Gulf Coast

(1) The Gulf Coast of the United States, from Key West to the Rio Grande, is low and mostly sandy, presenting seldomly marked natural features to the mariner approaching from seaward; shoal water generally extends well offshore. The principal ports and harbor entrances are marked by buoys and lights, which serve as navigational aids for approaching or standing along the coast.

(2) From the south shore of the Florida mainland, the **Florida Keys** and **Florida Reefs** extend for about 134 miles in the southwest curve to Sand Key Light and about 58 miles in a west direction to Loggerhead Key. These keys and reefs are of sand, shell and coral formation. The reefs have frequent shoal patches. The keys are generally low and covered with mangrove. Together, they form the north boundary of the **Straits of Florida**. Toward the west end are several openings between the keys offering passage from the straits into the Gulf.

(3) The southwest extremity of the Florida mainland is part of the Everglades National Park and Big Cypress Swamp. Much of these areas is under water throughout the year and is nearly all covered during the rainy summer season. Fronting the swampy areas are the Ten Thousand Islands, a group of low mangrove-covered islands divided by tidal channels. North of the Ten Thousand Islands the coast is low, sandy and generally backed by pine forests and **Hammocks**. These hammocks are a jungle of tropical trees, mostly hardwood, which appear as an impenetrable green wall.

(4) From Cape Romano to Anclote Keys the coast becomes a barrier beach of low islands separated by inlets, most of which are small and cannot be distinguished from offshore. Between Anclote Keys and St. James Island, the west side of Apalachee Bay, the coast is low and marshy for 1 to 2 miles inland then backed by pine forests. The shoreline is broken by a number of unimportant rivers and creeks.

(5) West of St. James Island to the South Pass of the Mississippi River, the coast is mostly a barrier beach of low, wooded sand islands. The general drift of these islands is to the west, which causes an encroachment upon the channels between them. Hurricanes and heavy gales will sometimes change the shape of these islands, and in some cases they have washed away leaving only shoals.

(6) Westward of the Delta to Galveston Entrance, the coast is a wide fringe of flat and generally treeless coastal marsh containing close growths of sedge, grass and rushes with several deep indentations or bays separated from the Gulf by chains of long narrow islands and many shallow saltwater lakes and lagoons. The islands and marshes are fringed with barrier beaches, mostly of fine sand, which rise to a crest with groves of trees on the inner slopes. Sand and shell ridges, sometimes several feet above the general level, are found throughout the marshes. These ridges, called **Chenieres** because of the oak groves usually found growing on them, are former barrier beaches; good examples are Grande Chenier and Pecan Island. In addition to the cheniere, three other marsh features are defined. Small solitary hills are called either **islands** or **mounds** depending on their height above the level of the surrounding marsh. Islands are greater than 25 feet while mounds are less. A **bayou** is a drainage stream for a swamp area or an auxiliary outlet for a river. They flow either to the Gulf of America or a large lake, rarely into a river or other bayou. The depth of water is nearly always sufficient for river-craft navigation. The current, except after a heavy rainfall, is very sluggish but often may be reversed by a change in the direction of the wind. The highest land is found immediately adjacent to the bayous in the form of natural levees; as a rule, the larger the bayou the higher its levee.

(7) From Galveston Entrance to the mouth of the Rio Grande the coast is a barrier beach of long narrow islands and peninsulas, which are generally low and sandy, with but few distinguishing marks, enclosing a chain of shallow bays or lagoons, some of considerable size. The passes between the islands, except where improvements have been made by constructing jetties and dredging, are narrow and cannot be distinguished from offshore.

(8)

State boundaries

(9) The boundary between Florida and Alabama follows the Perdido River. The Alabama-Mississippi boundary follows a marked line cutting across the east end of Petit Bois Island, through Grande Batture Islands. Pearl River, from its most east junction with Lake Borgne, forms the boundary between Mississippi and Louisiana. Sabine Pass, Lake and River form the boundary between Louisiana and Texas.

(10)

Disposal sites and dumping grounds

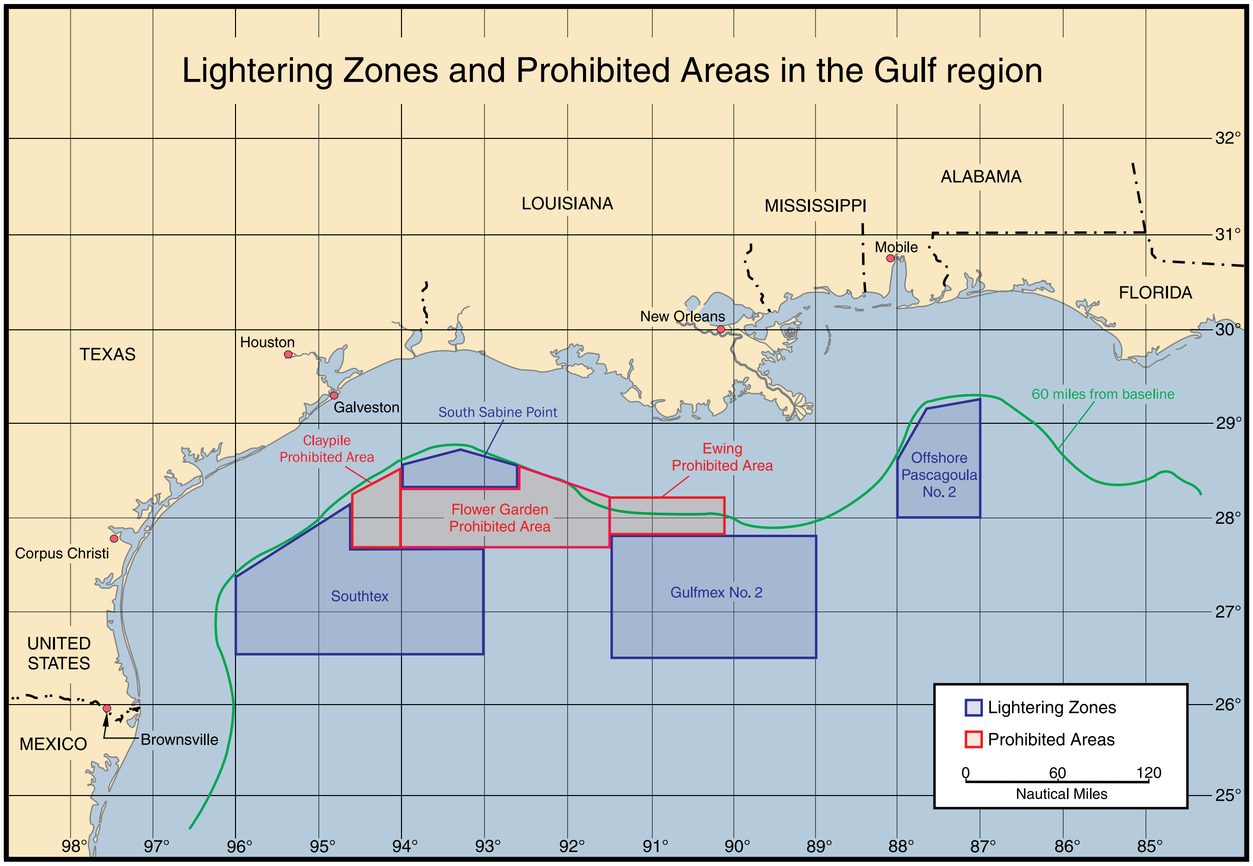
(11) These areas are rarely mentioned in the Coast Pilot but are shown on the nautical charts. (See Dump Sites and Dumping Grounds, chapter 1, and charts for limits.)

(12)

Aids to Navigation

(13) Lights and buoys are the principal guides to mark the approaches to the important harbors. Many of the light stations have sound signals, particularly those in the vicinity of the larger ports. Many of the coastal and

(29)



harbor buoys are equipped with radar reflectors, which greatly increase the range at which the buoys may be detected on the radarscope. Most of the critical dangers are marked. (See the Light List for a complete description of navigational aids.)

(14)

Radar

(15) Radar is an important aid to navigation in this area, particularly in detecting other traffic and offshore oil platforms and in the prevention of collisions during frequent periods of low visibility. The coast is generally low and does not present a good radar target, but many of the coastal buoys are equipped with radar reflectors.

(16)

COLREGS Demarcation Lines

(17) Lines have been established to delineate those waters upon which mariners must comply with the International Regulations for Preventing Collisions at Sea, 1972 (72 COLREGS) and those waters upon which mariners must comply with the Inland Navigational Rules Act of 1980 (Inland Rules). The waters inside of the lines are **Inland Rules Waters**, and the waters outside of the lines are **COLREGS Waters**. (See **33 CFR Part 80**, chapter 2, for specific lines of demarcation.)

(18)

Ports and waterways safety

(19) (See **33 CFR Part 160**, chapter 2, for regulations governing vessel operations and requirements for notification of arrivals, departures, hazardous conditions and certain dangerous cargoes to the Captain of the Port.)

(20)

Harbor entrances

(21) The entrances to most of the harbors along the Gulf Coast are obstructed by shifting sandbars. The more important entrances have been improved by dredging and in some cases by construction of jetties. On many of the bars the buoys are moved from time to time to mark the shifting channels. The best time to enter most of the harbors is on a rising tide.

(22) The tidal currents have considerable velocity in most of the harbor entrances, and their direction is affected by the force and direction of the wind. In south gales the sea breaks on some of the bars.

(23)

Shipping safety fairways

(24) A system of shipping safety fairways has been established along the Gulf Coast to provide safe lanes for shipping that are free of oil well structures. **Vessels should approach the harbor entrances and proceed coastwise between the ports within these fairways but should exercise due caution at all times as the lanes are unmarked.** (See **33 CFR 166.100** through **166.200**, chapter 2, for references to the charts showing the limits of the fairways, and the regulations governing them.)

(25)
Anchorages

(26) **Fairway anchorages** have been established off the entrances to some of the ports; these areas are generally free of oil well structures. (See **33 CFR 166.100** through **166.200**, chapter 2, for references to the charts showing the limits of the anchorages, and regulations governing them.) Other anchorages have been established along the Gulf Coast, bays, sounds and rivers. (See **33 CFR Part 110**, chapter 2, for limits and regulations.)

(27)
Lightering Zones

(28) **Lightering zones** and **prohibited-from-lightering zones** have been established in the Gulf region as follows These areas will be shown on the applicable nautical chart.

(30) Southtex-lightering Zone, centered about 150 miles, 105° from Aransas Pass;

(31) Gulfmex No. 2-lightering Zone, centered about 120 miles, 210° from Head of Passes, Mississippi River;

(32) Offshore Pascagoula No. 2-lightering Zone, centered about 130 miles, 150° from Pascagoula;

(33) South Sabine Point-lightering Zone, centered about 95 miles, 160° from Sabine Pass;

(34) Claypile-prohibited-from-lightering Zone, centered about 90 miles, 160° from Galveston Bay entrance;

(35) Flower Garden-prohibited-from-lightering Zone, centered about 120 miles, 150° from Sabine Pass;

(36) Ewing-prohibited-from-lightering Zone, centered about 100 miles, 240° from Head of Passes, Mississippi River (See **33 CFR Parts 156.300** through **156.330**, chapter 2, for limits and regulations.).

