Tides and Currents in Long Island Sound

A Brief History, and Some Fundamentals of Navigation

By Captain Bernie Weiss

There's nothing mysterious about the tides and currents in Long Island Sound. In fact, much is known about them. The times of the tides, as well as the velocity and direction of current flow, are predictable with astounding accuracy. With that knowledge, the savvy navigator - especially navigators of racing and cruising sailboats can use the tides and currents in Long Island Sound to great advantage while avoiding their adverse influences. This brief review will cover some of the basic principles and offer some suggestions for improved navigation.

The geologic history of the Sound

About a million years ago, during an ice age, a series of giant ice sheets started oozing southward from Canada. The most recent ice sheet, known as the Laurentide Ice Sheet, covered our region approximately 15,000 years ago. When this advancing glacial ice encountered the bumpy bedrock surface of Connecticut, it plucked up countless boulders, crushing them into rocks, gravel, sand, and mud. Much of this material was caught up in the ice, or pushed ahead of the ice by the leading edge of the advancing glacier.

About 12,000 years ago, when the Laurentide Ice Sheet started to melt, the leading edge of the glacier stopped advancing. Then it began to retreat toward the north, depositing a 100-mile-long strip of glacial till and debris, mostly sand. This strip of glacial moraine formed what is now known as Long Island. Glacial debris deposited at what is now Block Island was mostly clay. Cape Cod, Nantucket, Martha's Vineyard and most other islands in the New England region were also formed by deposits of rock, sand, clay, and other debris from the Laurentide Ice Sheet.

The strip of glacially deposited sand that we now recognize as Long Island was, initially, a continuous landmass extending from near City Island in the West to Fishers Island and the Rhode Island shore near Watch Hill. This long sandbar enclosed a body of glacial meltwater, forming a freshwater lake with its Western shore near City Island. Westchester County and Connecticut formed the northern lake-shore, and Long Island itself formed the southern lake-shore. We're not sure when, but near the end of the Ice Age the rising waters of the Atlantic Ocean broke through the low sand bar at several sites between Watch Hill and Orient Point (think Watch Hill Passage, the Race, and Plum Gut). The lake was now being flushed with seawater, and that's how Long Island Sound (LIS) was formed.

The currents of LIS

Sailors are familiar with many types of current, most prominently ocean currents (such as the Gulf Stream), river currents, and tidal currents. The currents in LIS are tidal currents, and they correlate with the local tidal patterns.

The word "tide" describes the vertical rise and fall of the water's movement. Water rises to high tide, then falls to low tide. The word "current" describes the horizontal movement of water. Current ebbs to the ocean, and floods to the land. In LIS, the current ebbs to the east out of the Sound into the ocean, and floods to the west from the ocean into the Sound.

In other words, when the LIS current floods, the local water level rises. At high tide, the current is briefly slack. Then the current reverses and ebbs east to the ocean; the local tide level drops until the time of low tide. After a brief period of slack water, the current again begins to flood. The currents and tides reverse themselves every 6 hours and 13 minutes, so one complete tidal/current cycle is achieved every 12 hours and 26 minutes. It should be noted that the relatively small volume of water flowing into and out of LIS by way of New York's East River has a negligible influence in terms of LIS tides and currents, compared to the vast volume of water flowing through Watch Hill Passage, the Race, and Plum Gut.

For sailors, the currents of LIS represent an opportunity to gain or lose significant speed over the ground ("SOG"). In a sailing yacht capable of 5 kts, a 1 knot current represents a potential gain or loss of 20% in SOG. Where possible, therefore, the prudent navigator plans a passage that takes advantage of a favorable current and avoids a foul current. Currents are particularly fierce in Watch Hill passage, the Race, and Plum Gut, reaching 4+ kts at max flood or max ebb, so transits past these areas should - when possible - be carefully planned to take advantage of a favorable current.

Observing and predicting currents

How does one know when the current is favorable? As Yogi Berra puts it, "You can observe a lot just by looking."

While on your boat, look at the water flowing past the buoys. In fact, anything in the water that is pinned to the bottom — a lobster float, a navigational aid, a moored vessel, a flagged oyster stake — will give you a clue. The surface water flowing around the anchored object will indicate the approximate direction ("set") and velocity ("drift") of the current. More importantly, the set and drift of the current - just like the rise and fall of tides - can be predicted days, months, even years in advance with great accuracy.

Predicted data are readily available in nautical almanacs such as *Reed's* or *Eldridge* (or from NOAA as provided in WindCheck's tide tables, pages 35-36). The almanacs also have diagrams that describe the direction and velocity of currents, as well as tidal data, for LIS and other regions. These predicted tide and current data are also available in a variety of government and commercial publications, many internet sites (e.g., boatersbox.com),

and in many navigation software packages.

