

Young Striped bass have very high salinity tolerance

Dalhousie University laboratory conducts tests for first phase of study with more to come

Study background

A series of rigorous tests developed by Dalhousie University researchers established young Striped bass are tolerant to very high salinity. All procedures were approved by the federal Department of Fisheries and Oceans and Nova Scotia Environment.

The tests are part of a multi-year laboratory study to measure the impact of brine from the Alton Natural Gas Storage Project on Striped bass, from the egg to early juvenile stages of this important species.

Researchers measured acute toxicity, which is an adverse effect (lethal or sublethal) on the test organisms within a short period of exposure to a test substance (in this case, Striped bass and brine). Striped bass are the test species because the Shubenacadie River estuary is the only remaining nursery habitat for the Bay of Fundy population and no other population relies solely on the estuary through the first year of life.

Alton Facts

To make underground natural gas storage caverns, dissolved salt and river water (called brine) will be released into the Shubenacadie River estuary.

Brine release will take place where powerful tides sweep Bay of Fundy tidal water past the Alton site twice a day.

Brine release will take place in a controlled and monitored process into a constructed channel. Within 5 meters of the release point, salinity in the channel must be less than 7 ppt above background salinity of the estuary to a maximum of 28 ppt.

Brine release will stop immediately when 28 ppt is detected 5 meters from the release point, the upper range for natural conditions in the river.

Water will move quickly through the channel at 1 to 2 metres per second.

Learn more on page 4 ►



The Alton river site alongside the Shubenacadie River estuary showing the curved, constructed channel where water intake and brine release will take place.



Figure 1. Set up of the 21 six-litre-size jars in the laboratory at Dalhousie University, showing testing on early juvenile Striped bass. The hoses in each jar are for air diffusion to provide oxygen to the water.

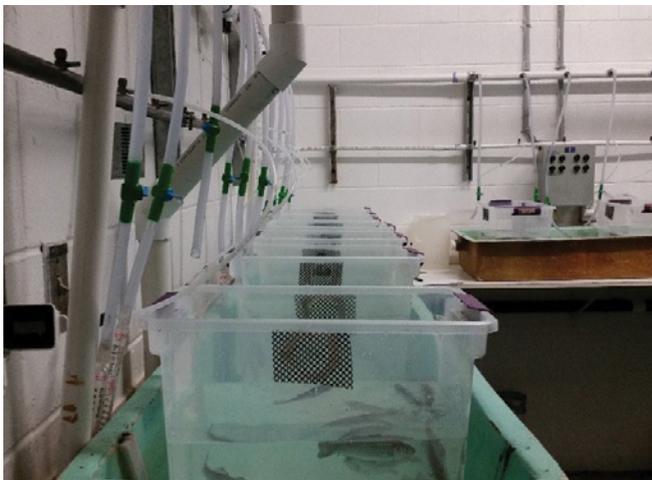


Figure 2. Set up of the 21, twenty-six-litre plastic totes in the laboratory at Dalhousie University used for testing larger Striped bass. Shown are 12 centimetre long juvenile Striped bass.

What were the tests?

In 2016, a purpose-built lab was set up at Dalhousie's Truro Campus in the Faculty of Agriculture (See Figures, 1 and 2). Tests to date compared a sea-salt mix used globally in research with a section of core drilled from the salt deposit where the natural gas storage caverns will be located. The sea-salt mix and the core salt were diluted with ground water or Shubenacadie estuary water. The salt core and Shubenacadie River water mixture should closely match the brine from the natural gas storage cavern development at Alton.

Wild Striped bass caught as eggs in the Stewiacke River and domestic fish reared at Dalhousie University were used in the tests. Striped bass eggs, larvae and young fish less than a year old (juveniles) were exposed for one hour to test salinities ranging from a control of 2 parts per thousand (ppt or grams of salt per litre) up to 100 ppt. As a comparison, the salinity of Nova Scotia's Bay of Fundy coastal waters is about 30 ppt and full ocean is around 35 ppt.