(37)
Vessel Traffic Services (VTS)

(38) **Vessel Traffic Services (VTS)** or **Vessel Traffic Information Services (VTIS)** have been established in Calcasieu Ship Channel (Lake Charles VTS), in the Houston-Galveston Bay area (Houston-Galveston VTS) and in the Atchafalaya River at Morgan City, LA (Berwick Bay VTS). The services have been established to prevent collisions and groundings and to protect the navigable waters from environmental harm.

(39) The Vessel Traffic Services for Berwick Bay and the Houston-Galveston Bay area provide for Vessel Traffic Centers (VTC) that may regulate the routing and movement of vessels by radar surveillance, movement reports of vessels, VHF-FM radio communications and specific reporting points. The services consist of precautionary areas and reporting points.

(40) The Lake Charles Vessel Traffic Information Service (VTIS) consists of reporting points and special conditions to be observed within the VTIS area.

(41) Lake Charles Vessel Traffic Service is voluntary, and Houston-Galveston and Berwick Bay Vessel Traffic Services are mandatory. (See chapters 8, 9, and 10 for details of the Vessel Traffic Services and Vessel Traffic Information Services.)

(42)
Tropical waters

(43) The most remarkable feature is the exceeding clearness of the sea water, enabling the bottom to be seen from aloft at considerable depths and at some distance. The navigation of the banks is consequently conducted almost entirely by the eye, but care must be taken not to run with the sun ahead of the vessel as that prevents the banks from being seen.

(44) The charts indicate clearly the positions of the many shoal heads, but considerable experience is required in identifying the patches by the color of the water. Small clouds, moving slowly and known to the pilots as flyers, are apt to deceive the inexperienced, their reflection on the surface of the sea over the clear white sandy bottom having every appearance of rocky shoals. It is prudent to avoid a dark spot.

(45) **Bank blink** is a phenomenon in tropical waters described as a bright reflected light hanging over the clear white sandbanks, serving to point them out from a considerable distance. From experience, it has been found to be untrustworthy, however, and should not be depended on in place of a lookout aloft. Soundings, the reckoning and especially the latitude, should be unremittingly checked.

(46)
Marine protected areas

(47) Marine protected areas (MPAs) are special places in ocean, coastal and estuarine ecosystems where vital natural and cultural resources are given greater protection than in surrounding waters. MPAs have been used in the U.S. for more than a century. Currently, there are over 1,600 MPAs in U.S. marine waters and the Great Lakes, with levels of protection ranging from a few "no-take" areas that prohibit all extractive uses to the more common multiple use areas in which a variety of consumptive and non-consumptive uses are allowed and often encouraged.

(48) MPAs are managed by dozens of federal, state, tribal and local authorities. For detailed information on MPA locations, types, purposes and legal restrictions, visit *www.marineprotectedareas.noaa.gov*.

(49) There are over 300 MPAs in this Coast Pilot Region from Texas to the west coast of Florida, and Puerto Rico and Virgin Islands. Most of these are small, near-shore MPAs managed by state agencies. Several large MPAs have been established in federal waters to restore fisheries and protect habitat. Other federal MPAs in the region include National Marine Sanctuaries, such as Flower Garden Banks; National Parks, such as Gulf Islands National Seashore in Texas; and National Wildlife Refuges, such as the Breton National Wildlife Refuge in Louisiana.

(50)
Area to Be Avoided

(51) The **Florida Keys Particularly Sensitive Sea Area (PSSA)** is an International Maritime Organization (IMO) designated zone that encircles the sea area around all of

the Florida Keys. The PSSA includes the entire Florida Keys National Marine Sanctuary as well as Biscayne National Park at the northeastern end of the Keys. The PSSA is bounded by a line connecting the following points:

(52)

In The Vicinity of the Florida Keys		
Point	Latitude	Longitude
1	25°45.00'N.	80°06.10'W.
2	25°38.70'N.	80°02.70'W.
3	25°22.00'N.	80°03.00'W.
4	25°06.38'N.	80°10.48'W.
5	24°56.37'N.	80°19.26'W.
6	24°37.90'N.	81°47.30'W.
7	24°29.20'N.	81°17.30'W.
8	24°22.30'N.	81°43.17'W.
9	24°28.00'N.	81°43.17'W.
10	24°28.70'N.	81°43.50'W.
11	24°29.80'N.	81°43.17'W.
12	24°33.10'N.	81°35.15'W.
13	24°33.60'N.	81°26.00'W.
14	24°38.20'N.	81°07.00'W.
15	24°43.20'N.	80°53.20'W.
16	24°46.10'N.	80°46.15'W.
17	24°51.10'N.	80°37.10'W.
18	24°57.50'N.	80°27.50'W.
19	25°09.90'N.	80°16.20'W.
20	25°24.00'N.	80°09.10'W.
21	25°31.50'N.	80°07.00'W.
22	25°39.70'N.	80°06.85'W.
23	25°45.00'N.	80°06.10'W.

(53)

In the Vicinity of Key West Harbor		
24	24°27.95'N.	81°48.65'W.
25	24°23.00'N.	81°53.50'W.
26	24°26.60'N.	81°58.50'W.
27	24°27.75'N.	81°55.70'W.
28	24°29.35'N.	81°53.40'W.
29	24°29.35'N.	81°50.00'W.
30	24°27.95'N.	81°48.65'W.

(54)

Area Surrounding the Marquesas Keys		
Point	Latitude	Longitude
31	24°26.60'N.	81°59.55'W.
32	24°23.00'N.	82°03.50'W.
33	24°23.60'N.	82°27.80'W.
34	24°34.50'N.	82°37.50'W.
35	24°43.00'N.	82°26.50'W.
36	24°38.31'N.	81°54.06'W.
37	24°37.91'N.	81°53.40'W.

Area Surrounding the Marquesas Keys		
Point	Latitude	Longitude
38	24°36.15'N.	81°51.78'W.
39	24°34.40'N.	81°50.60'W.
40	24°33.44'N.	81°49.73'W.
41	24°31.20'N.	81°52.10'W.
42	24°28.70'N.	81°56.80'W.
43	24°26.60'N.	81°59.55'W.

(55)

Area Surrounding the Dry Tortugas Islands		
44	24°32.00'N.	82°53.50'W.
45	24°32.00'N.	83°00.05'W.
46	24°39.70'N.	83°00.05'W.
47	24°45.60'N.	82°54.40'W.
48	24°45.60'N.	82°47.20'W.
49	24°42.80'N.	82°43.90'W.
50	24°39.50'N.	82°43.90'W.
51	24°35.60'N.	82°46.40'W.
52	24°32.00'N.	82°53.50'W.

(56)

Dangers

(57) **Danger zones** and **restricted areas**, extending as much as 100 miles offshore, are located in the Gulf of America from Key West to the Rio Grande. (See **33 CFR Parts 162** and **334**, chapter 2, for limits and regulations.)

(58) **Fish havens**, some marked by privately maintained buoys, are numerous along the Gulf coast. Navigators should be cautious about passing over fish havens or anchoring in their vicinity.

(59)

Wrecks

(60) Numerous wrecks, submerged and showing above water, in the bays, sounds and rivers and along the Gulf coast are obstructions to navigation. A careful check should be made of the chart to ensure that dangerous wrecks are not along the routes selected.

(61) Periodically, District Engineer, New Orleans Corps of Engineers, publishes in a navigation bulletin the locations of obstructions affecting navigation in navigable waterways within the State of Louisiana that are within the New Orleans district boundaries. (See Appendix A for extent of the New Orleans District.) This list includes obstructions in the Gulf within the 3-mile limit.

(62)

Oil Well structures

(63) Numerous submerged wells and oil well structures (platforms), including appurtenances thereto, such as mooring piles, anchor and mooring buoys, pipes and stakes, exist in the Gulf of America off the coasts of Mississippi, Louisiana and Texas. The heaviest concentration of these obstructions, however, is found between the Mississippi River Delta and Galveston Bay, extending as much as 70 miles offshore.

(64) In general, the oil well structures (platforms) in the Gulf are marked at night as follows:

(65) Structures outside the 5-fathom curve show quick flashing white lights visible from all directions at a distance of at least 5 miles; more than one light may be displayed. Sound signals are sounded from the structures when visibility is less than 5 miles; signal consists of a horn sounding one 2-second blast every 20 seconds.

(66) Structures between the 2-fathom and 5-fathom curves show quick flashing white lights visible from all directions at a distance of at least 3 miles. Sound signals are sounded from the structures when visibility is less than 3 miles.

(67) Structures along the coast in less than 2 fathoms and within the bays and sounds show either quick flashing white or red lights visible from all directions at a distance of at least 1 mile. Normally these structures are not equipped with sound signals.

(68) Structures on or adjacent to the edges of navigable channels and fairways, regardless of location, may be required to display lights and sound signals for the safety of navigation.

(69) Associated structures within 100 yards of the main structures, regardless of location, are not normally lighted but are marked with red or white retro-reflective material. Mariners are cautioned that uncharted submerged pipelines and cables may exist in the vicinity of these structures or between such structures and the shore.

(70) During construction of a well or during drilling operations and until such time as the platform is capable of supporting the required aids, fixed white lights on the attending vessel or drilling rig may be shown in lieu of the required quick flashing white lights on the structure. The attending vessel's foghorn may also be used as a substitute.

(71) Submerged wells may or may not be marked depending on their location and depth of water over them.

(72) All obstruction lights and sound signals used to mark the various structures are operated as privately maintained aids to navigation. The detailed regulations for the marking of offshore structures are contained in **33 CFR 67** (not carried in Coast Pilot 5.)

(73) Information concerning the establishment, change or discontinuance of offshore oil well structures and their appurtenances are published in Notice to Mariners with the exception of those inside the outer shoreline.

(74) All structures in the Gulf of America are shown on the latest issues of the 1:80,000 and/or larger scale nautical charts covering the area. A warning note in lieu of the individual obstructions is shown on some charts. Some Gulf charts show oil well structures only when they are offshore of the indicated purple limits of the 1:80,000 scale charts.

(75) Mariners are advised to use the Shipping Safety Fairways that have been established in the Gulf of America. These fairways provide shipping lanes free of oil drilling structures. Although the use of these fairways is not mandatory, mariners should take advantage of the safer passageways made available.

(76) Information concerning seismographic operations is not published in Notice to Mariners unless such operations will create a menace to navigation in waters used by general navigation. Where seismographic operations are being conducted, casings (pipes), buoys, stakes and detectors are installed. Pipes are marked with flags by day and fixed red lights by night, buoys are colored international orange and white horizontal bands, and stakes are marked with flags.

