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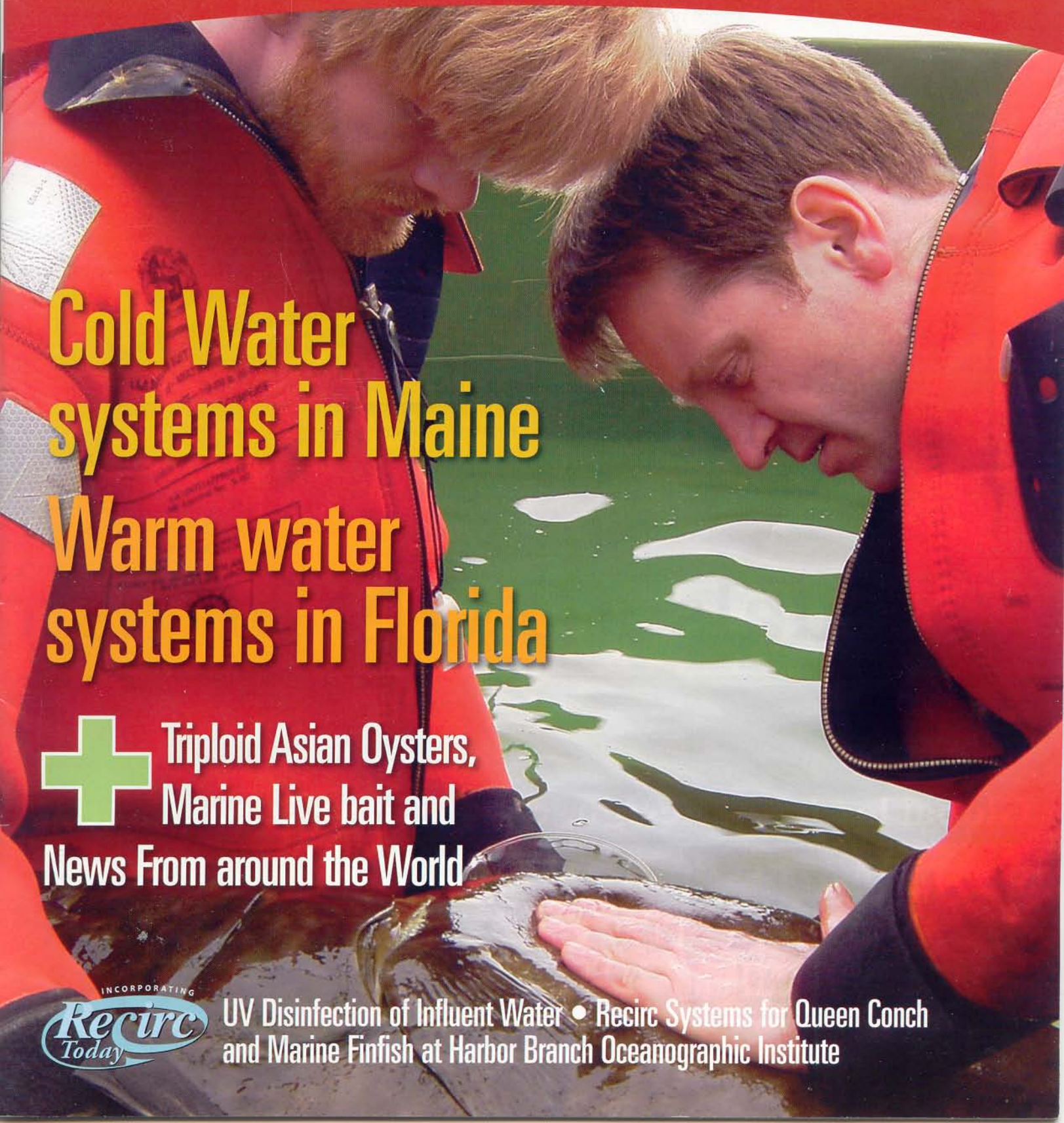

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University of Maine Commissions New Aquaculture Research Facility

The new Center for Cooperative Aquaculture Research at Franklin Maine.

By Nick Brown, Julia Eberhart, and David Scarratt

Franklin, Maine - The State of Maine might well be among the more favoured parts of the world for cool water marine fish farming. There is an abundance of sheltered ice-free water and a centuries old tradition of fishing and seafaring, into which aquaculture fits naturally. Several species are under cultivation, particularly salmon and steelhead in the 'down east' waters of Washington County. Recent problems in the salmon industry have shown that reliance on one major species is unstable, and economic losses can be considerable. The US industry has shown great interest in diversification, as in Europe where producers typically grow a mix of species, including salmon.

