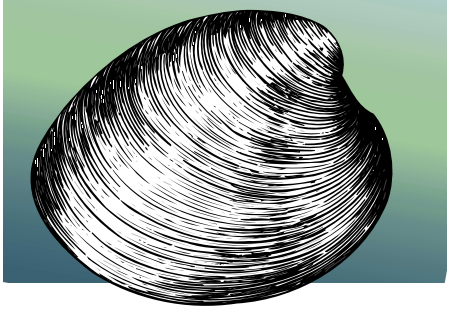
Eastern United States Interstate Shellfish Seed Transport Workshop

S.C. Marine Resources Center, 217 Ft. Johnson Rd.
Charleston, S.C. • February 21-22, 2002



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Eastern United States Interstate Shellfish Seed Transport Workshop

STATEMENT OF OBJECTIVE

There has been a long history of interstate transport of shellfish seed along the east coast of North America. Movement began as early as the 1800's with transplantation of large quantities of oyster (*Crassostrea virginica*) seed. Recently, interstate commerce in seed clams (*Mercenaria mercenaria)* has evolved throughout the eastern seaboard. Initially, northern shellfish hatcheries shipped small seed clams to southern states for overwintering. Surviving larger seed were transported back to the hatchery of origin in the spring. Limited movement of adult broodstock has also taken place. Markets for cultured clams continue to expand and many producers are now selling seed to commercial aquaculturists in other states directly from southern overwintering locations. The success of hard clam culture has created new field grow-out techniques, a robust industry and a plethora of state regulations pertaining to importation of shellfish.

Importing and exporting states have developed different disease and genetic entry requirements, often originating from livestock or non-marine fishery guidelines. A review of Southeastern states' hard clam seed importation requirements (Tuckey and Sturmer, 2001[1]) illustrates both disparities and similarities in state protocols. In addition to the difficulty of identifying and communicating with the appropriate state agency official, divergent certification requirements have plagued the industry and the testing laboratories. Several industry members and state regulators have stated that a workshop addressing these and other issues was long overdue.

As a result of these circumstances, a workshop was held at the South Carolina Marine Resources Center, Charleston, SC to provide a forum for the exchange of information concerning the need to protect state resource interests, reduce risks associated with shellfish importation and facilitate interstate commerce of aquaculture products. Three discussion panels were convened during the day and a half workshop: (1) disease testing and shellfish pathology issues, (2) state regulatory requirement issues and (3) shellfish industry issues. The agenda included presentations and panel discussions in sequential sessions.

This brief publication provides a summary of the three panel discussions, identification of research needs, development of a spreadsheet containing all fourteen east coast state regulations and points of contacts within each state, and recommendations for developing a uniform set of criteria for shipment of bivalves between jurisdictions. The workshop did not intend to address public health issues associated with clams or oysters, but focused on shellfish diseases specific to the bivalves imported and exported.

[1] Tuckey, L.M. & L. N. Sturmer. 2001. Requirements for the importation of hard clam (*Mercenaria mercenaria*) seed in the southeastern United States. University of Florida Cooperative Extension Service, Cedar Key, FL. 19pp.

Introductory Comments:

Hatchery/Nursery Operations

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The appendix 1 spreadsheet provides a general outline of the steps in a hatchery/nursery system for producing bivalve seed, and, in my view, the level of **potential** contamination with pathogens and how each step in the process ranks relative to other parts of the system. This is my best guess and there is little science to back up these assertions. In spite of the level assigned, I believe it provides guidance where the potential for movement of pathogens is highest, and how it might affect the product and local environment at each stage. We need to remember that disease and pathogens that cause the disease are not the same. Most of the organisms we test for are parasites that **may** be pathogenic and **may** cause disease. Please note—as with any exercise of this type, generalities mask the important details. These details are specific to the product of the hatchery/nursery, its exact mode of operation, the species being cultured and the specific pathogens.

Hatchery – I separate the hatchery/nursery process into two entities. A division occurs when the animals are provided with large quantities of untreated water, usually post set. Most hatcheries use some means of treating the incoming water such as a simple bag or sand filtration, but increasingly some form of sterilization occurs. This treatment (the batch culture nature of the system and the relatively small quantities of water) greatly reduces the probability that the pathogens we test for will be transmitted in the hatchery.

