THE UNIVERSITY OF RHODE ISLAND GRADUATE SCHOOL OF OCEANOGRAPHY

Ferry-based Observations for FOSTER Science Targeting Estuarine Research | LIS Long Island Sound

Did You Know You Are on a Research Vessel?

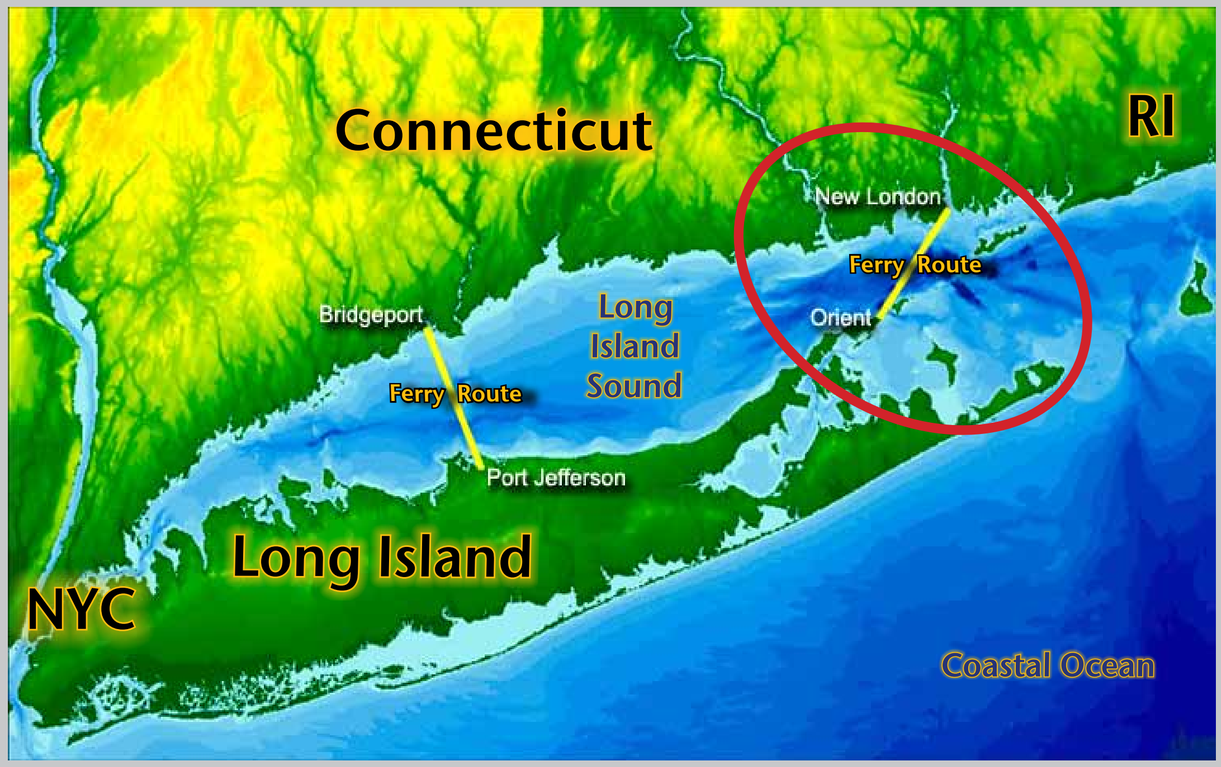
That's right! Together, with the help of Cross Sound Ferry, URI and UConn are using the ferry you are now riding (the M/V *John H.*) to collect observations of Long Island Sound's water properties and circulation.

WHY IS WATER QUALITY IMPORTANT?

- Long Island Sound plays a key role in support of the regional economy, provides habitat for marine life, and is a recreational haven for residents of its densely populated shores
- To best protect these resources, we must understand the system better
- Research is needed to improve water quality management decisions

WHY USE A FERRY TO COLLECT OCEANOGRAPHIC DATA?

