Wild-catch fisheries have supplied the bulk of man's seafood since before history — indeed, fishing may be the world's oldest profession. In the past two decades, however, the wild harvest has flatlined. Entities such as the United Nations' Food and Agriculture Organization are vigorously promoting aquaculture as a way to meet the protein needs of a world population expected to reach over 8 billion by 2025.

"Fisheries provide 60 million metric tons of the world's seafood," says Ed Rhodes, aquaculture coordinator for NMFS. "Aquaculture will have to provide an equal amount by 2025, provided fisheries remain at their current levels — and I wonder if they will hold their own."

According to Rhodes, the United States expects to see a fivefold increase in the value of its aquaculture industry in the next 25 years.

Aquaculture itself has existed for thousands of years, practiced mostly in the farmlands of Asia, where silver and grass carp are reared in flooded rice paddies. Carp and other freshwater finfish account for 57 percent of the world's aquaculture production. But much of the recent growth in aquaculture has been in higher-priced export commodities such as shrimp and salmon. Although shrimp and salmon aquaculture provide less than 6 percent of the volume of world production, they account for almost 30 percent of the value — and draw most of the criticism leveled at the industry. Backed by federal and most state and provincial governments, global corporations have expanded the cultivation of these more lucrative species in North America, giving rise to conflicts with traditional fishermen.

In Eastport, Maine, former fisherman Ralph DeWitt heads his 48-foot boat out of the harbor, loaded with 12 tons of salmon feed. Maine is the largest producer of farmed salmon in the United States, and last year, Maine growers harvested 36 million pounds of salmon, 8 million pounds more than the state's groundfish landings.

DeWitt steers a course for one of the 27 salmon aquaculture leases that cover more than 400 acres of the surrounding waters of Cobscook Bay and the St. Croix River. Most of the salmon farms of Maine and New Brunswick, Canada, are owned by one of three multinational corporations. The pens proliferate in this region where 30-foot tides can disperse the several thousand tons of waste they generate annually. DeWitt pulls alongside a feed barge and tosses his lines to a pair of waiting hands as workers jump aboard to unload feed for the hungry fish.

When DeWitt pulls away he'll spray his boat with an iodine solution to prevent the transfer of disease, and workers on the feed barge will do likewise. The 39-year-old DeWitt started fishing Cobscook Bay with his grandfather, and looked forward to continuing a family tradition. He landed a job running a 65-foot sardine carrier for Peacock's Canning Co. in nearby Lubec. But the company retired the boat in 1995 and switched from processing herring to processing farmed salmon.

"By the time I started looking for another fishery, everything had gone limited entry," DeWitt says. "I'd like to be fishing, but there's no way to get into it any more. It tore me to pieces, but aquaculture is the only way I see where I can stay on the water."

"The thing is, I think there's room for both."

DeWitt contends that fishermen have
already “privatized” the ocean through limited entry. “They’ve had 300 percent control of the resource forever, and I’m not too happy about what they’ve done with it,” he says. “I’d like to see the fish come back, but it ain’t gonna happen.”

Aquaculture is hoisting its train to the same environmental engine that pulls commercial fisheries. The question arises: “They shut down a weir that’s been catching fish almost every year for 80 years,” says Klaus Sonnenberg, director of the Grand Manan Fishermen’s Association. Sonnenberg agrees that there is room around the island for aquaculture, which now employs a large percentage of the local population. “But that room’s been taken up. Every salmon site that goes in now displaces a significant portion of traditional fisheries.”

In British Columbia, Pietro Parravano, head of the Pacific Coast Federation of Fishermen’s Associations, makes the case that the aquaculture industry is being developed “at a cost to the wild harvest.” Parravano points to FAO statistics that indicate 40 percent of the world’s wild harvest goes to fish meal and oil production. “Wild forage fish needed to support wild salmon runs are being harvested to feed farmed shrimp and salmon,” he says. “And privatization of the short or displacing traditional fisheries all over the world.”

