

## MANAGING MARYLAND AQUACULTURE

### Background

The Task Force on Seafood and Aquaculture finished its work in the fall of 2004 with a report to the General Assembly. This led to the passage of HB 1188 during May 2005 legislative session. The bill fundamentally changed the way aquaculture was dealt with in the state by helping to solve problems that had been identified by the task force as impediments to development.

Among significant changes were the creation of an Aquaculture Review Board (ARB) to assist in the timely processing of applications and an Aquaculture Coordinating Council (ACC) to advise on policy matters. These groups have been meeting for the past two years and have had significant achievements to date.

### MARYLAND AQUACULTURE REVIEW BOARD

Comprised of five (5) members from the state agencies with responsibility for aquaculture permitting and oversight in regulatory compliance. This Board meets monthly to discuss and process applications for aquaculture businesses and provides applicants with information during the review process. The Aquaculture Coordinator (AC) acts as the entry point for all applicants and provides tracking during this process. The AC serves as Chairman of the ARB and helps to guide interagency differences for resolution in a timely manner.

Membership, representatives of the Maryland:

- Department of Agriculture - Aquaculture Coordinator, Chair

- Department of the Environment

- Department of Health and Mental Hygiene

- Department of Natural Resources

- Board of Public Works

## AQUACULTURE COORDINATING COUNCIL

Comprised of seventeen (17) legislatively designated members who are impacted by, or have an interest in, aquaculture development. The Coordinating Council guides the responsible development of this industry. Their duties include:

- ▶ making annual proposals for “advancing the aquaculture industry” to the Governor and General Assembly
- ▶ conducting studies of projects and products that will lead to expanding the industry
- ▶ developing Best Management Practices
- ▶ providing recommendations for the establishment of Aquaculture Enterprise Zones
- ▶ the Council is also charged with regularly reviewing state regulations affecting aquaculture and recommending regulatory changes

### Membership:

Honorable Katherine Klausmeier, Maryland Senate

Honorable Tony O'Donnell, Maryland House of Delegates

Mr. Karl Roscher, Maryland Department of Agriculture

Vacant, Maryland Natural Resources Police

Ms. Gina Hunt, Maryland Department of Natural Resources

Vacant, Department of Business and Economic Development

Mr. George Harman, Maryland Department of Environment

Ms. Erin Butler, MD Dept of Health and Mental Hygiene

Dr. Andrew Lazur, University of Maryland Center for Environmental Science

Dr. Fredrick Wheaton, University of Maryland College Park

Mr. Donald Webster, Maryland Cooperative Extension, Vice Chairman

### Aquaculture Industry:

Mr. Howard Crum, Frederick, MD, freshwater fish

Mr. Stephen Gordon, Snow Hill, MD, shellfish

Mr. Robert Parkinson, Hollywood, MD, shellfish

### TFL Licensees:

Mr. Craig Mask, Port Republic, MD, Chairman

Mr. Benjamin Parks, Cambridge, MD

Mr. John VanAlstine, Shadyside, MD

Two projects of the Coordinating Council that have a direct bearing on oyster aquaculture are development of Best Management Practices for the aquaculture industry and the current project to recommend Aquaculture Enterprise Zones. These represent a significant step forward for the industry that will hopefully make Maryland a leader in the development of sustainable aquaculture in the US.

Portions of the Best Management Practices manual are provided here for use of the Commission. The entire document is available as a PDF file on the Maryland Department of Agriculture website. Therefore it is readily available to the industry and public. The BMP manual contains six sections. These were written to apply to the broad scale of products currently under cultivation in the state. We provide summary information on the sections but only the shellfish section is reprinted in its entirety.

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BEST MANAGEMENT PRACTICES  
MANUAL FOR MARYLAND AQUACULTURE  
Developed by the  
MARYLAND AQUACULTURE COORDINATING COUNCIL  
November 2006 (revised July 2007)

## INTRODUCTION

Aquaculture, or the production of aquatic plants and animals, has been a part of Maryland's history for over a century. The industry currently consists of a diverse array of products ranging from traditional shellfish such as oysters to aquatic plants for use in water gardens and shoreline stabilization. In addition, the use of

aquaculture products for the restoration of depleted or disrupted natural populations has been an area of increasing research and interest in recent years. Legislation enacted during 2005 created the Maryland Aquaculture Review Board (MARB), which provides regular interagency review of permits and issues across departmental lines. The Maryland Aquaculture Coordinating Council (MACC) was also created, comprising seventeen designated members from industry, academia, regulatory, and political categories. Among the tasks the MACC was charged with was the development of Best Management Practices (BMP) for all forms of aquaculture.

To address this, the MACC created six subcommittees. These were chaired by MACC members, with additional membership provided council members as well as knowledgeable individuals able to provide insight into development of the BMPs. During the summer and fall of 2006, these subcommittees met and formulated their drafts. Subcommittee meetings were open to the public for input by non-subcommittee members attending.

These BMPs are formed from existing state and federal laws and regulations, as well as voluntary measures that are recommended. Their purpose is to provide producers with a base of knowledge regarding expectations of them in the development of their businesses. In all, they comprise a roadmap for those entering the aquaculture industry to follow as they grow their businesses in the state. These will be reviewed and revised on a regular basis in the hope that the industry will continue to grow while maintaining a position of environmental compatibility. While these Best Management Practices represent the first effort, they should be seen as a "work in progress". Another task of the MACC is to review these, as well as all laws and regulations pertaining to aquaculture in Maryland, on a regular basis.

## DEFINITION

Best Management Practices are defined as methods of operating an aquaculture business to minimize to reduce, so far as practicable, pollution or environmental disruption. A key feature of aquaculture production is the reliance on clean water. Whether in the production of shellfish, finfish, or other aquatic life forms, water quality is a key parameter in the economic success of the business. In addition, aquaculture producers recognize the relationship between production and natural resources. These BMPs provide a voluntary set of standards and procedures for improving production while helping to preserve the environment. They are a key in the factor that has come to be known as "sustainability" – a desirable state that ensures the long-term efficacy of the business.

These BMPs combine legislative and regulatory mandates, as well as suggested and accepted practices, which can help the aquaculture producer become a good neighbor within his area of operation. Through them, the MACC hopes to provide support for the growth of the aquaculture industry in Maryland, as well as its continued economic success.

