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BOEM 2025-013

Qualitative Strike Risk Assessment for Gulf Sturgeon from Vessels Conducting BOEM-Regulated Activities

US Department of the Interior
Bureau of Ocean Energy Management
New Orleans Office
New Orleans, LA

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New Orleans Office
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Abbreviations and Acronyms

Short form	Long form
AIS	automatic identification system
BOEM	Bureau of Ocean Energy Management
CCS	carbon capture and sequestration
CO_2	carbon dioxide
ESA	Endangered Species Act of 1973
FPSO	floating production storage and offloading unit
Gulf	Gulf of America
IMO	International Maritime Organization
MMSI	Maritime Mobile Service Identities
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OWF	offshore wind farm
PCE	Primary Constituent Elements
ROW	rights-of-way
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
WEA	Wind Energy Areas
YOY	young-of-the-year

1. Abstract

Sturgeon species are vulnerable to being struck by vessels (e.g., propeller strikes); this causes injury and/or death. Vessel strike potential depends on four factors: (1) vessel presence, (2) vessel characteristics (e.g., draft, activity), (3) sturgeon presence, and (4) sturgeon behavior (e.g., location within the water column). For a strike to occur, vessels and sturgeon must be in the same location at the same time with the possibility for an interaction (i.e., occurrence within the strike zone of the vessel). The greatest potential for overlap between Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and vessels conducting BOEM-regulated activities occurs while sturgeon overwinter in marine waters (approximately October to April). However, during overwintering, the likelihood of encounter is considered low because of Gulf sturgeon's use of shallow water areas adjacent to barrier islands and non-island beaches that are nearshore.

As part of this assessment, characteristics that contribute to strike risk vulnerability of the East coast Atlantic sturgeon (*A. oxyrinchus oxyrinchus*) were examined. Due to differences in habitat use and exposure to large vessel traffic, strike risk for the Atlantic and Gulf sturgeon is dissimilar: Gulf sturgeon less likely to be vulnerable to strikes Gulf sturgeon vessel strike risk from BOEM-regulated activities is considered negligible (i.e., unmeasurable) and insignificant.

2. Gulf Sturgeon

Acipenser oxyrinchus is an anadromous fish species within the order Acipenseriformes that is divided into two subspecies separated by the Florida peninsula. The Atlantic sturgeon (*A. oxyrinchus oxyrinchus*) is distributed along the U.S. East Coast whereas the Gulf sturgeon (*A. oxyrinchus desotoi*) is only found within the northern Gulf of America (Gulf). Annually Gulf sturgeon migrate to upriver spawning grounds (i.e., hardbottom areas with clean gravel and cobble) in the spring (April) and then return to estuarine and marine waters in the fall (October). Post-spawning, Gulf sturgeon reside within spring and summer holding (or staging) areas within rivers. Holding areas are typically near deep river bends or upriver of sand shoals in mid- to lower river reaches. While in riverine habitats, Gulf sturgeon typically do not feed. In the fall they emigrate out of the river to overwinter in estuarine and marine waters with outbound movement triggered by environmental cues (e.g., day length, water temperatures, river discharge and/or flow rates). While overwintering, they take advantage of abundant prey resources, opportunistically foraging on benthic macroinvertebrates (e.g., polychaetes, callianassids, isopods, and amphipods) (USFWS and NMFS 2022).

In 1991, Gulf sturgeon were federally listed as threatened under the Endangered Species Act (ESA). Overfishing, loss of upriver spawning habitat (e.g., construction of dams), and alteration of riverine habitat were among the main factors contributing to population decline. Management units for Gulf sturgeon include seven river systems and their adjacent estuarine and marine habitats. These systems extend from the Pearl River in Louisiana to the Suwannee River in Florida, with a high degree of genetic discreteness found between the western (Pascagoula and Pearl River systems), central (Escambia, Yellow, and Choctawhatchee River systems), and eastern (Apalachicola and Suwannee River systems) populations (USFWS and NMFS 2022). Because Gulf sturgeon have a relatively long-life span and late age to maturity (Flowers et al. 2020), evaluating sources of mortality is important for addressing their overall recovery. A higher mortality rate appears to exist for the western population, possibly a result of contaminant releases (e.g., Bogalusa pot-liquor spill, *Deepwater Horizon* oil spill in 2010) (USFWS and

NMFS 2022) and hurricanes (Rudd et al. 2014). Ongoing modeling efforts using mark-recapture and telemetry data indicate that for the Pearl River population, adult mortality rates are highest, and are dangerously high relative to risk of extinction[1]. Thus, there is heightened concern over mortality risk from anthropogenic causes.

Sturgeon species have been found vulnerable to mortality from vessel strikes (see **Section 3**). Therefore, vessel traffic in the Gulf could pose a risk to Gulf sturgeon. The purpose of this white paper is to assess the potential risk to Gulf sturgeon from BOEM-regulated vessel activity within the Gulf (e.g., oil and gas [O&G], offshore wind, carbon sequestration, marine minerals).

2.1 Central and Northwestern Gulf Population

As described in **Section 4**, BOEM-regulated vessel activity is located primarily within the central and northwestern portion of the Gulf. Gulf sturgeon's natal rivers in this part of the Gulf include the Pascagoula and Pearl rivers of Mississippi and Louisiana, respectively. Sturgeon migrate from these rivers to estuarine (e.g., Lake Pontchartrain, Mississippi Sound, Mobile Bay) and marine habitat from October to April to forage on benthic macroinvertebrates. Young-of-the-year (YOY) remain within riverine habitat for the first nine to ten months while juveniles (< 6 years) overwinter within the shallow parts of estuaries (e.g., adjacent to the river mouths) to optimize foraging opportunities and/or physiological (e.g., osmoregulation) needs. Subadult and adults typically do not remain in estuaries, migrating to marine waters (Fleming 2013, Fox et al. 2002, Brogdon 2022, Baer et al. 2024, Greenheck et al. 2023, Sulak and Clugston 1998). The role of the estuary changes with ontogeny from a foraging habitat for juveniles to a travel corridor for subadults and adults (Havrylkoff et al. 2012), with adults moving quickly through estuarine areas (Peterson et al. 2016, Brogdon et al. 2024).

Once sturgeon are in the marine environment, they undertake alongshore movement (i.e., east-west migration) (Parauka et al. 2011, Vick et al. 2018a, Draper et al. 2025). There is no evidence of any large-scale use of deepwater habitat (i.e., north-south migration) on the Outer Continental Shelf (OCS) (Edwards et al. 2007). For the Pascagoula and the Pearl River populations, predominant overwintering habitat (subadult and adults) consists of relatively shallow waters (i.e., generally less than 10 m deep) within barrier island passes (Rogillio et al. 2007, Ross et al. 2009) and nearshore non-island beach areas (Peterson et al. 2018). Adult and subadult sturgeon can travel long distances (tens to hundreds of kilometers) to reach overwintering areas, potentially using navigation channels and waterways (deeper travel corridors) as migratory pathways (Edwards et al. 2007, Greenheck et al. 2023, Parauka et al. 2011, Peterson et al. 2016, Sulak et al. 2016).

2.2 Gulf Sturgeon Critical Habitat

On April 18, 2003, 14 geographic areas (units) along the Gulf coastline from Florida to Louisiana were designated by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) as Gulf sturgeon critical habitat (**Figure 1**). These areas encompass approximately 2,783 river kilometers (1,729 miles) and 6.042 square kilometers (2,333 square miles) of estuarine and marine habitat, respectively. Over half of the estuarine and

[1] Personal communication (email) from A. Kaeser (USFWS) on January 24, 2024.

marine habitat is located west of the Florida panhandle (approximately fifty-nine percent) with a large portion in Mississippi Sound (approximately 31 percent). Critical habitat within Mississippi Sound extends approximately 1.9 kilometers (6,076 feet) offshore of the barrier islands within the 10-meter (33 feet) bathymetric contour line. Unit 8 of Gulf sturgeon critical habitat, the most western unit and where BOEM-regulated vessel activity is primarily located (see **Section 4**), includes eastern Lake Pontchartrain, Lake St. Catherine, the Rigolets, Little Lake, Lake Borgne, and Mississippi Sound in Jefferson, Orleans, St. Tammany, and St. Bernard parishes, Louisiana; Mississippi Sound in Hancock, Jackson, and Harrison counties in Mississippi; and Mississippi Sound in Mobile County, Alabama. The Pearl River system and coastal bays (e.g., Lake Pontchartrain, Lake Borgne) encompass the western extent of Gulf sturgeon designated critical habitat (USFWS and NMFS 2003).

