DEEPWATER PORT LICENSE APPLICATION FOR THE BLUEWATER SPM PROJECT

VOLUME II – ENVIRONMENTAL EVALUATION

Section 7 – Commercial and Recreational Fisheries

TABLE OF CONTENTS

7 Commercial and Recreational Fisheries 7-1
7.1 Applicable Laws and Regulations 7-1
7.1.1 State 7-1
7.1.2 Federal and International 7-1
7.2 Proposed Project Impacts 7-2
7.2.1 Proposed Project Area 7-2
7.2.2 Proposed Project Area Existing Conditions 7-4
7.2.2.1 Fish 7-4
7.2.2.2 Crustaceans 7-6
7.2.2.3 Bivalve Mollusks 7-7
7.2.2.4 Federally Managed Fisheries 7-7
7.2.2.5 Commercial Fisheries 7-8
7.2.2.6 Recreational Fisheries 7-8
7.2.3 Proposed Project Construction Impacts 7-9
7.2.3.1 Inshore 7-10
7.2.3.2 Offshore 7-10
7.2.4 Proposed Project Operation Impacts 7-10
7.2.4.1 Inshore 7-10
7.2.4.2 Offshore 7-10
7.2.5 Proposed Project Decommissioning Impacts 7-11
7.2.5.1 Inshore 7-11
7.2.5.2 Offshore 7-11
7.2.6 Summary of Proposed Project Impacts 7-12
7.3 Alternative Project Impacts 7-12
7.3.1 Alternative Project Area 7-12
7.3.1.1 Fish 7-13
7.3.1.2 Crustaceans 7-15
7.3.1.3 Bivalve Mollusks 7-15
7.3.1.4 Federally Managed Fisheries 7-15
7.3.1.5 Commercial Fisheries 7-15
7.3.1.6 Recreational Fisheries 7-15
7.3.2 Alternative Project Construction Impacts 7-15
7.3.2.1 Inshore 7-15
7.3.2.2 Offshore 7-16
7.3.3 Alternative Project Operation Impacts 7-16
7.3.3.1 Inshore 7-16
7.3.3.2 Offshore 7-16

7.3.4 Alternative Project Decommissioning Impacts 7-16
7.3.5 Summary of Alternative Project Impacts 7-16
7.4 Summary of Impacts 7-17
7.5 Mitigation of Proposed Project Impacts 7-18
7.6 References 7-20

LIST OF FIGURES

Figure 7-1: Proposed Project Study Area 7-3
Figure 7-2: Alternative Project Study Area 7-14

LIST OF TABLES

Table 7-1: Major Coastal Pelagic Families Occurring in the Vicinity of the Proposed Project 7-6
Table 7-2: Summary of Potential Impacts on Commercial and Recreational Fisheries 7-19

LIST OF ACRONYMS

<	less than
ac	acre
bbl.	million barrels
BMP	Best Management Practice
BOEM	Bureau of Ocean Energy Management
BWTT	Bluewater Texas Terminal, LLC
CVB	Corpus Christi Convention & Visitors Bureau
DMPU	dredge management placement unit
DWPL	Deepwater Port License
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
FMP	Fishery management plans
FR	Federal Register
ft	feet
GMFMC	Gulf of Mexico Fishery Management Council
GOM	Gulf of Mexico
GSMFC	Gulf States Marine Fisheries Commission
ha	hectare
HDD	horizontal directional drill
IMO	International Maritime Organization
km	kilometer
LDWF	Louisiana Department of Wildlife and Fisheries
LEDPA	Least Environmentally Damaging Practicable Alternative
m	meter
m^3	cubic meter
mi	mile
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAA-ORR	NOAA Office of Response and Restoration
P.L.	Public Law
PLEM	Pipeline End Manifold
SPM	single point mooring
TPWD	Texas Park and Wildlife Department
TSS	total suspended solids
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
VLCC	very large crude carrier

7 Commercial and Recreational Fisheries

This section discusses the existing commercial and recreational fisheries within the vicinity of the Proposed Project and the Alternative Project, and the anticipated environmental impacts associated with the construction, operation, and decommissioning of the Proposed Project and the Alternative Project. The detailed description of the Proposed and Alternative Project and the framework for the evaluation of environmental impacts is provided in Section 3: Project Description and Framework for Environmental Evaluation.

7.1 Applicable Laws and Regulations

Bluewater Texas Terminal LLC (BWTT) has reviewed the laws and statutes that relate to commercial and recreational fisheries. Fishery laws in U.S. marine waters are typically a combination of international, federal, and state regulations that work in unison to protect and regulate fishery resources. The nation's premier fisheries law is the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) has ocean stewardship responsibilities that are directed by many federal laws in addition to the MSFCMA, the Endangered Species Act, and the Marine Mammal Protection Act (addressed in Section 8.0). For instance, the Lacey Act prohibits fish or wildlife transactions and activities that violate state, federal, and Native American tribal or foreign laws. The Fish and Wildlife Coordination Act authorizes NOAA to collect fisheries data for environmental decisions that affect living marine resources. Many other statutes, international conventions, and treaties also guide NOAA activities.

7.1.1 State

In Texas, commercial and recreational fishing is regulated by the Coastal Fisheries Division of the Texas Parks and Wildlife Department (TPWD). TPWD maintains regulatory authority of recreational fisheries, which includes fish and other aquatic organisms, habitat, and "users" of the fisheries. This applies to anglers, boaters, birdwatchers, and any other party that uses an aquatic resource (TPWD 2018a). Additionally, TPWD regulates commercial fishing which is defined as any activity that involves taking or handling fresh or saltwater aquatic resources/products for pay or purpose of barter, sale, or exchange. TPWD manages marine waters extending 9 nautical miles (nm) (10 statute-miles [mi]) off the cost of Texas (TPWD 2018b). All waters beyond this boundary are considered federal waters (also known as the Exclusive Economic Zone [EEZ]), where fishing is managed by the Gulf of Mexico (GOM) Fishery Management Council (GMFMC), and NOAA. Fishing regulations within the EEZ are not always the same as those within bordering state waters.

7.1.2 Federal and International

The MSFCMA, Public Law (P.L.) 104-297, 16 United States Code (U.S.C.) 1801 et seq., established eight Fishery Management Councils responsible for protecting and managing certain fisheries within specific geographic jurisdictions. The councils are required to prepare fishery management plans (FMPs) to regulate commercial and recreational fishing. Marine fisheries in the Project area are under primary jurisdiction of the GMFMC, established under authority of the MSFCMA. The GMFMC works together with NOAA to manage commercially and recreationally important marine fish stocks and to prepare FMPs for target species. The GMFMC and NOAA manage fisheries within the federal waters of the Project area.

The GMFMC develops management measures through FMPs for key marine species, and the NOAA GOM Operations Branch puts in place the resulting regulations. GOM Branch staff also provide: guidance on fisheries management; assessment of the environmental impacts of proposed management measures; public education on fishery management issues; technical assistance and advice during preparation of FMPs; coordination of public review and comments during regulation development; and direction related to fishing closures in order to prevent overfishing if landings approach prescribed annual catch limits.

As recognized and adopted by the U.S., the 1982 United Nations Convention on the Law of the Sea allowed for a change in strategy associated with the utilization of marine resources. This convention provided protections associated with the management of living marine resources within EEZ as pertaining to straddling stocks (stocks that migrate between different EEZs), highly migratory species, marine mammals, as well as anadromous and catadromous species.

To further promote regulations established in the United Nations Convention on the Law of the Sea, the U.S passed and implemented the High Seas Fishing Compliance Act in March of 1996 (61 U.S.C. 5501). This act established a system of permitting, reporting, and regulation of vessels of the U.S. fishing on the high seas. 'High seas' are defined as the waters beyond the territorial sea or EEZ; or the equivalent, of any nation, to the extent that such territorial sea or EEZ (or the equivalent) is recognized by the U.S. More specifically, high seas are those extending beyond the EEZ, or seaward of 200 mi (322 kilometer [km]). Vessels regulated by this Act are described as U.S. vessels that are used, or intended for use, on the high seas for the purpose of the commercial exploitation of living marine resources as a harvesting vessel, mothership, or any other support vessel directly engaged in a fishing operation.

Permitted vessels regulated under this Act are required to record all fishing efforts which occur on the high seas, including target species, equipment and gear used, dates, times, locations, and conditions under which fishing was conducted. Additionally, U.S. vessels are required to report all species caught, species retained, and amount retained and/or discarded including interactions with protected species such as turtles, marine mammals, and avian species.

