL FACTORS

PREDATION

Predation has a significant impact on the abundance of early stage blue crabs as smaller blue crabs are subject to higher predation rates than larger blue crabs. Guillory and Prejean (2001) found that almost half of blue crabs consumed by red drum were between 10 millimeters (0.39 inches) CW and 29 millimeter (1.14 inches) CW, and 78% were less than 50 millimeters (1.97 inches) CW. Heck et al. (2001) found that post-settlement loss to predators was the dominant factor influencing blue crab population dynamics in their study area in the north central Gulf of Mexico. Many studies have also found that there is a greater predation risk for blue crabs living on un-vegetated substrate than for those in submerged aquatic vegetation or marsh grass (Heck et al. 2001). Blue crabs are also cannibals and likely target other crabs when they are most vulnerable, just after they have molted. Mansour (1992) noted that the frequency of cannibalism among blue crabs increased with increasing crab size and rates were high during the period of juvenile recruitment.

Guillory and Elliot (2001) conducted an extensive literature review of blue crab predators and identified ninety-three species of invertebrates, fish, reptiles, birds and mammals that prey upon blue crab zoea, megalopae, juveniles, and adults. Red drum, sea catfish, black drum, sheepshead, and spotted seatrout are the dominant predators of blue crab, and they could potentially affect the blue crab population.

INCIDENTAL CATCH OF BLUE CRAB IN OTHER FISHERIES

Large numbers of both juvenile and adult blue crabs are captured in trawls, skimmer nets, and butterfly nets used in the shrimp fishery. Watts and Pellegrin (1982) compared bycatch rates in the Texas and Louisiana shrimp trawl fishery and reported that blue crabs comprised 5.07% and 3.5% of total bycatch biomass in Louisiana waters less than 10 fathoms in 1980 and 1981, respectively. Perret et al. (1971) examined blue crab catch rates in more than 18,000 16-foot trawl samples taken by LDWF in Louisiana inside waters from 1967 to 1994. Fluctuations in blue crab catch per unit effort varied greatly from year to year over the 28-year data span and ranged from a low of 2 in 1976 to 14 in 1980. Adkins (1993) estimated that bycatch in the Louisiana shrimp fishery totaled 227.8 million pounds in 1989 with blue crabs comprising 9% of total weight or 20.5 million pounds. Guillory et al. (2001) noted that crabs taken in shrimp gear are at smaller sizes than those taken in crab traps, and in consideration of estimated bycatch levels, more crabs are taken in shrimp gear than harvested in traps by commercial fishermen. In Texas, Hammerschmidt et al. (1998) estimated that an annual average of 82 million crabs was taken in the inshore shrimp fishery from 1990 to 1994.

Murphy and Kruse (1995) reported significant effects on blue crab survival resulting from capture in shrimp gear and associated culling practices. In North Carolina, average blue crab mortality rates in shrimp trawls were 36% with higher rates (80%) reported in summer months (McKenna and Camp 1992). Although tow time length and culling practices had greater influence on juvenile blue crab survival, the use of brine solutions

or "salt boxes" to separate catch may increase mortality in blue crabs, particularly if exposure is prolonged and repeated (Texas Parks and Wildlife Department and Alabama Department of Conservation and Natural Resources unpublished data).

Further research observed (Haddad 2019) that blue crab mortality caused by the use of salt boxes was near 0%. This study tested blue crab in salt boxes at varying salinities and with sulfite additives. Typical salt boxes range in salinities, but all serve the purpose of sorting shrimp from bycatch. Sulfites are sometimes added to prevent black spot on shrimp catch and starves the water of oxygen causing blue crab to rise to the water surface. During the salt box salinity test, only one of the fifty crabs died. Further testing was conducted to determine how juvenile blue crab handle exposure to high salinities and sulfites; none of the 24 blue crab died. Based on this study, temporary salt box exposure with or without sulfites does not cause mortality.

Guillory (2001) reviewed bycatch mortality in blue crabs and the effects of capture and handling in both shrimp gear and actively fished crab traps in a blue crab mortality symposium sponsored by the GSMFC. Shrimp gear type, blue crab molt stage, total catch biomass, and blue crab mortality associated with the stress and incidence of damage and injury were identified as directly proportional to tow and culling time. Trap catches of undersized crabs ranging from 100 to 126 millimeters (3.94 to 4.96 inches) CW were most affected by trap capture and handling, as crabs of this size must be returned to the water. However, certain culling practices may result in sublegal crabs being held out of the water for prolonged periods, causing additional mortality.

DISEASES AND PARASITES

A number of different parasites and diseases affect blue crabs throughout their entire range. Shields and Overstreet (2007) published a comprehensive chapter on diseases and parasites of blue crab. According to a study conducted by researchers at Louisiana State University (LSU) Agricultural Center (Anderson and Rogers 2013), research on blue crab diseases, parasites, and symbionts has been sporadic in the Gulf of Mexico. With a focus on blue crabs along Louisiana's Gulf coast, the objective of their study was to determine the prevalence of diseases and parasites known to occur in Gulf blue crabs and better understand the current health of the blue crab population. They found that Louisiana's blue crab nearshore populations are healthy, lacking parasitization by the two most ecologically and economically detrimental parasites, *Hematodinium perezi* and *Loxothylacus texanus*. However, they found that reo-like virus (RLV) should be extensively studied because it is also capable of decimating blue crab populations.

Additional work on CsRV1 focused on shedding systems in Louisiana and found in 2016 and 2017, the prevalence of CsRV1 in dead buster crabs within shedding systems was 21.9%. Sampling in 2017, of successfully molted soft shell crabs and live peelers, found a prevalence of 5% (Spitznagel et al. 2019).

Symbionts, such as *Lagenophrys callinectes*, have been observed recently during the 2019 flood event in the Pontchartrain basin. *L. callinectes* has been found in the Gulf and are capable of tolerating moderate salinities and low temperatures (Rogers 2014). *L. callinectes* can be fatal to blue crab by interfering with respiration, which causes the crab the asphyxiate.

LDWF also maintains a working relationship with LSU School of Veterinary Sciences Pathology Lab to evaluate any reports of pathogens or disease that could impact blue crab stocks in the wild.

INVASIVE SPECIES

Invasive species can impact blue crabs through direct competition for resources, predation, or disease transmission. Some of the potential threats to Louisiana blue crabs include the Asian tiger prawn (*Penaeus monodon*), Pacific swimming crab (*Charybdis hellerii*), European green crab (*Carcinus maenas*), Bocourt swimming crab (*Callinectes bocourti*) and Chinese mitten crab (*Eriocheir sinensis*). Of these species, only the Asian tiger prawn has established a population in Gulf waters (U.S. Geological Survey 2014). Asian tiger prawns prey on small crabs in their home range, but their potential impact to Louisiana blue crabs is currently unknown (Pascual 1989).

There have been reports of the other species, but none of them have established populations in Louisiana waters. There may be established populations of Pacific swimming crab in the Caribbean and Southern Florida, and one specimen was caught in Barataria Bay in 2012. Pacific swimming crabs could decrease the efficiency of the blue crab fishery: if caught in the trap, they could consume the crab bait but escape through the trap escape ring due to their smaller size, reducing the traps' ability to attract blue crabs; if hauled in as bycatch, they could increase fishermen and dealers' handling time of landed catch. Pacific swimming crabs may also compete with native crabs for resources (Dineen et al. 2001). Other than the one specimen from 2012, no additional specimens have been reported from nearshore waters.

Chinese mitten crabs and European green crabs are a concern for blue crab managers on the Atlantic Coast (Maryland Sea Grant 2011). Neither species has established a population in Louisiana or the Gulf of Mexico to date. There have been no reports of green crabs in Louisiana. There was one report of a Chinese mitten crab along the Mississippi River shoreline in Southern Plaquemines parish (U.S. Geological Survey 2014).

C. bocourti, or Bocourt crab, has been reported from the south Atlantic and Gulf of Mexico. This crab is closely related to the blue crab and, to the casual observer, it appears to be a blue crab with different coloration. It is not clear if *C. bocourti* could hybridize or outcompete native blue crab. The Bocourt crab could be sold alongside our blue crab and most consumers would only notice the differences in carapace color once cooked. As adults, they are smaller than blue, which may limit the commercial value.

Invasive species may increase the spread of disease to blue crabs. They may also harbor diseases that are not fully established in Louisiana. More research is needed to fully assess the potential impacts of invasive species on the Louisiana blue crab fishery.

HABITAT LOSS AND RESTORATION

Marsh loss may also affect the abundance of estuarine dependent species such as blue crab. Eighty percent of the annual coastal marsh loss in the United States occurs in Louisiana. 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 Louisiana's Coastal Master Plan. These projects may have a range of impacts on blue crab abundance and may also impact the blue crab fishery. However, the reality is that both habitat loss and efforts to minimize the impacts of this loss could affect the ability of marshes to provide habitats for blue crabs and other estuarine dependent species. In fact, the changing coast of Louisiana would impact the fishery and blue crabs even if nothing were done to counteract the natural and man-made causes of coastal land loss.

FRESHWATER INFLOW

Changes in salinity may have secondary effects on blue crab abundance, mainly due to predation being a major factor affecting blue crab survival. Salinity affects where predators live. During a wet year, the water is fresher and main predatory species remain offshore. When there is less rainfall, salinity is higher and predators move closer to shore. Blue crabs can thrive in low salinity waters for much of their life cycle and are not as affected by periods of fresh water, or changing salinity patterns, as other estuarine species. Blue crabs (in particular) should benefit from freshwater diversions' values to the balance of freshwater, intermediate, brackish, and saltwater habitats (Thomas 1999).

2010 *DEEPWATER HORIZON* OIL SPILL

Oil spills and corresponding response activities can impact blue crabs and blue crab habitat. Studies regarding the effects to Louisiana's natural resources, including blue crabs, from the 2010 *Deepwater Horizon* oil spill are ongoing. Restoration activities have commenced for damages documented through the Natural Resource Damage Assessment process, with $5 billion of total fine monies dedicated to restoration in Louisiana. Although blue crab was not a resource type which received specific restoration funding, it is likely that they will benefit from the suite of habitat enhancement and creation projects to be constructed across the coast and in nearshore waters to compensate for the injury sustained to Louisiana's coastal ecosystems.

Fishery Management Program

Collaborative Fishery Management
Louisiana's fishery management authorities collaborate with the other Gulf states, other aquatic and coastal resource management authorities, industry, and other stakeholders in the management of the state's blue crab resource and fishery.

MANAGEMENT FRAMEWORK

Louisiana's Constitution provides the foundation for the sustainable management of the state's fisheries resources, including blue crab, recognizing their importance to Louisiana's environment, citizens, and economy. According to the Constitution, "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 fisheries management system. The Louisiana Revised Statutes 56:638.1-5 define the legislative intent, findings, purposes, policy, and standards for the conservation and management of all species of fish in Louisiana, similar to those found in the federal Magnuson-Stevens Fishery Conservation and Management Act, the law that guides U.S. federal fisheries management. According to these statutes, fishery conservation and management should sustain:

- 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 blue crab fishery rests with the Louisiana State Legislature. The Legislature is the law-making body of the state and enacts revised statutes defining the rules of fisheries. Louisiana's Constitution 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 and entry limitations are under the authority of the Legislature.

The Legislature adopts laws according to Louisiana's legislative process. LDWF often develops a legislative package and finds sponsors for individual bills. Legislators also develop bills of their own. See *Appendix III* for a diagram outlining Louisiana's legislative process.

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 which actions will best achieve long-term management goals. With respect to blue crab, the Commission is charged with setting seasons, times, places, size limits, quotas, daily take and possession limits, and some license fees; establishing an effective marking system for crab traps; and developing and establishing an abandoned crab trap removal program, among other authorities. See *Appendix IV* for complete details on the Commission's authorities as outlined in Louisiana Revised Statutes Title 56.

The Commission adopts rules according to the process defined in Louisiana's Administrative Procedure Act (APA). 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 process and is approved, it is published as final in the Louisiana Register and is compiled with other Commission rules in Louisiana Administrative Code Title 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. See *Appendix V* for complete details of the Secretary's authorities related to blue crab as described in Louisiana Revised Statutes Title 56. The Legislature and Commission may grant the Secretary of LDWF additional authorities to create administrative rules. For example, the Secretary, when authorized, can make a "declaration of emergency" in times when public health, safety, and welfare are in jeopardy and quick and immediate action is required.

In general, LDWF conducts scientific research; collects and analyzes fishery dependent and independent data; provides this data and management recommendations to the Commission and Legislature; and administers and enforces laws, rules, and regulations as adopted by the Commission and Legislature.

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.

Crab Task Force

Louisiana's Legislature has established a Crab Task Force to advise LDWF and the Commission on matters pertaining to the management and development of the crab industry in Louisiana. The Secretary of LDWF appoints members to the task force, subject to Senate confirmation. The Crab Task Force's 20 members must include crab fishermen, crab dealers or processors, and soft-shell crab producers (who are all voting members), as well as LDWF and university biologists, LDWF enforcement, attorneys, and LDWF and university economists (who are all nonvoting members). The task force has no direct management authority for the blue crab fishery. However, according to Louisiana Revised Statutes Title 56, they have authority over administering the allocation and expenditure of funds deposited into the Crab Promotion and Marketing Fund and may contract with the Louisiana Seafood Promotion and Marketing Board to promote the crab industry. They may also receive assistance from universities within the state in the development of methods to increase the production and marketability of crabs.

The Crab Task Force works with the Shrimp Task Force to resolve issues of common interest, especially on potential changes to laws regulating possession of crab traps on shrimp vessels.

Other Management Authorities

Although not involved in marine fisheries management, several state or 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 Louisiana Department of Environmental Quality (LDEQ) is responsible for setting pollution standards and monitoring all waters of the state, including the Gulf of Mexico. CPRA is responsible for developing, implementing, and enforcing a comprehensive coastal protection and restoration master plan, which includes monitoring and measuring coastal habitat loss

and coordinating habitat restoration projects. LDWF 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.

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 (LDH) 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.

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 the Louisiana Department of Agriculture and Forestry throughout the advisory development and dissemination process.

LDEQ also monitors all waters of the state, including the Gulf of Mexico, to ensure they meet water quality standards.

Public Participation and Engagement

Louisiana's fisheries management authorities encourage public participation throughout the management process to not only ensure stakeholders' interests are considered but also to ensure they understand the regulatory process and resulting management actions. All meetings of the Natural Resources Committees of the Legislature, Commission, and Crab Task Force are open to the public, according to Louisiana's Open Meetings Law (Louisiana Revised Statutes 42:12-28). This law ensures that government decisions are 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 before the meeting, provide opportunities for public comment, allow for audience recording of the meeting, and have recorded minutes of the proceedings.

REGIONAL

The other U.S. states bordering the Gulf of Mexico are responsible for the conservation and management of blue crab fisheries within their respective waters. The State of Louisiana cooperates with these states in the scientific research and management of fisheries that cross jurisdictional boundaries, including blue crab, through the GSMFC. The Louisiana Revised Statutes establish Louisiana's authority to enter into the Gulf States Marine Fisheries Compact with other states. The GSMFC has no direct authority over the blue crab 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 characterizes the progress of each state toward implementing their recommendations. See *Appendix VI* for Louisiana's compliance with GSMFC recommendations for blue crab. The GSMFC also consults with and advises member states over fishery conservation problems, advises the U.S. Congress, and testifies on legislation and marine policies affecting the Gulf states.

The Gulf of Mexico Fishery Management Council and NOAA Fisheries are responsible for monitoring and managing fisheries resources in Gulf federal waters (from the seaward boundary of state waters to 200 nautical miles offshore). The blue crab fishery operates exclusively within state waters, so federal agencies do not directly manage blue crab. However, through their administration of laws, regulations, and policies, certain federal agencies may influence the blue crab resource and fishery and management thereof (Guillory et al. 1996). See *Appendix VII* for a list of related federal management institutions and their authorities and jurisdictions and *Appendix VIII* for a list of related federal laws, regulations, and policies.

EXISTING MANAGEMENT MEASURES

PLANS

LDWF's 1996 "Management Profile of Blue Crab in Louisiana" summarized standards for management of marine fishery resources, state and federal jurisdictions and authorities, Louisiana statutes and regulations relative to blue crab, and other Gulf states' blue crab regulations. The profile identified and discussed problems and data needs in the fishery, provided management recommendations and options for each issue, and listed research topics to address problems or data needs. LDWF implemented a number of the management recommendations and options, including the following:

- Adopting dual liability for sublegal crab violations, making both fishermen and dealers, processors, etc. responsible for meeting minimum size restrictions
- Establishing a possession limit for recreational crabbers
- Implementing gear restrictions to reduce sublegal crab catches
- Prohibiting trap placement in navigable channels and stream entrances
- Requiring solid floats and non-floating trap lines
- Redefining "crab" to exclude stone crab to allow for specific regulation of stone crabs.

LDWF also implemented a trap gear license moratorium in 2005 as they developed recommendations for a more extensive limited entry program. The moratorium was largely ineffective and was discontinued after one year, especially as there was little support from the Legislature and Crab Task Force for a limited entry program.

The GSMFC's "Blue Crab Fishery of the Gulf of Mexico, United States: A Regional Management Plan" summarizes, references, and discusses relevant scientific information and studies regarding the management of blue crabs; describes the biological, social, and economic aspects of the blue crab fishery; reviews state and federal management authorities and their jurisdictions, laws, regulations, and policies affecting blue crabs; describes the problems and needs of the blue crab fishery; and suggests management strategies and options. Louisiana has implemented all of GSMFC's current management recommendations, when applicable (*Appendix VI*). Representatives from each Gulf state and the GSMFC and other experts are currently updating this regional management plan.

POLICIES

Should the fishing mortality or exploitable biomass exceed the overfished or overfishing limits, or exceed the targets for three consecutive years, as defined in the most current Louisiana blue crab stock assessment, LDWF shall come before the Commission with an updated assessment and a series of management options for the Commission to review and act upon, intended to keep the fishery from becoming overfished, and that management options for review and action shall include provisions for emergency closures, time based closures, and spatial closures. (Louisiana Wildlife and Fisheries Commission 2014).

STATUTES AND RULES

The Louisiana blue crab fishery is governed by both State of Louisiana legislative statutes (Title 56) and rules promulgated by the Commission (Title 76). Specific regulations are listed below. This summary of regulations does not retain their exact language and should be not be relied on for legal purposes. See *Appendix IX* for the full text of these regulations. See *Appendix X* for a chronological history of major changes to Louisiana's blue crab regulations.

Commercial

Licensing

Both resident and non-resident fishermen must have the appropriate commercial fishing and gear licenses to legally harvest blue crab commercially in Louisiana waters. Vessel owners must also have the appropriate vessel licenses. Gear licenses may be temporarily transferred between licensed commercial fishermen with the same residency status. Non-residents may not purchase licenses for commercial fishing gear prohibited in the state in which they reside. Five dollars of each crab trap gear license fee is deposited in the Crab Promotion and Marketing Fund ($20 for non-residents). Another $5 of each gear license fee is deposited into the Derelict Crab Trap Removal Account ($20 for non-residents).

As of Nov. 15, 2014, to obtain a commercial crab trap gear license in Louisiana, a fisherman must have either possessed a valid commercial crab trap license during any two license years between 2011 and 2014 or enroll in and complete a professionalism program established by the Commission.

Licensed commercial fishermen may transport and sell their own catch to any licensed Louisiana wholesale/retail seafood dealer located within the state of 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 blue crab for sale or resale must have the appropriate licenses. A portion of each license fee is deposited in the Seafood Promotion and Marketing Fund.

Fishing licenses may be suspended, denied or revoked for failure to pay child support, nonpayment of unemployment compensation overpayment, and nonpayment of individual income taxes.

Legal Gear

Commercial fishermen primarily use crab traps to harvest blue crabs; other legal commercial crabbing gears include: crab dropnets, trawls, skimmer nets, butterfly nets, hoop nets, trotlines, handlines, bushlines, dip nets, and cast nets.

Commercial fishermen may only use trawls to harvest blue crabs during open shrimp seasons and must abide by commercial shrimping regulations, including minimum mesh size requirements.

There was an experimental dredge fishery for winter blue crabs in the late 1980s and early 1990s. The industry opposed this practice, and the Legislature subsequently prohibited the use of dredges to intentionally harvest crabs.

Gear Requirements

Statutes specify the size and configuration of legal crab traps. Specifically, crab traps must have:

- A minimum of three escape rings. All escape rings shall be placed on the vertical, outside walls. A minimum of two escape rings shall be located in the upper chamber flush with the baffle. A minimum of one escape ring shall be located in the lower chamber no greater than one mesh length from the trap floor. Beginning on July 1, 2022, all escape rings shall be located no greater than one mesh length from the corners. The minimum sizes of the rings shall be 2-3/8 inches in inside diameter, not including the ring material. The rings shall be rigid and attached to the trap with material of an equal or smaller diameter than the wire strands of the trap. However, escape rings are not required on any crab trap constructed of wire mesh 2-5/16 inches square or greater. Except from April 1 through June 30 and from Sept. 1 through Oct. 31, escape ring openings shall not be obstructed with any material that prevents or hampers exit of crabs.
- A stainless steel tag attached to the center of the trap ceiling or a durable plastic bait-box cover, legibly embossed or engraved with the fisherman's commercial license number to identify the owner of the trap.
- A solid float and non-floating line, unless located in waters (besides a lake) inland from the saltwater line. These requirements help prevent lost traps. These requirements do not apply in inland waters to allow fishermen to better conceal their traps and prevent theft as the highest quality crabs are caught in inland waters.

Seasons

There are no regulatory seasons for the harvest of blue crab in Louisiana. Fishermen may fish for blue crabs year-round. However, the Commission may prohibit the use of crab traps in certain areas for short periods of time to remove lost or abandoned traps through the Derelict Crab Trap Removal Program or is the most recent stock assessment indicates that one of the harvest control rules have been met.

Fishery Access

The blue crab fishery is an open-access fishery. However, as of Nov. 15, 2014, to obtain a commercial crab trap gear license in Louisiana, a fisherman must have either possessed a valid com-

mercial crab trap license during any two license years between 2011 and 2014 or enroll in and complete a professionalism program established by the Commission to increase and elevate professionalism in the commercial crab industry. This program may include an apprenticeship program.

Size and Possession Limits

Commercial fishermen may only harvest crabs 5 inches CW or wider. Since at least half of the crab population has sexually matured at this size, this minimum size limit helps ensure crabs have the opportunity to reproduce and replace those that are harvested. Fishermen must immediately return undersized crabs back to the water without injury, unless they are holding them for grow-out for the soft-shell crab market. No more than 10% of a fisherman's total crab harvest may be undersized crabs. If a commercial fisherman is convicted of possessing more than twice the percentage of undersized crabs allowed by law, his crab trap gear license may be suspended, in addition to other penalties. Dealers implicated in purchasing undersized crabs may also face penalties.

Additionally, commercial fishermen are permanently prohibited from the take or possession of immature female blue crab. This rule was established during the 2019 Legislative Session. A commercial fisherman may have in his possession no more than 5%, of a random 50 crab sample, immature female blue crab.

Fishermen may retain undersized crabs (pre-molt crabs less than 5 inches) if they are holding them for processing as soft-shell crabs or selling them to a processor for making soft-shell crabs. Fishermen must identify them as pre-molt crabs and hold them aboard the vessel in separate containers marked "peelers" or "busters." Soft-shell crabs make up a very small portion of the overall harvest in terms of numbers of crabs harvested due to the limitations of space for shedding facilities, economics of the soft-shell industry, and availability of "busters" and "peelers" for stocking into the shedding facilities.

Fishermen may not harvest female crabs of any size if they are bearing eggs on their abdomen and must immediately return them to the water without injury to protect this next generation of crabs. No more than 2% of the total number of crabs in a commercial fisherman's possession may be incidentally harvested, egg-bearing crabs.

Commercial fishermen must tag, mark, or otherwise identify any crabs they sell with their name and license number and the date on which the crabs were harvested to ensure the origin of the catch can be appropriately identified.

Bycatch

Crab traps can also catch non-target species such as finfish. Fishermen may retain for personal consumption finfish caught as bycatch in crab traps, up to an aggregate of 25 finfish per vessel per day. However, they may not keep gamefish or spotted seatrout. Any retained fish must be within minimum size and recreational daily possession limits. Fishermen may also retain finfish for commercial purposes as long as they are in compliance with appropriate regulations for those species. LDWF monitors landings and sales of these species through the state's trip ticket program.

Fishermen may not waste any fish of this state. "Waste" means 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."

Commercial fishermen may not take diamondback terrapins incidentally caught in crab traps.

Area Restrictions

Fishermen may not set crab traps in navigable channels or entrances to streams so vessels can safely navigate these waters.

Gear and other restrictions may vary in state wildlife management areas, state and federal wildlife refuges, and other areas to protect important habitat and reduce conflicts with other users.

Commercial fishing including commercial crabbing is prohibited in coastal National Wildlife Refuges. Commercial fishermen must have a permit to fish commercially in Jean Lafitte National Historical Park and Preserve.

Operational Restrictions

Fishermen may not bait, tend, check, or remove crab traps, their contents, lines, buoys, or markers in public waters from one-half hour after legal sunset until one-half hour before legal sunrise.

Derelict Gear

The Commission has the authority to develop and establish a program to remove derelict crab traps (those that have been discarded, lost, or abandoned) from state-owned lake and riverbeds and other water bottoms. The Commission may prohibit crab traps in state-owned lake and riverbeds and other water bottoms during the following times for the purpose of removing derelict traps:

- A period not to exceed 16 consecutive days between Feb. 1 and March 31
- A period not to exceed 14 consecutive-days which includes the opening day of the spring inshore shrimp season.
- If the harvest of crab is prohibited due to biological or technical reasons, the Commission may allow derelict crab trap cleanup during this period.

Any crab trap found in these areas of the state when the Commission has prohibited their use shall be considered abandoned and may be removed by persons authorized by the Commission.

LDWF, Louisiana Sea Grant, and volunteers run the annual Derelict Crab Trap Removal Program to retrieve these traps and reduce their potential impacts, which include "ghost fishing" (continuing to capture blue crabs and other species), navigational hazards for boats, and entanglement in other fishing gear such as shrimp nets. The program also collects data on the number and types of animals found in recovered traps.

Fishing Gear Interactions
Fishermen must properly dispose of unserviceable crab traps on shore to reduce the risk and potential impact of derelict traps. A shrimper who catches an unserviceable crab trap must keep it on board his vessel and properly dispose of it at a designated disposal site if one is available. A shrimper who catches an otherwise serviceable trap without a float shall return it to the water with a common float. Any fisherman with a crab fishing license may raise and check any trap with a common float to determine ownership. The owner of the trap shall return the common float to any shrimper for reuse. Only the crab trap license holder (or his agent) may intentionally damage or destroy a crab trap, the attached floats or lines, or its contents.

Bait
Fishermen may use any legal fish of legal size (other than gamefish) for bait. Most fishermen use crab traps baited with menhaden, shad, and freshwater catfish remains. Due to insufficient supplies of bait during the winter season, Louisiana fishermen must purchase bait menhaden and other less effective baits at greatly increased costs from other sources outside of the state. To assist these fishermen, the Legislature has extended the regular bait menhaden season by adding an additional quota of bait menhaden to be taken during the closed season.

Packaging
The Secretary of the 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 (LSPMB) may make recommendations to the Secretary for standards for the packaging of seafood. No rules and regulations specific to packaging of crabs have been adopted.

Shipments containing fish shall be plainly marked. The tags or certificates must 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
No license is required to harvest crabs recreationally, unless crabbing on an WMA or state or federal wildlife refuge or using crab traps to harvest crabs. Recreational fishermen must have a basic recreational fishing license or a Wild Louisiana Stamp to harvest crabs on an WMA or refuge; however, use of traps on these areas is prohibited. A recreational fisherman must have a recreational crab trap license to use crab traps. This license allows each licensed fishermen to deploy no more than 10 traps at a time, but use of traps is prohibited on WMAs and refuges. Fishermen may temporarily transfer recreational gear licenses to another person holding a basic fishing license with the same residency status.

Five dollars of each resident recreational crab trap license ($20 of each non-resident crab trap license) is credited to the Derelict Crab Trap Removal Account. Other revenues generated from the sale of recreational fishing licenses are dedicated exclusively to the operation of LDWF's Law Enforcement Division.

Legal Gear
Legal recreational crabbing gears include crab traps, crab dropnets, trawls, hoop nets, trotlines, handlines, bushlines, dip nets, and cast nets; however, recreational fishermen may not use hoop nets in saltwater areas. Fishermen may not use dredges to intentionally harvest crabs. Fishermen may use trawls to harvest blue crabs during open shrimp seasons and must abide by shrimping regulations, including minimum mesh size requirements.

Gear Requirements
Same as those listed under Commercial, except that trap tags should be legibly embossed or engraved with the fisherman's recreational crab trap gear license number to identify the owner of the trap.

Size and Possession Limits
There are no size limits for recreational harvest, but recreational fishermen may take no more than 12 dozen, or 144 crabs, per person per day. On WMAs or state wildlife refuges, the recreational limit is 12 dozen, or 144 crabs, per boat or vehicle per day. Recreational fishermen may not harvest egg-bearing female crabs. They must immediately return them to the water.

Area Restrictions
Same as those listed under Commercial.
Possession limits and gear and other restrictions vary in state WMAs, refuges, and other areas as well as coastal National Wildlife Refuges and Jean Lafitte Historical Park and Preserve.

Operational Restrictions
Same as those listed under Commercial.

Fishing Gear Interactions
Same as those listed under Commercial.

Other

Louisiana Seafood Promotion and Marketing Board (LSPMB)
The LSPMB 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. One member of the LSPMB is a representative from the Louisiana Crab Task Force.