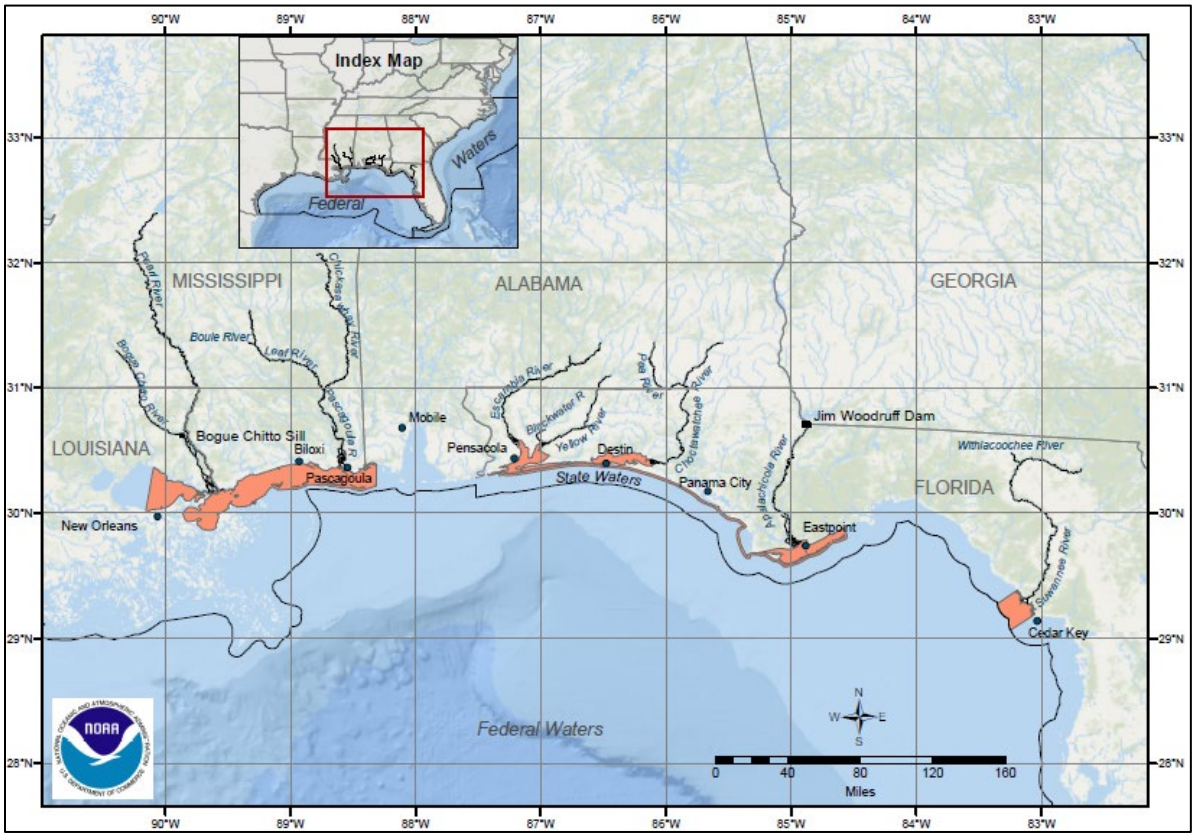

Figure 1. Designated Gulf sturgeon critical habitat.

Seven Primary Constituent Elements (PCEs) of Gulf sturgeon critical habitat have been deemed essential to conservation of the species and may require special management considerations or protection. The seven PCEs are: (1) abundant food items, (2) riverine spawning sites, (3) riverine aggregation areas (i.e., resting, holding, and staging areas), (4) flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of freshwater discharge over time), (5) water quality (e.g., temperature, salinity, pH, hardness, turbidity, oxygen content), (6) sediment quality, and (7) safe and unobstructed migratory pathways within and between riverine, estuarine, and marine habitats (e.g., an unobstructed river or a dammed river that still allows for passage) (USFWS and NMFS 2003). No PCEs are specific to the OCS.

Although historically present within the Mobile River System, it is thought that Gulf sturgeon have been extirpated from there because the system has been extensively impounded, fragmented, dredged, and industrialized (Sulak et al. 2016); critical habitat has not been designated in Mobile Bay. However, Greenheck et al. (2023) found Gulf sturgeon from the western and eastern river systems do consistently use the Mobile Bay area from October to late May or early June, including areas around Dauphin Island, Gulf Shores, and the mouth of Mobile Bay. These areas appear to provide winter foraging habitat and a corridor (e.g., the Mobile Ship Channel) for alongshore migration during the overwintering period. Due to Gulf sturgeon's consistent use of the Mobile Bay estuary, Greenheck et al. (2023) suggest that it be included as part of Gulf sturgeon designated critical habitat. To date, NMFS has not made that determination.

2.3 Gulf Sturgeon Jumping Behavior

Although considered a demersal species normally associated with bottom (benthic) habitat (see **Figure 2**), Gulf sturgeon breach the water surface (i.e., jump) occasionally (see **Figure 3**). Jumping is primarily observed while individuals are within riverine holding areas. They are found in these areas during the summer and fall months (May through October); jumping is most frequently observed mid-summer and at dawn and dusk (FWC, 2019). Two theories about why sturgeon jump include: (1) to allow them to equalize pressure in their swim bladder via the gulping of air, and/or (2) for intra-species communication (Sulak et al. 2016, FWC 2019). Because sturgeons are unable to secrete air into their gas bladder via a physiological mechanism, they must occasionally gulp air at the surface to fill their physostomous[2] gas bladder to achieve neutral buoyancy at desired depths. Buoyancy control, by gulping air at the water surface, is likely the main purpose for their occasional surfacing behavior (Logan-Chesney et al. 2018).

[2] Physostomous gas bladder: Gulf sturgeon have a pneumatic duct connecting their gas bladder to the alimentary canal, allowing the bladder to be filled or emptied via the mouth.

Figure 2. Gulf sturgeon near the sediment surface. [Credit: U.S. Fish and Wildlife Service.]

Figure 3. Gulf sturgeon jumping in riverine habitat [presumably the Suwanee River in Florida].

3. Vessel Strikes

Vessel strikes have been noted for several sturgeon species (e.g., Atlantic sturgeon: Balazik et al. 2012; Chinese sturgeon: Watanabe et al. 2013; Gulf sturgeon: Sulak et al. 2016; paddlefish: Killgore et al. 2011; lake sturgeon: Hondrop et al. 2017; shovelnose sturgeon: Killgore et al. 2011; white sturgeon: Demetras et al. 2020). Vessel strikes result from contact between any part of a vessel (e.g., bow, propeller) and an individual, resulting in injury (i.e., physical trauma) and/or death. Sharp or blunt force injuries (e.g., lacerations, fractures, abrasions, contusions) can be lethal immediately upon impact or result in delayed mortality several hours, days, or weeks after the incident. Factors affecting the degree of injury include an individual's size, injury location, and/or cut (e.g., propeller) penetration depth. Although sublethal injuries may heal, they can still lead to decreased fitness (e.g., increased energy expenditure, reduced foraging efficiency) (Schoeman et al. 2020). If the occurrence of vessel strikes is high, it can result in a mortality rate that exceeds the recruitment rate (i.e., decline in fertile animals). This is of particular concern for sturgeon which are long-lived, sexually mature relatively late, and generally have low recruitment rates (Schoeman et al. 2020).