(77)
Pipelaying barges

(78) With the increased number of pipeline-laying operations, operators of all types of vessels should be aware of the dangers of passing close aboard, close ahead or close astern of a jetbarge or pipelaying barge. Pipelaying barges and jetbarges usually move at 0.5 knot or less and have anchors that extend out about 3,500 to 5,000 feet in all directions and that may be marked by lighted anchor buoys. The exposed pipeline behind the pipelaying barge and the area in the vicinity of anchors are hazardous to navigation and should be avoided. The pipeline and anchor cables also represent a submerged hazard to navigation. It is suggested, if safe navigation permits, for all types of vessels to pass well ahead of the pipelaying barge or well astern of the jetbarge. The pipelaying barge, jetbarge and attending vessels may be contacted on VHF-FM channel 16 for passage instructions.

(79)
Drawbridges

(80) The general regulations that apply to all drawbridges are given in **33 CFR 117.1** through **117.49**, chapter 2, and the specific regulations that apply only to certain drawbridges are given in **33 CFR Part 117, Subpart B**, chapter 2. Where these regulations apply, references to them are made in the Coast Pilot under the name of the bridge or the waterway over which the bridge crosses.

(81) The drawbridge opening signals (see **33 CFR 117.15**, chapter 2) have been standardized for most drawbridges within the United States. The opening signals for those few bridges that are nonstandard are given in the specific drawbridge regulations. The specific regulations also address matters such as restricted operating hours and required advance notice for openings.

(82) The mariner should be acquainted with the general and specific regulations for drawbridges over waterways to be transited.

(83)
Routes

(84) On the east side of the Gulf of America, for a distance of possibly 100 miles outside the 100-fathom curve, southeast currents prevail and velocities as high as 2.5 knots have been reported. The Gulf Stream investigations indicated that the strongest current into the Straits of Florida is found near the 1,000-fathom curve west of

Dry Tortugas and that velocities of 1.5 to 2 knots are frequent in that locality. Approaching Dry Tortugas from the Gulf should, therefore, be regarded as a difficult run, as a vessel will overrun her log, and observations are the principal guide; currents may be expected at all times, but variations occur both in direction and velocity, due to the season of the year and the winds. Approaching Dry Tortugas a vessel must take care to stand outside the Area To Be Avoided Off the Coast of Florida (ATBAOCF, indexed as such, this chapter).

(85) Approaching the passage west of Rebecca Shoal from north, a number of vessels have stranded on New Ground, indicating an east set.

(86) **Junction point** for deep-draft vessels bound to or from Gulf Coast ports is **Straits of Florida** (24°25'N., 83°00'W.), which is 14 miles south-southwest of Dry Tortugas Light.

(87) From the Straits of Florida to Cape Hatteras vessels follow the Gulf Stream and pass about 14 miles south of Rebecca Shoal Light. Vessels then parallel the Florida Reefs, taking care to stand outside the ATBAOCF. See Area To Be Avoided Off the Coast of Florida (indexed as such), this chapter. Fowey Rocks Light is passed at a distance of 10 to 12 miles and Jupiter Inlet Light 15 miles. The velocity of the current varies greatly in different localities and is also subject to sudden changes, due to wind, differences in barometric pressure, and the like, so that no fixed hourly rate of drift can be given. Frequently high velocities will be carried between certain points and suddenly dropping off between others. The position should, therefore, be checked whenever possible by bearings. The ship speed plus supposed rate of current should not be assumed to fix the position. The greatest velocity will be found between Carysfort Reef and Jupiter Inlet, ranging from 2 to 4.5 knots.

(88) During the winter months when northers are frequent, it is well for westbound vessels to keep a little north of the **295°** course from Dry Tortugas to Heald Bank Lighted Whistle Buoy but go south of it in passing. In either direction, verify position as often as possible, because of the varying conditions of the current. For 300 miles before reaching Heald Bank, westbound craft frequently overrun, especially during the winter months, and eastbound vessels overrun the last 300 miles before reaching Dry Tortugas. Depend upon soundings westbound but upon observations eastbound.

(89) Currents along the course from Dry Tortugas to Galveston are subject to great variability. However, observations have shown that a 0.5-knot southeast current may be expected for 200 miles after leaving Dry Tortugas. For the next 100 miles the current generally sets east at 0.5 knot. For the next 200 miles the set is about north-northeast at 0.2 knot. For nearly 200 miles before reaching Galveston the set is approximately west-northwest at 0.2 knot. It is emphasized that this approximates the long-term mean current pattern and that it may not be experienced on any particular voyage. (See Loop Current, this chapter.) Winds and storms frequently modify conditions, and their effects must be taken into account.

(90)

Inside navigation

(91) Navigation on the waterways covered by this volume requires a knowledge of the channel conditions and other factors restricting navigation. General items of interest to the vessel operator are indicated in the paragraphs that follow; details are given in the text.

(92) **Special regulations** governing the use, administration and navigation of floodgates and locks of the Intracoastal Waterway are given in **33 CFR 207.185** and **207.187**, chapter 2.

(93)

Manmade canals

(94) In addition to the numerous bayous and natural canals, thousands of manmade canals have been dredged in the wetlands along the Gulf coast. While the original purpose of many of these canals was for private access to pipelines and well locations or for other mineral-related activities, some are used by boaters. These canals and bayous contain numerous obstructions including barriers, pipes, pilings and construction debris. Some of these structures are permanently maintained and have been suitably marked or lighted by their owners. Many others appear and disappear without notice and are uncharted, unlighted and unmarked. Even on the marked structures, mariners cannot rely on the markings always being maintained in good condition because of vandalism or weather damage. Therefore, all persons using canals and bayous must anticipate the hazards posed by these obstructions and navigate with extreme caution, especially at night and during periods of reduced visibility.

(95)

Bends and curves

(96) In the Intracoastal and adjoining waterways there are many sharp bends that are dangerous to vessels meeting or passing. On approaching a bend, a vessel should reduce speed sufficiently to be able to stop within half the distance to a ship coming from the opposite direction. Under no circumstances should a vessel attempt to overtake and pass another at a bend. Even with sufficient view of the channel ahead and after proper exchange and understanding of signals, the overtaken vessel may suddenly sheer from current action. This is even more pronounced with larger vessels and tows.

(97)

Crosscurrents

(98) Where two streams cross, the current will have a greater velocity in the deeper channel. This is noticeable along the Intracoastal Waterway where it follows a dredged canal cutting across a winding stream. Crosscurrents will also be noticed where either an inlet from the ocean or a drainage canal or a river enter the waterway.

(99) Crosscurrents are especially strong along the Intracoastal Waterway in San Carlos Bay, The

Rigolets-New Orleans Cut, Chef Menteur Pass, Vermilion River Cutoff and Brazos and Colorado Rivers.

(100)
Spoil banks

(101) Nature quickly covers her scars. This is true of the spoil banks made by dredging. When awash, these banks are often covered by grass, bushes and sometimes fairly large trees.

(102) **Water hyacinth** is a floating freshwater plant which infests numerous streams tributary to the South Atlantic and Gulf Coasts. It has bright green leaves and a purple flower. It propagates from seeds and suckers, spreads quickly in most localities and may cause complete suspension of navigation if not removed. The hyacinths form in mats or jams and float around driven by the wind or current. In open water these mats often resemble small islands. At times some of the bays and tributaries may be changed in appearance due to hyacinth jams. Where the water is apt to be brackish, an attempt can be made to force a boat through the mat. In doing so, however, care should be taken that any logs that might be floating in the weeds are not struck with force enough to damage the hull. Snakes may also be found on the hyacinth mats. The work of removing this growth is undertaken by the various Corps of Engineers districts and the State of Florida by the processes of spraying and cutting and the use of booms.

(103)
Mangrove

(104) Three distinct types of mangrove are found in the south section of this area. Yellow or white mangrove is found principally on the sand flats in front of the fast land. Red mangrove is rooted in water most of the time. Black mangrove grows on sand ridges and higher ground which cover only at very high water or storm tides. The black mangrove sometimes grows to a height of 50 to 60 feet. Along the coast from Cape Sable to Everglades City, most mangroves grow from 25 to 50 feet high with some stands of red mangroves reaching above 60 feet. Along the coast of Florida Bay, the red and black mangroves generally do not exceed a height of about 26 feet.

(105)
Stumps and sunken logs

(106) Reports are frequently made that vessels have struck shoals or rocks in rivers that have later proved to be stumps or sunken logs. Mariners are warned against navigating too close to the banks of streams where submerged stumps are known or may be expected to exist.

(107)
Hurricane moorings

(108) On receiving advisory notice of a tropical disturbance small boats should seek shelter in a small winding stream whose banks are lined with trees, preferably cedar or mangrove. Moor with bow and stern lines fastened to the lower branches; if possible snug up with good chafing gear. The knees of the trees will act as fenders, and the branches, having more give than the trunks, will ease the shocks of the heavy gusts. If the banks are lined only with small trees or large shrubs, use clumps of them within each hawser loop. Keep clear of any tall pines as they generally have shallow roots and are more apt to be blown down.

(109)
Manatees

(110) The West Indian manatee is a herbivorous marine mammal that is protected at the federal level by the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. These acts make it illegal to harass, hunt, capture or kill any marine mammal, including all dolphins, whales and manatees. The manatee is a large (approximately 8 to 10 feet in total length) and slow-moving marine mammal with a torpedo-like body and a paddle-shaped tail. These animals mainly inhabit the estuarine and inland waters of Florida, although they have been sighted in other geographic locations. Due to their sensitivity to colder temperatures, in the winter manatees move from cooler waters and congregate, sometimes in large numbers, in warmer rivers and springs, streams and canals and near the cooling water discharge outlets of power plants and other industrial sources. During the spring and autumn months, many manatees undertake extensive migrations along the Atlantic and Gulf Coasts. Manatee distribution in the warmer months of the year is typically more widespread.

(111) Manatees need to surface regularly to breathe, approximately every 2 to 10 minutes, but are capable of holding their breath for up to 20 minutes. Calves are approximately 3 feet in length at birth and stay with the mother for a period of up to 2 years. During this time, they nurse regularly from the mother and take more frequent breaths than a larger adult. This mother-calf bond is very important and critical to the survival of the calf; it is very important that the mother and calf do not become separated. Manatees are typically solitary in nature, found as a cow-calf pair, or found in small groups. However, when a female is in estrus, she may be accompanied by large numbers of males, typically referred to as a mating herd.

(112) Statewide aerial surveys (synoptic surveys) are conducted following significant cold weather to provide a minimum population estimate for manatees in Florida waters. In January 2009, the synoptic survey resulted in a total count of 3,802 manatees on both the east and west coasts of Florida. This is a minimum count, and it is reasonable to assume that some manatees were not detected during the surveys. Manatees are quite docile and have no natural enemies but are an endangered species, mostly due to collisions with boats, which have caused as many as 95 deaths per year. Watercraft-related mortality may result from injuries caused by the propeller and/or impact from a collision with a vessel. As such, manatee protection speed zones (ranging from no entry zones to 30 miles per hour zones) exist around the State

of Florida to provide additional protection in areas of high manatee use and high watercraft-related mortality.

