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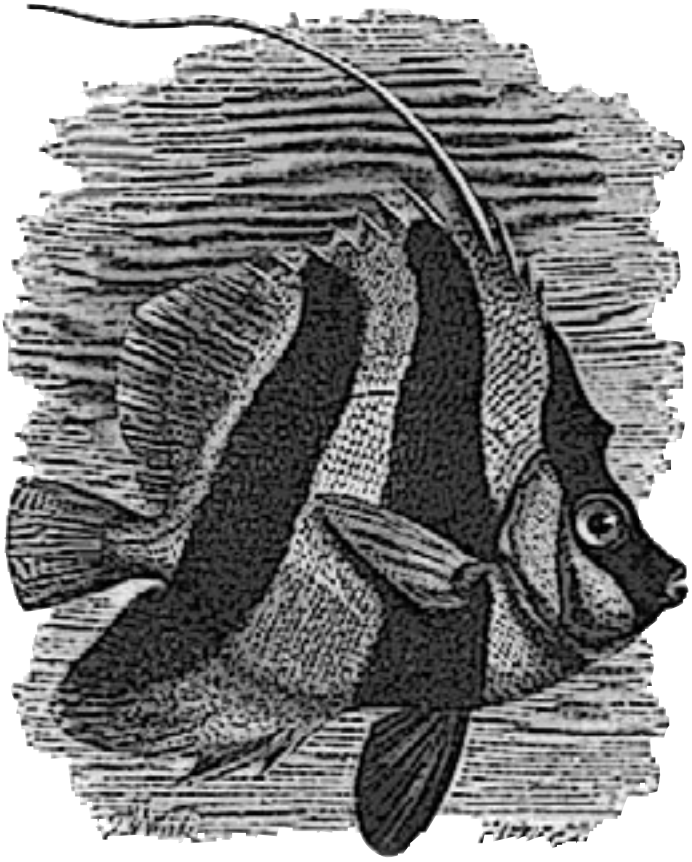
ISSUE 2003-03 SUMMER 2003



Finfish Farming
Opportunities for Maryland Growers

Andy Lazur
Sea Grant Extension
Aquaculture Specialist

For most people, aquaculture is synonymous with food production and with good reason. While farmed finfish accounts for 82.4% of annual aquaculture sales in the U.S., 71% of that is from foodfish production, led by catfish, rainbow trout, Atlantic salmon, tilapia and hybrid striped bass. Sizeable as the U.S. aquaculture industry is, it pales in comparison with global production by other countries, particularly China which is far and away the world's leading producer, followed by six other countries — U.S. production ranks eighth.

Though aquaculture in the U.S. has expanded in the last twenty years, some states have fared better than others. Maryland, which has seen a significant decline in food fish production, has been among the "others."

In the late 1980s and 1990s growers, researchers and Sea Grant Extension specialists played key roles in advancing the farming of hybrid striped bass — today, however, Maryland has little commercial production of this popular species. Though a number of food fish farms in the state are rearing tilapia, hybrid bluegill and, to a lesser extent, yellow perch, they are relatively small operations. Growers have found that high market demand in itself does not translate into a viable business, which must balance high operating costs (e.g., labor, feed and regulatory costs) with low-cost foreign imports and low-priced meat or poultry alternatives. Margins of profitability can be so thin, it is too risky for growers and backers to make the large investments that efficient operations require.

One recent example of the economic challenges facing U.S. producers is the importation of the Vietnamese Basa, which led to dramatic declines in domestic prices for channel catfish — prices went below the U.S. costs of production. Another is the tilapia industry: frozen whole fish has been imported from Asia at less than $0.55/pound, while it has cost U.S. growers at least $1.15/pound to produce.

Contents

U.S. growers who are committed to aquaculture have been trying to meet these economic challenges in different ways, for instance, by (1) growing higher value species, (2) introducing new product forms (e.g., pre-seasoned or microwavable fish entrees, smoked products), (3) developing new production techniques such as integrating fish with rearing other crops (e.g., vegetables or herbs) and (4), exploring alternative markets.