## SECTION I: WATER RESOURCES AND MANAGEMENT

### Subcommittee Membership:

Dr. Andrew Lazur, University of Maryland Center for Environmental Science, Chair

Mr. George Harman, Maryland Department of Environment

Mr. Jon Farrington, Industry

The intent of best management practices (BMP's) for the use and management of water resources for aquaculture purposes is to provide operational guidelines to ensure long term environmental and production sustainability. This collection of recommended practices is designed to address specific issues of water use and management covering a variety of aquaculture production systems and species and many are based on experience from other states which have implemented BMPs as

the primary means of regulating the industry. Though this section covers water use issues and practices, there are additional BMPs within other sections of this manual that producers will need to understand and implement depending on their specific production systems and goals. It is important to note that BMPs should be considered a continuous work in progress as new species; culture and water use technology are developed, and therefore, require periodic field verification and will be updated as necessary.

Best management practices for water resources and management are divided into sub-sections as follows:

- I. Site Development and Wetland/Habitat Protection
- II. Water Supply and Management
- III. Pond Water Management
- IV. Water Quality Enhancement
- V. Effluent Management and Treatment

## SECTION II: PRODUCTION SYSTEMS

Subcommittee Membership:

Mr. Craig Mask, TFL, Chair

Dr. Fred Wheaton, University of Maryland, College Park

Mr. Karl Roscher, Maryland Department of Agriculture

Mr. Jon Farrington, Industry

Mr. Rich Bohn, Maryland Department of Natural Resources

Production systems addressed in this section are land-based as opposed to systems in tidal waters. These production systems may utilize water that is fresh, brackish, or salt. The use of brackish water or saltwater requires special considerations. Design and operation must prevent environmental degradation caused by the salt content of the water or byproducts.

The following provides a framework with references to standards and publications. This should be used as a guideline when planning, designing, constructing, and operating a production system. Other laws and regulations may also apply. Best management practices for production systems are divided into the following sub-sections:

- I. Ponds
- II. Recirculating Systems
- III. Flow-through Systems
- IV. Species Management
- V. Worker Safety

### SECTION III. SHELLFISH CULTURE

#### Subcommittee Membership:

Mr. Steve Gordon, Industry, Chair

Mr. Ben Parks, TFL

Ms. Gina Hunt, Maryland Department of Natural Resources

Ms. Erin Butler, Maryland Department of Health and Mental Hygiene

Mr. Jon Farrington, Industry

Mr. Rich Bohn, Maryland Department of Natural Resources

Dr. Don Meritt, University of Maryland Center for Environmental Science

Mr. Mitch Tarnowski, Maryland Department of Natural Resources

Mr. Luke Breza, Industry

Mr. Thomas Taylor, Jr., Industry

Ms. Lori Orme, Industry

Mr. Ernie Nichols, Industry

Shellfish have long been a major part of Maryland seafood production. While the state had some of the earliest leasing laws, created from an interest in aquaculture and increasing production of the Eastern oyster, socio-political problems have kept

the shellfish aquaculture industry from growing significantly. With the drastic decline in the oyster resource due to diseases, and the growth of the hard clam industry in the region, there exists a need to encourage shellfish growers to add to the population of these important shellfish. Growers, and the shellfish they produce, can play a large part in the restoration of the Chesapeake and coastal bays while providing quality seafood to an expanding market.

This section addresses the following areas:

- I. Site Selection
- II. Operations and Management
- III. Permitting
- IV. Human Health Issues
- V. Biological Management

#### I. Site Selection and Access

##### A. Riparian Rights

Selecting a location to cultivate shellfish in Maryland requires many considerations, including legal restrictions and the rights of adjacent landowners. Maryland is one of many states that follow English common law often referred to as a Riparian Right. In *DNR v. Adams*, the Court of Special Appeals defined a riparian property owner as a person who owns property bordering on a body of water. Code of Maryland Regulation 08.04.01.20 further defines this as a person possessing riparian rights, specifically including the right to gain access to tidal water.

Riparian rights given to a property owner are legal principals that derive from legal cases rather than statute. Applicable cases are discussed under Legal Restrictions to Access. In summary form, a riparian right is the right of the landowner to access the navigable water, but with no right superior to any other water user unless provided by statute.

Ownership of state waters is intertwined with rights of waterfront land owners. By virtue of the state's succession to the rights of the title of the Lord Proprietor who received the land by grant from the Crown of England, navigable waters and the land beneath these waters are owned by the State. The concept of the Public Trust Doctrine is that these navigable waters are preserved for the benefit of the public. In essence, these areas are owned in common by all the state's citizens.

In *Caine v. Cantrell*, the Court of Appeals reiterated that the State owned the area between mean high water and mean low water for public benefit. Therefore, individual private property only extends to the mean high water line. However, the right of a riparian owner to access the water past this line is a right of being the owner of that adjacent property.

#### B. Legal Restrictions to Access

Following is a list of rights provided to landowners that will need to be evaluated when selecting a site:

**Access to water:** A shellfish growing area may not restrict a riparian owners right to access the water. *Causey v. Gray* states that a riparian proprietor, whose land is bounded by a navigable river, regardless whether his or her title extends beyond the dry land, has the right of access. In a similar manner, Environment Article 16-201, Annotated Code of Maryland provides that a person who is the owner of land bounding on navigable water is entitled to make improvements into the water in front of the land to preserve that person's access to the navigable water or protect the shore of that person against erosion.

**Improvement to property:** A shellfish growing area may not restrict a riparian owner's right to improve his or her private property. In *DNR v. Adams* the Court of Special Appeals lays out the rights of the riparian owner including: the right of access to the navigable waters; the right to build piers, wharves, docks, and the

other improvements to the line of navigation; the right to reclaim land; and the right to accretions to his lands. These rights do not depend upon ownership of the soil under water but upon lateral contact with the water. It is a universal rule that for riparian rights to attach to a tract of land, the water must form a boundary of the tract.

Narrow entrance: Statute does extend riparian rights to the use in any creek, cove, or inlet that is less than 300 feet or less in width at mean low water for the purpose of preserving or depositing oysters or other shellfish. This right of a riparian proprietor, provided by Natural Resources Article, 4-11A-06, Annotated Code of Maryland, extends only to the middle of the creek, cove, or inlet. This statute also extends the right to grow and harvest shellfish to the owner of any pier or structure in the water column and as approved by the Army Corps of Engineers with certain restrictions.

Aquatic vegetation: A shellfish grower may not impair submerged aquatic vegetation. This provision is part of the lease contract between the State and the shellfish grower. See: Section II. Operations and Management, subsection F, Habitat Protection, for Shellfish Culture Best Management Practices to comply with this restriction.