(113) The Florida Manatee Sanctuary Act authorizes the Florida Fish and Wildlife Conservation Commission (FWC) and, in some cases, local governments, to regulate motorboat speed and operation in areas frequently used by manatees. The **regulated zones** are marked by large reflective signs or buoys. In these zones, boat operators must operate their vessels at or below the established limits, and no person may intentionally or negligently annoy, molest, harass, disturb, collide with, injure or harm manatees. Maps of the state zones are available at *myfwc.com*. Questions about the state regulations should be directed to the FWC Imperiled Species Management Section, 620 South Meridian Street, Tallahassee, FL 32399. **Regulated zones** within the area covered by this Coast Pilot are in Faka Union Bay, River and Canal; in the Caloosahatchee River from San Carlos Bay to the Edison Memorial Bridge (U.S. 41); in Orange River and at its confluence with Caloosahatchee River; in Withlacoochee River; in the approach to Alafia River from the main channel through Hillsborough Bay; in the Homosassa River; and in Kings Bay on the Crystal River.

(114)

Tides

(115) Periodic tides in the Gulf of America usually are small and may, therefore, be greatly modified and sometimes obliterated by fluctuations in the water surface due to winds or other meteorological conditions.

(116) At Key West the mean range of tide is 1.3 feet. Extreme variations in the level from 1.5 feet below the plane of reference to 4 feet above may occur in this locality.

(117) Along the west coast of the peninsula of Florida from Cape Sable to Apalachee Bay, the mean range varies from 0.5 to 3.6 feet. Extreme tides from 3 feet below to 6 feet above the plane of reference have been observed on this coast.

(118) Along the north shore of the Gulf coast region from St. George Sound to the Rio Grande the tide is generally diurnal and the range is less than 3 feet, but fluctuations due to the wind from 3.5 feet below to 4 feet above the plane of reference are not uncommon. During the severe storms that occasionally visit this region, high waters from 10 to 12 feet above the plane of reference have been reported at Galveston, TX, and 12.7 feet has been observed at Port O'Connor, TX.

(119) The periodic or astronomical tide, small at the mouth of the Mississippi River, gradually diminishes as it ascends the river until it finally becomes completely masked by the larger fluctuations resulting from meteorological conditions. At New Orleans the diurnal range of the tide during low-river stages averages about 0.8 foot. There is no periodic tide at high-river stages. There is, however, a large fluctuation in the level due to the condition of the river. The mean annual fluctuation at New Orleans is about 14 feet, the water being highest in the spring months and lowest during the autumn and early part of the winter. An extreme fluctuation of 21 feet in the river level at this city has been reported. (See Tidal information, including real-time water levels, tide predictions and tidal current predictions is available at *tidesandcurrents.noaa.gov*.)

(120)

Currents

(121) Under normal conditions, at all seasons of the year, the great volume of water passing north through Yucatan Channel into the Gulf of America spreads out in various directions. Surface flows set: west across Campeche Bank, the Gulf of Campeche, and the Sigsbee Deep; northwest toward Galveston and Port Arthur; north-northwest toward the Mississippi Passes; and east into the Straits of Florida.

(122) A straight line drawn from Buenavista Key, Western Cuba, to the Mississippi Passes forms an approximate boundary between movements having different directions. West of this line the drift is generally north or west, while east of it the drift is east or southeast toward the Straits of Florida.

(123) There are north flows along the west side of the Gulf between Tampico and Corpus Christi in the vicinity of the 100-fathom and 1,000-fathom curves, north of the Sigsbee Deep between the 2,000-fathom and the 100-fathom curves, and along the west coast of Florida.

(124) In general, the surface circulation is the same at all seasons. There is, however, some seasonal change in velocity, the flow being generally stronger in spring and summer than in the autumn and winter.

(125) The current near the Florida Keys is variable and uncertain.

(126) Tidal currents are generally weak in the open Gulf, but they are strong at times near shore, in the vicinities of shoals, and in the entrances to harbors. See the Tidal Current Predictions at *tidesandcurrents.noaa.gov* for more information. Links to a user guide for this service can be found in chapter 1 of this book.

(127) The **Gulf Stream System** is the most famous of the principal ocean currents. The name was first used by Benjamin Franklin in 1769. In general, as the swift current of the Gulf Stream issues into the sea through Straits of Florida, its waters are characterized by a deep blue color, high salinity, high temperature in the upper stratum and absence of phosphorescence. Except near shoals where waves may stir up bottom sediments, Gulf Stream water is very clear, enabling visual penetration to unusually great depths. At its junction with coastal seawater, the edges may frequently be recognized in moderate weather by ripples, as well as by the difference in color. Northward, in the cooler regions, the evaporation from its surface, when the temperature of the air is lower than that of the water, is apparent as "sea smoke." In addition, the stream may carry with it some **Gulf weed** (Sargassum), which is olive brown, branched seaweed with berrylike air vessels.

(128) The upstream extent of the Gulf Stream System can be traced to the Yucatan Strait where a well-established current enters the Gulf of America. The current in the Gulf of America is called the **Loop Current**. The position of the Loop Current is quite variable, but there is some evidence of a cyclical pattern of about 290 days. The Loop Current begins with a short flow pattern protruding into the Gulf of America, then it slowly builds up, gradually protruding northward and westward into the Gulf and reaching as far as 28°N and 90°W before shedding a large warm ring. The remaining Loop Current has a shortened flow path and begins the process anew. The large detached warm ring will drift west about 1.5 miles per day to southwest into the western Gulf where it will eventually dissipate. Gulf of America warm rings average about 120 miles in diameter. The warm ring has a clockwise flow with a maximum current close inside its periphery of 0.5 to 1.5 knots.

(129) After entering the Straits of Florida between Cuba and the Florida Keys, the Gulf Stream System's path becomes much more stable. The major variation of the current from off Key West to off Little Bahama Bank appears to be a meandering of the axis of the current within the narrow confines of the Straits. The current within the Straits and slightly to the north is frequently referred to as the **Florida Current**.

(130) Shortly after emerging from the Straits of Florida, the Gulf Stream is joined by the **Antilles Current**, which flows northwest along the open ocean side of the West Indies. The Antilles Current, like the Gulf Stream, carries warm, highly saline waters of clear indigo blue. The union of the two currents gives rise to a broad and deep current possessing about the same characteristics as the Florida Current except that the velocity is somewhat reduced. The Gulf Stream from the Florida Straits flows north, then northeast, paralleling the general trend of the 100-fathom contour up to Cape Hatteras. From 32°N to Cape Hatteras the stream shows some lateral meandering that does not generally exceed one stream width, or about 40 miles.

(131) Beyond Cape Hatteras the Gulf Stream flows east away from the coast and into much deeper water. As it moves into progressively deeper water, the stream is subject to increased meandering, which can have as large a north-south extent as 270 miles. The wavelike meanders of the stream propagate east at speeds of about 3 to 5 miles per day. These meanders occasionally shed detached current rings or eddies that are found north and south of the stream and that are respectively warmer and cooler than the surrounding waters. Rings are generally formed east of 65°W.

(132) Warm rings average about 70 miles in diameter and are found north of the stream between it and the continental shelf. Warm rings rotate in a clockwise direction with a maximum flow of about 1.6 knots located about 2/3–3/4 from the center of the eddy. Warm rings generally move about 1.5 miles per day west after formation in the region between the stream and the continental shelf to about 70°W. From 70°W the rings generally move southwest along the continental shelf and eventually are absorbed into the stream near Cape Hatteras. Many warm rings are absorbed by the stream well before they reach Cape Hatteras. About 20 warm rings are formed each year and average about a 20-week life cycle. Cold rings average about 60 miles in diameter and are found south of the stream in the Sargasso water region. Cold rings rotate in a counterclockwise direction with a maximum flow of about 1.6 knots located 2/3-3/4 from the center. Cold ring velocities can be significantly higher than 1.6 knots. Cold rings tend to move about 1.5 miles per day southwest after formation and are eventually absorbed back into the Gulf Stream. About 20 cold rings are formed each year and average about a 1.5 year life cycle.

(133) East of the Grand Banks of Newfoundland, the whole surface is slowly driven east and northeast by the prevailing west winds to the coastal waters of northwestern Europe. For distinction, this broad and variable wind-driven surface movement is sometimes referred to as the **North Atlantic Drift**.

(134) On its west or inner side, the Gulf Stream is separated from the coastal waters by a zone of rapidly falling temperature, to which the term **north wall** (**west wall** from Georgia south) has been applied. The abrupt change in the temperature of the waters separated by the north wall (west wall) is frequently very striking and is a definite indication of the edge of the stream. It is most clearly marked north of Cape Hatteras but extends, more or less well defined, from the Straits of Florida to the Grand Banks of Newfoundland. In the vicinity of the Grand Banks, the north wall represents the dividing line between the warm current of the Gulf Stream and the cold waters of the **Labrador Current**, which according to observations, turns sharply, between 42°–43°N and 51°–52°W, and flows parallel to the Gulf Stream.

(135) Throughout the whole stretch from the Florida Keys to past Cape Hatteras the stream flows with considerable velocity. Characteristic average surface speed is on the order of 2.5 knots, increasing to about 4.5 knots off Cape Florida where the cross-sectional area of the channel is least. These values are for the axis of the stream where the current is a maximum, the speed of the stream decreasing gradually from the axis as the edges of the stream are approached. The axis of the stream is estimated to be about 3–15 miles seaward of the north wall. Both the speed and position of the axis of the stream fluctuate from day to day, hence description of both position and speed are averages.

(136) Crossing the stream at Jupiter or Fowey Rocks, an average allowance of 2.5 knots in a north direction should be made for the current.

(137) Crossing the stream from Habana, a fair allowance for the average current between 100-fathom curves is 1 knot in an east-northeast direction.

(138) A vessel bound from Cape Hatteras to Habana, or the Gulf ports, crosses the stream off Cape Hatteras. A fair allowance to make in crossing the stream is 1 to 1.5

knots in a northeast direction for a distance of 40 miles from the 100-fathom curve.

(139) Earlier systematic observations on the Gulf Stream dealt with the temperature of the water rather than its motion, and the axis was taken to be along the line of highest temperature obtained. Later the axis was taken to mark the line of greatest velocity. Ordinarily it is assumed that these two axes coincide, but this is by no means certain. The thermometer, although it indicates the limits of the stream in a general way, is therefore only an approximate guide to the velocity of the currents.

(140) The lateral boundaries of the current within the Straits of Florida are fairly well fixed, but as the stream crosses **32°N** its east boundary becomes somewhat vague. On the west side the limits can be defined approximately since the waters of the stream differ in color, temperature, salinity and flow from the inshore coastal waters. On the east, however, the Antilles Current combines with the Gulf Stream so that its waters here merge gradually with the waters of the open Atlantic. Observations of the National Ocean Survey indicate that, in general, the average position of the inner edge of the Gulf Stream from the Straits of Florida to Cape Hatteras lies inside the 100-fathom curve.