The jumping behavior of Gulf sturgeon (see **Section 2.3**) puts them at risk of a strike near and above the water surface; vessel strikes are considered one of several threats (e.g., fishery bycatch, dredging, point/non-point sources) to their recovery (USFWS and NMFS 2022). Documented collisions with jumping Gulf sturgeon have been predominantly with fast-moving boats on the Suwannee River in Florida, sometimes causing injury to boat passengers or skiers and/or tubers (FWC 2019). Between 2006 and 2015, the Florida Fish and Wildlife Conservation Commission (FWC) recorded 40 in-river Gulf sturgeon vessel strikes: 37 in the Suwannee River, two in the Santa Fe River, and one in the Choctawhatchee River (FWC 2019; USFWS and NMFS 2022). Gulf sturgeon have also been noted to occasionally jump in marine waters (Edwards et al. 2007); however, BOEM is not aware of any documented collisions with jumping sturgeon and fast boats offshore.

USFWS and NMFS (2022) indicates there have been five documented Gulf sturgeon mortalities that exhibited tell-tale signs of strikes by large vessels. Although not defined by USFWS and NMFS (2022), large vessels relative to strike risk are commonly thought of as vessels greater than 100 gross tonnage and longer than 30 meters (Schoeman et al. 2020). An overview of those five mortalities is provided in **Table 1**. O&G activity was occurring in the Gulf at the time of these instances; however, four of the five instances can likely be dismissed from being caused by O&G vessel activity. Rock Bluff and Governors Bayou are located well inland and not within an area adjacent to O&G traffic. The Santa Rosa Sound and Orange Beach areas are located east of Mobile Bay and northeast of any expected O&G vessel activity. The remaining incident observed near Davis Island is adjacent to the Port of Tampa in Tampa Bay. It is possible that a large vessel associated with the Port of Tampa resulted in the strike. However, it is unknown what type of ship (e.g., cruise ship, container ship, tug) caused the incident or what activities it was supporting. Demetras et al. (2020) reported a similar vessel strike, decapitation of a white sturgeon (*A. transmontanus*), in the San Francisco Bay Port area, presumably caused during departure of a crude oil tanker (approximately 250 meters [820 feet] in length, 14.8-meter [49 feet] draft).

Table 1. Gulf sturgeon mortalities that exhibited signs of collision with large vessels

Year Observed[1]	Month Recovered	Location Found	Identified Cause of Death	Notes[2]	Likely Caused by O&G Vessel
2015	Not provided	Escambia River - Governors Bayou, Florida - near a power plant	Likely ship strike	No photographs available	No, located far inland and not in a river system that supports O&G activity
2017	November	Santa Rosa Sound, Florida	Vessel strike	The lower third of the body appears to be almost severed from the rest of the body	No, not located in an area of O&G activity
2017	February	Orange Beach, Alabama – boat ramp	Head trauma	The sturgeon had a skull fracture between the eyes and the gills at the top of the head	No, not located in an area of O&G activity
2018	March	Tampa Bay (Davis Island), Florida – boat ramp	Possible propeller gash on the head	The location is adjacent to the Port of Tampa. The sturgeon had a clear gash above the eyes exposing the skull	Possible, but not likely: The Port of Tampa ranked 20th in U.S. coastal Port commerce in 2020, and is comprised of both public and private Terminals. It handles a diversified mix of freight including dry and liquid bulk, break-bulk, containerized cargo, neo-bulk, project cargo, roll on-roll off (cargo, as well as cruise passengers.[3] Conservatively, O&G use the Port of Tampa represents 2.4 percent of all port visits (see Table 2).
2018	April	Suwannee River – Rock Bluff	Boat strike with head severed off (spawning female)	No photographs available	No, located far inland and not in a river system that supports O&G activity

Source: Personal communication (email) from A. Kaeser (USFWS) on January 24, 2024.

Notes:

[1]No additions were made to the strike database since 2018 due to a shift in agency priorities. However, no additional large vessel strikes have been noted since 2018.

[2]BOEM interpretation based on pictures of the recovered sturgeon, if available.

[3]Source: USACE 2024.

Vessel traffic related to marine mineral (i.e., sand and gravel) leasing is the only other BOEM-regulated activity that might have been occurring at the time of the strikes listed in **Table 1**.

However, there were no active OCS sand and gravel projects in the vicinity of the reported incidents.

4. Assessment of BOEM-Regulated Vessel Traffic

The following is an overview of vessel traffic from the different programs BOEM regulates within the Gulf.

4.1 Oil and Gas (O&G)

Through the Outer Continental Shelf Lands Act (OCSLA) BOEM manages leases, easements, and rights-of-way (ROW) for O&G projects on the OCS. Vessels are used in support of the exploration (e.g., seismic survey vessels, drillships), construction (e.g., tugs, crane vessels, pipe lay vessels), and operation (e.g., supply vessels, crew boats) of these projects. At the end of the projects (e.g., end of O&G production), vessels, like those used for construction, are also utilized for infrastructure (e.g., platform, pipeline) decommissioning.

4.1.1 Analysis of O&G Vessel Activity

A ship's automatic identification system (AIS) transmits its position so that other ships are aware of its location. AIS data are collected by the U.S. Coast Guard (USCG) through an onboard navigation system device that transmits and monitors the location and characteristics of vessels in U.S. and international waters in real time. Through a partnership, BOEM, NOAA, and the USCG have worked to repurpose and make available records from the USCG's national network of AIS receivers (USDOI BOEM, NOAA, & USCG, 2023). To estimate vessel traffic in the Gulf related to O&G activities, AIS data from calendar year 2022 were analyzed.

To conduct the analysis, AIS Vessel Track datasets available at the Marine Cadastre Data Registry (https://marinecadastre.gov/data/) were used. There are advantages to using AIS data for depicting OCS O&G vessel traffic (e.g., publicly available, compiled annually). However, the vessel type categories within AIS data are broad, resulting in highly conservative estimates of vessel traffic. Vessel type categories in the AIS Vessel Track datasets include: cargo, fishing, other, passenger, pleasure craft and/or sailing, tanker, tug tow, and "not available". BOEM confirmed with NOAA that the best description of the AIS vessel type categories is provided in USCG, NOAA, and BOEM (2018). Based on this information, the most appropriate categories to capture O&G activity include vessel types "other" and "tug tow". Although tankers transport O&G, they are not regulated by BOEM and were excluded from the analysis. Because the "tug tow" category includes all tugs and the "other" category is a catch-all that contains some non-O&G vessels (e.g., USCG, dredgers, research vessels), the use of these two categories overestimates vessel activity attributed to BOEM-regulated O&G projects. However, larger sized vessels, such as container ships, are generally not included, excluding general shipping traffic from the analysis.

The Marine Cadastre AIS Vessel Track dataset for "other" and "tug tow" was downloaded for the area of interest: Gulf Federal jurisdiction to the shoreline, including inshore areas (e.g., Galveston Bay, Mobile Bay, Tampa Bay), spanning from the Mexico-U.S. border on the west side to Key West (i.e., the Eastern Planning Area boundary) on the east side. To further refine the dataset to represent traffic related to O&G activity, a list was then generated of vessels that appear within the "other" and "tug tow" categories within the clipped dataset. Individual vessels

were identified based on unique Maritime Mobile Service Identities (MMSI) and International Maritime Organization (IMO) identification numbers present within the data. BOEM then reviewed their presence/absence within two online databases: the Clarkson Research Services Limited's World Fleet Register (WFR) and the Marine Traffic Database. Vessels were removed from the AIS dataset prior to BOEM's analysis if the available summary of the ship type indicated the vessel would likely not be associated with BOEM-regulated O&G activities (e.g., anti-pollution vessels, buoy/lighthouse tenders, coastal dredgers, high-speed/pleasure crafts, inland supply vessels, law enforcement/military, pilot/port tenders, research vessels, salvage vessels, search and rescue). Otherwise, vessels were assumed to be of a type potentially associated with BOEM-regulated O&G activities and were retained in the dataset for analysis, this included when no vessel information was found, which was common.

