Aquaculture *continued from Page One*

culture site, south of White Island. We rode out in the *Bluefin*, the smaller of two vessels UNH uses to maintain the site.

Mussels and finfish raised at sea

Far from shore, buoys bob in the sea marking where a 380-foot (116-meter) line of blue mussels hangs beneath the water on longlines. Mussels grown at the site are ready for commercial development. Some have already found themselves on dinner plates at Portsmouth restaurants after a harvesting last March.

For finfish development, UNH is focusing on halibut, haddock and cod, hardy fish well suited to New Englands's cold waters. UNH stocked its first group of halibut at the OOA site last fall. The fish, the first halibut to be raised in open ocean pens, will swim in their cage, suspended in water 180 feet (55 meters) deep, for two years before harvesting.

The cage system makes an unobtrusive mark on the seascape. The pen itself is submerged, its nylon netting bulging just below the surface. In shape, it resembles a diamond, albeit 50 feet (15 meters) in diameter and 30 feet (9 meters) in height, swollen in the middle and tapering at the top and bottom. A metal feed hopper, built by MIT, sits over the pen, above the waterline.

The *Bluefin* crew, who has come out to repair this feed hopper, climbs out of the boat onto the structure and begins tinkering with the mechanism that controls the amount of feed pellets that filter down through the pen to the halibut below. When working properly, the MIT "Robofeeder" allows for remote controlled, automated feeding.

In the future, video cameras will be trained on the cages underwater so staff on land can monitor fish behavior and feed consumption. If the fish under observation stop eating, the pellet flow can be shut off by remote control, thereby minimizing the amount of food wasted and avoiding polluting the water with excess feed.

This is an "evolving technology," says Chambers, explaining that each prototype deployed enables UNH to identify and correct problems in design. The "next generation" of cages will be completely submersible, feed buoys and all, he says. The aim is for simple designs that are "user-friendly" and are automated as much as possible.

Another buoy afloat on the farm allows researchers to monitor environmental data from their offices on land. The buoy transmits real-time weather and environmental data—including waves, currents, temperature, salinity, fluorescence and turbidity—to UNH and the Seacoast Science Center in Rye.

Despite the farm's automated systems, maintenance of the site is done by old-fashioned manual labor. Divers must regularly attend to the nets year-round to prevent biofouling. The nets need to be clean so that waves will flow through the cage, otherwise the currents will drag the nets.

Today, the sea is calm with one to two foot seas, posing no danger to the workers as they work dangling off the Robofeeder. But inclement weather can bring hazards to the crew attending the open ocean farm site, unlike those experienced by aquaculturalists working in sheltered bays. Dive safety is a concern and poor visibility underwater can be a problem.

University of New Hampshire team conducting environmental monitoring at open ocean aquaculture site.

Troubleshooting back at the lab

New England's harsh marine conditions also presented a major challenge to the engineers who designed these cage systems.

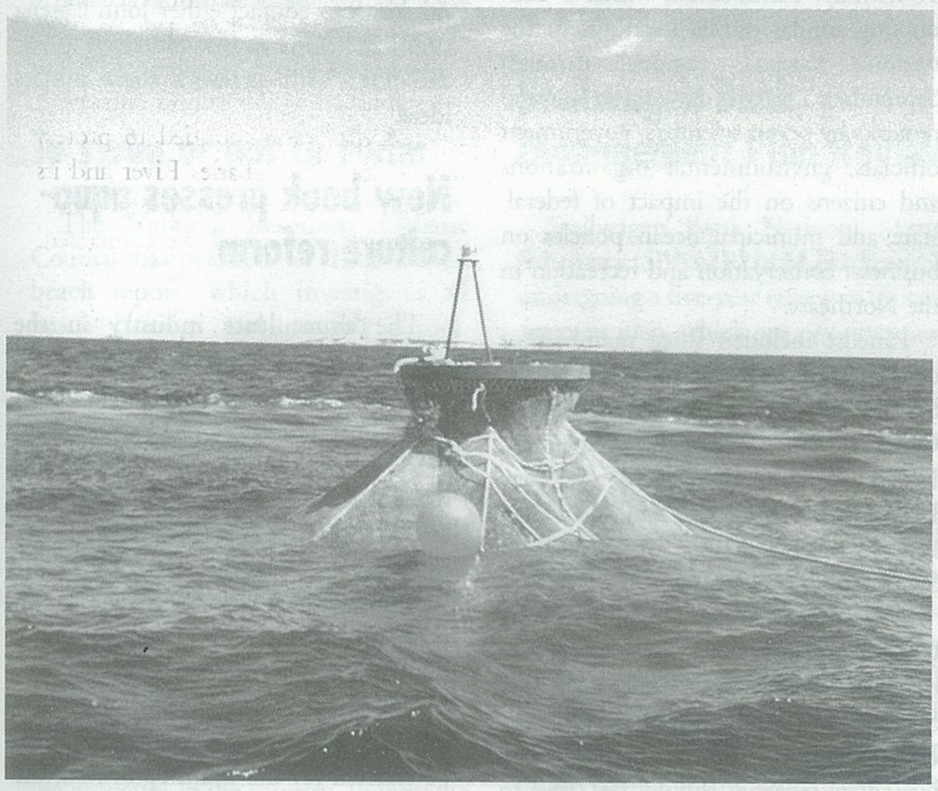
At UNH's Ocean Engineering Laboratory in Durham, a miniature version of a Russian-made pen, about the size of a birdcage, dangles in the warehouse-size building. It is one of the designs that have been tested in the lab's tow/wave tank to determine the motions of a full-size cage under stress of waves and currents in the ocean. Computer modeling based on the tank experiments enable researchers to simulate the tension of mooring lines and predict cage performance in the ocean. The simpler design of the cages at the OOA site went through the tow/wave tank before the full-size structures went into the ocean.

