MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK • EASTERN SHORE

MARYLAND AQUAFARMER ONLINE

http://www.mdsg.umd.edu/Extension/Aquafarmer/index.html

MARYLAND SEA GRANT EXTENSION • 4321 HARTWICK ROAD, SUITE 300 • UNIVERSITY OF MARYLAND • COLLEGE PARK, MD 20740 • (301) 403-4220

Issue 1999-01 **Winter, 1999**

In This Issue:

1. HACCP for Soft Crab Producers
2. Domesticating Striped Bass Broodstock
3. Hard Clam Potential for Maryland
4. Maryland Aquaculture: Looking Ahead
5. U.S. Aquaculture Census Underway
6. Permits Required for Fish Shipped to Maryland
7. Aquaculture Permit Requirements
8. Maryland Sea Grant Extension Program Internet Addresses
9. Subscription Information

HACCP for Soft Crab Producers

Thomas E. Rippen, Maryland Sea Grant, and Robert A. Fisher and Michael J. Oesterling, Virginia Sea Grant

Nearly everyone associated with the seafood industry is aware of the mandatory HACCP (Hazard Analysis Critical Control Point) regulation which took effect December 18, 1997. This is a proactive program designed to minimize food safety hazards associated with the consumption of seafood. It is based on a systematic process of identifying potential hazards associated with the product or processing steps, determining where those hazards are most effectively controlled, and documenting that proper procedures are followed.

Generally, watermen are exempt from this regulation which was written for the processing industry. Even boxing whole fish on ice and delivering them to the market is exempt if watermen (or aquaculture producers for that matter) only handle their own product and do not hold, or inventory, fish for a market advantage. Many individuals shed peeler crabs, including many watermen who produce their own soft crabs. Others buy all of their peelers. In either case, the HACCP exemption for watermen does NOT apply. Placing crabs in a "float" to shed is considered a holding function which is covered by the regulation as processing.

The requirement of HACCP compliance does not mean that soft crab producers must have a HACCP plan; in reality, most operations which shed domestic crabs will not need one. Processors are required to conduct a hazard analysis to determine the food safety implications of their products and processing procedures. HACCP is required only if that analysis reveals a hazard other than one directly related to sanitation. Crabs caught in waters open to commercial harvesting are nearly always within tolerances for contaminants, such as pesticides or heavy metals. This is confirmed during hazard analysis. Crabs may contain bacteria or viruses capable of causing illness in humans but only if eaten raw or very lightly cooked. Since soft crabs are thoroughly cooked in traditional recipes, they are inherently safe to eat.

Crab shedding operators are not off the hook though. Whether or not a HACCP plan is needed, the regulation requires that eight key sanitation areas be monitored and documented with a record keeping system. These are specific requirements extracted from the Good Manufacturing Practices (GMPs) published as federal regulation. Many shedding operations were not built to meet standards expected of more conventional processing facilities, leaving some confusion as to how the eight sanitation areas and records requirements should be implemented.

To help soft crab producers to better understand their obligations under the GMPs and the HACCP regulation, faculty at the Virginia Institute of Marine Science and the University of Maryland offered a series of workshops for the industry in 1997 and 1998; participants received an introduction to the essential principles of HACCP sanitation issues and their responsibilities under the regulation. A model hazard analysis worksheet was discussed in detail as was an example sanitation plan and related records.

Soft crab producers are expected to address the basic sanitation controls listed in the regulation (see "Sanitation Requirements Regulation"). In all cases, if any crabs are processed (for example, trimmed and wrapped), the facility must meet all of the sanitation requirements that are applicable to the site. A simple check sheet for recording conditions at the facility will usually suffice. Common areas needing attention include:

- A source of clean water for washing hands and utensils, and for rinsing trimmed crabs
- An area dedicated to processing, such as a screened-in area with sink and countertop
- Access to a sanitary toilet
- Use of appropriate detergents and sanitizers
- Pest control measures implemented
- Protection of packaging materials from contamination
- Proper storage of chemicals, pesticides, cleaning agents or fuel

When these conditions cannot be met at the shedding facility, they can be transported for processing to a suitable location off-site. Local ordinances permitting, most states allow the use of renovated garages or other fairly simple modifications to existing structures if dedicated to processing.

If you have questions or need assistance with HACCP implementation please contact: Tom Rippen, Seafood Technology Specialist, 30921 Martin Court, Princess Anne, MD 21801. Phone 410-651-6636 or send an e-mail to: terippen@umes.umd.edu.