Waterfowl hunting: The shellfish grower may not fish (i.e. work a shellfish growing area) while a duck blind is in use. Natural Resources Article, 4-512, Annotated Code of Maryland states that during the open season for migratory waterfowl, a person may not fish by any means within 500 yards of any stationary blind or blind site which is occupied and is being used for hunting migratory waterfowl.

### C. Bottom Leases

As stated, the State owns the waters of the State and the land beneath it. However, the State may grant rights to this land as part of a lease. Tidelands without

commercially significant quantities of naturally existing shellfish (i.e. unproductive tidelands) can be leased from the State for oyster cultivation. Productive tidelands with natural beds cannot be purchased or leased and remain part of the public fishery.

If your shellfish growing area involves use of State owned bottom, you must apply for a lease. Statute and Regulation specify criteria for a lease area. Natural Resources Article 4-11A-05 Annotated Code of Maryland states that a lease may not be granted for any of the following submerged areas of the State:

1. areas beneath a creek, cove, bay, or inlet less than 300 feet wide at its mouth at mean low tide
2. any natural oyster or natural clam bar as defined
3. any area within 150 feet of any natural oyster or natural clam bar in any county
4. any area within 600 feet of any natural oyster or clam bar in the Chesapeake Bay
5. any clam bed as defined by the charts of the Oyster Survey of 1906 to 1912 and its amendments

The lease area for production of clams or oysters must be on unproductive tideland. Unproductive is defined by harvesting rates listed in the Code of Maryland Regulation 08.02.08.11.

#### D. Water Column (Off Bottom) Leases

Statutes related to natural clam and oyster bars and their productivity do not apply to a lease of the water column. However, other statutes regarding riparian rights to access the water, navigation, and the hunting blind restriction still apply and should be considered in selecting a site.

Section III, Permitting, subsection C, Off-Bottom Shellfish Aquaculture covers the permits needed for water column leasing and off-bottom aquaculture. Part of the permitting process for off-bottom aquaculture is a Tidal Wetlands License. Approval is required from the Board of Public Works for this license. In selecting your site, it is important to note that the Board of Public Works will consider the public interest in respect to your license application. In particular Code of Maryland Regulation 23.02.04.01 specifies that the Board will consider:

- (a) The preservation of tidal wetlands;
- (b) The conservation of natural values and living resources;
- (c) Fishing and crabbing;
- (d) Navigational needs;
- (e) Water access and related recreation; and
- (f) Maritime commerce.

#### E. Water Quality Considerations

A person interested in raising shellfish intended for human consumption must verify the classification of growing waters under the National Shellfish Sanitation Program. It is valuable to research this aspect of your site prior to applying for any permits by contacting the Maryland Department of the Environment, Shellfish Program. Additional management considerations and recommended best management practices are covered under Section IV, Human Health Issues, of this document.

#### F. Best Management Practices - Being a Good Neighbor

An open discussion with neighbors early in the planning stage can minimize conflict later. Try to amend your plan to accommodate comments you receive.

- a. According to Natural Resources Article, 4-11A-10, Annotated Code of Maryland you must clearly mark the corner boundaries of your bottom lease and navigation hazards. However, markers should be made as visually unobtrusive as possible and the minimum number of markers should be used to protect a neighbor's view.

2. Recognize that other users have access to the water column above a bottom lease site. Be polite to visitors and look at these visits and a way to educate the public about aquaculture. Inform locals of site markers and their significance.
3. Placement of floating gear must be within the permitted boundaries and the leaseholder should be sensitive to navigation issues.
4. Recognizing that water column aquaculture enterprises affect traditional uses of the water, contact the local County Watermen's Association regarding site selection. The Maryland Watermen's Association can direct you to the leader of local county organizations. Understanding boat traffic and commercial use of an area will help minimize protests to your application.
5. Check local city and county ordinances. It is your responsibility to obtain necessary city and county permits. Zoning variances, critical area activity applications, and building permits may be required. Permits may also be required for commercial activities, especially in residential areas.
6. Keep noise to a minimum. Code of Maryland Regulation 08.18.03.03 requires maximum noise level of any vessel operating on the waters of the State not to exceed 90 decibels.
7. Maintain the gear and appearance of your growing area. See Section II, Operations and Management, for best management practices related to maintenance of shellfish gear.

## II. Operations and Management

### A. Site Marking and Access Control

The great variety of recreational and commercial opportunities on Maryland waters, along with the proliferation of residential development on waterfront property, may lead to user conflicts with aquaculture operations. Seascape impacts, obstacles to navigation, boating safety, waterfowl hunting, and access to the water column over the shellfish beds are all issues that may raise objections to shellfish farms.

While boundary markers for the shellfish grounds are important for boater safety and protecting the beds, a high density can raise complaints about interference with views and access to the area. State regulations already in place that delineate growing areas, ensure access for others, and reduce conflicts with watermen, along with the judicious application of best management practices, can address the concerns of property owners and the maritime community.

#### Issues

1. Delineating and protecting beds
2. Seascape Impacts
3. Navigation and boater safety
4. Public access
5. Water column access (boating, fishing, crabbing)
6. Waterfowl hunting blinds

#### Best Management Practices

1. Clearly mark corner boundaries and navigation hazards.
2. Markers should be as visually unobtrusive as is prudent. A minimum number of markers should be used to protect the seascape.
3. Unnecessary, damaged, or heavily fouled markers should be removed and disposed of in a timely manner.
4. Recognize other users have access to the water column above the site. Be polite to visitors and look at these visits as a way to educate the public about aquaculture. Inform locals of site markers and their significance.
5. Use of fencing, water-column netting, closely set stakes or other means that extend from the bottom to the water surface and restrict movement through site is strongly discouraged.
6. Be aware of the 500 yard restriction on any fishing activity around duck blinds when occupied for hunting migratory waterfowl. If site access is necessary during this period, work out a schedule with hunting neighbors.

7. Placement of floating gear must be within the permitted boundaries and should be sensitive to navigation issues.
8. It is recommended to not exceed an 18 inch elevation limit on structures placed on site bottom to minimize interference with watercraft.

#### B. Vessel and Equipment Use

Boats and engine-powered equipment are an integral part of aquaculture operations. However, care must be taken so that use of vessels and equipment, as well as accidental spills of toxic substances, does not damage the environment. Fuels, lubricants, and other chemicals used in routine operations should be properly stored and handled to minimize risk of spillage. Boat and equipment noise is another issue, particularly in residential and recreational areas, as well as areas occupied by noise-sensitive wildlife.

