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New Law Streamlines Aquaculture in Maryland

Donald Webster and Donald Meritt
Maryland Sea Grant Extension Program

MARYLAND'S NEW SEAFOOD and aquaculture legislation—signed into law by Governor Robert Ehrlich on May 10, 2005—supports changes in the way the state treats aquaculture and should lead to a user-friendly system that encourages economic development. House Bill 971 reduces red tape and streamlines the permit process, among other changes likely to bring positive benefits to Maryland's aquaculture industry.

Championed by Senator Kathleen Klausmeier and Delegate Anthony O'Donnell, members of the Task Force to Study the Economic Development of Maryland Seafood and Aquaculture Industries, the legislation reflects work the Task Force conducted since its creation in 2002. (See related article on page 3.)

Continued on page 2



Donald Webster

Ornamental plants and fish for water gardens dominate Maryland's aquaculture production and sales. The new law should spur further growth in these and other sectors of the industry, such as baitfish and restoration aquaculture.

Aquaculture At-a-Glance

► Laying Groundwork

2002 Task Force Helped Shape Maryland Law – Recommendations create framework for change

Florida Case Study – State's overhaul of industry is model for Maryland

► Industry Today

Status of Aquaculture in Maryland – National and global demand for seafood high, but state must overcome obstacles to growth

On the National Scene – Federal legislation would spur development of offshore aquaculture

► Moving into the Future

Unlocking Maryland's Aquaculture Potential – Some sectors poised to flourish

Technology to Minimize Environmental Impacts – University quarantine facility tailor-made for research on non-native species

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New Maryland Law, *continued*

Key Provisions

Among other changes, the new law will:

- Create an Aquaculture Review Board made up of members from the Departments of Agriculture, the Environment, Health and Mental Hygiene, Natural Resources, and the Board of Public Works. The Review Board will coordinate the development of statewide aquaculture policy and work to streamline the application process for permits.
- Create a broad-based Aquaculture Coordinating Council to replace the old Aquaculture Advisory Commit-

tee. This Council will have 17 members who represent the state government and agencies, and the University of Maryland, along with representatives from aquaculture, agriculture, retail, the scientific community, and the consumer sector. Among other responsibilities, the Council will formulate proposals to the Governor and state legislature for advancing Maryland aquaculture, establish a grant program for the implementation of projects to bolster the industry, and make recommendations to the Aquaculture Review Board regarding needed regulatory changes.

- Establish Best Management Practices for all segments of the aquaculture industry, a task that will be overseen by the Aquaculture Coordinating Council.
- Create a Seafood Program Management Team. This team will consist of 18 individuals appointed by the Department of Agriculture, including representatives from industry, the University of Maryland, and state agencies. Among other responsibilities, the expertise of this team will advise an Innovative Seafood Technologies Program—established to identify areas for growth.

Impacts for Industry

Time will tell what these provisions will mean to Maryland's small but diverse aquaculture industry. Although it traditionally focused on edible products such as oysters and clams, non-edible products have now taken the lead: ornamental and tropical fish as well as aquatic plants for shoreline stabilization and water gardening. Support businesses offering products from aerators to water testing equipment have also thrived.

The new legislation will likely bring about an increase in production of ornamental fish and plants and place a greater emphasis on “restoration aquaculture,” which produces animals and plants for use in replenishing depleted resources. Restoration aquaculture is a major growth area because of the role it plays in efforts to rejuvenate the Chesapeake Bay. With the streamlining of the state aquaculture permitting process and the centralized creation of aquaculture policy through the Aquaculture Review Board, the new law should facilitate growth and encourage technological innovation.

