INLET DYNAMICS

Tidal inlets — Floridians sometimes call them passes — are highly dynamic and visible features of Southwest Florida's geography. Inlets provide strategic points of entry and egress between the Gulf of Mexico and the inland waterways, but can be intimidating to navigate because of their shifting nature, strong ebb and flood currents and wave action — including breakers, which may extend clear across the inlet mouth even in a buoyed channel.

Waves propagating into an opposing current experience an increase in height and a decrease in length, resulting in steeper waves that are more difficult to navigate. Offshore shoals continually shift because of the moving beach sand, and it is sometimes not feasible to keep buoys in the best water. Local boaters, under such conditions, often leave the buoyed channel guided by their knowledge of local conditions and of the dynamic history of inlet development, which enables them to pick the best depth and avoid uncharted obstructions.

An understanding of why inlets develop their distinctive forms, coupled with a knowledge of inlet history, is a are useful tool that can aid the eco-tourist mariner to fathom the behavior and navigable condition of inlets.

Table 1.
Route Distances
Between Inlets

a. Gulf of Mexico (Outside) Route to Inlet (Sea Buoy) Entrance (Distances in Statute Miles)

Pass/Inlet	Longboat	New	Big Sarasota	Venice	Stump
Longboat		11.3	15.3	28.0	46.0
New	11.3		4.0	16.7	34.7
Big Sarasota	15.3	4.0		12.7	30.7
Venice	28.0	16.7	12.7		18.0
Stump	46.0	34.7	30.7	18.0	

b. Intracoastal Waterway (Inside) Route to Inlet Access Channel (Distances in Statute Miles)

Pass/Inlet	Longboat	New	Big Sarasota	Venice	Stump
Longboat		11.6	13.6	28.6	45.9
New	11.6		2.0	17.0	34.3
Big Sarasota	13.6	2.0		15.0	32.3
Venice	28.6	17.0	15.0		17.3
Stump	45.9	34.3	32.3	17.3	

c. Inlet and Access Channels From Gulf to Intracoastal (Distances in Statute Miles)

Pass/Inlet	Inlet Channel	ICW Access	Total
Longboat	1.3	1.0	2.3
New	0.87	2.0	2.7
Big Sarasota	3.3	1.7	5.0
Venice	0.3	0.2	0.5
Stump	1.5	0.8	2.3

d. Outside Route, including Runs from and to the ICW (Distances in Statute Miles)

Pass/Inlet	Longboat	New	Big Sarasota	Venice	Stump
Longboat		16.3	22.6	30.8	50.6
New	16.3		11.7	19.9	39.7
Big Sarasota	22.6	11.7		18.2	38.0
Venice	30.8	19.9	18.2		20.8
Stump	50.6	39.7	38.0	20.8	

Inlet Locations and Status

Five inlets are currently used by boaters to transit between Gulf and bay waters in the Sarasota Bay system: Longboat Pass, New Pass, Big Sarasota Pass, Venice Inlet and Stump Pass (Map 1). Distances for traversing the outside (Gulf of Mexico) and inside (Intracoastal Waterway) routes, and the intervening inlet access channels, are given in Table 1 (a-d). Outside route distances for mariners are slightly longer, but travel time under favorable conditions is usually less, especially for high-performance cruisers. Cruising sailboats often choose the outside route to catch a better breeze and to avoid bridges with restricted openings.

Longboat Pass, New Pass and Venice Inlet are federally maintained waterways between the Sarasota Bay system and the Gulf. They are periodically surveyed and, when shoaling occurs to a point where actual depths are less than the designed project depths, are dredged by the U.S. Army Corps of Engineers in cooperation with the West Coast Inland Navigation District (WCIND). Big Sarasota Pass and Stump Pass are not federally designated inlets, although Stump Pass was dredged by the WCIND in 1998.

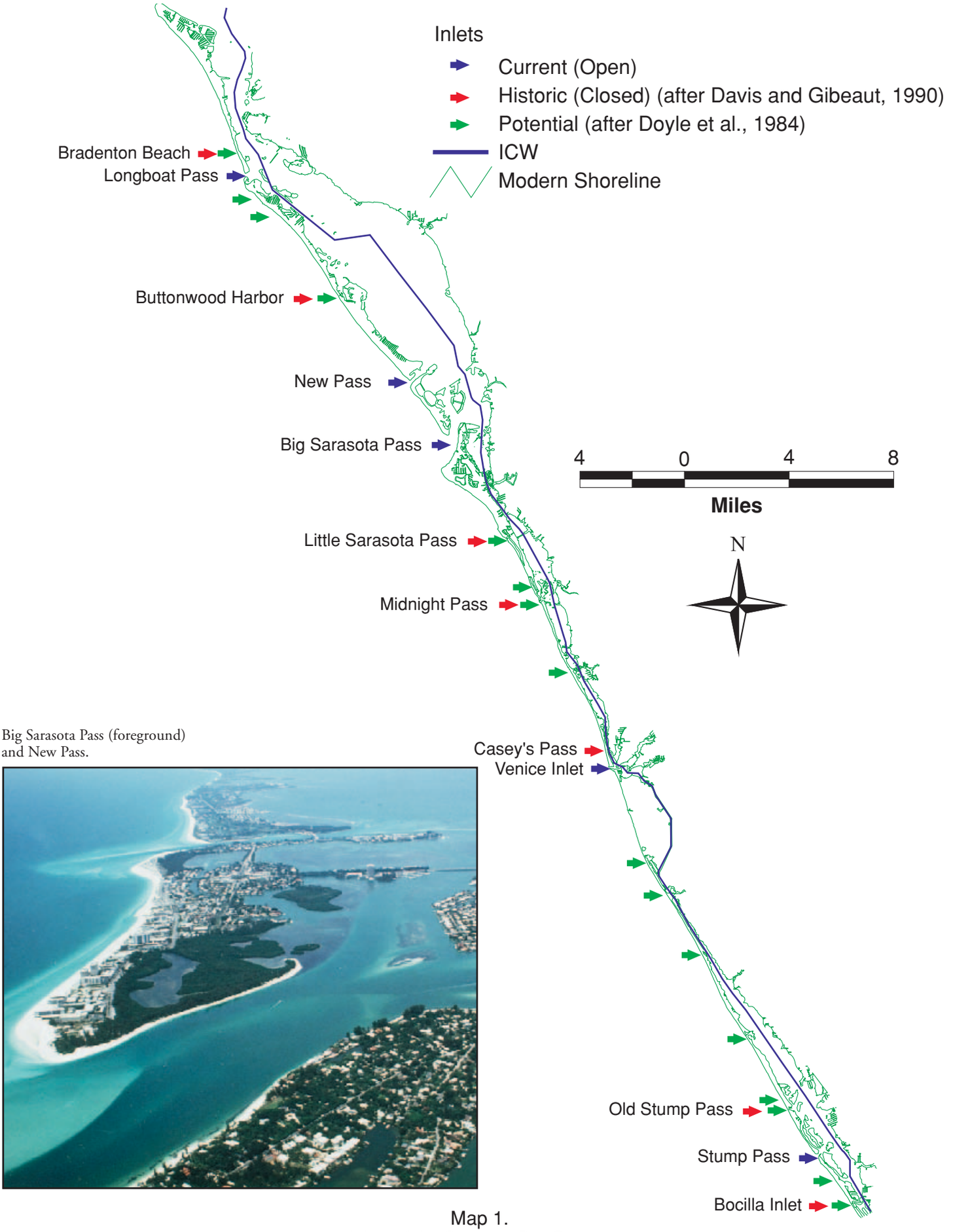
The U.S. Coast Guard maintains aids to navigation at all the inlets except Stump Pass, which as of the summer of 1998 was unmarked on the Gulf side.