Alternative Markets for Fish Production

Growing fish for the high-value organic market is one alternative now under evaluation. Meeting the requirements of organic products is currently difficult because grains in commercial feeds are grown using inorganic fertilizers, herbicides and pesticides. An organic fish could be herbivorous and raised in ponds that are fertilized organically or fed meal that has been certified as organic. But growers will have to determine whether the increased cost of producing so-called organic fish can be made up in the market place. Price is the driving force and marketing is critical: culturists will have to distinguish their product from natural fisheries or from imported products and must seek niche market opportunities to be profitable. Perhaps surprisingly, the profit potential from foodfish species is lower compared with other uses of aquaculture such as rearing ornamental fish and baitfish.

One promising niche for aquaculturists is the market for ornamental fish — while ornamentals may account for only 7% of annual finfish sales, the industry's current dollar value is about $70 million. And the prospects may be greater. Hundreds

Perhaps surprisingly, the profit potential from foodfish species is lower compared with other uses of aquaculture such as rearing ornamental fish and baitfish.

of species are either cultured on farms or collected from wild sources for supplying the second largest hobby in the U.S. A diverse number of freshwater tropical species account for over 80% of production, followed by goldfish and koi. Marine ornamentals are gaining in popularity because the vast majority of species are still collected from the wild rather than cultured. Florida is by far the leading ornamental fish culturing state, though California, Arkansas, Indiana, Hawaii and Maryland also account for significant production. Maryland's ornamental fish industry specializes in goldfish and koi and is the number two aquaculture sector in the state, running close behind ornamental aquatic plants.

Baitfish is the third largest fish commodity in U.S. aquaculture, accounting for about 3.8% of sales. Major species are the golden shiner, fathead minnow, and feeder goldfish. The majority of production is from growers in Arkansas, who account for over 60% of the $37 million dollar industry. Significant demand exists for marine baitfish species for near- and off-shore recreational fishing, with the vast majority of bait being harvested from natural waters. A few farms produce a small quantity of bull minnow or killifish — given the high market price for many marine

bait fishes growers have shown an increasing interest in culturing them. For many of these species, however, there are significant gaps in our understanding of their reproductive biology, hatchery technology, nutrition and basic culture requirements.

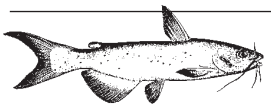
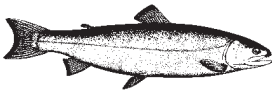
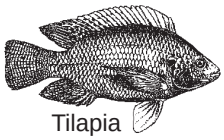
Another important culture sector is sport fish production for stocking the thousands of farm ponds, small lakes, and reservoirs for recreational fishing. While the major economic impact of freshwater recreational fishing is in natural bodies of water — an estimated $406 million in Maryland — private ponds and stocked lakes can be of significant economic importance. Hatcheries in the nation produce a variety of recreational species, including crappie, hybrid striped bass, largemouth bass, and sunfishes that account for $8 million in sales. In addition, millions of catfish and trout are also sold for stocking ponds. Currently, because Maryland does not have a private hatchery supplying gamefish species for private pond stocking, fish are imported from neighboring states.

Two other non-food markets of cultured fish, often overlooked, are of significance: research laboratories and fisheries restoration programs. Some hatcheries have discovered a high value market opportunity by selling various species of fish to industrial companies or laboratories that conduct chemical bioassays for environmental impact or biomedical studies. Carp, zebrafish, bull minnows, sunfishes are among the more commonly used species. Culturing fish for restoration or conservation purposes, typically conducted by state or federal hatcheries, accounts for a surprising number of fish annually. According to the USDA 1998 Census of Aquaculture, 11 million catfish, 2.4 billion salmon, 71 million bass, 117 million trout, 646 million walleye and 100 million other fish of various species were stocked in restoration efforts. The extent of private hatchery contributions to these numbers was not reported, though the total fish volume represents a highly significant economic value.

While aquaculture for food production will continue to dominate the world-wide industry, there are opportunities in Maryland and the mid-Atlantic for growers to produce a variety of higher-value species for niche markets. By thinking outside the dominant foodfish species box and investigating the potential of other applications of aquaculture, growers could enhance their prospects for a broader and more profitable industry.