Despite this legislation, many public policy issues related to aquaculture remain to be addressed. Access to subtidal grounds and the water column can be a contentious issue for aquafarmers. With increasing development along shores and riverbanks in Maryland, conflicts can occur related to aesthetics and water access between property owners and aquaculturists. Another key issue still outstanding is the state's role in clarifying the scope of private property rights for aquaculturists and in developing legislative measures to protect the integrity of such property—such as rafts and floats. And of course legislative actions could also help alleviate the intense competition for labor, a major problem for all of the seafood industry—as observed with Maryland Senator Barbara Mikulski's introduction of the “Save Our Small and Seasonal Businesses Act” in February 2005, which would exempt returning seasonal workers from the national cap of 66,000 people.

The new legislation is a positive step forward. But it is just one of many steps necessary if we are to build and maintain an economically vibrant and sustainable industry in the state of Maryland.

Task Force Recommendations Helped Shape Maryland Aquaculture Policy

Andy Lazur

Finfish Specialist, Maryland Sea Grant Extension Program

Simplify the aquaculture permit process and establish aquaculture enterprise zones. These are two of the top recommendations from the Task Force to Study the Economic Development of the Maryland Seafood and Aquaculture Industries, mandated by Maryland law in 2002 to develop creative solutions to pressing regulatory, environmental, and economic challenges.

Launched in response to critically declining fisheries, decreased competitiveness, and lost jobs in Maryland's seafood and aquaculture business, the Task Force was charged to identify challenges and impediments, make recommendations, and develop action plans for growth. The Task Force's efforts were carried out through two sub-groups, the Seafood Work Group and the Aquaculture Work

Mandates of the Task Force Work Groups

Seafood Work Group

- Study and develop methods of expanding local and national markets for Maryland seafood.
- Explore whether existing seafood marketing techniques are being fully used by the industry and, if not, what is needed to increase their use.
- Study and develop innovative seafood processing techniques.
- Review methods other states have implemented to develop their seafood industries.
- Consider the findings of any other task force or work group engaged in a study that impacts economic development of the seafood industry.
- Review and evaluate legislative and regulatory and permitting procedures to facilitate sustainable development of the industry.



Donald Meritt

Aquaculture Work Group

- Assess the status, economic viability, and potential of the Maryland aquaculture industry.
- Assess the economic, technical, and educational requirements for enhancing the Maryland aquaculture industry.
- Develop mechanisms to enhance coordination among agencies and the University of Maryland to strengthen the aquaculture industry.
- Study and recommend innovative methods for aquaculture to target commercial production and restoration of critical species.
- Review methods undertaken in other states to develop their aquaculture industries.
- Consider the findings of any other task force or work group engaged in a study that impacts economic development of the aquaculture industry.
- Review and evaluate legislative and regulatory issues and permitting procedures to facilitate sustainable development of the industry.

Group, whose efforts were overseen by an executive committee chaired by Senator Kathy Klausmeier, who was also the Task Force chairperson.

Work group members included key representatives of the legislature, agencies, university, and stakeholders—including those directly

involved in the industry—to ensure that all concerns, perspectives, and expertise were at the table. The sidebar on page 3 highlights each work group’s focus.

After a lengthy process of information gathering, discussion, analysis, and review, the Task Force rec-

ommendations summarized in the sidebar below ultimately formed the foundation for new aquaculture legislation that was signed into law this spring. (See “New Law Streamlines Aquaculture in Maryland on page 1.”)

Task Force Recommendations

Seafood Work Group

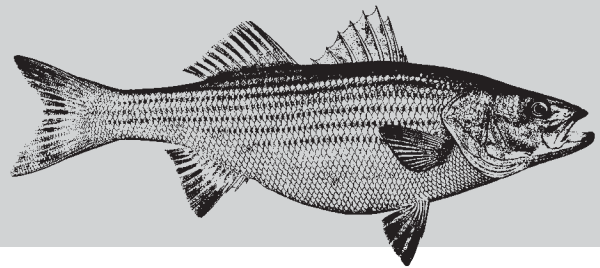
- Strengthen and expand marketing efforts within the Maryland Department of Agriculture’s Aquaculture and Seafood Marketing Program.
- Reform the H-2B visa program (for foreign non-professionals with seasonal jobs) to improve the numbers of workers in processing facilities.
- Establish a seafood technology review team.
- Form a research and development grants program to conduct priority seafood development studies.
- Review and modify existing fisheries regulations to address top commercial fishing issues.