Data analysis procedures prescribed by NMFS were then followed. These procedures allow for assessing vessel activity within a fishnet grid (10 x 10 kilometer [6 x 6 miles]) covering the area of interest. A pairwise intersection was conducted in ArcGIS between a feature class containing the vessel tracks and a grid cell polygon feature class. Total transit distance (kilometers) was then determined using Calculate Geometry Attributes and Summary Statistics tools.

4.1.1.1 OCS Vessel Activity

The results of the Vessel Tracks data analysis described above were clipped to the OCS boundary. If a grid cell overlapped the OCS-State waters boundary, the entire cell was included as part of the OCS. The rationale for clipping the results to the OCS is that for a vessel to be part of a BOEM-regulated O&G activity, it would need to be present at some point on the OCS (i.e., Federal waters). Therefore, BOEM determined that restricting the analysis to OCS vessel traffic was appropriate. BOEM acknowledges that vessels supporting BOEM-regulated activities mobilize out of and return to multiple ports along the northern Gulf coast (see **Section 4.1.1.2**). However, to include all nearshore (state waters and/or inland waters) tracks for vessels classified as either a "tug-tow" or "other" would grossly overinflate, and arguably mask, BOEM-regulated O&G vessel activity, making it indistinguishable from state-regulated and other unrelated nearshore vessel activities. The AIS derived vessel tracks are not "continuous" within the Marine Cadastre Vessel Tracks data; therefore, it is not feasible (on the scale of vessel traffic in the Gulf) to consistently follow individual vessels from the OCS back to a specific port or vice versa follow an individual vessel track from port out to the OCS. Therefore, by refining the analysis to only include tracks that intersect with the OCS, it excluded smaller tracks that never go into the OCS. The resultant OCS vessel traffic in 2022 is depicted in **Figure 4**.

The highest level of O&G vessel activity is within BOEM's Central Planning Area adjacent to south central Louisiana. This is consistent with Port Fourchon being a primary hub for O&G activity (see **Section 4.1.1.2**). Transits located entirely within the Eastern Planning Area (e.g., Tampa to Pensacola) would not be related to O&G activity and can be discounted as being related to a BOEM-regulated activity. Further, BOEM estimates that most of the transits out of Florida are port-to-port transits (i.e., not directly associated with BOEM-regulated activities) in contrast to transits between a shore base in Tampa Bay and OCS facilities (e.g., platforms) which would be BOEM-regulated.

Within Gulf sturgeon habitat, there is a relatively high level of alongshore O&G traffic between the New Orleans area and Pascagoula and Mobile Bay to the east (see **Figure 5**). The grid cell size of 10 x 10 kilometers (6 x 6 miles) is too large to determine specific vessel corridors (i.e., poor resolution). However, it is anticipated that this alongshore traffic traverses primarily the intracoastal waterway, particularly larger (i.e., deeper draft) vessels. Grid cell resolution is sufficient to determine that O&G vessel traffic heading offshore/inshore or west to the Mississippi River area (e.g., Port Fourchon, Venice) primarily uses fairways. East of Mobile Bay there is relatively little O&G vessel activity.

4.1.1.2 Port Activity

BOEM used the Marine Cadastre AIS Vessel Track dataset described in **Section 4.1.1** to assess relative differences in port use along the northern Gulf. Vessel transits were evaluated within the following major port areas in the northern Gulf:

- Alabama: Mobile and Theodore.
- Florida: Manatee, Panama City, Pensacola, St. Petersburg, and Tampa.
- Louisiana: Abbeville, Boothville, Cameron, Fourchon, Grand Isle, Houma, Intracoastal City, Lake Charles, Leeville, Morgan City, New Orleans, and Venice.
- Mississippi: Pascagoula.
- Texas: Corpus Christi, Freeport, Galveston, Ingleside, and Sabine Neches.

A summary of the number of vessel visits (i.e., AIS vessel tracks) that occurred within an assessed buffer zone around these different ports in 2022 is provided in **Table 2**.

O&G vessel traffic into and out of Port Fourchon, Louisiana, represents approximately 41 percent of all port visits combined, indicating it is the primary hub for O&G vessel activity. Port Fourchon is located well west of the Gulf sturgeon's range. Within Gulf sturgeon habitat, no ports experienced over five percent of the O&G vessel visits.

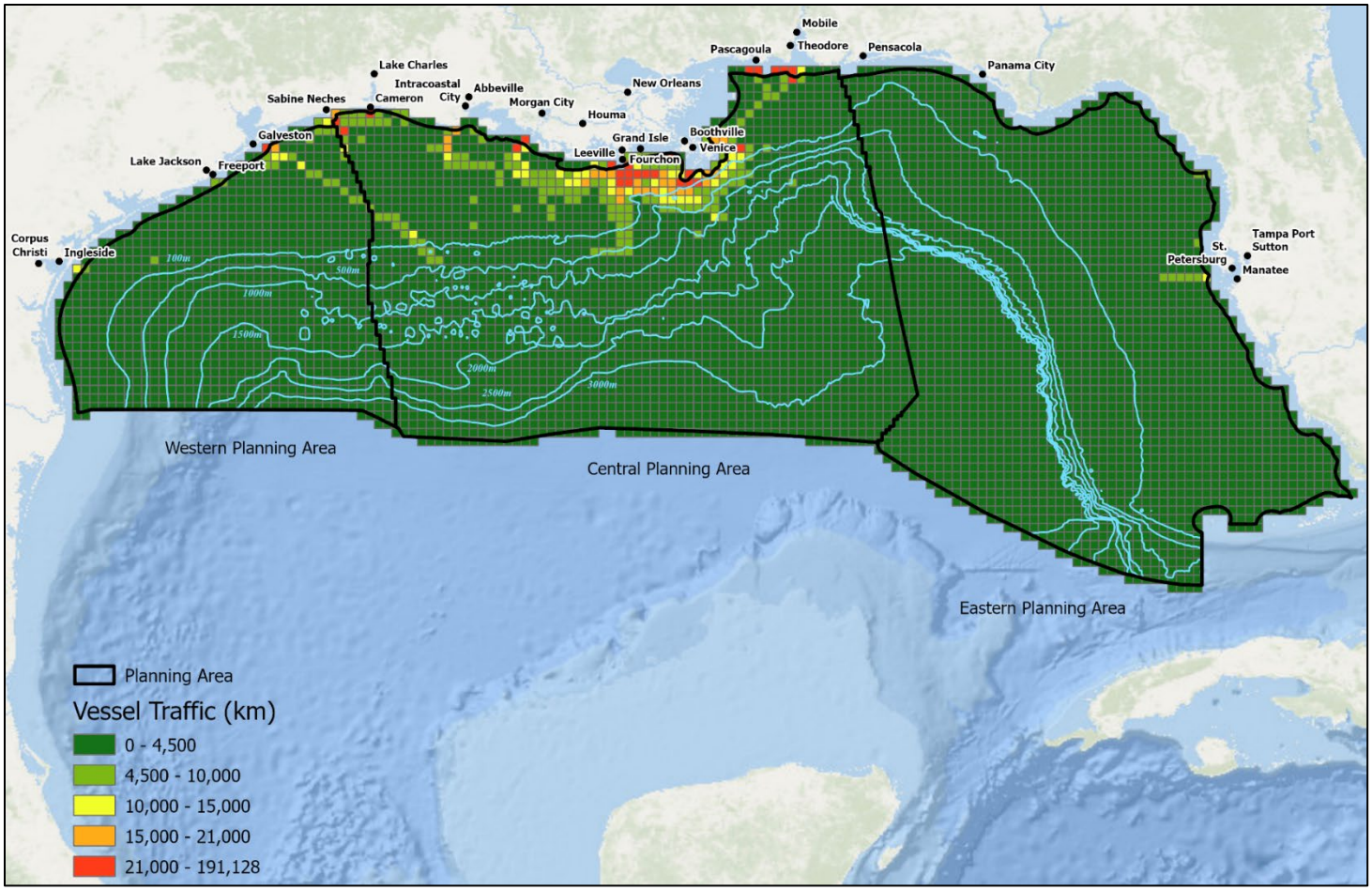

Figure 4. O&G Vessel Transit (kilometers) on the OCS in 2022 [total transit distance (kilometers) of "tug-tow" and "other" AIS vessel traffic on the Gulf OCS in 2022].