Two inlets — Longboat Pass and New Pass — have single-span lift bridges situated near the inlet mouths. The bridge at Longboat opens on demand for boaters from 6 a.m. to 6 p.m. and afterwards on three hours' notice. The New Pass bridge has restricted openings for boaters from 7 a.m. to 6 p.m. on the hour and every 20 minutes.

Six inlets have closed during the past century on this reach of the Florida coast: Bradenton Beach, Little Sarasota Pass, Midnight Pass, Casey's Pass, [Old] Stump Pass and Bocilla Inlet (Map 1). Another historic inlet probably existed at Buttonwood Harbor prior to 1883.

Both current and historic inlets have formed, closed and reopened over their life spans, due to natural processes as well as human intervention. Such events directly affect the amount of water flowing through an inlet during a tidal cycle, referred to as a tidal prism. Dredging inlet "A" can rob some of the tidal prism from inlet "B," situated several miles down the coast. Similarly, the tidal prism of an inlet may be affected by changing the area of the bay adjacent to it; an inlet may close due to an abundance of sediment and strong longshore drift coupled with a small tidal prism.

Considerable debate continues regarding the effects of the dredging and filling of mangrove and marsh environments along bay margins on decreasing the tidal prism and the related closing of inlets. Little disagreement exists, however, about the potential for storm overwash of the barrier islands and the creation of new inlets. Sixteen sites along this stretch of the coast are particularly vulnerable to storm overwash (Map 1). These locations are prone to overwash because of the narrow width of the barrier island, low elevation and orientation to storm-wave attack.



Big Sarasota Pass (foreground) and New Pass.

Map 1.
Inlets of the Sarasota Bay System

Inlet Features

Inlets are natural or manmade channels connecting the coastal Gulf to estuaries with strong tide-induced currents that build up supplies of sand, called shoals, just inside or adjacent to their channels. Inlets may close, open, migrate or stabilize in response to changes in sediment supply, wave climate, tidal regime and back-bay filling or dredging. Changes in inlets occur at different time scales, ranging from hours during severe storm events to decades or even centuries.

For the mariner running the inlet, the most recognizable feature is the steep groundswell that builds up across the inlet mouth, caused by resistance created by the sea bottom where offshore swells run into shoal water. Figure 1 is a perspective drawing of tide-generated and wave-generated transport features in a representative inlet system. The transport of sediment along the beach face, referred to as longshore drift, occurs on the Gulf side of barrier islands and is depicted to be moving from top to bottom. Figure 2 shows the elements of an inlet system; some features may or may not be present or well-developed in all inlets.

Sand is deposited as shoals just inside and outside the inlet because of the reduction in current speed in these areas. Ebb-tidal deltas occur at the seaward margin — outside — of the inlet and retreat or bend in response to the interaction between incoming waves and ebb tides. Large inlets, such as Big Sarasota Pass, build extensive, visible, ebb-tidal deltas. Sediment sources include material washed out from the bay, material eroded from the main ebb channel and longshore drift. Longshore drift is sand that moves up and down the coast between the beach and the outer edge of the breaker zone due to waves approaching the shore at an angle.

Material brought out on the ebb tide is deposited on the swash platform. The breaking waves that the mariner experiences at the inlet entrance are a dominant feature on swash platforms and help to create swash bars. Marginal channels may develop along the ends of barrier islands where incoming (flood) tidal flow is reinforced by wave-generated currents; the swash channel at Boca Grande is a good example of this phenomenon. From boat-deck level, these channel features appear to have the smoothest water surface and absence of breakers and, under favorable weather, may offer the mariner an alternative shorter route through the inlet.

Spits occur in areas with a high rate of sediment transport alongshore and a small tidal prism; spit growth eventually may restrict tidal flow in the main channel and cause downdrift migration or closure of the inlet. Migration of barrier island spits along this reach of the Florida coast is southward, in the direction of net longshore transport. The build-up of Englewood Beach on south Manasota Key adjoining Stump Pass illustrates this process.

Flood (incoming) tide transports sediment landward through the inlet via the main channel, producing a similar shallow-water, delta-like feature on the bay side of the pass. The interplay of ebb and flood tides on this bayside delta creates spits and spill-over lobes where ebb currents run strong. However, flood-tidal deltas are less prone to change than ebb-tidal deltas along this reach of the coast. Over time, they become stabilized by seagrasses and mangroves; they serve as nurseries for juvenile fish and are important fishing grounds.

Flood-tidal deltas, because of their bayside location, have been subjected to heavy land-development pressure. Much of the New Pass flood delta is covered by City Island; that of Big Sarasota Pass is occupied by Bird Key. Natural and improved (dredged) flood channels are marked with aids to navigation. The bayside flood channels may carry additional signage advising the mariner to avoid wandering outside the channel and on to the flood-tidal delta, where propeller scarring of sensitive bay bottom habitat may occur.

The intertidal community is one of Sarasota Bay's most biologically productive. This fringe area is a mix of land and water, where creatures of the land and water most often converge. The mangrove trees found here serve as home for birds, and the jutting prop roots of the red mangrove offer shelter to small fish and shellfish.

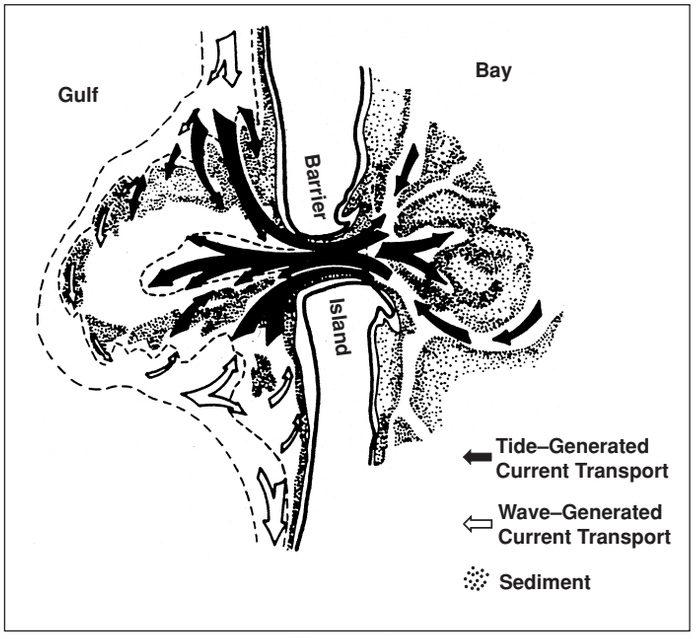


Figure 1.
Tide-Generated and Wave-Generated Transport Features in a Representative Inlet System (from Smith, 1984)