This article is the first of a periodic series on finfish aquaculture that will highlight different commodity groups, including foodfish, ornamentals, baitfish and sportfish. For more information, contact Andy Lazur at alazur@hpl.umces.edu.

Table 1. United States aquaculture production, farm gate value, and imports of major foodfish species.

Species	Production (Million lbs.)	Farm Value ($ Million)	Production Expansion (Since 1990)	Imports Quantity (Million lbs.)
 Channel catfish	630.6	358.0	40%	-
 Rainbow trout	54.5	72.3	-3%	-
 Atlantic salmon	39.2	103.8	468%	413
 Hybrid striped bass	10.5	27.8	820%	-
 Tilapia	19.6	26.4	100	148

An Asian Oyster for the Chesapeake
Update on Crassostrea ariakensis

Merrill Leffler, Maryland Sea Grant

This summer oyster farmers in Virginia will plant a million hatchery-spawned oysters on their leased grounds. Hatchery-bred oysters are hardly new to the Bay — all disease-free seed planted in Maryland, for example, begin life there. (Nearly all of these were spawned at the University of Maryland Center for Environmental Science Horn Point Laboratory facility. See "A Unique Partnership.")

What's new is that *these* hatchery oysters are *Crassostrea ariakensis*, the non-indigenous or "exotic" Suminoe that in growth trials of some 60,000 oysters in 2001 gave strong indication of resistance to MSX and Dermo — the two parasitic diseases that have been killing the native *Crassostrea virginica* — and very fast growth to harvestable size. Those trials were done with oysters that had been rendered sterile by Standish Allen and colleagues at the Virginia Institute of Marine Science (VIMS). Advances in technologies have made it possible for scientists to manipulate the oysters' chromosomes so that there is a low probability of these so-called "triploid" animals reverting to "diploids," which could enable them to develop eggs and sperm and eventually reproduce. Triploidy may also account for faster growth since nutritional energy is not diverted to developing eggs and gonadal tissue.

In its application on behalf of Virginia oyster growers, the Virginia Seafood Council submitted a proposal to the Virginia Marine Resources Commission — "Economic Analysis and Pilot-Scale Field Trials of Triploid Aquaculture" — requesting authorization for 10 leaseholders to each grow out 100,000 Suminoe oyster seed as part of an economic study that aims at exploring the feasibility of what the Council's executive director Francis Porter says could be the beginning of a "brand new industry." All ten growers participated in the 2001 trials.

According to the application, which VMRC approved after the Council revised it — in response to criticism by VIMS and the Chesapeake Bay Program Living Resources Subcommittee-*C. ariakensis* Ad Hoc Panel Review — oysters will be held in the water from 9 to 18 months, depending on growth rate, then harvested and marketed by the 10 industry participants.

In the seafood council's application, the participating growers have provided summaries of how they will handle the *C. ariakensis* oyster seed from planting to harvest, for instance, their methods for confining oysters, plans on harvesting them and strategies to prevent their release under storm events. Growers are employing different methods of confinement: five will use rigid bags in clam or bottom cages; three will plant oysters in bags on the bottom; one will use floating rafts; and one will employ a rack and bag method of growth.

Aquaculture and Wild Harvests

Throughout the world, the farming of non-native species has become the major means of producing commercial oyster harvests — this is the case in France, England, Australia, New Zealand and the west coast of the United States. While *Crassostrea gigas* was imported to the U.S. northwest near the beginning of the 20th century, it wasn't until the 1970s that growers there began employing hatcheries to produce oysters — today, more than 90 percent of oyster

production in the northwest is from hatcheries. In other parts of the world, in France, for example, *C. gigas* spawns in the wild. Growers use a variety of techniques for collecting spat and then planting them.

Until MSX spread throughout the lower Chesapeake in the late 1950s — Dermo became rampant some years later — Virginia's oyster production came primarily from private grounds: growers deposited shell on leased bottom for stabilization and then planted seed oysters, often from highly productive seed grounds in the James River and elsewhere. While Virginia watermen still harvested public grounds for "wild" oysters during the September to April growing season, oyster companies in Virginia harvested their leased grounds out of season; in this way, Virginia leaseholders had an all-year-round industry.