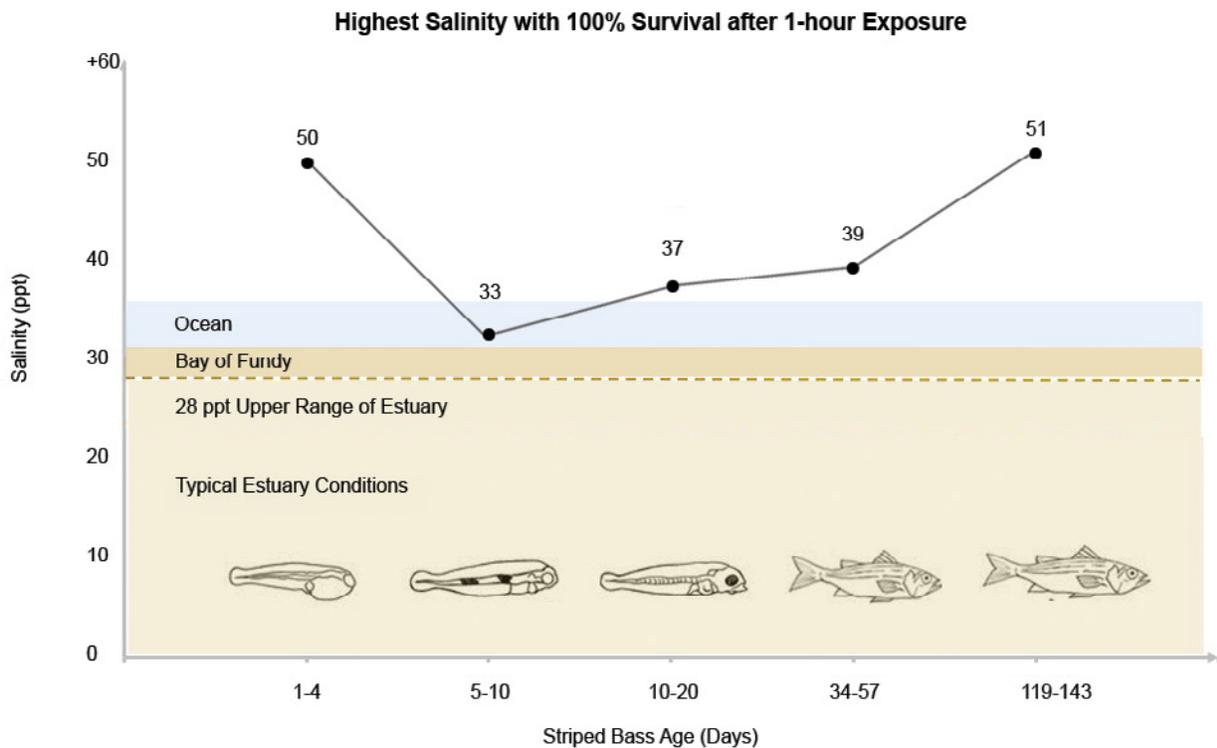


Figure 3. Highest concentration of sea-salt mix dissolved in ground water or river water at 17 to 22 °C with 100% survival of Striped bass after one hour. All life stages of Striped bass that were tested tolerated sustained salinities much higher than they will encounter at the Alton project.

Results establish Striped bass are highly salinity tolerant

The one hour tests in the Dalhousie laboratory exposed the Striped bass to a wide range of salinities, some much higher than they may briefly encounter in the constructed channel at Alton.

The highest salinity with 100% survival for one hour depended on life stage: 50 ppt for yolk-sac larvae (1-4 days old), 33 ppt for 5-10 day old larvae, 37 ppt for 10-20 day old larvae, 39 ppt for 34-57 day old juveniles, and 51 ppt for 119-143 day old juveniles (See Figure 3).

Even at hyper-salinities of 70-100 ppt, Striped bass survived up to 40 minutes, but progressively became more lethargic. Thus their very short encounter with potentially higher salinity as they move quickly through the constructed channel suggests no harm.

What's next?