(141) At the west end of the Straits of Florida the limits of the Gulf Stream are not well defined. Between Fowey Rocks and Jupiter Inlet the inner edge lies very close to the shoreline.

(142) Along the Florida Reefs between Alligator Reef and Dry Tortugas the distance of the north edge of the Gulf Stream from the edge of the reefs gradually increases toward the west. Off Alligator Reef it is quite close inshore, while off Rebecca Shoal and Dry Tortugas it is possibly 15 to 20 miles south of the 100-fathom curve. Between the reefs and the north edge of the Gulf Stream the currents are ordinarily tidal and are subject at all times to considerable modification by local winds and barometric conditions. This neutral zone varies in both length and breadth; it may extend along the reefs a greater or lesser distance than stated, and its width varies as the north edge of the Gulf Stream approaches or recedes from the reefs.

(143)
Location of the Gulf Stream

(144) The approximate position of the axis of the Gulf Stream for various regions is shown on NOS charts: the Straits of Florida; South Carolina to Cuba; Cape Canaveral to Key West; Alligator Reef to Habana. Southeastern U.S. charts show the axis and the position of the inner edge of the Gulf Stream from Cape Hatteras to Straits of Florida.

(145) Up-to-date information on the location, width and maximum surface temperature of the Gulf Stream System is available in a variety of ways. Such information is broadcast by NOAA Weather Radio stations from Key West, FL, to Cape Hatteras, NC. The times of these broadcasts and their formats vary from station to station, but in general, all give the distance to the inshore edge of the Stream with reference to a navigational light or buoy, the width of the Stream when that is known and the maximum temperature. This information is derived largely from infrared satellite imagery, and it is unfortunately not available during the warmer summer months south of about Jupiter Inlet. (See Appendix A for a list of NOAA Weather Radio stations.)

(146) For ships in port or with telecopy equipment, an analysis of the satellite-based Gulf Stream System from the central Gulf of America to Cape Hatteras, which includes an estimated location of the maximum current, is available through the Naval Oceanographic Office at *www.ncei.noaa.gov/jag/navy/data/satellite_analysis/gsscofa.gif* .

(147) An analysis of the Gulf Stream System from the western Gulf of America to Cape Hatteras (South Panel) and from Cape Hatteras to Nova Scotia (North Panel) is provided the National Weather Service (NWS) Weather Forecast Offices (WFOs) in their Coastal Waters Forecast Synopses. WFO Melbourne, FL; WFO Miami, FL and WFO Key West, FL are found at *www.weather.gov/marine/stheastmz* .

(148)
Currents

(149) **Wind-driven currents** are very complicated. Their velocities and directions depend upon a number of factors such as the velocity, direction and duration of the wind; the proximity of the coast and the direction of the coastline. Generally in the Northern Hemisphere the wind-driven current sets somewhat to the right of the wind, but in coastal waters there are many exceptions to this general rule, the current often setting to the left of the wind, due to the tendency of the current to follow the direction of the coastline or to other local conditions.

(150) The velocity of the wind current relative to that of the wind also varies with the locality. Wind-current information is available from the Tidal Current prediction service at *tidesandcurrents.noaa.gov*. Links to a user guide for this service can be found in chapter 1 of this book.

(151)
Weather

(152) Climatological tables for coastal locations and meteorological tables for coastal ocean areas are found within the appropriate chapters in which they are discussed. The climatological tables are a special extraction from the International Station Meteorological Climate Summary (ISMCS). The ISMCS is a CD-ROM jointly produced by the National Climatic Data Center, Fleet Numerical Meteorology and Oceanography Detachment-Asheville, NC, and the U.S. Air Force Environmental Technical Applications Center, Operating Location-A. The meteorological tables for the ocean areas are compiled from observations made by ships in passage and extracted from the National Climatic Data Center's Tape Deck-1129, Surface Marine Observations. Listed in Appendix A are National Weather Service

(153)

Mean Surface Water Temperatures (°C) and Densities

	Years		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Key West, FL	41	Temp	21.7	22.2	23.7	25.8	27.9	29.6	30.4	30.6	29.7	27.6	24.4	22.3	26.3
		Density	26.8	26.9	27.1	27.3	27.5	27.2	27.3	27.3	26.9	26.6	27.0	26.9	27.1
St. Petersburg, FL	25	Temp	16.7	17.6	19.7	23.1	26.4	28.8	29.7	29.7	28.7	25.4	21.0	17.6	23.7
		Density	19.7	19.6	19.4	19.5	20.5	21.2	20.6	18.6	17.1	17.5	18.8	19.5	19.3
Cedar Keys, FL	31	Temp	14.4	15.7	18.4	22.9	26.4	29.1	29.8	29.8	28.3	24.2	19.0	15.4	22.8
		Density	19.9	19.1	18.1	18.1	19.1	20.2	19.9	19.0	18.8	19.2	20.2	20.1	19.3
Pensacola, FL	48	Temp	13.1	14.3	17.1	21.6	25.4	28.6	29.6	29.7	27.8	23.5	18.1	14.2	21.9
		Density	13.0	11.9	9.5	8.2	10.9	12.8	12.9	12.9	14.6	15.9	17.2	15.5	12.9
Grand Isle, LA	21	Temp	16.1	16.2	17.6	20.9	25.2	28.3	29.3	29.4	28.3	25.0	21.2	18.1	23.0
		Density	22.9	21.0	20.3	17.3	16.7	17.3	20.1	20.8	21.2	22.7	24.1	23.9	20.7
Eugene Island, LA	28	Temp	10.8	11.9	15.3	19.9	24.6	28.3	29.4	29.6	27.9	23.3	17.3	12.6	20.9
		Density	1.9	1.1	1.1	0.8	0.6	0.6	1.0	2.4	5.7	5.5	4.7	3.3	2.4
Galveston, TX	50	Temp	13.1	14.2	16.8	21.4	25.6	28.8	30.2	30.3	28.5	24.4	18.8	14.8	22.3
		Density	17.1	16.7	16.8	16.2	15.1	16.0	19.1	22.1	19.9	18.6	18.8	18.2	17.9
Freeport Harbor, TX	16	Temp	11.9	13.5	16.2	21.4	25.1	27.7	28.7	29.3	27.9	23.8	18.9	14.9	21.6
		Density	18.1	17.6	18.9	18.5	17.0	19.1	22.5	24.5	20.9	18.4	19.0	18.4	19.4
Rockport, TX	7	Temp	16.7	16.8	19.8	23.5	27.1	30.1	30.8	30.8	29.1	25.6	20.1	16.9	23.9
		Density	20.6	20.0	19.6	20.6	20.9	22.4	25.6	27.6	23.2	20.4	20.5	19.2	21.7
Port Aransas, TX	11	Temp	13.6	14.3	16.7	22.2	25.8	28.8	29.8	30.0	29.2	25.3	20.7	16.3	22.7
		Density	22.5	23.1	23.4	22.9	21.8	24.3	26.2	27.2	24.8	22.6	22.8	23.3	23.7
Port Mansfield, TX	9	Temp	14.6	16.1	18.6	23.8	26.1	28.3	29.2	29.2	28.3	24.6	20.7	16.7	23.0
		Density	25.8	26.0	26.2	26.3	24.9	24.7	27.1	30.1	29.7	28.0	28.8	27.6	27.1
Brazos Santiago, TX	14	Temp	14.6	15.3	17.4	21.3	24.7	26.3	25.9	26.7	28.2	25.8	21.7	17.6	22.1
		Density	24.2	24.6	25.1	25.3	25.3	26.7	27.2	27.5	26.6	25.2	25.5	24.6	25.7
Port Isabel, TX	24	Temp	16.0	17.3	19.8	23.6	26.8	29.0	29.6	29.6	29.1	25.9	21.4	17.5	23.8
		Density	24.8	25.0	24.7	25.3	25.4	26.4	27.5	27.6	25.7	24.3	25.1	25.3	25.6
San Juan , PR	10	Temp	26.6	26.4	26.9	27.4	27.3	28.1	28.3	28.4	28.8	28.6	28.2	27.1	27.7
		Density	25.4	26.0	26.1	26.2	25.3	25.5	25.6	25.1	24.4	24.0	24.1	24.5	25.2
Isla Maguey, PR	15	Temp	26.6	26.4	27.1	28.0	28.6	28.8	28.9	28.9	29.3	29.2	28.6	27.2	28.2
		Density	26.3	26.7	26.8	27.0	27.0	26.9	26.9	26.9	26.6	5.9	25.9	26.1	26.5

Temperature (Celsius)
F (Fahrenheit) = 1.8C (Celsius) + 32

Density as used in this table is the specific gravity of the sea water or the ratio between the weight of a sea-water sample and the weight of an equal volume of distilled water at 15°C (59°F).

offices and radio stations that transmit weather information.

(154) This section presents a seasonal picture of the weather that can be expected to affect shipping in the Gulf of America and the northwest Caribbean. Detailed local weather is discussed in the appropriate chapters.

(155) While navigating the Gulf of America presents few weather hazards, the ones that occur can be treacherous. Winter storms and cold fronts can generate gales and rough seas. Sea fog, frequent from December through April, can plague the mariner in open and coastal waters. During summer and fall, there is the threat from hurricanes.

(156) During winter, the region is subjected alternately to maritime tropical and continental polar air masses. While the Gulf lies south of the primary winter storm tracks, one will occasionally stray through the region. When cold fronts push through and stall over the Gulf, they may trigger the formation of winter storms. These systems often parallel the north Gulf coast or move inland producing persistent low stratus clouds and rain ahead of their centers. About one-half of the 30 to 40 cold fronts that penetrate the Gulf each year bring strong north winds and whip up rough seas; these are known as **"northers."** The cold air behind the fronts can cause sudden and sometimes large drops in temperature. These cold air masses lower the sea surface temperatures, which aids in the formation of dense advection fog that occurs when warm southerlies blow across these cool waters. This fog is most prevalent along the north Gulf coast from January through April.

(157) By May, the semipermanent, subtropical **Atlantic High (Bermuda High)**, which extends westward across the Gulf of America, strengthens and tends to block storms and fronts from the north. Spring is one of the most trouble-free seasons in the Gulf. Easterly moving systems are infrequent until early summer when the threat

of easterly waves and tropical cyclones looms over the region.

(158) The summer wind flow around the Bermuda High is generally from the east through south, and this is reinforced along much of the coast by the afternoon sea breeze. These prevailing winds provide a source of moist tropical air that results in frequent shower activity along the coast, particularly during the afternoon and evening. Many of these showers develop into thunderstorms, which may drift offshore at night. Infrequently, west through north winds bring hot, dry weather to the Gulf coast.