Louisiana Wild Seafood Certification Program (LWSCP)
LDWF established the LWSCP to build a brand that guarantees the origin of Louisiana wild-caught seafood. The program establishes rules and guidelines throughout the seafood supply chain that ensure all seafood products bearing the program's logo have been caught in Louisiana waters by Louisiana licensed fishermen, then landed, processed, and packaged in Louisiana.

The program's goal is not only to increase consumer confidence in the source of their seafood but also to establish Louisiana seafood as a premium product and ensure the state's industry remains competitive in the constantly changing global marketplace.

The program requires participating seafood dealers and processors to be trained on the program guidelines, state and federal regulations, and best practices for quality and safety. It also requires that participating seafood retailers demonstrate that their seafood products registered and labeled with the LWSCP logo can be traced back to participating dealers and processors. The requirements for this origin-based brand help ensure the integrity and reputation of Louisiana seafood - when buyers see the program's logo, they know they are purchasing authentic Louisiana wild seafood, a product known for fresh flavor, consistent quality, and sustainability.

Seafood Technology Equipment Program (STEP)
To support the LWSCP, the LDWF has developed STEP, a cost-share assistance program for the commercial seafood community. STEP provides LWSCP participants with funding opportunities to improve their equipment and practices to increase the quality and value of their seafood, critical components for establishing a strong brand for Louisiana seafood. The Legislature allocated funding for STEP in 2009 by setting aside 10% of Artificial Reef Trust Fund revenues. LDWF launched the first round of STEP funding in September of 2013 to help docks and processors participating in LWSCP make necessary improvements to comply with LDH permit and LWSCP requirements. The STEP program has been indefinitely suspended and the 10% of the artificial reef fund has been redirected to other programs right now.

Professionalism Programs
As of Nov. 15, 2014, to obtain a commercial crab trap gear license in Louisiana, a fisherman must either possess a valid commercial crab trap license during any two license years between 2011 and 2014 or enroll in and complete a professionalism program established by the Commission to increase and elevate professionalism in the commercial crab industry. This program will include education in proper fishing techniques necessary for the health and sustainability of blue crab and best capture and presentation of blue crab for marketability as well as instruction regarding the placement, tending, and maintenance of crab traps to reduce potential conflicts with other user groups. This program may also include an apprenticeship program.

LDWF, in collaboration with Louisiana Sea Grant and the LSU AgCenter, has also developed a multi-year, multi-phase professionalism program for all sectors of Louisiana's commercial fishing industry, including fishermen, dock owners, processors, and distributors. This program provides education and training essential for the continued success of the industry and focuses on a number of important topics, including seafood quality and safety best practices. Launching in 2014, the first year/first phase initiatives included producing videos such as "How to be a Commercial Fishermen" and "How to be a Dock/Processor," with corresponding fact sheets, and holding the biennial Louisiana Seafood Summit, which offers informative presentations and materials, as well as hands-on workshops. These workshops include field activities and dockside demonstrations on a fishing vessel where experts demonstrate vessel refrigeration/cooler systems, seafood freezing equipment, fuel efficiency equipment, fishing/harvesting equipment, and seafood handling and processing techniques.

Fisheries Extension
Through outreach efforts, LDWF promotes public awareness and advises beneficiaries 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's Aquatic Outreach Program strives to foster a community sense of resource and habitat stewardship. An assortment of printed materials is distributed at these events which focus on fishing regulations, commercial and recreational fishing topics, as well as species profiles which highlight the life cycle and habitat requirements of blue crab and other native Louisiana species. Through participation in outreach events and distribution of educational materials and activities, the Aquatic Outreach Program message reaches over 200,000 Louisiana citizens each year.

COMPLIANCE

Reporting Requirements
Since 1999, LDWF has monitored harvest of blue crabs at the point of initial sale through a trip ticket program. Under the program, wholesale/retail seafood dealers purchasing or acquiring crab 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. The trip ticket must have the following information: wholesale/retail seafood dealer's name and license number; commercial fisherman's name and license number; vessel license number; vessel registration or U.S. Coast Guard documentation number; transaction date; species identification; quantity and units of each species; size and condition of each species; unit price of each species; and permit number for species requiring a permit to harvest.

Both the commercial fisherman and the dealer must sign the trip ticket, attesting that the information on the trip ticket is correct. The fisherman and the dealer each keep a copy of the trip ticket. The dealer must transmit trip tickets from all of its transactions to LDWF once a month. In addition, if the dealer sheds soft-shell crabs or operates soft-shell crab shedding facilities, they must also submit information relative to the amount of soft-shell crab they produce.

A commercial fisherman selling fish under a fresh product license must also complete trip tickets, except they record their fresh product license number in place of the wholesaler/retailer seafood dealer's license number. They must sign these trip tickets to confirm their accuracy and submit them to LDWF once a month.

Trip ticket records must be maintained for three years and are open to inspection by LDWF.

Trip ticket information 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 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.
- 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.

Enforcement

Through events, outreach materials, and other resources, LDWF informs commercial and recreational fishermen about programs, projects, and most importantly, relevant rules and 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 the State of Louisiana, Louisiana Revised Statutes, and numerous federal laws including the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, Marine Mammal Protection Act, and Lacey Act.

Penalties

Classes of violations vary by legislative statute or Commission rule. Penalties for violations vary with the severity of the violation and include fines, jail time, loss of fishing license, and forfeiture of property. Penalties for each class of violation are below:

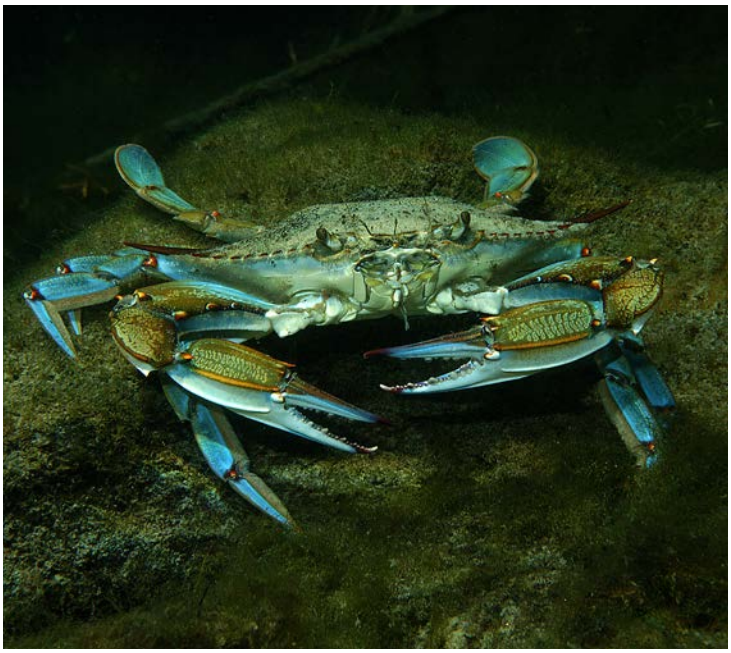
- *Class One:* First offense - fine of $50, imprisonment for no more than 15 days, or both; second offense - fine of $75-250, imprisonment of 30-60 days, or both; third and subsequent offenses - fine of $250-550 and imprisonment of 30-90 days
- *Class Two:* First offense - fine of $100-350, imprisonment 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, violators must forfeit any blue crabs in connection with the violation, may have their license revoked, and have illegal or improperly tagged fishing gear confiscated. A person who kills, catches, takes, possesses, or injures any fish or other 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 fish or other aquatic life, unlawfully killed, caught, taken, possessed, or injured. Civil restitution for blue crabs is currently assessed at $1.53 per pound.

OTHER STATES' BLUE CRAB REGULATIONS

See Appendices XII and XIII for a table of other states' commercial and recreational regulations for blue crab.

Current Issues & Management Options



This section identifies current issues facing the Louisiana blue crab fishery, provides a brief description of each issue, and recommends options for future consideration to address these issues. LDWF will work with stakeholders to prioritize these issues and identify preferred recommendations. Before implementing any recommendation, LDWF will evaluate its feasibility and potential impacts on the resource and fishery.

EFFORT MANAGEMENT

Prior to legislation enacted in the 2014 Louisiana Regular Legislative Session and a Notice of Intent adopted by the Commission in July 2014, there has been no limit on participation into Louisiana's blue crab fishery. Unrestricted participation refers to both the numbers of licensed fishermen in the fishery and the number of traps that an individual fisherman may fish. In recent history, this has led to high fishing rates that limit the profitability of individual fishermen. This can also lead to increased user conflicts and trap loss.

LDWF currently derives information about the number of fishing vessels active in the crab trap fishery from trip ticket data using information on the number of vessels landing blue crabs with crab trap gear. However, without corresponding trip information on the number of traps fished and trap soak times, comprehensive estimates of fishing effort remain unavailable. Similarly, blue crab fishing effort estimates from other directed and incidental gear (i.e. trawls, skimmer nets and butterfly nets) is unavailable as net size and net soak times are not captured on trip tickets.

According to LDWF's 1996 Management Profile of Blue Crab in Louisiana, the obvious solutions to excessive fishing effort are limited entry and/or trap limits. LDWF implemented a trap license moratorium in 2005 as they developed recommendations for a more extensive limited entry program. The moratorium was largely ineffective and was discontinued after one year, especially as there was little support from the Legislature and Crab Task Force for a limited entry program. Trap limits may be extremely difficult to manage and enforce; earlier attempts to implement trap limits in the 1970s were unsuccessful due to opposition from fishermen.

As of Nov. 15, 2014, to obtain a commercial crab trap gear license in Louisiana, a fisherman must have possessed a valid commercial crab trap license during any two license years between 2011 and 2014 or enroll in and complete a professionalism program established by the Commission.

This experience/education requirement could serve as an alternative method of limiting entry to the commercial fishery and help LDWF maintain records of fishermen with information on their service and qualifications. This new requirement does not affect recreational crab trap license applicants; however, the Crab Task Force has expressed concern over the potential for increased recreational crab trap use and has suggested that limiting effort in the recreational trap fishery may be beneficial.

OPTIONS

- Better characterize the number of vessels and traps active in the crab fishery to improve measurements of effort. Potential solutions include requiring gear endorsements for specific amounts of traps (e.g. Type 1 allows 50 to 100 traps, Type 2 allows 101 to 150 traps, etc.) and reevaluating trip ticket program reporting requirements.
- Evaluate fishing capacity for the blue crab fishery compared to current participation and effort.
- Evaluate other methods for limiting effort in the fishery (recreational trap fishery included) such as:
  - Raising license fees
  - Requiring drug testing for entry into the fishery
  - Eliminating latent licenses
  - Qualifying participation based on license history, historical landings levels, historical values of landings, etc.
  - Not allowing licenses to be renewed if not renewed in the immediate preceding license year
  - Establishing a license buyback program
  - Requiring license endorsements that scale/tier the number of traps individual fishermen are allowed to use
  - Requiring license endorsements that allow the taking of peeler crabs and/or shedding crabs
  - Requiring trap tags issued by LDWF, with provisions for the replacement of tags due to trap loss
  - Removing gear license transferability
  - Establishing endorsements for commercial harvest/sale of crabs with gear other than traps (trawls, skimmer and butterfly nets, etc.)
  - Capping the amount of crabs harvested and sold as bycatch from gear other than traps
  - Establishing trip limits
  - Restricting the number of traps used within certain waters.

USER GROUP CONFLICTS

There is long history of conflict between the blue crab fishery and the shrimp fishery in Louisiana with regard to space, loss or damage to gear in both fisheries, and related issues. LDWF's 1996 Management Profile of Blue Crab in Louisiana previously identified user group conflicts as a significant management issue for the blue crab fishery. Review of the issue found that options to ameliorate the conflicts between commercial crab and shrimp fishermen revolve around separating the two groups spatially or seasonally and restricting gear usage. Specific measures might include eliminating night trawling and inside double rig trawlers, designating commercial crabbing seasons, separating shrimping and crabbing areas during periods of intensive fishing pressure, limiting entry and/or traps, increasing distance between traps, and placing traps in a single straight line. Most options are either impractical, unenforceable, or not in the best interests of either fishery. However, conflict resolution meetings between user groups in impacted areas may prove beneficial and reduce the need for restrictive legislative statutes or Commission regulations that may negatively impact one or both fisheries.

The management profile also recommended two other solutions: reviewing area and time statutory restrictions on crab trap usage in specific localized geographical areas (although area restrictions may only shift conflicts elsewhere) and prohibiting crab traps in large, buoyed navigation or ship channels. Although Louisiana's Revised Statutes already prohibit placement of crab traps in navigable channels and stream entrances, this specific statute is vague and can be interpreted broadly as it does not name specific waterways and most waterways are navigable.

OPTIONS

- Create an inter-task force working group to resolve user conflicts.
- Implement area and/or time restrictions to reduce user conflicts.
- Further define statute regarding placement of crab traps in navigable channels and stream entrances.
- Require minimum distances between traps.
- Designate areas prohibited to the use of traps (e.g. by depth, season, critical habitat, etc.).
- Require crabbers to tend their traps within a specified amount of time and remove inactive traps from the water.
- Restrict shrimping in certain waters.
- Restrict shrimping to daylight hours in certain waters.

BYCATCH

According to the few studies completed to date, the blue crab fishery seems to have low bycatch. However, bycatch varies with trap soak time, and more research is needed to better characterize overall bycatch. LDWF's two and a half year coast-wide crab trap bycatch and diamondback terrapin study gave insight on bycatch within the commercial crab fishery. Blue crab was the most common species collected during the study while bycatch species remained low. Hardhead catfish was, by far, the most common bycatch species captured during the study, making up 59% of all bycatch species landed and 6% of all species landed.

While industry-driven revisions to escape ring requirements are intended to reduce incidental capture of undersized blue crabs, they may also potentially reduce other bycatch. Changes to the number and size of escape rings became effective in November 2017. Beginning on July 1, 2022, all escape rings shall be located no greater than one mesh length from the corners. The minimum sizes of the rings shall be 2-3/8 inches in inside diameter, not including the ring material.

OPTIONS

- Evaluate effects of revised escape ring requirements (once implemented) on bycatch reduction in the blue crab fishery.
- Characterize bycatch rates in commercial crab traps and traps fitted with bycatch reduction devices.
- Require use of terrapin excluder devices in certain waters.
- Require use of biodegradable panels in traps.
- Restrict or prohibit sale of finfish bycatch from traps.

- Restrict or prohibit bycatch species from being retained as bait and/or personal consumption.
- Designate areas prohibited to the use of crab traps near important habitat for bycatch species.

HABITAT LOSS

In general, the management community recognizes the landscape of Louisiana's coast is rapidly changing due to a history of manmade and natural events. As a result of these changes, the State of Louisiana has developed and is implementing plans to attempt to minimize loss of marsh habitat. Both factors have the potential to impact the ability of these marshes to provide suitable habitat for marine and estuarine organisms, including blue crabs as well as their predators and prey. This could result in long-term changes in the abundance of the blue crab stock. However, at this time, it is not possible to predict with any confidence the direction or magnitude of these changes.

OPTIONS

- Support programs that identify, preserve, and/or restore essential blue crab habitat and assess and discourage projects which negatively alter blue crab habitat or impede access by crabs to essential habitats (as previously recommended in Guillory et al. 2001).

TRAP AND CRAB THEFT

Theft of traps and/or their contents continues to be a problem in the Louisiana blue crab fishery. LDWF's Law Enforcement Division regularly patrols fishing grounds for trap and/or crab theft violations. As recommended in the 1996 Management Profile of Blue Crab in Louisiana, LDWF enforcement agents also communicate and cooperate with local parish law enforcement officers and the crab industry to increase coverage in investigating trap and/or crab theft.

Management measures such as restrictions on baiting, tending, checking, and removing traps, their contents, lines, buoys, or markers at night and requirements to mark traps with tags to identify a trap's owner also help deter theft and help enforcement apprehend violators. However, these identification tags can be easily removed by thieves. To deter theft, many crabbers voluntarily use plastic bait box covers engraved with their name and license number, essentially building their identification into the trap and making it difficult for a thief to remove the identification without destroying the trap.

Among other elements, the new professionalism program includes education on the proper placement, tending, and maintenance of crab traps to reduce potential conflicts with user groups. This program may also help reduce trap and crab theft.

HB 355 was promulgated in 2019 and was designed to increase the penalty for crab and/or crab trap theft. With this new law, a commercial crab fisherman can lose their crab trap gear license for up to 10 years depending on the number of theft violations one has accumulated along with a monetary fine and VMS requirement.

OPTIONS

- Revise gear identification requirements such as:
  - Requiring the use of buoys identifying the trap owner
  - Requiring the use of buoy color and shapes registered with LDWF
- Ensure trap and/or crab theft violations are fully prosecuted.

HARVEST OF UNDERSIZED AND/OR FEMALE CRABS

Excessive harvest of undersized crabs is no longer as significant an issue as previously identified in LDWF's 1996 Management Profile of Blue Crab in Louisiana. Several recommended measures have been implemented since then to reduce harvest of undersized crabs including adopting dual liability (fisherman and buyer) for undersized crab violations and requiring escape rings in crab traps. In 2014, legislation was adopted that would require three escape rings in each crab trap, two rings in the upper chamber and one in the lower chamber, and the minimum escape ring inside diameter increased from 2-5/16 to 2-3/8. This rule became effective in November 2017, which allowed time for fishermen to adapt to these changes.

However, some concern remains over the harvest of legal size immature female blue crabs. Industry representatives have cited examples of significant numbers of legal size immature females harvested and graded for live market sales, as opposed to the legal harvest of immature female peeler crabs for shedding purposes. Their concerns center around the lost opportunity for these crabs to mate and reproduce before they are harvested. In response to these concerns, the Crab Task Force adopted a motion endorsing legislation in 2019 that would prohibit harvest of legal size immature females, except for shedding purposes. During the 2019 Legislative Session, HB 355 was promulgated to prohibit the commercial harvest of immature female blue crab.

OPTIONS

- Evaluate effects of revised escape ring requirements (once implemented) on reducing harvest of undersized blue crabs, especially with removing the exemption for Lake Pontchartrain.
- Reduce allowable tolerances for undersized blue crabs.
- Increase minimum trap mesh size.
- Increase legal minimum blue crab size.

COMPETITION FROM FOREIGN IMPORTS

Every year the United States imports hundreds of millions of pounds of crab products made from various species of crabs. Crab product imports of all types of crabs totaled 237.4 million pounds with a real value of $1.9 billion in 2018 and averaged 235.9 million pounds and $1.6 billion over the previous five years. The majority of the volume and value of these imports were associated with an array of species that appear in many ways to be dissimilar from blue crabs, such as, snow crabs, king crabs, and Dungeness crabs.

The classification of imports with the closest relationship to blue crabs, swimming crab products, includes separate catego-

ries for products made of crabs from the same taxonomic family (Portunidae) and genus (Callinectes). Imports of swimming crab product rose from 23.4 million pounds and $149.8 million in 2000 to 56.4 million pounds and $476.9 million in 2008 then dropped to 39.5 million pounds and $347.8 million in 2011. A few years later imports started rising again from 37.7 million pounds and $317.5 million in 2013 to 63.0 million pounds and $655.7 million in 2018. Crab meat in air tight containers comprised 92.3% of the volume and 94.7% of the value of total swimming crab products in 2018 and at least 89% of the volume and 92% of the value in every year between 2000 and 2017.

Though the United States imported swimming crab products from 40 countries at some point between 2000 and 2018, the majority entered the nation through just a handful of countries. In every year between 2010 and 2018, at least two-thirds of the value of U.S. swimming crab product imports originated in three nations, Indonesia, China, and the Philippines. The leading eight nations (Thailand, Vietnam, Mexico, India, and Venezuela in addition to the aforementioned three) collectively represented at least 95% of the import value in each year during that period.

OPTIONS

- Evaluate the effect of imported swimming crab on the domestic blue crab market.
- Raise awareness of the quality, availability, and sustainability of Louisiana blue crab.

BAIT

In Louisiana, most crabbers use crab traps baited with Atlantic menhaden. Despite a substantial menhaden resource and fishery in the Gulf of Mexico, most Louisiana crabbers source menhaden bait from Virginia and sometimes New Jersey as Gulf menhaden is not typically processed for bait. In fact, the last menhaden bait supplier in Louisiana had gone out of business following Hurricane Katrina in 2005. Subsequent hurricanes further affected Louisiana in 2008; disaster funding associated with the 2008 hurricanes was awarded to Louisiana. In 2011, some of the disaster funding was provided through a grant to reestablish the menhaden bait industry.

In the past few years, concern has grown over the status of the Atlantic menhaden stock and fishery. In response, the Atlantic States Marine Fisheries Commission recently established a total allowable catch for Atlantic menhaden at a level that represents a significant reduction from previous average landings. As a result, it may become more difficult and more expensive to source Atlantic menhaden for bait.

Through a National Oceanic and Atmospheric Administration Grant and GSMFC Sub-Award, LDWF created the Commercial Menhaden Bait Industry Cooperative Research Grant in 2011 to provide funding to qualified applicants to establish locally harvested menhaden operations that would offer a continual supply of bait throughout the year for Louisiana fishermen. LDWF awarded two applicants grant funding to support the development of their bait businesses. These businesses must ensure that at least 90% of the bait they produce is sold to Louisiana businesses. The bait must be harvested from a Louisiana licensed vessel in Louisiana waters or from a Louisiana licensed vessel in federal waters. One company only remained in business a few years, but the second opened in 2013. However, the single company only has one vessel and sells to the crawfish industry as well as blue crab and others. They upgraded vessels in 2016, but they still cannot meet demand even regionally.

A researcher with LSU and Louisiana Sea Grant has also recognized this issue and has developed an alternative, artificial bait using waste from the commercial shrimp fishery. However, a manufacturer has not been found for the bait (Anderson 2014 and Clowes 2016).

OPTIONS

- Monitor and evaluate success of development of a bait component for Louisiana's menhaden fishery to reduce the need for Atlantic menhaden and create a more reliable, cost effective source of bait for Louisiana fishermen.
- Evaluate manufacturing options for the artificial bait for the crab fishery to reduce the need for Atlantic menhaden and add value to current waste products from the Louisiana seafood industry.
- Develop an alternative source of cost-effective, natural bait.

DERELICT TRAPS AND GHOST FISHING

As previously identified in the 1996 Management Profile of Blue Crab in Louisiana, substantial numbers of crab traps are abandoned or lost due to uncontrollable factors (i.e., tides, currents, and storm surges), simple negligence by fishermen in properly assembling and maintaining attachment lines and floats, inadvertent clipping of float line by vessel propellers, and the use of plastic jugs or bottles as floats, which may become brittle with weathering and later crack and sink. Lost or abandoned traps can continue to fish, capturing blue crabs and other species (ghost fishing). They can also create a navigational hazard for boats and become entangled in other fishing gear such as shrimp nets. This issue can also create additional costs for crabbers who have to replace their lost traps.

A number of regulations have been implemented to address this issue including requiring proper disposal of unserviceable crab traps, mandating the use of solid floats with non-floating lines, requiring trap placement that allows vessels to safely navigate waters, requiring traps to have multiple escape rings, and sponsoring an annual derelict trap removal program. However, derelict traps remain an issue, likely related to the significant number of traps set each year and the tendency for crabbers to set inactive traps as placeholders.

OPTIONS

- Require biodegradable panels or hardware to reduce long-term ghost fishing mortality in lost or abandoned traps.
- Require crabbers to tend their traps within a specified amount of time and remove inactive traps from the water.
- Include crab fishermen in derelict crab trap cleanups, focusing specifically on fishermen that use the area designated for cleanup.
- Use side scan sonar to survey the water bottom and locate derelict traps without visible floats.
- During derelict crab trap cleanups, document gear license numbers from retrieved crab traps. Send a warning and/or impose a penalty for repeat offenders.

Future Research & Data Needs

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

Specific research projects are listed below. Additional research needs are listed in West et al. 2014 and Guillory et al. 2001.

- Estimates of total mortality from all sources for use in stock assessments. Currently, stock assessments are only able to account for natural mortality, fishing mortality from the commercial fishery, and derived fishing mortality from recreational fishery. A better understanding of mortality from other sources such as ghost fishing, bycatch of undersized crabs, and bycatch in other fisheries as well as obtaining harvest data from the recreational fishery would allow the assessment to consider total mortality.
- Development of predictive models that take into account an understanding of predator-prey relationships between blue crabs and other estuarine organisms, especially how predation and food availability influence blue crab population dynamics. Also, development of models than can evaluate the potential ecosystem impacts of fishery removals of blue crabs and of invasive species. These models would be useful to inform managers and help industry plan for the future.
- Understanding of the relationship between changing habitats and continued production of the Louisiana blue crab fishery, including the impacts of altered salinity regimes on juvenile blue crab nursery grounds as well as the impacts of marsh loss and various marsh management regimes on blue crab populations, specifically recruitment and availability to the fishery.
- Statistical sampling of commercial harvest, including size composition, sex distribution, and more detailed information on effort (e.g. soak time, number of traps run, etc.), in a framework consistent with other commercial sampling (e.g. Fisheries Information Network (FIN) program).
- Analysis of the demographics of commercial crabbers in Louisiana such as age, ethnicity, years fishing, fishing income, gender, education, and if they also operate as a dealer.
- Develop a recreational creel survey to characterize harvest rates, size composition, sex distribution, and catch by habitat type. This will allow for a more accurate estimation of recreational blue crab harvest for the blue crab stock assessment.
- Studies to determine migration patterns and fishing mortality.

RESEARCH PRIORITIES, FUNDING AND PUBLICATION

LDWF prioritizes future research according to several factors, including the following:

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

Research is funded through state license fees and federal grants and programs; funding is allocated based on priority as described above.

LDWF analyzes all research and reports results in multiple formats, as appropriate. Ultimately, all information is publicly available (other than information linked to private enterprises, i.e. confidential landings data).

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Appendices

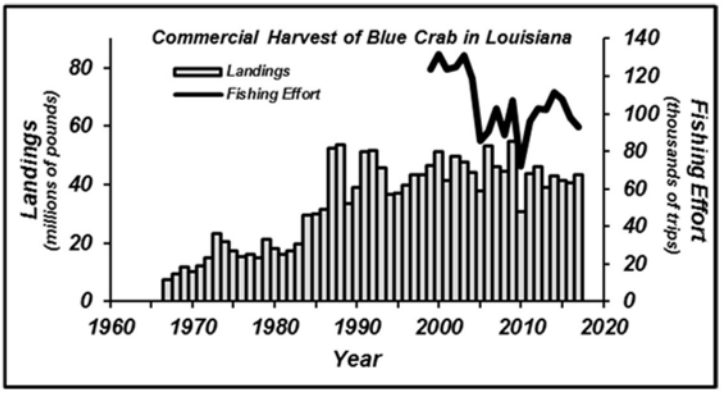
APPENDIX I.
Update Assessment of Blue Crab in Louisiana Waters, 2019 Report

Update Assessment of Blue Crab in Louisiana Waters
2019 Report

Executive Summary

- Based on results of this assessment update, the Louisiana blue crab stock is currently not overfished or exceeding the exploitable biomass target, but was considered overfished in 1995, 2013, and 2015. Further, the stock is currently not experiencing overfishing or exceeding the fishing mortality target.

- Commercial landings of blue crab in Louisiana have remained above 40 million pounds per year since 1997 with the exception of 2005, 2010, and 2013. The highest reported landings were 53.7 and 55.0 million pounds harvested in 1988 and 2009, respectively.



- This assessment update is based on a Collie-Sissenwine or catch-survey analysis and results in estimates of exploitable biomass and recruitment of the Louisiana blue crab stock, 1968-2018. Annual fishing mortality is estimated, but is not available for the last year of the time-series. This assessment model has been extensively used in crustacean stock assessments. Data requirements include a time-series of observed landings and corresponding abundance indices for juvenile and exploitable life stages. Indices of abundance are derived from the Louisiana Department of Wildlife and Fisheries fishery-independent marine inshore trawl survey. Landings are taken from National Marine Fisheries Service statistical records, 1968-1998, and the Louisiana Department of Wildlife and Fisheries Trip Ticket Program, 1999-2018.

- In an earlier assessment (West et al. 2011), explicit limits and targets of fishing were proposed as conservation standards to ensure sustainability of the Louisiana blue crab resource. The Louisiana Wildlife and Fisheries Commission adopted a resolution on February 6, 2014 establishing the following policy based on the proposed limits and targets of fishing: "Should the fishing mortality or exploitable biomass exceed the overfished or overfishing limits, or exceed the targets for three consecutive years, as defined in the most current Louisiana blue crab stock assessment, LDWF shall come before the Commission with an updated assessment and a series of management options for the Commission to review and act upon, intended to keep the fishery from becoming overfished, and that management options for review and action shall include provisions for emergency closures, time based closures, and spatial closures."

- In the 2016 assessment update (West et al. 2016), the Louisiana blue crab stock was identified as overfished. Based on that status, the Louisiana Legislature and the Wildlife and Fisheries Commission took actions to reduce harvest. Management actions included: legislation to modify escape rings and to expand crab trap cleanup abilities; commission rule to ban harvest of immature females, allow seasonal closures of all crab harvest in 2017, and allow seasonal closure of female crab harvest in 2018 and 2019. This update assessment is intended to explore the response of the blue

crab stock to recent environmental conditions and the effectiveness of those management actions enacted.

Summary of Changes from Previous Assessment

- Assessment model inputs have been updated through 2018. A correction was made to the assessment model in this update. Recruit abundance is estimated in the time-series terminal year by using the observed relative abundance of juvenile crabs. In the previous assessment update (West et al. 2018), the observed relative abundance of juvenile crabs was also used to generate the recruit abundance estimates in 2015 and 2016 rather than model predicted relative abundance. This correction increased the 2015 and 2016 recruit abundance estimates and lowered the corresponding fishing mortality rate estimates from above the fishing mortality target to below. This correction had no effect on the 2015 and 2016 exploitable biomass estimates.