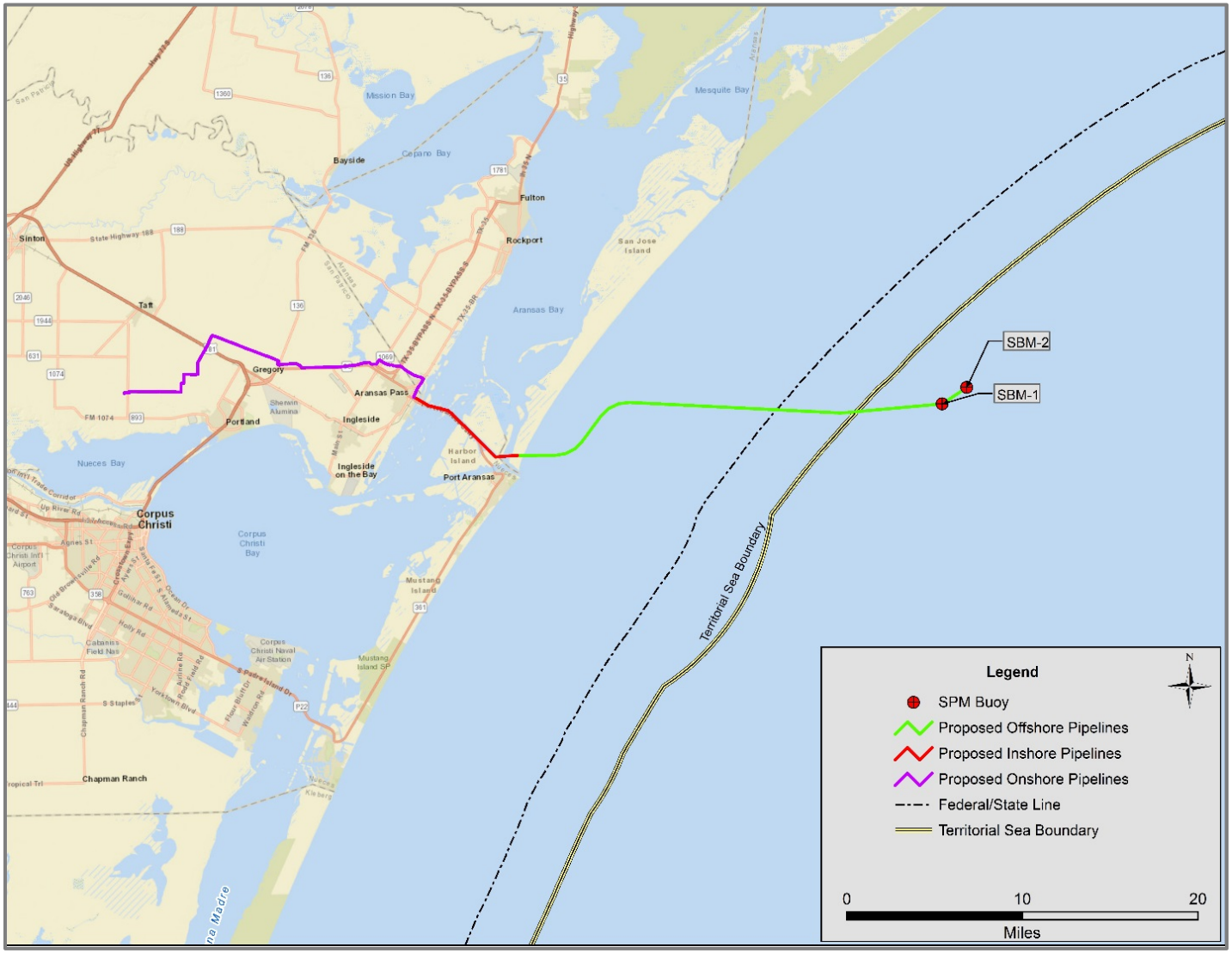
7.2 Proposed Project Impacts

7.2.1 Proposed Project Area

The marine habitats in the GOM, ranging from coastal marshes and estuaries to the deep-sea abyssal plain, support a diverse and abundant fish assemblage. The distribution of species is related to a variety of ecological factors, including salinity, primary productivity, and bottom substrate. These factors differ widely across the Gulf and between the inshore, nearshore, and offshore waters. The Proposed Project area considered for commercial and recreational fisheries encompasses all freshwater, estuarine, and marine waters within the immediate vicinity of the Onshore Pipelines, Inshore Pipelines, Offshore Pipelines, and both SPM buoys (which make up the single point mooring [SPM] buoy systems), as depicted in Figure 7-1. The Proposed Project Onshore Pipelines will cross freshwater surface waterbodies, where the Proposed Project area is considered to include waterbodies within, or immediately adjacent to, the construction workspaces. More specifically, a total of 54 waterbodies including 36 ephemeral waterbodies, four intermittent waterbodies, four manmade waterbodies, six natural ponds, and four perennial streams were identified within the survey corridor for the Proposed Project. Although freshwater waterbodies will be crossed by the Onshore Pipelines, these waterbodies are predominantly ephemeral/intermittent streams, and manmade ponds and no commercial fisheries or significant recreational fisheries are anticipated; therefore, onshore fisheries are not discussed further.

The Proposed Project Inshore Pipelines will occur in estuarine and marine waters between Redfish Bay and San Jose Island, opposite the City of Aransas Pass and including Aransas Channel; this roughly triangular area makes up the Inshore Project area. Estuarine and estuarine-dependent species, as well as fishermen targeting those species, will be present in the inshore waters.

Figure 7-1: Proposed Project Study Area



The Proposed Project Offshore Pipelines and SPM buoys will be in the marine waters of the GOM; effects to commercial and recreational fisheries are assessed within marine waters shoreward of San Jose and Mustang Islands, out to the EEZ. Fish species likely to be found in the vicinity of the Offshore Project Components are characterized as demersal and coastal pelagic; however, certain life stages of estuarine and reef species will also be present in the vicinity of the Offshore Project Components. Reef species are generally associated with coral reefs or hard-bottom habitat. Demersal species are those that feed on or near the seafloor. Coastal pelagic species can be found from the shoreline to the shelf edge in open waters. Each fish assemblage is further discussed below.

7.2.2 Proposed Project Area Existing Conditions

7.2.2.1 Fish

7.2.2.1.1 ESTUARINE FISHES

Approximately 42 percent of U.S. estuaries are in the GOM (U.S. Environmental Protection Agency [USEPA] 1999). Consequently, many fishes and invertebrates found in shelf waters are dependent on, or make use of, estuaries at some point in their life cycle (Bureau of Ocean Energy Management [BOEM] 2017). Most fish reside in estuaries during the late larval/early juvenile stage of development, resulting in commercial and recreational fisheries being estuarine-dependent (USEPA 1999). They tend to leave the estuaries as juveniles or subadults (once they are reproductive) and spawn at sea. Spawning activities typically are more concentrated in shallower waters during spring and summer, in response to warmer temperatures and variable salinity conditions. Eggs hatch in the waters of the open GOM, and the developing larvae become part of the offshore planktonic community. Under the influence of tides, currents, and winds, the young eventually arrive at the estuarine nursery grounds, where they feed, grow, and mature prior to migrating out to sea to repeat the spawning process. Most estuarine-dependent species grow rapidly and reach maturity in about one year; during that time, the young remain in the estuaries, taking advantage of the greater availability of food and protection that the estuarine habitats afford. They may remain in the estuary, migrate to sea to spawn (returning to the estuary between spawning), or migrate from the shallow estuaries to spend the rest of their lives in the deeper waters of the GOM.

There is a nearly continuous estuarine ecosystem along the northern GOM coast, comprising 31 major estuarine systems (BOEM 2016). The inshore areas (landward of San Jose Island) between Corpus Christi and Aransas Bays are part of the Coastal Bend Bays and Estuaries complex. The complex includes barrier islands, tidal marshes, seagrass meadows, mangroves, open bays, oyster and serpulid worm reefs, wind tidal flats, and freshwater marshes. This estuarine complex is estimated to include 40 percent of the seagrasses in Texas (Byrnes et al. 2017).

Estuarine-dependent species constitute more than 95 percent of the commercial fishery harvests from the GOM (USEPA 1999). Several species known to occur in the estuarine Project area are economically important as commercially or recreationally targeted species. This includes Gulf menhaden (*Brevoortia patronus*), spotted sea trout (*Cynoscion nebulosus*), blue crab (*Callinectes sapidus*), brown shrimp (*Farfantepenaeus aztecus)*, gag (*Mycteroperca microlepis*), and red drum (*Sciaenops ocellatus*) (BOEM 2017, USEPA 1999).

7.2.2.1.2 REEF FISHES

Reef fishes are distributed widely in the GOM and occupy both pelagic and benthic habitats during their life cycle. Although juvenile and adult reef fish are typically demersal and associated with areas of higher relief (including artificial structures) on the continental shelf, several species can also be found over sand or soft bottom substrates (e.g., juvenile red snapper [*Lutjanus campechanus]*) and in seagrass beds (e.g., juvenile snappers and groupers; GMFMC 2004). The importance of artificial reefs to fishes is discussed in Section 6: Aquatic Environment. The nearest artificial reef to the Proposed Project is Boatmen's Reef, about 5.7 mi (9.2 km) south of the Proposed Project.

A number of important reef fish species share the common life history characteristics of offshore spawning and transport of larvae inshore to settle in estuaries and seagrass meadows, where they spend the nursery phase, before

recruiting to adult stocks offshore. Examples of estuarine-dependent reef fish are the gag (*Mycteroperca microlepis*) and the gray snapper (*Lutjanus griseus*). Other reef fish species are considered non-estuary dependent such as the red snapper and wenchman (*Pristipomoides aquilonaris*), which remain in offshore waters throughout their entire life cycle. Life histories for managed reef species that occur in the Proposed Project area are described in the Essential Fish Habitat Assessment, which can be referenced in Appendix J.

7.2.2.1.3 DEMERSAL FISHES

The bottom-oriented, or demersal, fish fauna of the northwestern GOM are characterized by substrate composition and water depth (Gallaway 1981). Demersal fish assemblages are named by the dominant shrimp species found in the same sediment/depth regime. The dominant assemblages at the depths associated with the Proposed Project includes the white and brown shrimp assemblages.