Appendix 1 clearly indicates the primary source for potential problems in the hatchery is broodstock. After the broodstock are eliminated from the system, because of filtration or sterilization of water and because of the small quantities of water being used, and because of the loss of animals, the hatchery reduces the potential for transmission of most of the pathogens in question.

There are a host of diseases that cause problems in the hatchery, but these are most often bacterial and are often lethal to the larvae. Whether or not these bacterial infections move beyond the hatchery is unknown, but most are ubiquitous problems in aquaculture operations and are caused by infections moving from the water or air sources into the hatchery. We know little or nothing about bacterial or viral transmission by bivalves and we know little or nothing about the potential for vertical transmission of disease-causing organisms in bivalves.

Nursery - I define the end of the hatchery phase not biologically (it would be at set), but operationally—the time when untreated water is introduced to the animals. This is often after set. Many hatcheries keep the set process as a batch system and continue to provide unicellular algae. This process may last for a few days to several weeks depending on the hatchery, time of year, species and other factors. If untreated water is used for setting, then the potential for introduction of disease causing organisms

increases. We have very few reports of important bivalve pathogens diagnosed in set to 1mm animals. The longer an organism is kept in flowing water the higher the potential for it to become infected. It is important to note that many of these pathogens have seasonal infection periods and thus seed may not become infected during the nursery process if it is out of phase with the disease.

Although the potential for export of a disease increases, actual transmission of a disease may be much lower. This is because the disease level may be low in the seed, or low in the water the seed are being subject to, or the numbers being moved are relatively small, or the disease is already present in the area the seed are being sent to. However, if there is an ongoing epizootic in the area of the nursery, the probability of heavily infected seed increases. There is no evidence that I know of where hatchery produced seed from native species have been shown to cause the introduction of a pathogen.

It is my view that we are spending far too much of our valuable resources examining seed when we should be examining broodstock and wild and aquacultured stocks in the source and destination areas.

East Coast States Shellfish Seed Interstate Transport:

A Regulatory Overview

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Thirteen east coast shellfish regulators provided information describing how their respective states handle shellfish diseases and other issues involving indigenous shellfish (*Crassostrea virginica* and *Mercenaria mercenaria*) importations. These requirements are summarized as Appendix 2 in spreadsheet format. Additionally, the appropriate office and contact person with permitting authority is listed in Appendix 3.

Guidelines for indigenous shellfish importation evolved in each of the east coast states as laws, regulations, policies and best management practices with little coordination amongst neighboring states. Furthermore, different agencies are responsible for permitting and inspecting imported shellfish, such as departments of agriculture, natural resources and environmental health.

As a general consensus, all east coast states have three basic management strategies: (1) reduce the risk of importing shellfish diseases, endeavoring to prevent pathogens from spreading to cultured and wildstock shellfish, (2) inhibit the importation of exotics and non-target species, and (3) allow seed and broodstock importation in order to sustain a healthy shellfish mariculture industry.

***Narrative summary of regulatory requirements*:**

Minimum sample quantities for each shellfish batch size (point of origin and size class) ranged from 30 – 100 animals; four states required 30, another four states asked for 50. Eleven states mandated that an approved shellfish pathologist examine tissues and perform disease testing. These pathologists, utilized by most east coast states for interstate shellfish transport, are listed in Appendix 4.

Oyster specific pathogen tests: All states required Dermo (*Perkinsus marinus*) and MSX (*Haplosporidium nelsoni)* testing, however there was disagreement (5 yes vs. 8 no) regarding the necessity of SSO (*Haplosporidium costale*) and JOD (*Juvenile Oyster Disease*) examinations. Eight saw no need to test for *Vibrio spp.* while five states required testing.

Hard clam specific pathogen tests: Ten states required Dermo testing and 12 asked for QPX (*Quahog Parasite* X) assays (NJ did not) and, similar to oysters, eight states did not test for *Vibrio spp.* in clams while five required testing.

Florida was the only state with genetic requirements, requiring documentation of broodstock origin from the exporting hatchery and a requirement that out-of-state seed be offspring from original Florida broodstock. Four states conducted on-site inspections for non-target and exotic species. Eight states approved hatcheries (or other closed systems) to allow importations of small seed (usually 1mm or smaller) without disease testing provided these hatcheries followed certain standard procedures and maintained disease records. Once permits were issued, health certifications were valid for periods ranging from 30 to 365 days.