Sanitation Requirements Regulation

a. **Sanitation SOP.** Each processor **should** have an implement at written sanitation standard operating procedure (herein referred to as SSOP) or similar document that is specific to each location where fish and fishery products are produced. The SSOP should specify how the processor will meet those sanitation conditions and practices that are to be monitored in accordance with paragraph (b) of this section.

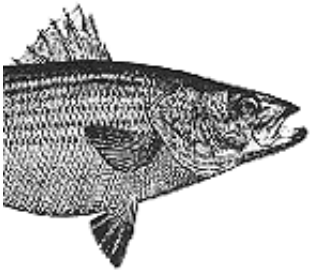
b. **Sanitation Monitoring.** Each processor **shall** (must) monitor the conditions and practices during processing with sufficient frequency to ensure, at a minimum, conformance with those conditions and practices specified in part 110 [GMPs] of this chapter that are both appropriate to the plant and the food being processed and relate to the following:
    1. Safety of the water that comes into contact with food or food contact surfaces, or is used in the manufacture of ice;
    2. Condition and cleanliness of food contact surfaces, including utensils, gloves, and outer garments;
    3. Prevention of cross-contamination from insanitary objects to food, food packaging material, and other food contact surfaces, including utensils, gloves, and outer garments, and from raw product to cooked product;
    4. Maintenance of hand washing, hand sanitizing, and toilet facilities;
    5. Protection of food, food packaging material, and food contact surfaces from

adulteration with lubricants, fuel, pesticides, cleaning compounds, sanitizing agents, condensate, and other chemical, physical, and biological contaminants;
6. Proper labeling, storage, and use of toxic compounds;
7. Control of employee health conditions that could result in the microbiological contamination of food, food packaging materials, and food contact surfaces; and
8. Exclusion of pests from the food plant. The processor shall correct in a timely manner, those conditions and practices that are not met.

c. **Sanitation Control Records.** Each processor shall maintain sanitation control records that, at a minimum, document the monitoring and corrections prescribed by paragraph (b) of this section. These records are subject to the requirements of Sec. 123.9.

d. **Relationship to HACCP Plan.** Sanitation controls may be included in the HACCP plan, required by Sec. 123.6(b). However, to the extent that they are monitored in accordance with paragraph (B) of this section they need not be included in the HACCP plan, and vice versa.

top



Domesticating Striped Bass Broodstock

Merrill Leffler, Maryland Sea Grant

The striped bass aquaculture industry may have grown rapidly over this last decade - still it constitutes only a tiny portion of the U.S. seafood economy. A major limitation to that growth is an inability to spawn the fish year round as is done with other more valuable aquaculture species. The fact that growers must depend on collecting fish from the wild restricts the numbers of fish they can spawn. What we need, says Reginal Harrell, Maryland Sea Grant Finfish Specialist, is "domesticated, not captive, broodstock." He has focused his research career on the culture and genetics of striped bass and its hybrids. In a current project, he and John Jacobs have been comparing the growth characteristics of striped bass juveniles from five different regions of the east coast in order to determine if some strains reach harvest size substantially faster than others.

While their findings will be of interest to growers, there are limitations, he says, to just how applicable the results are - that is because Harrell has to evaluate the offspring of broodstock captured in the wild. There is no baseline to the broodstock stripers from Florida, South Carolina, Maryland and Canada - they all came to maturity under different conditions in their regions. Different temperatures, different salinities, different nutrition. In other words, says Harrell, we don't know whether our results of juvenile growth to harvest size were the result of inherent differences in those strains or if they were due to the environmental conditions the fish experienced before we captured and spawned them.

The only way to derive conclusive comparisons would be to have broodstock fish that were first reared, then bred in the hatchery. But domesticated striped bass broodstock have been very slowly coming - that means rearing juvenile striped bass to maturity, perhaps four to six years or so, then spawning them; that second generation is then raised to maturity, then spawned, and so on. The ability to do this has been nearly impossible. And yet, without such domesticated broodstock, it is next to impossible to compare different strains, let alone breed fish for different traits, as agriculturalists have bred animals for centuries.

Over the last 15 years, though, University of Maryland researcher Curry Woods has quietly been doing just that: breeding striped bass at the Crane Aquaculture Facility. And he has begun to have success - small, but significant success, says Harrell - that holds exciting promise for the future farming of striped bass and its hybrids.

"Some of Curry's work," says Jim Carlberg, president of Kent Sea Farms in San Diego, one of the nation's largest striped bass producers, "is the only such work of its kind in the world."