The white shrimp (*Litopenaeus setiferus*) assemblage is found at depths of 0 to 66 feet (ft) (0 to 20 meters [m]). It is dominated by drums (*Sciaenids*), with the Atlantic croaker (*Micropogonias undulatus*) being the dominant species. Other abundant species include the Atlantic cutlassfish (*Trichiurus lepturus*), silver seatrout (*Cynoscion nothus*), star drum (*Stellifer lanceolatus*), sand seatrout (*Cynoscion arenarius*), Atlantic threadfin (*Polydactylus octonemus*), and hardhead catfish (*Arius felis*). As these assemblages were specifically identified for areas north of Matagorda Bay, the relative abundance of these species may vary at the Proposed Project site (Gallaway 1981). The brown shrimp assemblage is found at depths of 72 to 299 ft (22 to 91 m) (Gallaway 1981). The brown shrimp assemblage consists of species such as the longspine porgy (*Stenotomus caprinus*), sea robins (*Triglidae*), and dwarf goatfish (*Upeneus parvus*) (Gallaway 1981). Phillips and James (1988) identify the highest density of demersal fishes on the Texas shelf at depths between 240 and 269 ft (73 and 82 m). Similar to the white shrimp assemblage noted above, inshore Texas fisheries were noted as being dominated by Atlantic croaker, silver seatrout, and southern kingfish (*Menticirrhus americanus*) (Phillips and James 1988).

7.2.2.1.4 COASTAL PELAGIC FISHES

Coastal pelagic fish inhabit shelf waters of the GOM throughout the year. The distribution of most species depends on water column structure, which varies seasonally and spatially. These species can be divided into two groups: the large predatory species (e.g., mackerels, dolphinfish, jacks) and the smaller planktivorous species (Gulf menhaden, round scad [*Decapterus punctatus*], anchovies [*Engraulidae*]). Both groups form schools, undergo migrations, grow rapidly, mature early, and exhibit high fecundity. Spawning adults, eggs, and larvae occur over the continental shelf in pelagic waters; juveniles often occur in estuaries and coastal waters. Some species, such as Spanish mackerel (*Scomberomorus maculatus*), Gulf menhaden, anchovies, and herrings (*Clupeidae*), form large schools. Others, such as cobia (*Rachycentron canadum*), form small schools or travel singularly. The smaller coastal pelagic species often are preyed upon by the larger species, as well as by piscivorous (fish-eating) birds (BOEM 2017).

Some coastal pelagic species (especially Spanish sardine [*Sardinella aurita*], round scad, blue runner [*Caranx crysos]*, king mackerel [*Scomberomorus cavalla*], and cobia) show an affinity for vertical structure and often are observed around natural or artificial structures, where they are classified best as transients rather than true residents (BOEM 2017). Most of the large-bodied, predatory coastal pelagic species are important to commercial or recreational fisheries. King and Spanish mackerel, cobia, and jacks (*Carangidae*) are sought by the charter and recreational fisheries in the region. The major coastal pelagic families occurring in the waters covered by the Proposed Project are presented in Table 7-1.

Table 7-1: Major Coastal Pelagic Families Occurring in the Vicinity of the Proposed Project			
Family	**Common Name**	**Trophic Level**	
		Predatory	**Planktivorous**
Carcarhinidae	Requiem sharks	X	
Elopidae	Ladyfish	X	
Engraulidae	Anchovies		X
Clupeidae	Herring		X
Scombridae	Mackerel and tuna	X	
Carangidae	Jacks and Scads	X	
Mugilidae	Mullet		X
Pomatomidae	Bluefish	X	
Rachycentridae	Cobia	X	
Source: BOEM 2017			

7.2.2.2 Crustaceans

Although many kinds of shrimp are found in the GOM, only those of the family Penaeidae are large enough to be considered seafood (TPWD 2010). Brown shrimp, white shrimp, and pink shrimp (*Farfantepenaeus duorarum*) make up the bulk of shrimp landings, with brown shrimp accounting for 80 percent of shrimp landings in Texas. Other shrimp of minor commercial value in the GOM are the seabob, (*Xiphopenaeus kroyeri*), the rock shrimp, (*Sicyonia brevirostris*), and a deep-water type called the royal red shrimp *(Pleoticus robustus*) (TPWD 2010). The most economically important fisheries in the GOM include brown shrimp, white shrimp, and eastern oyster (*Crassostrea virginica*) (BOEM 2017).

Brackish wetlands, saline marsh, and inshore coastal areas provide habitat for shellfish in the GOM. Tides, lunar cycles, maturation state, and estuarine temperature changes influence life history strategies. Generally, individuals are 6 months old or less when they enter the extensive inshore and nearshore fishery, and it is rare for individuals to live longer than a year. Variation in salinity and temperature during the period of larval development are the primary causes of shellfish populations that vary year to year.

Brown shrimp have the greatest abundance in the central and western GOM. They are found in estuaries and offshore waters to depths of 361 ft (110 m), although they are most common in water depths of 90 to 180 ft (27 to 55 m; Louisiana Department of Wildlife and Fisheries [LDWF] 2015). Species abundance and habitat requirements for the brown shrimp are separated by life stage. Post larvae and juveniles typically occur within estuaries, while adults occur outside of bay areas. In estuaries, brown shrimp post larvae and juveniles are associated with shallow vegetated habitats, but they also are found over silty sand and non-vegetated mud bottoms. The density of post larvae and juveniles is highest in marsh edge habitat and submerged vegetation, followed by tidal creeks, inner marsh, shallow open water, and oyster reefs (GMFMC 2004).

White shrimp are offshore and estuarine dwellers and are pelagic or demersal, depending on life stage. They are found in depths as great as 131 ft (40 m) but are most commonly found at depths of 86 ft (27 m). Spawning generally occurs at depths ranging from 30 to 112 ft (9 to 34 m); however, spawning is most common at a depth of 89 ft (27 m) in the GOM from Florida to Texas. The eggs are demersal and larval stages are planktonic; both occur in nearshore marine waters. Post larvae migrate through passes mainly from May-November with peaks in June and September. Migration occurs in the upper 7 ft (2 m) of the water column at night and at mid-depths during the day. Post larval white shrimp become benthic upon reaching nursery areas in estuaries, where they seek shallow water with muddy-

sand bottoms high in organic detritus or abundant marsh vegetation and develop into juveniles. Juveniles dwell within marsh edge microhabitats and feed on sand, detritus, organic matter, mollusk fragments, ostracods, copepods, insect larvae, and forams. Sub-adult white shrimp leave estuaries in late August and September on ebb tides during full moons. Adult shrimp inhabit nearshore GOM waters at depths of less than (<) 98 ft (30 m) with soft mud or silt bottoms (GMFMC 2004).

Between 2010 and 2016, four species of crab and two species of lobster were subject to commercial fishing: Gulf stone crab (*Menippe adina*), golden crab (*Chaceon fenneri*), Atlantic horseshoe crab (*Limulus Polyphemus*), blue crab, Caribbean spiny lobster (*Panulirus argus*), and slipper lobsters (*Scyllarids*; NMFS 2018). Although there are relatively substantial fisheries for some of these species on the west coast of Florida, blue crab are the only commercially targeted crab species in the western Gulf States.

Blue crab is a highly productive, short-lived (about 3 years) and fast-growing species that have the ability to recover rapidly over time. This species of crab is estuarine-dependent and have planktonic, nektonic, and benthic stages that occur within the estuarine and nearshore marine environment (Gulf States Marine Fisheries Commission [GSMFC] 2015). Blue crabs generally range from shore to depths of 120 ft (60 m), although they have been noted as occurring to depths of 298 ft (90 m) (TPWD 2018c, GSMFC 2015).

Estuaries, such as Redfish Bay, provide marsh, seagrasses, and wetland habitats that are crucial to the success of blue crab communities (TPWD 2018a). Eggs hatch into free swimming larvae in nearshore waters and then enter estuaries when they are ready to molt into the first stage of juvenile (GSMFC 2015). Blue crabs enter estuarine habitat as juveniles, using available aquatic vegetation for protection from predator species such as heron, red drum, and sea turtles and graze on mollusks within these habitats (TPWD 2018a, b and the Florida Fish and Wildlife Conservation Commission [FFWCC] 2018). Female blue crabs move into the upper waters of estuaries to molt and mate; spawning season extends from December through October (GSMFC 2015, FFWCC 2018, TPWD 2018a, b). Following mating, female blue crabs will move offshore into higher salinity; however, the males remain in the estuary for the remainder of their life cycles (FFWCC 2019). The estuarine phase is the most pivotal for the species because crab development, reproduction, and overall year-class success occur here. Although blue crab populations have declined in Texas over recent years, TPWD has identified decreases in freshwater runoff, overharvesting, and loss of habitat as the reasons for the decline, although implemented fishing programs are helping the fishery to recover (TPWD 2018a).

7.2.2.3 Bivalve Mollusks

Mussels, oysters, scallops, and clams are widespread throughout the GOM, inhabiting tidal to deepwater habitats. They are benthic organisms that live either in or on the substrate, where they filter water for food and aerate the sediments (Turgeon et al. 2009). Bivalves play an important role in the marine ecosystems by filtering the water, creating habitat for various species, and providing a food source for others (NOAA 2017).

The eastern oyster, an important commercial species, is found throughout the GOM in intertidal and subtidal areas with high salinities and moderate temperatures. Estuarine areas containing suitable substrate that are relatively calm, but with continuous water flow and low sedimentation, are ideal habitats for oysters. Oyster reefs in the northern GOM are most extensive in Louisiana and Florida, but also occur in the vicinity of the Proposed Project (Section 6: Aquatic Environment).

7.2.2.4 Federally Managed Fisheries

As discussed in Section 8: Wildlife and Protected Species and the Essential Fish Habitat (EFH) Assessment in Appendix J, commercial and recreational fisheries resources in federal waters of the GOM are managed by the GMFMC and NOAA. Federal FMPs developed for the GOM include:

- Shrimp Fishery of the GOM, U.S. Waters;

- Red Drum Fishery of the GOM;
- Reef Fish of the GOM;
- Coastal Migratory Pelagic Resources in the GOM;
- Spiny Lobster in the GOM and South Atlantic;
- Coral and Coral Reefs of the GOM; and
- Highly Migratory Species.