#### Issues

1. Mechanical damage to marine life and habitat
2. Pollution
3. Noise

#### Best Management Practices

1. Avoid damaging marine life and sensitive habitat such as seagrass meadows or salt marshes when operating vessels and equipment.
2. Take precautions to prevent release of contaminants from vessels and equipment into the marine environment.
3. Vessels must be in compliance with Code of Maryland Regulation 08.18.03.03 concerning noise.
4. When operating equipment, be aware of the noise generated and try to reduce its impact on neighbors.
5. Keep vessels and equipment clean and well maintained.

### C. Predator Control

Predators are the major cause of shellfish mortality in field-culture operations. Maryland waters contain an abundance of mollusk-eating species. To control loss, growers use nets, mesh bags, cages, or other means to exclude predators. This gear must be routinely inspected for displacement, damage, or burial and cleaned of bio-fouling. Because ice can dislodge or damage nets and other gear, they are sometimes removed in winter when predation is low.

There are environmental, navigation, and aesthetic issues regarding protective gear. Dislodged gear can be transported and serve as an entanglement to wildlife and boat propellers. Derelict gear washed up on shore is unsightly and often malodorous. Lost, abandoned, and improperly disposed of netting also creates a negative image of the industry and builds opposition to it.

It is the grower's responsibility to be sure gear is securely anchored, old netting is properly disposed of, and to completely remove gear and associated materials when operations end. Beyond caring for their own site, growers should retrieve others derelict gear. Virginia growers have a Clam Net Hotline with a year-round commitment to cleaning up stray nets. This is an idea Maryland growers should seriously consider. A strong group effort by the shellfish aquaculture community to police themselves as well as educating their fellow growers is crucial in dealing with this problem and fostering good will towards the industry.

#### Issues

1. Abandoned, lost, or improperly discarded nets and associated gear
2. Pollutants from culture gear
3. Loss of access to water column
4. Aesthetic impacts

## Best Management Practices

1. Make periodic inspections and repair or replace damaged gear.
2. Assure gear is securely anchored.
3. Police site immediately following a storm event to ensure gear and materials are secure.
4. Remove all old or unnecessary gear and associated materials in a timely manner. Re-use, recycle, or properly dispose of all materials.
5. Fencing, water column nets, and closely set stakes are not considered to be best management practices. If absolutely necessary, additional permits are required.
6. In addition to your own, keep an eye on your neighbors' sites and equipment for vandalism and theft.
7. Prepare for winter conditions.
8. Secure or remove gear and be sure it is in good condition
9. Regularly monitor site
10. Conduct a spring cleanup with other growers
11. Do not use exposed lead to secure gear. Dispose of lead responsibly.
12. Use only durable, long-life materials. Materials that readily deteriorate (e.g. unprotected Styrofoam) are unacceptable.
13. Follow good neighbor practices with regards to noise. Restrict activities to daylight hours.
14. Where possible, try to be consistent in color scheme and design (e.g. uniform flotation, structures, rafts, etc.) to present a neat, orderly appearance.
15. Identify gear with tags.
16. Be on the lookout for abandoned gear from others. Always gather this and dispose of properly. Notify the owner of the problem, if possible.
17. Industry and the bay or river keepers might wish to establish an aquaculture gear hotline, similar to Virginia's Clam Net Hotline, for the public to report derelict gear. Industry should make a commitment to provide cleanup of any gear reported through this system.

18. All culture materials including cover nets, bags, markers, etc. should be clean and free of pollutants, including petroleum-based products such as creosote, oils, greases, or other contaminants.

#### D. Biological Fouling Organisms

Marine organisms that accumulate on submerged aquaculture gear are known collectively as biofouling. Among many others, these include tunicates (sea-squirts), mussels, and tube-building worms, as well as macroalgae (seaweeds). Although biofouling usually relates to attached organisms, the definition can be broadened to include drift macroalgae and the sloughed-off leaves of seagrasses that may be trapped by aquaculture structures.

Biofouling can become a problem when it clogs the mesh of grow-out nets, bags, and cages, cutting off water circulation to the shellfish. This can inhibit growth and ultimately kill the shellfish unless measures are taken to control the biofouling. Using a hand brush can usually remove most biofouling, especially macroalgae, on the surface of the structure. High-pressure spraying with water is especially effective for mud and sand tubes, especially if they accumulate inside the container. For more stubborn biofouling, the gear may have to be swapped out and dried in an upland location before cleaning, or perhaps even discarded.

There are environmental and aesthetic issues associated with biofouling control, especially concerning the destination of removed macroalgae. The macroalgae may accumulate downstream from the site, smothering organisms or leading to a buildup of organic detritus, or it may wash up on the shoreline, creating visual and odor problems. These concerns are conditions dependent and may not be an issue on a specific site.

#### Issues

1. Water flow

2. Macroalgal growth
3. Odors and noise

#### Best Management Practices

1. Inspect gear and routinely to maintain adequate water flow to shellfish.
2. When practical, cleaning should be confined to the aquaculture site. Otherwise, old, heavily fouled gear should be removed and taken to upland sites for cleaning, disposal or replacing.
3. Sweeping with brush can remove most biofouling.
4. Do not allow removed material to accumulate on downstream sites where it may cause local environmental degradation.
5. Take care that removed macroalgae does not pose a nuisance. If so, transport it to a more acceptable overboard or upland disposal site.
6. If using internal combustion engine, be aware of noise issues.
7. When drying gear be mindful of adjacent upland owners. Clean heavily fouled gear prior to dry storage.
8. Make sure that all upland cleaning activity is conducted at an approved site. Public access boat ramps and parking lots are not approved sites.
9. Do not use anti-fouling paints on shellfish culture gear.

#### E. Trash Management

Aside from primary gear such as nets, mesh bags, and stakes, aquaculture operations and workers generate other refuse, including used cable ties, old lines, broken baskets, leaking buckets, cans, bottles, plastic bags, cigarette wrappers, etc. It is essential that trash be managed responsibly, both for the environment and the success of the industry. The sight of garbage floating on the water or washed up on shore creates a negative image in the public's mind, turning people against aquaculture.

## Issues

1. Effects of discarded or abandoned ancillary materials (cable ties, lines, baskets, etc) on the environment.

## Best Management Practices

1. Remove trash from your grounds, even if not from your operation, and dispose of in an appropriate upland location.
2. Be conservative in using materials; re-use and recycle when possible. This also makes economic sense.
3. Educate members of the industry and their staff on the importance of waste management.