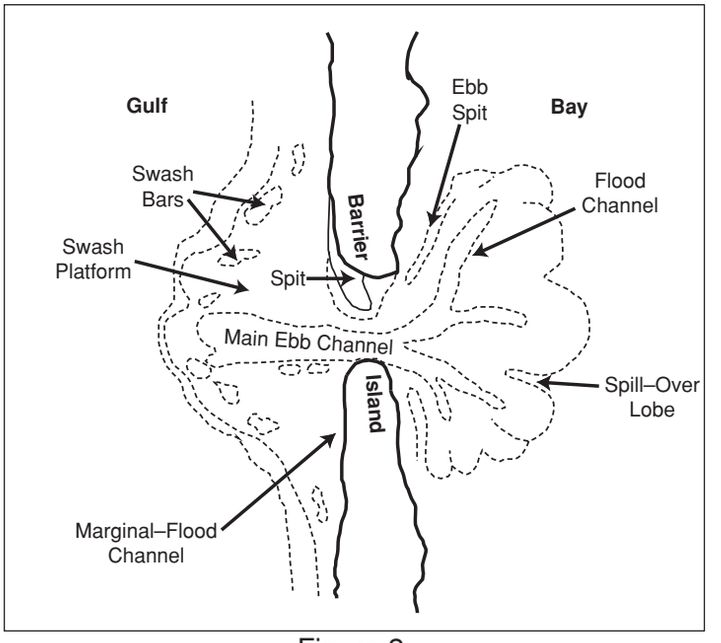


Figure 2.
Tidal Inlet Features (from Smith, 1984)

Types of Inlets

Tidal and wave energies determine the form of seaward flowing ebb-tidal deltas. The varying mix of these two forces determines the movement and deposition of sediments. The character of an inlet — its shape, dynamics, navigability — may change over time as the inlet adjusts to changes in the way tides and waves interact. Since Southwest Florida is a low-wave-energy coastline and the mean tidal range is relatively small (two feet), a delicate balance exists between tide- and wave-dominated conditions. A slight decrease in tidal prism (e.g., due to bayside filling) may cause a change from tide-dominated to wave-dominated conditions in inlets. Likewise, a change in wave energy due to sediment accumulation and spit development along the beach face may cause development of an offset alignment to the ebb delta.

In addition to these natural forces, shoreline engineering through the construction of groins, jetties and bulkheads — features designed to stabilize the shoreline by holding beach sand in one place — can dramatically alter the supply of sediment and the course of development and shape of an inlet. Another factor leading to inlet alteration is beach renourishment activities, which can contribute to pass shoaling through sand transport via longshore drift.

The drawings in Figure 3 depict four types of inlets found in Southwest Florida, based on the shape of ebb-tidal deltas: tide-dominated, wave-dominated, mixed-energy with straight shape and mixed-energy with offset shape. The Gulf is to the left side of the diagram and the bay is to the right, as in Figures 1 and 2.

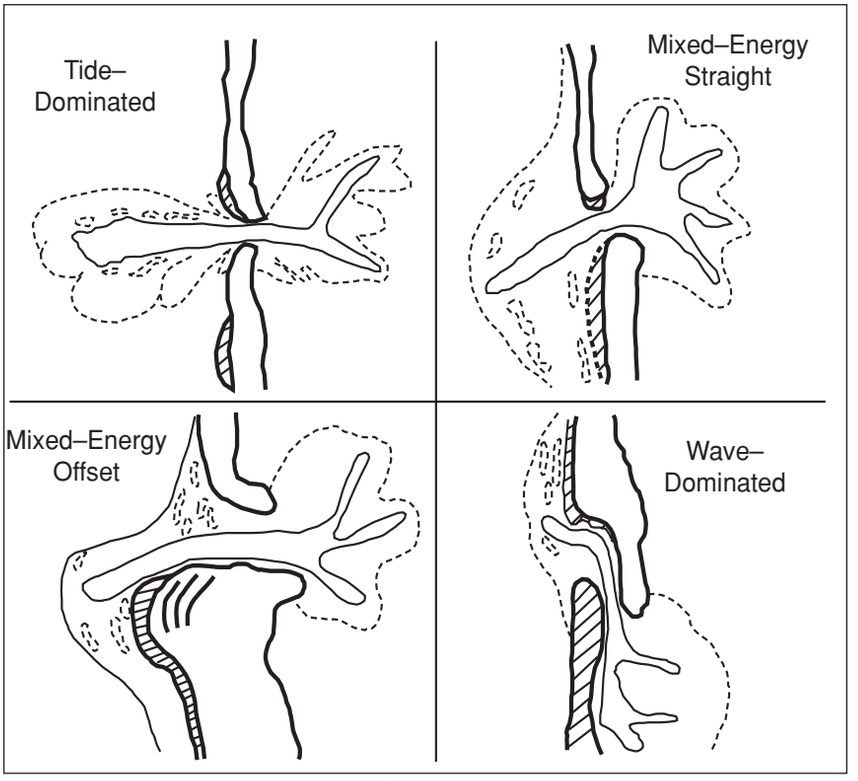


Figure 3.
Inlet Types Along the Southwest Florida Coast
(from Davis Jr. and Gibeaut, 1990)

The signature feature of tide-dominated inlets is a well-defined main ebb channel with deposits of beach sand on adjacent Gulf shores. Longboat Pass and Venice Inlet fall under this category; these inlets have relatively stable ebb-tidal deltas. Mariners should exercise caution in approaching tide-dominated inlets from the Gulf under ebb-tidal conditions, because maximum ebb current velocities are considerably higher than currents at flood stage at these locations. A combination of strong on-shore winds and peak ebb tide can be especially hazardous because of the amplitude and steepness of the waves. Furthermore, the Longboat Pass entrance channel is over one statute mile long, and a lift bridge must be negotiated within the throat of the main ebb channel, an area where currents are particularly strong. Venice Inlet is jettied and, while passage through this entrance channel is less than 0.5 statute miles, currents and eddies adjacent to the rock revetments make for potentially precarious conditions.

Wave-dominated inlets are very unstable and prone to migration. As wave-dominated inlets migrate along the coastline, their main channel is lengthened and becomes hydraulically inefficient for tidal exchange. Sometimes referred to as "wild inlets," no such passes currently exist in the Sarasota Bay system, but historically such an inlet existed at Little Sarasota Pass in 1883. Wave-dominated inlets are susceptible to closure by the formation of new, more hydraulically efficient inlets, formed when storms breach spits on the updrift side. Such an event occurred when Little Sarasota Pass closed and Midnight Pass formed during the hurricane of 1921.

Mixed-energy inlets have ebb-tidal (outside) deltas shaped by a combination of tidal and wave forces. Their maximum ebb- and flood-tidal current velocities tend to be equal, with a lower magnitude than those of other inlet types. The main ebb channel may shift its location as a result of drifting beach sediment.