These FMPs cover 40 stocks of managed species, about 23 percent of which are overfished (i.e., the stock size is below that which produces maximum yield on a continuing basis) and/or are undergoing overfishing (subject to fishing rates that do not produce the maximum sustainable yield over the long-term) (Karnauskas et al. 2017, 83 Federal Register (FR) 9298). Continued fishing at the current levels may result in rapid declines in commercial landings and eventual failure of certain fisheries. However, management actions in the recent past (e.g., implementation of rebuilding plans, increased regulations, and identification of at-risk stocks) have led to a general decrease in the number of stocks that are overfished or are experiencing overfishing (Karnauskas et al. 2017). Corals and spiny lobster do not occur in the Proposed Project area and are not discussed further.

7.2.2.5 Commercial Fisheries

In 2017 the GOM provided just over 14 percent of the commercial fish landings in the continental U.S. (NMFS 2019). Between 2014 and 2017, the GOM's average annual commercial fishery landings were nearly 1.4 billion pounds (about 5.9 billion pounds total), valued about $925 million annually ($3.7 billion total). For this period, Gulf menhaden comprised the bulk of the commercial landings (over 3.4 billion pounds total) in the GOM; the annual average catch over this period was 1.1 billion pounds (over 57 percent of all landings) (NMFS 2019). Gulf menhaden are typically used as bait in other fisheries (versus for consumption) and are processed as fish meal for farm and aquaculture feed. Brown shrimp (5.0 percent), white shrimp (4.9 percent), and blue crab (2.6 percent) collectively comprised 12.6 percent of commercial landings for this time period.

Between 2014 and 2017, the commercial fisheries in Texas were dominated (by weight) by shellfish (shrimp, oyster, and crab), reef fish (snappers), and black drum. A list of commercially landed species in Texas during 2017 is provided in Section 12: Coastal Zone Use, Recreation, and Aesthetics. Shrimp are among the most economically important fisheries harvested in the GOM, with landings valued at $455 million in 2017 (NMFS 2019). The primary catches in Texas, and the GOM as a whole, comprise brown and white shrimp with some pink, marine, and ocean shrimp catches (NMFS 2019). The value of shrimp landings in 2017 accounted for 51 percent of total value of all landings group in the GOM (NMFS 2019).

The eastern oyster (See Section 7.2.3), another important commercial species, is found in areas of high salinities and moderate temperatures throughout the GOM in intertidal and subtidal waters. Ideal conditions for oysters are estuarine areas containing suitable substrate that are relatively calm with continuous water flow and low sedimentation. In the northern GOM, oyster reefs are predominately located in Louisiana and Florida. However, oyster reefs are present in the Proposed Project area throughout portions of Redfish Bay. The closest oyster reefs identified in NOAA's GOM Data Atlas are on the shoreward side of Redfish Bay, 220 ft (less than 0.1 km) from the Inshore Pipelines (NOAA 2019). In addition, about 0.4 acre (ac) of oyster beds were identified within the inshore survey polygons, as described in Section 6: Aquatic Environment. However, the pipelines will be installed through Redfish Bay using horizontal directional drill (HDD) construction methods, which typically do not result in impacts on the seafloor. Additional information on commercial fishing in the Proposed Project area is provided in Section 10: Socioeconomics and Section 12: Coastal Zone Use, Recreation, and Aesthetics.

7.2.2.6 Recreational Fisheries

Corpus Christi, Texas is a fishing hot-spot on the Gulf Coast of Texas that attracts anglers from all over the world (Corpus Christi Convention & Visitors Bureau [CVB] 2019). The vast majority of these anglers focus on the estuaries

and marine waters in and adjacent to Corpus Christi. TPWD estimates over 600,000 marine recreation fishing trips are taken to the Corpus Christi and Aransas Bay Systems annually (Ropicki et al. 2016a, b). About 8 percent of these recreational fishing trips were conducted from charter boats or guide service (2014 – 2015), and about 31 percent were from private boats (2013 – 2014). The remaining 61 percent of recreational fishing occurs onshore. These trips are predominately taken by residents of Texas (93 percent), who contribute 93 percent of the economic impacts. Characteristics of the recreational fisheries in the Proposed Project vicinity are also discussed in Section 10: Socioeconomics and Section 12: Coastal Zone Use, Recreation, and Aesthetics.

The Redfish Bay State Scientific Area, which includes Redfish Bay, South Bay, and intersecting channels, supports many recreational fishing opportunities due to its varied habitat (TPWD 2019). The area is known for catching redfish and trout (Coastal Bend Fishing 2019). Due to the presence of seagrasses and the potential for long-term scarring from propeller scars, TPWD recommends the use of airboats, johnboats, shallow water boats, or trolling motors when traversing shallow waters. Although anchoring is allowed in the area, it is illegal to allow the uprooting of any seagrass plants by submerged propeller (TPWD 2019). The Inshore Pipelines will cross the Redfish Bay State Scientific Area for a total of about 6.5 mi (10.5 km); however, all open water areas will be crossed using HDD.

In the U.S., about 28 percent of recreational fishing trips are to the Gulf coast (NMFS 2018). Almost 404 million fish were caught by recreational anglers in the GOM in 2017. Spotted seatrout, gray snapper, blue runner, sand, sand seatrout, and Atlantic croaker were the most commonly caught non-bait species. Based on weight, the greatest harvests were of red snapper, sheepshead, spotted seatrout, red drum, Spanish mackerel, and blue runner. Of the 57 million recreational fishing trips taken to the GOM in 2017, 52 percent of the catch was from inland waters, and about 38 percent was from state territorial seas (NMFS 2018). Additional information on recreational fishing in the Proposed Project area is provided in Section 10: Socioeconomics and Section 12: Coastal Zone Use, Recreation, and Aesthetics.

7.2.3 Proposed Project Construction Impacts

Significant impacts on the commercial and recreational fisheries resources described above are those that measurably impact the ecological viability and sustainability of the resource. As proposed, the Proposed Project will include installation of approximately 56.5 mi (90.9 km) of dual, 30-inch-diameter pipeline and the offshore SPM buoy systems located in 88.5 to 89.5 ft (27.0 to 27.3 m) of water, within the EEZ. Impacts on commercial and recreational fisheries will be limited to those components of the Proposed Project that are located in inshore (Redfish Bay) or offshore (seaward of San Jose Island) locations; those impacts are discussed below. Refer to Appendix A: Construction, Operation, and Decommissioning Procedures, for a detailed description of techniques, procedures, and phases of the Proposed Project that were used to evaluated environmental consequences in the following sections.

Potential impacts to commercial and recreational fisheries resources can result from impacts to habitat that support species within a fishery, including EFH. Potential impacts from construction, operation, and decommissioning of the Proposed Project to fish (including ichthyoplankton) and shellfish are examined in Section 8: Wildlife and Protected Species. Impacts to EFH are provided in Appendix J. These impacts are not expected to be significant or result in a significant reduction in stock biomass for any commercially and/or recreationally important species that occur in the Proposed Project area. Impacts on commercial and recreational fishermen and fishing activities are discussed in Section 10: Socioeconomics and Section 12: Coastal Zone Uses, Recreation and Aesthetics.

As discussed in Section 3: Project Description and Framework for Environmental Evaluation, the environmental consequences of the Proposed Project will vary in duration and significance. Four levels of impact duration were considered: temporary, short-term, long-term, and permanent. Temporary impacts generally occur during construction, with the resource returning to pre-construction conditions almost immediately afterward. Short-term impacts are considered to be those that may continue for up to 3 years following construction. Impacts are

considered long-term if the resource will require more than 3 years to recover. A permanent impact could occur as a result of any activity that modified a resource to the extent that it will not return to pre-construction conditions during the life of the Proposed Project, such as within the footprint of Project. When determining the significance of an impact, we consider the duration of the impact, the geographic and biological context in which the impact will occur, and the magnitude and intensity of the impact. The duration, context, and magnitude of impacts vary by resource and therefore significance varies accordingly.

7.2.3.1 Inshore

Construction and installation of the Proposed Inshore Pipelines will not result in impacts on fisheries within inshore waters. Although pipeline installation will result in impacts on the islands through trenching and HDD placement, all aquatic habitats will be crossed using the HDD methodology, which avoids impacts on the crossed features. Impacts on fisherman during construction of the Inshore Pipelines are discussed in Section 12: Coastal Zone Uses, Recreation and Aesthetics.

7.2.3.2 Offshore

Construction of the Proposed Project Components will likely result in a temporary and negligible impact on commercial and recreational fisheries. From the seaward edge of the San Jose Island HDD (HDD 10; about 3,900 ft [1,188.7 m] from shore) to the SPM buoy systems about 17.26 mi (27.4 km) offshore, the Offshore Pipelines will cross soft bottom habitats, which are ubiquitous in the general area. Although the Offshore Pipelines will be installed through jetting, which will cause localized turbidity, sedimentation, and noise for about 26.4 mi (42.5 km), these impacts will be temporary and are unlikely to result in a measurable effect on the fisheries. Hydrostatic testing of two 30-inch-diameter pipelines will require approximately 5.0 million gallons of seawater, which will entrain or impinge fish larvae and eggs in the test water; as discussed in Section 8: Wildlife and Protected Species, this entrainment is expected to result in a negligible impact on fisheries populations.