## F. Habitat Protection

Among the important marine habitats are seagrass beds, or rooted vascular submerged aquatic vegetation (SAV), which supports a diverse community of animals. Seagrass often occurs in environments that are conducive to shellfish aquaculture, which potentially can affect each other.

Aquaculture activities, such as placing nets or other gear directly on the grasses, boat and foot traffic within beds, and some harvesting practices, can damage plants. The presence of SAV also makes the task of growing shellfish more difficult as nets are lifted off the bottom by the plants, allowing predators access to the shellfish. Sediment and detritus accretion can foul gear and suffocate animals; dissolved oxygen fluctuation and organic sediment common in seagrass beds can inhibit shellfish growth; and the structure of the plants (roots, rhizomes, and shoots) can make it difficult to harvest the shellfish.

On the other hand, the proximity of cultured shellfish to SAV can be beneficial to seagrass. Bivalves filter the water, improving water clarity, which is a limiting factor for SAV growth since plants need light. Shellfish transfer nutrients from the water

column to the sediment, fertilizing the grasses. Seagrass seeds and reproductive shoots get trapped in netting, allowing plants to colonize previously unvegetated areas.

Avoid existing seagrass beds when planning an aquaculture operation. If the site is in shallow water, check with DNR for SAV maps but, more importantly, inspect the site during warm weather when the plants are actively growing to determine location and density. Destruction of seagrass through aquaculture is not acceptable and is prohibited in the bottom lease agreement.

#### Issues

1. Damage to important habitat, especially submerged aquatic vegetation, from gear, traffic, and harvesting associated with aquaculture operations.

#### Best Management Practices

1. Conduct a site visit to a prospective growing area to ensure that it does not contain significant amounts of submerged aquatic vegetation.
2. Avoid planting shellfish or placing gear in existing seagrass beds.
3. If SAV invades areas of existing aquaculture, growers should avoid unnecessary damage to grasses.
4. Minimize damage to seagrass when operating vessels in SAV beds by running vessels at the lowest possible speed with the prop raised to avoid bottom contact.

### III. Permitting

There are three major types of shellfish culture in Maryland: the culture of shellfish or seed in land-based facilities, grow-out on submerged (leased) bottoms, and off-bottom grow-out in containers suspended in the water column. State aquaculture permits are not required for grow-out on leased bottom, but harvesting or leasing laws can vary from county to county. Land-based systems will require an aquaculture permit, and may need to address water appropriation or discharge

issues. Off-bottom grow-out requires a state aquaculture permit as well as approval from a joint state/federal program for navigable waters (with final approval from the Maryland Board of Public Works).

A Shellfish Import Permit is required for imports across state lines that are destined for placement in the waters of the state. Harvesting and selling seafood, particularly for human consumption, may require Water Quality Certification and harvesting permits discussed in the section on Human Health Issues.

#### A. Shellfish Bottom Leasing

There are three ways to obtain control of Shellfish Bottom Leases in Maryland. The typical method for obtaining a lease involves checking charts for Natural Oyster Bottom or designated Clam Bottom, then examining areas outside of these for suitable locations. A number of factors determine what might be a suitable location, and it is the responsibility of the applicant to make these decisions, see Section I, Site Selection and Access. Applications returned with the appropriate non-refundable fees are followed by a hydrographic and biological survey of the site (see the Shellfish Leasing flow chart). Lease applications are then posted for public comment for four consecutive weeks in that county. Discovering commercial quantities of clams or oysters on the site, as well as evidence of recent harvests there, may result in the denial of a lease application.

Another avenue may be to locate abandoned leases in an area, and apply in the same way as for a new lease. Often areas that have been leased in the past are more easily prepared or used for shellfish culture. There are a number of abandoned leases, but about half of the tidewater Chesapeake Bay counties are closed to new leasing, particularly in the upper Bay area. These closures were requested by the affected counties and are legislated. Previous leases are honored, but new leases are prohibited.

A third approach would be to transfer an existing parcel from a current leaseholder. Transfers require only a \$5 fee. In all cases the recipient of the lease must also meet the standards required of an applicant or leaseholder, such as full-time residency in Maryland and prompt payment of fees or rents.

Maps of existing leases, charted natural resources and cancelled leases may be obtained from the Hydrographic Operations office at the DNR Matapeake Work Station. This office receives applications and performs the hydrographic survey. It should be noted that a number of statutes affect the size, area controlled, and harvest methods used on leases; these laws are located in the Natural Resources Article, 4-11A-01 through 15, Annotated Code of Maryland.

#### B. Land-based Shellfish Aquaculture

Shellfish aquaculture facilities on land (without water column or bottom rights) will require a state aquaculture permit. Aquaculture permits are issued by the Department of Natural Resources (as required by Natural Resources Article, 4-11A-02 (2)(b), Annotated Code of Maryland) to protect wild stocks of fish, identify fish as products of aquaculture operations rather than natural resources, and serve as a primary entrance to other required permits.

Contact the Maryland Aquaculture Review Board to request information on aquaculture permitting. Applications for an aquaculture permit are also available directly from the permit coordinator in the DNR Fisheries Service or on-line at the Department's website. Applications for an aquaculture permit should include site plans and descriptions, maps to the facility, a solid waste management plan for disposing of processing wastes or mortalities, and (if employing others) a certificate of compliance with state workman compensation laws.

The species to be raised and its origin must be detailed. Permit holders must keep production records quarterly, and report yearly production to the Department.

For land-based aquaculture, water appropriation and use permits may be required, as well as discharge and/or NPDES permits, pond construction or mining permits (depending on the extent of proposed activities). Appropriate county zoning and use permits must also be obtained. It is the responsibility of the applicant to obtain appropriate county permits. Zoning variances, critical area activity applications, and building permits may be required. Permits may also be required for conducting commercial activities, especially in residential areas.

On land as well as in state waters, water quality criterion for the harvest of shellfish for human consumption must be met. Contact the Department of Health and Mental Hygiene Office of Food Protection and Consumer Health Services to inquire if such standards apply to shellfish grown or held in land-based systems.

#### C. Off-bottom Shellfish Aquaculture

Shellfish culture (not on leased bottom) in public waters involves areas perceived to be utilized by multiple stakeholders, including recreational and commercial fishers, boaters and adjacent landowners. Permission to raise shellfish in navigable waters includes a state aquaculture permit and a Tidal Wetlands License, which is available from the Department of the Environment Water Management Administration.

A permitted area may not exceed 5 acres per individual. Two persons may jointly obtain a permit for up to 10 acres. A single permit may include more than one location.