Where longshore drift is pronounced, a channel offset may occur. New Pass is an example of a mixed-energy inlet with a straight ebb-delta shape. Its main ebb channel is periodically dredged on an alignment perpendicular to the shore (east-west heading). Net longshore drift, from north to south, builds a shoal over the swash platform. When this occurs, the best water for boaters is usually found along the marginal flood channel, which follows the north end of Lido Key into the throat of the main ebb channel.

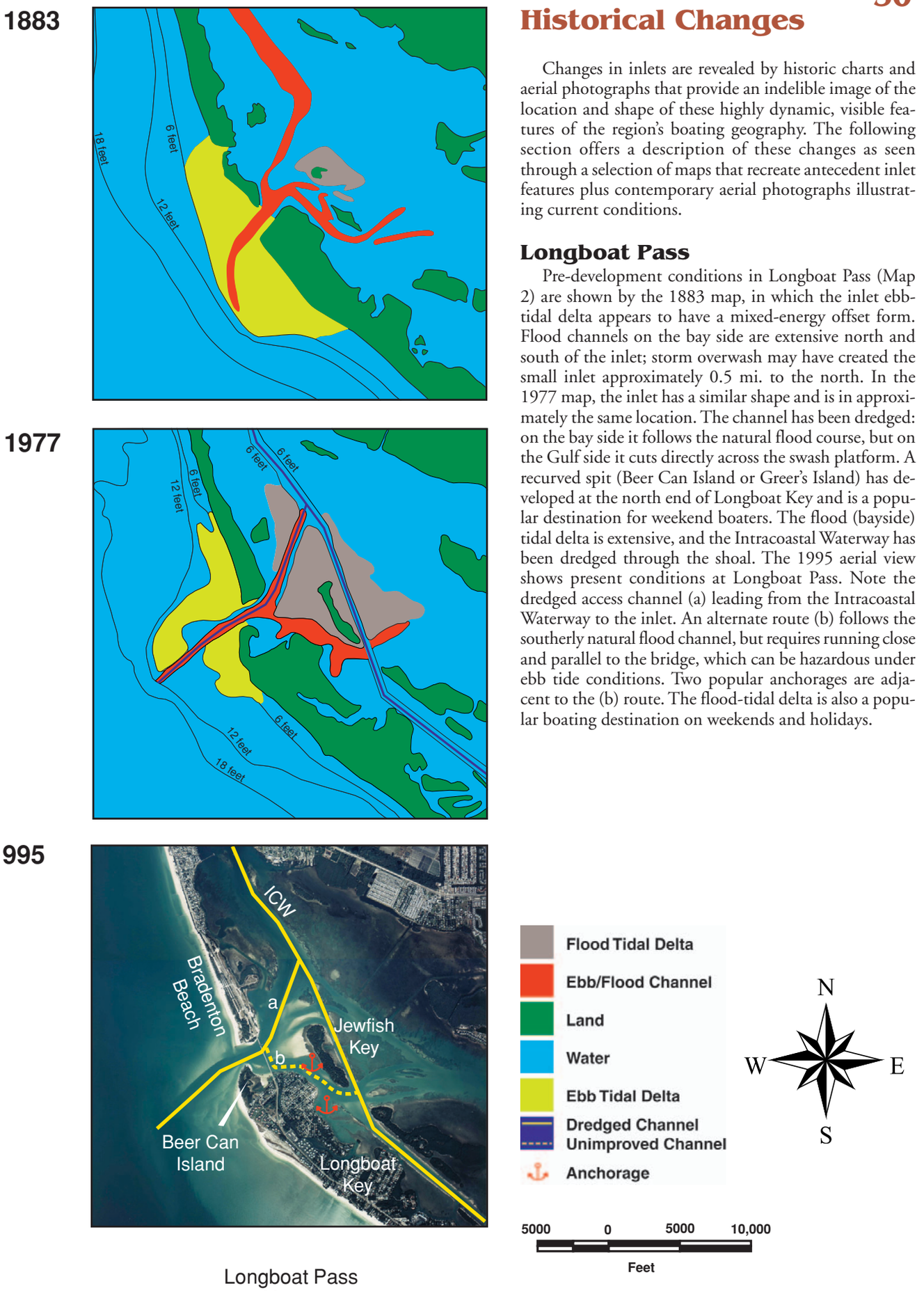
Big Sarasota Pass and Stump Pass are mixed-energy systems with offset alignments. The approach from the Gulf to the main ebb channel at Big Sarasota Pass is from the south off the north end of Siesta Key. Once inshore of the swash bar shoals, the channel parallels the curved north shore of Siesta Key. Stump Pass was dredged in 1998 to offset the deposition of sediment southward from Englewood Beach. This is an unmarked channel and should be approached from the Gulf with extreme caution.

Historical Changes

Changes in inlets are revealed by historic charts and aerial photographs that provide an indelible image of the location and shape of these highly dynamic, visible features of the region's boating geography. The following section offers a description of these changes as seen through a selection of maps that recreate antecedent inlet features plus contemporary aerial photographs illustrating current conditions.

Longboat Pass

Pre-development conditions in Longboat Pass (Map 2) are shown by the 1883 map, in which the inlet ebb-tidal delta appears to have a mixed-energy offset form. Flood channels on the bay side are extensive north and south of the inlet; storm overwash may have created the small inlet approximately 0.5 mi. to the north. In the 1977 map, the inlet has a similar shape and is in approximately the same location. The channel has been dredged: on the bay side it follows the natural flood course, but on the Gulf side it cuts directly across the swash platform. A recurved spit (Beer Can Island or Greer's Island) has developed at the north end of Longboat Key and is a popular destination for weekend boaters. The flood (bayside) tidal delta is extensive, and the Intracoastal Waterway has been dredged through the shoal. The 1995 aerial view shows present conditions at Longboat Pass. Note the dredged access channel (a) leading from the Intracoastal Waterway to the inlet. An alternate route (b) follows the southerly natural flood channel, but requires running close and parallel to the bridge, which can be hazardous under ebb tide conditions. Two popular anchorages are adjacent to the (b) route. The flood-tidal delta is also a popular boating destination on weekends and holidays.

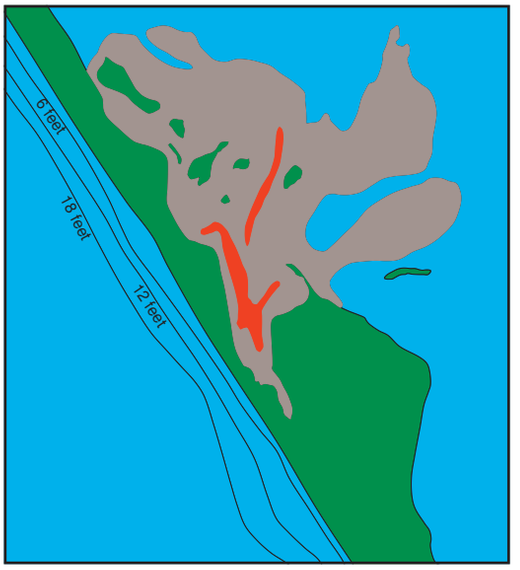


Longboat Pass
Map 2.