(159) Easterly wave and tropical cyclone activity increases during August and reaches a peak in September. The principal paths of tropical cyclones moving into the Gulf are from the Straits of Florida and the Yucatan Channel. More than one-half of the tropical storms reach hurricane strength, threatening ships at sea as well as coastal installations. This threat remains through November.

(160) During autumn, the Bermuda High begins to weaken and retreat eastward, opening the way for cold fronts and an occasional winter storm. This increases the frequency of gales and rough seas. However, there are still many days of fine sailing weather. Locally, along the coast, radiation fog forms on clear, calm nights but disperses quickly with the rising sun or if the wind picks up.

(161) Puerto Rico and the Virgin Islands lie directly in the path of easterly trade winds throughout the year. Surrounded by warm tropical waters, the islands have fairly uniform year-round weather with small annual and diurnal temperature changes and slight wet and dry seasons. In winter, the trades are occasionally interrupted by weak cold fronts from north that generate shifting winds and provide some rain during the normally dry winter season. From May through November, easterly waves, which are migratory, unorganized masses of clouds and showers, occasionally move through the region. Sometimes they organize into tropical storms or hurricanes, which are a threat to the mariner and marine coastal facilities. Normally in summer, rain falls as brief showers or thunderstorms, the result of warm, moist air being forced aloft by mountainous or hilly terrain.

(162)

Extratropical cyclones

(163) From October through April, cold continental air masses enter the Gulf of America some 30 to 40 times. These cold outbreaks may become unstable as they spread across the warm water. Squalls containing thick clouds and heavy showers may develop, and local winds may reach 50 knots or more. Initially these fronts may be accompanied by gale-force winds. About 15 to 20 of them are considered by mariners to be true "northers," with winds exceeding 20 knots. Ship observations indicate that winds exceed 20 knots 5 to 15 percent of the time in the north Gulf region. Close to the north coast, rough seas are less likely than farther south because of the limited fetch. Northers usually last 1 to 2 days but can persist for 4 days. The passage of these fronts often results in sudden, large temperature drops, particularly close to the coast.

(164) These fronts often stall over the Gulf of America. The contrast between the cold continental air to north and warm tropical air to south may result in the formation of an atmospheric wave along the front. Depending upon supporting environmental conditions, the wave may develop into a low-pressure system. These lows often move northeast or east-northeast and sometimes develop into major winter storms off the Atlantic coast. North Gulf waters are considered a region of cyclogenesis from December through March, and the waters off the central coast of Texas are particularly active. February is usually the most active month. These low-pressure systems spread dense low clouds and rain ahead of their centers and draw in cold air in their wakes.

(165) Lows and northers are mainly responsible for the strong winds and rough seas that hamper navigation from fall through spring. Wave heights of 10 feet or more are encountered up to 8 percent of the time while winds of 28 knots or more blow up to 6 percent of the time. January and February are the worst months, and conditions are roughest off the coasts of Mississippi, Louisiana and Texas. Gale-force winds (speeds of 34 knots or more) are encountered up to 2 percent of the time.

(166)

Tropical cyclone

(167) To the meteorologist, the tropical cyclone is a warm-core low-pressure system that develops over the warm waters of the tropical oceans with a counterclockwise rotary circulation in the northern hemisphere. When maximum sustained windspeeds exceed 63 knots, it is called a **hurricane** in the North Atlantic. To the mariner, the tropical cyclone is a storm to be avoided, a relatively small, unpredictable system capable of generating 200-knot winds, 40-foot seas and 20-foot storm surges. Aboard today's ships, the wind itself is usually not the greatest problem. However, in open water a ship is at the mercy of the combination of wind and wave. The sides of a ship tend to act as a sail. Under certain conditions this sail effect may be critical. In hurricanes, the combination of this sail effect, the wave action, stress on the vessel and ship's handling can cause a vessel to capsize. The more the mariner knows about tropical cyclones, their habits and the areas in which they may be encountered, the better are his chances of survival.

(168) Rarely does the mariner who has experienced a fully developed tropical cyclone (hurricane) at sea wish to encounter a second one. He has learned the wisdom of avoiding them if possible. The uninitiated may be misled by the deceptively small size of a tropical cyclone as it appears on a weather map and by the fine weather experienced only a few hundred miles from the reported center of such a storm. The rapidity with which the weather can deteriorate with approach of the storm, and the violence of the hurricane, are difficult to visualize if they have not been experienced.

(169) As a tropical cyclone moves out of the tropics to higher latitudes, it normally loses energy slowly, expanding in area until it gradually dissipates or acquires the characteristics of extratropical cyclones. At any stage, a tropical cyclone normally loses energy at a much faster rate if it moves over land. As a general rule, tropical cyclones of the North Atlantic Region move with the prevailing winds of the area. In small hurricanes the diameter of the area of destructive winds may not exceed 25 miles while in some of the greatest storms the diameter may be as much as 400 to 500 miles.

(170) At the center is a comparative calm known as the "eye of the storm." The diameter of this "eye" varies with individual storms and may be as little as 7 miles but is rarely more than 30 miles. The average is 15 to 20 miles. This center is the region of low atmospheric pressure around which winds blow in a more or less circular course, spiraling inward in a counterclockwise direction. Winds at the outer edge of the storm area are light to moderate and gusty, and often increase toward the center to speeds too high for instrument recording. Although the air movement near the center of the hurricane is usually light and fitful, the seas in this area are in most cases very heavy and confused, rendered so by the violent shifting winds which surround it. Furthermore, after the center has passed a vessel, she may expect a sharp renewal of the gales, with winds from a more or less opposite direction. The hurricane may affect an area covering tens of thousands of square miles.

(171) In the North Atlantic, tropical cyclones form over a wide range of ocean between the Cape Verde Islands and the Windward Islands, over the west Caribbean Sea and the Gulf of America. In an average year nine or ten tropical cyclones come to life and about six of these reach hurricane intensity. Early and late season tropical cyclones tend to form in the west Caribbean or east Gulf of America and move in a northwest through northeast direction. In both June and November an average of two tropical cyclones develop every three years; one of these usually reaches hurricane strength. By July, activity spreads east to the Windward Islands, and four tropical cyclones can be expected every five years. Storms have a tendency to move into the Gulf of America or along the east coast of the United States. During August and the first half of September, the breeding grounds lie between the West Indies and Africa, while during the latter part of September they extend into the Caribbean and Gulf region. During this 2-month period about seven tropical cyclones come to life, with about four reaching hurricane strength. Early August tracks are similar to those of July, while later in the month storms move in a more west direction in the lower latitudes and either continue into the southern Gulf region or recurve over Puerto Rico. This is also true for many late-September storms, while earlier in the month many move west-northwest to the north of Puerto Rico and either through the Straits of Florida into the Gulf of America or northeast into the mid-Atlantic. October activity decreases to August levels while development is concentrated in the west Caribbean and just east of the West Indies. October storms frequently move into the Gulf of America from the southeast.

(172)

Locating and tracking tropical cyclones

(173) By means of radio, the National Weather Service collects weather observations daily from land stations, ships at sea and aircraft. When a tropical cyclone is located, usually in its early formative stage, it is followed closely. In the North Atlantic, U.S. Air Force and NOAA aircraft make frequent flights to the vicinity of such storms to provide information needed for tracking the tropical cyclone and determining its intensity. Long-range shore radar stations follow the movement of the storm's precipitation area when it is in range.

(174) All tropical cyclones in the Atlantic Ocean are routinely and continuously monitored by satellite. In areas far removed from the United States and the West Indies, satellite observations are the primary and often the only means of tracking tropical cyclones, other than ship reports. Satellite imagery, in addition to other means of observation such as aircraft reconnaissance, also provides estimates of the strength of the maximum sustained winds and minimum central pressure in tropical cyclones. Bulletins are broadcast to ships several times daily, giving information on each storm's location, intensity and movement. As a further aid, the mariner may obtain weather reports by radio directly from other ships in the vicinity of a tropical cyclone.

(175)

Signs of approach

(176) While National Hurricane Center warnings provide information for locating and avoiding a tropical cyclone, it is important to know the sequence of events leading to its passage.

(177) An early indication of the approach of such a storm is the presence of a long swell. In the absence of a tropical cyclone, the crests of swell in the deep waters of the Atlantic pass at the rate of perhaps eight per minute. Swell generated by a tropical cyclone is about twice as long, the crests passing at the rate of perhaps four per minute. The swell may be observed several days before the arrival of the storm.

(178) When the storm center is 500 to 1,000 miles away, the barometer usually rises a little and exhibits a slight pumping action. Skies are relatively clear, and cumulus clouds, if present at all, are few in number and their vertical development appears suppressed. Snow-white, fibrous "mare's tails" (cirrus) appear when the storm is about 300 to 600 miles away. Usually these seem to converge more or less in the direction from which the storm is approaching.

(179) Shortly after the cirrus appears, but sometimes before, the barometer starts a long, slow fall. At first the fall is so gradual that it appears only to alter somewhat the normal daily cycle (two maximums and two minimums in

the tropics). As the rate of fall increases, the daily pattern is completely lost in the more or less steady fall.

(180) The cirrus becomes more confused and tangled, and then gradually gives way to a continuous veil of cirrostratus. Below this veil, altostratus forms, and then stratocumulus. These clouds gradually become more dense, and as they do so, the weather becomes unsettled. A fine, mist-like rain begins to fall, interrupted from time to time by showers. The barometer has fallen perhaps 0.1 inch (3 mb).

(181) As the fall becomes more rapid, the wind increases in gustiness, and its speed becomes greater, reaching perhaps 22 to 40 knots (Beaufort 6–8). On the horizon appears a dark wall of heavy cumulonimbus, the **bar** of the storm. Portions of this heavy cloud become detached from time to time and drift across the sky, accompanied by rain squalls and wind of increasing speed. Between squalls, the cirrostratus can be seen through breaks in the stratocumulus.

(182) As the bar approaches, the barometer falls more rapidly and wind speed increases. The seas, which have been gradually mounting, become tempestuous, and squall lines, one after the other, sweep past in ever-increasing number and intensity.

(183) With the arrival of the bar, the day becomes very dark, squalls become virtually continuous and the barometer falls precipitously, with a rapid increase in the wind speed. The center may still be 100 to 200 miles away in a hurricane. As the center of the storm comes closer, the ever-stronger wind shrieks through the rigging and about the superstructure of the vessel. As the center approaches, rain falls in torrents. The wind's fury increases. The seas become mountainous. The tops of huge waves are blown off to mingle with the rain and fill the air with water. Objects at a short distance are not visible. Even the largest and most seaworthy vessels become virtually unmanageable and may sustain heavy damage. Less sturdy vessels do not survive. Navigation virtually stops as safety of the vessel becomes the prime consideration. The awesome fury of this condition can only be experienced. Words are inadequate to describe it.