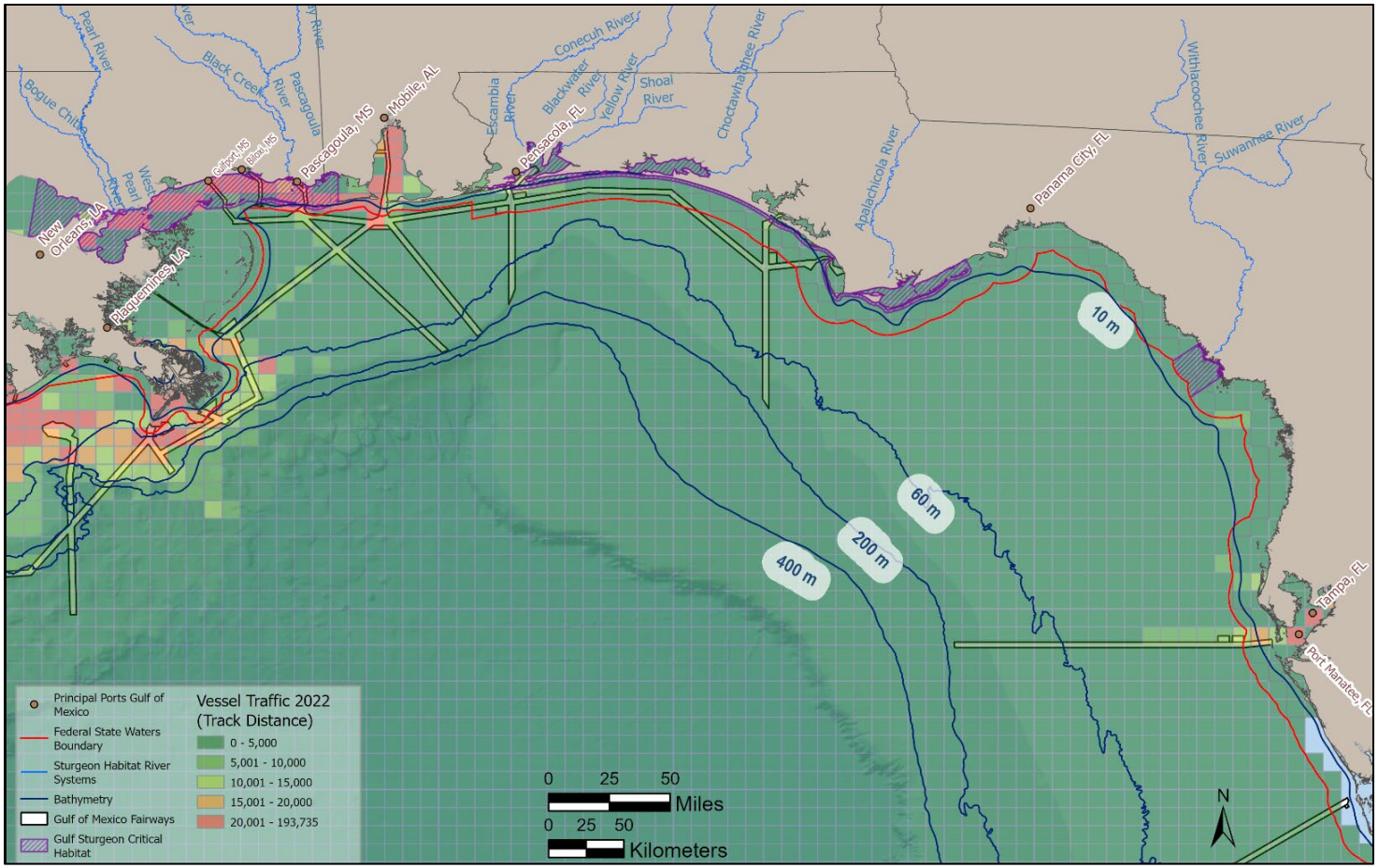

Figure 5. O&G Vessel Transit kilometers) through Gulf Sturgeon Habitat in 2022 [total transit distance (kilometers) of "tug-tow" and "other" AIS vessel traffic in 2022].

Table 2. Number port visits based on available AIS data, between January 1, 2022 and December 31, 2022

Port Name	State[a]	Latitude[a] (N)	Longitude[a] (W)	Buffer[b] (miles)	Number of Port Visits[c,d]	Percent of Port Visits
Mobile	AL	30.7020	88.0376	2.5	242	0.9
Theodore	AL	30.5340	88.1190	2	406	1.6
Manatee	FL	27.6339	82.5605	1	105	0.4
Panama City	FL	30.1787	85.7294	1	89	0.3
Pensacola	FL	30.4052	87.2175	1	45	0.2
St. Petersburg	FL	27.7660	82.6278	1	109	0.4
Tampa including Port Sutton	FL	27.9219	82.4366	2.5	620	2.4
Abbeville	LA	29.8941	92.1188	1	57	0.2
Boothville	LA	29.3500	89.4330	1	1,155	4.5
Cameron	LA	29.7707	93.3440	1	2,074	8.0
Fourchon	LA	29.1201	90.2077	3.5	10,627	41.0
Grand Isle	LA	29.2500	89.9830	1.5	619	2.4
Houma	LA	29.5660	90.7000	1	266	1.0
Intracoastal City	LA	29.7854	92.1594	1	646	2.5
Lake Charles	LA	30.1810	93.2968	4	159	0.6
Leeville	LA	29.2369	90.2126	2.5	196	0.8
Morgan City	LA	29.6954	91.2107	2.5	430	1.7
New Orleans	LA	29.9569	90.1459	5	523	2.0
Venice	LA	29.2660	89.3330	3	1,785	6.9
Pascagoula	MS	30.3535	88.5447	3	788	3.0
Corpus Christi	TX	27.8271	97.4681	4	191	0.7
Freeport / Lake Jackson	TX	28.9330	95.3000	3	545	2.1
Galveston	TX	29.3099	94.7994	4	2,467	9.5
Ingleside	TX	27.8500	97.2115	4.5	306	1.2
Sabine Neches	TX	29.7356	93.8937	3	1,474	5.7

Notes:

[a]Sources: Marine Traffic 2024; Vessel Tracker 2024; Abbeville Harbor 2024.

[b]Buffer area around the port location assessed for vessel presence (transits).

[c]Marine Cadastre Vessel Tracks data January 1, 2022 through December 31, 2022.

[d]AIS vessel type categories: “tug-tow” and “other”.

4.1.1.3 Use of AIS Data to Assess O&G Vessel Activity

The advantage of using AIS data for depicting O&G vessel traffic is that they are publicly-available data compiled annually. However, as noted above, the vessel type categories within the data are broad and result in inflated estimates of vessel traffic due to the level of granularity currently available within the AIS data for assessing what might be an O&G-related vessel. Review of the WFR, which includes detailed vessel information, did confirm that the “tug/tow” and “other” categories are capturing typical O&G vessels (e.g., crane/heavy lift vessels, crew/suppy boats, drillships, seismic survey). However, the “tug” category includes all tugs and the “other” category is a catch-all that contains some non-O&G vessels that could not be parsed

out using available database information. Further, direct port-to-port transits (e.g., Tampa to Fourchon), which are not BOEM-regulated, are not discernable yet thirteen of the northern Gulf ports are within the top 25 U.S. ports in terms of total tonnage (USDOT 2023). Thus, the assessment of O&G vessel traffic described above is highly conservative.