Even with the plethora of state regulations, some originating from livestock or marine fishery laws, the intent of regulations originating in east coast states was similar: protect state shellfish resource interests and reduce risks associated with interstate transport.

Aquatic Animal Disease Management:

A National Perspective

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Synopsis

Biosecurity and the protection of wild and farmed aquatic animal populations from the adverse effects of pathogens and disease is progressively becoming more important for ecological, industry-development, and public safety reasons. As a result, disease management programs, and regulations that contribute to the success of shellfish biosecurity, are being evaluated at the national level by federal and state agencies, industry organizations, and producers in the U.S. and other countries. The primary focus of all biosecurity programs, policies, and regulations is prevention, control, and eradication of pathogens in populations, whether they are farmed (cultured) or wild (managed, or unmanaged). By default, an absolute prerequisite for sustained population dynamics and production in the wild or commercial aquaculture operations is the movement of animals; hence, biosecurity policies, programs, and regulations revolve around facilitating animal movement, while mitigating any possible adverse effects of pathogens that may accompany movement of animals.

Over the past ~20 years aquatic animal (including gastropod shellfish) biosecurity programs and requirements (termed Codes of Practice, Best Managed Plans, policies or regulations) have gained increasing attention at all levels (producer, regional, state, national and international) primarily because of economic and ecological factors. The U.S. attention to animal biosecurity has recently further increased with the unfortunate events of bioterrorism, the British outbreak of Foot-and-Mouth Disease, and the National Emergency Declaration in response to Infectious Salmon Anemia outbreak in 2001. Unfortunately, progress in aquatic animal biosecurity implementation has been hampered by numerous factors including unclear identification of issues, unclear objectives, competing interests, regulatory competition, lack of resources, and lack of adequate knowledge concerning the biopathophysiology and epidemiology of many diseases. By example, examination of state authority over wild and cultured aquatic animal health as of 2001, revealed 12 different agencies or entities claiming responsibility, ranging from none in several states, and up to six in others; although shellfish diseases are becoming better known, they are still referred to by acronyms that indicate incomplete knowledge—MSX, QPX, SSO, etc; many diagnostic tests are still equivocal; and, reporting and response systems for shellfish pathogens and diseases are clearly not in place.

In recognition of the importance of aquatic animal biosecurity programs, and in response to a request from the AVMA, the Joint Subcommittee on Aquaculture has again initiated a new Task Force in 2001, to examine the development of a National Aquatic Animal Health Plan (NAAHP) for aquaculture. Although early in the process, it has been emphasized that the objectives of establishing biosecurity frameworks for regions, states, agencies and producers to follow, any plan must adopt disease management and epidemiological principles that encompass protection from, response to, and possible eradica-

tion of aquatic animal disease, while encouraging movement for commercial or other purposes. Many of these principles are well developed for aquatic animal diseases and are encompassed in, for example, the several EU Directives[1], Australia's AQUAPLAN[2], FAO's Code of Conduct[3], WTO's SPS Agreement[4], etc. In all cases, international issues dealing with aquatic animal health are deferred to the OIE Code and Manual[5]. In the U.S., several initiatives are beginning to encompass many aspects of aquatic animal biosecurity, from the local to the level national level, including, for example, MD's Aquatic Animal Policy[6], the NASDA Safeguarding report[7], and NAHEMS[8], CEAH[9] and the associated surveillance, monitoring and reporting systems, and others[10].

Biosecurity Principles

To be most effective, and serve as good frameworks for wild fisheries management and aquaculture operations at local, state, national or international levels, shellfish biosecurity programs should encompass the general principles adopted elsewhere (with refinement relevant to the particular situations), including:

- Address the four cornerstones of biosecurity—animal health, public health (zoonoses), food safety, and environmental health;
- Focus on pathogen and disease prevention, control and eradication;
- Harmonized (made consistent with, but not necessarily identical to) at vertically (i.e. local, state, national and international), and horizontally (i.e. all states) levels, for wild and farmed (cultured) aquatic animals, and with existing approaches already developed for terrestrial and avian species;
- Based on sound science-based decisions;
- Relatively easily applied;
- Be economically and socio-politically rational;
- Be transparent and widely known (input from all stakeholders, easily accessible and publicized); and,
- Enforceable.

Once the primary issues and objectives of disease protection, control and eradication are linked with appropriate animal movement, and the appropriate authority (ownership or jurisdictiton of all stakeholders) identified, a series of applied steps can be used for developing biosecurity programs.