(184) If the eye of the storm, which may be from 5 to 30 miles across, passes over the vessel, the winds suddenly drop to a breeze as the wall of the eye passes. The rain stops and skies clear to permit the sun to shine through the thin cloud cover. Visibility improves and confused, mountainous seas approach from all sides. The barometer reaches its lowest point. As the wall on the opposite side of the eye arrives, the full fury of the wind strikes as suddenly as it ceased, but from the opposite direction. The sequence of conditions that occurred during approach of the storm is reversed, and pass more quickly, as the various parts of the storm are not as wide in the rear as on the forward side of the storm.

(185)

Locating the center of a tropical cyclone

(186) If intelligent action is to be taken to avoid the full fury of a tropical cyclone, early determination of its location and direction of travel relative to the vessel is essential. The bulletins and forecasts are an excellent general guide, but they are not infallible and may be sufficiently in error to induce a mariner in a critical position to alter course so as to unwittingly increase the danger of the vessel. Often it is possible, using only those observations made aboard ship, to obtain a sufficiently close approximation to enable the vessel to maneuver to the best advantage.

(187) As previously stated, the presence of an exceptionally long swell is usually the first visible indication of the existence of a tropical cyclone. In deep water it approaches from the general direction of origin (the position of the storm center when the swell was generated). However, in shoaling water this is a less reliable indication, because the direction is changed by refraction, the crests being more nearly parallel to the bottom contours.

(188) When the cirrus clouds appear, their point of convergence provides an indication of the direction of the storm center. If the storm is to pass well to one side of the observer, the point of convergence shifts slowly in the direction of the storm movement. If the storm center will pass near the observer, this point remains steady. When the bar becomes visible, it appears to rest upon the horizon for several hours. The darkest part of this cloud is in the direction of the storm center. If the storm is to pass to one side, the bar appears to drift slowly along the horizon. If the storm is heading directly toward the observer, the position of the bar remains fixed. Once within the area of the dense, low clouds, one should observe their direction of movement, which is almost exactly along the isobars, with the center of the storm being 90° from the direction of cloud movement (left of direction of movement in the Northern Hemisphere).

(189) The winds are probably the best guide to the direction of the center of a tropical cyclone. The circulation is cyclonic, but because of the steep pressure gradient near the center, the winds there blow with greater violence and are more nearly circular than in extratropical cyclones.

(190) According to Buys Ballot's law, an observer who faces into the wind has the center of the low pressure on his right (Northern Hemisphere) and somewhat behind him. If the wind followed circular isobars exactly, the center would be exactly eight points, or 90°, from dead ahead when facing into the wind. However, the track of the wind is usually inclined somewhat toward the center, so that the angle dead ahead varies between perhaps 8 and 12 points (90° to 135°). The inclination varies in different parts of the same storm. It is least in front of the storm, and greatest in the rear, since the actual wind is the vector sum of that due to the pressure gradient and the motion of the storm along the track. A good average is perhaps 10 points in front and 11 or 12 points in the rear. These values apply when the storm center is still several hundred miles away. Closer to the center, the wind blows more nearly

along the isobars, the inclination being reduced by one or two points at the wall of the eye. Since wind direction usually shifts temporarily during a squall, its direction at this time should not be used for determining the position of the center.

(191) When the center is within radar range, it might be located by this equipment. However, since the radar return is predominately from the rain, results can be deceptive, and other indications should not be neglected.

(192) Distance from the storm center is more difficult to determine than direction. Radar is perhaps the best guide. The rate of fall of the barometer is of some help; this is only a rough indication, however, for the rate of fall may be quite erratic and will vary somewhat with the depth of the low at the center, the speed of the storm center along its track and the stage in the life cycle of the storm.

(193)

Hurricane avoidance

(194) Most mariners agree that ocean-going ships should leave ports that are threatened by a hurricane. Despite this natural caution, ships continue to be damaged by tropical cyclones both in port or after leaving port. This can be due to the relative unpredictability of storm movement. In making a decision to leave or stay, the mariner must take into account the local climatology of tropical cyclones, the local predictability of their movement, the speed of movement and the suitability of the port. The Gulf region displays a balance of these factors. However, the reduced flexibility in evasion options created by the shape of the Gulf region biases the leave/stay decision in favor of an early departure. This effectively reduces the predictability of the threat at the time of decision. The large range of storm speeds affecting the section of the coast from New Orleans to Pensacola encourages an even earlier departure. These are considered "high risk" ports. Local factors in the Gulf region further diminish the security of many ports. For example, the strong impact of storm surge along much of the Gulf coast in places leads to closure of ports due to sudden silting of their long dredged approach channels. Detailed information on the vulnerability of North Atlantic ports to hurricanes may be found in the **Hurricane Havens Handbook for the North Atlantic Ocean** published by the Marine Meteorology Division, Naval Research Laboratory, Monterey, CA 93943. Additional local information may be found in the individual chapters of this book.

(195) The safest procedure with respect to tropical cyclones is to avoid them. If action is taken sufficiently early, this is simply a matter of setting a course that will take the vessel well to one side of the probable track of the storm and then continuing to plot the position of the storm center, as given in the weather bulletins, revising the course as needed.

(196) However, such action is not always possible. If one finds oneself within the storm area, the proper action to take depends in part upon one's position relative to the storm center and its direction of travel. It is customary to divide the circular area of the storm into two parts. In the Northern Hemisphere, that part to the **right** of the storm track (facing in the direction toward which the storm is moving) is called the **dangerous semicircle**. It is considered dangerous because (1) the actual wind **speed** is greater than that due to the pressure gradient alone, since it is augmented by the forward motion of the storm, and (2) the **direction** of the wind and sea is such as to carry a vessel into the path of the storm (in the forward part of the semicircle). The part to the **left** of the storm track is called the **navigable semicircle**. In this part, the wind is decreased by the forward motion of the storm, and the wind blows vessels away from the storm track (in the forward part). Because of the greater wind speed in the dangerous semicircle, the seas are higher there than in the navigable semicircle.

(197) A plot of successive positions of the storm center should indicate the semicircle in which a vessel is located. However, if this is based upon weather bulletins, it is not a reliable guide because of the lag between the observations upon which the bulletin is based and the time of reception of the bulletin, with the ever present possibility of a change in the direction of motion of the storm. The use of radar eliminates this lag, but the return is not always a true indication of the center. Perhaps the most reliable guide is the wind. Within the cyclonic circulation, a **veering wind** (one changing direction to the right in the Northern Hemisphere and to the left in the Southern Hemisphere) indicates a position in the dangerous semicircle, and a **backing wind** (one changing in a direction opposite to a veering wind) indicates a position in the navigable semicircle. However, if a vessel is underway, its motion should be considered. If it is outrunning the storm or pulling rapidly toward one side (which is not difficult during the early stages of a storm, when its speed is low), the opposite effect occurs. This should usually be accompanied by a rise in atmospheric pressure, but if motion of the vessel is nearly along an isobar, this may not be a reliable indication. If in doubt, the safest action is usually to stop long enough to determine definitely the semicircle. The loss in valuable time may be more than offset by the minimizing of the possibility of taking the wrong action and increasing the danger to the vessel. If the wind direction remains steady (for a vessel which has stopped), with increasing speed and falling barometer, the vessel is in or near the path of the storm. If it remains steady with decreasing speed and rising barometer, the vessel is on the storm track, behind the center.

(198) The first action to take if one finds oneself within the cyclonic circulation is to determine the position of one's vessel with respect to the storm center. **While the vessel can still make considerable way through the water, a course should be selected to take it as far as possible from the center**. If the vessel can move faster than the storm, it is a relatively simple matter to outrun the storm if sea room permits. But when the storm is faster the solution is not as simple. In this case, the vessel, if ahead of the storm, will approach nearer to the center. The

problem is to select a course that will produce the greatest possible minimum distance. This is best determined by means of a relative movement plot.

(199) As a general rule, for a vessel in the Northern Hemisphere, safety lies in placing the wind on the starboard bow in the dangerous semicircle and on the starboard quarter in the navigable semicircle. If on the storm track ahead of the storm, the wind should be put about 2 points on the starboard quarter until the vessel is well within the navigable semicircle, and the rule for that semicircle then followed. With a faster than average vessel, the wind can be brought a little farther aft in each case. However, as the speed of the storm increases along its track, the wind should be brought farther forward. If land interferes with what would otherwise be the best maneuver, the solution should be altered to fit the circumstances. If the speed of the vessel is greater than that of the storm, it is possible for the vessel, if behind the storm, to overtake it. In this case, the only action usually needed is to slow enough to let the storm pull ahead.

(200) In all cases, one should be alert to changes in the direction of movement of the storm center, particularly in the area where the track normally curves toward the pole. If the storm maintains its direction and speed, the ship's course should be maintained as the wind shifts.

(201) If it becomes necessary for a vessel to heave to, the characteristics of the vessel should be considered. A power vessel is concerned primarily with damage by direct action of the sea. A good general rule is to heave to with head to the sea in the dangerous semicircle or stern to the sea in the navigable semicircle. This will result in greatest amount of headway away from the storm center and least amount of leeway toward it. If a vessel handles better with the sea astern or on the quarter, it may be placed in this position in the navigable semicircle or in the rear half of the dangerous semicircle, but never in the forward half of the dangerous semicircle. It has been reported that when the wind reaches hurricane speed and the seas become confused, some ships ride out the storm best if the engines are stopped and the vessel is permitted to seek its own position. In this way, it is said, the ship rides with the storm instead of fighting against it.

(202) In a sailing vessel, while attempting to avoid a storm center, one should steer courses as near as possible to those prescribed above for power vessels. However, if it becomes necessary for such a vessel to heave to, the wind is of greater concern than the sea. A good general rule always is to heave to on whichever tack permits the shifting wind to draw aft. In the Northern Hemisphere this is the starboard tack in the danger semicircle and the port tack in the navigable semicircle.

(203) The rules for avoiding the storm center for power-driver vessels are summarized as follows:

(204)

Right or dangerous semicircle

(205) Bring the wind on the starboard bow (**045°** relative), hold course and make as much way as possible. If obliged to heave to, do so with head to the sea.

(206)

Left or navigable semicircle

(207) Bring the wind on the starboard quarter (**135°** relative), hold course and make as much way as possible. If obliged to heave to, do so with stern to the sea.

(208)

On storm track, ahead of center

(209) Bring wind two points on the starboard quarter (**157½°** relative), hold course and make as much way as possible. When well within the navigable semicircle, maneuver as indicated above.

(210)

On storm track, behind center

(211) Avoid the center by the best practicable course, keeping in mind the tendency of tropical cyclones to curve north and east.

(212)

Coastal effects

(213) The high winds of a hurricane inflict widespread damage when such a storm leaves the ocean and crosses land. Aids to navigation may be blown out of position or destroyed. Craft in harbors, unless they are properly secured, drag anchor or are blown against obstructions. Ashore, trees are blown over, houses are damaged, power lines are blown down, etc. The greatest damage usually occurs in the dangerous semicircle a short distance from the center, where the strongest winds occur. As the storm continues on across land, its fury subsides faster than it would if it had remained over water.