4.2 Renewable Energy

Like O&G, through the OCSLA BOEM manages leases, easements, and ROW for renewable energy projects on the OCS. Leasing for offshore wind energy is currently being conducted in the Gulf and BOEM has identified potential Wind Energy Areas (WEAs) within the Central and Western Planning Areas. All Gulf WEAs have a minimum depth of 10 meters (33 feet) or more and are located deeper than areas generally used by Gulf sturgeon while overwintering in marine waters (i.e., shallow areas off barrier islands). Further, Gulf sturgeon habitat use was incorporated into the significant effort that went into marine spatial planning of the Gulf WEAs (Randall et al. 2022).

Offshore wind developments in the Gulf are expected to use existing O&G vessels (e.g., seismic survey vessels, diver support vessels, supply vessel), as practicable. However, due to the size of wind turbines, vessels specific to offshore wind farm (OWF) construction (e.g., wind turbine installation vessel, feeder support vessels, cable laying vessel) and operation (e.g., crew transfer vessel, service operations vessel) will also be needed (USCG 2024), including newly constructed Gulf vessels or vessels brought in from outside of the Gulf. Vessels conducting OWF activities, even those specialized for OWFs, are expected to be like those used for O&G in terms of the vessel characteristics that could affect Gulf sturgeon strike risk (e.g., draft, speed). Further, the ports and routes used by OWF vessels are expected to be like those used for O&G. Thus, the analysis conducted above for O&G vessels should be consistent with the potential activity patterns of OWF-related vessels, yet the number of vessels involved in OWF activities significantly less.

4.3 Carbon Capture and Sequestration

Under the 2021 Infrastructure Investment and Jobs Act, BOEM manages leases, easements, and ROW for long-term sequestration of carbon dioxide (CO_2) on the OCS, referred to as carbon capture and sequestration (CCS). Leasing for CCS on the OCS has not yet begun, but it is anticipated that future lease areas will be like those used for O&G. For CCS in the Gulf, compressed CO_2 will be injected into subsurface geological formations, either depleted O&G reservoirs or saline reservoirs, that are one kilometer deep or deeper under the seafloor. Further, the vessels used for CCS exploration, construction, and operation will be like those used for O&G (e.g., seismic survey vessels, drill ships, pipelay vessels, crew boats). Therefore, vessel characteristics and activity patterns (e.g., ports, routes) for CCS on the Gulf OCS should be consistent with the analysis conducted above for O&G vessels.

4.4 Marine Minerals

Through the OCSLA, BOEM manages OCS minerals resources (i.e., sand and gravel) used for coastal restoration. Sand and gravel lease activities occur in the shallower portions of the Gulf OCS and require specialized vessels for material extraction (e.g., dredgers) and transport (e.g., barges, scowls). Dredges are relatively stationary during sediment extraction and dredging operations lose efficiency (i.e., increased costs, time) if there is a long transit between extraction

and placement areas. Thus, vessel movements related to OCS sand and gravel use are expected to be minimal. None of the current OCS sand and gravel requests, active leases, or recently completed projects overlap with the Gulf sturgeon's range (**Table 3**).

Table 3. Requests and active BOEM sand and gravel leases in the Gulf of America

Status	State	Date	Project Location	Borrow Area Location	Approximate Depth of Borrow Area (meters)	Volume Requested (millions of cubic yards)
Current Request	FL	Request/Cooperation Date: 2020	Bonita Beach and Lovers Key, Lee County	OCS Block Charlotte Harbor 606	9 – 14	3
Current Request	LA	Request/Cooperation Date: 2022	West Belle Headland, Lafourche Parish	Ship Shoal: OCS Blocks South Pass 12 and Ship Shoal 88	3 – 8	4
Current Request	TX	Request/Cooperation Date: 2020	Texas Point National Wildlife Refuge, Jefferson County	Sabine Bank: OCS Blocks SA 14 and SA 15	4.5 – 9	4.2
Active Negotiated Agreements	None in the Gulf	N/A	N/A	N/A	N/A	N/A
Recently Completed Projects	None in the Gulf	N/A	N/A	N/A	N/A	N/A

[a] Source: https://www.boem.gov/marine-minerals/requests-and-active-leases [accessed September 10, 2024].

5. Gulf Sturgeon Vessel Strike Risk from BOEM-Regulated Activities

The potential for Gulf sturgeon vessel strikes depends on four factors: (1) vessel presence, (2) vessel characteristics (e.g., draft), (3) Gulf sturgeon presence, and (4) Gulf sturgeon behavior (e.g., location within the water column). For a strike to occur, vessels and sturgeon need to occupy the same space at the same time (i.e., overlap in space and time) with the possibility for an interaction (i.e., occurrence within the strike zone of the vessel underwater). High risk areas are areas where many vessels are present (e.g., shipping lanes, port approaches) and overlap with a relatively high number of Gulf sturgeon (e.g., aggregation areas where individuals converge in high numbers on a regular basis) with the potential for frequent interaction between the two. The potential for frequent interaction can be influenced by factors such as vessel draft (i.e., large vessels tend to have deeper drafts, a larger strike zone) and the depth where sturgeon reside; the time sturgeon spend at or near the surface (e.g., jumping); the activity being conducted (e.g., seismic survey, crew transport); and any behavioral response to vessels (e.g., avoidance) (Schoeman et al. 2020).

Typically, vessel strike risk for marine animals, such as marine mammals and sea turtles, is assumed to increase within increased vessel speeds. The faster the vessel is traveling (speed over ground) the less time there is for an animal and/or vessel operator to react and avert the collision. The degree of injury might also be affected by vessel speed, with faster speeds causing more injury upon contact (Barkaszi et al. 2021, Stevens et al. 2024). For benthic species like sturgeon, aversion would rely predominantly on hearing a vessel coming. Very little is known about

sturgeon behavioral responses to sound, or their use of sound, and it is very likely that sturgeons detect particle motion but not sound pressure. Based on information from lake sturgeon, they can detect sound from below 50 Hz (the lowest frequency tested) to perhaps as high as 1,000 Hz. However, data are lacking on how well sturgeon can discriminate between different sounds or can detect the direction from which a sound comes from (Popper and Calfee 2023). Based on observations of Atlantic sturgeon, Gulf sturgeon would not be expected to be deterred, or impeded, by the presence of vessels and the sounds they produce (Balazik et al. 2012, Balazik et al. 2020, Balazik et al. 2021, Dijohnson 2019). Therefore, they would not be expected to actively avoid areas of vessel traffic (i.e., no aversion behavior) and strike risk is expected to be the same regardless of vessel speed or presence.

Along the U.S. Atlantic (East) Coast, Atlantic sturgeon strikes by large vessels are common in riverine channel systems. The East Coast range of Atlantic sturgeon is from the George River in Labrador to the Saint Johns River in Florida; they are anadromous, with adults migrating into major coastal rivers to spawn upstream of the fall line. Adults leave the river system after spawning; subadults and adults spend most of their time in marine habitat, remaining near the coastline in relatively shallow areas, although they have occasionally also been found using deeper, offshore areas during the winter months (ASSRT 2007, Hilton et al. 2016, Altenritter et al. 2017). Several factors likely contribute to Atlantic sturgeon's vulnerability to vessel strikes. First, Atlantic sturgeon commonly use high traffic shipping channels for upriver and downriver movements, especially within constricted areas of the river (i.e., narrowing of the river morphology constrains sturgeon to the channel). Second, large vessels (e.g., large ocean-going cargo ships) transiting East Coast shipping channels typically draft very close to the bottom of the channel. Third, vessels typically transit long river reaches (>100 river kilometers [62 miles]) to reach/depart port (e.g., Delaware River, James River) resulting in prolonged exposure times between sturgeon and vessels (ASSRT 2007, Balazik et al. 2012, Brown and Murphy 2010, Hilton et al. 2016). Most of the observed strikes appear to result from interactions with large vessels (e.g., tankers), most likely due to their deep draft. Few Atlantic sturgeon have been found with injuries consistent with a strike from the propeller of a small vessel (e.g., recreational or commercial fishing vessel) (ASSRT 2007, Brown and Murphy 2010, Hilton et al. 2016).