David Fredriksson, a UNH research assistant professor, stands on a platform overlooking the tank, which could pass for a one-lane lap swimming pool were it not for the contraption at one end that pushes the water to form waves and a buffer, or "beach," at the opposite end, which absorbs the energy from the waves. He asks his colleague at the computer controls to send a wave coursing down the length of the tank. A wave, barely knee-high, ripples through. In the sea, that wave would be 30 feet, Fredricksson explains. Cages deployed in the ocean need to be able to withstand the surge of waves that size in the Gulf of Maine.

The cages at the OOA site offshore are secured by a one ton (1000 kg) anchor, and held in place with four mooring lines; each line is anchored to the seafloor with a 90-foot (27-meter) chain, each link weights about 34 lb (15 kg). The design is proving successful. These nets have been in the sea for over three years and have "survived multiple Northeast storm events,"says Fredriksson.

Since there is no blueprint to go by when constructing systems for open ocean aquaculture, all the pieces that go into a successful farm system need to be developed simultaneously.

"We're tackling all the issues at once," he says, and "we're troubleshooting all the time."



Fish cage *Photos: Maureen Kelly*

Q&A *continued from Page Four*

Are grassroots organizations in the region's small communities hindered by embracing controversial issues?

Sure, if you're in Yarmouth for instance, and you come out with a strong anti-dragger campaign, you're not going to get local businesses to support you. You'll just remain a marginal group. In a larger city like Halifax, you can mount a campaign against something and you don't have to worry about running into your neighbor Buddy at the corner store. But even though EAC is in an urban area and we've come out against dragging, it's not this big glossy campaign that demonizes people. Living in Nova Scotia we try to look at the social side of this too, and ask what's fair.

What are some of the major differences between conservation groups in Atlantic Canada and those in New England?

Here everything is much smaller and there are many more resources available to New England groups. We don't have the tradition that exists in the United States of private or foundation funding for environmental groups. Overall, the foundations here are small and the money available is much less. Most of our wealth in Atlantic Canada is in relatively young businesses; we don't have large foundations that made their fortunes in the 1920s, or before. This is not a whine, mind you, because at the same time, the problems are much more severe in the States.

Do you think a conservation group is compromised once it receives funding from corporations or government?

It's the perennial question and it's what busts up a lot of groups. In our own organization we have different points of view. We've taken funding from DFO in the past, but we don't take corporate funding. Our rule is never, ever let funding determine what you want to say. You always have to be ready to move on if the funder doesn't like what you're doing, or if they want to pull the funding. You may even have to end the program being funded. I think our bigger responsibility is to our members and to doing what's right for the environment—we have to make choices and compromises too, but those two things should be first and foremost in our consideration.

What's the key to EAC's longevity?

We have long and strong roots in the community with more than 150 active volunteers to raise money each year. We also have around 500 members. A good strong volunteer and membership base is very important. Say if tomorrow all of our foundations deserted us, we'd still have our members to provide staffing.

Another aspect is core funding. For instance, to develop our Marine Issues Committee we got a small grant, which allowed us to hire somebody, then we used that to get further funding and bring in other people. To get that first bit of funding that allows you to grow is hard. There's no guarantee that you'll succeed, but at least it's some initial funding that enables you to go out and initiate projects.