Historically, this was not the case for Maryland where companies by law are not allowed to lease grounds for aquaculture — only individuals can do so. While some individuals put together large leasing acreage and sold oysters commercially out of season, the state discouraged the growth of oyster farming, for example, by making it nearly impossible for Maryland leaseholders to buy oyster seed from state grounds (most growers had to buy and transport seed from Virginia, which added to their production costs).

Maryland's historical lack of support for oyster farming may be reflected in the many public harvesters in the state who reject a triploid-based aquaculture industry and have called for introducing reproductive *C. ariakensis* into the Chesapeake. Larry Simns, president of the Maryland Watermen's Association, has become a strong supporter of *C. ariakensis* since the 2001 Virginia growth trials — at the annual Watermen's Exposition in Ocean City, Simns said that while he had not given up on the native *Crassostrea virginica*, it was time to look to a non-native oyster that gives evidence of being able to survive MSX and Dermo.

With the state's worst harvest on record this season, Maryland Governor Robert Ehrlich directed the Department of Natural Resources in June 2003 to begin preparing an Environmental Impact Statement for introducing *C. ariakensis* to the Bay. While such a process can take several years, the governor has called restoration of oysters to the Chesapeake "an economic and environmental priority."

Research on *C. ariakensis* in Maryland

Two research studies on *Crassostrea ariakensis* are getting underway at the University of Maryland Center for Environmental Science, with support from the NOAA National Sea Grant College Invasive Species Program.

Roger Newell and Victor Kennedy at the UMCES Horn Point laboratory will assess the potential for natural predators to control the spread of this non-native species. Without natural controls, the oyster population could potentially grow unimpeded to become a nuisance, possibly out-competing the native eastern oyster *Crassostrea virginica* for food and settlement space for larvae. Newell and Kennedy will examine the Asian oysters' vulnerability to natural predators that feed on the native eastern oyster: in quarantined laboratory experiments, the two-year study will test how *C. ariakensis* responds to predators commonly found on a Chesapeake Bay oyster bar.

Ken Paynter and Don Meritt will characterize survival and performance of *C. ariakensis* in Maryland waters, which are lower in salinity than in Virginia. While the field trials in Virginia in 2001 indicated that the Suminoe is resistant to MSX and Dermo, little is known about its biology or reef building capabilities; moreover, Maryland's low salinity and sediment-laden waters differ from Virginia's higher salinity waters. In this study, Paynter and Meritt will collaborate with VIMS scientists to study habitat and mortality rates of sterile (i.e., triploid) native and non-natives at sites in the Choptank, Patuxent and Severn Rivers.

Coming Next — Report on C. ariakensis *and the Chesapeake*

In mid-August, the Ocean Studies Board of the National Academies of Science will issue its report on introducing *C. ariakensis* to the Chesapeake Bay. The study will address how *C. ariakensis* might affect the ecology of the Bay, including effects on native species, water quality, habitat, and the spread of human and oyster diseases. It will also consider effects on recovery of the native oyster *C. virginica* as well as its potential range and effects within the Bay and in neighboring coastal areas.

The release of this year-long study will give a first glimpse on just what the prospects are for importing *C. ariakensis* into the Chesapeake. *Stay tuned.*

A Unique Partnership

Horn Point Laboratory and the Oyster Recovery Partnership

Merrill Leffler, Maryland Sea Grant

In 1994, the oyster hatchery at the Horn Point Laboratory produced about four million seed oysters, most of which were destined for Chesapeake Bay restoration research. By 2000, 40 million spat left the hatchery — last year, more than 70 million went into bay waters, primarily for reef restoration in rivers throughout Maryland's portion of the Bay system. By 2004, when Horn Point's new Aquaculture and Restoration Ecology facility becomes operational, "the hatchery could have the capacity to produce 150 million spat a year," says Sea Grant Shellfish Specialist and hatchery director Don (Mutt) Meritt.