The demographics of many coastal municipalities have changed so that they should not have veto power over the aquaculture industry. “The catchment area of the aquaculture sites does not correspond to the industry in the area,” he says. “The area affected by the proximity of fish hatcheries is because of holding animals in pens.”

On the province’s northern border, British Columbia biologist Alexandra Morton believes that bacterial diseases such as furunculosis are being incubated and transferred to wild runs that pass the farms. “They lost 98 percent of the stock at the Tidnish River,” says the press. “The fish farms admitted putting diseased fish into nearby pens.”

On the province’s northern border, Alaska regulators, supported by state fisherman, have banned salmon for all the reasons cited by the industry’s critics.

STEBAN BELLE, executive director of The Maine Aquaculture Association, says, “The industry has taken the position that the stakeholder approach, in which all interested parties have a seat at the table, offers an opportunity for the industry to earn public acceptance.”

He calls it a “fishing expedition,” and points to the controversy over protecting wild salmon from the industry. “People want to protect wild salmon from the industry.”

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In 1980 Congress formed the joint subcommittee on aquaculture to promote aquaculture and coordinate policy between various agencies. But most aquaculture occurs in freshwater or within the three-mile limit, and state fishermen have found themselves making the final decisions on aquaculture regulations.

And he points out, “It’s very frustrating when we have to debate simple things that have already been settled elsewhere.

People need to read the literature.”

The literature Belle refers to, written primarily by Norwegian scientists, generally promotes the stakeholder approach, in which all interested parties have a voice. Belle supports that process, with qualifications. “Aquaculture is a handi-cap to aquaculture.” But the demographics of many coastal municipalities have changed so that they no longer reflect the interests of those who make their living from the sea,” he says, contending that gentrified coastal towns “should not have veto power over aquaculture and fisheries development.”

In trying to mitigate the environmental and social impacts of the expanding aquaculture industry, fisheries managers must also wrestle with economic reali-ties. For instance, developing nations, more concerned with capturing markets than protecting the environment, dump low-priced salmon and shrimp on the world market — the wholesale price of Atlantic salmon was around $1.50 pound in July — making it difficult for domestic regulators to foster a sustainable industry that can remain globally competitive.

When it comes to competing with wild harvesters and fish farmers, belle believes that, in Maine at least, traditional fisheries are well represented. He and many others choose to see the debate between the two industries as just another gear conflict to be worked out.

In nearby Grand Manan, New Brunswick, however, fishermen’s representative Klaus Sonnenberg sees a way of life in jeopardy. Although family-owned companies hold some leases, most of the industry in the area is controlled by 3 multinational corporations. “Aquaculture in not locally owned,” says Sonnenberg, “The people here will end up as servants to a corporation with its headquarters in another country.”

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According to Belle, monitoring the health of their fish will help aquaculturists avoid exporting problems beyond their boundaries. "Farmers are trying to maximize the performance of their animals," he says. "Stress reduces growth and suppresses the immune system of the fish." It is in the farmers' best interest to closely monitor their fish and respond quickly to environmental strains that eventually show up on the bottom line.

Belle points out that infectious salmon anemia, a pervasive virus that has devastated salmon farms all around the world, has always been present. "It percolated up in the last 20 or 30 years," he says. "Norway has been dealing with ISA for years. They manage it like any other livestock disease."

He says the use of medication and pesticides has dropped dramatically in recent years, and that farmers are developing systems and practices — growing single year-classes on sites left fallow after harvest, stocking at low density and enclosing pens in bags before dosing for sea lice — that will further reduce the cost and impact of salmon farming. (A fallow period allows lease sites to regain their productivity. Otherwise pervasive diseases, the buildup of toxic gases in the mud under the pens, and rampant sea lice outbreaks could make it difficult, if not impossible, to grow even selectively bred and inoculated salmon.)

But Belle also criticizes the lack of research being done to develop a sustainable industry. "We are reinventing the wheel when it comes to regulating this industry," he says.