Early steps in this process include:

- Development of a list of significant diseases;
- Prioritization of diseases based on risk-assessment (a four-tier system appears to be appropriate for the US, those of international, national, regional/state, and emerging diseases of importance);
- Standardized techniques for identifying disease and pathogens (validated diagnostic tools);
- Active and passive disease/pathogen surveilance;
- Reporting (mandatory and voluntary) system;
- Competent authorities and competent officials for identification, surveillance, reporting and certifying absence or presence of disease.

Application of sound epidemiological principles applied to any shellfish disease allow the establishment of practical and effective biosecurity programs which can be then applied to overall management programs, at any level. Implementation of these as hard, legally binding federal or state regulations, or adoption as industry driven "Codes of Practice" or "Best Management Plans", is determined by the stakeholders, the degree of effective application, and the risk-based prioritization of the effects on animal health, public health, seafood safety, and the environment.

The focus of this workshop on shellfish diseases, and the approaches of the eastern states and industries to biosecurity and shellfish movement, provide an immediate opportunity for the uniform application of biosecurity principles into developing frameworks for adoption at local, state and national levels. If appropriately developed they will serve to safeguard and protect all shellfish wild and cultured populations, while still encouraging their movement for commercial or ecological reasons.

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[1] Minimum Community Measures for Controlling of Certain Fish Diseases (1986 – 2001). European Union Council Directives, 93/53/EEC, 2000/27/EEC, including amendments: located through EUR-Lex http://europa.eu.int/eur-lex/en/search/index.html

[2] AQUAPLAN: Australia's National Strategic Plan for Aquatic Animal Health, 1998 – 2003 (1999). National Office of Animal and Plant Health, Agriculture, Fisheries and Forestry – Australia: http://www.affa.gov.au/content/output.cfm?ObjectID=D2C48F86-BA1A-11A1-A2200060B0A00657

[3] Code of Conduct for Responsible Fisheries (1995). Food and Agriculture Organization of the United Nations, Rome: http://www.fao.org/fi/default.asp

[4] Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) (1995). World Trade Organization, Geneva: http://www.wto.org/english/docs_e/legal_e/final_e.htm

[5] International Aquatic Animal Health Code (4th Ed.) (2001), and Diagnostic Manual for Aquatic Animal Diseases (3rd Ed.) (2000). Office International des Epizooties, Paris: http://www.oie.int/eng/normes/en_norm.htm

[6] Maryland Aquatic Animal Health Policy and Implementation Plan (2001). Maryland Department of Agriculture, Annapolis.

[7] Safeguarding (2001). National Association of Sate Departments of Agriculture – Report commissioned by USDA-APHIS: http://www.nasda.org/ASGRwebsite/Index.pdf

[8] National Animal Health Emergency Management System: http://www.usaha.org/NAHEMS/

[9] USDA-APHIS Centers for Epidemiology & Animal Health: http://www.aphis.usda.gov/vs/ceah/ceahpage.htm

[10] Shortly after this Workshop the Atlantic Sates Marine Commission issued a new preliminary report, "Guidance Relative to Development of Responsible Aquaculture Activities in Atlantic Coast States", that address some relevant Biosecurity issues: http://www.asmfc.org/NEWS/May%202002%20Meeting%20Week/Documents/Aquaculture%20Guidance%20doc.pdf

Shellfish Hatchery Certification for Seed Importation:

The South Carolina Policy

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South Carolina requires a permit for importation of molluscan shellfish that will be placed in state waters. Issues of concern are transfer of shellfish pathogens, transfer of non-indigenous species, and transfer of non-target indigenous species. Advance testing is required for shellfish pathogens, while other issues are handled through an inspection upon arrival. An exception to disease testing is made for hatcheries that have been pre-approved. Recognizing that accurate disease testing on hatchery seed (generally < 1mm) is difficult, that the likelihood of hatchery seed harboring pathogens of concern or non-target organisms is low, that product consistency should be high in a well-run hatchery, and that timing of shipments for seed is critical, disease testing would impose an undue hardship.

The hatchery certification process must be renewed annually. Applicant hatcheries must complete a questionnaire documenting standard operating procedures and any disease history in the hatchery, broodstock, or surrounding waters. Other factors SCDNR may consider include industry reputation and customer references. Importation from a pre-approved hatchery still requires a molluscan indigenous importation permit but the disease testing requirement is waived.