While Horn Point, which is part of the University of Maryland Center for Environmental Science, has been able to expand production because of funding support from state and federal agencies, a key factor in the need for expansion has been the lab's unique relationship with the Oyster Recovery Partnership, says Meritt. That uniqueness has to do with the way that Horn Point and ORP support each others' objectives. In this case, the lab's mission is to develop the scientific knowledge that can best contribute to restoration in the Chesapeake, Meritt says, together with outreach efforts for putting that knowledge to work. ORP Director Charles Frentz's goal is "to make oyster restoration work successfully." The means towards trying to achieve this goal have been made possible in part by Congressional support of the National Oceanic and Atmospheric Administration's Chesapeake Bay Office, which helped fund new equipment for stepping up production, Frentz says. "Over these years," he adds, "ORP has increased planting operations because of Horn Point's expanding capability for producing seed while seed production has increased because of our growing capability to get these oysters into the field."

The Horn Point-ORP connection has its origins in the Maryland Oyster Roundtable, convened in 1993 when Department of Natural Resources Secretary Torrey Brown brought together a group of stakeholders representing watermen, aqua-

culturists, scientists, legislators, environmentalists and agency managers. Brown charged them with developing a consensus plan on returning sustainable oyster populations to the Bay. A century of stress from overfishing, habitat loss, sedimentation and contaminants had been exacerbated for more than twenty years by two parasitic diseases — MSX (caused by *Haplosporidium nelsoni*) and Dermo (caused by *Perksinsus marinus*) — that were killing oysters before they reached three inches, the minimum harvestable size.

The Roundtable members reached important consensus agreements that are in place today and, in effect, set the stage for expanding hatchery production of oysters in Maryland. An important agreement was dividing Maryland rivers into several zones and allowing only certifiable, disease-free seed to be planted in upriver zones — in fact, this meant the planting of only hatchery-produced seed, since virtually all public oyster grounds in Maryland had been tainted by Dermo disease. Roundtable members also called for establishing a non-profit co-venture among watermen, aquaculturists and environmentalists that would be responsible for raising money and coordinating restoration projects in Maryland — the Oyster Recovery Partnership was the resulting organization.

The first ORP director, Dr. Dennis Walsh brought strong technical expertise to the partnership, says Bill Goldsborough of the Chesapeake Bay Foundation and a member of ORP's Executive Board. In the mid-nineties, then-director Bob Pfieffer first began working with Meritt to produce oyster seed in shell bags. (The bags made it easier to handle large number of seed oysters.) Early on, Pfieffer attracted a host of volunteers who would fill bags with shell, load them into tanks so that larvae would have surfaces to settle on, then unload the bagged seed and move them onto boats for placing in nurseries — after spat had grown for a month or two, the bags were hauled up and shipped to restoration sites where they were cut open and oysters sent to the bottom for grow out.

"All in all, this process is tremendously labor intensive," Meritt says, "but we went from making and moving a few thousands shell bags a year to more than 25,000." This number was hardly huge by west coast production standards where the industry is nearly all based on hatchery production, says Meritt, "but as we produced more shell bags, we also had to produce more larvae and then more algae [for feeding larvae]."

To produce substantially more oyster seed, more setting tanks were required — ORP and its partners were major players in helping to get grants that justified that need. When Charles Frentz took over ORP, he brought a strong business background, Meritt says. "He's been a key player in the advances we see today."

Those advances are not only in greater production of spat, but in getting new technology online, for example, a specially designed shell-washing machine located at Horn Point for cleaning large volumes of shell to remove organic and inorganic matter before the shells are put into setting tanks. Another significant change has been the handling of shell and seed. "Shell bags were always a great limiting factor in significantly increasing production," Meritt says, "and I've always disliked using them for the obvious reasons of the large need for manpower." Several years ago he, Goldsborough, Eddie Walters, ORP field manager, and Frentz got together to look at alternatives. Using the high grade stainless steel proven effective in setting tanks used by French hatcheries, Meritt helped design the stainless steel setting cages that are in use today. One cage handles the same amount of shell as 54 shellbags, and it is all done mechanically.

It only takes a couple of people and a boom truck a short time, says Meritt. And those tanks are always filled, Frentz adds.