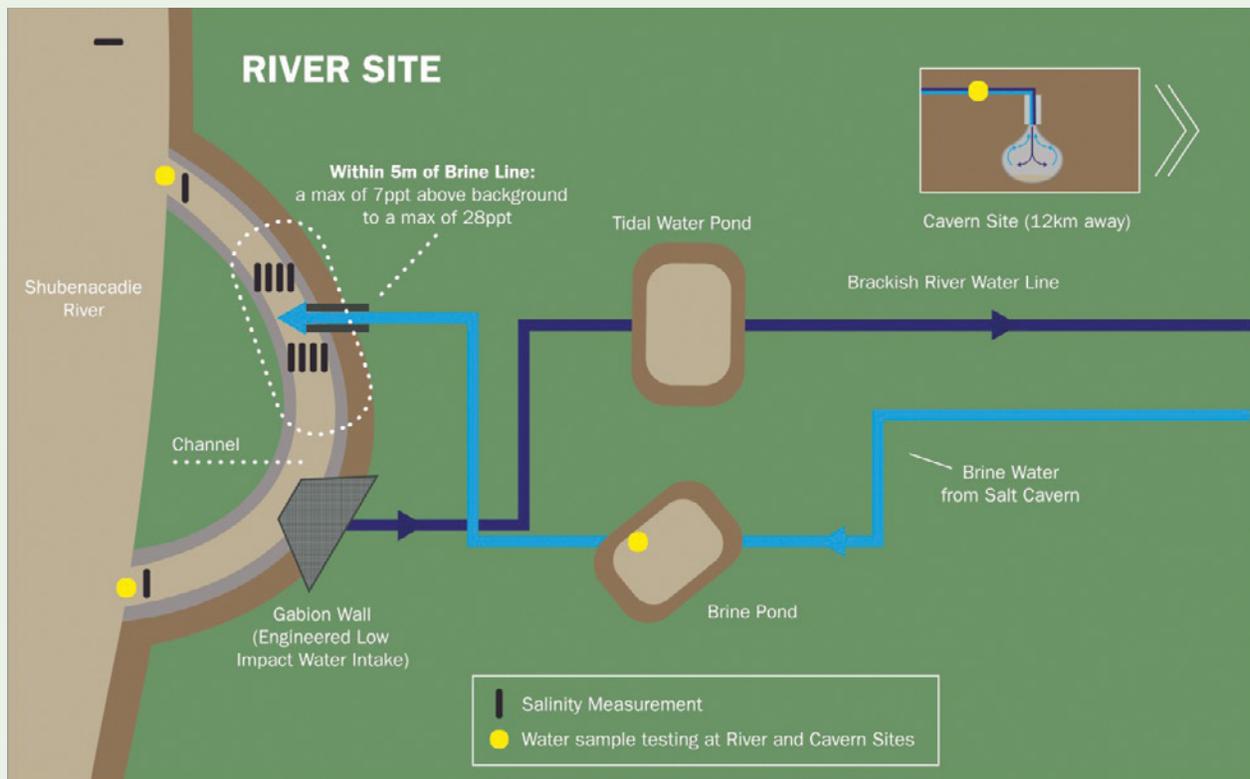
In 2018, all brine tested in the study will be made only from salt core samples and estuary water. In 2019, it is anticipated that all Striped bass life stages will be tested with brine from natural gas storage cavern development.

The test results established all stages of young Striped bass have very high salinity tolerance. All species living in the Shubenacadie River estuary experience changes in salinity twice a day. These species are well adapted to encounter quick and large salinity fluctuations.

Salinity, the Alton project, and Striped bass

Natural gas storage caverns will be created at Alton by dissolving ancient sea salt buried deep underground. The resulting brine from cavern creation, a combination of water and the dissolved salt, will be released gradually into the tidal Shubenacadie River estuary.

The brine released into the constructed channel will be diluted to less than 7 ppt above background river salinity within 5 metres of the release point. Brine release stops automatically when river salinity reaches 28 ppt within 5 meters of the release point, which is the upper range of natural conditions.



The water flow in the constructed channel will be between 1 and 2 meters per second with the tide, so drifting organisms with the flow will pass very quickly through the 5 m of potentially higher salinity at the outfall. Striped bass juveniles moving with the current will be in contact with potentially higher salinity for only a few seconds, which is well within their tolerance levels.

As an added protection, the brine release will be shut down for 24 days in the spring when Striped bass eggs are detected. The shut down further protects the eggs and early life stages of the fish, and also protects young salmon called smolts because they migrate from the river to the ocean at about the same time Striped bass are spawning.