Aquaculture Work Group

- Establish a single point of contact for aquaculture permitting through a review board that provides a comprehensive yet timely application process.
- Restructure the Maryland Aquaculture Advisory Committee into the Aquaculture Coordinating

Council, through which agencies and industry will develop best manufacturing processes and provide technical expertise.

- Establish aquaculture enterprise zones for sustainable development in the Chesapeake Bay and coastal bays.
- Establish research and development grants, overseen by the Aquaculture Coordinating Council, to address industry problems and advance development.
- Provide funding for Maryland Department of Natural Resources to monitor and regulate aquaculture in enterprise zones and leases.
- Provide funding for the Maryland Department of the Environment to survey and certify additional shellfish culture waters.



Restructuring Florida Aquaculture

A Success Story with Lessons for Maryland

Andy Lazur

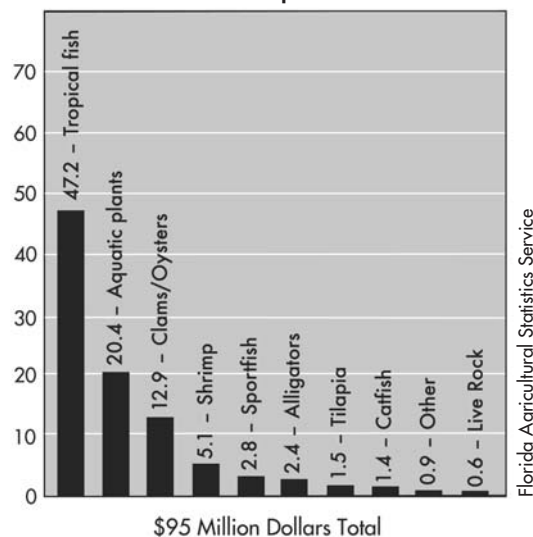
Finfish Specialist, Maryland Sea Grant Extension Program

Florida has much more than a warm climate and abundant coastline to thank for its position as the fourth leading aquaculture-producing state in the country. Although today Florida boasts more than \$95 million in aquaculture sales annually, less than 10 years ago the industry was struggling, faced with a regulatory quagmire not unlike the situation in Maryland today.

Before 1999, Florida aquaculture facilities were required to have as many as 15 to 50 permits. The growing industry was also plagued by resource rules that classified it as an industrial rather than an agricultural commodity (subjecting it to overly stringent regulatory requirements), cumbersome overlap of agency jurisdictions, and a 1995 ban on inshore nets that put hundreds of fishermen out of work.

In 1999 the Florida legislature undertook a decisive streamlining effort to address problems in the aquaculture industry. It created a one-stop shop for the aquaculture regulatory process within the Department of Agriculture. This new office worked with agencies previously involved in the permitting process to ensure that environmental and natural resources issues were enforced, while working to foster the development of aquaculture. In addition, the Department of Agriculture developed Best Management Practices (BMPs) to address key issues

2003 Florida Aquaculture Sales



Following the alleviation of many regulatory impediments, the aquaculture industry in Florida experienced a major growth spurt—increasing in value from \$86 million in 1999 to \$95.5 million in 2003. Much of the economic growth occurred in the clam sector.

such as effluents, water use, and non-native species. The Department also implemented annual inspections to certify that facilities were operating within the BMP guidelines. Shellfish aquaculture leases and training programs, along with a research and development support fund, enabled 200 displaced fishermen to become clam producers, leading to significant increases and stability in their income.

Since this streamlining took place, Florida's aquaculture industry has become a national model for its positive regulatory climate and environmentally sound practices. Aquaculture sales have increased \$10 million and

over 385 new jobs have been launched. There are a host of parallels between pre-1999 Florida and Maryland today. Similarities include:

- A hugely diverse industry that includes shellfish, ornamental fish, plants, and foodfish culture.
- A non-agricultural classification by agencies for regulatory purposes.
- Multiple agency permitting /oversight and a time-consuming application process.
- Perception as overly regulated and noncompetitive.
- Critically declining commercial fisheries; yet having abundant supporting infrastructure, expertise, and opportunity.