- We can learn a lot because we have very few observations from this important part of Long Island Sound, where exchange with the coastal ocean occurs
- The ferry crosses about 8 times a day anyway, and can gather data more cost-effectively than running a separate research vessel



Long Island Sound Study | Cross Sound Ferry | Sea Grant Connecticut

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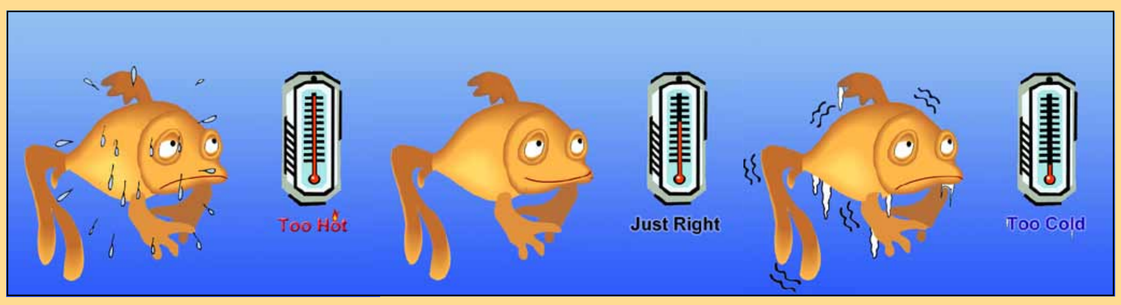
THIS FERRY IS MEASURING TWO IMPORTANT INFLUENCES ON WATER QUALITY

- Near-surface water properties: Temperature and salt concentration—also known as salinity
- Circulation: Currents, including how different they are nearer to the surface as compared to near the seafloor

WHY DO WATER PROPERTIES MATTER?

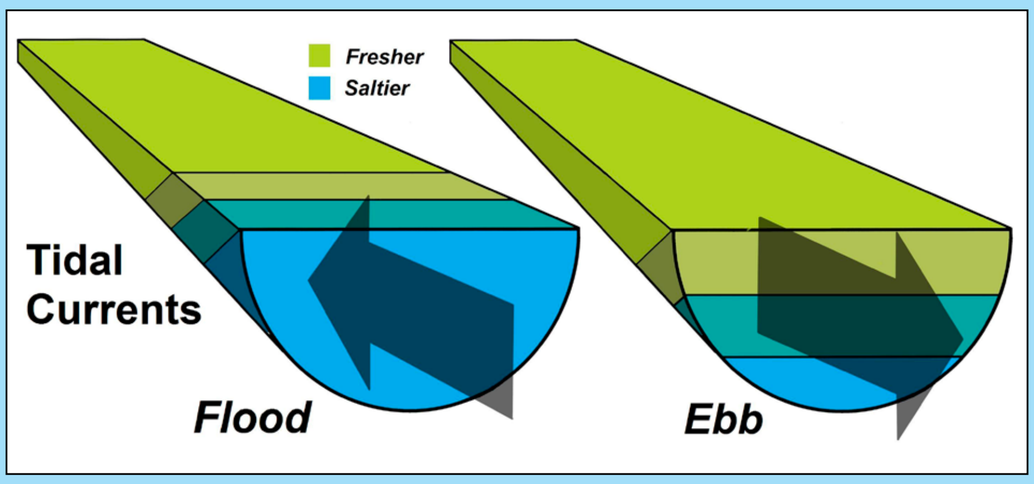
- Temperature and salinity determine which marine organisms can flourish
- Example: Why are some fish species doing well, while others are disappearing?
- Different species of fish like different water temperatures



WHY FOCUS ON WATER FLOW?