As further described in Section 4: Water Quality and BWTT's total suspended solids (TSS) model results presented in Appendix D, impacts from turbidity and sedimentation will be temporary and minor, with suspended sediment levels along the trench generally returning to pre-construction levels within 1-2 days. TSS concentrations will be highest in the immediate area of the trench and will dissipate with distance from the trench, returning to ambient levels within a maximum distance of about 2.1 mi (3.5 km), an area in which no hard-bottom or sensitive habitats have been identified. Based on conservative model assumptions, sedimentation exceeding 0.04 inch thick will be limited to within 250 ft (76.2 m) of the Offshore Pipelines, and the layer of sediment deposited on the seafloor will decrease with distance. Over time, any difference in deposition thickness will be reduced by ongoing hydrodynamic forces; therefore, impacts will be temporary, localized, and negligible. Similarly, placement of the Pipeline End Manifolds (PLEM) and anchor chains for the SPM buoys will permanently affect 700 square ft (0.02 ac) of soft bottom habitat, and will result in temporary increases in noise, but will result in negligible impacts on the fisheries.

7.2.4 Proposed Project Operation Impacts

7.2.4.1 Inshore

No impacts on inshore fisheries will occur through operation of the Inshore Project Components.

7.2.4.2 Offshore

The safety zone established for the SPM buoy systems and very large crude carriers (VLCCs) will result in the loss of approximately 939 ac (380 hectares [ha]) of the marine environment which will otherwise be available for fishing opportunities. However, the hard structures associated with the SPM buoy systems will provide new structure for epifaunal colonization and fisheries recruitment over time; therefore, as the safety zones will prohibit fishing activities, this new habitat and faunal community will be protected from fishing pressures. Although the presence of the safety zones will not necessarily result in a measurable difference in fish populations, over the long-term it may

result in larger, mature fish remaining in the system longer, and therefore producing a higher number of eggs over its lifespan, resulting in a minor, permanent, and beneficial impact. The Offshore Pipelines will be buried, and as such, there will be no impact on fisheries populations based on their presence during operations.

During facility operations, VLCCs will require the uptake and discharge of seawater for vessel services. The volume of water withdrawn due to vessel use is conservatively estimated to be about 1.04 billion gallons per year (see Section 4: Water Quality), which will result in approximately 90.0 million larval fish and 57.9 million fish eggs being lost by entrainment or impingement through the VLCC systems. Although the number of eggs and larvae that will be annually entrained appears high, many fish species are broadcast spawners that release a high number of eggs that are subject to high mortality rates; therefore, the overall effect of the water intake is expected to be permanent but minor.

In the event that an inadvertent release of crude oil was to occur, safety measures would be implemented to ensure that the amount of oil released was restricted to the extent possible. A worst-case-scenario discharge volume has been calculated for the Proposed Project and a Tactical Response Plan has been submitted as part of the Deepwater Port License (DWPL) Application (Volume I). The worst-case-scenario spill would be limited to 120,770 barrels (bbl.) over a 10-day period. An response plan would be created for the Proposed Project under various modeled scenarios and trajectories. As discussed in Section 8: Wildlife and Protected Species, in open, marine environments spills do not often result in direct mortality of juvenile and adult finfish. Therefore, significant adverse impacts on populations of recreationally and commercially important finfish are not likely in the event of an oil spill. Fish are less vulnerable to contamination than crustaceans or mollusks, and spills in shallow nearshore areas and confined waterbodies are more likely to result in contamination of shellfish and finfish that use these habitats (Law and Hellou 1999, International Maritime Organization [IMO] 1993, NOAA Office of Response and Restoration [NOAA-ORR] 2018). However, commercial and recreational fishing may sustain temporary or short-term, adverse effects in the event that a local fishery is closed by state or federal regulatory agencies following an oil spill. If an agency determines that fish and/or shellfish in the vicinity of a spill may be contaminated, the fishery would remain closed until testing indicates that the relevant resources are no longer contaminated (NOAA-ORR 2018). Because a fishery closure would be limited to the vicinity of the spill and would likely be temporary, and because of the large area of fishing grounds available in the GOM, impacts on commercial and recreational fishing in the event of a spill would be temporary and minor.

7.2.5 Proposed Project Decommissioning Impacts

7.2.5.1 Inshore

At the end of its useful life (50 years), the Proposed Project will be decommissioned. The Inshore Pipelines will be abandoned in place, avoiding impacts on the fisheries that will be associated with their removal. However, decommissioning of the Proposed Inshore Pipelines will consist of purging the pipe of crude oil liquids and filling them with water. Similar to hydrostatic testing, as described above, fish eggs and larvae present within any seawater used for flooding will be lost, but this loss is not believed to result in a reduction in fish or prey species at the population-level and the impact will therefore be negligible. No decommissioning activities are anticipated to occur in onshore or inshore waterbodies.

7.2.5.2 Offshore

The Offshore Pipelines (from a point about 3,900 ft [1,188.7 m] offshore) will be removed, as will the SPM buoy systems. Decommissioning of the Offshore Pipelines will consist of divers to cut sections of the pipe and a heavy lift vessel to retrieve the cut segments from the seafloor for offsite disposal. The SPM buoy systems will be removed using divers and offshore cranes. The Offshore Components will be generally be disconnected and hauled to shore for proper disposal. The anchor piles will either be removed by vibration or cutting the piles 15 ft (4.6 m) below the mudline. The removal by vibration involves utilizing a vibrating hammer to loosen and remove the pile, as opposed

to the impact hammer that will drive in piles during construction. A crane will be attached to the top of the pile and will apply tension to retrieve the piling at the surface. Removal by cutting, which is standard practice in the GOM, involves the jetting and removal of the seafloor materials around each pile to facilitate the cut; deeper portions of the pile are left in place, buried below the seafloor. Either removal option will result in increased turbidity, sedimentation, and noise adjacent to the activity; however, given the small amount of area impacted and the duration of impacts (approximately 25 days for removal of the anchor piles), these impacts will be minor and temporary.

Loss of the hard-bottom components in the offshore environment will result in loss of the epifaunal community that had likely colonized the structures, resulting in a permanent and adverse, but minor impact. Once removed, the decrease in this prey base and the loss of structure will likely result in any congregated mobile species dispersing from the area as it returns to its pre-construction state. The planned decommissioning sequence is provided in Appendix A; however, a decommissioning plan will be prepared prior to any decommissioning activities taking place. It is estimated that decommissioning will take approximately 5 months to complete.

7.2.6 Summary of Proposed Project Impacts

Impacts on commercial and recreational fisheries from the Proposed Project would generally be restricted to the offshore areas where the Proposed Project's Offshore Pipelines will be installed by jetting and where the SPM buoy systems will be placed. Construction impacts will be temporary (during jetting and SPM buoy installation activities) or permanent (from the loss of 700 square ft [0.02 ac] of soft bottom habitat through placement of the SPM buoy systems) and negligible. Installation of the Offshore Pipelines by jetting will occur across 26.4 mi (42.5 km), which will cause temporary, localized, minor turbidity impacts and temporary, localized, negligible sedimentation impacts.

Impacts during normal operations will result in permanent and beneficial, but minor impact on the fisheries through protection of a 939-ac (380-ha) safety zone, in which fishing would be precluded. However, seawater intake by the VLCCs will result in a minor, but permanent impact on fisheries through the loss of fish eggs and larvae.

Impacts on inshore fisheries will be avoided during decommissioning as in-water infrastructure will be abandoned in place; however, seawater usage during abandonment, if applicable, could result in a negligible impact on ichthyoplankton. Decommissioning of the Offshore Components will result in temporary and minor impacts on the fisheries related to removal of the Offshore Components, including localized increases in turbidity, sedimentation, and noise.

7.3 Alternative Project Impacts

The Alternative Project would include installation of approximately 48.6 mi (78.2 km) of dual, 30-inch-diameter pipeline and the offshore SPM buoy systems located in 87 ft (27 m) of water, within the EEZ. Impacts on commercial and recreational fisheries would be limited to those components of the Alternative Project that cross waterbodies within the onshore environment or are in inshore (Corpus Christi Bay) or offshore (seaward of Mustang Island) locations; those impacts are discussed below. Refer to Appendix A: Construction, Operation and Decommissioning Procedures, for a detailed description of techniques, procedures, and phases of the Alternative Project that were used to evaluated environmental consequences in the following sections.

7.3.1 Alternative Project Area

The Alternative Project area considered for commercial and recreational fisheries encompasses all freshwater, estuarine, and marine waters within the immediate vicinity of the Onshore Pipelines, Inshore Pipelines, Offshore Pipelines, and both SPM buoys (which make up the SPM buoy systems), as depicted in Figure 7-2. The Onshore Pipelines would cross freshwater surface waterbodies, where the Proposed Project area is considered to include waterbodies within, or immediately adjacent to, the construction workspaces. The Alternative Onshore Pipeline would cross ephemeral, intermittent, and perennial waterbodies similar to the Proposed Project and as described in

Section 5: Wetlands and Waters of the U.S. No commercial fisheries or significant recreational fisheries are anticipated; therefore, onshore fisheries are not discussed further.

The Alternative Project would then transition to the Alternative Inshore Pipelines at the shore of Corpus Christi Bay on the mainland. The Alternative Inshore Pipelines would traverse Corpus Christi Bay for 8.5 mi and would reach landfall at Mustang Island, crossing undeveloped lands interspersed with oil and gas facilities and residences; the whole of Corpus Christi Bay is considered the Alternative Project area for the Inshore Pipelines. The Offshore Pipelines, commencing just landward of Mustang Island's beach would transit offshore to the Alternative Project's SPM system, approximately 18.9 mi (30.4 km) southwest of the Proposed Project's SPM system; effects to commercial and recreational fisheries are assessed within marine waters shoreward of San Jose and Mustang Islands, out to the EEZ.

7.3.1.1 Fish

7.3.1.1.1 ESTUARINE FISHES

As discussed for the Proposed Project, there is a nearly continuous estuarine ecosystem along the northern GOM coast, comprising 31 major estuarine systems (BOEM 2017). Corpus Christi Bay is one of the three individual estuaries that make up the Coastal Bend Bays and Estuaries complex (USGS 2010).