Testing for Molluscan Pathogens:
An Overview

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Types of Diagnostic Tests

Assays to diagnose the pathogens in molluscan shellfish range from visual inspection of tissues and shells to detecting pathogen-specific DNA molecules. The method used depends on the pathogen or pathological condition in question. Several standard assays are used in screening oysters, clams, and other commercial bivalves intended for shipment along the east coast of the USA. The most common method is tissue-section histology, in which a thin section of tissue, which includes most of the major organ systems (digestive gland, stomach, intestine, gonad, gill, mantle, and connective tissue/storage cells), is placed on a slide, stained and examined microscopically. Histology is the standard method currently used for detecting the oyster parasites MSX (*Haplosporidium nelsoni*) and SSO (*Haplosporidium costale*) and the hard clam parasite QPX (Quahog Parasite X).

In some cases, such as JOD (Juvenile Oyster Disease), a causative agent has not been positively identified and diagnosis must be made using a symptom. The most consistent JOD symptom is a brown, ring-like deposit on the inner valves of affected oysters.

Incubation of pieces of tissue (usually the rectum and pieces of gill and mantle) in a nutrient solution called Ray's Fluid Thioglycollate Medium (RFTM) is the standard assay for detection of DERMO (*Perkinsus marinus*). The parasite enlarges in RFTM and after several days, the tissues can be removed from the medium, minced, stained, and examined microscopically. Both MSX and DERMO circulate in the blood of infected oysters and can be detected by examining fresh, fixed, or RFTM-incubated blood samples, as appropriate.

Over the past decade, molecular detection methods using antibody- or DNA-based assays have been developed and tested against the "standard" assays. These tests make use of molecules specially designed and synthesized to recognize and attach to other molecules that are found on or in a specific parasite. The DNA tests are typically more specific and sensitive; and the PCR (Polymerase Chain Reaction) assay is able to amplify DNA many fold, thus allowing detection of extremely small numbers of parasites in a sample of molluscan tissue.

Effectiveness of Diagnostic Assays

Each diagnostic test has advantages and disadvantages. Tissues-section histology is expensive and time-consuming, but it allows the observer to actually view the pathogen or tissue pathology being sought. In addition, other organisms or conditions not specifically targeted can be detected and the slide can be archived for future examination. On the other hand, a standard 5- to 6-µm section represents only a very small portion of the entire clam or oyster: about 1/2000 of the tissue in a 10-mm individual

and only 1/10,000 that of a 30-mm individual. It probably requires a true MSX density of 1,000 to 10,000 cells per gram wet weight before tissue sections reliably detect all positive infections. The same density of DERMO is also needed before the standard RFTM assay (which uses pieces of tissue) becomes consistently reliable. The RFTM method can be adapted to isolate and recover all DERMO parasites in an oyster, but this is too expensive for routine use. Nevertheless, seed-sized oysters and clams are small enough so that their entire soft tissues can be incubated and examined as easily as pieces of larger clams. The standard RFTM assay, including whole body incubation of seed, is relatively inexpensive and can provide results within 5 days. One drawback is that other species of *Perkinsus* also enlarge in the medium and cannot be distinguished from *P. marinus*, the oyster pathogen.

Blood diagnosis is rapid and inexpensive, and can be done without sacrificing the animal, but it is reliable only when infections have entered the circulatory system (i.e., become "systemic"). The blood assay is nearly as sensitive as the standard RFTM assay, but the blood test for MSX is less sensitive than histology because it does not detect localized infections, which can often be detected in tissue sections. In contrast to MSX and DERMO, QPX parasites remain largely localized in the tissue of infected clams so that they would be difficult to detect in blood samples.

The PCR assay is the most sensitive and specific of all tests because it is designed to detect molecules distinctive to a particular parasite. It can distinguish among organisms that closely resemble each other when viewed microscopically, and can detect DNA or RNA molecules from an extremely small number of parasites. The downside is that a highly specific PCR assay can detect only that particular parasite. If infections are advanced to the point where they can be reliably detected by standard methods, there is little advantage in using PCR. It is faster, but still expensive. PCR is most valuable when infections are light enough to be missed by standard methods. Some studies have shown high prevalences of MSX using PCR whereas histology detected few or no infections. Histology and PCR are about equally effective for detection of QPX because this parasite is typically concentrated in localized lesions. The chance that one of these concentrations is in the piece of tissue sampled, not the assay method, is what determines a positive or negative result.