Actual set and drift of current will, of course, be affected by changeable weather conditions such as strong winds and heavy rains. For example, a strong and sustained easterly wind will accentuate a flood current in LIS and may lead to higher tides than predicted. And it's important to remember that the velocity of LIS currents varies widely, reflecting not only changes in weather conditions, but also the depth of the water, the quality of the bottom, the specific location, time into the tidal/current cycle, and phase of the moon. From a practical perspective, in most places you can count on a drift averaging about 1 knot, sometimes a little more, sometimes a little less, through the flood and ebb cycle. As Yogi advises, observe a lot by looking at the buoys.

A few words about tidal currents in rivers. Two rivers in our region, the Housatonic and the Connecticut, are notorious for their strong tidal currents, especially near their mouths at Stratford and Saybrook, respectively. Heavy rains accentuate the discharge velocities of the ebb currents near the river mouths, especially in the spring, and the rivers are typically clogged with debris such as partially submerged trees that have been uprooted by flooding. When possible, plan your transit in these rivers so as to go with the flow, not against it.

The tides of LIS

As everywhere, the tides in Long Island Sound are produced by the gravitational attraction of the moon on earth, and to a lesser extent, the sun's gravitational attraction on earth. Even the sun's much larger mass (26 million times that of the moon) can't compete with the moon's proximity to earth, and so the moon's effect on tides is 2.17 times that of the sun. Tides are also influenced by centrifugal forces produced by the revolutions of the earth and moon (and earth and sun) around their common centers of gravity (mass).

The general physical and astronomical forces producing the tides is well described elsewhere (e.g., *Reed's Nautical Companion,* Third Edition, page 436; *Eldridge Tide and Pilot Book,* 2006 edition, page 235) and so will not be reviewed here. Suffice it to say that the tides in LIS govern the LIS currents. As described above, when the tide falls from high to low, the huge volume of water in the Sound moves east toward the ocean, and is described as an ebbing current. When the tide rises, it draws water from the ocean into the Sound. This is represented by a current flooding to the west until the tide is high.

The times of high and low tide vary all over the Sound, but not by much. For example, the difference in times of high tide between Stamford and Bridgeport is - most times - less than 5 minutes; the difference between Stamford and Madison is about 25 minutes.

The times of high and low tides, and the tidal time differences between harbors, are described in the *Reed's* and *Eldridge* almanacs, and are available online and in many navigation software packages. These times are predictable with great accuracy. In the Sound, slack water at high tide after a flood current occurs precisely 6 hours and 13 minutes after slack water following an ebb current at low tide - and vice-versa. It's different in the Sound's rivers, however, because the discharges of river currents retard the tidal currents flooding into the river mouths, and river currents accentuate the tidal ebbs. Typically, near a river mouth, the ebb will flow for about 8 hours of every 12.

Implications for navigators

With this basic knowledge of currents and tides, the savvy navigator can readily take advantage of what Mother Nature offers in LIS, namely:

If making a transit east or west through the Sound, time your departure to go with the flow.

The best way to get into or out of the Sound at either the east or west ends is to transit these areas at slack water or with a favorable current. The turbulence and velocity of foul currents at the Race, Plum Gut, and Fishers Island Sound and Watch Hill Passage to the east, as well as with the East River (Hell Gate) and New York Harbor to the West, will be uncomfortable at best, unless your vessel is capable of speed well in excess of 6 knots.

If crossing the Sound — for example, if heading from Bridgeport or Milford to Port Jefferson — allow for current set and drift. Offset your steering course by a mile or two

so that the current will push you down onto the rhumb line course between your originating and destination marks. Offset "up-current." In other words, at times other than slack water, allow your boat to "crab" across the Sound. The more precisely you can do this, the more time and fuel you'll save. For planning purposes, figure 1 nm of offset for every hour your boat will be exposed to current on the beam.

Approaching a dock or mooring, or joining a raft of other boats, do so up-current. The foul current will help slow your boat and improve your maneuverability.

Finally, since the charted depths in LIS are marked in feet, and since the average range of tide hereabouts is 7+ feet, at times of high water the savvy navigator need not sail around those mud and sand shoals; the shoals' depth at high water is likely to be 12-15 feet more than the charted depth, giving you plenty of clearance to cross. I do not routinely recommend this — especially over a reef or rocky bottom — and it is prudent to honor the buoys marking charted channels. But crossing a shoal can be done, and frequently it's a shortcut to a finish line or safe harbor. ✦

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