Update Assessment of Blue Crab in Louisiana Waters
2019 Report

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Table of Contents

1. Introduction

A catch-survey or Collie-Sissenwine analysis (Collie and Sissenwine, 1983) is applied to the Louisiana (LA) blue crab *Callinectes sapidus* stock. This model balances the number of individuals from one life stage to the next (i.e., juveniles to exploitable sizes) given constant natural mortality, while scaling these values to harvest. Data requirements are a time-series of observed landings and corresponding abundance indices for juvenile and adult life stages. Indices of abundance are derived from the Louisiana Department of Wildlife and Fisheries (LDWF) fishery-independent marine inshore trawl survey. Landings are taken from National Marine Fisheries Service (NMFS) statistical records, 1968-1998, and the LDWF Trip Ticket Program, 1999-2018.

1.1 Regulations

The Louisiana blue crab fishery and its industry are governed by the Louisiana State Legislature, the Wildlife and Fisheries Commission, and the Department of Wildlife and Fisheries. The Louisiana commercial blue crab fishery is currently regulated with a minimum size limit (i.e., a minimum carapace width of 5 inches) in addition to gear restrictions. Recreationally caught blue crabs are not subject to a minimum size limit. No bag and possession limits exist for the recreational and commercial fisheries.

In the 2016 assessment update (West et al., 2016), the Louisiana blue crab stock was identified as overfished. Based on that status, the Louisiana Legislature and the Wildlife and Fisheries Commission took actions to reduce harvest as described below.

Regulations were enacted by the Wildlife and Fisheries Commission protecting commercially landed immature female blue crabs from harvest provisionally from 2017 through 2019 except when in a pre-molt stage being held for processing as a soft-shell crab. In September 2018, the prohibition on the commercial harvest of immature female blue crabs was made permanent. Additional regulations were also enacted for a seasonal closure of all crab harvest in 2017 (30-day period beginning on 3rd Monday in February) and seasonal closures of all female crab harvest in 2018 and 2019 (March 1st through April 30th).

Legislation that become effective November 2017 modified escape ring requirements where each crab trap must now have a minimum of three escape rings that are 2-3/8 inches in inside diameter or larger. Legislation enacted in 2016 expanded crab trap cleanup abilities where at any time crab harvest is closed for biological or technical reasons, the Wildlife and Fisheries commission may prohibit the usage of crab traps for the duration of the closure. Additional legislation was enacted in 2018 allowing the Wildlife and Fisheries Commission to determine the disposition of abandoned crab traps removed from a closed area. This modification will allow future programs to be established, such as trap recycling or buyback programs.

1.2 Trends in Harvest

Trends in harvest were reviewed in the earlier assessment report (West et al. 2011). The time-series of annual LA commercial hard crab landings used in this assessment (1968-2018) is presented (Table 1, Figure 1).

2. Data Sources

2.1 Fishery Dependent

Louisiana blue crab commercial harvest is derived from NMFS statistical records, 1968-1998, and the LDWF Trip Ticket program, 1999-2018 (Table 1). A time-series of recreational harvest records currently does not exist. Guillory (1999b) estimates the recreational harvest rate as 4.1% of the reported commercial harvest in a survey of the recreational blue crab fishery in Terrebonne Parish, LA.

2.2 Fishery Independent

Blue crab abundance indices are derived from the LDWF fishery-independent marine inshore 16-foot trawl survey. This survey is primarily used to sample peniad shrimp, blue crabs, and bottomfish in inshore bays and lakes. Sampling gear is a 4.9m flat otter trawl with a body and cod-end consisting of 19mm and 6.4mm bar meshes, respectively. Samples are 10 minute tows. All captured crabs are enumerated and a maximum of 50 randomly selected crabs per sample are measured (in 5mm CW bins). When more than 50 crabs are captured, catch-at-size is derived as the product of total catch and proportional subsample-at-size.

The survey has been conducted from 1967 to present at fixed sampling locations. In October of 2010, additional fixed sampling locations were added to this survey. To alleviate time-series bias associated with addition of these new stations, relative abundance time-series used in this assessment are constructed by retaining only the long-term stations for analysis.

Abundance indices are developed for life stages relative to the fishery. These include: 1) adult or exploitable crabs (i.e., ≥125mm CW), 2) juveniles or crabs that will recruit to the fishery during the survey year (i.e., by December 31st), and 3) young-of-the year or crabs that will not recruit to the fishery during the survey year (Tables 2-4). Due to size selectivity of the survey gear, crabs <25mm CW are excluded from index development. Crabs that will not recruit to the fishery during the survey year are identified by seasonal growth functions (see *Growth* section).

Mean catch-per-tow and its variance are calculated by assuming a delta-lognormal distribution. This method is appropriate for log-normally distributed survey datasets when a proportion of zero catches occur (Pennington, 1983; Pennington, 1996). In this case, the means are the product of the proportion of positive catches (assuming a binomial error structure) and the geometric mean catch-per-unit effort of successful trips (assuming a lognormal error structure). Its variance is approximated as:

$$Var(XY) \approx \mu_Y^2\sigma_X^2 + \mu_X^2\sigma_Y^2 + 2\mu_X\mu_Y\rho\sigma_X\sigma_Y \quad [1]$$

where μ_Y is the binomial mean proportion of positive catches, μ_X is the geometric mean catch-per-unit-effort of successful tows, σ_Y^2 and σ_X^2 are the respective variances, and ρ is the correlation between X and Y.

3. Life History Information

Guillory et al. (1996) summarized literature and data on the biology and ecology of blue crabs in a source document for the management of the Louisiana blue crab fishery. In addition to describing the fishery and commenting on research needs, the authors described blue crab taxonomy and nomenclature; larval, juvenile and adult morphology; distribution and abundance; habitat utilization; reproduction; age and

growth; trophic relationships; behavior; movement and migration; pathology and parasitology; environmental tolerances; recruitment mechanisms; and mortality.

In "The Blue Crab Fishery of the Gulf of Mexico, United States: A Regional Management Plan", Guillory et al. (2001) developed a broad and comprehensive document addressing all relevant aspects of blue crab biology and the fishery. In addition to describing stock habitat, fishery management jurisdiction, economic and sociocultural characteristics of the fishery, management considerations/recommendations, and research needs, the authors provided detailed information on blue crab life history, including: geographic distribution; classification, morphology and genetic characterization; age, growth and maturation; reproduction; stock-recruitment relationship; larval development, distribution and abundance; megalopal settlement and recruitment; juvenile development, distribution and abundance; seasonal and areal distribution; factors influencing survival; parasites and diseases; food habits; predator/prey relationships; interspecific and intraspecific predation; foraging behavior; larval, juvenile and adult behavior; autonomy; and movements/migrations. This document was updated in 2015 by the Blue Crab Technical Task Force of the Gulf States Marine Fisheries Commission.

3.1 Unit Stock Definition

Adult blue crabs in the northern Gulf of Mexico (GOM) generally remain within one estuary for life. Females, however, migrate to higher salinity nearshore waters to spawn, where larvae are then dispersed offshore via tidal transport (Guillory et al. 2001). Recruitment and settlement of larvae into northern GOM estuaries as megalopae is likely influenced by wind and tidal circulation processes (Perry et al. 1995). Stock mixing between estuaries (and states) is very probable given these larval transport mechanisms. Nonetheless, blue crab landings from the northern Gulf of Mexico (GOM) are primarily of Louisiana origin.

For purposes of this assessment the blue crab unit stock is defined as those crabs occurring in LA waters. This approach is consistent with the current non-regional or statewide management strategy.

3.2 Maturity

Carapace width (CW) at maturity is reported by Guillory and Hein (1997a) for blue crabs from the Terrebonne Basin, LA. Males and females reached 50% sexual maturity at 110mm and 125mm CW, respectively. The CW-at-50% sexual maturity for female crabs corresponds with the minimum size limit of the LA commercial blue crab fishery (i.e., 127mm CW). Males and females reached 100% sexual maturity at 130mm and 160mm CW, respectively.

3.3 Growth

Blue crabs exhibit a discontinuous growth pattern; where growth occurs during the molting process (Guillory et al., 2001). Continuous growth models, however, are used to describe blue crab growth (Helser and Kahn, 2001; Pellegrin et al., 2001; Rugolo et al., 1998; Smith, 1997). In this assessment, Gompertz growth functions developed in the earlier LDWF crab assessment (West et al. 2011) are used to describe LA blue crab growth. The Gompertz model is configured as:

$$CW_t = CW_\infty e^{\alpha(e^{\beta t})} \quad [2]$$

where CW_t is CW-at-age, CW_∞ is the asymptotic average maximum CW, and α and β are constant growth coefficients. The seasonal and non-seasonal parameter estimates are presented in Table 5.

A monthly size-at-capture matrix is developed from the seasonal growth functions (Table 6) to identify crabs that will not recruit to the fishery during the survey year (i.e., by December 31st). This matrix represents CW-at-capture of monthly crab cohorts and implies variation in CW-at-age is primarily due to time of hatching. Carapace widths of crabs not fully-recruited to the trawl gear (i.e., < 25mm CW) are excluded. Rows represent monthly cohorts (or seasonal growth trajectories), with the current year-class above the diagonal and the previous year-class below the diagonal. Columns represent months of the LDWF fishery independent trawl survey. As an example, blue crabs captured by the trawl survey in August that are ≤63mm CW (or the current year's March-August cohorts) are considered young-of-the year crabs. An obvious discrepancy exists for the survey month of June, where the previous years' December cohort is approximately the same size as the current years' March cohort. To account for this, young-of-the-year crabs are only identified from July-December captures.

3.4 Morphometrics

Carapace width-weight regressions were developed by Guillory and Hein (1997a) for blue crabs from the Terrebonne Basin, LA. For the purpose of this assessment, only the pooled (or non-sex specific) model is used. Blue crab weight at CW is calculated from:

$$W = 8.26 \times 10^{-4} CW^{2.446} \quad [3]$$

where W is weight in grams and CW is carapace width in mm.

3.5 Natural Mortality

Due to the difficulty of directly estimating instantaneous natural mortality (M) of blue crab, M is estimated based on assumptions of maximum age and the proportion of the stock surviving to the maximum age (Quinn and Deriso, 1999). Reported maximum age of blue crab along the Atlantic Coast range from 3-6 years (Kahn and Helser, 2005; Miller et al., 2005; Murphy et al., 2007). There are no longevity estimates for blue crab in the GOM (Guillory et al., 2001). Instantaneous natural mortality in this assessment is estimated as M=1.0, based on the assumption that approximately 5% of the stock remains alive to 3 years of age.

3.6 Relative Productivity/Resilience

Productivity is a function of fecundity, growth rates, natural mortality, age of maturity, and longevity and can be a reasonable proxy for resilience. We characterize the relative productivity of GOM blue crab based on life-history characteristics, following methods described in SEDAR 9 (SEDAR, 2006), 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 7). Each life history characteristic (von Bertalanffy growth rate, age at maturity, longevity, and natural mortality rate) was assigned a rank (low=1, medium=2, and high=3) and then averaged to compute an overall productivity score. Parameter estimates are taken from West et al. (2011) and VanderKooy (2013). In this case, the overall productivity score is 3.0 for GOM blue crab indicating high productivity and resilience.

4. Assessment Model

A catch-survey (CS) or Collie-Sissenwine analysis (Collie and Sissenwine, 1983) is used in this assessment to describe the dynamics of the LA blue crab stock. The CS modeling approach is intended for data moderate situations where a full age structure is lacking. Model requirements include: 1) annual abundance indices for juvenile and adult life stages, 2) annual harvest estimates as individuals, 3) an estimate of instantaneous natural mortality, and 4) the relative selectivity of the juvenile and adult life stages to the survey gear.

4.1 Catch-Survey Model Configuration

The CS model is based on the modified Delury discrete difference equation (Collie and Sissenwine, 1983):

$$N_{y+1} = (N_y + R_y - C_y)e^{-M} \quad [4]$$

where y is the fishing and survey year (i.e., January 1st through December 31st), N_y is the abundance of adult crabs in that year, N_{y+1} is the abundance of adult crabs in the following year, R_y is the abundance of juveniles, C_y is harvest as individuals, and M is the constant natural mortality rate. To approximate landings occurring throughout the year, the model equation is reconfigured as:

$$N_{y+1} = \left[\left(N_y + R_y\right)e^{-0.50M} - C_y\right]e^{-0.50M} \quad [5]$$

where juvenile and adult crabs are reduced by a half year of natural mortality before the catch is removed. Remaining survivors from the fishery are then reduced by another half year of natural mortality.

Survey indices of abundance are scaled to absolute abundance as:

$$n_y = q_n N_y e^{\eta_y} \text{ and } r_y = q_r R_y e^{\delta_y} \quad [6, 7]$$

where r_y and n_y are the observed abundance indices of juvenile and adult blue crabs, q_r and q_n are the respective catchabilities of the survey gear for juvenile and adult crabs, and e^{δ_y} and e^{η_y} are the log-normally distributed observation errors for the juvenile and adult abundance indices. Reconfiguring the model equation by substituting abundance indices for absolute abundance and incorporating lognormal process error e^{ε_y} yields:

$$n_{y+1} = \left[\left(n_y + \frac{r_y}{s_r}\right)e^{-0.50M} - q_n C_y\right]e^{-0.50M}e^{\varepsilon_y} \quad [8]$$

where $s_r = \frac{q_r}{q_n}$ is the relative selectivity of juveniles to adult crabs in the sampling gear. Log-normal process error e^{ε_y} is taken as the difference between n_y calculated from equations [6] and [8]. Equation [8] is solved iteratively by minimizing the following objective function:

$$SSQ(\Theta_{CS}) = \lambda_\varepsilon \sum_{y=2}^{Y} \varepsilon_y^2 + \sum_{y=1}^{Y} \eta_y^2 + \lambda_\delta \sum_{y=1}^{Y-1} \delta_y^2$$

[9]

where Θ_{CS} is the parameter vector and λ_ε and λ_δ are user-defined weights of the process and juvenile observation error relative to the adult observation error. Thus, $2Y$ parameters are estimated: n_y for all years, r_y for all years except the terminal year, and q_n. Given these estimates, absolute abundances are estimated from the following:

$$R_y = \frac{\hat{r}_y}{s_r \hat{q}_n} \text{ and } N_y = \frac{\hat{n}_y}{\hat{q}_n} \quad [10, 11]$$

where $\hat{r}_y$ and $\hat{n}_y$ are the model estimated abundance indices of juvenile and adult crabs, respectively, and $\hat{q}_n$ is the model estimated catchability of adult crabs to the survey gear. Recruit abundance is estimated in the terminal year by using observed r_y.

4.2 Fishing Mortality Estimation

Annual estimates of instantaneous total mortality are derived from the following survival ratio:

$$Z_y = log_e\left[\frac{N_y + R_y}{N_{y+1}}\right] \quad [12]$$

Estimating annual instantaneous fishing mortality F_y from $Z_y - M$ would include R_y (or crabs not available to the fishery) into the fishing mortality calculation. Because harvest occurs concurrently with M in this fishery (i.e., type II fishery; Ricker, 1975) and to avoid additional bias from $F_y = Z_y - M$, we estimate F_y from the following rearrangement of Baranov's catch equation:

$$F_y = \frac{u_y Z_y}{1 - e^{-Z_y}} \quad [13]$$

where annual exploitation is estimated as:

$$u_y = \left[\frac{C_y}{(R_y + N_y)}\right] \quad [14]$$

4.3 Biomass Conversions

Annual size distributions of Louisiana blue crab landings currently do not exist. Due to this lack of fishery dependent information, annual size distributions of blue crab captured from the LDWF FI marine inshore trawl survey are used as proxies to describe the annual size compositions of blue crab landings (see *Research and Data Needs*).

Annual landings in biomass are converted to individuals as:

$$C_y = H_y / \bar{W}_{y,\geq 125mm} \quad [15]$$

where C_y is annual harvest as individuals, H_y is annual harvest as biomass, and $\bar{W}_{y,\geq 125mm}$ are annual mean weights of adult blue crab catches derived from the LDWF FI marine inshore trawl survey (Table 8).

Model estimated abundance is converted to biomass as:

$$B_y = R_y \bar{W}_{y,<125mm} + N_y \bar{W}_{y,\geq 125mm} \quad [16]$$

where B_y is total annual biomass, R_y and N_y are model estimated annual abundances of juvenile and adult crabs, and $\bar{W}_{y,<125mm}$ and $\bar{W}_{y,\geq 125mm}$ are annual mean weights of juvenile and adult blue crab catches derived from the LDWF FI marine inshore trawl survey (Table 8).

4.4 Model Inputs / Assumptions

Catch-survey model assumptions are: 1) the stock is closed to migration, 2) natural mortality occurs at a constant rate, and 3) all surviving recruits will grow into the fully-recruited stage within the model year. Survey indices of abundance are assumed proportional to absolute abundance. Crabs greater than 25mm CW are assumed equally vulnerable to the survey gear implying s_r=1.0. Relative weights λ_ε and λ_δ are fixed as 1.0 in this assessment.

Louisiana blue crab harvest is derived from commercial hard crab landings, which include: NMFS statistical records, 1968-1998, and the LDWF Trip Ticket Program, 1999-2018 (Table 1). Commercial hard crab landings as individuals are expanded by 5% to approximate for recreational harvest. This rate is consistent with Guillory's (1999b) survey of the recreational blue crab fishery in Terrebonne Parish, LA.

Through simulation analysis, Mesnil (2003) demonstrates how staging error (i.e., analogous to aging error in a VPA) can bias estimates of absolute abundance and recommends "carefully allocating members to either stage". Individuals that will not recruit to the fishery during the survey year are accounted for by reconfiguring r_y as the sum of the young-of-the-year index in year and the juvenile index in year+1 (Table 9). This creates an index where all surviving recruits will recruit to legal-size within the survey year.

4.5 Model Results

The assessment model provides reasonable fits to the adult and juvenile abundance indices (Figures 2-4); however, patterning of the residuals is apparent in the more recent years of the time-series where model predictions of adult relative abundance are consistently underestimated and model predictions of juvenile relative abundance are consistently overestimated. The juvenile index suggests a considerable decline over the latter half of the time-series examined. The assessment model tracks this decline, but underestimates its magnitude suggesting additional processes aren't captured by the assessment model (e.g. temporal, spatial, and/or environmental; see *Research and Data Needs* Section).

The catchability coefficient is estimated as $\hat{q}_n$ =0.0045 in this assessment. Annual exploitable (adult) biomass estimates range from 16 to 97 million pounds (Table 10, Figure 5). The 2018 exploitable biomass estimate is 40 million pounds. Exploitable biomass levels generally decline after 1990, where estimates from previous years were rarely below 40 million pounds. Increases in exploitation during the 1990s coincide with this decline (Figure 6). A large population response is evident in the years following the passages of Hurricane Katrina and Rita which caused a substantial reduction in the directed effort and supporting infrastructure of the Louisiana commercial blue crab fleet. These storms also provided optimum environmental conditions for settlement of megalopae and young crabs into Louisiana estuaries via storm surge and likely enhanced recruitment.

Juvenile abundance estimates range from 169 to 602 million individuals (Table 10, Figure 5) and exhibit a considerable decline over the latter half of the time-series examined. The nine most recent juvenile abundance estimates are the lowest on record with the exception of the 1976 estimate. The 2018 juvenile

abundance estimate (169 million individuals) is the lowest on record. Additionally, in the last twenty years only one juvenile abundance estimate is above the time-series average and in the most recent decade no estimates are above the time-series average (Figure 7). It's important to point out here the consequence of this decline on management reference point estimation. Because equilibrium conditions (i.e., average recruitment) are assumed in reference point estimation, biomass-based management benchmarks will generally be biased when below average conditions persist for extended time periods.

Annual instantaneous fishing mortality estimates range from 0.07-0.88, with peaks in exploitation occurring in 2002, 2012 and 2014 (Table 10, Figure 8). Trends in fishing mortality estimates, 1999-2017, are generally consistent with fishing effort (i.e., trap fisher trips) derived from the LDWF Trip Ticket Program (Figure 8). A large reduction in fishing mortality/effort was observed in the years following the passages of Hurricane Katrina and Rita. Fishing effort is not used in the assessment model but is presented here to validate trends in fishing mortality. However, the number of trap fisher trips may not be a suitable measure of fishing effort (specifically for catch per unit effort analysis) if the number of traps fished per trip increases (or decreases) through time and should be considered with caution.

A downward trend has become apparent between exploitable biomass and subsequent recruitment (Figure 9). With one exception, the two most recent decades of data pairs are all below the recruitment time-series average and are some of the lowest adult biomasses observed.

4.6 Management Benchmarks

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

Precautionary limits to fishing were established in an earlier assessment (West et al. 2011) by requiring that exploitable biomass not fall below the three lowest levels observed (1968-2009) where the stock demonstrated sustainability (i.e., no observed declines in recruitment over a wide-range of exploitable biomasses). This is equivalent to maintaining the stock above a limit spawning potential ratio (SPR; Goodyear, 1993). The method for calculating SPR_{limit} or equivalently SSB_{limit} is presented below.

Equilibrium recruitment (under current biomass) is assumed as the average recruitment $\bar{R}$, 1968-2017. This is the horizontal line in Figure 10. Exploitable biomass (i.e., crabs ≥125mm) is used as a measure of spawning stock biomass (SSB). When the stock is in equilibrium, equations [5, 12, and 13] can be rearranged excluding the year index into SSB/R for any given exploitation rate as:

$$\frac{SSB}{R}|F = \sum_a p_{Na} W_a \times \frac{e^{-M-F/Z(1-e^{-Z})e^{-0.5M}}}{1-[e^{-M-F/Z(1-e^{-Z})e^{-0.5M}]}} \quad [17]$$

where a are ages in months ($a = 1\ to\ 36$), p_{Na} is the proportional equilibrium abundance of crabs ≥125mm (see below), W_a is the average weight-at-age, and M, F, Z are the instantaneous natural, fishing and total mortality rates. Equilibrium abundance-at-age is estimated as:

$$N_a = \bar{R} S_a \quad [18]$$

where survivorship is calculated recursively from $S_a = S_{a-1}e^{-Z_a}$, $S_1 = 1$. Size-at-age, vulnerability-at-age v_a (i.e., knife-edged selection for ages ≥125mm) and resulting monthly mortality vectors (i.e., $Z_a = M/12 + F_a$ and $F_a = v_a F/12$) are derived from the non-seasonal Gompertz growth parameters (Table 5). To approximate changes in growth through the age interval, size-at-age is calculated using the midpoints of the months. Equilibrium N_a of exploitable sized crabs is normalized to 1 as $p_{Na}=\frac{N_{a\geq 125mm}}{\sum_a N_{a\geq 125mm}}$.

If the biomass limit is chosen as the geometric mean of the three lowest exploitable biomasses observed (1968-2009), then the recruitment per SSB (R/SSB_{limit}) that is equivalent to the biomass limit is the slope of the diagonal line from the origin that intersects equilibrium recruitment at SSB_{limit}. This is the left-most diagonal line in Figure 10; unfished recruits per SSB ($R/SSB_{F=0}$) is a slope equivalent to the rightmost diagonal line.

The equilibrium SPR corresponding with the exploitable biomass limit is:

$$SPR_{limit} = \frac{R/SSB_{F=0}}{R/SSB_{limit}} \quad [19]$$

and is estimated to be 21.0%. This is equivalent to specifying SSB_{limit} equal to the average of the three years with the lowest biomasses (1968-2009) in which the stock demonstrated sustainability. Additionally, equations [17, 19] are solved for the fishing mortality rates that correspond with the SPR_{limit} and a SPR_{target} discussed below.

Overfishing, Overfished, and Target Definitions

The existing Louisiana blue crab data does not allow reliable estimates of MSY. Therefore, we have defined a limit based upon the history of the fishery as defined above (i.e., a 21.0% SPR_{limit}). The fishing mortality rate limit F_{limit} and SSB_{limit} that are equivalent to this SPR_{limit} are estimated as 0.93 $years^{-1}$ and 19.4 million pounds, respectively (Table 11).

The targets of fishing, (i.e., SSB, F, and SPR) should not be so close to the limits that the limits are exceeded by random variability of the environment. Therefore, the biomass target reference point SSB_{target} is defined as SSB_{limit}× 1.5, or 29.1 million pounds. This biomass is achieved when there is an equilibrium SPR_{target} of 31.5% and F_{target} of 0.70 $years^{-1}$ (Table 11).

5. Stock Status

The history of the Louisiana blue crab stock relative to the reference points described above is illustrated in Figures 11 and 12. Fishing mortality rates exceeding F_{limit} (or ratios of $F/F_{limit}>1.0$) indicate overfishing; stock biomasses below SSB_{limit} (or ratios of $SSB/SSB_{limit}<1.0$) indicate an overfished condition.

Overfishing Status

The 2017 estimate of F/Flimit is 0.60 suggesting the stock is not currently experiencing overfishing. The 2017 fishing mortality rate estimate is also below its target. Estimates of fishing mortality are not available for the terminal year of the assessment.

Overfished Status

The 2018 estimate of SSB/SSBlimit is 2.05, suggesting the stock is currently not in an overfished condition. The 2018 SSB estimate is also above its target. The stock was considered overfished in 1995, 2013, and 2015.

Control Rule

The Louisiana Wildlife and Fisheries Commission adopted a resolution on February 6, 2014 establishing the following policy based on the overfishing and overfished limits and targets of fishing described above: "Should the fishing mortality or exploitable biomass exceed the overfished or overfishing limits, or exceed the targets for three consecutive years, as defined in the most current Louisiana blue crab stock assessment, LDWF shall come before the Commission with an updated assessment and a series of management options for the Commission to review and act upon, intended to keep the fishery from becoming overfished, and that management options for review and action shall include provisions for emergency closures, time based closures, and spatial closures."

In an earlier assessment update (West et al., 2016), the Louisiana blue crab stock was identified as overfished. Based on that status, the Louisiana Legislature and the Wildlife and Fisheries Commission took actions to reduce harvest. This update assessment is intended to be the second measure of the effectiveness of those management actions enacted.

7. Research and Data Needs

Research emphasis on the Louisiana blue crab fishery is lacking, particularly in consideration of the value and size of the fishery (Guillory et al. 1996). The authors suggest that blue crab research done on the Atlantic coast may not be applicable to Gulf of Mexico populations. Based on this assessment, the following research and data needs are identified as priorities for future assessment of the Louisiana blue crab stock.

Due to the rapid growth and short life span of blue crab an annual time-step in the assessment model may not adequately describe the population dynamics of blue crab. Future assessment modeling efforts should explore finer temporal scales.

Environmental factors influencing year-class strength and the survival of recruits to exploitable life stages are not well understood. Further analysis of these factors could elucidate the link between the environment and blue crab productivity. Contributing factors could also be used in development of predictive models allowing for short-term forecasts for resource managers and industry.

In addition to research specific to the Louisiana blue crab stock, continuous fishery dependent monitoring programs, as part of a comprehensive monitoring plan, are needed. Differences in exploitation rates of male and female blue crabs likely exist. Continuous information on size and sex distributions of the commercial and recreational harvest are not available. Continuous harvest data for the recreational sector is also lacking. These data would reduce the number of assumptions required in future assessments.

The magnitude of blue crab catch in the trawl fishery and the associated mortality is currently unknown. In this assessment, this mortality was assumed negligible. Future estimates of blue crab catches in trawls and the mortality induced would reduce the number of assumptions required in future assessments.

Commercial effort data is currently only available in terms of the number of trips taken. A more useful measure of effort that could improve future blue crab stock assessment and management is the number of traps fished by basin/season/region.

Estimates of natural mortality in this assessment are based on assumptions of longevity. Without the ability to directly age blue crabs with conventional methods, growth estimation and resulting longevity estimates remain difficult to quantify. Estimates of these life history parameters for the Louisiana blue crab stock, perhaps from tagging or pond studies, would aid in refining life history assumptions in future assessments.

Assessment of regional or basin-specific sub-populations could differentiate exploitation rates and stock status within the state. If available data is adequate for regional assessment, results could be used to determine if regional management is an effective alternative to optimize yield within the state.

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

With the recent trend toward ecosystem-based assessment models, more data is needed linking blue crab population dynamics to environmental conditions. The addition of environmental data coupled with food web data may lead to a better understanding of the blue crab stock and its habitat.

Fishery dependent data alone is not sufficient to accurately assess stock status and trends in abundance. Consistent fishery independent monitoring, in addition to fishery dependent monitoring, are integral components of this ability. Present monitoring programs should be assessed for adequacy with respect to their ability to evaluate stock status and should be modified or enhanced to optimize their capabilities.

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10. Tables

Table 1: Louisiana blue crab *Callinectes sapidus* landings and dockside value (1968-2018). Landings and values, 1968-1998, are taken from NMFS statistical records. Landings and values, 1999-2018 (shaded values), are taken from the LDWF Trip Ticket Program. Landings are millions of pounds. Values are millions of dollars.