Maryland's aquaculture industry has already benefited from Florida's efforts. The Seafood and Aquaculture Task Force (see related article on page 3) looked to Florida as a model as it prepared its recommendations and sought to emulate its efforts in streamlining the permitting process and unifying its regulatory structure. The new legislation passed this May (HB 971) reflects many of the same structural changes adopted in Florida over the past six years.

Maryland Aquaculture

Karl Roscher, Aquaculture Coordinator, Maryland Department of Agriculture

Today, supported by increasing consumer demand for high quality seafood products, aquaculture has become the fastest agricultural growth industry nationwide. Within the U.S., the farm gate value of aquaculture products sold has risen from \$45 million in 1974 to over \$1 billion in 2002, according to the U.S. Department of Agriculture.

Aquaculture products from around the world now account for over one-third of total fisheries production. According to statistics from the United Nations Food and Agriculture Organization, worldwide aquaculture production has been growing at about 10% annually since 1970, compared to only 1.4% for capture fisheries and 2.8% for land-based meat production. In 2001, total fisheries production was 130 million metric tons and aquaculture production accounted for 38 million metric tons of this total. Nearly 90% of this production comes from Asian countries with a strong tradition in the culture of aquatic animals and cultural acceptance of farm-raised products.

In 2002, imports accounted for nearly 45% of the seafood consumed in the U.S., and of this total, over 1 billion pounds were aquaculture products, with a value of \$2.7 billion. Statistics show that nationwide, consumers eat an average of 15 pounds of seafood products per year, and that nearly 5 pounds of this is raised on an aquafarm.

The industry in the United States is growing about half as fast as worldwide production rates at about 5% annually. The U.S. industry is currently worth about \$1.1 billion. Most

of the growth within the U.S. has been in three areas:

- Catfish farming—accounts for 75% of production volume and worth \$390 million to the U.S. economy.
- Shellfish aquaculture—worth nearly \$145 million.
- Salmon farming—worth a little over \$175 million.

Aquaculture Status in Maryland

Maryland is known for high quality seafood and was once a leading national seafood producer. Traditional fisheries can no longer meet increased consumer demand, providing a growing role for aquaculture production of farm-raised products.

In 2003, there were approximately 35 commercial aquafarms in production in Maryland. Several additional aquafarms plan to go back into business in the future. These businesses employ 82 full-time, 31 part-time, and 13 unpaid workers. Another 49 paid workers and 300 unpaid volunteers were involved in educational or restoration efforts. Maryland has 10 licensed fee-fishing operations and 40 schools, nature centers, government agencies, and private organizations producing fish, shellfish, and aquatic plants for educational and restoration projects.

Maryland aquafarmers raise a variety of products, including foodfish, sportfish, mollusks, crustaceans, bait fish, algae, ornamental fish, and aquatic plants. Aquatic plants and ornamental fish dominate Maryland aquaculture production and sales, accounting for over 80% of the total farm gate value. Tilapia is the number one food fish in terms of production and sales. Growers

use a variety of culture methods to raise their product including recirculating systems, ponds, and flow-through systems. Most Maryland growers sell their products live, directly to consumers, wholesalers, and retailers.

The overall farm gate value of Maryland aquaculture products, in 2003, was estimated at nearly \$4 million. Maryland growers experienced an increase in the production and market values for clams, and oysters. Shrimp farming is gaining recognition with the construction of an indoor production facility on the Eastern Shore and plans for two others to be established on the western shore in 2005. While the 2003 farm gate value is low when compared to other aquaculture producing states, it still represents a solid industry base on which to build.