Issues in Disease Testing

There is no such thing as a "Disease-Free Certification". Tests use a certain number of animals, collected at a certain time of the year, using a subsample of tissue examined with a particular assay for a certain parasite or parasites. Failure to detect disease organisms arises because too few animals are tested, they are tested at a time when infections are very light and localized, or only a small portion of each organism is examined, or some combination of these factors. No one should believe that a negative result in a diagnostic assay provides complete assurance that the population from which the sample was taken is free from disease-causing organisms. Once molluscs are placed in unfiltered, untreated water (i.e., once they leave the hatchery), they are exposed to any parasite resident in that body of water—regardless of what a disease diagnosis says.

Because seed oysters and clams have been exposed to a disease agent like MSX, DERMO, or QPX for a relatively short time, they are likely to have early-stage, localized, and difficult-to-detect infections. On the other hand, their small size counteracts the problem because the tissue subsample examined is a relatively large portion of the total animal. However, sampling of each batch of seed is neither efficient nor particularly effective. It may be more effective to "certify" a hatchery based on how it treats incom-

ing water; its historical record of disease testing results; and knowledge of disease agents in the water to which seed are exposed.

Marine and estuarine parasites do not respect state boundaries so it makes little sense for each state to have separate, often different, criteria for testing. An alternative would be to define zones for parasites of interest. For instance, three zones could be established: a zone in which the parasite has never been detected; a zone where it is known to be present, but at a low level; and a zone where it is widespread and abundant. Seed or broodstock might be moved within the same zone or from a "low" to "high" region without testing for that parasite. Movement in the opposite direction would not be permitted, or would be allowed only under specified conditions. A program such as this, of course, would require knowledge of the regional distribution and abundance of parasites so that the zones could be defined (and changed if necessary). This knowledge would come about only through regular and standardized monitoring.

Regulations must be flexible. For instance, when a new disease agent is discovered, it is wise to take all possible precautions to prevent it from spreading by implementing very strict regulations. As more information about the agent becomes available, however, it may be possible to relax the rules. This would be true if we find that the parasite is not particularly lethal or is already widespread. In the end, we must make decisions based on what we know because we will never know everything about the disease and there are always risks that disease agents will spread, via means other than aquacultural practices, no matter how stringent regulations are. Above all, regulations must be perceived by the industry as reasonable and effective. If not, the rules will be useless because they will be ignored.

A Shellfish Industry Perspective

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The East Coast United States shellfish industry has a long history dating back to pre-Revolutionary War times. Both the fishery and more recent aquaculture components are comprised of only a few species. The East Coast shellfish aquaculture industry has undergone major growth in recent years compared to other marine aquaculture due to utilization of public lands, little or no feed costs, lack of foreign competition due to live markets, concerns over human health, and little to no discharge problems. The industry perceives shellfish transport regulations to be well developed with certain specific impediments, which could be improved. Industry is also concerned about the potential for over-regulation, which could dramatically restrict the present operations and future growth. In summary:

Genetic Concerns – The shellfish industry is based on the same major species throughout the Atlantic Coast. There is a well-documented historical record of shellfish adult and seed transport throughout the region and concerns over any specific genetic stocks issues would have long been diluted through years of transfers in the natural environment.

Disease Concerns – The industry feels that certain disease concerns are valid throughout the East Coast. It must be understood, however, that shellfish have been transported throughout the region for years and certain diseases have not been established in certain areas where introduction of the pathogen has been likely. The shellfish industry believes there is no need to require disease certification when shipping shellfish from an area with the disease to another area with the disease, unless it is well documented that different strains of a disease exist. The shellfish industry is concerned that relaying and wet storage of market product between states are only tested for human health pathogens, but not shellfish diseases, which could lead to the spread of molluscan diseases.

Non-native species – Similar to the evolution of management in the terrestrial environment, non-native species may become the basis for both aquaculture and natural fisheries industries. The industry is opposed to direct bans on the utilization of non-native species and has identified a need for research directed at the potential for the prudent use of non-native species as aquaculture products.