	Total		Hard crab		% Hard crabs		Soft/peeler		% Soft/peeler	
Year	Landings	Value	Landings	Value	Landings	Value	Landings	Value	Landings	Value
1968	9.83	1.01	9.55	0.81	97.11	79.64	0.28	0.21	2.89	20.36
1969	11.80	1.23	11.60	1.07	98.33	86.93	0.20	0.16	1.67	13.07
1970	10.34	1.01	10.25	0.93	99.13	92.11	0.09	0.08	0.87	7.89
1971	12.31	1.38	12.19	1.26	98.97	90.90	0.13	0.13	1.03	9.10
1972	15.18	1.89	15.08	1.78	99.33	94.21	0.10	0.11	0.67	5.79
1973	23.20	2.94	23.08	2.81	99.48	95.53	0.12	0.13	0.52	4.47
1974	20.74	2.83	20.64	2.70	99.54	95.51	0.10	0.13	0.46	4.49
1975	17.25	2.67	17.14	2.51	99.36	94.18	0.11	0.16	0.64	5.82
1976	15.30	3.21	15.21	3.06	99.42	95.48	0.09	0.14	0.58	4.52
1977	16.38	4.33	16.15	3.77	98.63	86.86	0.22	0.57	1.37	13.14
1978	15.21	3.47	15.07	3.19	99.13	92.04	0.13	0.28	0.87	7.96
1979	21.48	5.11	21.33	4.78	99.32	93.40	0.15	0.34	0.68	6.60
1980	18.30	4.60	18.18	4.33	99.35	94.06	0.12	0.27	0.65	5.94
1981	16.34	4.71	16.24	4.47	99.39	94.94	0.10	0.24	0.61	5.06
1982	17.45	5.28	17.28	4.84	99.06	91.82	0.16	0.43	0.94	8.18
1983	19.72	6.66	19.62	6.37	99.49	95.64	0.10	0.29	0.51	4.36
1984	29.69	8.40	29.62	8.19	99.75	97.58	0.08	0.20	0.25	2.42
1985	29.93	8.59	29.85	8.39	99.73	97.68	0.08	0.20	0.27	2.32
1986	31.69	9.48	31.61	9.30	99.75	98.09	0.08	0.18	0.25	1.91
1987	52.48	20.51	52.34	20.13	99.74	98.19	0.14	0.37	0.26	1.81
1988	53.72	21.89	53.55	21.45	99.70	97.99	0.16	0.44	0.30	2.01
1989	33.56	15.20	33.39	14.78	99.49	97.23	0.17	0.42	0.51	2.77
1990	39.14	14.83	38.89	14.21	99.36	95.81	0.25	0.62	0.64	4.19
1991	51.29	17.77	51.09	17.47	99.61	98.32	0.20	0.30	0.39	1.68
1992	51.98	27.20	51.74	26.67	99.54	98.04	0.24	0.53	0.46	1.96
1993	45.95	24.47	45.85	24.04	99.79	98.26	0.10	0.43	0.21	1.74
1994	36.76	22.53	36.66	22.09	99.73	98.07	0.10	0.44	0.27	1.93
1995	36.97	29.54	36.91	29.05	99.86	98.36	0.05	0.48	0.14	1.64
1996	40.00	24.48	39.90	23.96	99.75	97.89	0.10	0.52	0.25	2.11
1997	43.53	27.74	43.44	27.14	99.80	97.86	0.09	0.59	0.20	2.14
1998	43.66	30.74	43.48	29.34	99.59	95.45	0.18	1.40	0.41	4.55
1999	46.66	26.18	46.35	25.46	99.33	97.25	0.31	0.72	0.67	2.75
2000	52.04	34.40	51.44	33.23	98.84	96.62	0.60	1.16	1.16	3.38
2001	41.87	32.05	41.46	30.98	99.04	96.66	0.40	1.07	0.96	3.34
2002	50.08	30.69	49.71	29.76	99.26	96.99	0.37	0.92	0.74	3.01
2003	48.09	33.63	47.70	32.60	99.20	96.94	0.38	1.03	0.80	3.06
2004	44.41	29.70	44.08	28.83	99.26	97.08	0.33	0.87	0.74	2.92
2005	38.12	27.41	37.90	26.83	99.42	97.89	0.22	0.58	0.58	2.11
2006	53.29	32.31	53.15	31.91	99.74	98.77	0.14	0.40	0.26	1.23
2007	46.20	35.77	46.00	35.22	99.56	98.45	0.20	0.55	0.44	1.55
2008	44.66	34.61	44.56	34.32	99.77	99.15	0.10	0.29	0.23	0.85
2009	54.99	38.43	54.78	37.89	99.62	98.59	0.21	0.54	0.38	1.41
2010	30.90	30.50	30.76	30.10	99.56	98.69	0.13	0.40	0.44	1.31
2011	43.97	36.91	43.78	36.32	99.57	98.41	0.19	0.58	0.43	1.59
2012	46.38	44.15	46.22	43.64	99.65	98.84	0.16	0.51	0.35	1.16
2013	39.22	51.65	39.08	51.24	99.64	99.20	0.14	0.41	0.36	0.80
2014	43.30	67.15	43.13	66.65	99.61	99.25	0.17	0.50	0.39	0.75
2015	41.47	58.43	41.28	57.88	99.55	99.07	0.19	0.55	0.45	0.93
2016	40.79	50.18	40.63	49.71	99.61	99.06	0.16	0.47	0.39	0.94
2017	44.11	54.72	43.98	54.33	99.72	99.28	0.12	0.39	0.28	0.72
2018	43.70	61.85	43.59	61.39	99.75	99.26	0.11	0.46	0.25	0.74

Table 2: Catch-per-unit-effort of adult blue crab *Callinectes sapidus*. Abundance indices are the delta-lognormal mean of fully-recruited crabs per tow from the LDWF fishery-independent marine trawl survey, 1967-2018. Adult crabs are≥125mm carapace width. Shaded areas represent the maximum of the monthly-cpue distributions.

Catch-per-unit- effort (adults)														
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**est**	**CV**
1967	1.4	0.3	1.4	0.8	1.1	1.6	1.6	1.1	0.9	0.6	0.4	0.7	0.9	0.5
1968	0.5	0.3	0.9	1.1	0.8	1.3	1.0	0.6	0.8	0.8	0.5	0.5	0.7	0.5
1969	0.3	0.2	0.4	0.9	0.7	1.2	0.9	0.9	0.7	0.8	0.6	1.4	0.7	0.6
1970	0.7	1.3	1.4	1.8	1.1	1.2	1.0	0.9	1.3	0.6	1.2	1.2	1.1	0.5
1971	0.6	0.7	1.3	1.1	1.8	1.7	1.5	1.3	0.8	0.6	0.6	0.9	1.1	0.5
1972	0.7	0.9	1.7	1.0	0.8	1.3	0.5	1.0	0.9	0.8	0.8	0.5	0.9	0.5
1973	0.2	0.4	0.6	0.7	1.3	1.2	1.8	1.2	0.8	0.9	0.8	0.6	0.9	0.5
1974	0.7	0.5	0.8	1.2	1.4	1.9	1.4	1.3	0.7	1.0	0.8	0.4	1.0	0.5
1975	0.8	0.5	0.5	0.6	0.7	1.1	1.9	0.9	0.6	0.5	0.5	0.3	0.8	0.5
1976	0.2	0.6	0.7	0.9	0.5	0.9	0.5	0.5	0.2	0.1	0.2	0.2	0.5	0.6
1977	.	0.1	0.3	0.1	0.2	0.6	0.5	0.7	0.2	0.6	0.6	0.7	0.4	0.7
1978	0.1	0.1	0.2	0.2	0.7	0.7	1.3	0.8	0.5	0.4	0.7	0.2	0.5	0.6
1979	0.1	0.2	0.6	0.5	0.4	1.4	1.4	0.9	0.9	0.9	0.7	0.4	0.8	0.5
1980	0.7	0.1	0.6	0.9	2.0	1.6	1.5	0.9	0.8	0.9	0.4	0.9	1.0	0.5
1981	0.1	0.2	0.5	0.4	1.0	1.8	1.2	1.2	1.0	0.9	0.6	0.3	0.9	0.5
1982	0.4	0.1	0.2	0.6	0.7	1.0	1.2	1.0	0.7	0.4	0.2	0.3	0.6	0.5
1983	0.3	0.3	0.2	0.3	0.4	0.9	1.4	1.1	0.8	0.4	0.2	0.5	0.6	0.5
1984	0.2	0.4	0.7	0.6	0.8	1.2	2.1	1.1	0.7	0.5	0.4	0.3	0.9	0.5
1985	0.2	0.3	0.6	0.9	1.4	1.4	1.3	0.6	0.5	0.5	0.5	0.4	0.8	0.5
1986	0.2	0.5	0.4	0.8	0.8	1.6	1.4	0.6	0.5	0.4	0.3	0.4	0.7	0.6
1987	0.4	0.3	0.2	0.5	0.9	1.1	1.0	0.6	0.5	0.3	0.3	0.3	0.6	0.6
1988	0.3	0.3	0.5	0.7	0.6	0.6	0.7	0.7	0.4	0.4	0.2	0.0	0.5	0.6
1989	0.1	0.1	0.2	0.1	0.5	1.2	0.8	0.7	0.4	0.3	0.1	0.1	0.4	0.6
1990	0.2	0.5	0.3	0.5	1.1	1.6	1.6	0.9	0.8	0.7	0.5	0.3	0.8	0.5
1991	0.6	0.5	0.5	0.7	1.0	1.4	1.0	0.9	0.4	0.3	0.2	0.2	0.7	0.5
1992	0.1	0.2	0.2	0.3	0.5	0.5	0.6	0.2	0.5	0.1	0.2	0.4	0.3	0.7
1993	0.1	0.1	0.1	0.1	0.3	0.8	0.9	0.5	0.5	0.4	0.3	0.1	0.4	0.6
1994	0.2	0.2	0.3	0.2	0.3	0.6	0.5	0.2	0.1	0.3	0.1	0.2	0.3	0.7
1995	0.2	0.1	0.1	0.1	0.2	0.3	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.9
1996	0.1	0.1	0.2	0.1	0.2	0.3	0.2	0.3	0.2	0.2	0.3	0.1	0.2	0.7
1997	0.1	0.1	0.0	0.1	0.2	0.6	0.5	0.3	0.3	0.4	0.3	0.2	0.3	0.7
1998	0.2	0.1	0.1	0.1	0.1	0.6	0.7	0.5	0.4	0.3	0.3	0.2	0.3	0.7
1999	0.1	0.2	0.2	0.2	0.4	0.7	0.8	0.6	0.1	0.2	0.1	0.1	0.3	0.6
2000	0.2	0.2	0.1	0.3	0.7	0.6	0.5	0.2	0.2	0.1	0.1	0.1	0.3	0.7
2001	0.0	0.1	0.1	0.0	0.1	0.4	0.5	0.3	0.3	0.2	0.3	0.1	0.2	0.8
2002	0.2	0.1	0.1	0.1	0.2	0.5	0.9	0.7	0.4	0.1	0.4	0.2	0.3	0.6
2003	0.1	0.1	0.1	0.1	0.2	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.2	0.7
2004	0.0	0.2	0.1	0.1	0.2	0.6	0.5	0.4	0.2	0.2	0.3	0.1	0.2	0.7
2005	0.2	0.1	0.1	0.0	0.1	0.7	1.1	1.3	1.4	0.6	0.7	0.6	0.5	0.5
2006	0.9	0.8	0.5	0.6	1.5	2.5	2.4	1.3	0.7	0.5	0.6	0.4	1.1	0.5
2007	0.4	0.3	0.3	0.3	0.3	1.0	1.1	0.9	0.5	0.4	0.2	0.2	0.5	0.6
2008	0.2	0.4	0.1	0.1	0.2	0.6	0.8	0.6	0.4	0.4	0.4	0.6	0.4	0.6
2009	0.6	0.4	0.2	0.2	0.7	1.3	1.4	0.6	0.3	0.3	0.3	0.2	0.5	0.6
2010	0.1	0.0	0.1	0.1	0.2	0.7	0.9	0.6	0.5	0.2	0.5	0.2	0.3	0.6
2011	0.2	0.1	0.1	0.3	0.5	0.9	1.1	0.5	0.3	0.5	0.4	0.2	0.5	0.5
2012	0.1	0.4	0.1	0.1	0.3	0.5	0.5	0.2	0.2	0.2	0.2	0.1	0.3	0.6
2013	0.2	0.1	0.0	0.1	0.1	0.4	0.4	0.1	0.2	0.3	0.2	0.1	0.2	0.7
2014	.	0.2	0.0	0.1	0.3	0.6	0.8	0.5	0.4	0.2	0.2	0.1	0.3	0.6
2015	0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.1	0.2	0.2	0.2	0.8
2016	0.1	0.1	.	0.2	0.2	0.6	0.7	0.5	0.5	0.3	0.4	0.2	0.3	0.7
2017	0.0	0.2	0.4	0.3	0.4	0.4	0.4	0.2	0.4	0.0	0.4	0.2	0.3	0.7
2018	0.2	0.2	0.2	0.2	0.6	1.1	1.3	0.4	0.4	0.3	0.4	0.2	0.5	0.5
est	0.3	0.3	0.3	0.3	0.5	0.9	0.9	0.7	0.5	0.4	0.4	0.3		
CV	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6		

Table 3: Catch-per-unit-effort of juvenile blue crab *Callinectes sapidus*. Abundance indices are the delta-lognormal mean of juvenile crabs per tow from the LDWF fishery-independent marine trawl survey, 1967-2018. Juveniles are crabs ≥25mm and <125mm carapace width that will grow to legal size during the survey year. Shaded areas represent the maximum of the monthly-cpue distributions.

Catch-per-unit- effort (juveniles)														
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**est**	**CV**
1967	1.8	1.0	2.6	3.0	3.9	2.5	1.6	0.8	0.5	0.2	0.1	0.1	1.0	0.4
1968	1.2	1.4	2.0	2.1	3.0	3.5	1.4	0.6	0.4	0.2	0.1	0.1	1.3	0.4
1969	1.1	1.6	1.7	3.1	2.3	2.5	0.6	0.5	0.5	0.2	0.1	0.2	1.6	0.4
1970	2.2	2.2	2.5	2.5	1.6	1.9	1.2	0.5	0.6	0.3	0.1	.	1.2	0.4
1971	2.1	2.1	4.1	2.6	4.8	3.1	1.9	0.6	0.2	0.1	0.0	0.1	1.5	0.3
1972	4.6	5.3	2.6	2.9	1.8	2.9	1.0	0.7	0.6	0.4	0.1	0.1	1.6	0.3
1973	1.8	2.2	1.8	2.1	5.0	2.9	2.0	0.9	0.7	0.3	0.1	0.1	1.6	0.3
1974	1.6	2.2	2.3	2.7	3.3	3.7	1.2	0.7	0.4	0.3	0.1	0.0	1.7	0.3
1975	2.1	1.8	1.8	1.4	2.3	2.1	1.6	0.6	0.3	0.2	.	0.0	1.3	0.4
1976	0.4	0.7	1.8	1.4	1.2	1.9	0.7	0.2	0.2	0.1	0.0	.	0.7	0.5
1977	0.6	1.8	1.5	1.1	1.6	1.6	0.5	0.3	0.1	0.3	0.1	.	0.8	0.5
1978	1.4	1.8	1.3	1.9	2.7	2.3	1.4	0.5	0.5	0.1	0.1	.	1.0	0.4
1979	1.9	2.4	5.5	2.1	2.3	6.4	2.9	1.3	1.3	0.4	0.2	0.1	2.1	0.3
1980	3.6	2.6	2.8	5.0	6.2	5.8	1.8	0.6	0.3	0.4	0.0	0.2	2.4	0.2
1981	1.0	1.3	1.7	2.4	5.3	5.0	1.4	0.8	0.8	0.4	0.0	0.0	1.7	0.3
1982	1.3	1.7	4.4	3.5	3.2	5.0	2.8	1.4	0.9	0.3	0.0	0.1	2.2	0.3
1983	2.7	4.0	2.8	2.7	2.6	5.0	3.3	1.4	0.6	0.2	0.1	.	2.3	0.3
1984	2.0	1.7	2.7	3.2	3.2	3.2	2.3	0.9	0.6	0.2	0.1	.	1.8	0.3
1985	0.8	2.0	2.8	3.1	4.1	3.5	1.7	0.7	0.6	0.2	0.1	0.0	1.8	0.3
1986	1.1	3.0	2.6	2.6	2.3	3.1	2.0	0.5	0.4	0.3	0.1	0.1	1.7	0.3
1987	1.4	1.6	2.7	2.9	4.5	3.3	1.9	1.3	0.7	0.2	0.1	0.0	2.0	0.3
1988	3.3	4.2	4.4	5.3	4.9	3.1	2.0	1.2	0.6	0.2	0.0	0.0	2.2	0.2
1989	1.9	2.1	3.4	2.3	3.3	4.2	1.6	0.9	0.5	0.2	0.1	0.0	1.7	0.3
1990	1.4	3.3	3.7	5.0	5.2	5.3	2.8	1.1	1.0	0.5	0.3	0.0	2.5	0.2
1991	3.3	6.0	4.0	4.7	6.5	6.3	2.1	0.9	0.5	0.2	0.1	.	2.9	0.2
1992	5.1	2.1	1.9	1.9	2.2	2.5	1.2	0.3	0.3	0.1	0.0	0.1	1.4	0.3
1993	3.0	2.8	2.5	3.9	3.5	4.0	1.5	0.7	0.4	0.1	0.2	.	1.8	0.3
1994	5.6	3.3	4.0	4.3	4.1	3.4	0.9	0.3	0.1	0.1	0.0	0.0	2.1	0.2
1995	1.8	2.0	2.8	2.4	2.4	1.6	0.7	0.2	0.2	0.1	0.1	0.0	1.2	0.4
1996	3.4	1.2	2.1	2.1	2.2	1.6	0.7	0.6	0.2	0.0	0.0	0.0	1.2	0.4
1997	1.4	1.7	1.6	1.7	2.2	2.9	0.9	0.6	0.3	0.2	0.0	0.1	1.1	0.4
1998	3.3	2.8	2.2	1.3	1.8	4.5	1.2	0.6	0.3	0.1	0.0	0.0	1.4	0.3
1999	0.7	1.3	1.2	2.0	1.7	2.1	1.0	0.6	0.2	0.1	0.0	0.0	0.9	0.4
2000	1.9	3.2	2.4	1.9	2.1	1.3	0.6	0.2	0.2	0.1	0.0	0.0	1.0	0.4
2001	0.5	1.0	1.3	1.2	1.4	2.2	0.7	0.2	0.3	0.0	0.1	0.0	0.7	0.4
2002	0.6	1.7	1.3	1.3	1.8	1.8	0.8	0.2	0.2	0.0	0.0	.	0.8	0.4
2003	1.1	0.7	0.8	1.0	1.9	1.4	0.5	0.2	0.2	0.0	.	0.0	0.6	0.4
2004	0.8	2.6	1.7	1.2	1.3	2.3	0.7	0.3	0.2	0.1	0.0	.	0.9	0.4
2005	2.3	2.2	2.3	1.4	1.4	1.7	0.8	0.3	0.7	0.0	0.0	0.0	1.1	0.4
2006	1.5	2.4	2.3	2.8	3.3	2.2	0.8	0.2	0.3	0.1	0.1	0.0	1.3	0.4
2007	1.5	1.6	1.3	1.1	2.2	2.8	1.0	0.4	0.4	0.1	.	.	1.0	0.4
2008	0.9	1.9	1.5	1.0	1.5	1.5	0.7	0.4	0.1	0.0	.	0.0	0.8	0.5
2009	1.1	1.5	1.4	1.4	1.8	2.1	0.8	0.2	0.1	0.0	0.0	0.0	0.9	0.4
2010	0.7	0.5	1.0	1.3	1.1	1.6	0.4	0.3	0.3	0.0	0.1	0.0	0.6	0.5
2011	1.1	1.1	1.5	1.6	1.4	1.8	0.8	0.5	0.4	0.1	0.0	0.0	0.9	0.4
2012	1.6	2.1	1.5	1.0	0.7	1.0	0.3	0.1	0.2	0.1	0.0	.	0.7	0.4
2013	1.0	1.3	1.0	0.5	0.8	1.4	0.7	0.1	0.2	.	0.0	.	0.7	0.5
2014	1.4	0.6	2.1	1.2	0.7	0.9	0.6	0.5	0.3	0.1	0.0	.	0.7	0.5
2015	0.8	2.0	1.3	1.6	1.6	1.2	0.5	0.1	0.1	0.0	.	.	0.7	0.4
2016	0.7	1.3	0.5	0.7	1.2	1.1	0.7	0.3	0.3	0.1	0.0	.	0.6	0.5
2017	0.4	0.7	1.1	0.7	0.7	0.7	0.5	0.0	0.2	0.0	.	.	0.4	0.6
2018	0.3	1.3	1.6	0.8	0.9	1.2	0.6	0.0	0.2	0.1	0.0	0.0	0.6	0.5
est	1.6	2.0	2.1	2.0	2.4	2.6	1.2	0.6	0.4	0.1	0.1	0.0		
CV	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.6	0.6	0.8	0.8	0.9		

Table 4: Catch-per-unit-effort of young-of-the-year blue crab *Callinectes sapidus*. Abundance indices are the delta-lognormal mean of pre-recruit crabs per ton from the LDWF fishery-independent marine trawl survey, 1967-2018. Young-of-the-year crabs are ≥25mm and <125mm carapace width and will not grow to legal size during the survey year. Shaded areas represent the maximum of the monthly-cpue distributions.

Catch-per-unit- effort (young-of-the-year)														
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**est**	**CV**
1967	.	.	.	.	.	.	0.1	0.5	0.6	0.9	0.3	0.7	0.4	0.6
1968	.	.	.	.	.	.	0.3	0.4	0.8	1.5	1.0	1.2	0.4	0.5
1969	.	.	.	.	.	.	0.7	0.3	0.5	2.2	1.5	2.0	0.2	0.5
1970	.	.	.	.	.	.	0.5	0.1	0.9	1.0	2.3	1.6	0.5	0.4
1971	.	.	.	.	.	.	0.6	0.5	0.5	1.0	2.1	3.2	0.6	0.4
1972	.	.	.	.	.	.	0.5	0.4	0.4	0.7	1.4	1.8	0.4	0.4
1973	.	.	.	.	.	.	0.6	0.5	0.7	1.1	1.0	1.6	0.4	0.4
1974	.	.	.	.	.	.	0.2	0.4	0.4	0.7	0.7	1.5	0.2	0.6
1975	.	.	.	.	.	.	0.2	0.5	0.4	0.9	0.8	0.4	0.2	0.5
1976	.	.	.	.	.	.	0.4	0.1	0.3	0.4	0.7	1.6	0.3	0.4
1977	.	.	.	.	.	.	0.1	0.3	0.2	0.9	1.9	1.2	0.3	0.5
1978	.	.	.	.	.	.	0.4	0.3	0.8	0.7	0.9	1.8	0.4	0.6
1979	.	.	.	.	.	.	1.1	0.8	2.5	1.9	1.6	2.0	0.8	0.4
1980	.	.	.	.	.	.	0.8	0.6	0.9	1.5	1.2	2.1	0.5	0.4
1981	.	.	.	.	.	.	0.5	0.5	0.9	1.5	0.5	1.3	0.4	0.4
1982	.	.	.	.	.	.	1.5	1.1	1.5	1.9	2.5	2.3	0.9	0.3
1983	.	.	.	.	.	.	1.3	0.8	0.9	1.9	0.9	1.9	0.5	0.4
1984	.	.	.	.	.	.	0.7	0.8	1.3	1.5	1.7	1.9	0.5	0.4
1985	.	.	.	.	.	.	0.6	0.6	1.7	1.5	2.0	1.3	0.5	0.4
1986	.	.	.	.	.	.	0.8	0.4	0.8	1.7	1.0	4.0	0.5	0.4
1987	.	.	.	.	.	.	0.7	1.4	1.5	1.4	0.8	2.8	0.6	0.3
1988	.	.	.	.	.	.	0.6	0.7	1.0	0.8	1.1	0.3	0.4	0.5
1989	.	.	.	.	.	.	0.6	0.5	1.4	1.8	0.9	1.9	0.5	0.4
1990	.	.	.	.	.	.	1.4	0.7	1.7	2.3	1.9	2.9	0.8	0.3
1991	.	.	.	.	.	.	0.5	0.4	1.5	1.2	0.7	1.5	0.4	0.4
1992	.	.	.	.	.	.	1.5	0.6	1.0	0.7	0.6	1.2	0.4	0.4
1993	.	.	.	.	.	.	1.7	0.8	1.7	1.5	3.4	2.4	0.8	0.3
1994	.	.	.	.	.	.	0.8	0.7	0.7	1.4	3.3	1.7	0.5	0.4
1995	.	.	.	.	.	.	0.7	0.3	0.9	1.2	2.0	1.8	0.4	0.4
1996	.	.	.	.	.	.	1.0	0.6	0.7	0.6	1.8	1.7	0.4	0.4
1997	.	.	.	.	.	.	0.7	1.2	1.7	2.6	2.4	2.1	0.9	0.3
1998	.	.	.	.	.	.	0.6	0.7	0.6	0.8	0.6	0.8	0.3	0.5
1999	.	.	.	.	.	.	0.4	1.0	1.3	1.1	0.6	1.4	0.5	0.3
2000	.	.	.	.	.	.	0.3	0.5	0.8	0.6	0.8	1.2	0.3	0.4
2001	.	.	.	.	.	.	0.4	0.4	0.9	0.6	0.7	1.0	0.3	0.5
2002	.	.	.	.	.	.	0.4	0.4	0.4	0.7	1.1	0.5	0.3	0.5
2003	.	.	.	.	.	.	0.6	0.4	0.7	0.4	0.9	1.4	0.3	0.4
2004	.	.	.	.	.	.	0.7	0.6	0.8	0.9	1.5	2.0	0.5	0.4
2005	.	.	.	.	.	.	0.6	0.2	1.1	0.5	1.1	1.2	0.3	0.5
2006	.	.	.	.	.	.	0.4	0.2	0.3	0.4	0.5	0.5	0.2	0.6
2007	.	.	.	.	.	.	0.5	0.3	0.3	0.5	0.7	0.7	0.2	0.6
2008	.	.	.	.	.	.	0.6	0.6	0.4	0.4	0.5	0.6	0.2	0.6
2009	.	.	.	.	.	.	0.3	0.3	0.4	0.6	0.5	0.8	0.2	0.6
2010	.	.	.	.	.	.	0.4	0.2	0.3	0.2	0.6	0.3	0.2	0.6
2011	.	.	.	.	.	.	0.3	0.3	0.5	0.3	0.7	1.5	0.2	0.4
2012	.	.	.	.	.	.	0.2	0.2	0.7	0.2	0.2	0.4	0.1	0.6
2013	.	.	.	.	.	.	0.6	0.3	0.7	0.3	0.9	0.6	0.2	0.5
2014	.	.	.	.	.	.	0.6	0.7	0.9	0.6	0.3	0.4	0.3	0.5
2015	.	.	.	.	.	.	0.4	0.4	0.5	0.3	0.4	0.4	0.2	0.6
2016	.	.	.	.	.	.	0.8	0.3	0.5	0.4	0.3	0.8	0.3	0.5
2017	.	.	.	.	.	.	0.3	0.3	0.3	0.5	0.5	0.3	0.2	0.7
2018	.	.	.	.	.	.	0.4	0.0	0.3	0.5	0.7	0.6	0.2	0.6
est	.	.	.	.	.	.	0.6	0.5	0.8	1.0	1.0	1.2		
CV	.	.	.	.	.	.	0.4	0.5	0.4	0.4	0.4	0.3		

Table 5: Gompertz growth parameters of blue crab *Callinectes sapidus* from West et al. (2011). Sizes are carapace-widths in mm.

	Gompertz parameters			
	Jan-Apr	May-Aug	Sept-Dec	non-seasonal
CW_∞	164.8	175.9	174.8	174.5
α	-4.9	-4.6	-19.8	-5.5
β	-3.5	-2.6	-4.4	-3

Table 6: Size-at-capture matrix of Louisiana blue crab *Callinectes sapidus* used to identify crabs that will not recruit to the fishery during the survey year. Cells represent carapace-widths at capture in mm from the LDWF fishery independent trawl survey. Crabs not fully-selected by the survey gear (<25mm) are not shown (i.e., blank cells). Month of capture represents samples from the trawl survey. Month of hatch represents monthly cohorts. Cells above the diagonal represent size-at-capture of the current year-class. Cells below the diagonal are size-at-capture of the previous year-class. The shaded area represents cohorts that will not recruit to the fishery during the survey year. Carapace widths in bold represent the maximum size-at-capture of crabs that will not recruit to the fishery during the survey year. Seasonal size-at-age (Jan-Apr, May-Aug, and Sept-Dec) is estimated from Gompertz growth models.

		Month of Capture											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Month of Hatch	Jan				29	45	63	80	96	110	122	132	140
	Feb	140				29	45	63	80	96	110	122	132
	Mar	132	140				29	**45**	**63**	**80**	**96**	**110**	**122**
	Apr	122	132	140				29	45	63	80	96	110
	May	85	98	110	120					31	44	57	71
	Jun	71	85	98	110	120					31	44	57
	Jul	57	71	85	98	110	120					31	44
	Aug	44	57	71	85	98	110	120					31
	Sept			28	50	73	95	115	131				
	Oct				28	50	73	95	115	131			
	Nov					28	50	73	95	115	131		
	Dec						28	50	73	95	115	131	

Table 7: FAO proposed guideline for indices of productivity for exploited aquatic species. Parameter values are taken from West et al. (2011) and GDAR1.

Parameter	Productivity			Species	
	Low	Medium	High	Blue Crab	Score
M	<0.2	0.2 - 0.5	>0.5	**1.0**	3
K	<0.15	0.15 - 0.33	>0.33	**1.9**	3
t_{mat}	>8	3.3 - 8	<3.3	**1**	3
t_{max}	>25	14 - 25	<14	**3**	3
Examples	orange roughy, many sharks	cod, hake	sardine, anchovy	**Blue Crab Productivity Score = 3.0 (high)**	

Table 8: Annual mean weights (pounds) of juvenile and adult blue crabs captured from the LDWF fishery-independent marine trawl survey, 1968-2018. Adult crabs are≥125mm carapace width. Juveniles are crabs ≥25mm and <125mm carapace width.