Overcoming Impediments

Current production represents only a fraction of the potential for aquaculture development in Maryland. Legal, regulatory, and technical limitations, as well as funding availability, have impeded its development. Although the Maryland General Assembly defines aquaculture as an agricultural activity, it has struggled to achieve recognition as a member of this industry.

As aquaculture grows, impediments must be effectively addressed and supporting programs developed to relieve the pressure that restricts investment, innovation, and expansion. Without taking aggressive action to address these issues the industry may fail to reach its potential. These impediments include:

- Excessive regulations
- Multiple agency oversight

in a National and Global Setting

- Complicated permitting process
- Lack of coordination within all levels of government
- Environmental impacts
- Land use restrictions
- User group conflicts
- Inadequate funding resources
- Limited industry-driven research and development

The benefits that a growing industry could provide—producing food, creating jobs and tax revenue, revitalizing farming and fishing communities, providing for restoration of species and habitat, and supplementing the demand for seafood while commercial fishery stocks recover—are often overlooked in the development

of policies and regulations that affect the industry. Aquaculture development will likely benefit if the industry becomes a priority agricultural activity for policy decisions and resource allocation. Changes to existing policy identified by stakeholders as the tools needed to promote the growth of aquaculture in various states, including Maryland, are as follows:

- Creating a one-stop shop for permitting, hearings and regulatory oversight.
- Coordinating policy development through one agency by legislation and inter-agency agreements.
- Developing regulations specific to the aquaculture industry.

- Establishing Best Management Practices.
- Supporting research and development that is industry driven and funded.
- Creating educational and training programs that link aquaculture and commercial fishing.

The recommendations developed by the Task Force (page 3) and accompanying legislation in 2005 (page 1) help resolve these lingering issues and provide support for the future of Maryland's aquaculture. It is now up to the stakeholders to work out the details and provide this industry with a clear path to follow.

National Scene: Expanding Aquaculture to Open Waters

Vicki Meade

On June 7 the Bush Administration submitted the National Offshore Aquaculture Act to Congress for consideration—a bill that would grant the Secretary of Commerce authority to issue permits for offshore aquaculture in ocean waters under federal jurisdiction. The bill also provides safeguards for wild stocks, marine ecosystems, and other ocean users.

Existing law does not have clear mechanisms to allow commercial aquaculture in federal waters in the Exclusive Economic Zone (3 to 200 miles off the coast). The proposed legislation would respond to this gap and act upon recommendations by the U.S. Commission on Ocean Policy in its final report, released in September 2004, which calls for a comprehensive offshore aquaculture regulatory framework in the United States.

Currently, the U.S. lags far behind other countries in aquaculture, accounting for less than 3% of the world's total production. "We need to operate our fisheries in the U.S. as a business," said National Marine Fisheries Service Director William



Hogarth at a press conference when the bill was unveiled. "Wild-capture fisheries will not be able to meet future demand."

If taken up and moved through Congress, the bill is expected to spur development of innovative technologies for environmentally sustainable offshore aquaculture and support thousands of U.S. jobs. Ongoing offshore research projects in Florida, Puerto Rico, New England, and Hawaii are already evaluating new approaches and commercial feasibility, while assessing potential ecological concerns.

Since the bill's submission, debate has escalated about potential environmental consequences of open ocean aquaculture—such as pollution, impacts on tourism, and disease transmission from farmed to wild fish stocks. In late June the Pew Charitable Trusts and Woods Hole Oceanographic Institution established the Marine Aquaculture Task Force to recommend national aquaculture standards to safeguard fish, wildlife, and ecosystems. After conducting meetings with scientists and leaders from government, industry, and the environmental community, the Task Force plans to publish its recommendations by early 2007.