Thor Lassen, executive director of Ocean Trust, a fishing-industry-supported conservation foundation, dismisses much of the outcry against aquaculture. When he hears critics talk about net protein loss from raising salmon on feed made from fish meal, Lassen is quick to point out that worldwide fish meal production has remained constant while aquaculture has expanded exponentially. "That fish meal is going to feed something — hogs, chickens — aquatic animals are the best use of it. The feed conversion ratio for salmon is nearly 1 to 1, which is better than any land-based animal."

According to Lassen, "aquaculture is not going to go away," and commercial fishermen are going to have to learn to live with it. He points to Texas, where both industries have managed to sort out their differences.

In Brownsville, Texas shrimp packer Bill Zimmerman, owner of Texas Pack, buys from fishermen. "We got nothing against them," he says of the region's shrimp farmers. "They have their market, we have ours. The only problem we had was what they did with their waste. The government made recommendations and they did the smart thing and cleaned up their act."
needed to predict the outcome of an aquaculture experiment would forestall development. "In most cases development is research," Bengston says. Often, risk assessments are nonexistent. "People make their best guess on limited data, and just do it," he says.

Farmers have begun experiments with offshore aquaculture in places like Hawaii, the Gulf of Mexico, and New Hampshire. In New Hampshire cod will be grown amid their commercially important wild counterparts.

"Everything we're guessing about cod, we're taking from salmon. And there's a lot we don't know," Bengston says. Because of the lack of information, NMFS' Ed Rhodes claims no visionary approach. "We make predictions and compare that with reality," he says. In Texas that approach appears to be working. "We were very involved in eliminating disease in the Texas shrimp industry. They have better production now, due to better husbandry."

In the uncharted waters of an emerging industry, Rhodes says the agency wants to steer aquaculture development carefully. "When we started this we knew we didn't want to make the same mistakes we did with commercial fisheries," he says, pointing to the need to avoid overcapitalization. Representatives of the commercial fishing industry like Parravano and Sonnenberg want to proceed even more carefully, focusing on rebuilding depleted wild fisheries and protecting healthy ones. While both men support sustainable forms of aquaculture, and believe there is room for both industries, they contend that wild-catch fisheries offer the most promise for providing high quality seafood to a hungry world.

"Proven fisheries should not have to suffer for the sake of an emerging industry," Sonnenberg says.

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**HEADED OFFSHORE**

Waterfront houses line the shores of Washington's Puget Sound. "These people don't want to look at aquaculture pens," says Andy Appleby, a biologist with the Washington Fish and Wildlife Department. "Yet the Department of Commerce wants to double aquaculture production in this country in the next five years." Asked where that expanded production will take place, Appleby has a simple response: "Offshore."

Constrained by available sites and conflict with other user groups, the Commerce Department began pouring money into developing offshore aquaculture technology. According to a rough estimate by NMFS aquaculture coordinator Ed Rhodes, Sea Grant projects in New Hampshire, Hawaii and the Gulf of Mexico receive more than $20 million a year to solve problems such as how to maintain cages and feed finfish on sites in the open ocean.

Aquaculture in federal waters is regulated only by the Army Corps of Engineers with regard to water quality issues, and Rhodes expects the Corps to ask NMFS to put conditions on any permits. He hopes to develop procedures for obtaining offshore aquaculture leases much as is done for oil and gas extraction.

He also sees new opportunities for fishermen. The Portsmouth Fishermen's Co-op joined the University of New Hampshire and Great Bay Aquafarms in Newington, N.H., in developing the technology for mussel and finfish farming offshore. George Nardi, president of Great Bay, acknowledged the value of fishermen in the expanding industry. "But it's selective, based on their aptitude for caring for the fish over the long term." The experimental project in New Hampshire utilized fishermen to help feed the fish. "A number of fishermen took an interest," says Nardi. "Some get a feel for how the fish are feeding and let the managers know."

With startup costs in the millions, it is unlikely that fishermen will become owner operators in the offshore scenario, but Nardi speculates that cooperatives could set up their own farms.

Sebastian Belle of the Maine Aquaculture Association finds the efforts to develop offshore aquaculture discouraging. "Regulators are taking the path of least resistance rather than educate coastal communities about the benefits of aquaculture. We should be using that money to develop best management practices for what we have," he says.

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