The shellfish industry requests from the shellfish regulatory community:

- Development of a coast-wide framework for interstate shellfish seed transport
- East coast regulations for the transport of shellfish seed among states
- Standardization of testing required throughout the east coast
- Pre-certification programs for hatcheries and nurseries
- Testing on a rational and scheduled basis
- Regulations developed through a BMP-based system
- A faster turnaround of required documentation through the utilization of electronic transfer of disease certificates, licenses and permits

Electronic Health Certificates:
Potential and Development

Kevin D. Maher, President

GlobalVetLink, L.C.

Iowa State University Research Park

GlobalVetLink, L.C. (GVL) is headquartered in Ames, Iowa, in the Iowa State University Research Park. GlobalVetLink's mission is to be the primary information system platform for the animal health regulatory industry through utilization of secure, web-based Internet applications.

The company specializes in state of the art Internet application tools for State and Federal Animal Health Officials, Private Practicing Veterinarians, Diagnostic Labs and Animal Industry Owners for animal health regulatory management by facilitating efficient compliance with intrastate/interstate, international animal health regulations, commerce as well as EIA/Coggins, by automatically initiating the appropriate e-document for the requested animal movement. GVL is purely a regulatory-based business.

GlobalVetLink maintains up to date Internet based technology, while providing a safe, robust, and efficient system for the industry. Additionally, this service is an important vehicle for integrating diagnostic laboratory into the food animal and companion animal regulatory process.

GVL also works with more than 14 internationally recognized animal health specialists as well as State/Federal Agencies and USDA/APHIS/VS.

Current GlobalVetLink online applications interface with all existing State and Federal proposals for: Government Paperwork Elimination Act (GPEA) of 1998, Center for Emerging Issues and the National Disease Reporting System.

In November 2001, United States Animal Health Association passed a resolution that requests the United States Department of Agriculture (USDA), Animal and Plant Inspection Services (APHIS), Veterinary Services (VS) in cooperation with the states, to utilize an existing or develop an electronic certificate of veterinary inspection that utilizes a web based platform to document intrastate, interstate and international movement of livestock and poultry.

GlobalVetLink's secure web-based platform was developed in partnership with the State of Florida. Under the leadership of Dr. Leroy Coffman, Florida State Veterinarian, GVL was proven effective during Florida's 1999-2000 pilot study involving more than 20,000 animals. The state officially launched the GVL system in September 2001 during the Florida Veterinary Medical Association's annual meeting.

To date, more than 15 states, animal diagnostic laboratories and numerous private veterinarians are in various stages of negotiating implementation of the GlobalVetLink system.

This technology application to aquaculture is easily adaptable by GlobalVetLink with the experience and precedent in Florida. GlobalVetLink currently enables the system to be successful by all 50 State's agreement by State veterinarian's to a standardized format for interstate movement of livestock and companion animals. Additional information is available upon request: 515-296-0860 or www.globalvetlink.com.

Charges for Breakout Sessions

Following the formal presentations and panel discussions, three groups, consisting of approximately equal numbers of shellfish regulators, pathologists, industry members and others were divided into separate sessions to develop answers to these questions and present recommendations to the workshop general session.

1. Can we develop a recommended standardized set of tests for the pathogens of interest to the states for each bivalve species? Should the tests include life cycle (or production cycle) stage, numbers of organisms required, and the test to be performed? Some possible diseases are:
    a. Dermo
    b. MSX
    c. SSO
    d. QPX
    e. JOD

2. Design the best, cost effective, scientifically relevant bivalve shellfish pathogen testing and test interpretation system that will:
    a. Allow the interstate transport of bivalve shellfish seed.
    b. Take into account the levels of pathogens in the source and receiving waters.
    c. Protect cultured shellfish.
    d. Protect wild stocks.

Breakout Session Summaries

Each workgroup reported their response to the general session and summarized their deliberations as follows:

Workgroup 1

Group Leader: Paul Waterstrat
Recorder: John Kraeuter

Response to question 1. Can we develop a recommended standardized set of tests for the pathogens of interest to the states for each bivalve species? Should the tests include life cycle (or production cycle) stage, numbers of organisms required, and the test to be performed? Some possible diseases are:

a. Dermo
b. MSX
c. SSO
d. QPX
e. JOD

It would be desirable to obtain histology on animals collected from all areas because unknown pathogens may be found and a permanent record can be established. To standardize test numbers and protocols, use OIE or other international standards to test for *Perkinsus, Bonamia, Martelia, and Haplosporidium.*

Ray's thioglycollate method is adequate for Dermo presence, but it doesn't have the ability to distinguish different species. With this and other parasitic pathogens, PCR's (polymerase chain reaction) may distinguish between parasite species or even strains. Unfortunately, techniques have not yet been validated for these uses. Strains of Dermo exist, but little is known about their distribution. There is some evidence that regionally defined strains may be scattered up and down the coast. This may reflect previous oyster movement, or lack of information on the zoogeographic or ecological distribution of strains.