	Mean Weight (lbs)	
Year	Adults	Juveniles
1968	0.40	0.05
1969	0.42	0.05
1970	0.41	0.06
1971	0.41	0.05
1972	0.41	0.05
1973	0.42	0.06
1974	0.42	0.06
1975	0.40	0.05
1976	0.44	0.05
1977	0.42	0.04
1978	0.42	0.05
1979	0.42	0.05
1980	0.42	0.04
1981	0.39	0.06
1982	0.39	0.05
1983	0.38	0.05
1984	0.40	0.06
1985	0.40	0.06
1986	0.38	0.05
1987	0.37	0.06
1988	0.40	0.05
1989	0.38	0.05
1990	0.38	0.05
1991	0.39	0.05
1992	0.39	0.04
1993	0.39	0.03
1994	0.40	0.03
1995	0.39	0.03
1996	0.40	0.03
1997	0.39	0.03
1998	0.40	0.03
1999	0.39	0.03
2000	0.42	0.03
2001	0.44	0.03
2002	0.42	0.04
2003	0.46	0.03
2004	0.45	0.03
2005	0.45	0.03
2006	0.44	0.04
2007	0.42	0.04
2008	0.44	0.03
2009	0.44	0.05
2010	0.43	0.04
2011	0.46	0.04
2012	0.46	0.03
2013	0.48	0.03
2014	0.47	0.03
2015	0.46	0.02
2016	0.45	0.04
2017	0.46	0.04

Table 9: Catch-per-unit-effort of blue crab *Callinectes sapidus*. Adult, juvenile, and young-of-the-year abundance indices are derived as the delta-lognormal mean catch-per-tow from the LDWF fishery-independent marine trawl survey, 1967-2018. The juvenile abundance index r_y used in the catch-survey model is derived as the sum of young-of-the-year cpue in year and juvenile cpue in year+1. The shaded cells represent values not used as model inputs.

	Catch-per-unit-effort (crabs per tow)			*Model inputs*	
Year	*Adults*	*Juveniles*	*Young-of-the-year*	n_y	r_y
1967	0.87	0.97	0.38		
1968	0.74	1.28	0.40	0.74	1.66
1969	0.66	1.64	0.22	0.66	2.03
1970	1.12	1.24	0.49	1.12	1.46
1971	1.08	1.52	0.64	1.08	2.01
1972	0.88	1.63	0.43	0.88	2.27
1973	0.93	1.65	0.45	0.93	2.08
1974	1.04	1.71	0.19	1.04	2.16
1975	0.78	1.28	0.23	0.78	1.46
1976	0.45	0.67	0.31	0.45	0.90
1977	0.37	0.78	0.30	0.37	1.09
1978	0.53	0.98	0.39	0.53	1.28
1979	0.75	2.14	0.79	0.75	2.52
1980	1.01	2.35	0.51	1.01	3.14
1981	0.88	1.74	0.39	0.88	2.25
1982	0.63	2.17	0.86	0.63	2.55
1983	0.63	2.27	0.55	0.63	3.14
1984	0.86	1.83	0.52	0.86	2.38
1985	0.79	1.80	0.55	0.79	2.32
1986	0.75	1.65	0.46	0.75	2.20
1987	0.57	1.97	0.56	0.57	2.44
1988	0.50	2.24	0.38	0.50	2.79
1989	0.41	1.75	0.48	0.41	2.12
1990	0.84	2.53	0.78	0.84	3.01
1991	0.70	2.86	0.41	0.70	3.64
1992	0.32	1.38	0.40	0.32	1.79
1993	0.38	1.84	0.80	0.38	2.24
1994	0.27	2.07	0.53	0.27	2.87
1995	0.14	1.18	0.44	0.14	1.71
1996	0.19	1.16	0.42	0.19	1.61
1997	0.27	1.13	0.87	0.27	1.54
1998	0.30	1.38	0.34	0.30	2.25
1999	0.32	0.93	0.46	0.32	1.27
2000	0.30	1.03	0.32	0.30	1.49
2001	0.21	0.72	0.33	0.21	1.04
2002	0.33	0.81	0.27	0.33	1.14
2003	0.19	0.64	0.33	0.19	0.91
2004	0.24	0.90	0.50	0.24	1.22
2005	0.54	1.10	0.32	0.54	1.60
2006	1.06	1.29	0.19	1.06	1.61
2007	0.51	1.00	0.24	0.51	1.19
2008	0.40	0.79	0.25	0.40	1.03
2009	0.53	0.93	0.21	0.53	1.18
2010	0.31	0.60	0.16	0.31	0.81
2011	0.50	0.94	0.25	0.50	1.10
2012	0.25	0.66	0.14	0.25	0.90
2013	0.17	0.71	0.18	0.17	0.84
2014	0.29	0.68	0.25	0.29	0.85
2015	0.16	0.74	0.20	0.16	0.99
2016	0.33	0.61	0.28	0.33	0.82
2017	0.29	0.45	0.16	0.29	0.73
2018	0.51	0.61	0.17	0.51	0.76

Table 10: Assessment model inputs and resulting estimates for the Louisiana blue crab *Callinectes sapidus* stock, 1968-2018. Descriptions of model inputs are: M = constant instantaneous natural mortality rate, C_y = harvest (as individuals), r_y = juvenile cpue, n_y = adult cpue, s_r = relative selectivity of juveniles to adult crabs in the survey gear. Descriptions of model estimates are: $\hat{q}_n$ = predicted catchability of adult crabs to the survey gear, $\hat{r}_y$ = predicted juvenile cpue, $\hat{n}_y$ = predicted adult cpue, n_y = calculated adult cpue (i.e., from process error), R_y = juvenile abundance, N_y = adult abundance, Z_y = instantaneous total mortality rate, u_y = exploitation rate, F_y = instantaneous fishing mortality rate. CPUE is derived as the delta-lognormal mean catch per tow from the LDWF fishery-independent trawl survey. Juveniles are crabs ≥25mm and <125mm carapace width. Adult crabs are ≥125mm carapace width. Abundance units are millions of individuals. Biomass units are millions of pounds.

Model inputs $M = 1.0$					***Model estimates*** $\hat{q}_n = 0.00453$									
Year	C_y	r_y	n_y	s_r	$\hat{r}_y$	$\hat{n}_y$	n_y	R_y	N_y	Z_y	u_y	F_y	R_y Biomass	N_y Biomass
1968	24.85	1.66	0.74	1.00	1.57	0.72	0.00	346.63	159.58	1.16	0.05	0.08	18.82	64.40
1969	28.80	2.03	0.66	1.00	2.18	0.72	0.78	480.29	159.03	0.99	0.05	0.07	25.33	67.26
1970	26.31	1.46	1.12	1.00	1.54	1.07	0.99	340.41	236.73	0.99	0.05	0.07	20.22	96.87
1971	31.24	2.01	1.08	1.00	1.93	0.97	0.89	425.31	214.08	1.14	0.05	0.08	19.44	87.67
1972	38.76	2.27	0.88	1.00	2.18	0.92	0.98	480.12	203.61	1.15	0.06	0.10	22.55	83.19
1973	58.23	2.08	0.93	1.00	2.09	0.98	1.03	460.56	216.19	1.15	0.09	0.14	26.18	89.97
1974	51.16	2.16	1.04	1.00	1.95	0.98	0.97	429.64	215.18	1.28	0.08	0.14	26.71	91.15
1975	45.33	1.46	0.78	1.00	1.27	0.82	0.93	281.10	179.99	1.37	0.10	0.18	14.87	71.48
1976	36.17	0.90	0.45	1.00	0.86	0.53	0.64	190.46	117.54	1.26	0.12	0.21	9.46	51.91
1977	40.49	1.09	0.37	1.00	1.18	0.39	0.41	259.90	87.09	1.13	0.12	0.19	11.30	36.48
1978	37.87	1.28	0.53	1.00	1.41	0.51	0.47	310.54	112.11	1.05	0.09	0.14	16.06	46.85
1979	53.75	2.52	0.75	1.00	2.46	0.67	0.60	542.82	148.00	1.17	0.08	0.13	29.79	61.67
1980	45.80	3.14	1.01	1.00	2.66	0.98	1.00	587.19	215.35	1.30	0.06	0.10	24.17	89.78
1981	43.89	2.25	0.88	1.00	1.89	0.99	1.21	417.35	217.77	1.35	0.07	0.13	23.82	84.59
1982	46.12	2.55	0.63	1.00	2.13	0.74	0.94	470.31	163.98	1.34	0.07	0.13	22.63	64.52
1983	53.96	3.14	0.63	1.00	2.73	0.75	0.93	602.44	165.97	1.28	0.07	0.12	30.58	63.36
1984	77.45	2.38	0.86	1.00	2.17	0.97	1.13	478.07	213.87	1.31	0.11	0.20	28.10	85.88
1985	78.79	2.32	0.79	1.00	2.11	0.84	0.94	465.44	186.21	1.33	0.12	0.22	25.95	74.07
1986	86.64	2.20	0.75	1.00	1.89	0.78	0.87	417.48	172.56	1.44	0.15	0.28	21.95	66.11
1987	148.31	2.44	0.57	1.00	2.10	0.63	0.75	462.45	139.99	1.64	0.25	0.50	25.85	51.88
1988	140.69	2.79	0.50	1.00	2.17	0.53	0.60	479.06	117.23	1.68	0.24	0.49	21.62	46.85
1989	93.32	2.12	0.41	1.00	2.20	0.50	0.61	485.64	110.68	1.27	0.16	0.28	22.59	41.58
1990	107.26	3.01	0.84	1.00	2.46	0.76	0.74	542.52	168.21	1.48	0.15	0.29	27.31	64.03
1991	137.95	3.64	0.70	1.00	2.26	0.73	0.89	497.51	161.24	1.84	0.21	0.46	25.65	62.70
1992	138.42	1.79	0.32	1.00	1.64	0.48	0.72	361.68	104.90	1.73	0.30	0.62	14.35	41.17
1993	122.40	2.24	0.38	1.00	1.56	0.37	0.40	345.03	82.62	1.87	0.29	0.63	11.14	32.49
1994	95.96	2.87	0.27	1.00	1.39	0.30	0.38	307.27	65.62	2.06	0.26	0.61	9.20	26.33
1995	99.14	1.71	0.14	1.00	1.25	0.22	0.36	275.74	47.68	1.89	0.31	0.68	9.59	18.64
1996	105.51	1.61	0.19	1.00	1.40	0.22	0.27	309.03	49.04	1.75	0.29	0.62	9.73	19.47
1997	115.48	1.54	0.27	1.00	1.43	0.28	0.31	315.27	62.44	1.75	0.31	0.65	10.56	24.66
1998	114.56	2.25	0.30	1.00	1.77	0.30	0.31	389.96	65.81	1.70	0.25	0.52	13.63	26.23
1999	123.28	1.27	0.32	1.00	1.31	0.38	0.45	288.14	83.22	1.78	0.33	0.71	9.35	32.85
2000	127.27	1.49	0.30	1.00	1.32	0.28	0.28	291.89	62.83	1.95	0.36	0.82	9.42	26.66
2001	100.07	1.04	0.21	1.00	1.25	0.23	0.24	274.72	50.27	1.60	0.31	0.62	8.20	21.87
2002	124.22	1.14	0.33	1.00	1.17	0.30	0.27	258.28	65.43	1.99	0.38	0.88	9.34	27.49
2003	109.95	0.91	0.19	1.00	1.17	0.20	0.20	257.02	44.30	1.81	0.36	0.79	7.64	20.18
2004	103.22	1.22	0.24	1.00	1.62	0.22	0.20	356.30	49.54	1.36	0.25	0.47	9.42	22.22
2005	87.64	1.60	0.54	1.00	2.03	0.47	0.39	448.21	104.20	1.08	0.16	0.26	12.02	47.31
2006	126.87	1.61	1.06	1.00	1.59	0.85	0.68	349.98	186.97	1.51	0.24	0.46	14.01	82.24
2007	115.70	1.19	0.51	1.00	1.33	0.54	0.55	293.07	119.07	1.54	0.28	0.55	11.24	49.70
2008	105.92	1.03	0.40	1.00	1.38	0.40	0.37	304.70	88.65	1.38	0.27	0.50	10.47	39.16
2009	130.40	1.18	0.53	1.00	1.33	0.45	0.36	292.78	99.34	1.72	0.33	0.70	13.38	43.82
2010	75.22	0.81	0.31	1.00	1.09	0.32	0.30	240.71	70.02	1.28	0.24	0.43	9.79	30.07
2011	100.65	1.10	0.50	1.00	1.08	0.39	0.31	238.65	86.61	1.72	0.31	0.65	10.63	39.56
2012	104.49	0.90	0.25	1.00	0.98	0.26	0.27	215.22	58.02	1.96	0.38	0.87	6.18	26.94
2013	85.28	0.84	0.17	1.00	1.08	0.17	0.17	237.18	38.52	1.57	0.31	0.61	7.86	18.54
2014	95.73	0.85	0.29	1.00	0.89	0.26	0.23	195.85	57.10	1.96	0.38	0.86	6.55	27.01
2015	94.78	0.99	0.16	1.00	1.27	0.16	0.16	280.33	35.73	1.54	0.30	0.588	6.96	16.34
2016	94.09	0.82	0.33	1.00	1.05	0.31	0.27	232.07	67.71	1.57	0.31	0.62	8.18	30.70
2017	100.07	0.73	0.29	1.00	1.21	0.28	0.24	266.65	62.39	1.38	0.30	0.56	10.45	28.79
2018	94.81	0.76	0.51	1.00	--	0.37	0.27	168.65	82.66	--	0.38	--	6.42	39.90

Table 11: Derivation and management reference point estimates for the Louisiana blue crab *Callinectes sapidus* stock. Fishing mortality units are years^{-1}. Biomass units are millions of pounds.

Management Benchmarks		
Parameters	*Derivation*	*Estimates*
SPR_{limit}	*Equations [17,19] and* SSB_{limit}	*21.0%*
SSB_{limit}	*Geometric mean of 3 lowest biomasses (1968-2009)*	*19.4*
F_{limit}	*Equations [17,19] and* SPR_{limit}	*0.928*
SPR_{target}	*Equations [17,19] and* SSB_{target}	*31.5%*
SSB_{target}	$SSB_{limit} \times 1.5$	*29.1*
F_{target}	*Equations [17,19] and* SPR_{target}	*0.696*

11. Figures

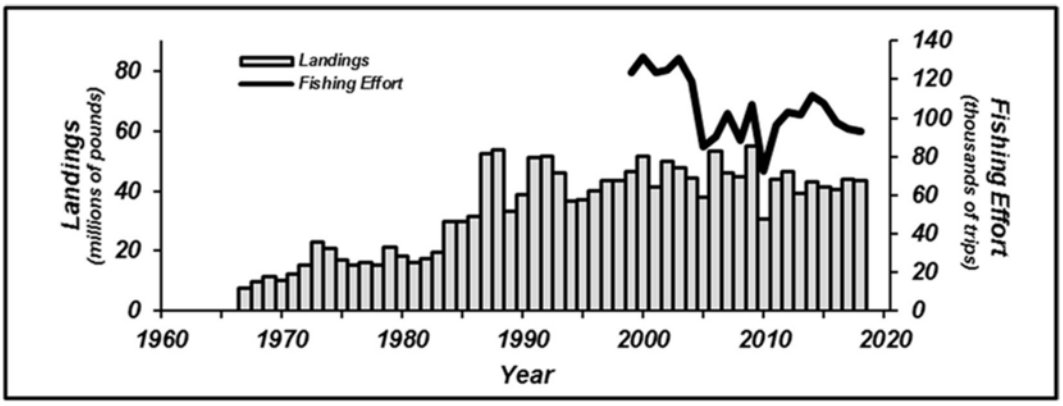


Figure 1: Commercial hard crab landings and fishing effort for Louisiana blue crab *Callinectes sapidus*. Landings, 1967-1998, are taken from NMFS statistical records. Landings and fishing effort, 1999-2018, are taken from the LDWF Trip Ticket Program. Landings are millions of pounds. Fishing effort is thousands of trap fisher trips.

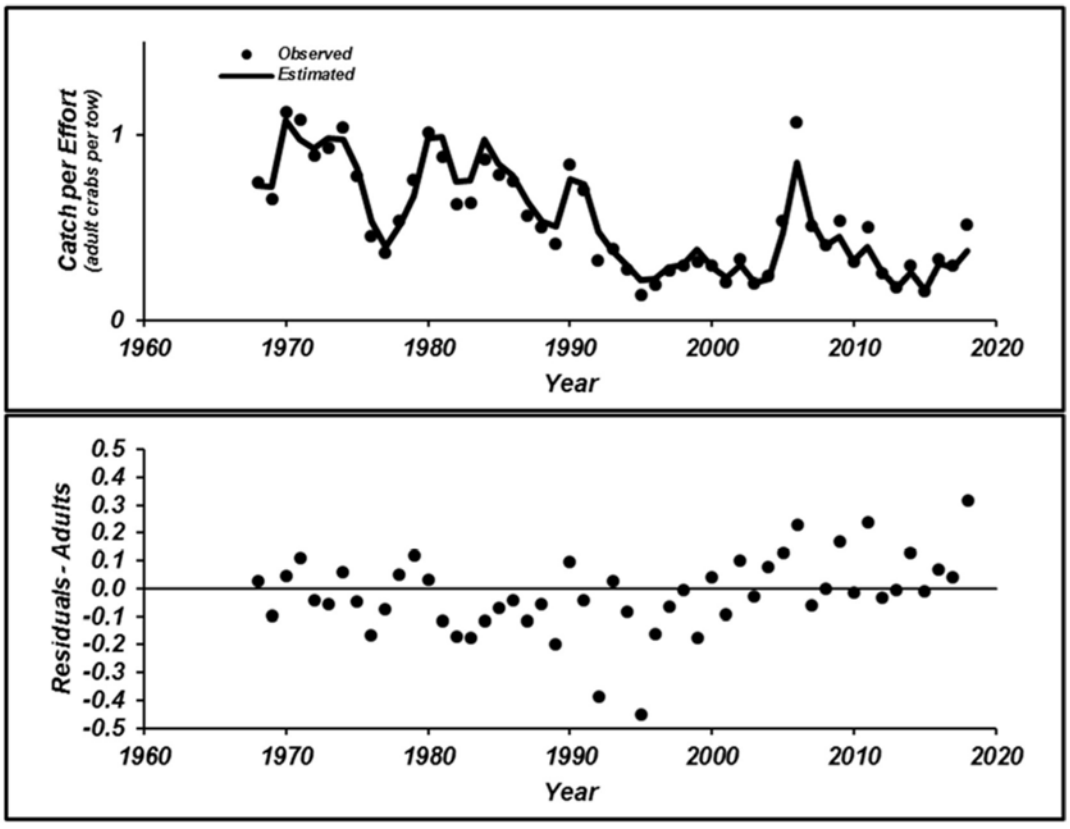


Figure 2: Catch-per-unit-effort of adult Louisiana blue crab *Callinectes sapidus*. The predicted index is derived from lognormal **observation error** of the catch-survey model. The observed index is the delta-lognormal mean catch-per-tow from the LDWF fishery-independent trawl survey, 1968-2018. Bottom graphic depicts lognormal residuals. Adult crabs are ≥125mm carapace-width.

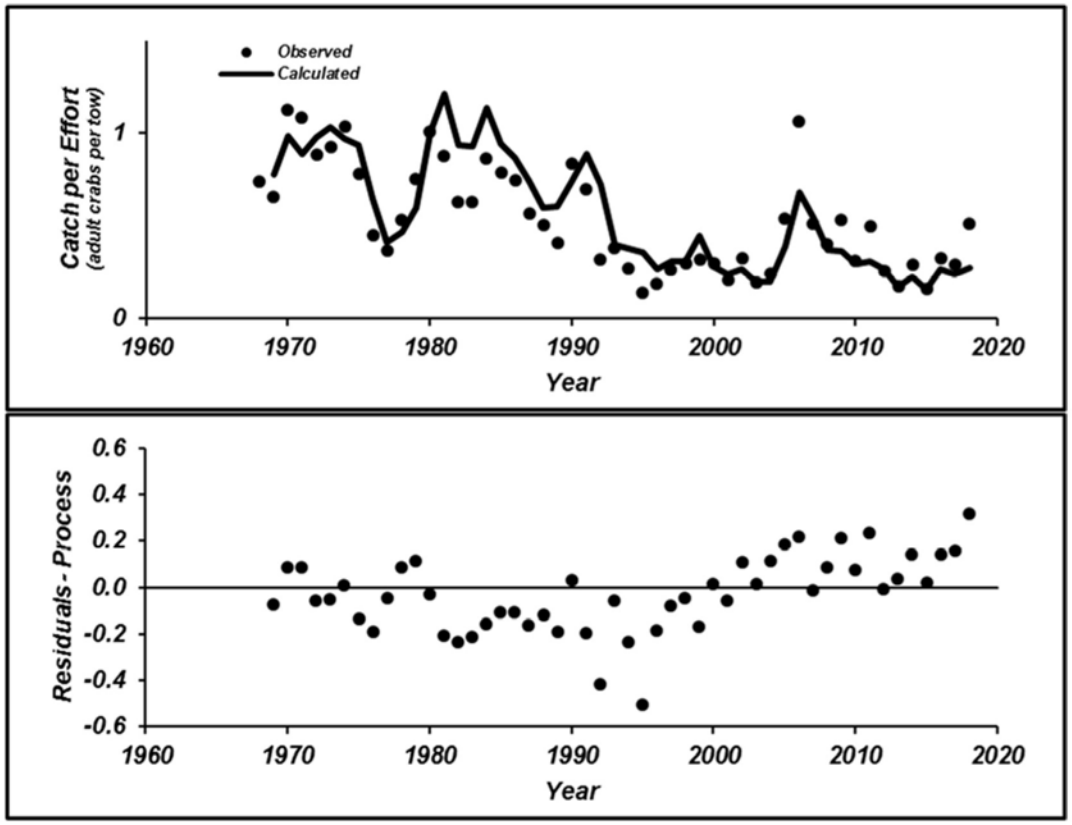


Figure 3: Catch-per-unit-effort of adult Louisiana blue crab *Callinectes sapidus.* The calculated index is derived from lognormal **process error** of the catch-survey model. The observed index is the delta-lognormal mean catch-per-tow from the LDWF fishery-independent trawl survey, 1968-2018. Bottom graphic depicts lognormal residuals. Adult crabs are ≥125mm carapace-width.

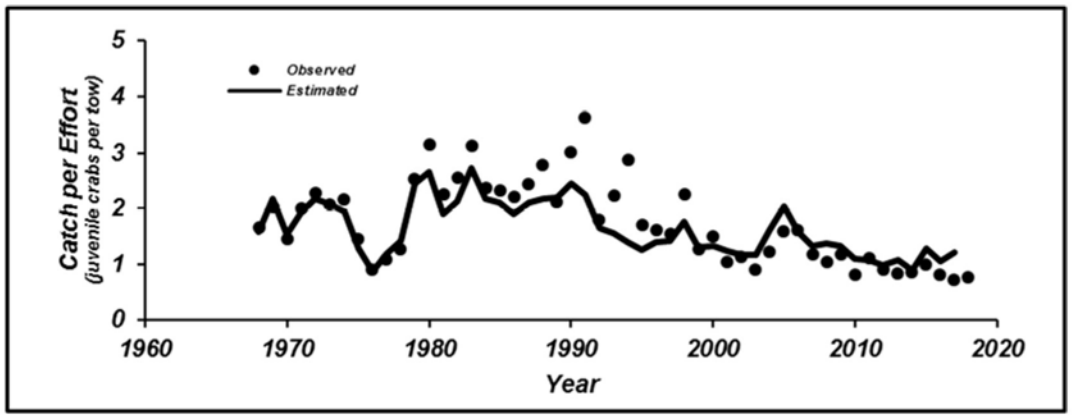


Figure 4: Catch-per-unit-effort of juvenile Louisiana blue crab *Callinectes sapidus*. The predicted index is derived from lognormal observation error of the catch-survey model. The observed index is the delta-lognormal mean catch-per-tow from the LDWF fishery-independent trawl survey, 1968-2018. Bottom graphic depicts lognormal residuals. Juveniles are crabs ≥25mm and <125mm carapace-width.

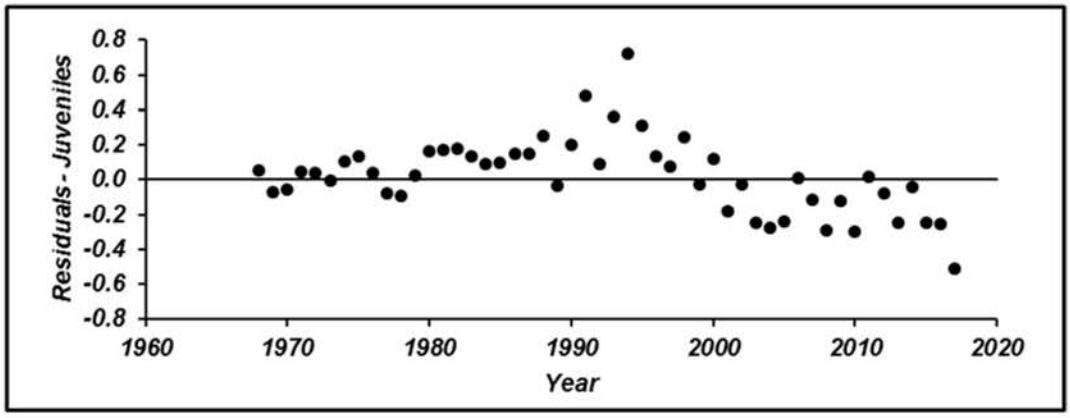


Figure 4 (continued):

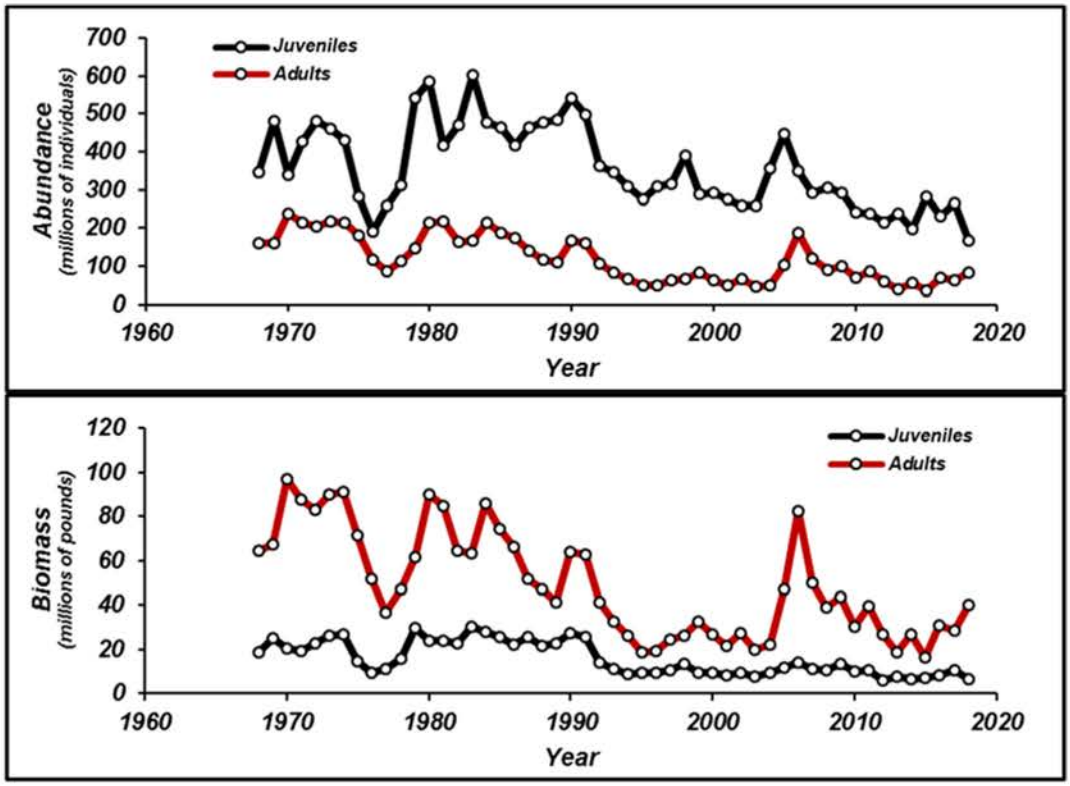


Figure 5: Abundance (top graphic) and biomass estimates (bottom graphic) of Louisiana blue crab *Callinectes sapidus* derived from the catch-survey model. Abundance units are millions of individuals. Biomass units are millions of pounds. Juveniles are crabs ≥25mm and <125mm carapace width. Adult crabs are ≥125mm carapace width.

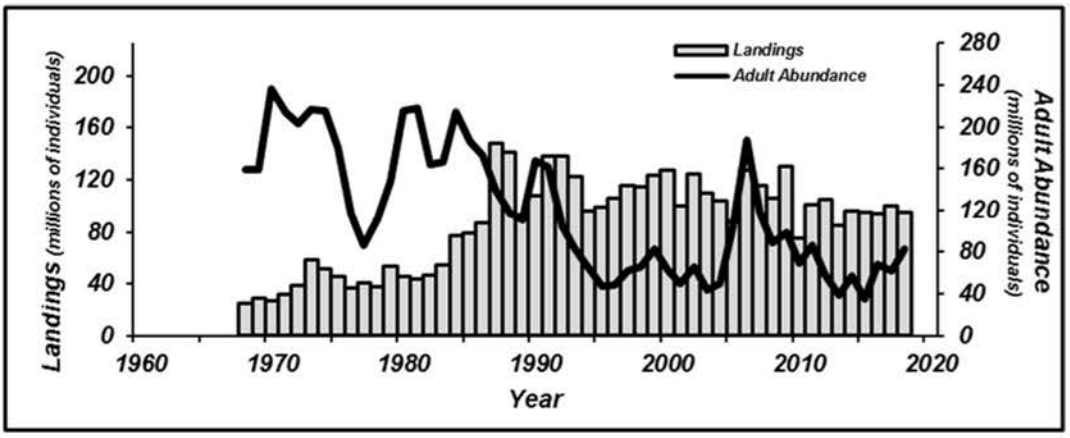


Figure 6: Estimated adult abundance and observed harvest of Louisiana blue crab *Callinectes sapidus*. Abundance is estimated from the catch-survey model. Commercial hard crab landings are expanded by 5% to approximate for recreational harvest. Units are millions of individuals.