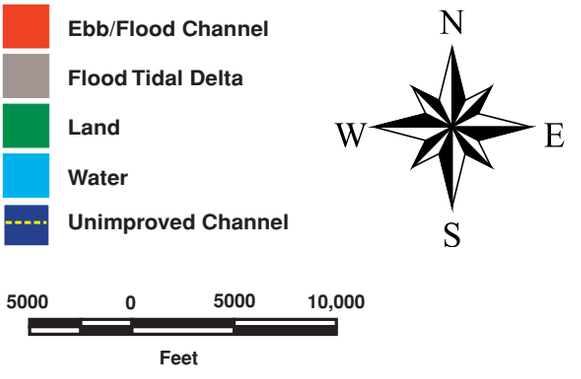
Buttonwood Harbor

Buttonwood Harbor (Map 3) on Longboat Key retains many bayside features of a historic antecedent inlet. The flood-tidal delta is one of the largest of all the inlets along the Sarasota Bay system. Extensive beds of seagrass cover this feature, a prime recreational fishing area in Big Sarasota Bay. The access channel from the Bay to Buttonwood Harbor follows the relict flood channel. The barrier island at this location is prone to beach erosion, storm wave attack and potential breaching, and is one of the narrowest points on the key.

1883



1995

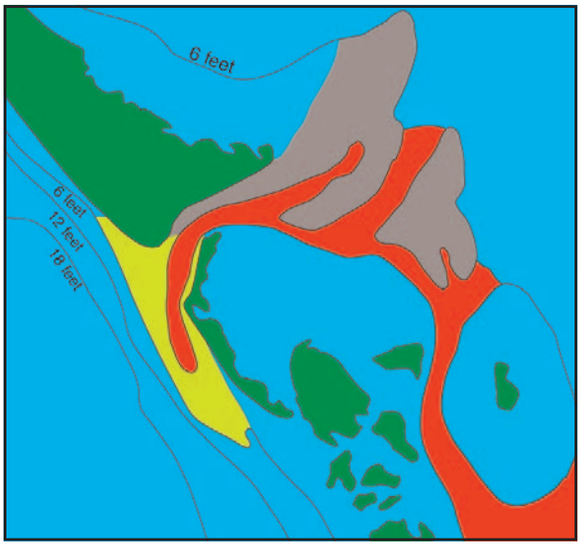


Buttonwood Harbor
Map 3.

New Pass

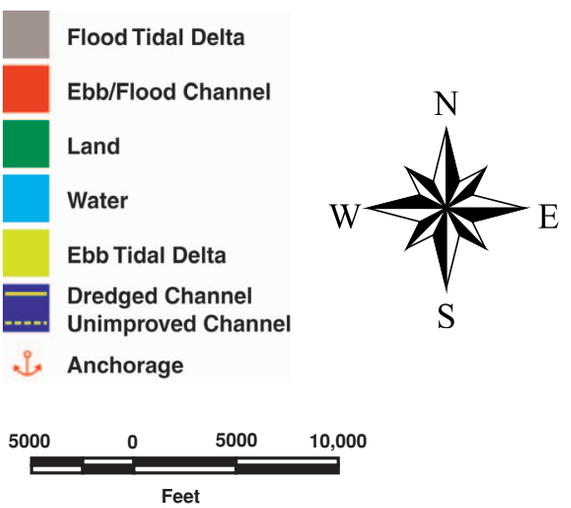
New Pass (Map 4) was well developed in 1883. A comparison with the 1977 map shows substantial changes to the Lido Key barrier island and to the bayside flood delta and channel features due to dredge-and-fill development in the 1920s. The flood delta area has been reduced substantially by creating City Island and, as a result, one can surmise that a similar reduction has occurred in seagrass habitat. Tidal exchange also has been reduced: before development (1883 conditions), the flood channels were linked between New Pass and Big Sarasota Pass, and overwash from the Gulf to the Bay probably occurred between the islets south of Lido Key. The inlet has been dredged since 1926. The 1998 aerial shows the effects of longshore drift from Longboat Key and sediment accumulation on the swash platform. The marginal flood channel that parallels the north Lido shore is used under these conditions by boaters with local knowledge. An anchorage, popular with weekend recreational boaters, is situated inside the recurved spit on the south end of Longboat Key.

1883



1977

1998

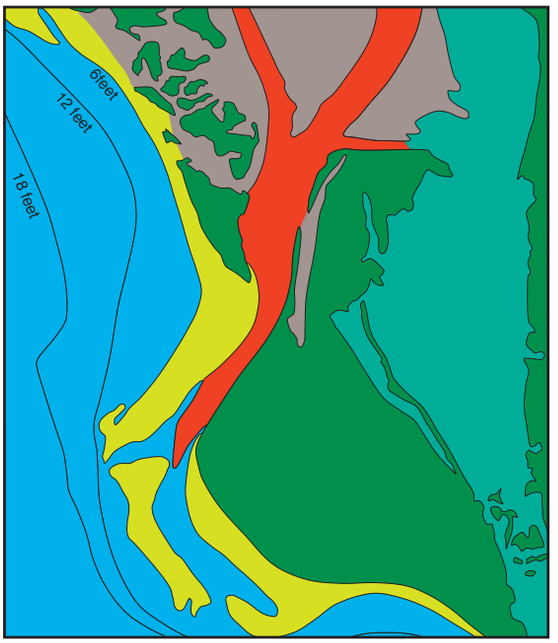


New Pass
Map 4.

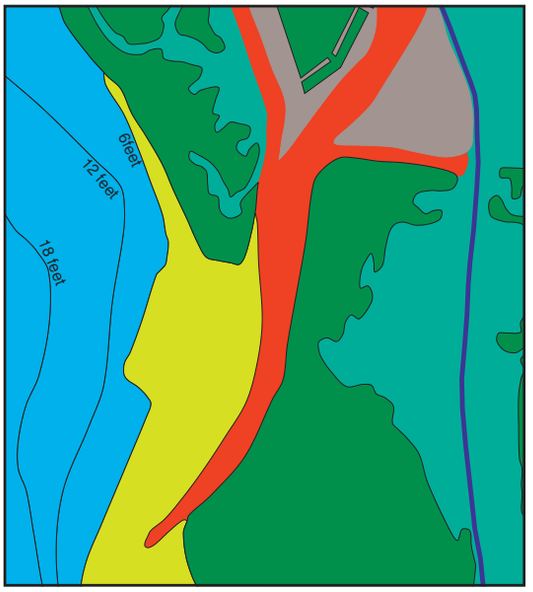
Big Sarasota Pass

Big Sarasota Pass (Map 5) on the Gulf side retains much of its pre-development (1883) form with a large ebb-tidal delta and large main channel. It is on the bayside, where large changes are manifest (1977) due to extensive dredge and fill that has dramatically reduced the flood-tidal delta at Lido and Bird keys. In the early 1900s, these areas were expansive seagrass habitats and popular sportfishing locales. Land development on Lido Key occurred in the 1920s and on Bird Key in the 1960s (1977 map). The 1995 aerial shows the presentday swash platform and current extent of the southward trending sediment drift. The northwest shore of Siesta Key has been bulkheaded, which has stabilized the position of the main channel. There are three natural flood-channel tributaries: northwest leading to the Sarasota Yacht Club (SYC), northeast to the Intracoastal Waterway and the City of Sarasota and east around Fishery Point and along the north shore of Siesta Key to the Siesta Key Bridge and the Intracoastal Waterway. A pocket anchorage behind Otter Key is reached off the SYC flood channel.