5.1 Gulf Sturgeon Strike Risk within Riverine Habitat and Similarity to Atlantic Sturgeon

Conditions along the U.S. East Coast that contribute to increased vessel strike risk for Atlantic sturgeon (i.e., large, deep draft vessels combined with long transits in constricted channels) are not present for Gulf sturgeon. The natal river systems within which Gulf sturgeon reside (West: Pascagoula / Pearl; Central: Escambia / Yellow / Choctawhatchee; and East: Apalachicola / Suwannee) do not have major upriver ports that require long distance transits within constricted riverine areas. Further, navigation within these systems would typically not accommodate the drafts required for larger vessels. Thus, Gulf sturgeon natal river systems are not frequented by commercial vessels, including large vessels used for BOEM-regulated activities.

One exception is the presence of commercial vessel traffic within the lower part of the Pascagoula River. The Pascagoula River mouth splits into two branches at approximate river kilometer 23. The east branch is industrialized, bordered by a large shipyard, and dredged to allow ship traffic; the west branch is relatively non-impacted with a marsh shoreline (Peterson et

al. 2007). Based on results of tracking and sampling efforts, the non-industrialized western branch is more highly used by Gulf sturgeon during seasonal migration between upriver and marine habitats and appears to represent the main entrance point utilized by Gulf sturgeon to the Pascagoula River watershed (Havrylkoff et al. 2012, Heise et al. 2004, Peterson et al. 2013, Peterson et al. 2016). There is almost no occupancy of the eastern branch by any size class, presumably due to industrialization and sediment alteration (e.g., dredging) resulting in degraded sediments and foraging habitat (Peterson et al. 2013). Therefore, even though a branch of its river mouth is industrialized, the Pascagoula River does not mimic the conditions that lead to increased vessel strike risk for Atlantic sturgeon.

The Suwannee River is located approximately 193 kilometers (120 miles) north of the mouth of Tampa Bay and contains the largest Gulf Sturgeon population of the natal (spawning) river systems and is the southernmost system. Recent (2018 / 2019) red tide related mortalities of Gulf sturgeon (n=3) in upper Tampa Bay do provide evidence it is being utilized by some sturgeon during the winter as the Suwannee River population begins to recover and increase in numbers (USFWS and NMFS 2022). However, Gulf sturgeon use of highly industrialized Tampa Bay is described as sporadic and no spawning areas are located there (Sulak et al. 2016). Further, its use does not require long vessel transits within constricted areas. Thus, although commercial vessel traffic is present there, including potential O&G related traffic albeit minimal (~2.4 percent of the assessed O&G vessel port visits, see **Table 2**), Tampa Bay doesn't mimic the conditions which lead to increased vessel strike risk for Atlantic sturgeon.

Although Gulf sturgeon use the Mobile Bay estuary (Greenheck et al. 2023), like Tampa Bay, no spawning areas are in Mobile Bay and industrial vessel activity does not require long transits through constricted areas. Thus, although commercial vessel traffic is present, including potential O&G related traffic (~2.5 percent of the assessed O&G vessel port visits, see **Table** 2), the Mobile Bay system does not fulfill the conditions identified as leading to increased vessel strike risk for Atlantic sturgeon. Further, when in estuarine areas, Gulf sturgeon tend to occupy much shallower waters than Atlantic sturgeon, almost three times shallower (Gilligan-Lunda et al. 2024).

The four simultaneous factors required for vessel strikes to occur (i.e., overlap in vessels and sturgeon in space and time with vessel characteristics and sturgeon behavior resulting in the possibility for an interaction) are not typically found in the industrialized ports used by oil and gas vessels and not present within typical Gulf sturgeon riverine habitat. Vessels conducting BOEM-regulated activities are not typically expected to transit the natal rivers of Gulf sturgeon. Further, in areas where there could be overlap (e.g., lower Pascagoula River), the potential for interaction is very low. BOEM considers the potential for strikes to Gulf sturgeon from vessels conducting BOEM-regulated activities to be negligible (i.e., unmeasurable) and insignificant, not amenable to statistical assessment.

5.2 Gulf Sturgeon Strike Risk within Marine Habitat

YOY and juvenile Gulf sturgeon do not occur within marine habitat. YOY and juveniles are only found in riverine and shallow estuarine areas (Fleming 2013, Fox et al. 2002, Brogdon 2022, Greenheck et al. 2023, Sulak and Clugston 1998), such as the northeastern shoreline of Lake Pontchartrain and Bay St. Louis for the Pearl River population (Baer et al. 2024). There is no

overlap in YOY and juvenile sturgeon presence with vessels conducting BOEM-regulated operations on the OCS. Due to the lack of overlap, the four simultaneous factors required for vessel strikes to occur (i.e., overlap in vessels and sturgeon in space and time with vessel characteristics and sturgeon behavior resulting in the possibility for an interaction) are not present and the potential for vessel strikes to YOY and juvenile Gulf sturgeon is considered discountable. There is no effect expected to YOY and juveniles from vessel strikes.

Subadult and adult Gulf sturgeon could be vulnerable to vessel strikes as they overwinter within marine habitat. However, there typically would not be overlap in sturgeon presence and vessels conducting BOEM-regulated operations on the OCS. While overwintering, sturgeon are generally located in shallow, nearshore habitat which is less than 10 meters (33 feet) deep and adjacent to barrier islands (Rogillio et al. 2007, Ross et al. 2009) and nearshore beach areas (Peterson et al. 2018). It is presumed they are more concentrated in these sandy, nearshore areas due to high availability of prey items (Sulak et al. 2016, Vick et al. 2018b). In contrast, BOEM-regulated operations (e.g., platforms, turbines) are occurring in deeper waters. O&G development in the Gulf has continued to slowly move into deeper waters since the 1940s as resources closer to shore become depleted and new drilling technologies allow for exploration and development farther offshore (BOEM 2008). Shallow water production (i.e., production within water depths of less than 400 meters [1,312 feet]) has been declining since the 1990s. As of 2022, production in water depths of 400 meters (1,312 feet) or more (i.e., deepwater) constitutes approximately 90 percent of total Gulf production (BOEM 2022). This downward trend in shallow water O&G production and upward trend in deepwater production is expected to continue in the future. Further, all locations identified by BOEM as potential WEAs have a minimum depth of 10 meters (33 feet) or more (Randall et al., 2022). Although CCS leasing has not begun in the Gulf, CCS will be done either in depleted O&G reservoirs or salt domes, likely not in waters adjacent to barrier islands or nearshore beach areas. Thus, the four simultaneous factors required for vessel strikes to occur (i.e., overlap in vessels and sturgeon in space and time with vessel characteristics and sturgeon behavior resulting in the possibility for an interaction) are not present and the potential for vessel strikes to subadults and adult Gulf sturgeon within their overwintering habitat is considered discountable.