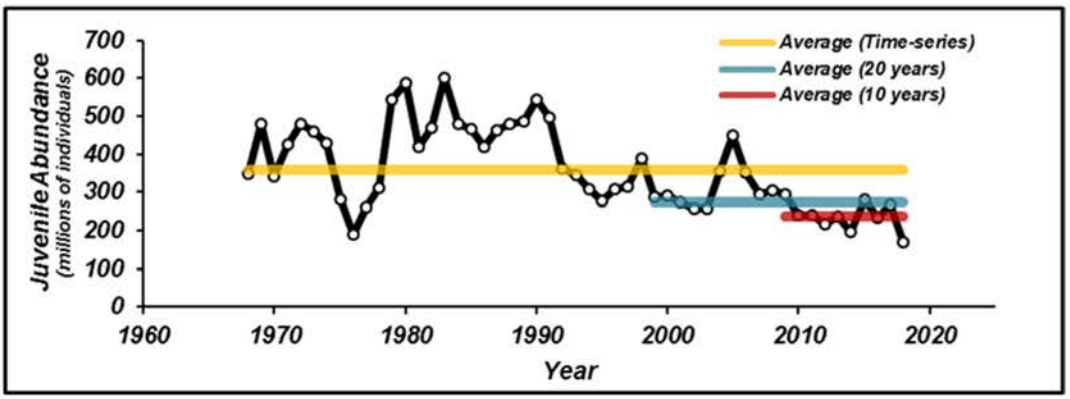


Figure 7: Juvenile abundance estimates of Louisiana blue crab *Callinectes sapidus* derived from the catch-survey model. Units are millions of individuals. Juveniles are crabs ≥25mm and <125mm carapace width. The yellow horizontal is the average juvenile abundance across the time-series. The blue and red horizontals are the most recent 20 and 10 year averages.

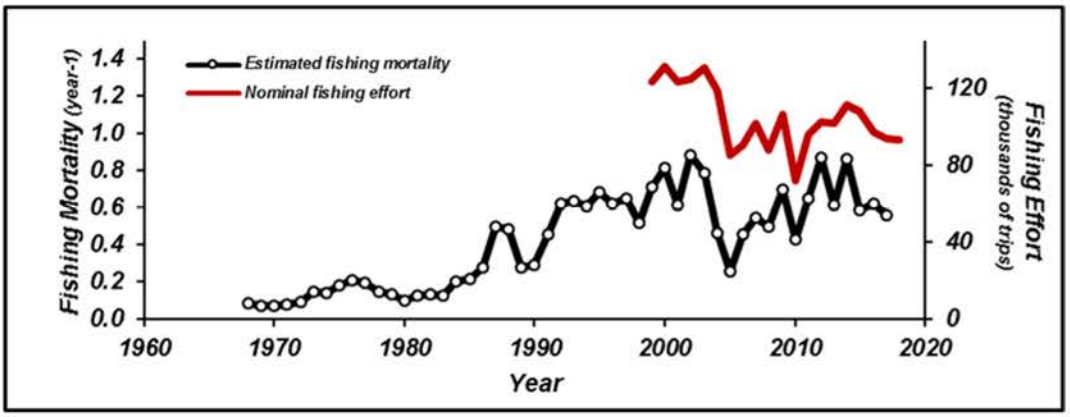


Figure 8: Estimated fishing mortality and nominal fishing effort for Louisiana blue crab *Callinectes sapidus*. Fishing mortality, 1968-2017, is estimated from the catch-survey model. Fishing effort, 1999-2018, is thousands of trap fisher trips per year taken from the LDWF Trip Ticket Program. Fishing effort is not used in the assessment model, but is presented here to validate trends in fishing mortality estimates.

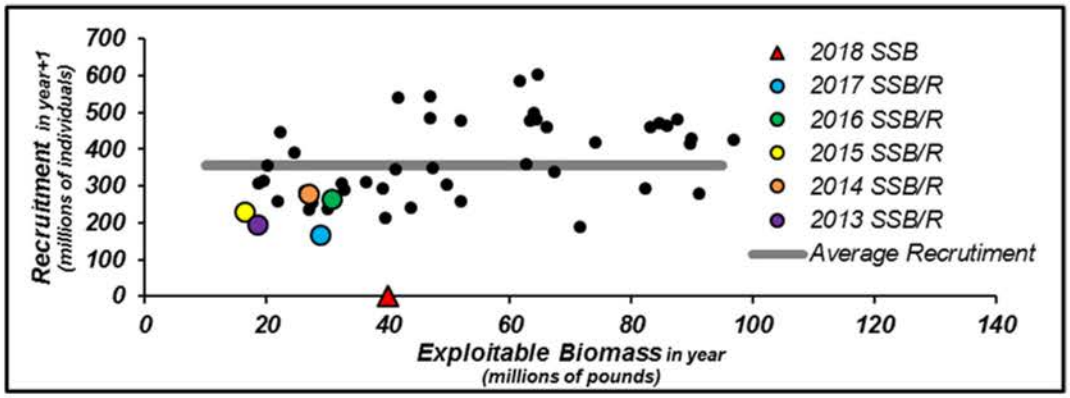


Figure 9: Exploitable biomass and subsequent recruitment of Louisiana blue crab *Callinectes sapidus*. Estimates are derived from the catch-survey model. Recruits (juveniles) are crabs ≥25mm and <125mm carapace width. Adult crabs are ≥125mm carapace width. Abundance units are millions of individuals. Biomass units are millions of pounds. The 5 most recent data pairs and the 2018 exploitable biomass estimate are identified.

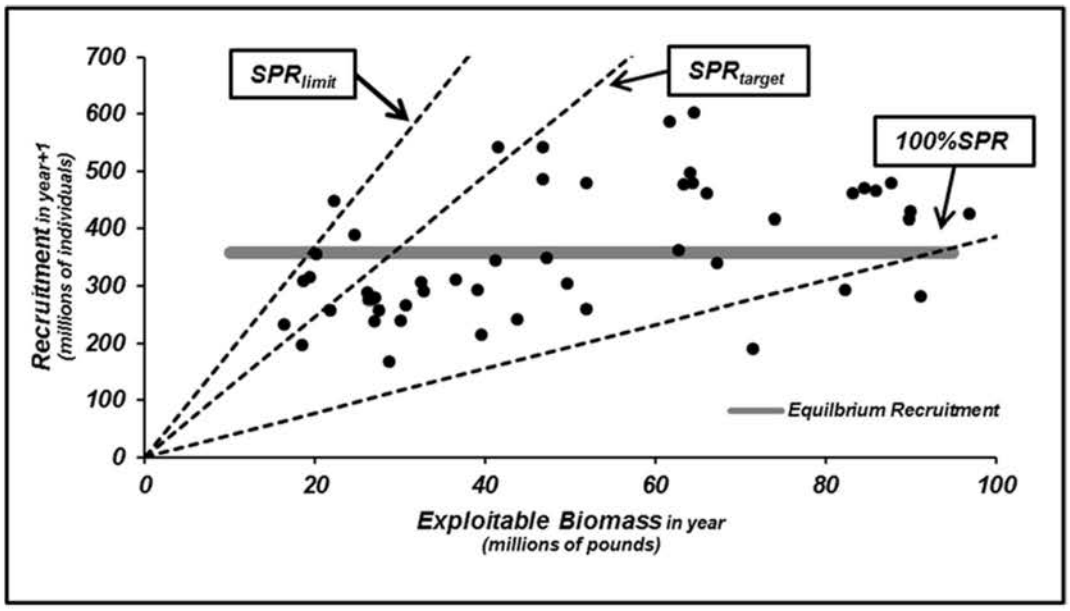


Figure 10: Equilibrium recruitment and the fished and unfished estimates of recruitment per spawner (represented by the slopes of the diagonal lines) corresponding with 21.0, 31.5, and 100% SPR. Exploitable biomass and recruitment of Louisiana blue crab *Callinectes sapidus* are derived from the catch-survey model. Recruits (juveniles) are crabs ≥25mm and <125mm carapace width. Adult (exploitable) crabs are ≥125mm carapace width. Abundance units are millions of individuals. Biomass units are millions of pounds.

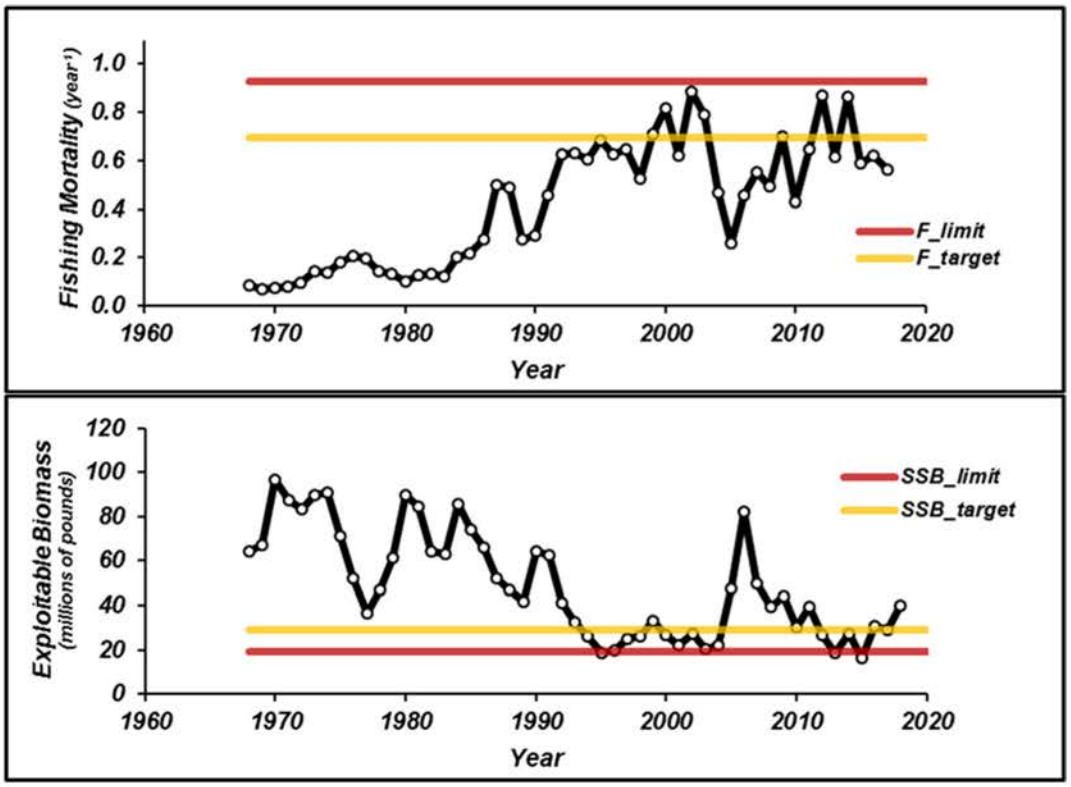


Figure 11: Time-series of catch-survey model fishing mortality rates and exploitable biomass estimates relative to management benchmarks.

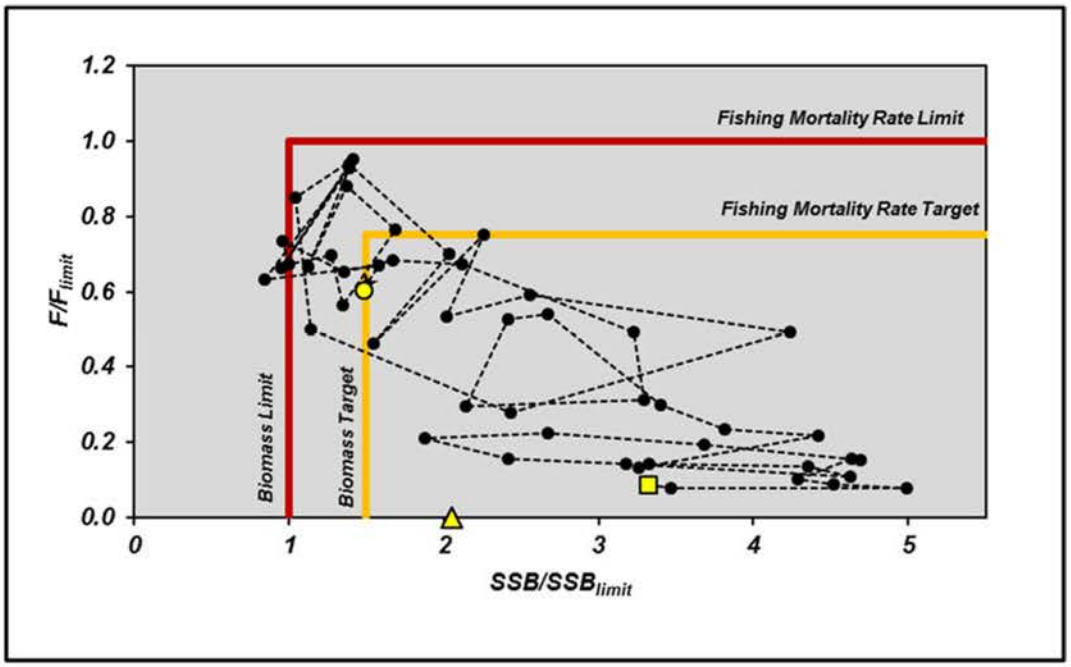


Figure 12: Ratios of annual fishing mortality rates and exploitable biomass estimates to F_{limit} and SSB_{limit}. Exploitable biomass and instantaneous fishing mortality are estimated from the catch-survey model. The biomass limit and target are represented by the solid vertical lines. The fishing mortality rate limit and target are represented by the solid horizontal lines. The square represents the first year of data pairs and the circle represents the last. The triangle represents the 2018 exploitable biomass estimate.

APPENDIX II. Louisiana Revised Statutes 56:638.1-5 - Saltwater Fishery Conservation and Management: Intent, Findings, Purpose, Policy and Standards

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:

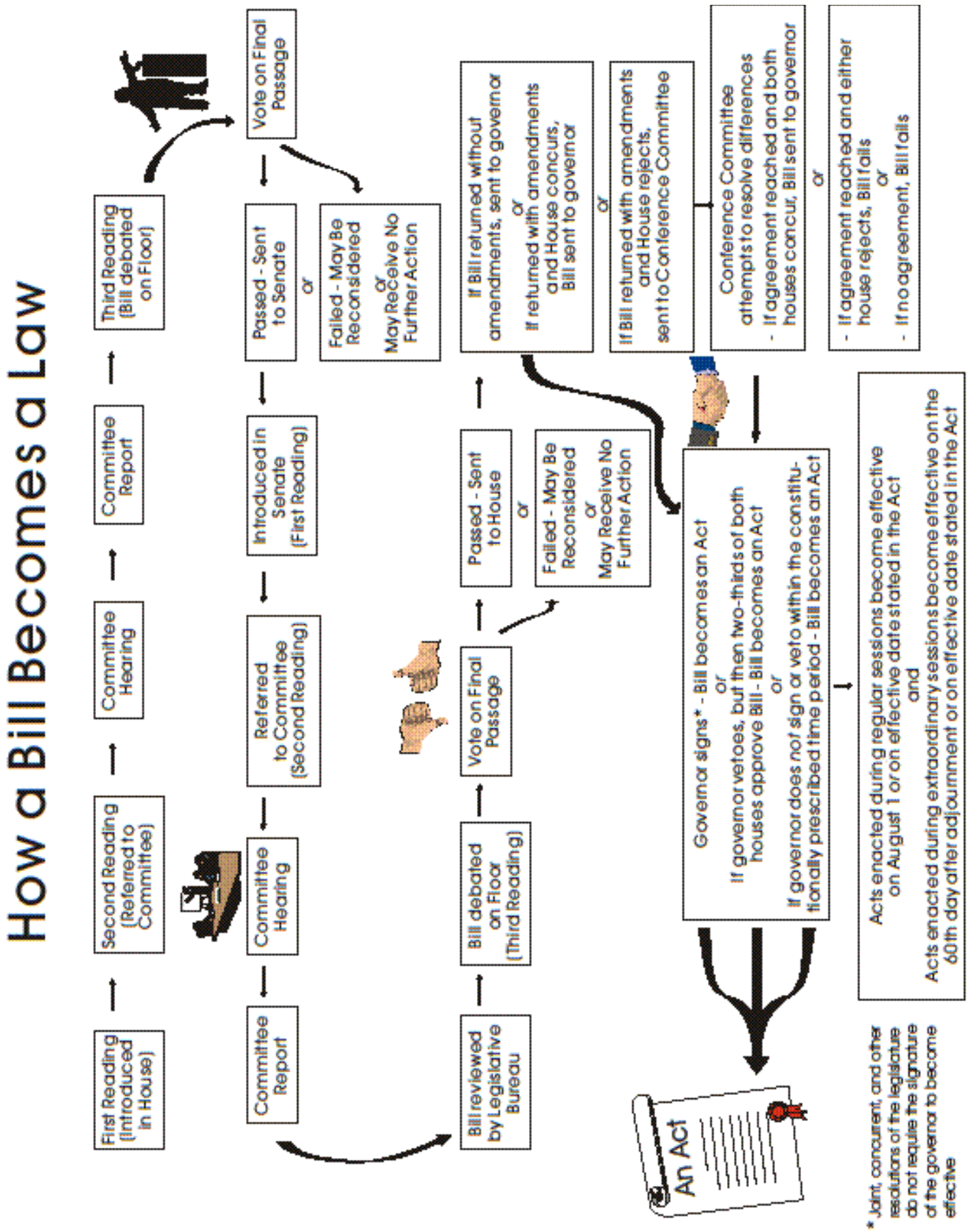
Stewardship of the state's renewable fish resources shall have as its utmost concern the continued health and abundance of the resource and its habitat, shall provide for optimum sustained benefits to the state, shall be responsive to the needs of interested and affected citizens, shall ensure the proper 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.

APPENDIX III. Louisiana Legislative Process



APPENDIX IV. Authorities of the Louisiana Wildlife and Fisheries Commission

According to Louisiana Revised Statutes Title 56, the Commission's authorities related to blue crab include:

- Sole authority to establish and define management programs and policies and conduct management studies and investigations as necessary.
- Ownership and title to all wild birds, and wild quadrupeds, fish, other aquatic life and water bottoms within the territory and jurisdiction of the state, including all oysters and other shellfish.
- Promulgation of rules and regulations setting seasons, times, places, size limits, quotas, daily take and possession limits based upon biological and technical data; and setting fees for nonresident recreational hunting and fishing licenses.
- Prohibiting the taking of any species of fish in any part of the state, particularly in any lake or stream either wholly or partially within the state, for not more than a three-year period.
- Exclusive control of fish having a game or commercial value.
- Operating and maintaining hatcheries, sanctuaries, and propagating places for the protection and propagation of fish; and restricting fishing in any manner it deems advisable.
- Setting size limits for all freshwater and saltwater fish for which no limits have been set by law.
- Splitting, staggering, or otherwise arranging 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.
- Promulgate and adopt rules and regulations to establish a marking system for crab traps sufficient to enable the department's agents to clearly identify crab traps including the name and license number of the owner of such crab traps and sufficient to enforce all laws relative to such crab traps.
- Developing and establishing a program for the removal of abandoned crab traps from state-owned river bottoms and other water bottoms of the state and for their removal and disposal. The use of crab traps may be temporarily prohibited as follows:
- During a period not to exceed 16 consecutive days between Feb. 1 and March 31 of each year in one more areas of the state.
- During a period not to exceed 14 consecutive days which includes the opening of the spring inshore shrimp e or more areas of the state.
- At any time crab harvest is closed for biological or technical reasons, the commission may prohibit crab traps for the duration of the closure.
- Adopt and promulgate under the Administrative Procedure Act rules and regulations to provide for a prohibition on the use of crab traps and for the removal of abandoned traps and their disposal. The rules shall, at a minimum, specify the beginning and ending dates for the prohibition on the use of crab traps, the geographical area within which the use of crab traps shall be prohibited, who is authorized to remove the abandoned traps, and the disposition of the abandoned traps.

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

According to Louisiana Revised Statutes Title 56, the Secretary's authorities related to blue crab include:

- Declaring a closed season on any or all species of fish found within the state or restricting fishing in the closed season in any manner deemed advisable.
- Adopting rules to govern the procedures of advisory committees created in or for the department.
- Taking fish of any kind in any manner or place for the purpose of science and cultivation and distributing and granting permits to other persons for the same purpose.
- Issuing permits to any persons to take fish for scientific or educational purposes or for propagation or distribution.
- Setting seasons, regulating type of gear used, and setting possession limits for estuarine fish where it is clearly demonstrated that intense fishing competition exists, pollution levels exceed adopted standards, or biological studies indicate the need.
- Issuing permits to persons who are interested in the development of new gear and equipment to harvest fish.
- Issuing permits for mariculture projects within the coastal zone
- Exempting permittees from statutory limitations to the kind, number or size of fish which may be harvested or as to the method of harvesting or taking fish, seasons, or other limitations.
- Recommending 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. Federal Management Institutions

The following list of federal management institutions was taken directly from the Blue Crab Fishery of the Gulf of Mexico Regional Management Plan developed by GSMFC (GSMFC Blue Crab Technical Task Force 2015).

Regional Fishery Management Councils

Although blue crabs are found in the exclusive economic zone (EEZ) of the Gulf of Mexico, they are most abundant in state waters. The commercial and recreational fisheries occur almost exclusively in state management jurisdictions. Consequently, laws and regulations of federal agencies primarily influence blue crab abundance by maintaining and enhancing habitat, preserving water quality and food supplies, and abating pollution. Federal laws may also affect consumers through the development of regulations to protect product quality.

With the passage of the Magnuson Fishery Conservation and Management Act (MFCMA) and the subsequent Magnuson-Stevens Conservation and Management Act (Mag-Stevens) of 1996, the federal government assumed responsibility for fishery management within the EEZ, a zone contiguous to the territorial sea and whose inner boundary is the outer boundary of each coastal state. The outer boundary of the EEZ is a line 200 nautical miles from the (inner) baseline of the territorial sea. Management of fisheries in the EEZ is based on fishery management plans (FMPs) developed by regional fishery management councils. 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 (USDOC).

The councils must operate under a set of National Standards and guidelines laid out in the Mag-Stevens, and to the extent practicable, an individual stock of fish must be managed as a unit throughout its range. Management must, where practicable, promote efficiency, minimize costs, and avoid unnecessary duplication (MFCMA Section 301a).

There is no significant fishery for blue crab in the EEZ of the U.S. Gulf of Mexico. Consequently, the Gulf of Mexico Fishery Management Council (GMFMC) has not developed a management plan for blue crab.

National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Department of Commerce (DOC)

The Secretary of Commerce, acting through the NMFS, has the ultimate authority to approve or disapprove all FMPs prepared by regional fishery management councils. Where a council fails to develop a plan, or to correct an unacceptable plan, the Secretary may do so. The NMFS also collects data and statistics on fisheries and fishermen. It performs research and conducts management authorized by international treaties. The NMFS has the authority to enforce the Mag-Stevens and the Lacey Act and other federal laws protecting marine organisms, including the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) and is the federal trustee for living and nonliving natural resources in coastal and marine areas.

The NMFS exercises no management jurisdiction other than enforcement with regard to blue crabs in the Gulf of Mexico. It conducts some research and data collection programs and comments on all projects that affect marine fishery habitats.

The USDOC, 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. Those protected areas serve to provide suitable habitat for a multitude of estuarine and marine species and serve as sites for research and education activities relating to coastal management issues.

Treaties and Other International Agreements

There are no treaties or other international agreements that affect the harvesting or processing of blue crabs. No foreign fishing applications to harvest blue crabs have been submitted to the United States.

APPENDIX VII. Federal Laws, Regulations and Policies

The following federal laws, regulations, and policies may directly and indirectly influence the quality, abundance, and ultimately the management of blue crabs.

Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MFCMA); Sustainable Fisheries Act of 1996; Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006

The MFCMA mandates the preparation of FMPs for important fishery resources within the EEZ. It sets national standards to be met by such plans. Each plan attempts to define, establish, and maintain the optimum yield for a given fishery. The 1996 reauthorization of the MFCMA set three new additional national standards to the original seven for fishery conservation and management, included a rewording of standard number five, and added a requirement for the description of essential fish habitat and definitions of overfishing. The 2006 reauthorization builds on the country's progress to implement the 2004 Ocean Action Plan which established a date to end overfishing in the United States by 2011, use market-based incentives to replenish U.S. fish stocks, strengthen enforcement of U.S. fishing laws, and improve information and decisions about the state of ocean ecosystems.

Interjurisdictional Fisheries (IJF) Act of 1986 (P.L. 99-659, Title III)

The IJF established a program to promote and encourage state activities in the support of management plans and to promote and encourage management of IJF resources throughout their range. The enactment of this legislation repealed the Commercial Fisheries Research and Development Act (P.L. 88-309).

Federal Aid in Sport Fish Restoration Act (SFRA); the Wallop-Breaux Amendment of 1984 (P.L. 98-369)

The SFRA provides funds to states, the USFWS, and the GSMFC to conduct research, planning, and other programs geared at enhancing and restoring marine sportfish populations.

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

The MPRSA provides protection of fish habitat through the establishment and maintenance of marine sanctuaries. The MPRSA and the SPA acts regulate ocean transportation and dumping of dredged materials, sewage sludge, and other materials. Criteria for issuing such permits include consideration of effects of dumping on the marine environment, ecological systems, and fisheries resources.

Federal Food, Drug, and Cosmetic Act of 1938 (FDCA)

The FDCA 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, the FDCA also requires FDA approval for distribution of certain products.

Clean Water Act of 1981 (CWA)

The CWA requires that an USEPA approved NPDES permit be obtained before any pollutant is discharged from a point source into waters of the United States including waters of the contiguous zone and the adjoining ocean. Discharges of toxic materials into rivers and estuaries that empty into the Gulf of Mexico can cause mortality to marine fishery resources and may alter habitats. Under Section 404 of the CWA, the USACOE is responsible for administration of a permit and enforcement program regulating alterations of wetlands as defined by the act. Dredging, filling, bulk-heading, and other construction projects are examples of activities that require a permit and have potential to affect marine populations. The NMFS is the federal trustee for living and nonliving natural resources in coastal and marine areas under United States jurisdiction pursuant to the CWA.

Clean Vessel Act of 1992 (CVA), as Amended

The CVA of 1992 (Public Law 102-587) amended the Sport Fish Restoration Act (SFR), commonly referred to as the Dingell-Johnson (DJ) Act. The original SFR Act was passed on Aug. 9, 1950. The 1992 amendment to the SFR Act established a five year federal grant program and provided $40 million out of the Aquatic Resources Trust Fund for the CVA Program. The CVA Grant Program provides grant funds to the states, the District of Columbia and insular areas for the construction, renovation, operation, and maintenance of pumpout stations and waste reception facilities for recreational boaters and also for educational programs that inform boaters of the importance of proper disposal of their sewage. The governmental agency designated by each respective governor is eligible to participate in the CVA Program. The governmental agency may partner with local governments, private marinas, and others to fund eligible projects.

Federal Water Pollution Act of 1972 (FWPCA) and Marpol Annexes I and II

Discharge of oil and oily mixtures is governed by the FWPCA and 40 Code of Federal Regulations (CFR), Part 110, in the navigable waters of the United States. Discharge of oil and oily substances by foreign ships or domestic ships operating or capable of operating beyond the United States territorial sea is governed by MARPOL Annex I. MARPOL Annex II governs the discharge at sea of noxious liquid substances primarily derived from tank cleaning and deballasting. Most categorized substances are prohibited from being discharged within 22 km of land and at depths of less than 25 m.

Coastal Zone Management Act 1972 (CZMA), as Amended

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

Endangered Species Act (ESA) of 1973, as Amended (P.L. 93-205)

The 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 DOI to be critical.

National Environmental Policy Act of 1970 (NEPA)

The NEPA requires that all federal agencies recognize and give appropriate consideration to environmental amenities and values in the course of their decision-making. In an effort to create and maintain conditions under which man and nature can exist in productive harmony, the 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, alternatives to the proposed action that may better safeguard environmental values are to be carefully assessed.

Fish and Wildlife Coordination Act of 1958

Under the Fish and Wildlife Coordination Act, the 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 fishery resources from activities that may alter critical habitat in nearshore waters. The act is important because federal agencies must give due consideration to the recommendations of the USFWS and NMFS.

Fish Restoration and Management Projects Act of 1950 (P.L. 81-681)

Under this act, the 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 the 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 with its more stringent penalties has probably reduced interstate transport of illegally possessed fish and fish products.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCL or "Superfund")

The CERCLA names the NMFS as the federal trustee for living and nonliving natural resources in coastal and marine areas under United States jurisdiction. It could provide funds for "clean-up" of fishery habitat in the event of an oil spill or other polluting event.

MARPOL Annex V and United States Marine Plastic Research and Control Act of 1987 (MPRCA)

MARPOL Annex V is a product of the International Convention for the Prevention of Pollution from Ships, 1973/1978. Regulations under this act prohibit ocean discharge of plastics from ships; restrict discharge of other types of floating ship's garbage (packaging and dunnage) for up to 46 km from any land; restrict discharge of victual and other recomposable waste up to 22 km from land; and require ports and terminals to provide garbage reception facilities. The MPRCA of 1987 and 33 CFR, Part 151, Subpart A, implement MARPOL V in the United States.

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.

National Aquaculture Act (NAA) of 1980, Reauthorization 1985

The NAA in 1980 established national policy to encourage the development of aquaculture in the United States. The National Aquaculture Improvement Act (NAIA) of 1985 designated the U.S. Department of Agriculture (USDA) as the lead federal agency for coordination of federal activities and for dissemination of aquaculture information. Under this act, advisory, educational, and technical assistance is provided to encourage the implementation of aquaculture technology in rehabilitation and enhancement of publicly-owned fish and shellfish stocks, and in the development of private commercial aquaculture enterprises. The Joint Subcommittee on Aquaculture (JSA), established by the NAA, issued the National Aquaculture Development Plan of 1983, recognizing the status of aquaculture (including oyster culture), current technologies, impediments to development, existing programs, recommended programs and actions, and anticipated impacts.