ORP Partners

Maryland Department of Natural Resources
Maryland Watermen's Association
Chesapeake Bay Foundation
University of Maryland Center for Environmental Science
NOAA
Chesapeake Bay Program
State of Maryland Office of the Governor
Chesapeake Alliance
Chesapeake Bay Trust
EPA
Army Corps of Engineers
Maryland Department of Agriculture
Maryland Department of the Environment
National Fish & Wildlife Foundation
University of Maryland Sea Grant College
The Academy of Natural Sciences
World Wildlife Federation
Nanticoke Watershed Alliance
Keith Campbell Foundation for the Environment
Community Foundation of the Eastern Shore
Century Ford
Maryland Saltwater Sportfishing Association
Maryland Scuba Association
Weems Creek Conservancy
Northrup Grumman

From the ORP website, www.oysterrecovery.org

Frentz has also had a hand in helping develop the concept of "managed reserves," an approach to managing public oyster grounds for sustainability that the Maryland Watermen's Association, Maryland Department of Natural Resources and the ORP have agreed to. In contrast to oyster sanctuaries, reserves will be harvested on a limited basis only after oysters have reached four inches (the legal minimum is three inches) — oyster bars will be monitored, so that if disease does become established before oysters reach four inches, watermen will be given the go-ahead to harvest them.

Just how ORP has been going about coordinating oyster restoration is available at its web site at www.oyster recovery.org. Look up oysters plantings over these last couple of years and you'll find out *how many* oysters have been planted and *where* in systems such as the Severn, the Patuxent, the Chester, the Choptank, the Magothy rivers. You'll find other information such as the date and extent of the plantings, how many seed were planted and the broodstock they derive from.

ORP and its partners have been targeting some of their restoration projects at mid-range salinity sites in these rivers, regions where native oysters are especially vulnerable to Dermo disease and, in some instances where salinities are above 15 parts per thousand, MSX as well. They have been having success, Frentz says, despite disease pressures. Still, Dermo and MSX are entrenched throughout the Bay. While their virulence may abate this year because of heavy rainfall — lowered salinities generally lead to decreases in virulence — disease remains the major limiting factor in restoring sustainable populations of *Crassostrea virginica* in the Chesapeake.

Did the ITC Get It Wrong?
Crabmeat Imports Three Years Later

Doug Lipton, Marine Economics Specialist, Maryland Sea Grant Extension

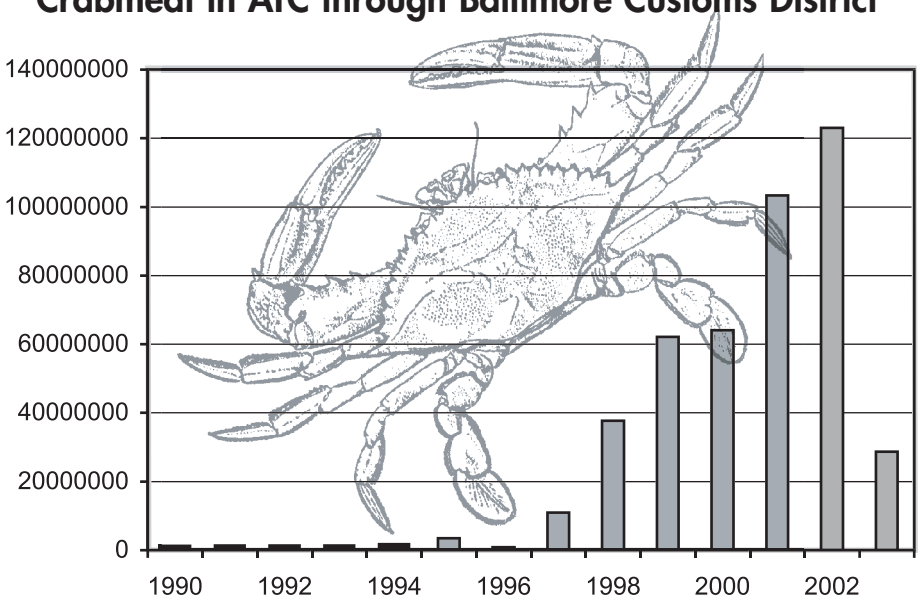
Maryland recently lost yet another of its few remaining major crabmeat plants, the owner citing competition from low-priced imports as a major reason, though the Chesapeake Bay's continuing low harvests of blue crab and new regulations that prevented Maryland processors from buying legally caught sponge crabs (egg-bearing females) were also factors. Imports, however, have had the major impact. An article in *Maryland Aquafarmer* in 2000 chronicled the increase in imported crabmeat and the International Trade Commission's (ITC) investigation (see www.mdsg.umd.edu/Extension/Aquafarmer/Summer00. html#4).