Activities may not interfere with ongoing oyster bottom leases or fisheries at the same location, and aquaculture is not permissible over chartered natural resources or protected State oyster sanctuaries or reserves. In some designated Oyster Recovery Areas, typically in upper reaches of major tributaries, only oysters free of specified oyster diseases may be stocked.

Following an application for an aquaculture permit, an application for a Tidal Wetlands License (required in navigable waters, and for the alteration of any flood plain, tidal or nontidal wetland in Maryland) is normally the next step in receiving approval to conduct aquaculture in State waters. The Tidal Wetlands License is a joint Federal/State application, submitted to the MDE Water Management Administration, Regulatory Services Coordination Office. This joint permit application receives a tracking number and is distributed by the Water Management Administration to the appropriate agencies.

The U.S. Army Corps of Engineers (ACE) will coordinate efforts with other Federal agencies, such as the Environmental Protection Agency, Fish and Wildlife Service, and National Marine Fisheries Service. The MDE Tidal Wetlands Division will coordinate with other State agencies, including the Chesapeake Bay Critical Areas Commission, the MDNR Environmental Review Unit, Natural Resource Police and Boating and Hydrographic Operations Unit, the Maryland Historical Trust and the MDHMH. MDE will also contact the local Planning and Zoning offices.

Upon receipt of the Tidal Wetlands License application, all agencies involved will initiate procedures for issuing any other necessary permits. These permits may include a water use permit, waste water discharge permit and Section 401 Water Quality Certification.

The Tidal Wetlands License application review involves issues of conflicting uses of the waterway, as related to activities in navigable waters and land-based operations. Many of the impacts of aquaculture are reviewed, and may include conflicts with established recreational and commercial boating or fisheries, water quality impacts, the protection of submerged aquatic vegetation, boating safety issues, and the like. These considerations are important with the understanding that any water column aquaculture enterprise will impact public rights and traditional uses of the waters, at least to some degree.

A major consideration is that the use of an area for aquaculture does not unreasonably impair navigation. For example, an aquaculture site may not be within a navigable channel marked or maintained by a State, local, or federal agency, or unreasonably interfere with the exercise of riparian rights by adjoining riparian landowners, including access to navigation channels from piers or other means of access.

For many projects at and above 500 square feet of surface area used, a lease of State real property is required. A lease is required because the structures would occupy State Tidal wetlands or waterways for commercial benefit. Following public review and processing of the application, the MDE Water Management Administration makes a recommendation to the Maryland Board of Public Works Wetlands Administration concerning issuance of a Tidal Wetlands License and the granting of a water column aquaculture lease by the Board. Upon approval by the Board, a prescribed one-time license fee is paid to the Board and a rate-per-acre fee is set. The annual fee is paid through the Department of Natural Resources to the State Treasurer for the term during which a pertinent water column lease is valid.

#### D. Shellfish Import Permit

To protect the shellfish resources of the state from introduced diseases and parasites, imports of shellfish which are destined for immersion in state waters require prior approval and a permit from the Department of Natural Resources. Diseases of concern are identified and classified in accordance with the State's Aquatic Animal Health Policy and Implementation Plan to ensure protection of our natural resources and other aquaculturists who may be affected by disease-causing agents.

An application for a Shellfish Import Permit, and listed diseases, may be found on the DNR website ([www.dnr.state.md.us](http://www.dnr.state.md.us)). A Certificate of Health (examining for

specific diseases or parasites) may be required from the importer prior to approval. The application should be submitted 30 days before a planned shipment; contact the Permit Coordinator at the Department of Natural Resources in advance of any application to determine the animal health status that is required for a given species.

#### Best Management Practices

1. Contact the Aquaculture Coordinator ([www.marylandseafood.org/aquaculture/](http://www.marylandseafood.org/aquaculture/)) prior to applying for permits for shellfish culture other than shellfish leases. Specific limitations to and permits required for different types of aquaculture operations are dependent on the proposed activities.
2. File reports required by permit agencies in a timely manner.
3. Contact the Department of Natural Resources for harvesting or planting restrictions on shellfish bottom leases in specific counties or restrictions on shellfish introductions based on disease status.

#### IV. Human Health Issues

Molluscan shellfish such as clams, oysters, scallops, and mussels, are filter-feeding organisms. They strain surrounding water through their gills which trap and transfer food particles to their digestive tract. If the water is contaminated with disease-causing bacteria, these bacteria are also trapped and consumed as food. Because shellfish pump large quantities of water through the gills each day, bacterial concentrations in shellfish from polluted waters can accumulate to dangerous levels.

Shellfish can be contaminated either in a growing area before harvest or during activities involving harvesting, processing, or distribution. Since shellfish are routinely eaten raw or partially cooked, the risk is high that if shellfish contaminated by polluted waters or poor handling practices are consumed, human illness will result. Therefore, to assure that molluscan shellfish are safe for human

consumption, it is mandatory that shellfish be harvested from approved harvest waters and be harvested, handled, and processed in a sanitary manner.

The Maryland Department of the Environment (MDE) is responsible for conducting sanitary surveys of all shellfish growing waters. This includes monitoring and assessing shellfish waters and the adjacent shoreline to properly classify shellfish harvest waters. The Maryland Department of Health & Mental Hygiene (DHMH) is responsible for the inspecting, licensing, and certifying shellfish dealers to control the processing and distribution of shellfish.

#### Management Considerations

1. Classification of the shellfish growing waters determines if shellfish aquaculture may be conducted at a specific location.
2. License and certification will be required to harvest shellfish for human consumption.

#### A. Site Selection of Traditional On-bottom and Surface Aquaculture

Select sites that have the least variability in water quality, meaning areas where water classification is consistent or remains unchanged. Classifying shellfish waters is an on-going process because water quality is dependent on many uncontrolled factors and the shellfish water classification for any given area is subject to change. An aquaculture business should be aware of and be able to adapt to the potential change in shellfish water classification.

Contact MDE to determine the classification of the proposed aquaculture site. Four classifications are possible:

- A. Approved- direct harvest of product allowed
- B. Conditionally Approved- direct harvesting allowed when the conditional area is in the open status
- C. Restricted- no direct harvest allowed, relay required

#### D. Prohibited- growing or harvesting of shellfish not allowed

A site may turn out to be unclassified because the MDE has not made appropriate investigation through sampling and shoreline survey to determine its classification. If the site is unclassified it will take between 18 months and 3 years to gather suitable data to determine the classification.