The University of Maine has an important role in this development, both in conducting research into the culture of other species, as well as in educating and training the next generation of fish farmers and researchers. The University established the Center for Cooperative Aquaculture Research (CCAR) in 1999 when it purchased a land-based salmon culture facility on a 25 acre (10 ha) waterfront lot on Taunton Bay. The farm was built in the early 1990's by Penobscot Salmon, as one of the first land-based recirculating fish farms in the region. Since then, the Center has expanded and now covers some 60,000 sq.ft. (5,500m^2). The latest addition is a 24,000 sq.ft. (2,200 m^2) marine finfish hatchery that will allow yearly production of several hundred thousand juveniles, and with the potential to produce two species simultaneously in separate units.

Environmental control system for the cod broodstock unit.

So far, $2.4 million have been spent on the hatchery, half from federal sources (Department of Commerce: Economic Development Administration) and the rest from the State of Maine and the University of Maine. Dr. Nick Brown, the Center's Director, drew up the original plans soon after joining the University of Maine in 2001 based on crop models for two species, halibut and haddock, and lessons learnt in the marine fish industry over the last several years. Ames A/E Architects & Engineers of Bangor, Maine, was selected to take the design to construction and provided valuable input in terms of building choice and engineering of HVAC and electrical systems. Construction was by local builders, E.L. Shea from Ellsworth, Maine. Systems manager Peter Harvey joined the CCAR in 2003 just as the hatchery construction was started, and was heavily involved during the construction phase.

The first task was to select a building system that would work in wet conditions, prevent the growth of molds, and provide a clear 80 ft (24 m) span to accommodate tanks and allow for flexibility. Although other buildings on the Franklin site are metal, architect Judy Graebert and her team selected prestressed, insulated concrete, given that high humidity and the need for frequent washing of floors and walls would quickly cor-

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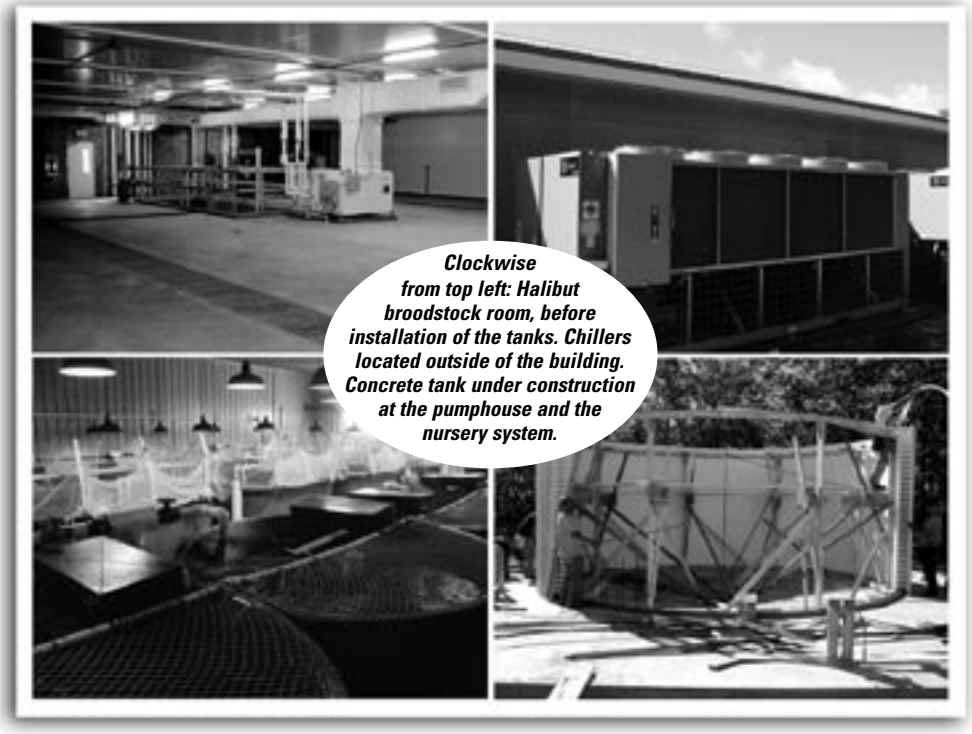
rode metal panels. The outcome is a simple gray building with upper and lower pressed trim that exposes the aggregate and gives some artistic flair. Silhouettes of halibut and cod pressed into the concrete reflect two of the species that will be studied. The concrete external wall panels have an R-value of R-25, and the interior composite metal insulated panels are R –25 or R-35. This allows for good interior temperature control. The interior faces of the panels are 7000 psi high-strength concrete with a steel-troweled surface for washability.



Clockwise from top left: Halibut broodstock room, before installation of the tanks. Chillers located outside of the building. Concrete tank under construction at the pumphouse and the nursery system.

Over half of the construction cost was spent on environmental control systems. Both water and air temperature can be closely controlled from between 42 and 90°F (6-32°C), depending on the room function. Each room will have its own recirculation system, and floors have been built to include floor drains, pipe channels for drains, and integral concrete sumps for water treatment equipment. Central HVAC systems control makeup air to each room, and, each space has its own air handling systems for heating and cooling. Heating is provided by central oil-fired boilers with around 2 million BTU/hr capacity. Central chilling units have about the same capacity (2 million BTU/hr or 166 tons of refrigeration).