In August 2002 the ITC voted 3-2 to reject the petition of the Blue Crab Coalition — an organization of domestic blue crab processors — that sought relief from injury resulting from large and rapid increases in crabmeat imports. Notably, the Commission Chair and Vice Chair dissented from the determination:

> crabmeat from swimming crabs [they wrote] is not being imported into the United States in such increased quantities as to be a substantial cause of serious injury or the threat of serious injury to the domestic industry producing an article like or directly competitive with the imported article (USITC Publication No. 3349. August, 2000). (The report is available at FTP://ftp.usitc.gov/pub/reports/opinions/PUB3349.PDF)

In reaching its decision, the ITC looked at a "snapshot" of the state of the domestic crabmeat processing industry in 1999 and then based their findings on a survey that covered the period from 1995 to 1999. While reasonable people can disagree that

Crabmeat in ATC through Baltimore Customs District



increased levels of imported crab meat was not currently the cause of serious injury to the domestic industry (the 3-2 vote is evidence of the disagreement), it takes some prognostication to determine whether imported crabmeat is causing a threat of serious injury. With the closure of Maryland companies and the continued increase in imports, a Monday morning quarterback might conclude that the ITC missed the threat that imports have created.

The figure on the left shows the value of imported crabmeat in airtight containers (ATC) through the Baltimore customs district from 1990 to March 2003. Baltimore has become the dominant entry place in the U.S. for imported crabmeat from swimming crabs. The Commission was deliberating in early 2000, so it only saw the three years of substantial growth that started in 1997 when imports into Baltimore went from less than one million dollars in 1996 to almost $11 million in 1997. This growth was followed by a jump to $38 million in 1998 and $62 million in 1999.

After the three years of tremendous increases, imports increased only slightly in 2000 to $64 million. There has been speculation that expansion of imports slowed as the industry waited to see what the Commission would decide. A year after the ITC determination of no injury, imports jumped to $103 million in 2001 and $123 million in 2002.

One can only wonder what the ITC determination would have been if it had waited until 2002 to file its petition. Using the five-year time frame of 1998-2002, the Commission would have seen the value of imports skyrocket by 326% and the impact on the domestic industry, would have been more evident.

The Aquaculture Research and Development Project at the University of Maryland Eastern Shore

Steven Hughes, University of Maryland Eastern Shore

The University of Maryland Eastern Shore (UMES) has been involved in aquaculture research, graduate education, and industry support for more than a decade. UMES's Aquaculture Research and Development Project (ARDP) is currently conducting studies on the nutritional and physiological requirements of several species including striped bass, hybrid bass, tilapia, American eels, and blue crabs. In addition, we are working on the development of tertiary water treatment methods for recirculation systems for fish and blue crabs.

Though many of the research projects are basic in nature, several are designed to provide information directly to aquaculturists. We are also seeking to work cooperatively with Maryland growers in developing projects addressing their specific needs.

UMES facilities for aquaculture and fish physiology research include a nutrition laboratory equipped for both basic and applied research in feed compositional analyses; hatchery and rearing space with both flow-through and recirculating system capabilities; a recently completed fish physiology and water quality laboratory that contains equipment and instrumentation required for supporting the ARDP research program; and a laboratory-scale California Pellet Mill for producing experimental feeds.

ARDP's focus is fish physiology and nutrition, aquatic animal husbandry, the impacts of water quality on fish growth and physiology, and the chemosensory control of feeding behavior. The project also supports graduate-level courses and participates in training courses, technical conferences, and extension activities for the general public. Staff also visits private facilities to help assess culture or system design problems.