It is best to find a site that is classified as approved where direct harvesting is permitted at anytime. Restricted sites require relay, where shellfish are harvested and moved to an approved area for natural cleansing. There are water temperature and seasonal restraints in using relay. See Procedures for Relay for requirements. It is the responsibility of the aquaculturist to locate a suitable relay site and get written permission for its use.

#### B. Site Selection of Off-bottom, Near-Shore Aquaculture

Off-bottom aquaculture of shellfish in floats is often conducted in areas that have traditionally had no known shellfish population or harvest. Because shellfish sanitary surveys for classification are conducted in areas that have a known shellfish harvest the near-shore sites are often unclassified.

Established sampling stations for natural oyster bottom and lease bottom shellfish do not capture the water quality on the surface; therefore the sampling data may not be applied to a near-shore off-bottom aquaculture site. In order to classify an area MDE must conduct an appropriate investigation of the site through a thorough assessment of the site to include sufficient water sample results to determine water quality and a shoreline survey. The process can take 10 to 18 months before preliminary classification can be determined. The other licenses issued by MDE, BPW and ACE as outlined in Shellfish Culture, section III Permitting, of this document will not be issued until the classification is determined. Growers should

have an approved relay site available since shellfish growing water at off-bottom, near-shore aquaculture sites may be classified as restricted.

### C. Land-based Aquaculture

1. Local zoning laws may apply.
2. Tanks, pumps, and lines must be constructed of food-grade materials.
3. Water classification requirements are dependent on the type of operation.
4. Wet storage, which is the storage of shellfish after harvest in tanks for purging or salting, requires a DHMH license.

### D. Harvest and sale

Molluscan shellfish are susceptible to contamination during harvest, storage, and transportation. Temperature abuse of harvested shellfish allows bacteria to grow in the shellfish which may cause illness and shorten shelf life. To assure that post-harvest shellfish sanitation is maintained, license / certification is required from the MD Department of Health and Mental Hygiene. To gain this license / certification, an aquaculturist must have:

Received the required permits from DNR, MDE, BPW, and ACE to operate the aquaculture site;

1. An approved relay area if site is classified as restricted;
2. Taken Hazard Analysis Critical Control Point (HACCP) training;
3. A written operational plan; and
4. A HACCP plan

It is best to contact DHMH, complete HACCP training, and develop plans before shellfish are of harvest size.

### V. Biological Management

Successful shellfish culture depends upon having access to sufficient supplies of high quality water. The parameters that are required depend largely upon the species being cultured and the use of those species. Species destined for human

consumption will also be expected to be cultured in water that meets standards developed by government agencies designed to protect human health. Location of an aquaculture operation at a site with poor water quality is usually problematic and should be avoided.

#### A. Water Quality for Shellfish Growth and Health

Site selection should result in locations that provide the water quality parameters necessary for good growth and survival of the species being grown. Issues include:

**Salinity:** The amount of salt in the water can be highly variable both seasonally and from year to year. Care should be taken to insure that those variations are not so severe as to cause problems with either growth or survival of the shellfish.

**Temperature:** Water temperatures also vary seasonally and geographically within Maryland. As with salinity, care should be taken to insure that those variations are not so severe as to cause problems.

**Dissolved Oxygen:** Many water sources experience fluctuations in dissolved oxygen with severe cases resulting in hypoxia or anoxia. Either of these events are capable of causing problems during culture either in growth or survival.

**Suspended Sediments:** Heavy sediment loads can cause problems with culture. While usually not as severe as A, B, and C above, extremely heavy sediment loads should be avoided.

**Algal Blooms:** Many shellfish are filter feeders and as such depend upon algae for growth. The presence of sufficient quantities of high quality phytoplankton will largely determine the growth rate and impact the survival of the crop. Where possible, care should be taken to locate shellfish operations where advantageous algal blooms are typical.

Harmful Algal Blooms: Harmful algal blooms (HABs) are common in Maryland and around the world. Not all HABs are harmful to shellfish growing operations but many are. HABs can cause growth to stop or cause mortality. There may also be human health risks associated with HABs. Location of a shellfish growing operation in locations where regular HABs occur could result in unmarketable product for at least part of the year.

Disease: Shellfish are prone to several diseases and some of these can cause huge mortalities in the crop. Potential growers should become familiar with those diseases likely to affect their crop and the water quality conditions necessary for them to proliferate. It may be possible to locate all or part of an operation away from some water quality parameters to minimize effects of disease.

Polluted Waters: There are many types of pollutants possible in any water source. In general, it is recommended that shellfish growing operations be located away from waters that contain toxic pollutants. While impossible to list all potential pollutants in this document, some of the more commonly encountered are:

1. runoff from industrial or urban areas
2. point source discharge from industrial or sewage treatment plants, marinas (which may contain high concentrations of anti-fouling chemicals) and
3. areas subject to episodes where heavily polluted bottom sediment may be stirred up and re-suspended

In summary, BMPs for shellfish culture should incorporate all of these issues. It should be understood that often more than one of these water quality concerns will be an issue at a site. The presence of a single water quality issue may not be a make or break decision but many of them are. Often the presence of several of these issues, while even on a minor basis, may jointly become severe and render the shellfish culture operation ineffective.

## B. Restoration Shellfish Aquaculture

A recent emphasis in Maryland has been the production of shellfish for use in restoration programs. While most of the above concerns apply to this specific type of aquaculture there may be instances where some of them are not applicable. For instance, water quality associated with human health issues need not be applicable to shellfish used to restore sites that are not designated for human consumption.

Also, production of some stages of the shellfish life cycle may be able to be cultured even in the face of some water quality issues if they will be re-located to other sites sometime during their life cycle. BMPs for restoration aquaculture may be very different than those recommended for shellfish destined for harvest and subsequent human consumption.

In summary, it is best to locate any aquaculture operation away from water quality problems. The benefits to not only the species under culture but also to the amount of regulatory issues that need to be dealt with in order for the crop to be sold for human consumption.

## C. Genetics

Shellfish growers may benefit from recent advances in the field of genetics. Hatchery production of oysters, clams and other shellfish species are generally produced through the use of wild broodstock or from broodstock that have been produced in other hatchery operations. Recently, researchers have successfully produced broodstock that may result in superior performance for farming. Much of this effort has been targeted on the development of oyster stocks that survive to market size in the face of disease and yield (the product of survival and growth). For example, several stocks have been developed by the Mid-Atlantic Shellfish Genetics and Breeding Consortium that have been used to produce market sized oysters in areas impacted by disease. This work is ongoing and some success is evident in the growth of oyster culture especially in Virginia. Further success is

anticipated with additional improvements in traits, such as shell growth, meat quality, or shelf life. Selection, particularly by commercial hatcheries themselves, has also begun on hard clams and it is likely that future research could include other economically important species as the need is identified.