One exception is vessels conducting sand and gravel extraction on the OCS which occurs in relatively shallow waters. Associated material placement is regulated and generally overseen by the U.S. Army Corps of Engineers and occurs in in shallow, nearshore areas (e.g., barrier island protection). When such projects use sediments dredged from OCS borrow areas, BOEM is responsible for evaluating the potential risks to species and habitats within the Bureau's OCS jurisdiction and coordinates closely with other agencies, such as the USACE, to ensure continuity of risk reduction measures (i.e., mitigation) across offshore and nearshore action areas. The risk of a vessel strike during OCS sand and gravel extraction is minimized by several factors. Dredge vessels remain relatively stationary during extraction. For example, the average speed of a hopper dredge while dredging is between 1 to 3 knots (1.2-3.5 miles-per-hour [mph]), with most dredges never exceeding 4 knots (4.6 mph) (NMFS 2020). Such slow vessel movements should allow individuals ample time to move out of the way of the propeller and would not likely result in significant injury should a bow strike occur. In addition, NMFS-approved protected species observers are required on hopper dredges to look out for listed-species (NMFS 2022). Further, vessels hauling material from the extraction to placement site are

expected to travel minimal distances since cost and schedule are tied to haul distances. With these factors considered (i.e., slow vessel speeds, minimal transit distances, protected species observers), as well as the limited amount of sand and gravel extraction activity occurring at any one time on the OCS and limited geographic extent of sand and gravel projects, the potential for vessel strikes to subadult and adult Gulf sturgeon within their overwintering habitat is considered insignificant. BOEM is not aware of any evidence Gulf sturgeon are struck by vessels conducting dredging activities on the OCS.

Vessels conducting BOEM-regulated activities on the OCS would transit through the Gulf sturgeon's range when departing and returning to port. As noted above, overwintering subadult and adult sturgeon are in shallow water habitat adjacent to barrier islands and nearshore beach areas. It is expected that vessels transiting through shallow waters to conduct BOEM-regulated OCS activities use existing shipping and navigational channels, which do not overlap with these overwintering areas. It is possible that some sturgeon may use shipping and navigation channels as pathways during alongshore (east-west) migration to and from their natal rivers and overwintering habitat (Greenheck et al. 2023), provided individuals have time to adapt (i.e., osmoregulation) to the higher bottom salinity of the channels (Draper et al. 2025), which could potentially result in overlap between sturgeon and vessels transiting to and from port. However, none of the ports evaluated within the range of Gulf sturgeon (e.g., Mobile Bay, Pascagoula, Tampa Bay) represent over five percent of the assessed visits for vessels conducting BOEM-regulated O&G activities (see Section 4.1.1.3). The most active ports (e.g., Port Fourchon, Galveston) are far west of Gulf sturgeon habitat. Therefore, BOEM-regulated vessel transits occur primarily well west of the Gulf sturgeon's range (e.g., to and from Port Fourchon, Galveston) and west of where sturgeon would be conducting any alongshore migration to and from their overwintering habitat.

For alongshore migrating subadult and adult Gulf sturgeon, strike vulnerability appears to be highest in navigation channels where vessels pass into and out of the Pascagoula and Mobile areas, as well as intracoastal waterways between the Mobile and Lake Pontchartrain areas if sturgeon are using the waterways as a travel corridor and at a depth that makes them vulnerable to vessel drafts. Gulf sturgeon alongshore migration through these areas does not require long passages within constricted areas that would mimic the conditions which lead to increased vessel strike risk for Atlantic sturgeon (i.e., narrowing of habitat constraining sturgeon to the channel/waterway). Further, BOEM reviewed the average draft listed in the WFR for presumed vessels conducting BOEM-regulated O&G activities on the OCS. When drafts were available in the WFR, crane vessels, drill ships, and floating production and storage and off-loading units (FPSOs) were the only vessels with an average draft greater than 10 meters (33 feet). Crew/fast supply vessels had an average draft of less than 3 meters (10 feet) and utility/workboats, hydrographic/oceanographic vessels, and tugs (<2,000 GT) an average draft of less than 5 meters (16 feet). If Gulf sturgeon occupy the lower part of the water column during migration within channels and waterways, they would be below the draft of most vessels (i.e., outside of the strike zone of the vessel). BOEM was unable to identify information on the travel depth(s) Gulf sturgeon use while migrating to and from their overwintering habitat. Although Atlantic sturgeon do not necessarily remain at the very bottom of the water column while transiting, they do not appear to use the upper water column, remaining below the draft of at least smaller vessels (e.g., tugboats) (Balazik et al. 2012, Redden and Stokesbury 2014).

Even with enhanced awareness of Gulf sturgeon since their listing under the ESA over 30 years ago, there is a lack of documented O&G vessel strikes with Gulf sturgeon. Although possible, given (1) the majority of vessel traffic related to BOEM-regulated activities is west of the Gulf sturgeon's range, (2) Gulf sturgeon overwintering habitat (<10 meters deep between island passes and nearshore beach areas) does not overlap with vessel activity, (3) there are no restricted corridors with prolonged exposure times to large vessels within Gulf sturgeon habitat, and (4) the lack of documented strikes by large O&G or marine minerals vessels, BOEM considers the potential for vessel strikes to subadult and adult Gulf sturgeon from vessels conducting BOEM-regulated activities to be negligible (i.e., unmeasurable) and insignificant, not amenable to statistical assessment.

5.3 Critical Habitat

In response to public comments on the 2003 designation of critical habitat for Gulf sturgeon, NMFS and USFWS noted that regulating the speed of boats to prevent vessel strikes (i.e., sturgeon injury or death) is an issue related to "take" of sturgeon and is not related to critical habitat. They further determined that vessel speed is unlikely to have any significant effect on PCEs for Gulf sturgeon, including PCE No. 7 which is the safety of migratory pathways (USFWS and NMFS 2003). Major shipping channels, including the Gulf Intracoastal Waterway, are excluded from Gulf sturgeon critical habitat and most of the vessel traffic from BOEM-regulated activities is west of designated Gulf sturgeon critical habitat. Therefore, mitigating BOEM-regulated vessel traffic to reduce strike risk does not appear to be warranted.

6. Conclusions

Vessel interactions with sturgeon species have been documented within riverine habitats and port areas. This includes a high strike risk for the Atlantic sturgeon subspecies *A. oxyrinchus oxyrinchus* along the U.S. East Coast. The estuarine (i.e., tidal river) and riverine habitat for the Gulf sturgeon subspecies *A. oxyrinchus desotoi* is not comparable to that of the Atlantic sturgeon. Atlantic sturgeon's riverine habitat is highly constricted in some areas creating significant overlap between sturgeon and large vessel traffic. The constraints of river morphology place Atlantic sturgeon within the propeller (i.e., strike) zone for prolonged exposure times due to the long transit distances (>100 river kilometers [62 miles]) required to reach/depart East Coast ports. In contrast, the riverine and estuarine areas occupied by Gulf sturgeon in the Gulf are not industrialized nor areas that experience a high level of large vessel traffic. Further, the river systems within which Gulf sturgeon reside do not have major upriver ports that require long distance transits within constricted areas. Thus, the vessel strike risk is not comparable between the two subspecies.

Although there is evidence that vessel strikes are an anthropogenic source of mortality to sturgeon, including Gulf sturgeon, the likelihood of interaction between Gulf sturgeon and vessels conducting BOEM-regulated activities is considered extremely unlikely. This is due to a general lack in overlap of species presence and vessel activity. Port Fourchon and Port of Galveston are the primary hubs for vessels conducting BOEM-regulated activities, which are both located far west of Gulf sturgeon habitat. Further, while in marine habitat, Gulf sturgeon are located in shallow, nearshore areas, generally less than 10 meters deep, and not within areas where vessels conducting BOEM-regulated operations are expected to occur. Strike vulnerability

appears to be highest when (if) sturgeon use navigation channels and waterways as pathways for alongshore (east-west) migration to and from their natal rivers and overwintering habitat in the areas off Mobile west to Lake Pontchartrain. However, transit along these areas would not require long passages within constricted areas that mimic conditions which lead to increased vessel strike risk for Atlantic sturgeon. Vessel strike risk to Gulf sturgeon from vessels conducting BOEM-regulated activities is considered negligible (i.e., unmeasurable) and insignificant, not amenable to statistical assessment.

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