Breeding Selective Stock

"We have been slowly developing a domestic population of pure striped bass," says Woods - "we're now into the fourth filial generation removed from the wild." This is a domestic population, he points out, rather than an acclimated captive one. "It's a distinction" he says "that's not often made."

Woods's operation at Crane, in Baltimore City, has produced the first selectively bred stocks, namely superior males and superior females. "We have a database on each fish. We know what we have to choose from," he says, with regard to growth. In a recent field trial, for example, he compared the progeny produced by third generation striped bass with a first generation sunshine bass (a hybrid cross between a white bass female and striper male). "Our fish are growing 40 percent faster," he says. With domesticated broodstock whose characteristics are known, growers can selectively breed for those characteristics, whether they are faster growth, better disease resistance, or higher feed conversion efficiency. "We already have examples of how you can breed for growth," Woods says. "It took us six years to get the first females to produce; we've gotten third generation stripers to reach maturity in three years."

"We're still in a research phase," Woods is quick to point out. "If you cannot provide the exact environmental cues that fish experience in the wild, you reach hurdles that can only be overcome by hormonal induction therapies, such as Yonathan Zohar at the University of Maryland, Center of Marine Biotechnology has been developing." Ninety-five percent of the time, he says, "our fish will not spawn without such assistance."

But maybe five percent of the time they do, which means that some individual fish in some families are getting the correct environmental signals. Woods points out, however, that he cannot get domestic fish to spawn with regularity. "Without hormonal therapies," he says, "we would be unable to continue our program." That's why he is focusing his research on understanding just what kind of stress broodstock fish undergo. "Stress physiology is one area that we have to quantify with science," he says. Such quantification involves understanding the role of diet.

Research has been underway to clarify the nutritional requirements stripers at different stages must have. For example, what are the amino acid requirements, the fatty acids that larvae, juveniles, or mature females need? "We are trying to develop effective diets for broodstock fish," he says, "so that they can make great gametes." These are major challenges. If commercialization is to really take off, says Woods, it will need an integrated operation.

"Domestication is the key," he reiterates. "Simply bringing in captive fish will not do it." Through domestication, he says, we'll have individual stripers that will enable us to provide more uniformity - "we won't have to catch wild fish, hoping they don't die on the way to the hatchery. We won't have to play Russian roulette anymore."

- Adapted from Maryland Marine Notes.

top

Hard Clam Potential for Maryland

Don Meritt and Don Webster

The hard clam *Mercenaria mercenaria* has long been harvested in the saltier waters of the lower portion of Maryland's Chesapeake Bay south into Virginia and along the coastal bays that border the Atlantic. Clams are a profitable fishery along most of the Atlantic coast from New England to Florida.

Largely forgotten by most Marylanders are the seaside bays of the state where Maryland has some of the cleanest seaside estuaries in the region. While severe disease problems have all but wiped out oyster culture in the bays, there is a viable hard clam fishery. Hard clams are not susceptible to the diseases that have so severely impacted oyster populations in the region although one, known as QPX, looms in the background. QPX (short for Quohog Parasite Unknown) has recently been showing up in a wide range of locations, although it has not yet shown itself in Maryland.

Hard clams are also excellent candidates for aquaculture. Many of the clams produced along the Atlantic seaboard are the result of a hatchery-based aquaculture. While the culture of hard clams is a common practice in many areas, until now few serious efforts have been made in Maryland to add this species to the list of aquaculture products.

One only has to look at the flourishing and expanding hard clam aquaculture industry in place in most Atlantic coastal states to see the potential for production from Maryland's seaside bays. During 1998, a commercial-scale hard clam aquaculture facility was established near Public Landing, Maryland. Working with personnel from the Maryland Sea Grant Extension Program, and with additional expertise from Sea Grant aquaculture specialists in nearby states, a hard clam system was installed and successfully operated by a local resident.

A series of trays were set up as upwellers and seed clams of 2 mm were placed in them. Growth up to 20 mm took place over the following weeks. While many of these initial clams were sold as seed to others, some were retained in order to evaluate local growout areas and techniques. In addition to the clams, some seed oysters were also introduced into the operation in order to assess their growth and survival in the face of normally severe disease pressure. Plans for 1999 are to expand the growout operation and analyze the growout potential of the area.