APPENDIX VIII. Commercial and Recreational Blue Crab Regulations - Full Text

EXISTING COMMERCIAL CRABBING REGULATIONS

LICENSING

	Resident	Non-Resident
Commercial Fisherman[1]	$55	$460
Senior Commercial Fisherman[1,2]	$20	N/A
Certified Commercial Fisherman	No added fee	No added fee
Fresh Products License[1]	$20	$120
Fresh Products License (Spouse)[1]	$5	N/A

1 May be purchased Nov 15 for the immediately following license year
2 Includes crab trap gear license

Crab Trap[1]	$50	$200
Crab Drop Net	$25	$100
Trot Lines	$25	$100
Hand Lines	$25	$100
Bush Lines	$25	$100
Hoop Net	$25	$100
Dip Net	$25	$100
Cast Net	$25	$100
Trawl	$25	$100
Butterfly Net	$25	$100
Skimmer Net	$25	$100

Gear Licenses may be purchased Oct. 1 for the immediately following license year. Licenses may be temporarily transferred between licensed commercial fishermen having the same residency status, except crab trap gear licenses are not transferable. No non-resident gear license available for sale if domiciliary state prohibits the use of similar commercial fishing gear
1 $10.00 of license cost is dedicated to the Crab Promotion and Marketing Fund and $10.00 dedicated to the Derelict Crab Trap Removal Account ($40.00 dedications for non-residents). Persons holding a Senior Commercial Fisherman's License are exempt from these dedications.

Vessel License[1,2]	$15	$60
Wholesale/Retail Seafood Dealer[2] (Business or Vehicle)	$250	$1,105
Retail Seafood Dealer[2] (Business or Vehicle)	$105	$405
Seafood Transport (Wholesale/Retail and Retail Seafood Dealers)	$30	$30
Wholesale Out-of-State Crab Shipping	$100	$100
Retail Out-of-State Crab Shipping	$100	$100
Commercial Fisherman Transport	$30	$30

1 Must be issued in the name of the vessel owner
2 May be purchased beginning Oct. 1 for the immediately following license year.

Commercial Fisherman's License

- A commercial fisherman taking crabs for sale must purchase a commercial fisherman's license. R.S.56:303(A)1
- Cost is $55 for residents and $460 for non residents R.S.56:303(B)
- Valid for one year beginning Jan. 1 and ending Dec. 31 R.S.56:303.1(A)
- Available for purchase at any time of the year for the current license year and from Nov. 15 for the immediately following license year. R.S.56:303.1(B)
- A commercial fisherman holding 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. R.S.56:303.7(A)
- Holder of a commercial fisherman's license who sells or transfers his catch to a wholesale/retail seafood dealer must present his license to the dealer for verification and provide the dealer with the necessary information needed to complete trip tickets R.S.56:303.7(B)
- Unlawful for the owner of a commercial fishing vessel to allow any person who does not hold a commercial fisherman's license to operate the vessel while commercial fishing or in possession of fish for sale while on the water. R.S.56:304.2(A)
- Senior Commercial Fisherman's license available to residents 70 years of age or older at a cost of $20 and also serves in lieu of any required commercial gear licenses, including crab traps. R.S.56:303 (F)

- Certified Commercial Fisherman's license available upon presentation to LDWF of a notarized statement from the tax preparer certifying that based upon his most recent tax return the individual earns at least 50% of his income from commercial fishing activities. R.S.56:303(E)1
- Five dollars of each commercial fisherman's license fee is deposited in the Seafood Promotion and Marketing Fund. R.S.56:10(B)1

Fresh Products License

- A commercial fisherman selling his catch directly to a consumer must possess a fresh product's license. R.S.56:303(A)2 and R.S.56:303.1.1(A)
- A commercial fisherman may purchase a secondary fresh products license for a spouse at a cost of $5.00. R.S.56:303.1.1(E)
- The cost of a fresh products license shall be $20 for residents and $120 for nonresidents. The fresh products license shall be valid for one year, beginning on Jan. 1 of each calendar year and expiring on Dec. 31 of the same calendar year. R.S.56:303.1.1(B)

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 any shrimp gear on the fishing grounds. R.S.56:303.2(A) and R.S.56:305 (A)
- A commercial gear license can only be purchased by a person possessing a valid commercial fisherman's license. R.S.56:305.2 (A)
- 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 used to take fish. R.S.56:305(A) and R.S.56: (E)
- Cost of a crab trap license is $50 for residents and $200 for non residents R.S.56:305(2)
- Cost of a trawl, skimmer net, butterfly net, cast net, hoop net, dip net, drop net, trot line, hand line and bush line is $25 for residents and $100 for non residents R.S.56:305(B)1, R.S.56:305(B)11 and R.S.56:305(B)13
- Licenses may be temporarily transferred between licensed commercial fishermen having the same residency status, except for the crab trap gear license. R.S.56:305.3(A)
- Not available for sale if domiciliary state prohibits the use of similar commercial fishing gear. R.S.56:30(C)2
- Five dollars of each gear license fee is deposited in the Seafood Promotion and Marketing Fund. R.S.56:10(B)1
- Valid for one year beginning Jan. 1 and ending Dec. 31. R.S.56:305.1(A)
- Available for purchase at any time of the year for the current license year and from Nov. 15 for the immediately following license year. R.S.56: 305.1(B)
- The commission shall establish a program to increase and elevate professionalism in the commercial crab industry. Such professionalism program shall include education in the proper fishing techniques necessary for the health and sustainability of the species; proper techniques for the best capture and presentation of the crabs for marketability; proper instructions regarding the placement, tending, and maintenance of crab traps to reduce potential conflicts with other user groups, and may include an apprenticeship program. The professionalism program shall be established no later than Nov. 15, 2014, through rules promulgated pursuant to the Administrative Procedure Act. Beginning Nov. 15, 2014, and applicable to license year 2015 and thereafter, no person shall be issued a commercial crab trap gear license unless that person qualifies under one or both of the following provisions:
  1. The person possessed a valid commercial crab trap gear license during any two license years between 2011 and 2014.
  2. The person has enrolled in and completed the program to increase and elevate professionalism in the commercial crab industry established pursuant to the provisions of this Section. R.S.56:305.6, as amended and reenacted.

Vessel License

- A vessel must be licensed whenever engaged in commercial fishing in the saltwater areas of the state defined in R.S. 56:322 or whenever possessing fish for sale in freshwater and saltwater areas of the state. R.S.56:304(A)
- Cost of the vessel license is $15 for residents and $60 for nonresidents. R.S.56:304(B)
- Issued only to the owner of the vessel. R.S.56:304(D)
- Five dollars of each vessel license fee is deposited in the Seafood Promotion and Marketing Fund. R.S.56:10(B)1
- Valid for one year beginning Jan 1 and ending Dec 31. R.S.56:304.1(A)
- Available for purchase at any time of the year for the current license year and from Nov. 15 for the immediately following license year. R.S.56:304.1(B)
- Are not transferable and the name of a vessel for which a vessel license has been issued cannot be changed without prior notification to the department. R.S.56:304.5(A) and R.S.56:304.5(B)

Wholesale/Retail Seafood Dealer's License

- 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, must possess a wholesale/retail seafood dealer's license. R.S.56:306(A)1
- The owner or operator of any fish factory, platform, soft shell crab shedding facility, or other processing plant must possess a wholesale/retail seafood dealer's license. R.S.56:306(A)2(a)
- Five dollars of each wholesale/retail seafood dealer license fee is deposited in the Seafood Promotion and Marketing Fund. R.S.56:10(B)1

- If the place of business is a vehicle, the license shall state "vehicle" and shall list the legal mailing address and physical location of the licensee. R.S.56:306(B)1
- Any person shipping fish into or out of the state shall possess wholesale/retail seafood dealer's license. R.S.56:306(A)2b
- A wholesale/retail seafood dealer's license is required for each place of business. R.S.56:306(B)3
- Must operate from the physical location of the business except for a wholesale/retail seafood dealer's license issued to a vehicle. R.S.56:306(B)1
- A commercial fisherman selling his catch to anyone or any business other than a consumer or licensed wholesale/retail seafood dealer must possess a wholesale/retail seafood dealer's license. R.S.56:303(A)2
- Five dollars of each wholesale/retail seafood dealer's license fee is deposited in the Seafood Promotion and Marketing Fund. R.S.56:10(B)1
- The cost of the wholesale/retail seafood dealer's license is $250 for residents and $1,105 for nonresidents. R.S.56:306.2(A)1
- The license shall be valid for one year, beginning on Jan. 1 of each calendar year and expiring on Dec. 31 of the same calendar year. R.S.56:306.3(A)
- The license may be purchased at any time of the year for the current license year and from Nov. 15 for the immediately following license year. R.S.56:306.3(B)

Wholesale Out-Of-State Crab Shipping License

- Any wholesale/retail seafood dealer who exports outside of the state of Louisiana any crabs, soft shell crabs, boiled crabs, containerized crabmeat, or containerized pasteurized crabmeat shall purchase a wholesale out-of-state crab shipping license. R.S 56:306(B)6(a)
- The cost of the wholesale out-of-state crab shipping license is $100. R.S.56:306(B)6(b)
- The license shall be valid for one year, beginning on Jan. 1 of each calendar year and expiring on Dec. 31 of the same calendar year. R.S.56:306(B)6(b)
- The license may be purchased at any time of the year for the current license year and from Nov. 15 for the immediately following license year. R.S.56:306(B)6(b)
- 90% of the fees collected for wholesale out-of-state crab shipping licenses shall be deposited into the Crab Promotion and Marketing Fund. R.S.56:306(B)6(c)

Retail Seafood Dealer License

- Any person buying, acquiring, or handling by any means whatsoever, from a Louisiana wholesale/retail seafood dealer, any species of fish whether fresh, frozen, processed, or unprocessed, that sells to the consumer for personal or household use and any person who ships fish out of or within the state of Louisiana to the consumer for personal or household use shall purchase a retail seafood dealer's license. R.S.56:306.1(A)
- A retail seafood dealer's license is required for each place of business. R.S.56:306.1(B)3
- Must operate from the physical location of the business except for a retail seafood dealer's license issued to a vehicle. R.S.56:306.1(B)1
- Retail seafood dealers, restaurants and retail grocers shall buy directly only from wholesale/retail seafood dealers licensed in Louisiana. R.S.56:306.4(C)1
- If the place of business is a vehicle, the license shall state "vehicle" and shall list the legal mailing address and physical location of the licensee. R.S.56:306.1(B)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. R.S.56:306.1(B) 6
- The cost of the retail seafood dealer's license is $105 for residents and $405 for nonresidents. R.S.56:306.2(A)2
- A retail seafood dealer's license is valid for one year, beginning on Jan. 1 of each calendar year and expiring on Dec. 31 of the same calendar year. 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 Nov. 15 for the immediately following license year. R.S.56:306.3(B)

Retail Out-Of-State Crab Shipping License

- Any retail seafood dealer who exports outside of the state of Louisiana any crabs, soft shell crabs, boiled crabs, containerized crabmeat, or containerized pasteurized crabmeat shall purchase a wholesale out-of-state crab shipping license. R.S 56:306.1(B)7(a)
- The cost of the retail out-of-state crab shipping license is $100. R.S.56:306.1(B)7(b)
- The license shall be valid for one year, beginning on Jan. 1 of each calendar year and expiring on Dec. 31 of the same calendar year. R.S.56:306.1(B)7(b)
- The retail out-of-state crab shipping license may be purchased at any time of the year for the current license year and from Nov. 15 for the immediately following license year. R.S.56:306.1(B)7(b)
- 90% of the fees collected for retail out-of-state crab shipping licenses shall be deposited into the Crab Promotion and Marketing Fund. R.S.56:306.1(B)7(c)

Seafood 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 a commercial fisherman's license or wholesale/retail dealer's license or transport license. R.S.56:307(A)
- In lieu of a wholesale/retail seafood dealer or retail seafood dealer license, a seafood transport license is required for each vehicle when delivering for or on behalf of a wholesale/retail seafood dealer or retail seafood dealer. R.S.56:306(B)4 and R.S.56:306.1 (B)4
- No license required to transport processed fish or fish products. R.S.56:307(C)
- Issued in the name of the wholesale/retail seafood dealer or valid Louisiana commercial fisherman's license. R.S.56:307.1
- Remain transferable between vehicles. R.S.56:307.5
- Employees of a wholesale/retail seafood dealer or retail seafood dealer operating under authority of a transport license for the dealer, the wholesale/retail seafood dealer or retail seafood dealer remains responsible for all activities taking place under authority of that license. R.S.56:306(B)4
- The cost of a transport license is $30 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. R.S.56:307.1(A)
- If a restaurant or retail grocer buys fish from an out-of-state seller and brings fish into the state, the restaurant or retail grocer must possess a transport license when bringing such fish into the state. R.S.56:306.4(C)1
- Five dollars of each transport license fee is deposited in the Seafood Promotion and Marketing Fund. R.S.56:10(B)1

Commercial Fisherman Seafood Transport License

- A licensed commercial fisherman who possesses a transport license in his name may allow other individuals to transport his catch, provided these individuals are in possession of the fisherman's transport license. R.S.56:307.5
- The transport license must be issued in the name of the commercial fisherman whose catch is being transported. R.S.56:307.1(B)
- Five dollars of each transport license fee is deposited in the Seafood Promotion and Marketing Fund. R.S.56:10(B)1

LICENSING/RESIDENCY ELIGIBILITY

"Bona fide resident" means any person who is a United States citizen or resident alien and has resided in this state continuously during the twelve months immediately prior to the date on which he applies for any license and who has manifested his intent to remain in this state by establishing Louisiana as his legal domicile, as demonstrated by compliance with all of the following, as applicable: R.S. 56:8(16)

- If registered to vote, he is registered to vote in Louisiana.
- If licensed to drive a motor vehicle, he is in possession of a Louisiana driver's license, or, if over the age of fifteen years and not licensed to drive, he is in possession of a special identification card issued by the Department of Public Safety and Corrections under the provisions of R.S. 40:1321.
- If owning a motor vehicle located within Louisiana, he is in possession of a Louisiana registration for that vehicle.
- If earning an income, he has filed a Louisiana state income tax return and has complied with state income tax laws and regulations.

As to a corporation or other legal entity, a resident shall be any which is incorporated or otherwise organized under and subject to the laws of Louisiana, and which is domiciled in Louisiana and has a permanent physical location of business in Louisiana where records are held. R.S.56:8(16)B

Any person, corporation, or other legal entity which possesses a resident license from any other state or country shall not qualify for a resident license in Louisiana. R.S.56:8(16)C

Helpers, deckhands or any person assisting in commercial fishing while on board a fishing vessel need not have a commercial fisherman's license provided the person in charge of the operation of a commercial fishing vessel, whether or not that person is the owner of the commercial fishing vessel, has a commercial fisherman's license and is on board the commercial fishing vessel. R.S.56:303.3

Fishing licenses may be suspended, denied or revoked for failure to pay child support, nonpayment of unemployment compensation overtime and nonpayment of individual income taxes. R.S. 56:647

GEAR RESTRICTIONS

- Crabs or stone crabs may be taken with any legal crab trap, crab dropnet, trawl, skimmer net, butterfly net, hoop net, trotline, handline, bushline, dip net, or cast net. R.S. 56:320(B)3
- No person shall use a trawl with a mesh size less than that of commercial shrimp trawls for the purpose of taking crabs during open shrimp season. R.S. 56:332(A)
- A dredge shall not be used for the intentional taking of crabs. R.S. 56:320(B)3
- Harvest and sale of crabs produced in private artificial reservoirs may be carried out at any time desired by the grower R.S. 56:551(A) and the grower may harvest and sell any species of crabs or other crustacean grown in his private artificial reservoir with prior approval of the LWFC. R.S. 56:551(B)

- "Crab trap" means a cube-shaped device which is constructed of wire and is no larger than 30 inches on any side with entrance funnels extending no further than 7 inches into the inside of the trap and either a bait box or materials providing cover or shelter for peeler crabs, which is used for the sole purpose of taking crabs or stone crabs. This device shall be fished in a stationary, passive manner with the openings to the entrance funnels such that the horizontal diameter of each opening on the vertical wall of the trap is at least one and one-half times the vertical diameter of the opening. R.S. 56:8(35)a
- "Crab dropnet" means any device constructed with vegetable, synthetic, or metal fibers and without flues or throat, attached to a wire frame that forms a net basket and is used for the purpose of taking crabs. This device shall be operated solely by hand and fished in a stationary, passive manner. R.S. 56:8(34)
- "Trawl" means any net, generally funnel-shaped, pulled through the water or along the bottom with otter boards to spread the mouth open while being fished. The term trawl also means and includes plumb staff beam trawls that do not exceed sixteen feet, that do not use otter boards but are held open laterally by a horizontal beam and vertically by two vertical beams (plumb staffs), and that are used while the vessel is under way. R.S. 56:8(138)
- "Skimmer nets" means a net attached on two sides to a triangular frame and suspended from or attached to the sides of a boat, with one corner attached to the side of the boat and one corner resting on the waterbottom. A ski and one end of the lead line are attached to the corner of the frame that rests on the waterbottom and the other end of the lead line attached to a weight which is suspended from the bow of the boat. R.S. 56:8(122)
- "Butterfly net" means a fixed, frame-mounted net, used to fish the near-surface waters, which is suspended from the side or sides of a boat, pilings, floats, rafts, or shore installation. R.S. 56:8(17)
- "Hoop net" means a cone-shaped net of vegetable or synthetic materials having throats or flues and which is stretched over a series of rings or hoops to support the webbing. R.S. 56.8(70)
- "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. R.S. 56:8(70)
- "Dip net" means a net, usually a deep mesh bag of vegetable or synthetic materials, on a fixed frame attached to a handle and held and worked exclusively by hand and by no more than one individual. R.S. 56:8(42)
- "Cast net" means a light circular net of vegetable or synthetic materials and weighted around its perimeter that is thrown by hand over the water. R.S. 56:8(19)

GEAR REQUIREMENTS

- Each crab trap shall have a minimum of three escape rings. All escape rings shall be placed on the vertical, outside walls. A minimum of two escape rings shall be located in the upper chamber flush with the baffle. A minimum of one escape ring shall be located in the lower chamber no greater than one mesh length from the trap floor. Beginning on July 1, 2022, all escape rings shall be located no greater than one mesh length from the corners. The minimum sizes of the rings shall be two and 3/8 inches in inside diameter, not including the ring material. The rings shall be rigid and attached to the trap with material of an equal or smaller diameter than the wire strands of the trap. Except from April 1 through June 30 and from Sept. 1 through Oct. 31, escape ring openings shall not be obstructed with any material that prevents or hampers exit of crabs. However, the provisions of this Subsection shall not apply to any crab trap constructed of wire mesh two and 5/16 inches square or greater. R.S. 56:332(K)
- Each crab trap shall be marked with a 2-inch stainless steel self-locking tag attached to the center of the trap ceiling, or a durable plastic bait-box cover. Said tags shall be supplied by the fishermen and shall have the commercial fisherman's license number (not the commercial gear license) or the recreational crab trap gear license number legibly embossed or engraved thereon. LAC 76:VII.345(A)
- For the purposes of R.S. 56:8(28.1) which specifies that a serviceable trap must be "legally marked with a float," each trap shall be attached by a 1/4-inch minimum diameter, non-floating line to a solid float 6 inches minimum diameter, or equivalent. Crab traps attached to a trotline must also have such a float and line attached to at least one end. For the purposes of R.S. 56:332.G, a common float is defined as a 1 gallon or larger all-white plastic bleach bottle. LAC 76:VII.345(B)
- Crab traps located in areas north of the northern bank of the Intracoastal Waterway and west of Louisiana Highway 70 and those areas located on the eastern side of the Mississippi River and inland from the saltwater line are not required to be marked with a float and float line, unless the trap is placed in a lake. R.S. 56:320(B)3

SIZE AND POSSESSION LIMITS

- Hardshell crabs - 5 inches in width as measured from point to point of the upper shell, except when held for processing as soft crabs or sold to a processor for the making of crabs. R.S. 56:326(A) 1
- Blue crabs of legal size may be taken in unlimited quantities, provided in compliance with all other requirements of the law. R.S. 56:326(A)
- Any blue crabs under the minimum legal size shall be returned immediately to the waters from which taken without avoidable injury. R.S. 56:326(A)
- No person shall keep or sell immature female crabs or adult female crabs in the berry stage, that is, when they are carrying the eggs or young attached to the abdomen. All immature female crabs and crabs in the berry stage taken by any means shall be returned immediately to the waters. However, a legally licensed commercial crab fisherman may have in his workbox an incidental take of immature female crabs in an amount not to exceed 5% of the total; number of crabs in his possession or crabs in the berry stage in an amount equal to not more than 2% of the total number of crabs in his possession. R.S. 56:332(B)

- Workbox means a standard crab crate as used by a commercial crab fisherman aboard the vessel to sort or cull undersized crabs from the harvest in order to obtain a legal catch. R.S. 56:8(151)
- Premolt crabs less than 5 inches in width held by a fisherman for processing as softshell crabs or sold by him to a processor for the making of softshell crabs must be identifiable as premolt crabs and must be held in a separate container marked "peelers" or "busters" while in the possession of the fisherman. Obvious signs that such crabs are in the premolt stage shall include the fact that they are no further from molting than having a white line on the back paddle fin. R.S. 56:326(A)2
- However, as to all commercial fish 5% of the total number of crabs in possession may be smaller than the legal limit. R.S. 56:326(B)1
- To determine whether the total number of crabs in possession violates this Subsection, the enforcement agent shall take a random sample of fifty crabs from each crate or group of crabs equivalent to one crate. Notwithstanding R.S. 56:326(B)1, if more than 10% of the crabs in that 50 crab random sample are less than the minimum size limit set by law, the entire number of crabs in that crate or group of crabs equivalent to one crate shall be considered to be in violation. R.S. 56:326(B)2
- No person shall possess more than twice the percentage of undersize crabs allowed by law. Any person convicted of violating these provisions shall, in addition to any other penalties imposed have his crab trap gear license suspended. R.S. 56:326(F)5(a)
- Crabs in a work box are not subject to the minimum prescribed commercial size limits for hardshell crabs while held aboard the vessel. Commercial crab fishermen shall be allowed to have in possession aboard the vessel, either one work box, if not using a grader, or two work boxes under the grader, if using a grader. R.S. 56:326(B)4
- "Work box" means a standard crab crate as used by a commercial crab fisherman aboard the vessel to sort or cull undersized crabs from the harvest in order to obtain a legal catch. R.S. 56:8.151
- Notwithstanding any provision of law to the contrary, a wholesale or retail dealer and a commercial fisherman may be subject to the penalties provided by law for the possession of undersized crabs. If the wholesale or retail dealer can provide to wildlife and fisheries agents at the time of discovery the identity of the commercial fisherman who harvested the undersized crabs and subsequently sold such crabs to the wholesale or retail dealer, the dealer shall not be subject to the penalties. The department may check unboiled crabs for violations of the undersized crab provisions of this Section. R.S. 56:326(F)1(a)
- It shall be an affirmative defense for a wholesale or retail dealer charged with possessing undersized crabs, after the crabs leave the dock or while some or all of the crabs are in transport after leaving the dock, that the invoice or other written documentation possessed by the dealer reflect that the total number of undersized crabs possessed by the dealer did not exceed 10% of the total number of crabs bought for processing and shipping. R.S. 56:326(F)1(b)
- Commercial fishermen shall tag, mark, or otherwise identify any crabs that are sold, in a manner which will insure that such commercial fisherman can be identified as the person who harvested the crabs. The identification required herein shall include the commercial fisherman's name, license number, and date on which the crabs were harvested. R.S. 56:326(F)2
- A licensed commercial fisherman may retain for personal consumption finfish caught as by-catch in crab traps up to an aggregate of twenty-five finfish per vessel per day. However, no game fish or spotted sea trout may be kept as a part of the aggregate allowed by the provisions of this Subsection. Any fish kept under the provisions of this Subsection shall be subject to statutory and regulatory size and possession limits applicable to recreational fishing. R.S. 56:332(M)1
- In addition to any fish retained as by-catch, any licensed commercial fisherman holding a gear license which allows him to take finfish for commercial purposes may possess any finfish caught under that gear license up to the commercial possession limit allowable for such finfish and such finfish shall not be required to be segregated from the by-catch allowed. R.S. 56:332(M)2
- No person shall take diamondback terrapins by means of traps of any kind, R.S. 56:635(A)

AREA RESTRICTIONS

- No crab traps shall be set in navigable channels or entrances to streams. It shall be the responsibility of the crab fisherman to place his crab traps so vessels can safely navigate and also to dispose of his unserviceable crab traps. LA R.S. 56:332(G)
- Metal tackle or metal crab traps shall not be used in any of the public waters north of the Intracoastal Canal in the Calcasieu River or in any body of water comprising the Calcasieu River System north of the Intracoastal Canal, or in the waters of Vermilion Bay from Cypremort Point 1 mile offshore to Blue Point. R.S. 56:332(J)
- The use of seines, nets, webbing or traps of any and all types, including slat traps, for the taking of fish in the Tchefuncte River or its tributaries from its origin in Washington Parish to where it empties into Lake Pontchartrain in the parish of St. Tammany, Louisiana is hereby prohibited. R.S. 56:405(A)
- The taking of crabs with legal crab traps, crab pots, nets, and lines shall be permitted in the Lake Catherine and Lake Pontchartrain Sanctuary including the waters of Lake Catherine, and its passes, the Rigolets, Unknown Pass, and Chef Menteur, and that portion of Lake Pontchartrain as follows: The whole area from where the Rigolets and Chef Menteur Passes enter Lake Pontchartrain extending in a westerly direction to a point 4 miles west of the Southern Railway Bridge, being all of Lake Pontchartrain and its tributaries lying east of the Southern Railway Bridge, and all that portion of Lake Pontchartrain extending 4 miles west of the Southern Railway Bridge, between the northern and southern shore line, as well as that portion extending out 4 miles from shore along the Orleans Parish shore line to the Jefferson-Orleans Parish line, and that area of Lake Pontchartrain along the north shore extending out 4 miles from shore and running from the Southern Railway Bridge to a line drawn between a point 4 miles southwest of Goose Point and Goose Point. R.S. 56:332(I)

- 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. R.S. 56:804(B)
- The use of crab traps in the Lake Catherine and Lake Pontchartrain Sanctuary is authorized. The use of legal trawls, skimmer nets, and butterfly nets is authorized in open seasons in the area of the sanctuary located south and east of the Interstate 10 bridge. R.S. 56:804(C)
- 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
- Use of crab traps prohibited on Manchac Wildlife Management Area. LAC 76:XIX
- Commercial fishing including commercial crabbing is prohibited in the following WMAs:
  - 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 including commercial crabbing is prohibited in the following coastal National Wildlife Refuges:

- Big Branch Marsh National Wildlife Refuge: *www.fws.gov/bigbranchmarsh/_documents/BigBranchHunt13.pdf*
- Bayou Sauvage National Wildlife Refuge: *www.fws.gov/bayousauvage/_documents/BayouSauvageHunt13.pdf*
- Breton National Wildlife Refuge: *www.fws.gov/southeast/pubs/BretonGeneral.pdf*
- Delta National Wildlife Refuge: *www.fws.gov/delta/_documents/DeltaHunt13.pdf*
- Mandalay National Wildlife Refuge: *www.fws.gov/mandalay/_documents/MandalayHunt13.pdf*
- Shell Keys National Wildlife Refuge: *www.fws.gov/swlarefugecomplex/shellkeys/*
- Lacassine National Wildlife Refuge: *www.fws.gov/southeast/pubs/SWLAcomplex_Fish.pdf*
- Cameron Prairie National Wildlife Refuge: *www.fws.gov/southeast/pubs/SWLAcomplex_Fish.pdf*
- Sabine National Wildlife Refuge: *www.fws.gov/southeast/pubs/SWLAcomplex_Fish.pdf*

Jean Lafitte National Historical Park and Preserve: Commercial fishing allowed by permit only.