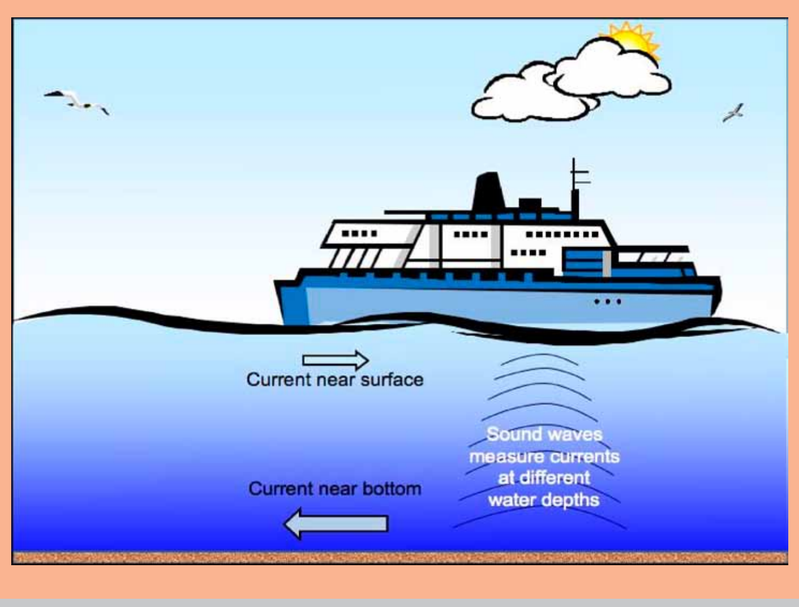
Circulation (currents, water flow) matters because it

- Sets rates and pathways for movement of water and waterborne materials (plankton, pollution, sediments, etc.)
- Controls exchange with the coastal ocean—a major influence on all water properties, including temperature and salinity



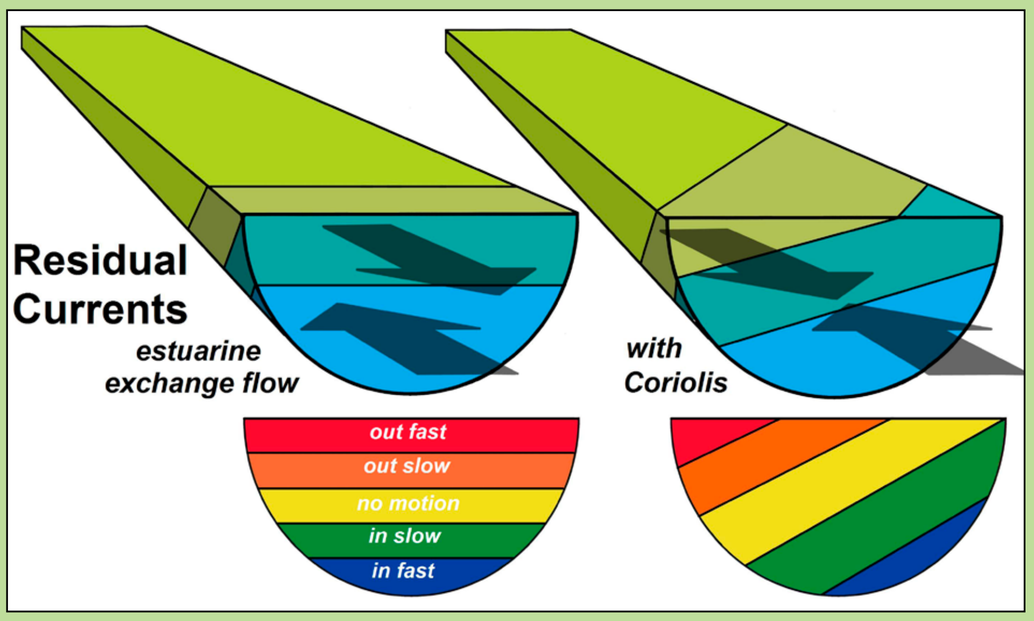
HERE'S HOW IT WORKS

- As the ferry moves, surface water is pumped through a sensor in the engine room that measures its temperature and the amount of salt it holds
- A sensor on the ferry hull measures the speed and direction of currents (shallow and deep, which can be very different) using sound waves, similar to sonar used by submarines
- Sampling is automated so we don't have to get our feet wet

