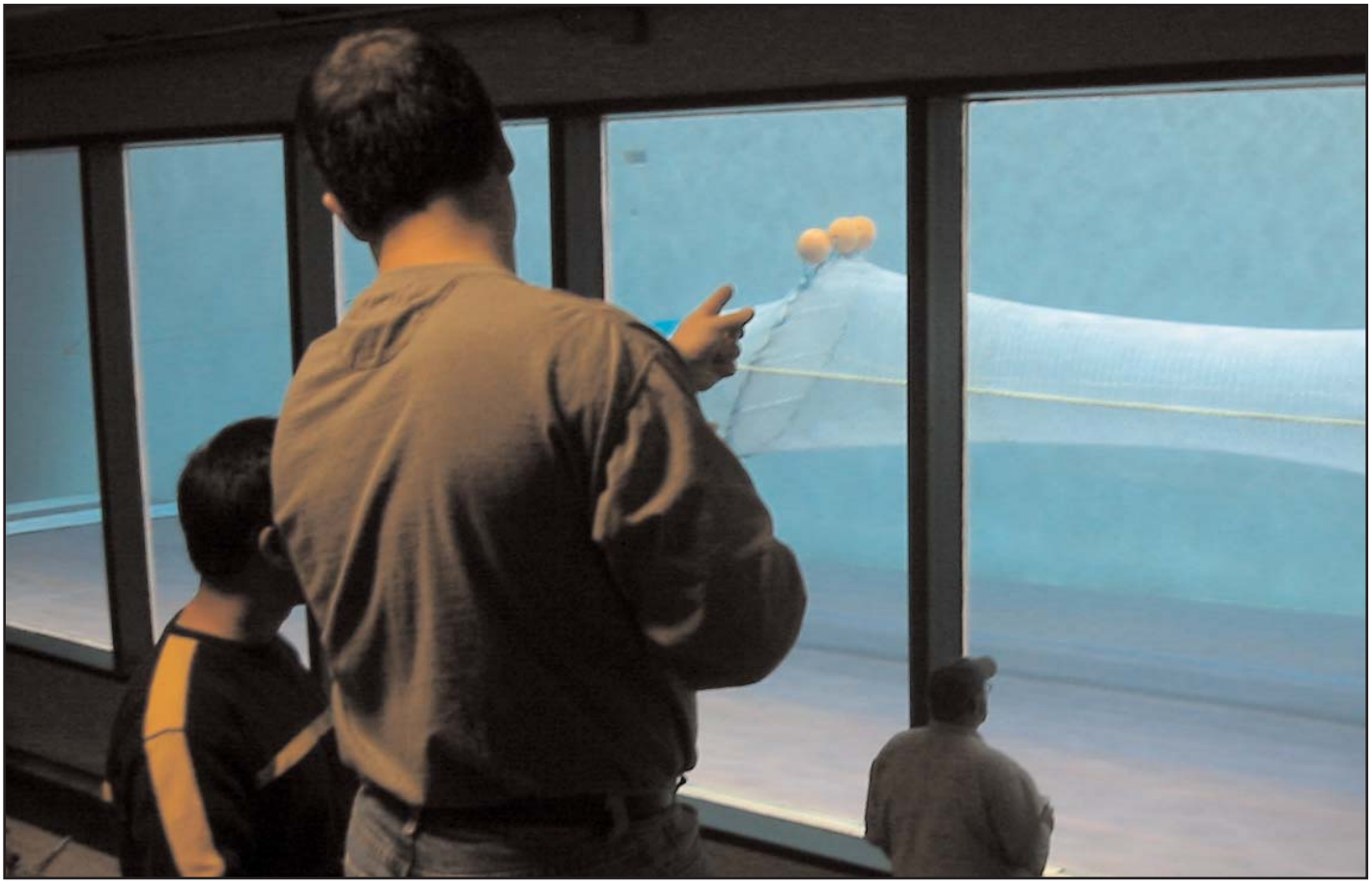
January 2004

Collaborations

A monthly report on collaborative research projects in the northwest Atlantic Ocean.



Portland Fisherman, Vincent Balzano (foreground), consults with Dr. Pingguo He on the performance of shrimp gear in Memorial University's flume tank, as fisherman Proctor Wells steps up to the 72-foot-long glass walled tank for a closer look.

Catching the Right Fish, Not Just More Fish

At 13 feet deep by 26 feet wide by 72 feet long, the flume tank at Memorial University's Marine Institute in St. John's, Newfoundland is the largest in the world, circulating some 450,000 gallons of water at up to six feet per second through a complex system of propellers, pumps, and pipes to mimic flowing ocean.

Peering through a wall of glass panels that form one side of the tank, two fishermen, two biologists, an engineer, a naval architect, and I, point and stare at the codend of a shrimp trawl—the cylindrical part of the net that holds the catch—suspended inside.

It is nearly identical to codends used on hundreds of commercial trawlers in the Gulf of Maine, with one important difference: small "kites," flexible plastic scoops, were attached to help hold the net's diamond-shaped mesh open.

The devices are meant to release undersize shrimp back into the ocean.