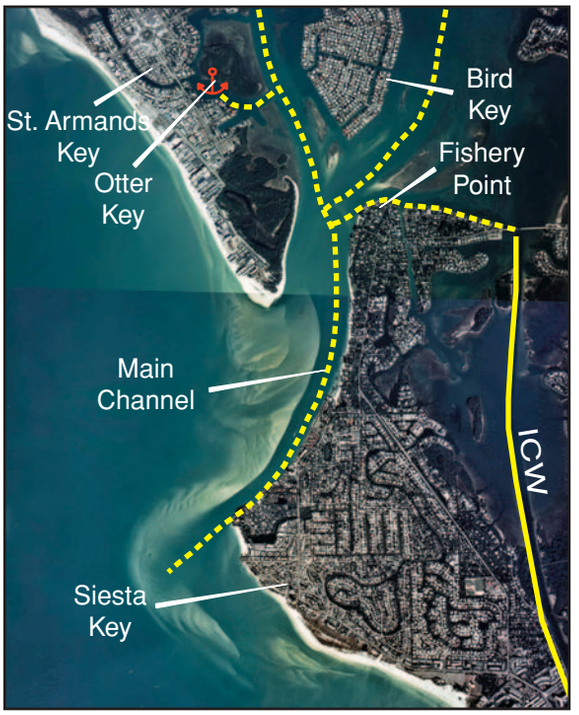
1883

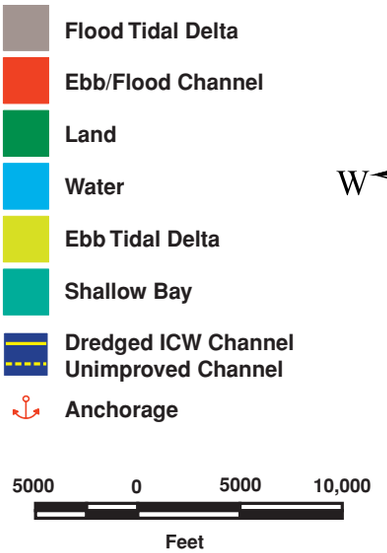


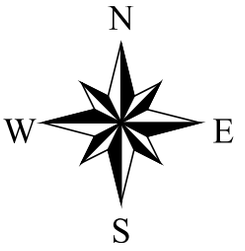
1977



1995

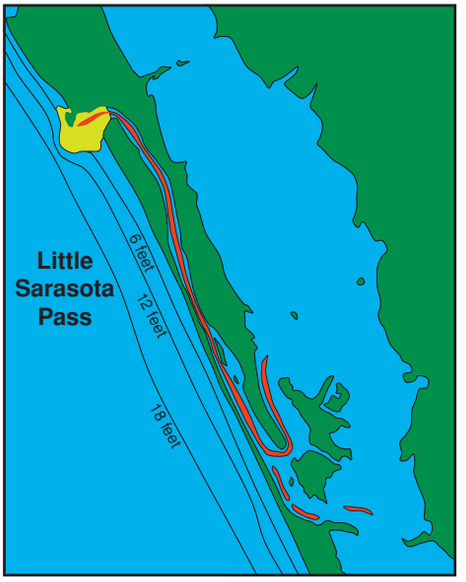




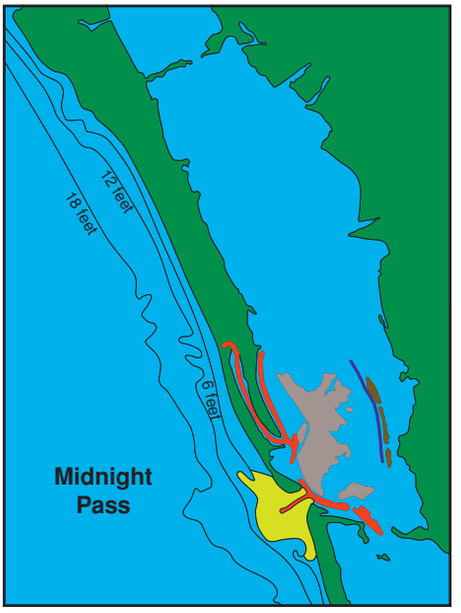


Big Sarasota Pass
Map 5.