Vicki Meade is a freelance writer

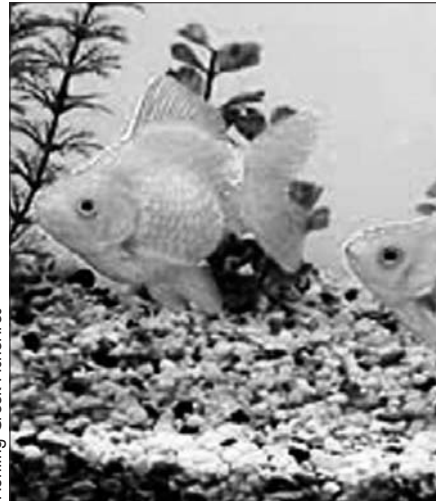
Unlocking Maryland's Potential for Aquaculture

Andy Lazur

Finfish Specialist, Maryland Sea Grant Extension Program

Maryland's aquaculture industry involves one of the most diverse arrays of species in the United States—not to mention ambitious production goals and huge market opportunities. Yet Maryland accounts for less than 1% of the annual \$1.13 billion sales of aquaculture products in the U.S., mainly because individual operations tend to be small scale, the growing season in Maryland is short, and the regulatory climate can be confusing and cumbersome.

With a history entwined with the Chesapeake Bay and rooted in seafood production, Maryland has a bounty of technical resources and great potential to play a key role in using aquaculture to produce food, develop biotechnology products for use in medicine, and restore declining shellfish, finfish, and aquatic vegetation. Table 1 highlights each com-



Hunting Creek Fisheries



Andy Lazur

modity's potential for economic viability, market outlets, degree of current knowledge and technology. Unlocking Maryland's aquaculture potential means removing regulatory barriers and facilitating development by proactive streamlining of the permitting process. The following areas show particular promise.

Aquatic Plants: A Key Strength

Unlike the states that focus on high production of foodfish, Maryland's strengths lie in culturing ornamental fish and plants. In terms of annual sales, the state's largest aquaculture sector is aquatic plants for water gardens, and to a much smaller degree, for restoration

Table 1. Overview of Major Aquaculture Commodities in Maryland

Commodity/Species	What is the market outlet?	How high is the potential economic viability?	How much knowledge is there about production technology?
Aquatic Plants (ornamental)	wholesale/retail	high	moderate
Aquatic Plants (restoration)	wholesale	high	low to moderate
Bait (fish and other)	wholesale	high	moderate
Biotechnology products	laboratory/bioassay specimens medical/nutritional/pharmaceutical	moderate to high high	moderate limited
Fish	restoration	moderate to high	moderate
Foodfish	processed for wholesale live sales recreation or pond stocking	low low to moderate moderate	extensive moderate moderate
Ornamental fish (freshwater)	wholesale	high	moderate
Ornamental fish (marine)	wholesale	high	limited
Shellfish	live wholesale restoration	low to moderate high	moderate moderate to high

or environmental mitigation. If the past decade is a good indicator, water gardens will continue to grow in popularity and the demand for ornamental aquatic plants will climb.

Many species cultured for water gardens are native, and thus are attractive for restoring aquatic habitats and reducing excess nutrients in the water. Therefore, environmental mitigation and nutrient management are likely to be key growth areas. Though most of the species currently grown are freshwater, more attention is now devoted to culturing brackish and saltwater species. Several Maryland operations are currently producing or researching the culture of marsh plants and submerged aquatic vegetation (SAV).

Ornamental Fish, Longstanding Industry

Second only to aquatic plants, Maryland has a longstanding ornamental fish industry that focuses on culturing goldfish and koi for the water garden market. Ornamental fish sales have been relatively steady as new culture operations have been established in other states, bringing increased competition for household hobby expenditures. Growth potential exists in new and unique species, such as new varieties, hybrids, and genetically designed ornamentals. Culture of marine ornamental species including fish and invertebrates, though a new addition to Maryland aquaculture, offers promise due to high market price and declining wild stocks.

Baitfish Promising

Mummichog and spot, in particular, are promising because preliminary efforts to culture them have gone well, bait shops want them for sale to recreational fishermen, and they draw a relatively high market price.