In one short growing season this facility has produced market quantities of seed clams for sale. Using equipment provided by the Horn Point hatchery, part of the University of Maryland, Center for Environmental Science, this operation has seen excellent growth of seed clams. Plans are underway to expand this project and evaluate various grow-out methods for hard clams in Maryland. Indications are that there is room for other operators and grow-out sites and that this could be a boost to the economically depressed seafood industry of the region. Given the amount of suitable bottom available for clam grow-out in the state's seaside bays the potential for the industry to expand is excellent.

top

Maryland Aquaculture: Looking Ahead

Jackie Takacs, Southern Maryland Agent

Ten years ago, the state of Maryland published the Maryland Aquaculture Plan - developed from the recommendations of an aquaculture task force and the House Environmental Matters Aquaculture and Oyster Workgroups, it set out three broad strategies for fostering the development of aquaculture in Maryland: administrative, legislative and research, technology transfer and higher education.

The plan identified the Maryland Department of Agriculture as the lead agency to promote development and coordinate efforts of all other state agencies. It established an Aquaculture Policy committee responsible to the Governor and an Aquaculture Advisory Committee, which included individuals representing aquaculture, commercial fishing, seafood wholesalers/retailers, legislators, agriculture and state agencies. The plan identified the need for funding and financing mechanisms. And it delineated the roles of state agencies and the University of Maryland: the Department of Agriculture was to responsible for coordination and promotion; the Department of Natural Resources was to be responsible for regulation and enforcement; and the University was to be responsible for research, technology transfer and higher education.

The Maryland Aquaculture Plan has provided the framework over the last decade from which the state has operated. While numerous goals have been met, the aquaculture industry in the state and nationally has developed in ways that the current plan cannot address. For instance, advanced research in reproductive endocrinology, immunology, genetics, nutrition and engineering has made important gains that need to be addressed. Meanwhile, industry producers are faced with challenges and problems that relate to a number of wide-ranging issues from disease to wastes to seafood safety regulations.

For these reasons, a new five year plan to cover the years 2000-2005 is now being developed. It will focus on four general topics: (1) finfish culture, (2) shellfish culture, (3) culture of other species (e.g., baitfish, ornamentals), and (4) education, extension, research and technology. Topic committees will review and comment on current production status and technologies, permitting and legal requirements/restrictions, economic marketing requirements and needs and education and research needs in general and for specific species.

If you have an interest in the Maryland aquaculture industry, you should involve yourself directly by becoming a member of any of these committees. For more information, contact Roy Castle, Maryland Department of Agriculture, Aquaculture Office, 410-841-5724.

top

U.S. Aquaculture Census Underway

If you are an aquaculture producer, you should have received a 1998 Census of Aquaculture questionnaire from the National Agricultural Statistics Service, U.S. Department of Agriculture. According to Ray Garibay of the Maryland Agricultural Statistics Service, this first-ever national aquaculture census will provide a comprehensive picture of the industry's size and diversity. The census includes all operations that produced or sold $1,000 or more in aquaculture or aquaculture products during 1998. In addition to food fish and molluscs, the census will cover baitfish, ornamental fish, crustaceans, animals (e.g., frogs, turtles), algae and sea vegetables such as seaweed. While the National Agricultural Statistics Service has recorded trout and catfish production for the past 10 years, the 1998 Census will be the first accounting of all aquaculture of all aquaculture species nationwide and will provide a benchmark of the industry's size and diversity. The census is planned for every five years, Garibay says, or as the industry requires it.

Producers are being asked about the size of their operation, methods of production, sales by type of aquaculture produced, point of first sale outlets, cooperative agreements and contracts, source of water and distribution of aquaculture products for restoration or conservation.

Results of the census will be available beginning in the fall of 1999 for free on the Internet at http://www.usda.gov/nass/ and selected universities, colleges and public libraries. To purchase a copy, call 1-800-999-6779 or write ERS/NASS, 5285 Port Royal Road, Springfield, Virginia 22161.

top

Permits Required for Fish Shipped to Maryland

All live fish entering Maryland require a health certificate, unless they are delivered directly to the restaurant or market. Food size and other fish that will be held for resale must have a certificate, according to Roy Castle of the Maryland Department of Agriculture. All fish stocked in public and private open waters are required to have a health certificate. Only tropical aquarium fish are exempted.

For further information, contact Roy Castle at (410) 841-5724.

top

Aquaculture Permit Requirements

Permits are required to operate aquaculture facilities in Maryland, for instance to propagate finfish, shellfish, crustaceans and aquatic plants. They are also required for ornamental fish (Koi, goldfish), aquatic plants, fee fishing, crawfish and recirculating systems. The permit allows for the purchase, possession, sale or transport of aqua-farmed products.

For an application or further information contact, Ben Florence, Maryland Department of Natural Resources, 410-841-5914.

top