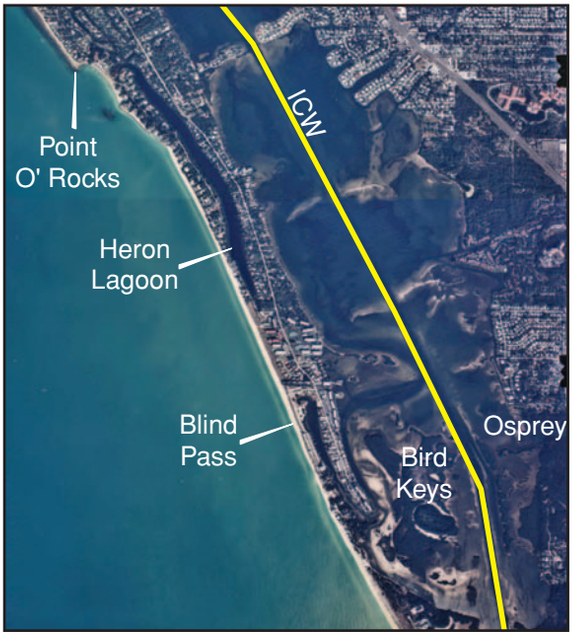
1883



1955

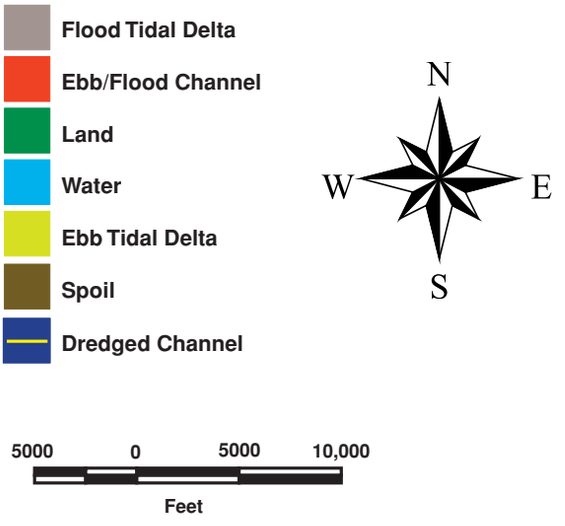


1995



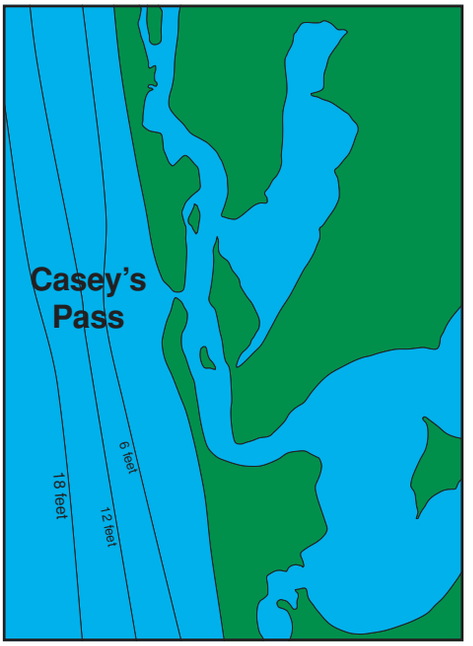
Little Sarasota Pass and Midnight Pass

Little Sarasota Pass and Midnight Pass (Map 6) are closed inlets. Little Sarasota Pass on Siesta Key ceased to exist when the hurricane of 1921 created Midnight Pass, which in turn was closed in 1984 by bulldozers. Blind Pass is another former inlet. Heron Lagoon (1995 aerial) is a remnant flood channel of Little Sarasota Pass, which is an enclosed water body. Another portion of the old flood channel (1955 map) is a navigable arm of Little Sarasota Bay (1995 aerial). The flood delta is large and upland vegetation is present on Bird Keys, also called the Jim Neville Marine Preserves, a marine park and bird sanctuary. Neville Preserve, which received extensive spoil during the dredging of the Intracoastal Waterway, is inhabited mostly by exotic plant species, inhibiting its use by birds and other Bay life. The aerial shows the course of the ICW, which was widened and deepened in 1963-64; the 1955 map shows the spot dredging and spoil placement from the earlier 1900s waterway improvement. The bay side of these historic inlets is important for its recreational fisheries and bird rookeries, habitats that owe their existence to antecedent inlet conditions.

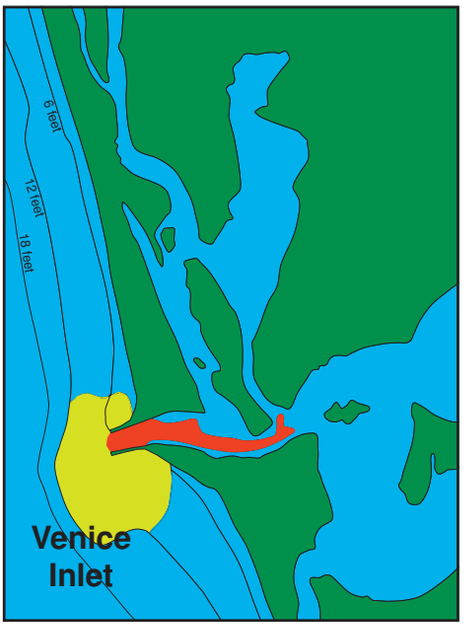


Little Sarasota
and Midnight Passes
Map 6.

1883



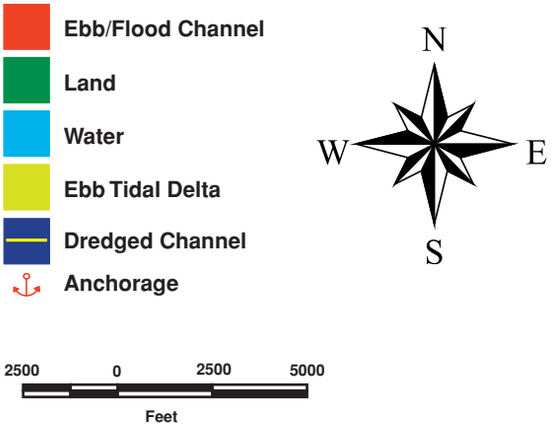
1955



1998

Casey's Pass (Venice Inlet)

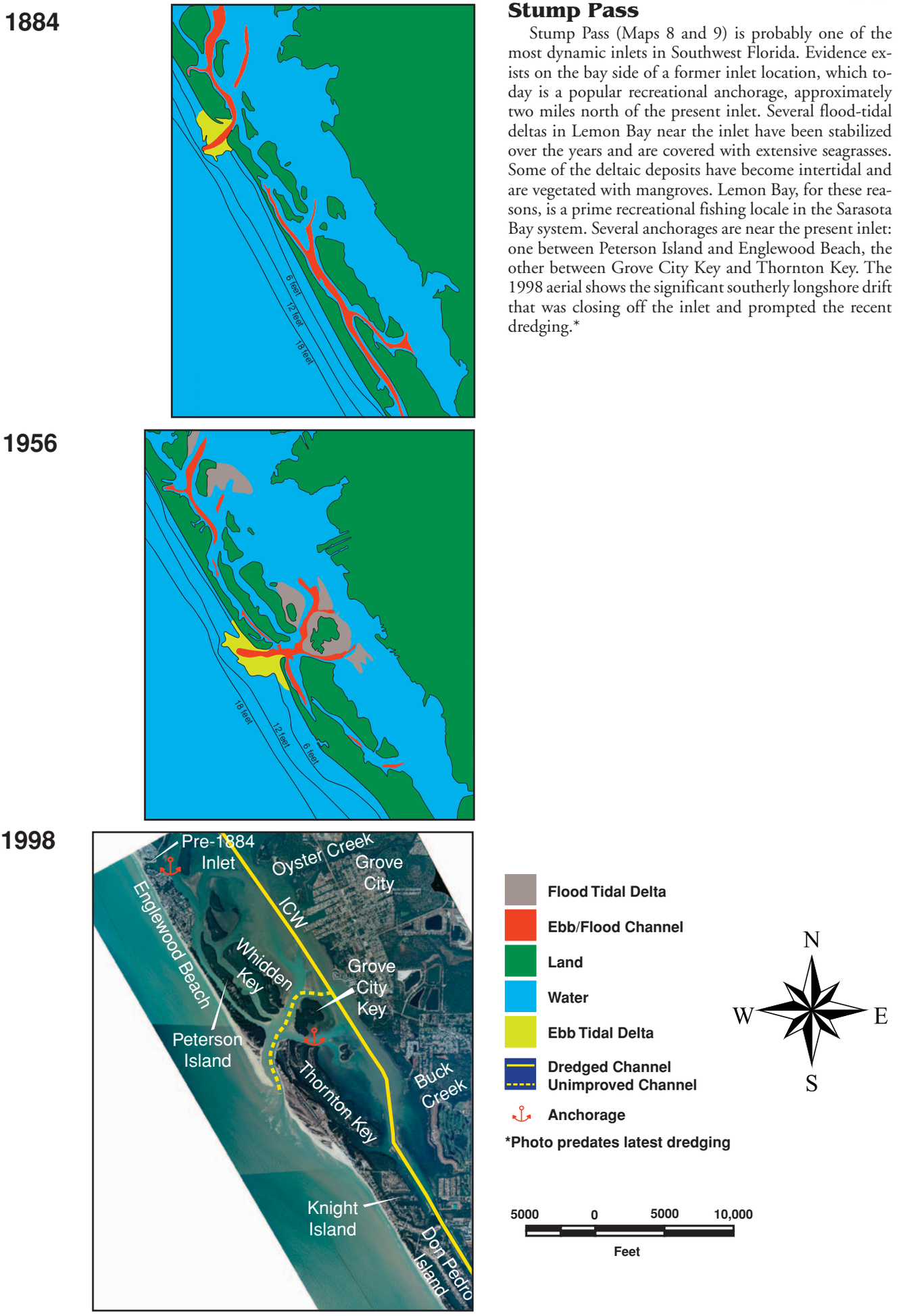
Casey's Pass and Venice Inlet (Map 7) are situated midway along the Sarasota Bay system. Casey's Pass was an unimproved inlet that provided access between the Gulf and Lyons, Dona and Roberts bays. It was susceptible to repeated closing and reopening over its history as it migrated up and down the coast. In 1883, Casey's Pass was about a quarter-mile north of its present location. The pass was jettied in 1937; since 1945 it has been maintained by the U.S. Army Corps of Engineers, and is commonly referred to today as Venice Inlet. It is navigable under most conditions because of the straight, short channel. The Intracoastal Waterway (1998) runs between Turner Key and Casey Key before turning east by Snake Island and south into Roberts Bay. Ebb currents run strong between Turner Key and Snake Island, and a shoal has built up between Snake Island and the southern end of Casey Key. The north shore of Venice has been bulkheaded; the main channel follows close to this shoreline. A small anchorage in southwestern Roberts Bay, adjacent to the Venice Yacht Club, can be approached either from the north along the bulkheaded eastern shore of Venice or by the yacht club channel from Roberts Bay.