Foodfish for Niche Markets

Foodfish culture, by contrast, has declined significantly in the last decade due to fluctuating market prices, increasing production costs, and competition with lower-priced imports. Live sales to niche markets, specialty products such as organic fish, value-added products, and research on culture techniques for fish that bring a higher price in the market, such as cobia, flounder, sea bream, and sturgeon, may help increase the profitability of foodfish.

Restoring Depleted Fish Stocks

Ecological restoration is a growing area. Shad and yellow perch are being restocked in the Chesapeake Bay through efforts of the Maryland Department of Natural Resources Fisheries Service. Atlantic sturgeon are also a possible area of focus. Although fish restoration and re-stocking programs will probably stay within state hatcheries and universities in the short term, private hatcheries may become an economical source of juvenile fish.

Private hatcheries may also play a role in stocking ponds with recreational sportfish, such as bluegill, perch, and bass species. Maryland does not have a commercial sportfish hatchery. The Maryland Department of Natural Resources provides some fish for pond stocking, but most are imported from neighboring states. Similarly, hatcheries could provide fish for fee-fishing operations, in which a user pays to recreationally fish a privately owned pond or pays per unit catch.

New legislative efforts should remove some barriers that currently impede Maryland's potential for aquaculture growth. The next few years could be decisive for these different sectors of the aquaculture industry.

Research

Quarantine Facility Key for Studies on Non-Native Oyster

Donald Meritt, *Shellfish Specialist*
Maryland Sea Grant Extension Program

With the opening of the Aquaculture and Restoration Ecology Laboratory (AREL) at the University of Maryland Center for Environmental Science's (UMCES) Horn Point Lab in 2003, oyster research entered a new and exciting era in Maryland. The lab greatly increases the production of spat for the University's oyster restoration program. The University's program has also helped to forge ties between faculty of the University, Sea Grant, and non-university partners, including the Oyster Recovery Partnership, the Maryland Department of Natural Resources, NOAA, the U.S. Army Corps of Engineers, the Maryland Watermen's Association, and other dedicated groups working to promote the ecologically sound restoration of oysters in Chesapeake Bay.

AREL will be used to continue to produce millions of spat for planting restoration sites while providing researchers with state-of-the-art facilities for wide-ranging investigations. An important feature of AREL is the 1,540 ft² quarantine lab for research on non-native species, such as *Crassostrea ariakensis*, which is currently being evaluated for introduction to the Bay. This lab provides control of culture water for researchers, while preventing the unwanted escape of

Continued on page 10

Quarantine Facility, *continued*

biological material into nearby waters.

The quarantine lab contains a broodstock conditioning system that can hold several thousand animals in flow-through, temperature-controlled water. Flow-through conditioning water minimizes or eliminates the need for supplemental algal feeding, adding efficiency and economy to the operation. The system is made up of three motorized ball valves, controllers, a head tank for water mixing, and a conditioning table with eight isolation chambers. Two identical systems allow



Don Meritt

operation at different temperatures, where they can range from 8°C to over 35°C, with less than one degree of variation.

The lab contains varying numbers and sizes of fiberglass larval cones that allow different broods to be cultured at the same time. In response to the needs of the research projects being supported, the lab features upweller/downweller tanks that allow larvae to be set on micro-cultch or whole shell.

Variety is the key to water supply in the new quarantine lab. The system includes Choptank River water filtered to either 10 or 2

Continued on page 11

Perspectives

A Role for Aquaculture in Maryland's Oyster Fishery

Donald Meritt and Donald Webster
Maryland Sea Grant Extension Program



Stan Allen, VIMS

Oysters have been raised for thousands of years, even in ancient Roman times, but in Maryland, a fight ongoing for well over a century has impeded oyster culture. The interests of private culturists in leasing Bay bottom from the state to grow oysters conflict with watermen who believe harvest should be permitted only from natural oyster bars. As the oyster population dwindles, we are left without a significant public or private fishery.

In the fall of 2004, "managed reserves" were established for restoring the native oyster, *Crassostrea virginica*, in Chesapeake Bay. These reserves are oyster bars that have been populated with hatchery-raised disease-free larvae. On October 30, after several seasons of

growth, these oyster grounds opened to limited-take harvest.