7.3.1.1.2 REEF FISHES

Life history characteristics and habitat use of reef fishes for the Alternative Project are identical to that described for the Proposed Project. As described in Section 6: Aquatic Environment, the nearest artificial reef (Lonestar Reef) is located approximately 0.2 mi (0.3 km) south of the Alternative Offshore Pipelines.

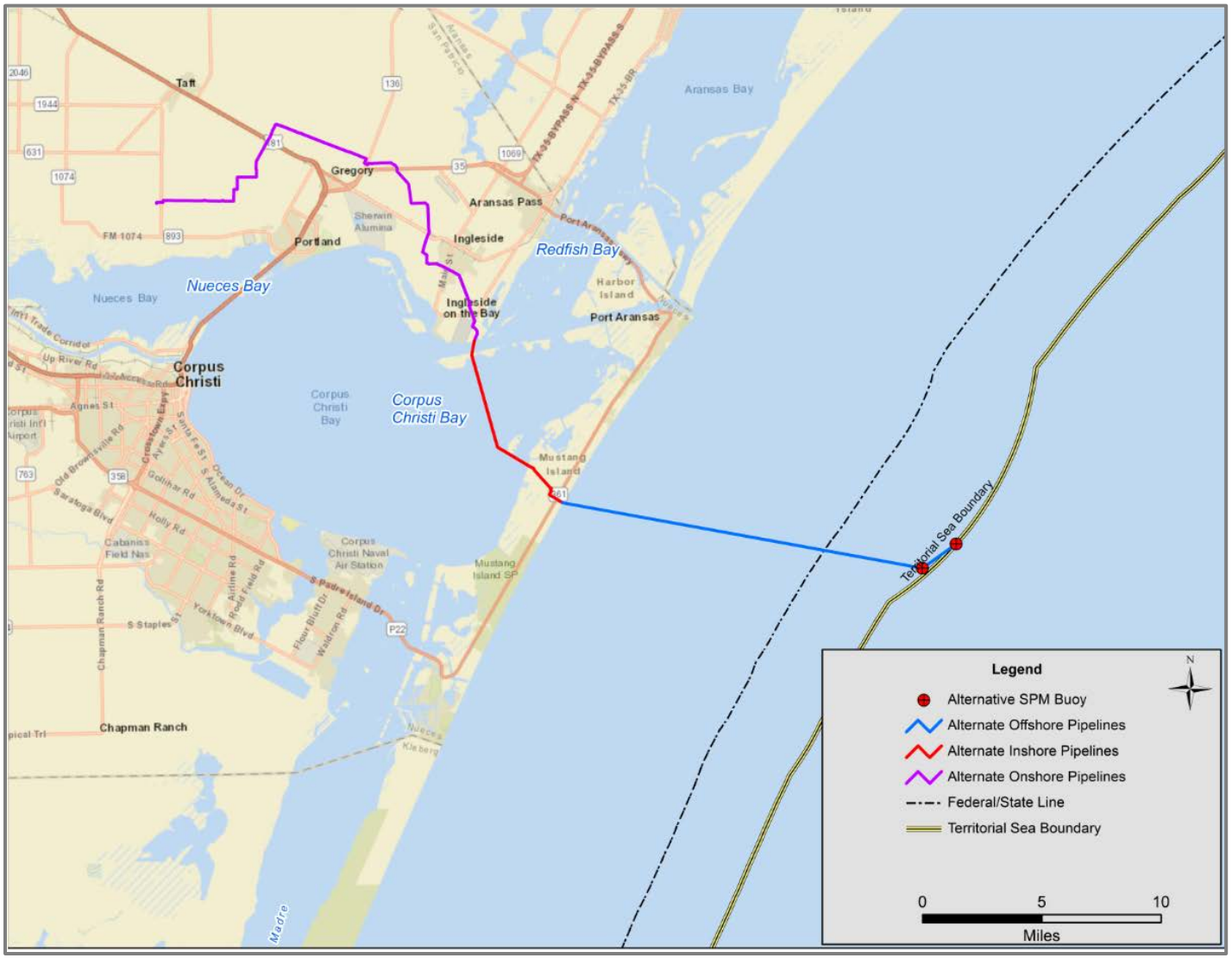
7.3.1.1.3 DEMERSAL FISHES

Life history characteristics and habitat use of demersal fishes for the Alternative Project are identical to that described for the Proposed Project.

7.3.1.1.4 COASTAL PELAGIC FISHES

Life history characteristics and habitat use of coastal pelagic fishes for the Alternative Project are identical to that described for the Proposed Project.

Figure 7-2: Alternative Project Study Area



7.3.1.2 Crustaceans

Life history characteristics and habitat use of crustaceans for the Alternative Project are identical to that described for the Proposed Project.

7.3.1.3 Bivalve Mollusks

Life history characteristics and habitat use of bivalve mollusks for the Alternative Project are identical to that described for the Proposed Project.

7.3.1.4 Federally Managed Fisheries

Federally managed fisheries for the Alternative Project are identical to that described for the Proposed Project.

7.3.1.5 Commercial Fisheries

Commercial fisheries described for the Proposed Project would be similar to those for the Alternative Project. However, commercial fishing vessels are more likely to be present in inshore areas associated with the Alternative Project than the Proposed Project given the higher availability of open water and vessel transit routes. NOAA's GOM Data Atlas identifies oyster reefs intermittently within Corpus Christi Bay (Figure 7-2). The closest known reef area is approximately 1.8 mi (2.9 km) from the alternative pipelines.

7.3.1.6 Recreational Fisheries

As discussed for the Proposed Project, Corpus Christi, Texas is a fishing hot-spot on the Gulf Coast of Texas that attracts anglers from all over the world (Corpus Christi CVB 2019). The vast majority of these anglers focus on the estuaries and marine waters in and adjacent to Corpus Christi.

7.3.2 Alternative Project Construction Impacts

7.3.2.1 Inshore

The Alternative Inshore Pipelines would cross Corpus Christi Bay using a combination of HDD and open trench construction methods. The Alternative Inshore Pipelines would cross the Corpus Christi Ship Channel using an HDD between the mainland and a dredge management placement unit (DMPU) island. From the DMPU island, BWTT would trench through the open waters of Corpus Christi Bay for about 5.8 mi (9.3 km), crossing immediately adjacent to Shamrock Island and landfalling on a small upland area associated with Mustang Island. From there, another HDD would be staged to cross a shallow area containing seagrasses and landfall on Mustang Island proper. No waterbodies would be crossed on Mustang Island. As discussed above, the HDD crossing methodology generally avoids impacts on the crossed features.

Where the Proposed Project Inshore Pipelines will HDD all inshore waters and shorelines however, the Alternative Inshore Pipelines would cross about 5.8 mi (9.3 km) of open water, as well as the shoreline of the DMPU island and the upland staging area associated with Mustang Island, using trenching and/or jetting. Active trenching would significantly increase TSS concentrations along the trenched portions of the Alternative Inshore Pipelines as the distance at which these concentrations return to ambient would likely be greater than the 2.1 mi (3.5 km) estimated for the Alternative Project Offshore Pipelines; this distance was also based on a 3 ft (1 m) depth of cover as opposed to the 5 ft (1.5 m) depth of cover required in Corpus Christi Bay. Increased turbidity and sedimentation, although temporary, can affect seagrasses (important habitat for estuarine species) around the edges of Corpus Christi Bay, which would take approximately 3 to 5 years to recover, if buried by no more than 3-inches of sediment. Long-term impacts on seagrasses could affect recruitment of fishes that use seagrass as nursery habitat. However, all impacts on seagrasses would need to be minimized and mitigated in accordance with Best Management Practices (BMP) and the U.S. Army Corps of Engineers permit; therefore, impacts on seagrasses, and the fish that use them, would likely be minor and temporary or short-term.

7.3.2.2 Offshore

Impacts from Offshore Pipeline installation of the Alternative Project would be similar to those impacts described for the Proposed Project, with few exceptions. The Alternative Offshore Pipelines would be installed by HDD for the first approximate 4,950 ft (1,508.3 m) from shore; the remaining 16.2 mi (26.1 km) of the pipelines would be installed by jetting, as discussed for the Proposed Project. However, where the Alternative Offshore Pipelines would cross a shipping fairway, a greater depth of cover (10 ft [3 m]) and placement of rip-rap over the pipeline trench is required; therefore, the volume of sediment disturbed for trenching along that 3.1 mi (5.0 km) of pipe would be greater, and localized construction would require more time, than elsewhere along the Alternative Offshore Pipelines. In addition, jetting for the Alternative Offshore Pipelines would result in temporary impacts on Lonestar Reef given its proximity (0.2 mi [0.3 km]); sediment levels would be expected to be similar to those experienced along the trench but, given the relatively short duration of impacts they would be minor. Given the decreased length required to be hydrostatically testing, the total volume of seawater required is estimated to be 3.2 million gallons (12,113 cubic meters [m^3]), which would entrain or impinge fewer fish larvae and eggs than the Proposed Offshore Pipelines.

7.3.3 Alternative Project Operation Impacts

7.3.3.1 Inshore

No impacts on inshore fisheries would occur through operation of the Alternative Inshore Project Components.

7.3.3.2 Offshore

Impacts from the Offshore Components of the Alternative Project would be consistent with those impacts described for the Proposed Project.

7.3.4 Alternative Project Decommissioning Impacts

Impacts from the decommissioning of the Alternative Project would be consistent with those impacts described for the Proposed Project, with offshore removal of the pipelines beginning about 4,806 ft (1,465 m) from the shore and extending for 16.2 mi (26.1 km).