There are two broodstock rooms, isolated from the rest of the facility for biosecurity reasons. The first, around 5000 sq.ft. (~460 m^2), will house the large population of wild and F_1 halibut broodstock in six 7m-diameter tanks (each 45 m^3). The second room (2240 sq.ft. ~205 m^2) will likely hold cod in four 5m-diameter tanks, 2 m deep (~40 m^3 each).

There are two egg-handling rooms for fertilization and disinfection of eggs, and two egg incubation rooms, each with 12 x 250 l conical tanks.

There is a dedicated room for the long yolk-sac-absorption phase of Atlantic halibut. This room will be stocked with up to 600,000 larvae to rear a projected output of 100,000 juvenile halibut per pulse. Brown has many years experience with this species and has developed a unique set of culture protocols. Although the hatchery is as yet unfinished, Brown and his team had opportunity to put those protocols into practice this year with the first batch of eggs produced at the Center. Five thousand juveniles were reared in the pilot hatchery and the experience has provided valuable training for large-scale production. This year's fish were reared in recirculation systems all the way from broodstock, through incubation, yolk sac, first feeding, and weaning. According to Brown, recirculation technology adds stability to the process and has improved survival rates.

In the new building, a 3300 sq.ft. (300m^2) room will be dedicated to a 120 m^3 first-feeding system for halibut, with another room (2100 sq.ft. ~190m^2) housing a 50-m3 unit for the second species, probably cod. There is a separate 1400 sq ft (128 m^2) space for a weaning/early nursery system. Another four separate rooms are dedicated to raising live rotifers and Artemia as well as algae for green water and life-food enrichment, and for pretreatment of rearing water.

At the western end of the building, a 6000 sq.ft. (550 m^2) area is dedicated to business incubation. A 20 tonne demonstration recirculating system for on-growing halibut to market size will be installed as part of a partnership agreement between the University of Maine and Maine Halibut Farm, LLC. Together, CCAR and Maine Halibut will refine methods and designs for on-growing systems, and CCAR will supply juveniles to

the company as production increases. The company expects to reach commercial scale after 2 - 3 years of proving the technical and economic feasibility of land-based halibut farming in Maine. Funding has already come from the Maine Technology Institute and The Maine Aquaculture Innovation Center. Last year Maine Halibut purchased 10,000 fish from a Canadian hatchery. These fish are being grown in a 5 tonne innovative pilot system designed by Brown and Harvey and built by the CCAR team. Alan Spear, president of the company, is gaining experience growing these fish, and exploring market opportunities through test sales of juvenile halibut grown by the CCAR. According to Spear, there is a large market potential for farmed halibut, and he believes that much of the farm's production could be sold direct to local restaurants and retailers.

Also incubating their business at the CCAR is Seabait Maine LLC, a subsidiary of Seabait (UK) that grows sand worms (a.k.a. ragworm, Nereis virens). Seabait is poised to expand to commercial scale with a new 130-t/yr facility. The worms are sold as bait for local sport fishing, and as feed for shrimp brood-stock conditioning. Peter Cowin, co- founder of SeaBait (UK) manages the company's US development. In cooperation with CCAR, Seabait has adapted its outdoor pond grow-out techniques to indoor recirculating raceway culture to combat Maine's more severe winter climate. Designs developed at CCAR have gradually been improved using funds from the Maine Technology Institute and Seagrant. The resulting system is stable and very productive. CCAR and Seabait are examining other applications of the technology: for example using farm-raised worms in experimental halibut broodstock feeds, and the possibility of integrating land-based culture of fish and worms.

The CCAR, with industry partner Stolt Seafarms Inc., is also exploring the future of cod farming in Maine. Harvest data from 20,000 juveniles, reared at the facility in 2003 and transferred to a net pen in Eastport in 2004, will be used to develop an economic model for cod culture in the region. And there is more. With industry partner, Friendship International, CCAR plans to build a sea-urchin broodstock conditioning unit and hatchery, and help develop on-bottom culture techniques.

The US Department of Agriculture's Agricultural Research Service (ARS), is establishing its National Cold Water Marine Aquaculture Center (NCWMAC) in Maine. The CCAR and the NCWMAC will share infrastructure components such as the new federally funded pump house and water treatment system. Construction is about to start on new ARS facilities located on the adjoining property. Research Director, Dr William Wolters, and his team started a salmon breeding program in 2003, which is aimed at developing a native salmon aquaculture stock. Their mission is to provide research services to the existing industry, focusing on the challenges facing local salmon farms. As new species come on line, ARS and CCAR will collaborate on research activities, and it is likely that halibut and cod breeding programs will follow ARS' efforts on salmon.

For more information, visit the web site http://www.ccar.um.maine.edu/ or email Nick Brown at npbrown@maine.edu. Julia Eberhart is with Ames Engineering. Contact her at: jeberhart@amesae.com.