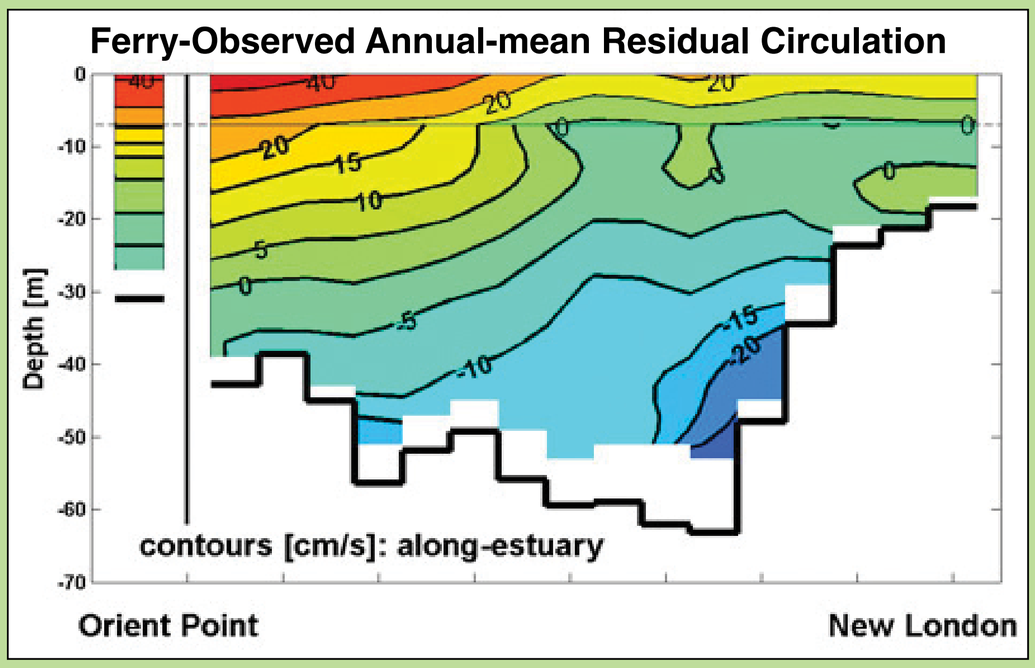


WHAT HAVE WE LEARNED SO FAR?

- Surface water on the southern portion of the ferry crossing, when compared to the northern portion, is
  - ❍ colder in winter, but warmer in summer
  - ❍ less salty throughout the year
- After large rainstorms, excess river flow makes water fresher for a few days—most strongly on the southern portion of the ferry crossing
- Twice a day, tidal currents bring an amount of water in and out of the sound that would take about 2 months, on average, to arrive from all the rivers entering the sound
- The near-surface tidal currents at the center of the ferry crossing, where the water is deepest, are
  - ❍ up to twice as fast as they are near the shores to the north and south
  - ❍ up to twice as fast as they are near the seafloor
- The residual current (non-tidal flow, averaged over many tidal cycles, which determines the fate of waterborne materials such as a bottle adrift) forms an "estuarine exchange flow:" one main limb exits the sound and another enters it



- The ferry-observed estuarine exchange flow
  - ❍ is about one third as strong as tidal currents, or less
  - ❍ moves fastest outward from the sound near the surface and in the south
  - ❍ moves fastest into the sound, from the ocean, near the bottom and in the north
  - ❍ has these asymmetries because of the Coriolis effect, due to the Earth's rotation on its axis
  - ❍ strengthens in summer as compared to winter



Surface current in southern portion of crossing (nearer Orient Point) LEAVES Long Island Sound at fastest rate. Bottom current in northern portion of crossing (nearer New London) ENTERS Long Island Sound from the ocean at fastest rate.

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