Another aspect of genetics is ploidy manipulation. It is possible through hatchery manipulation of the fertilization process or using tetraploids to produce shellfish that are triploids (three sets of chromosomes, like many domesticated plant species). Triploids have been a valuable tool in many shellfish grow-out operations around the world and increasingly in aquaculture in the Bay. Since triploids do not expend much energy producing gametes they may exhibit increased growth. The extent of this growth advantage can only be determined by deploying them in specific grow-out systems and recording their performance over non-triploid animals.

Another benefit of triploid animals is that they do not spawn and therefore they do not undergo a dramatic loss of meat quality during the spawning season like their diploid counterparts. This can result in a superior quality product to market during periods of the year when diploid animals are difficult to sell.

Finally, a third advantage of triploids, because they are sterile, is that they can be farmed in close proximity to natural populations of shellfish with no effect on the population genetics in wild animals. That is, they can not interbreed with natural populations (or themselves) making it possible to juxtapose farming and restoration.

Despite the use of domesticated stock for farming, hatchery operators should still consider proper fertilization techniques that insure the maximum genetic diversity among the larvae produced. Failure to use reasonable number of parents for larval batches could result in partial or total larval failure. Even in batches of larvae that successfully complete the larval period and result in seed stocks, limiting the

number of broodstock can result in genetic bottlenecks that could begin to express themselves in poor performance of the stocks over time.

For restoration aquaculture, genetic considerations may be quite different than for farming. Typically, every effort should be made to insure that the effective population number of parents is as high as possible. For one, restoration animals are planted in the environment with the expectation that they will survive, grow, and contribute to the natural recruitment of the species in the region. There have been concerns raised over the potential for creating genetic bottlenecks in the wild populations that could ultimately have deleterious effects on the naturally occurring stocks. Conversely it has also been proposed to use selected stocks (which by design have some degree of bottlenecking) to infuse desirable characteristics into stocks suffering from disease. Neither of these concerns has been adequately proven and it remains to be seen whether shellfish growers will need to be concerned with special genetic practices for restoration in the future. However, there are some simple steps that can help to moderate any ill effects from hatchery planting of oysters for restoration.

Most restoration projects are fairly large in scale involving millions of animals. Additionally, most sites receive seed oysters more than once and in multiple years. One approach to minimizing potentially harmful effects of limited parental contribution is to plant seed oysters from spawns produced from as many parents as possible, to plant sites with seed oysters from multiple spawns, and to plant sites with multiple year classes. Unless broodstock are collected from the population that is being restored B a practice surely to result in population bottlenecks B using multiple spawns over multiple years will increase the number of parents that contribute to the genetic diversity of the population on the restored bar.

## SECTION IV: NON-NATIVE SPECIES

### Subcommittee Membership:

Chip Crum, Industry, Chair

Rich Bohn, Department of Natural Resources

Harley Speir, Department of Natural Resources

Many species raised by aquaculturists are not native to Maryland. The typical aquatic organisms raised are hardy in captivity, have life-cycles that can be controlled and manipulated, and have good marketability. These species may or may not have a natural range in Maryland, and non-native species warrant special consideration from an environmental and regulatory viewpoint.

Best management practices for Non-Native Species are divided into the following sub-sections:

I. Background

II. Definitions

III. Permitting

IV. Best Management Practices

## SECTION V. AQUATIC ANIMAL HEALTH

### Subcommittee Membership:

Karl Roscher, Maryland Department of Agriculture, Chair

Larry Pieper, Maryland Department of Natural Resources

Dr. Ana Baya, Maryland Department of Agriculture

The success of aquaculture depends on minimizing the impacts of disease producing organisms. This requires rapid detection and control of pathogens as they appear, anticipation of problems resulting from pathogens before they occur, and managing around pathogens when they become established. The goal is to reduce loss that

results in economic harm to the aquafarmer by establishing an infrastructure of support to the aquaculture industry similar to that enjoyed by traditional forms of agriculture. Without support provided by a combination of both public and private assistance, aquaculture within the state could be seriously deterred in its becoming an economic asset to the State of Maryland.

The legal authority for state fish health standards resides in agriculture and resource agencies. Federal health standards apply to international movement of fish and are administered by the U.S. Department of Agriculture or the U.S. Fish & Wildlife Service.

Maryland's Aquatic Animal Health Policy and Implementation Plan has been established to protect the ecological integrity of natural aquatic populations and economic integrity of the aquaculture and fisheries industries. It is the policy of the State of Maryland to control or prevent the introduction and spread of pathogens and other substances that threaten the health of fish, mollusks and crustaceans resident to the State. This document is available on the web at:  
[www.marylandseafood.org/aquaculture/animal\\_health.php](http://www.marylandseafood.org/aquaculture/animal_health.php)

Best management practices for aquatic animal health are divided into the following sub-sections:

- I. Facility Management
- II. Animal Husbandry
- III. Disease Prevention and Management

## SECTION VI. SHIPPING, TRANSPORT, AND SALE

Subcommittee Membership:

Bob Parkinson, Industry, Chair

Erin Butler, Department of Health and Mental Hygiene

Kathy Magruder, Department of Business and Economic Development

The intent of aquaculture is to grow a product for entry into commerce. In order to manage his crop the aqua farmer must be able to freely access the chosen site for moving equipment and supplies on and off site and for the harvest and shipment of the final product. This section addresses site selection in regard to transportation, disease transmission prevention through shipment control, and provides operational guidelines for the safe and cooperative movement of aquaculture products from location of aquaculture operations to point of sale. Practices are designed and recommended to address general issues related to the transport, shipping and sale of the many possible species in Maryland aquaculture.

Best management practices for shipping, transport and sale are divided into the following sub-sections:

- I. Transportation prior to post-harvest shipping and sale
- II. Motorized transport to and from aquaculture site
- III. Prevention of spread of aquaculture farm diseases
- IV. Traceability of product
- V. Control of chemicals, additives and equipment
- VI. Shipping considerations

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The best management practices, originally passed in November 2006, were modified at the July 2007 meeting of the Aquaculture Coordinating Council. This was done in response to the legislative mandate to include diamondback terrapin regulations. Rather than add a species specific section, an appendix was placed at the end of the BMPs referencing specific items that should be addressed by producers in the culture of amphibians.

Don Webster  
University of Maryland