7.3.5 Summary of Alternative Project Impacts

The Alternative Project would include installation of approximately 48.6 mi (78.2 km) of dual, 30-inch-diameter pipeline and the offshore SPM buoy systems located in 87 ft (27 m) of water, within the EEZ. Impacts on commercial and recreational fisheries would be limited to those components of the Project that are located in inshore (Corpus Christi Bay) or offshore (seaward of Mustang Island) locations; those impacts are discussed below. Refer to Appendix A: Construction, Operation and Decommissioning Procedures, for a detailed description of techniques, procedures, and phases of the Alternative Project that were used to evaluated environmental consequences in the following sections.

Impacts on commercial and recreational fisheries from the Alternative Project would occur in inshore and offshore areas. The Alternative Inshore Pipelines would cross approximately 5.8 mi (9.3 km) of open water as well as the shoreline of a DMPU island and upland staging area associated with Mustang Island. Active trenching would significantly increase TSS concentrations along the trenched portions of the Alternative Inshore Pipelines as the distance at which these concentrations return to ambient would likely be greater than the 2.1 mi (3.5 km) estimated for the Alternative Project Offshore Pipelines; this distance was also based on a 3 ft (1 m) depth of cover as opposed to the 5 ft (1.5 m) depth of cover required in Corpus Christi Bay. Increased turbidity and sedimentation, although temporary, can affect seagrasses (important habitat for estuarine species) around the edges of Corpus Christi Bay, which would take approximately 3 to 5 years to recover, if buried by no more than 3-inches of sediment. However, these impacts are anticipated to be minor and temporary with implementation of BMPs. Installation of the Offshore Pipelines by jetting would occur across 16.2 mi (26.1 km), which would cause temporary, localized, minor turbidity

impacts and temporary, localized, negligible sedimentation impacts. In addition, the loss of 700 square ft [0.02 ac] of soft bottom habitat through placement of the SPM buoy systems would be permanent, but negligible

Impacts during normal operations would result in permanent and beneficial, but minor impact on the fisheries through protection of a 939-ac (380-ha) safety zone, in which fishing would be precluded. However, seawater intake by the VLCCs would result in a minor, but permanent impact on fisheries through the loss of fish eggs and larvae.

Impacts on inshore fisheries would be avoided during decommissioning as in-water infrastructure would be abandoned in place; however, seawater usage during abandonment, if applicable, could result in a negligible impact on ichthyoplankton. Decommissioning of the Offshore Components would result in temporary and minor impacts on the fisheries related to removal of the Offshore Components, including localized increases in turbidity, sedimentation, and noise.

7.4 Summary of Impacts

Based on the analysis presented in the sections above, potential impacts on commercial and recreational fisheries are summarized in Table 7-2.

The Proposed and Alternative Projects have significantly different impacts on inshore habitats, with respect to the method of construction through inshore waters. While both Projects cross wetlands, the Proposed Project will cross all major inshore waterbodies (e.g., Redfish Bay, navigable channels) using HDD construction methods, which generally avoids impacts on the features crossed. Therefore, although seagrasses and oysters are present along the Proposed Inshore Pipelines, impacts on these sensitive features, and the species that use them, will be avoided. However, about 82 percent (5.8 mi [9.3 km]) of the Alternative Inshore Pipelines will cross the open waters of Corpus Christi Bay by trenching. Given the shallow depths of Corpus Christi Bay, the 5 ft (1.5 m) of covered needed for pipeline burial, and the presence of seagrasses, extended durations of turbidity and the subsequent sedimentation is considered a potentially significant impact on fisheries, although these impacts are anticipated to be minor and short-term with implementation of BMPs.

The majority of impacts associated with the Proposed and Alternative Offshore Projects will be identical, including the increased vessel traffic, noise, SPM buoy systems installations, and potential for inadvertent releases or spills. However, the Alternative Offshore Pipelines would require about 10.2 mi (16.4 km) fewer miles of offshore trenching than will the Proposed Offshore Pipelines. Fewer miles of pipeline installation corresponds to a decrease in relative turbidity and sedimentation, as well as decreased impacts on the plankton community through decreased hydrostatic test water requirements. However, although impacts on these resources from the Alternative Offshore Pipelines would be proportionally less than those impacts associated with the Proposed Offshore Pipeline, both projects would have temporary to short-term, negligible to minor impacts on these resources in the offshore environment. Further, where the Alternative Offshore Pipelines would cross navigational fairways (about 3.1 mi [5.0 km]), the depth of cover would increase from 3 ft (1 m) to 10 ft (3 m), which would result in higher turbidity and sedimentation levels during crossing of the fairways when compared to other locations along the Proposed or Alternative Offshore Pipelines. In addition, rip-rap would be installed over the Alternative Offshore Pipelines in the fairway, and would remain during operations. Where the Alternative Offshore Pipelines are within 0.2 mi (0.3 km) of the Lonestar Reef, impacts from sedimentation would be temporary and minor; the nearest artificial reef is 5.7 mi (9.2 km) from the Proposed Project.

In summary, The Alternative Project has an overall greater potential for impacts on commercial and recreational fisheries from loss or disturbance of wildlife habitat and from the open water trenching that would be needed through Corpus Christi Bay. Although the Proposed Project will result in slightly greater impacts in the offshore environment from the additional 10.2 mi (16.4 km) of Offshore Pipeline installation, offshore benthic habitat is relatively benign and ubiquitous when compared to the seagrass habitat that would likely be affected by open water

trenching through Corpus Christi Bay. Further, the Alternative Offshore Pipelines would affect turbidity levels at an artificial reef (Lonestar Reef). For these reasons, the Proposed Project is the Least Environmentally Damaging Practicable Alternative (LEDPA) and is considered to be environmentally preferable to the Alternative Project.

7.5 Mitigation of Proposed Project Impacts

The Proposed Project is the LEDPA choice in regard to impacts on commercial and recreational fisheries. Therefore, mitigation measures for the anticipated impacts on fisheries from the only the Proposed Project are discussed in this section.

Based on the Project location (away from unique fishing habitat) and design (minimal footprint), impacts to commercial and recreational fisheries will be negligible and no additional mitigation measures are proposed for the mitigation of impacts to commercial and recreational fisheries.

Table 7-2: Summary of Potential Impacts on Commercial and Recreational Fisheries

		Construction	Operation	Decommissioning
Proposed Project	**Onshore**	No impacts anticipated due to lack of significant commercial or recreational onshore fisheries.	No impacts anticipated due to lack of significant commercial or recreational onshore fisheries.	No impacts anticipated due to lack of significant commercial or recreational onshore fisheries.
	Inshore	None anticipated as all inshore aquatic habitats will be crossed by HDD.	No impacts on aquatic habitats are planned.	Permanent, but negligible impacts on ichthyoplankton from flooding of the abandoned pipelines with seawater, if applicable.
	Offshore	Impacts from installation of the Offshore Pipelines will be temporary and negligible to minor. Impacts from hydrostatic testing of the Offshore Pipelines will be negligible but permanent.	Permanent, minor, beneficial impact on marine fauna from the presence of hard structure for colonization and the safety zone (restricted fishing). Permanent, minor impacts from entrainment of fish eggs and larvae into VLCC system water. Inadvertent product spills would be temporary and minor.	Impacts from installation of the Offshore Pipelines will be temporary and minor. In addition, there will be a permanent and adverse, but minor impact from removal of colonized hard structure at the SPM buoy systems.
Alternative Project	**Onshore**	No impacts anticipated due to lack of significant commercial or recreational onshore fisheries.	No impacts anticipated due to lack of significant commercial or recreational onshore fisheries.	No impacts anticipated due to lack of significant commercial or recreational onshore fisheries.
	Inshore	*Significant increases in TSS would occur from trenching through 5.8 mi (9.3 km) of seafloor in Corpus Christi Bay. This increase in TSS could impact nearby seagrasses, although overall impacts are anticipated to be minor and short-term with the implementation of any BMPs required by the applicable agencies.	No impacts anticipated due to lack of significant commercial or recreational onshore fisheries	Permanent, but negligible impacts on ichthyoplankton from flooding of the abandoned pipelines with seawater, if applicable.
	Offshore	Impacts along the Alternative Offshore Pipeline route would be generally consistent with those identified for the Proposed Project, although over a shorter distance of pipeline requiring trenching (16.2 mi [26.1 km]). *Locally greater turbidity impacts where deeper trenching is required across the navigational fairway. *Temporary, minor sedimentation impacts would occur due to trenching 0.2 mi (0.3 km) from the Lonestar Reef. Impacts from hydrostatic testing of the Alternative Offshore Pipelines would be negligible but permanent.	Permanent, minor, beneficial impact on marine fauna from the presence of hard structure for colonization and the safety zone (restricted fishing). Permanent, minor impacts from entrainment of fish eggs and larvae into VLCC system water. Inadvertent product spills would be temporary and minor.	Impacts along the Alternative Offshore Pipeline route would be generally consistent with those identified for the Proposed Project, although over the shorter distance of pipeline requiring trenching (16.2 mi [26.1 km]). *Locally greater turbidity impacts where deeper trenching would be required across the navigational fairway and in the vicinity of the Lonestar Reef.

*Indicates an environmental consequence that is significantly more impactful as compared to the other Project alternative.

7.6 References

Bureau of Ocean Energy Management (BOEM). 2016. Outer Continental Shelf Oil and Gas Leasing Program: 2017-2022. Final Programmatic Environmental Impact Statement. BOEM 2016-060. Available online at: https://www.boem.gov/National-OCS-Program-for-2017-2022/. Accessed January 2018.