Without them, heavily loaded nets tend to stretch and close, preventing juvenile shrimp from escaping before they've had a chance to spawn.

The tank is something like a wind tunnel with water: Just as aeronautical engineers use wind tunnels to observe wing performance in simulated flight, fisheries engineers use the flume tank to test gear in simulated fishing conditions.

It was early December, two months before the start of Maine's shrimp season, and I had traveled to St. John's with Proctor Wells and Vincent Balzano, both commercial fishermen, as well as Dan Schick, a biologist at Maine's department of marine resources.

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FLUME TANK STATS:

Year opened: 1988
Cost: $8.5 million (Canadian)

Purpose: To carry out performance evaluations, gear tests and other observations on newly developed or existing fishing gears and other related equipment in simulated underwater and near surface conditions; provide consultancy and technical services for fishermen, fishing equipment manufacturers/suppliers, other fishing industry groups and public and private organizations; demonstrate the operations and behavior of fixed and mobile fishing gear in water to members of the fishing industry and the general public.

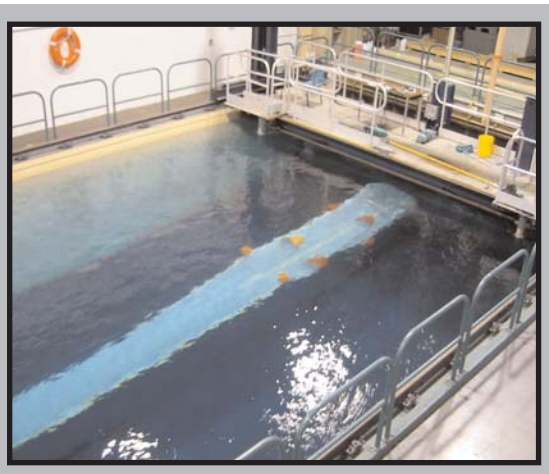
Dimensions: The test section is 8m wide x 4m deep x 22.25m long (the water level may be changed from 4m to 3m depth). These dimensions make the tank the largest flume tank of its type in the world.

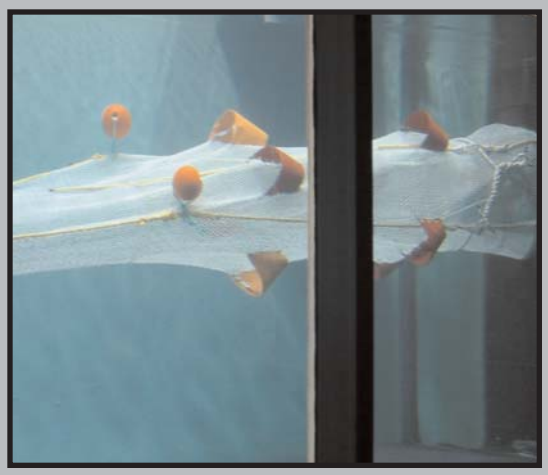
Viewing Gallery: The gallery is accommodates approximately 150 people and faces a 20 meter by two meter observation window.

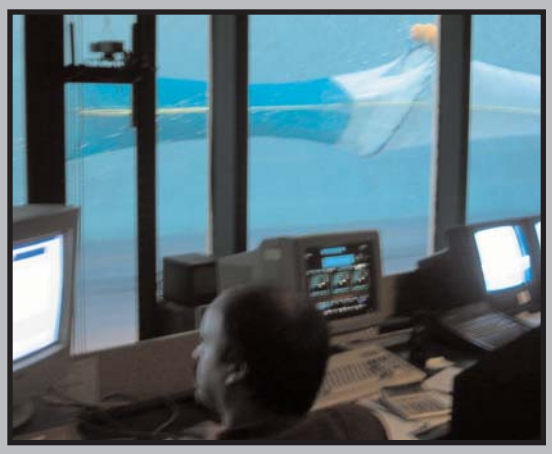
Capacity: 1.7 million litres

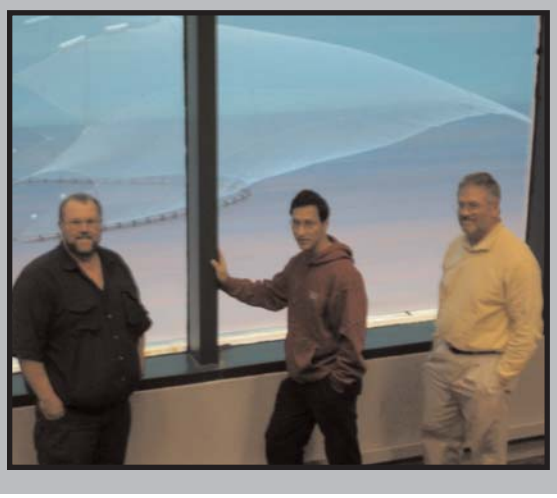
Performance: The tank is divided horizontally into two sections. The lower section allows water to circulate. The upper test section holds the gear and allows observation from above and from one side.

Tank Sides: The sides are made of reinforced concrete (or concrete and acrylic).