For this project, a multidisciplinary group of resource managers, scientists, and watermen had to reach a consensus on locations for constructing the reserves, develop criteria for initiating harvest, obtain equipment necessary to handle large volumes of shell as cultch for hatchery oysters, establish an infrastructure for producing billions of oyster larvae, and work together to monitor the reserves. An important aspect of any restoration aquaculture project is for diverse interest groups to work together in this manner toward common goals.

To advance the debate over oyster culture, we need oysters that are able to resist the diseases that have plagued the region for the past 50 years—namely MSX and Dermo, which are caused by protozoan parasites. The industry will languish until a solution is found—whether by introducing non-native oysters or developing stronger animals through breeding and selection, an approach recently successful in trials in Virginia.

No strains of native oysters today have the disease resistance needed for system-wide restoration of oyster populations. Resistant strains have been developed for aquaculture operations that deploy oysters in the Bay, such as the managed reserves, for two or three years before removal for harvest, but they do not have the long-life characteristics needed for large-scale oyster restoration.

Commercial watermen could help in oyster restoration by applying their vessels, work ethic, and practical knowledge to restoration demonstration projects. This role could bring economic benefit to the industry and provide an important service to restoration efforts. Extension faculty could assist with formal training, technology transfer, and monitoring, which would help make these efforts a financial success.

Quarantine Facility, *continued*

microns, as well as raw or filtered water that is heated or chilled. Well water and seawater are polished in a cartridge filter and may also be treated with ultraviolet light. Low-pressure air is introduced through a high-volume blower system.

Total available water exceeds 350 gallons per minute. Discharge passes through a series of chlorination stations and sodium bisulfate treatment before flowing into a series of settle-

ment ponds prior to discharge back into the river. Sophisticated monitoring equipment continuously tracks the concentration of chlorine and sodium bisulfate and is connected to emergency valves that can shut off all water to the lab. In the event that sterilization fails to stay within set limits, the system is designed to protect against unwanted escapes. An alarm and automatic dialer will notify personnel so that repairs can be dealt with immediately.

Research on *C. ariakensis* is currently underway in the AREL quarantine lab. The species has been successfully spawned with larvae currently undergoing culture. As more emphasis is placed on research on non-native species, the quarantine lab will continue to play an important role in assuring the ecological safety of this work. Such information will help decision-makers in their role to shape the future of our Chesapeake Bay.

Sea Grant Extension Phone Numbers and E-Mail Addresses

Doug Lipton, SGEP Coordinator and Marine Economist	301-405-1280	dlipton@arec.umd.edu
Don Webster, Marine Agent	410-827-8056	dw16@umail.umd.edu
Jackie Takacs, Marine Agent	410-326-7356	takacs@cbl.umces.edu
Don Meritt, Shellfish Aquaculture Specialist	410-221-8475	meritt@hpl.umces.edu
Andy Lazur, Finfish Aquaculture Specialist	410-221-8474	alazur@hpl.umces.edu
Dan Terlizzi, Water Quality Specialist	410-234-8896	dt37@umail.umd.edu
Tom Rippen, Seafood Technology Specialist	410-651-6636	trippen@mail.umes.edu
Adam Frederick, Education Specialist	410-234-8850	frederic@mdsg.umd.edu
Vicky Carrasco, Coastal Community Specialist	301-405-5809	vcarrasco@arec.umd.edu
Gayle Mason-Jenkins, Seafood Specialist	410-651-6212	gmjenkins@mail.umes.edu
Erica Goldman, Communications Specialist	301-403-4220, x20	goldman@mdsg.umd.edu

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Maryland Aquafarmer
Sea Grant Extension Program
Wye Research and Education Center, P.O. Box 169
Queenstown, Maryland 21658
Phone: 410-827-8056/Fax 410-827-9039

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Symons Hall
University of Maryland
College Park, Maryland 20742

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