Bureau of Ocean Energy Management (BOEM). 2017. Gulf of Mexico OCS Region. Volume 1. Oil and Gas Leasing Program: 2017-2022. Final Programmatic Environmental Impact Statement. U.S. Department of the Interior. BOEM 2017-0009. Available online at: https://www.boem.gov/BOEM-EIS-2017-009-v1/. Accessed January 2018.

Byrnes, Mark R.; Davis Jr., Richard A.; Kennecott II, Mahlo C.; Knee, Ronald T.; Mendelssohn, Irving A.; Rowe, Gilbert T.; Tunnel Jr., John W.; Vittore, Barry A.; Ward, Herb C. 2017. Habitats and Biota of the Gulf of Mexico: Before the Deepwater Horizon Spill. Volume 1: Water Quality, Sediments, Sediment Contaminants, Oil and Gas Seeps, Coastal Habitats, Offshore Plankton and Benthos, and Shellfish. Edited by C. Herb Ward. Rice University. 917 Pages

Coastal Bend Fishing. 2019. Redfish Bay. Available online at: https://www.coastalbendfishing.com/coastal-bend/redfish-bay. Accessed March 2019.

Corpus Christi Convention & Visitors Bureau (CVB). 2019. Fishing 101: A Beginner's Guide to Fishing in Corpus Christi. Available online at: http://www.visitcorpuschristitx.org/trip-ideas/must-see/fishing-101-a-beginners-guide-to-fishing-in-corpus-christi/. Accessed March 2019.

Federal Register (FR). Chapter 83. Determination of Overfishing or an Overfished Condition. A notice by the National Oceanic and Atmospheric Administration (NOAA) on 3/05/2018. Page 9298-9299. Available online at: https://www.federalregister.gov/documents/2018/03/05/2018-04398/determination-of-overfishing-or-an-overfished-condition. Accessed May 2018.

Florida Fish and Wildlife Conservation Commission. FFWCC. 2018. The Life Cycle of a Blue Crab in Florida. Available at: http://myfwc.com/research/saltwater/crustaceans/blue-crabs/life-cycle/. Accessed September 11, 2018.

Florida Fish and Wildlife Conservation Commission. FFWCC. 2019. The life cycle of a Blue Crab in Florida. Available at: https://myfwc.com/research/saltwater/crustaceans/blue-crabs/life-cycle/. Accessed April 2019.

Galloway, B.J. 1981. An ecosystem analysis of oil and gas development on the Texas-Louisiana continental shelf. U.S. Fish and Wildlife Service, Office of Biological Services. Washington, D.C. FWS/OB-81/27. 89 pages. FWS/OBS-81/27. Available online at: https://www.boem.gov/ESPIS/3/3990.pdf. Accessed January 2018.

Gulf of Mexico Fishery Management Council (GMFMC). 2004. Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment to the following fishery management plans of the GOM: Shrimp Fishery of the Gulf of Mexico, Red Drum Fishery of the Gulf of Mexico, Reef Fish Fishery of the Gulf of Mexico, Stone Crab Fishery of the Gulf of Mexico, Coral and Coral Reef Fishery of the Gulf of Mexico, Spiny Lobster Fishery of the Gulf of Mexico and South Atlantic Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic. March 2004. National Oceanic and Atmospheric Administration Document NA17FC1052. Available online at: https://gulfcouncil.org/wp-content/uploads/March-2004-Final-EFH-EIS.pdf. Accessed February 2018.

Gulf States Marine Fisheries Commission (GSMFC). 2015. The Blue Crab Fishery of the Gulf of Mexico: A Regional Management Plan. Publication No. 243. Available online at: https://www.gsmfc.org/publications/GSMFC%20Number%20243_web.pdf. Accessed April 2018.

International Maritime Organization (IMO). 1993. Impact of oil and related chemicals on the marine environment. Report 50: 180pp. Available online at: http://www.gesamp.org/publications/impact-of-oil-based-substances-on-the-marine-environment. Accessed April 2018.

Karnauskas, M., Kelble, C. R., Regan, S., Quenée, C., Allee, R., Jepson, M., Freitag, A., Craig, J. K., Carollo, C., Barbero, L., Trifonova, N., Hanisko, D., Zapfe, G. 2017. 2017 Ecosystem status report update for the Gulf of Mexico. NOAA Technical Memorandum NMFS-SEFSC-706, 51 p. Available online at: http://www.aoml.noaa.gov/ocd/ocdweb/ESR_GOMIEA/report/GoMEcosystemStatusReport2017 NMFS-SEFSC-706_FINAL.pdf. Accessed March 2018.

Law, R. and J. Hellou. 1999. Contamination Fish and Shellfish Following Oil Spill Incidents. Environmental Geosciences. 6(2). Available online at: https://pubs.geoscienceworld.org/eg/article-abstract/6/2/90/61349/contamination-of-fish-and-shellfish-following-oil?redirectedFrom=fulltext. Accessed May 2018.

Louisiana Department of Wildlife and Fisheries (LDWF). 2015. Louisiana Shrimp Fishery Management Plan. Available online at: http://www.wlf.louisiana.gov/sites/default/files/pdf/page/37762-fishery-management-plans-marine/shrimpfmp7-27-15.pdf. Accessed May 2018.

National Marine Fisheries Service (NMFS). 2018. Fisheries of the United States, 2017. Current Fisheries Services Office of Science and Technology. National Oceanic and Atmospheric Administration. Available online at: https://www.fisheries.noaa.gov/resource/document/fisheries-united-states-2017-report. Accessed March 2019.

National Marine Fisheries Service (NMFS). 2019. Landings. Available at: https://foss.nmfs.noaa.gov/apexfoss/f?p=215:200::: NO:::. Accessed: January 2019.

National Oceanic and Atmospheric Administration – Office of Response and Restoration (NOAA-ORR). 2018. How Oil Spills Affect Fish and Whales. Available online at: https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/how-oil-spills-affect-fish-and-whales.html. Accessed April 2018.

National Oceanic and Atmospheric Administration (NOAA). 2017. What is a Bivalve Mollusk? Available online at: https://oceanservice.noaa.gov/facts/bivalve.html. Accessed March 2018.

National Oceanic and Atmospheric Administration (NOAA). 2019. Gulf of Mexico Data Atlas. Available online at: https://www.ncei.noaa.gov/maps/gulf-data-atlas/atlas.htm. Accessed February 2019.

Phillips and James. 1988. Offshore Texas and Louisiana Marine Ecosystems Data Synthesis. Volume 1. Executive Summary. U.S. Department of the Interior Minerals Management Service. Gulf of Mexico OCS Region. OCS Study MMS 88-0066. 52 pages. Available online at: https://www.boem.gov/ESPIS/3/3700.pdf. Accessed January 2018.

Ropicki, Andrew, Daniel Hanselka, and Rebekka Dudensing. 2016a. The Economic Impacts of Recreational Fishing in the Corpus Christi Bay System. Available online at: http://texasseagrant.org/assets/uploads/resources/16-514_Corpus_Christi_Bay_System_Marine_Recreational_Fishing_Economic_Impacts.pdf. Accessed March 2019.

Ropicki, Andrew, Daniel Hanselka, and Rebekka Dudensing. 2016b. The Economic Impacts of Recreational Fishing in the Aransas Bay System. Available online at: http://texasseagrant.org/assets/uploads/resources/16-511_Aransas_Bay_System_Marine_Recreational_Fishing_Economic_Impacts.pdf. Accessed April 2019.

Texas Parks and Wildlife Department (TPWD). 2010. Coastal Fisheries Shrimp in Texas. TPWD Sport Fish Restoration. Available online at: https://tpwd.texas.gov/publications/pwdpubs/media/pwd_br_v3400_046_shrimp.pdf. Accessed March 2018.

Texas Parks and Wildlife Department (TPWD). 2018a. Commercial Fishing General Information. Accessed Online at: https://tpwd.texas.gov/fishboat/fish/commercial/. Accessed March 2018.

Texas Parks and Wildlife Department (TPWD). 2018c. Blue Crab (Callimachus sapidus). Available online at: https://tpwd.texas.gov/huntwild/wild/species/bluecrab/. Accessed March 2018.

Texas Parks and Wildlife Department (TPWD). 2019. Mud Flats – Corpus Christi. Available online at: https://tpwd.texas.gov/fishing/sea-center-texas/flora-fauna-guide/bays-and-estuaries/bay-habitats/mud-flats-corpus-christi. Accessed March 2019.

Texas Parks and Wildlife Department (TPWD).2018b. Fishing in Federal Waters. Outdoor Annual. Texas Hunting and Fishing Regulations. Available Online at: https://tpwd.texas.gov/regulations/outdoor-annual/fishing/general-rules-regulations/fishing-in-federal-waters. Accessed March 2018.

Turgeon, D. D., W. G. Lyons, P. Mikkelsen, G. Rosenberg, and F. Moretzsohn. 2009. Bivalvia (Mollusca) of the Gulf of Mexico, Pp. 711–744 in Felder, D.L., and D.K. Camp (eds.), Gulf of Mexico–Origins, Waters, and Biota. Biodiversity. Texas A&M University Press, College Station, Texas. Available online at: https://www.researchgate.net/publication/251566451_Bivalvia_Mollusca_of_the_Gulf_of_Mexico. Accessed March 2018.

U.S. Environmental Protection Agency (USEPA). 1999. Ecological Condition of Estuaries in the Gulf of Mexico. EPA 620-R-98-004. U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, Florida. Available online at: https://www.epa.gov/sites/production/files/2015-08/documents/ecocondestuariesgom_print.pdf. Accessed April 2018.

U.S. Geological Survey (USGS). 2010. Texas Coastal Bend. Available at: https://pubs.usgs.gov/sir/2006/5287/pdf/TexasCoastalBend.pdf. Accessed February 2019.