Among ARDP's research focuses are stress physiology of fishes, the role of aqueous ions on the mitigation of stress and their impact on nitrogen metabolism within fishes. Research on the effects of aqueous calcium, sodium, potassium, and chloride will help clarify the control mechanisms involved in osmoregulation and the levels of ammonia and urea carried in the blood or excreted. The results of these studies could provide a better understanding of the functional cause of several unexplained mortality syndromes, including the impact of aqueous ions on the survival and development of larval striped bass.

I have been involved in aquaculture diet development research for over 20 years; my most recent work has aimed at developing more efficient feeds for tilapia and striped bass. Identifying alternative protein sources to provide more economical food is a current research priority, and understanding the roles of lipids in the nutrition and health of these species is becoming another important focus.

Other research is examining the effects of different feed and ingredient-processing methods on nutrient availability, the use of animal waste products from other animal husbandry industries as feed ingredients for fish, and the role of environmental parameters on nutrient digestibility. Grant program, www.nsgo.seagrant.org

For more information on ARDP research and outreach, contact Steven Hughes at sghughes@umes.edu.

Upcoming Meetings

Oyster Research and Restoration in U.S. Coastal Waters: Strategies for the Future

September 8-9, 2003 • Annapolis, Maryland

This meeting will be organized around a series of plenary sessions that will (1) summarize the status of oyster fisheries in the U.S., (2) share recent developments at the leading edge of oyster disease research, (3) Synthesize developments for management and restoration of oyster populations. Facilitated workgroups will be charged with developing recommendations and strategies for future research investments focused on:

* Managing Around Disease
* Genetic Manipulation and Population Genetics
* Frontiers in Disease Research
* Managing for Ecological Benefit
* Public Health Issues and Impacts on Oyster Marketing

For the agenda, registration and hotel reservations, please visit the web, www.mdsg.umd.edu/oysters/meeting, or contact Maryland Sea Grant, 301-403-4220, x 11.

New Maryland Sea Grant Magazine

The first issue for 2003 of *Chesapeake Quarterly*, Maryland Sea Grant's new magazine, focuses on skipjacks and the oyster fishery in Maryland. The official Maryland state boat, skipjacks have become a symbol of the Bay itself and its rich maritime history. Both keepers of a tradition and exploiters of an important ecological resource, skipjacks have captured our imagination while presenting us with a poignant dilemma. How do we preserve the precious past while safeguarding the Bay's ecological future? Michael Fincham considers this question, while tracing both current scientific efforts to restore the Bay's vertical oyster reefs and maritime heritage programs aimed at repairing and keeping afloat the nation's last commercial sailing fleet.

This issue of the online version of the magazine also features video clips for the first time, including footage of Art Daniels, the oldest working skipjack captain; the restoration of his boat, the *City of Crisfield*; and scientists working to restore oyster reefs. To see them, visit the web at www.mdsg.umd.edu/CQ.

This issue complements and serves as a companion to the last issue for 2002 (volume 1, number 3) of *Chesapeake Quarterly*, which posed the question, "Does the Bay need a new oyster?" Taken together, these two issues help to explain many of the complexities — ecological, scientific, social and historical — that face the Chesapeake's struggling oyster fishery. For a free subscription to the magazine, e-mail connors@mdsg.umd.edu or call Jeannette Connors at 301-403-4220, x 22.

New Publications

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Finfish

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Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, University of Maryland, College Park, and local governments. Thomas A. Fretz, Director of Maryland Cooperative Extension, University of Maryland, College Park.

The Maryland Sea Grant Extension Program is a joint effort of the Maryland Cooperative Extension and the Maryland Sea Grant College, supported in part by NOAA Office of Sea Grant, Department of Commerce.

The **Maryland Aquafarmer** is a quarterly publication of the **MARYLAND COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MARYLAND COLLEGE PARK AND EASTERN SHORE** with support from the **MARYLAND SEA GRANT COLLEGE PROGRAM**. This publication is mailed free of charge to those interested in aquaculture research and education. Address corrections are requested. The publication is also accessible on the World Wide Web through the Maryland Sea Grant College home page. Our address is:

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