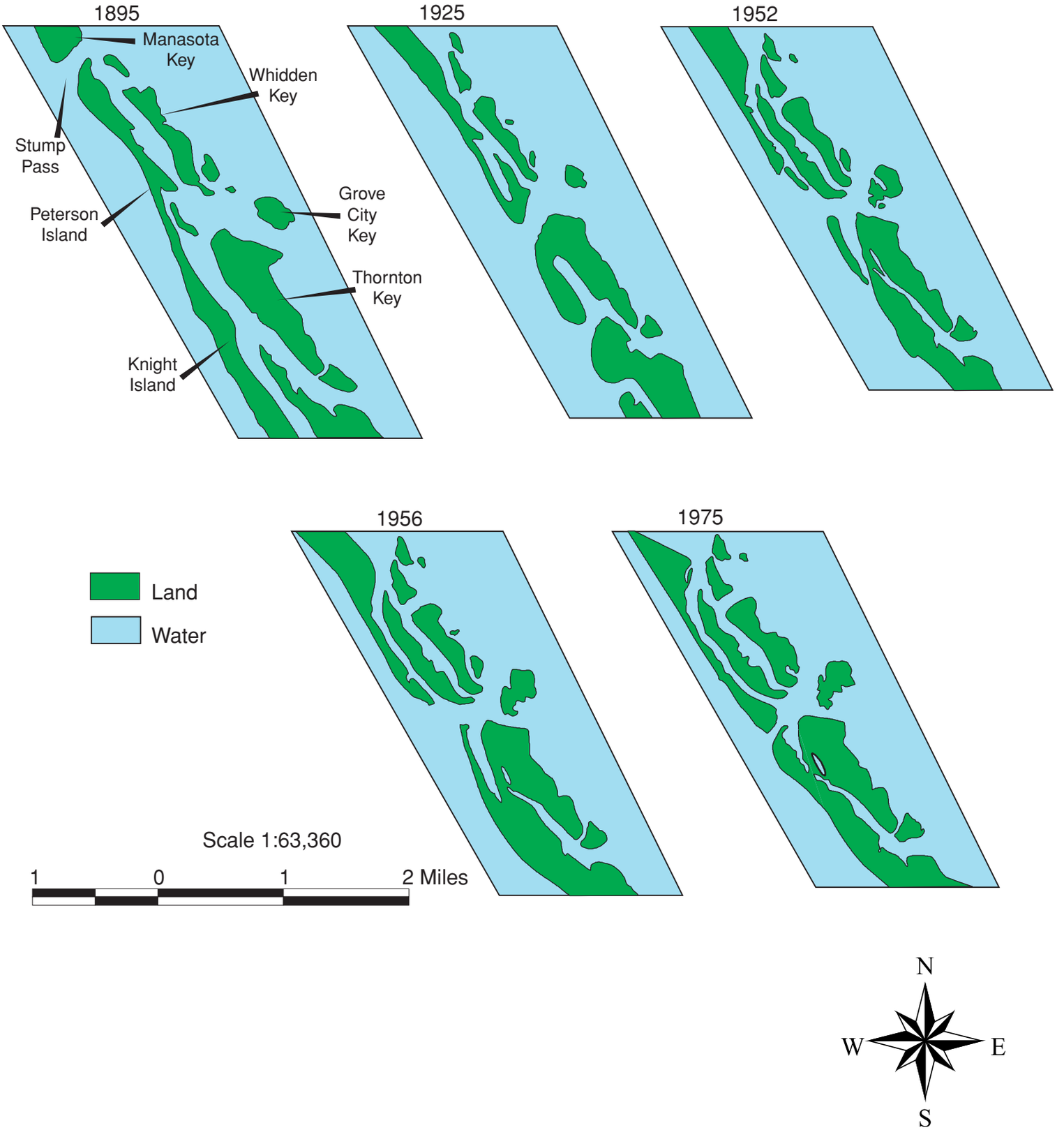
Casey's Pass and Venice Inlet
Map 7.

Stump Pass

Stump Pass (Maps 8 and 9) is probably one of the most dynamic inlets in Southwest Florida. Evidence exists on the bay side of a former inlet location, which today is a popular recreational anchorage, approximately two miles north of the present inlet. Several flood-tidal deltas in Lemon Bay near the inlet have been stabilized over the years and are covered with extensive seagrasses. Some of the deltaic deposits have become intertidal and are vegetated with mangroves. Lemon Bay, for these reasons, is a prime recreational fishing locale in the Sarasota Bay system. Several anchorages are near the present inlet: one between Peterson Island and Englewood Beach, the other between Grove City Key and Thornton Key. The 1998 aerial shows the significant southerly longshore drift that was closing off the inlet and prompted the recent dredging.*



Stump Pass
Map 8.



Map 9.
Historical Changes at Stump Pass

Epilogue

The Sarasota Bay inlet system has experienced many changes in its location, shape and dynamics during the past 100 years. These changes have affected mariners' ability to enter and leave inland waters and make passages in the Gulf of Mexico. Natural processes and human intervention have influenced the evolution of these inlets.

Notwithstanding the history of change, mariners can use this knowledge of inlet history and understanding of the inlet forms and features to determine their behavior and navigable condition. While the focus of concern for safe navigation often is on the Gulf side, it is important to remember that the bay sides of inlets, particularly their flood tidal deltas, play a significant role in the creation of important recreational fisheries and bird rookery habitats.

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