OPERATIONAL RESTRICTIONS

- The baiting, tending, checking, or removing of serviceable crab traps in use and the contents of such crab traps or their lines, buoys, or markers shall be prohibited in public waters during the time period from one-half hour after legal sunset until one-half hour before legal sunrise R.S. 56:332(C)1
- 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. 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
- Harvest and sale of crabs produced in private artificial earthen reservoirs may be carried out at the time desired by the grower, and with seines or tackle selected by the owner. R.S. 56:551(A)
- A fish farmer may harvest and sell any species of crab or other crustacean that has been grown or stored in his private artificial reservoirs with prior approval of the Louisiana Wildlife and Fisheries Commission. R.S. 56:551(B)
- The Commission may develop and establish a program to remove abandoned crab traps from state-owned lake and river beds and other water bottoms of the state. Any crab trap found in state-owned lakes and river beds and other water bottoms of the state during a period of time when their use has been prohibited by the commission shall be considered abandoned and may be removed by those persons authorized by the commission. R.S. 56:332(N)1
- The commission may prohibit crab traps in state-owned lake and river beds and other water bottoms of the state as follows: During a period not to exceed sixteen-consecutive-days between Feb. 1 and March 31, the commission may prohibit crab traps in one or more geographical areas of the state. During a period not to exceed 14 consecutive days which includes the opening day of the spring inshore shrimp season the commission may prohibit crab traps in one or more geographical areas of the state,

or at any time crab harvest is closed for biological or technical reasons, the commission may prohibit crab traps for the duration of the closure. R.S. 56:332(N)1

- No person shall interfere with or disturb any fishermen engaged in the lawful taking of wild animals on lands and waters managed by the state, or upon private lands or waters where a fishermen has been give permission by the owner to take wild animals. R.S. 56:648.1

FISHING GEAR INTERACTIONS

- Crab traps which are no longer serviceable or in use shall be removed from the water by the owner thereof and properly disposed of or stored by him. No person shall intentionally damage or destroy serviceable crab traps or the floats or lines attached thereto, or remove the contents thereof, other than the licensee or his agent. R.S. 56:332(E)1
- A shrimper who catches an unserviceable crab trap shall keep it on board his vessel and properly dispose of it at a designated disposal site if one is available. A shrimper who catches an otherwise serviceable trap without a float shall return it to the water with a common float. Any fisherman with a crab fishing license may raise and check any trap with a common float to determine ownership. The owner of the trap shall return the common float to any shrimper for reuse. R.S. 56:332(G)

BAIT

- Use of any legal fish of legal size other than gamefish allowed.
- The Louisiana Legislature finds and declares there is great financial hardship imposed upon Louisiana crawfish, blue crab, and catfish fishermen because of insufficient supplies of bait during the winter season. This insufficiency compels Louisiana fishermen to purchase bait menhaden and other less effective baits at greatly increased costs from other sources outside the state. In order to assist these fishermen, the legislature hereby extends the regular bait gulf menhaden season by adding a quota of bait gulf menhaden to be taken during the closed season. R.S. 56:325.6(A)

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. R.S. 56:578.10

REPORTING REQUIREMENTS

- 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 the LDWF. R.S. 56:306.5(B)1
- Wholesale/retail seafood dealers are responsible for recording on the commercial receipt form that information provided by the commercial fisherman and is responsible for the following information at the time of purchase or transfer of possession of the catch from a commercial fisherman to a wholesale/retail seafood dealer: wholesale/retail seafood dealer's name and license number, commercial fisherman's name, license number and signature, transaction date, species identification, quantity and units of each species, size and condition of each species, unit price of each species, and permit number for species requiring a permit to harvest. R.S. 56:306.5(B)2
- Records required must be maintained for three years and shall be open to inspection by the department. R.S. 56:306.5(C)
- Wholesale/retail seafood dealers shall, on or before the tenth 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 fishermen for that particular month. Additionally, those wholesale/retail seafood dealers who shed soft shell crabs or operate soft shell crab shedding facilities shall, on or before the tenth of each month, submit to the department, on forms specified by the department, information relative to the amount of soft shell crab produced. R.S. 56:306.6(A)
- A commercial fisherman selling fish under a fresh product license shall record all information required on trip tickets, 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 for wholesale/retail seafood dealers. The commercial fisherman shall sign each commercial receipt form attesting that the information provided therein is correct. R.S.56:303.7(C)

RECORDKEEPING REQUIREMENTS

- Wholesale/retail seafood dealers, retail seafood dealers, restaurants, and retail grocers shall keep, in the English language the following: 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. 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. R.S. 56:306.5(A)2
- 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. R.S. 56:307.7(A)
- 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. R.S. 56:307.7(A)

EXISTING RECREATIONAL CRABBING REGULATIONS

LICENSING

	Resident	**Non-Resident**
Basic Fishing License[1]	$9.50	$60
Basic Fishing License (Daily)[1]	N/A	$5
Non-Resident Student Basic Fishing License[1]	N/A	$9.50
Senior Hunting and Fishing License[1,2]	$5	N/A
Senior Hunting and Fishing License (Lifetime)	$50	N/A
Sportsman's Paradise License[1,3]	$100	N/A
Lifetime Fishing License (5-13 years old)	$200	N/A
Lifetime Fishing License (14 years or older)	$300	N/A
Lifetime Hunting & Fishing License (0-4 years old)	$200	N/A
Lifetime Hunting & Fishing License (5-13 years old)	$300	N/A
Lifetime Hunting & Fishing License (14 years or older)	$500	$3,000
Lifetime Fishing Gear License	N/A	10 X Annual fee per gear type
Wild Louisiana Stamp[4]	$9.50	$9.50
Wild Louisiana Stamp[4] (1-day)	$2	$2

1 May be purchased June 1 for the immediately following license year. Required in order to purchase any recreational gear license.
2 Available for residents 60 years of age or older.
3 Includes use of all recreational gear
4 Required in lieu of a basic recreational fishing license if taking crabs on LDWF Wildlife Management Areas (WMAs) or Wildlife Refuges.

Gear Licensing

Crab Trap License[1,2]	$15	$60
Trawl (16 ft. or less in length)	$25	$100
Trawl (16 – 25 ft. in length)	$80	$320
Hoop Net	$20	$80
Dropnet[3]		
Trotline[3]		
Handline[3]		
Bushline[3]		
Dip net[3]		

1 10 trap limit. $5 of each resident and $20 of each non-resident license credited to the Derelict Crab Trap Removal Account
2 Persons holding a either a Sportsman's Paradise license or a combination lifetime hunting and sports fishing license are exempt from the $5 credited to the Derelict Crab Trap Removal Account.
3 No basic fishing or gear license required

Residents and nonresidents under 16 years of age are not required to obtain a basic or saltwater recreational fishing license. R.S. 56:302.2(A)

Recreational fishing and recreational gear licenses may be purchased at any time of year and are valid from the date of purchase through the following June 30. R.S. 56:302.4(A)

Recreational fishermen must possess a basic fishing license in order to purchase a recreational gear license. R.S. 56:302.3(A)

BASIC FISHING LICENSE EXCEPTIONS

Residents who are totally and permanently disabled and receiving social security benefit payments or disability retirement income from a retirement system whose members are exempt from federal social security may purchase a basic recreational fishing license for $2.50 and a saltwater fishing license for $2.50. R.S. 56:302.1(C)2(d)i

The following shall be issued a basic and saltwater recreational fishing license without payment of fees R.S. 56:302.2(B):

- Residents who are a veteran of the armed forces, the Louisiana Army or Air National Guard, having a permanent service connected disability classification of 50% or more. R.S. 56:302.2 (B)1
- Residents who are blind, paraplegic, or who is a single or multiple amputee, or is required to use one or more artificial limbs or permanent braces for mobility as a result of a permanent and total disability. R.S. 56:302.2(B)2
- The Secretary may exempt for good cause persons or groups of people from the basic and saltwater fishing license. R.S. 56:302.2(C)

The Department may allow recognized nonprofit rehabilitation programs, licensed hospitals, residences, community homes, schools or other facilities to purchases recreational fishing permits rather than individual fishing licenses for clients. R.S. 56:302.1(E))and (F)

Non-residents who are full time students enrolled in an accredited college or university that has a physical campus in Louisiana may purchase a non-resident basic fishing license at the cost of a resident fishing license, provided the domiciliary state of that non-resident offers the same option to Louisiana resident students to purchase a license at a resident fee. R.S. 56:302.1(H)

Revenues generated from the sale of recreational fishing licenses shall be dedicated exclusively to the operation of the Enforcement Division. R.S. 56:302.1(B)2

Recreational gear licenses may be transferred for temporary use to any person holding a basic fishing license and having the same residency status. R.S. 56:302.3(E)

Persons currently on active military duty with any one of the armed forces of the United States, including the National Guard, or the spouse or dependent of such person, may be issued a license for hunting or recreational fishing in Louisiana after payment of the same fee as that required of Louisiana residents for that same license. R.S. 56:643(B)1

Louisiana residents who are an active member of the Louisiana National Guard or any reserve component of the United States armed forces, though not currently on active duty may be issued a resident Louisiana National Guard license for a fee of $50. This license shall be in lieu of basic and saltwater fishing, basic hunting, big game, bow, primitive firearms, and waterfowl licenses, turkey hunting stamps, and WMA hunting permits. R.S. 56:643(B)2

LICENSING/RESIDENCY ELIGIBILITY

Same as those listed under “Commercial Regulations.”

GEAR RESTRICTIONS

- Crabs or stone crabs may be taken with any legal crab trap, crab dropnet, trawl, hoop net, trotline, handline, bushline, dip net, or cast net. R.S. 56:320(B)3
- See “Commercial Regulations” for definitions of a crab trap, crab dropnet, trawl, hoop net, trotline, dip net and cast net
- No person shall use a trawl with a mesh size less than that of commercial shrimp trawls for the purpose of taking crabs during open shrimp season. R.S. 56:332(A)
- Use of hoop nets in saltwater areas prohibited. R.S. 56:320(A)1
- A dredge shall not be used for the intentional taking of crabs. R.S. 56:320(B)3
- No person shall sell or barter any fish taken recreationally or under authority of any type of recreational fishing license or with any recreational gear R.S. 56:302.10(A)

GEAR AND MARKING REQUIREMENTS

- Same as those listed under “Commercial Regulations.”
- Trap tags shall bear the recreational crab trap gear license number. LAC 76:VII.345(B)

SIZE AND POSSESSION LIMITS

- No size limits
- The limit for blue crabs taken for recreational purposes is twelve dozen, or one hundred forty-four crabs, daily and in possession. R.S. 56:332(L)
- See possession limits on Wildlife Management Areas and Refuges
- No person shall keep or sell adult female crabs in the berry stage, that is, when they are carrying the eggs or young attached to the abdomen. All crabs in the berry stage taken by any means shall be returned immediately to the waters. R.S. 56:332(B)

POSSESSION LIMITS/RESTRICTIONS - LDWF WILDLIFE REFUGES AND MANAGEMENT AREAS

- **Isles Dernieres Barrier Island Refuge:** No boat traffic in man-made or natural waters within the refuge other than in California Canal. LAC 76:III.331
- **Elmer's Island Refuge:** Twelve dozen, or one hundred forty-four crabs, daily per person and in possession. Night-time access prohibited. Requirements for a Wild Louisiana Stamp waived. LAC 76:III.337
- **Marsh Island Wildlife Refuge :** Twelve dozen crabs per boat or vehicle per day. Night-time access prohibited. LAC 76:III.310
- **State Wildlife and Paul J. Rainey Wildlife Refuge:** Crabs may be harvested from the open portion of the refuge; and 12 dozen crabs are allowed per boat or vehicle per day. A maximum of 12 crab nets is allowed per boat or vehicle. Night-time access prohibited. LAC 76:III.323
- **White Lake Wetlands Conservation Area :** Sport fishing with rod and reel only and under a lottery system. LAC 76:III.335
- **Rockefeller Wildlife Refuge:** Crabs may be harvested from the open portion of the refuge; and 12 dozen crabs are allowed per boat or vehicle per day. Night-time access prohibited. LAC 76:III.309
- **Manchac Wildlife Management Area:** Use of crab traps prohibited. Attended lift nets are allowed. LAC 76:XIX
- **Salvador/Timken Wildlife Management Area:** Twelve dozen crabs maximum are allowed per boat or vehicle per day. Crabs may be taken only through the use of hand lines or nets; however, none of the lines are to remain set overnight. LAC 76:XIX
- **Pointe aux Chenes Wildlife Management Area:** Twelve dozen crabs maximum are allowed per boat or vehicle per day. Crabs may be taken only through the use of hand lines or nets; however, none of the lines are to remain set overnight. LAC 76:XIX

AREA RESTRICTIONS

Same as those listed under "Commercial Regulations."

FEDERAL AREA RESTRICTIONS

- **Big Branch Marsh National Wildlife Refuge:** Recreational crabbing permitted year-round from 30 minutes before sunrise to 30 minutes after sunset. Crabbing at night permitted from the bank and pier on Lake Road.
- **Bayou Sauvage National Wildlife Refuge:** Recreational crabbing permitted year-round from 30 minutes before sunrise to 30 minutes after sunset inside the Hurricane Protection Levee and only after 2:00 p.m. outside of the Hurricane Protection Levee from Nov. 1 through Jan. 31 and during the state teal season.
- **Breton National Wildlife Refuge:** Recreational crabbing permitted year-round from 30 minutes before sunrise to 30 minutes after sunset. Crabbing equipment must be attended at all times. Use of trotlines, slat traps and nets prohibited.
- **Delta National Wildlife Refuge:** Recreational crabbing permitted year-round from 30 minutes before sunrise to 30 minutes after sunset in designated areas. However, during state waterfowl season, all public entry is prohibited between Main Pass and Raphael Pass and recreational crabbing is only permitted from 2:00 p.m. until one-half hour after sunset on lands northwest of Main Pass and south of Raphael Pass. All public entry is prohibited between Main Pass and Raphael Pass during state waterfowl and light goose conservation season.
- **Mandalay National Wildlife Refuge:** Recreational crabbing permitted year-round from sunrise to sunset. Lines must be attended at all times. Use of nets, traps, jug lines, trot lines, bush lines prohibited.
- **Shell Keys National Wildlife Refuge:** Recreational crabbing allowed.
- **Lacassine National Wildlife Refuge :** Crabs may be taken with hand lines or drop nets. Only cotton line and drop nets up to 24" outside diameter may be used. Floats on crab lines are prohibited. All hand lines, drop nets, and bait must be removed from the refuge upon leaving. The daily crab limit is five dozen (60) crabs per day, per vehicle or boat.

Fishing, crabbing, and cast netting for bait from a boat are permitted March 15 through Oct. 15 throughout the refuge. Boat admittance into the refuge is permitted from one hour before legal sunrise until one hour after legal sunset; however, fishing, crabbing, and cast netting for bait are prohibited until legal sunrise and after legal sunset.

- **Cameron Prairie National Wildlife Refuge:** Crabs may be taken with hand lines or drop nets. Only cotton line and drop nets up to 24" outside diameter may be used. Floats on crab lines are prohibited. All hand lines, drop nets, and bait must be removed from the refuge upon leaving. The daily crab limit is 5 dozen (60) crabs per day, per vehicle or boat. Boat admittance into the refuge is permitted from one hour before legal sunrise until one hour after legal sunset; however, recreational fishing, crabbing, and cast netting activities are prohibited until legal sunrise and after legal sunset.

- **Sabine National Wildlife Refuge:**
  - Crabs may be taken with hand lines or drop nets. Only cotton line and drop nets up to 24" outside diameter may be used. Floats on crab lines are prohibited. All hand lines, drop nets, and bait must be removed from the refuge upon leaving. The daily crab limit is five dozen (60) crabs per day, per vehicle or boat.
  - No crabbing, fishing, or cast netting are permitted from the Blue Goose Trail or the Wetland Walkway, including associated entrance bridges, drives, parking areas, walking trails, and surrounding areas. Areas closed to boats for fishing, crabbing and/or cast netting include under the bridges to the water control structures at Hog Island Gully and West Cove Recreation Areas, the canal on both sides of the entrance bridge to the Wetland Walkway, and the canal adjacent to the Blue Goose Trail parking lot and walking path. Additional areas designated by **No Fishing, Crabbing or Cast Netting** or **Area Closed** signs are also closed to fishing, crabbing or cast netting for safety and/or management purposes. Fishing, crabbing, and cast netting for bait from a boat are permitted March 15 through Oct. 15 throughout the refuge. Boat admittance into the refuge is permitted from one hour before legal sunrise until one hour after legal sunset; however, fishing, crabbing, and cast netting for bait are prohibited until legal sunrise and after legal sunset. Bank fishing and crabbing are open year round from legal sunrise until legal sunset at North line, Hog Island Gully, Blue Crab, and West Cove Recreation Areas.
- **Jean Lafitte Historical Park and Preserve:** Certain waterways closed to motorized vessels. Fishing is only permitted at the Barataria Preserve park unit. Use of more than 10 baited drop nets or wire traps prohibited. Traps are to be constantly tended.

OPERATIONAL RESTRICTIONS

Same as those listed under "Commercial Regulations."

FISHING GEAR INTERACTIONS

Same as those listed under "Commercial Regulations."

APPENDIX IX. Historical Changes to Blue Crab Regulations that Potentially Influence Catch

YEAR	CHANGES TO BLUE CRAB REGULATIONS
1974	Established a 5 inch carapace width minimum size limit for hard crabs.
	Established the law that made it illegal to retain sponge crabs.
1977	Required commercial license and tagging of traps and fishermen could not have more than 300 total traps.
	Made it illegal to set traps in navigable channels or entrances to streams.
	Allowed recreational fishermen to use up to 5 traps without a license and a maximum of 10 if they obtained a recreational crab trap license.
1979	Allowed trawls as a legal gear for taking blue crabs in inside waters during the open shrimp season.
1986	Removed the maximum number of crab traps for commercial crab fishermen.
1987	Made it illegal to bait, tend, check or remove crab traps from ½ hour after legal sunset to ½ hour before legal sunrise.
	Recreational crab trap license required for recreational fisherman using up to 10 traps.
1988	Established a 5% of a 50 crab sample to contain undersized crabs excluding crabs held for shedding.
1989	Raised the 5% tolerance for undersized crabs to 10%.
1991	Made dredges illegal for the intentional taking of crabs.
1995	Established that crabs in "work boxes" not subject to minimum commercial size limits.
1997	Established rules that required two escape rings per trap minimum. Minimum size of rings required to be 2 5/16 inches inside diameter.
1999	Recreational take of blue crabs limited to 12 dozen daily.
2001	Louisiana Crab Task Force was created.
2003	Allowed for a closure period between Feb. 1 and March 31 and allowed the removal of "abandoned" traps inside the closure areas.
	Established a maximum height of crab traps to be 30 inches.
2005	Established a one-year moratorium on commercial crab trap license gear sales.
	Crab Promotion and Marketing Account was created.
	Derelict Crab Trap Removal Program Account was created.
2006	Eliminated the soft shell crab shedders license and included those operating a shedding facility as a wholesale/retail seafood dealer.
2014	Established a rule that requires three escape rings to be placed on the vertical, outside wall flush with the trap floor or baffle, with at least two rings located in the upper chamber and at least one ring in the lower chamber. The size of each ring shall be 2-3/8 inches in inside diameter, not including rind material. This becomes effective on Nov. 15, 2017.
	Creation of a professionalism program for new entrants into the commercial crab fishery.
2015	The commercial crab trap gear license fee was increased from $35 to $50.
	An increase from $5 to $10 for each crab trap gear license sold would be credited to the Crab Promotion and Marketing Account. An increase from $20 to $40 for non-resident commercial crab license would be credit to this account.
	An increase from $5 to $10 for resident commercial crab trap gear license and from $20 to $40 for non-resident crab trap gear license would be credited to the Derelict Crab Trap Removal Program Account.
2017	Added additional language under the Derelict Crab Trap Removal program that allowed for the removal of derelict or abandoned crab traps at any time crab harvest is closed for biological or technical reasons.
2018	Added language to the Derelict Crab Trap Removal Program authorizing the Commission to determine the disposition of abandoned crab traps.
2019	Prohibited the commercial harvest of immature female crabs, except those being held for soft shell processing and set the incidental take of immature female crabs at an amount not to exceed 5% of the total number in possession.
	Total number of crabs in possession are determined by taking a random sample of 50 crabs from each crate. If more than 5% of the sample are immature female crabs then the entire crate is considered in violation.
	Penalties for theft of crab traps and the take of immature female crabs were increased. Additional information is in LA R.S. 56:332.
	Additional language was added to define the placement of escape rings. A minimum of two escape rings shall be located in the upper chamber flush with the baffle, while a minimum of one escape ring shall be in the lowered chamber no greater than one mesh length from the trap floor. Beginning on July 1, 2022, all escape rings shall be located no greater than one mesh length from the corners.
	The rings shall be attached to the trap with a material an equal diameter or smaller diameter than the wire strands of the trap.

APPENDIX X. Summary of States' Commercial Blue Crab Regulations

NOTE: These charts compare regulations related to traps/pots and hard-shell crabs among major blue crab harvesting states. Trap and pot are used interchangeably.

STATE	LICENSE REQUIREMENTS AND FEES	HARVEST RESTRICTIONS					
		Seasons	Days/Times	Min. Size Limit	Egg-Bearing Females	Harvest Limits	Culling Tolerance
TX	Commercial crab fisherman: $630 resident, $2,520 non-resident	No traps for 10 days in February - March for derelict trap removal	No night fishing	5 inches	Prohibited	None	5% by number (in separate container, for bait only)
LA	Commercial fishing: $55 resident, $460 non-resident; trap: $50 resident, $200 non-resident; gear fee: $10 resident, $40 non-resident	Closures for derelict trap removal	No night fishing	5 inches	Prohibited	None	10% by number in 50 random crab sample
MS	Trap: $75 resident, $200 non-resident	Closures for derelict trap removal	No night fishing	5 inches	Prohibited	None	None
AL	Commercial crab fisherman: $67 resident; non-resident varies by state	Closures for derelict trap removal	No night fishing	5 inches	Allowed Jan. 15 - May 15	None	None
FL	Commercial fishing: $50 resident, $200 non-resident; endorsement: $125; tags: $0.50 per trap	10-day regional closures for derelict trap removal	No night fishing	5 inches	Prohibited	None	5% by number in any container
MD	Crab harvester: $100-150 (depends on amount of pots)	Bay: April 1 - Dec. 15; Coast: April 1 - Oct. 31; additional seasonal restrictions for females	Times depend on gear, season, and area but essentially no night fishing; Bay: no harvest on Sun and/or Mon	None for mature females; Bay: 5 inches April 1 - July 14; 5-1/4 inches July 15 - Dec. 31; Coast: 5 inches	Prohibited	Limits on mature females by area and license type (based on abundance)	Varies by license type and the winter crab dredge survey
VA	Commercial fishing: $190; pot: $48- 127, depending on number	March 17 - Nov. 30; no mature females Nov. 21-30	6am - 2pm March 17 - April 30, Sept. 1 - Nov. 30; 5am - 1pm May-Aug; no Sun	5 inches	Dark sponge crabs prohibited	Between 8 and 47 bushels per day, depending on license and season	10 per bushel; 5% in any other container
NC	Commercial fishing: $400 resident, non-resident varies by state	Pots: Jan. 1 - March 15 (area specific)	No night fishing	5 inches, except March 1 - Oct. 31 and mature females	Allowed; sanctuary for spawning crabs	None	5% by number in any container
NJ	Pot: $100 resident; $500 non-resident	Delaware Bay: April 6 - Dec. 4; other waters: March 15 - Nov. 30	4am - 9pm in Delaware Bay and 24hrs in other waters	4-3/4 inches; mature female: 4-1/2 inches	Prohibited	None	None
SC	Commercial fishing: $25 resident, $300 non-resident; pot: $25 resident, $125 non-resident (both up to 50 pots; each additional $1 and $5, respectively)	Year-round	No night fishing	5 inches	Prohibited	None	None
DE	Commercial fishing: $150 resident, $1,500 non-resident; pot: $28.75-115 resident, $287.50-1,150 non-resident (both depend on amount of pots)	Dec. 1 - last day of February	No night fishing	Males: 5 inches; none for mature females	Prohibited	None	5% of any commercial measure
GA	Commercial fishing: $20 resident, $200 non-resident; trap: $2.50 each	Year-round	None	5 inches	Prohibited	None	None

STATE	GEAR RESTRICTIONS AND REQUIREMENTS							EFFORT MANAGEMENT	
	Max. Trap/Pot Size	Min. Mesh Size	Escape Rings	Degradable Panel	Trap/Pot Limits	Owner ID	Trap/Pot Attendance	Limited Entry	Apprenticeship Program
TX	18 cubic feet	None	Four with 2-3/8 inches min. diameter (two in each chamber of the trap)	Yes	200	Buoy	None	Yes - license moratorium and buyback program	No
LA	15.625 cubic feet (no longer than 30 inches on any side)	None	Three with 2-3/8 inches min. diameter (two in upper chamber and one in lower)	No	None	Trap tag or bait box cover	None	No	Yes
MS	None	None	Two with 2-3/8 inches min. diameter (one in each chamber)	No	None	Buoy and trap tags	None	No	No
AL	27 cubic feet	None	Two with inches min. diameter 2-5/16 (one in each chamber)	No	None	Buoy	None	No	No
FL	8 cubic feet	1-1/2 inches	Three with 2-3/8 inches min. diameter	Yes; terrapin excluder device also required	600 inshore, 400 offshore	Buoy and trap tags	None	Yes - endorsement program	No
MD	8 cubic feet	1-1/2 inches	One 2-3/16 inches min. diameter and one 2-5/16 inches min. diameter	No	Between 50 and 900, depending on license	Buoy	None	Yes - license authorization targets	No
VA			Tidal: one 2-5/16 inches min. diameter and one 2/3-16 inches min. diameter; Bay and tributaries: two 2-3/8 inches min. diameter	No	Bay and Potomac River tributaries: 255; Bay and tidal waters: 425	Buoy or stake	None	Yes - license sale moratorium; limited and delayed access (waiting list)	No
NC		1 inches	Three with 2-5/16 inches min. diameter (must be separated based on trap type)	No	Newport River: 150	Buoy	5 days	Yes - license cap	No
NJ	15.625 cubic feet (no longer than 30 inches on a side)	1 inches	None	Yes; terrapin excluder device also required in some areas	Delaware Bay: 600; all other waters: 400	Buoy or stake	3 days	Yes - license cap	No
SC			Two with 2-3/8 inches min. diameter June 1 - March 14; one with 2-3/8 inches min. diameter for single chamber traps	No	None	Buoy, certain colors	5 days	No	No
DE			None	No	200 per licenseholder, 500 per vessel	Buoy, color coded	3 days	Yes - license cap	No
GA			Two with 2-3/8 inches min. diameter	No	200	Float (not green)	None	Yes - license cap	No

APPENDIX XI. Summary of States' Recreational Blue Crab Regulations

NOTE: These charts compare regulations related to traps/pots and hard-shell crabs among major blue crab harvesting states. Trap and pot are used interchangeably.

STATE	LICENSE REQUIREMENTS AND FEES	HARVEST RESTRICTIONS				
		Seasons	Days/Times	Min. Size Limit	Egg-Bearing Females	Harvest Limits
TX	Fishing: $35 resident; $63 non-resident	No traps for 10 days in February - March for derelict trap removal	No night fishing	5 inches	Prohibited	None
LA	Fishing (required in certain areas or to use traps): $9.50 resident, $60 non-resident; trap: $15 resident, $60 non-resident	Closures for derelict trap removal	No night fishing	None	Prohibited	12 dozen per person per day
MS	Trap: $5	Closures for derelict trap removal	No night fishing	5 inches	Prohibited	None
AL	Fishing: $25 resident, $53.70 non-resident	None	None	5 inches	Allowed - Jan. 15 - May 15	None
FL	Fishing: $17 resident, $47 non-resident	10-day regional closures for derelict trap removal	No night fishing	None	Prohibited	10 gallons per person per day
MD	Crabbing (to use certain gear, harvest certain quantities, or fish in certain areas): $5 resident, $10 non-resident; registration required for crab pots on private shoreline property (free)	April 1 - Dec. 15; Coast: April 1 - Dec. 31	Bay: No night fishing, no Wed;	Bay: 5 inches April 1 - July 14; 5-1/4 inches July 15 - Dec. 31; Coast: 5 inches and no size on mature females.	Prohibited	No female hard-shell or peeler; Bay: Licensed: 1 bushel hard-shell crabs; Unlicensed: 2 dozen; Coast: 1 bushel
VA	Trap: $6 for 1, $36 for 3-5	1-2 pots - March 17 - Nov. 30. 3-5 pots June 1 - Sept. 15		Males, immature females: 5 inches	March 17 - June 15 no dark sponge crabs	1 bushel hard-shell crabs per person per day
NC	Pot: $70 resident, $500 non-resident (exempt if using 1 pot from private property or private pier)	North Hwy 58 bridge Feb. 1 - Dec. 31. South Hwy 58 bridge March 16 – Feb.	No night fishing	Males, immature females: 5 inches; Sept. 1 - April 30: 6-3/4 max. for females	Berry females with dark sponge April 1-30	50 crabs per person per day, not to exceed 100 crabs per vessel per day
NJ	Pot: $2	Delaware Bay: April 6 - Dec. 4; all other waters: March 15 - Nov. 30	No night fishing in Delaware Bay	4-1/2 inches	Prohibited	1 bushel
SC	Fishing (required to use pots): $15 resident, $75 non-resident	Year-round	None	5 inches	Prohibited	None
DE	Fishing: $8.50 resident, $20 non-resident	Pots: March 1 - Nov. 30	None	5 inches; none for mature females	Prohibited	1 bushel per person per day
GA	Fishing: $15 resident, $50 non-resident	Year-round	None	5 inches	Prohibited	1 bushel per person per day; 2 bushels per vessel (with more than one person) per day

STATE	GEAR RESTRICTIONS AND REQUIREMENTS						OTHER
	Max. Trap Size	Min. Mesh Size	Escape Rings	Degradable Panel	Trap Limits	Owner ID	
TX	18 cubic feet		Two 2-3/8 inches min. diameter for each chamber	Yes	6	Tag on buoy or pier	No more than 5% under-sized
LA	15.625 cubic feet (no longer than 30 inches on one side)		Three 2-3/8 inches min. diameter	No	10	Trap tag	
MS	27 cubic feet		Two 2-3/8 inches diameter	No	6	Buoy and trap tags	
AL	27 cubic feet		Two 2-5/16 inches min. diameter	No	5	None	
FL	8 cubic feet	1-1/2 inches	Three 2-3/8 inches min. diameter	Yes	5	Trap tag	
MD	8 cubic feet	1-1/2 inches	One 2-3/16 inches min. diameter and one 2-5/16 inches min. diameter	No; terrapin excluder device required	2 (private shore-line property)	Buoy	
VA			Bay/tidal: two 2-3/8 inches min. diameter; seaside: one 2-3/16 inches and one 2-5/16 inches min. diameter	No; terrapin excluder device required with licensed 5-pot	5	Buoy	
NC			Three 2-5/16 inches min. diameter	No	5	Buoy	Traps must be fished every 5 days
NJ	15.625 cubic feet (no larger than 2.5 feet on a side)	1 inch	None	Yes; terrapin excluder device also required in some areas	2	Buoy, stake or tag	Traps must be tended every 3 days
SC			None	No	2	Buoy	Traps must be tended every 5 days
DE			None	No	2	Buoy	Pots must be tended every 3 days
GA	8 cubic feet		Two 2-3/8 inches min. diameter	No	6	Buoy	