(214) Along the coast, particularly, greater damage may be inflicted by water than by the wind. There are at least four sources of water damage. First, the unusually high seas generated by the storm winds pound against shore installations and craft in their way. Second, the continued blowing of the wind toward land causes the water level to increase perhaps 3 to 10 feet above its normal level. This **storm tide**, which may begin when the storm center is 500 miles or even farther from the shore, gradually increases until the storm passes. The highest storm tides are caused by a slow-moving hurricane of larger diameter, because both of these effects result in greater duration of wind in the same direction. The effect is greatest in a partly enclosed body of water, such as the Gulf of America, where the concave coastline does not readily permit the escape of water. It is least on small islands, which present little obstruction to the flow of water. Third, the furious winds which blow around the wall of the eye often create a ridge of water called a **storm surge**, which strikes the coast and often inflicts heavy damage. The effect is similar to that of a **tsunami (seismic sea wave)** caused by an earthquake in the ocean floor. Both of these waves are popularly called **tidal waves**. Storm surges of 20 feet

or more have occurred. About 3 or 4 feet of this is due to the decrease of atmosphere pressure and the rest to winds. Like the damage caused by wind, that due to high seas, the storm tide and the storm surge is greatest in the dangerous semicircle, near the center. The fourth source of water damage is the heavy rain that accompanies a tropical cyclone. This causes floods that add to the damage caused in other ways.

(215) When proceeding along a shore recently visited by a hurricane, a navigator should remember that time is required to restore aids to navigation that have blown out of position or have been destroyed. In some instances the aid may remain but its light or sound apparatus may be inoperative. Landmarks may have been damaged or destroyed.

(216)

Cargo care

(217) The temperature at which condensation to water droplets occurs is called the dew point. When the dew point is above freezing, condensation will be in the form of water; below freezing dew points, when reached, will result in the formation of ice crystals deposited upon cold surfaces. Knowledge of the dew point along with the cargo temperature and moisture content is vital for hold ventilation decisions.

(218) The relatively high humidities and temperatures encountered in this subtropical region make protection of cargoes from sweat an important consideration. Critical conditions are most likely to occur when cargoes are loaded under conditions of high temperatures, which are prevalent from spring through autumn.

(219) When free air has a dew point temperature higher than the temperature of the surface with which it comes in contact, the air is often cooled sufficiently below its dew point to release moisture. When this happens aboard ship, condensation will take place on relatively cool cargo or on the ship's structure within the hold where it later drips onto the cargo. Thus, if cargo is stowed in a cool climate and the vessel sails into warmer waters, ventilation of the hold with outside air will likely lead to sweat damage in any cargo sensitive to moisture. Under such conditions external ventilation should, as a rule, be closed off entirely, unless the cargo generates internal heat, that hazard being greater than sweat damage. In the opposite case, when a vessel is loaded during a warm period, and moves into cooler weather, vulnerable cargo should be ventilated.

(220) A safe rule for ventilation directed toward moisture control may be stated as follows: Whenever accurate measurements show the outside air has a dew point below the dew point of the air surrounding the cargo to be protected, such outside air is capable of removing moisture from the hold and the ventilation process can be safely started. Whenever the reverse is true, and the outside dew point is higher than the dew point temperature around the cargo, then ventilation will increase the moisture content of the hold and may readily result in sweating within the ship. The above does not take into account possible fumes or gases in the compartment; in such cases discretion must be used.

(221)

Principal ports

(222) The principal deep-draft commercial ports within the area of this Coast Pilot are Port St. Joe, Panama City, Pensacola, Tampa, Mobile, Pascagoula, New Orleans, Baton Rouge, Lake Charles, Orange, Freeport, Port Lavaca-Point Comfort, Port Arthur, Beaumont, Galveston, Texas City, Houston, Corpus Christi, Port Brownsville and Port Isabel. (See chapters 13 and 14, respectively, for the principal deep-draft commercial ports of Puerto Rico and U.S. Virgin Islands.)

(223) Other ports are Key West, Port Boca Grande, Sarasota, St. Petersburg, St. Marks and Carrabelle.

(224)

Pilotage

(225) In general, pilotage is compulsory for all foreign vessels and U.S. vessels under register in the foreign trade. Pilotage is optional for coastwise vessels that have on board a pilot properly licensed by the federal government for the waters that the vessel travels.

(226) Arrangements for pilots, including pilot services between ports and sea buoys, are generally made in advance by the ships' agents. Pilots serving the larger ports maintain a 24-hour radio watch, while those at the smaller ports maintain a radio watch only when vessels are expected. Detailed information on pilotage procedures is given in the text for the ports concerned.

(227) <Deleted Paragraph>

(228)

Towage

(229) Tugs are available at all major ports; they can usually be obtained for the smaller ports on advance notice if none are available locally. Arrangements for tugs should be made in advance through ships' agents or the pilots. (See the text for the ports concerned as to the availability of tugs.)

(230)

Vessel arrival inspections

(231) Vessels subject to U.S. quarantine, customs, immigration and agricultural quarantine inspections generally make arrangements in advance through ships' agents. Government officials conducting such inspections are stationed in most major ports. Mariners arriving at ports where officials are not stationed should contact the nearest activity providing that service. (See Appendix A for addresses.) Unless otherwise directed, officials usually board vessels at their berths. **Note:** U.S. Public Health quarantine matters for ports in Puerto Rico and the U.S. Virgin Islands are handled by the U.S. Quarantine Station, San Juan, PR.

(232) **Harbormasters** where appointed are mentioned in the text. They usually have charge of the anchorage and berthage of vessels.

(233)
Supplies

(234) General supplies, including fuel oil, diesel oil and fuel, gasoline, water and marine supplies are available at the principal ports. Similar items but in more limited quantities can be obtained at many places mentioned under descriptions of the different ports.

(235)
Repairs-salvage

(236) Hull and engines of medium to large vessels can be repaired at Tampa, Mobile, New Orleans, Port Arthur, Beaumont, Orange, Galveston and Houston. Smaller vessels can be handled at numerous other ports. Extensive above-the-waterline hull and engine repairs can be made at Pensacola, Pascagoula and Lake Charles. Minor repairs can be made at Freeport and Port Brownsville. Marine railways are available, and repairs to smaller craft can be made at many other places on the Gulf Coast, as listed under the descriptions of the different ports.

(237) Deep-sea salvage equipment is available at Key West, Tampa, Mobile, New Orleans, Port Arthur, Beaumont and Galveston.

(238)
Small-craft facilities

(239) There are numerous places where fuel, supplies, repairs, slips for dockage and launching ramps are available for small craft. For isolated places and small cities, the Coast Pilot describes the more important of these facilities; for large port areas, where individual facilities are too numerous to mention, the information given is more general. Additional information may be obtained from various local small-craft guides.

(240) A vessel of less than 65.6 feet (20 meters) in length or a sailing vessel shall not impede the passage **of a vessel that can safely navigate only within a** narrow channel or fairway. (Navigation Rules, International-Inland Rule 9(b).)

(241)
Standard time

(242) Port St. Joe, Florida and the areas east observe eastern standard time (e.s.t.), which is 5 hours slow of Coordinated Universal Time (UTC). When it is 1000 UTC, it is 0500 at Tampa, Florida. The area from Port St. Joe to the Rio Grande uses central standard time (c.s.t.), which is 6 hours slow of UTC. When it is 1000 UTC, it is 0400 at Corpus Christi, Texas. Puerto Rico and the U.S. Virgin Islands observe Atlantic standard time (A.s.t.), which is 4 hours slow of UTC. When it is 1000 UTC, it is 0600 at San Juan, Puerto Rico and Charlotte Amalie, U.S. Virgin Islands.

(243)
Daylight saving time

(244) In all states covered by this Coast Pilot clocks are advanced one hour on the second Sunday of March and are set back to standard time on the first Sunday of November. Puerto Rico and the U.S. Virgin Islands do not observe daylight saving time.

(245)
Legal public holidays

(246) New Year's Day, January 1; Martin Luther King, Jr.'s Birthday, third Monday in January; Washington's Birthday, third Monday in February; Memorial Day, last Monday in May; Independence Day, July 4; Labor Day, first Monday in September; Columbus Day, second Monday in October; Veterans Day, November 11; Thanksgiving Day, fourth Thursday in November; and Christmas Day, December 25. The national holidays are observed by employees of the federal government and the District of Columbia and may not be observed by all the areas in every case.

(247) In addition, the following holidays are also observed in the area covered by this Coast Pilot:

(248) Three Kings' Day, January 6: Puerto Rico and Virgin Islands.

(249) Battle of New Orleans, January 8: Louisiana.

(250) De Hostos' Birthday, January 11: Puerto Rico.

(251) Robert E. Lee's Birthday, January 19: Florida and Louisiana. (Third Friday in January in Mississippi and Alabama.)

(252) Arbor Day, Third Friday in January: Florida.

(253) Franklin D. Roosevelt's Birthday, January 30: Virgin Islands.

(254) Lincoln's Birthday, February 12: Virgin Islands.

(255) Washington's Birthday, February 22: Louisiana and Virgin Islands.

(256) Texas Independence Day, March 2: Texas.

(257) Emancipation Day, March 22: Puerto Rico.

(258) Mardi Gras (Shrove Tuesday): Alabama, Florida and Louisiana.

(259) Transfer Day, March 31: Virgin Islands.

(260) Holy Thursday: Virgin Islands.

(261) Good Friday: Florida, Louisiana, Puerto Rico and Virgin Islands.

(262) Easter Monday: Virgin Islands.

(263) Pascua Florida Day, April 2: Florida.

(264) Thomas Jefferson's Birthday, April 13: Alabama.

(265) Jose de Diego's Birthday, April 16: Puerto Rico.

(266) San Jacinto Day, April 21: Texas.

(267) Whit Monday: Virgin Islands.

(268) Confederate Memorial Day, April 26: Florida. (Last Monday in April in Alabama and Mississippi.)

(269) Memorial Day, May 30: Louisiana and Virgin Islands.

(270) Confederate Memorial Day, June 3: Louisiana.

(271) Jefferson Davis' Birthday, June 3: Florida and Texas, (First Monday in June in Alabama and Mississippi.)

(272) Organic Act Day, June: Virgin Islands.

(273) Munoz Rivera's Birthday, July 17: Puerto Rico.

(274) Constitution Day, July 25: Puerto Rico.

(275) Supplication Day, July 25: Virgin Islands.

(276) Dr. Jose C. Barbosa's Birthday, July 27: Puerto Rico.

(277) Huey P. Long's Birthday, August 30: Louisiana.

(278) Columbus Day, October 12: Louisiana, Puerto Rico and Virgin Islands.

(279) Thanksgiving Day, October 25: Virgin Islands.

(280) Liberty Day, November 1: Virgin Islands.

(281) Discovery Day, November 19: Puerto Rico.

(282) Second Christmas Day, December 26: Virgin Islands.