There we joined Pingguo He, a research professor at the University of New Hampshire's Institute for Earth, Oceans and Space. Prof. He, Wells, and Balzano had worked on the conceptual design of the gear as part of a multi-year $160,000 grant from the Northeast Consortium, however, the flume tank offered the first opportunity to get it wet.

The tank is something like a wind tunnel with water: Just as aeronautical engineers use wind tunnels to observe wing performance in simulated flight, fisheries engineers use the flume tank to test gear in simulated fishing conditions.

Since it opened in 1988, fishermen and scientists from as far away as Alaska, Iceland, Norway, Denmark, and South-East Asia have traveled to the marine institute to fine-tune their gear before committing it to expensive and sometimes dangerous trials at sea.

"As far as the structural and hydrodynamic advantages of the flume it's the next best thing to sea trials. And, unlike sea trials, it offers immediate results with the opportunity to make adjustments on site," said Carl Harris, an engineer at the institute. Until recently, most of the work done in the tank was aimed at catching more fish. Now, Harris said, the majority of research

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-Carl Harris

looks for ways to reduce "bycatch," captured fish that cannot be sold because they are too small or the wrong species.

Fishermen on both U.S. coastlines are increasingly more interested in lessening the capture of these non-targeted species.

In 1996, the Magnuson-Stevens Act, the law that governs the country's marine resources, compelled fisheries managers to find ways to reduce bycatch, which often winds up thrown overboard dead.

Typically, government regulations manage bycatch by limiting the number of days fishermen can work at sea, increasing mesh size, and closing areas to fishing.

While this strategy has likely reduced the mortality of certain species it can also devastate fishermen economically.

The marine institute is a leader in finding a compromise: Net technology that is capable of harvesting certain sizes and species of fish, simultaneously helps the industry and conserves resources.

A good example of such gear is the Nordmore Grate, a hard plastic panel with openings that capture shrimp while diverting finned-fish out a hole on the top of the net.

The grate has been required on Maine's shrimp trawls since the mid-1990s, lowering some bycatch by as much as 95 percent.

But finding a way to select for the appropriate size shrimp has proved more elusive.

Understanding the life history of *Pandalus borealis*, as Northern shrimp are known to biology texts, helped the scientists and fishermen get started.

Pandalus inhabit the cold waters of the world's northern oceans below the Artic Circle; the Gulf of Maine represents the southern extreme of its range.

These crustaceans are hermaphrodites—creatures that are equipped with both male and female organs.

Hermaphrodites come in all shapes and sizes and use their unique reproductive strategy in a variety of ways: Some are capable of self-fertilization, like oysters, others cross-fertilize, like barnacles.

Northern shrimp are different. They begin life as males, spending a year near muddy bottoms along Maine's rocky coast, before transforming into females about a year and a half later.

Typically, females come inshore in January and February to drop their eggs. This happens each year until they die around age five.

"So we want to build a net that catches only full-grown females at the end of their life cycle. That kind of harvesting is good for fish and fishermen," said Wells.

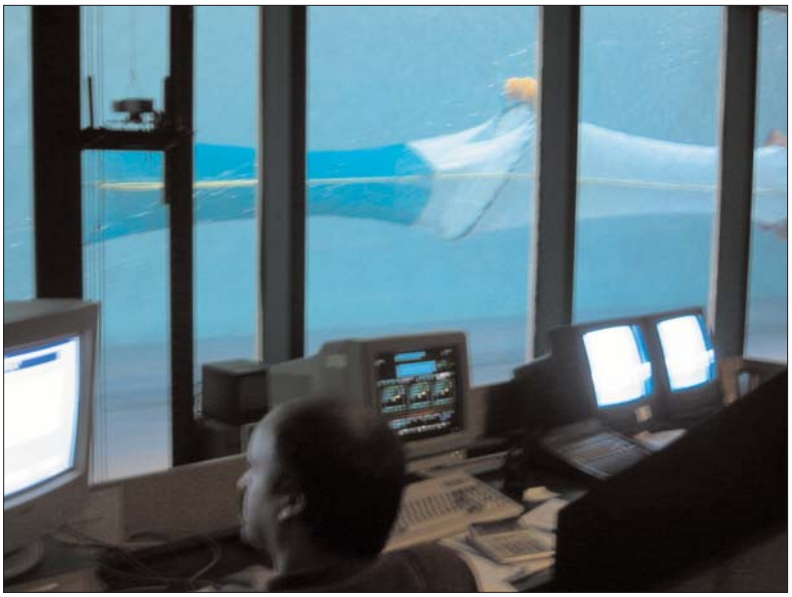
To determine if the gear was working, the tank's calibrated cameras took measurements of the mesh with and without the kites.

Preliminary results indicate that the innovation increased both mesh openings and water flow, which, according to Schick, will likely increase the selectivity of the net.

The real test however comes later this winter when sea trials begin in back in Maine.

A traditional "control" net will be towed alongside the experimental gear to compare the catches.

"We've gotten to the point in fishing where we need to think about conservation. Work like this is headed in the right direction. I'm optimistic about the future," said Balzano.



Collaborations is published each month by the Northwest Atlantic Marine Alliance with support of the Northeast Consortium. Please visit www.namanet.org for more information about our organization or call (207) 284-5374.