For QPX and *Haplosporidium,* standard histology should be the test of choice. For the number of animals sampled, international standards should be followed.

JOD - since the organism responsible is not yet identified, the only test is identification of clinical signs on the shell, however there is the problem of other conditions resembling these clinical signs.

No *Vibrio* testing should be required for larvae or seed. These are human health issues that should be tested for under the ISSC/NSSP protocols for organisms for human consumption.

It was felt that eyed larvae could be exempted from batch testing with hatchery certification.

Response to Question 2: Design the best, cost effective, scientifically relevant bivalve shellfish pathogen testing and test interpretation system that will:

a. Allow the interstate transport of bivalve shellfish seed.
b. Take into account the levels of pathogens in the source and receiving waters.
c. Protect cultured shellfish.
d. Protect wild stocks.

A model program should be developed that all states could build upon. The structure should be similar to the ISSC/NSSP process, so that all groups, academia, regulators and industry would have input to the basic program and review potential changes. Again, the internationally accepted standards for tests and protocols should be adopted.

Model Program

1. Include pathogens and "associated" fauna
   The model program should have testing that is now in place in some form, but the breakout group felt that for seed (particularly for larger seed), some program should be in place to evaluate the presence or absence of other fauna. The major concern is that because other bivalves may be included with the seed (ark shells seem to be fairly common), and because seed are being shipped through different zoogeographic zones (Gulf to Atlantic Coast, etc.), there is some possibility for introducing "non-native" species. There is an ancillary problem in that other species are not being tested for potential pathogens and may be carriers even if the seed are not.
2. Recommend state surveillance system be put in place
   Unless the states have some general surveillance system in place that focuses on wild stocks, the current batch testing system has the potential to impede commerce that should be permitted, and epizootic conditions could be missed. The concept of developing zones that would define pathogens present and the levels of infection should be implemented. One note of caution recommended that the zones be an appropriate size.
3. Mechanism for "certification"
   There was agreement that the states, in conjunction with pathologists, industry and academics, develop a mechanism by which hatcheries and nurseries could be certified at varying levels. This concept would include maintaining some general testing scheme and records, but might be used in lieu of batch testing. The zone system (see above) would be an important component of overall certification. A last option would be batch testing.
4. Centralized (within state) data retention
   A great deal of information is being collected by the states. This should be retained and analyzed periodically to provide background for zones or certification. It was noted that some means of maintaining confidentiality should be reviewed, but that given the nature of zoning, it might be impossible to have the specificity needed while retaining confidentiality.
5. Technical review board
   A technical review board should be established that could provide advice on new issues, review government decisions and provide expert opinion to decision-making bodies in times of controversy.

Workgroup 2

Group Leader: Knox Grant
Recorder: Bill Anderson

Response to Question 1: **Can we develop a recommended standardized set of tests for the pathogens of interest to the states for each bivalve species? Should the tests include life cycle (or production cycle) stage, numbers of organisms required, and the test to be performed? Some possible diseases are:**

a. **Dermo**
b. **MSX**
c. **SSO**
d. **QPX**
e. **JOD**

Tests for pathogens should be disease specific, not by bivalve species because of the overlapping nature and distribution of many shellfish species.

Dermo – Use the standard Ray/Mackin assay for animals > 10 mm, using selected tissues. For animals <10 mm (up to 250 mg wet wt.), assay entire animal in RFTM, mince all tissue on a slide, stain and examine as a modified body burden assay, which does not require treating the oyster tissue with NaOH, but results in examining all of the soft tissues.

MSX – Standard tissue section histology is the accepted test. A highly desirable test would be PCR, but it has not been validated for this use. The PCR test, in which the entire soft tissue can be assayed, is highly desirable to determine **if** movement from an enzootic region into an MSX free region should be considered (see SSO below).

SSO – Testing protocols are the same as MSX. There can be mixed infections of SSO and MSX and the plasmodia may be difficult to distinguish. Use of a DNA assay could differentiate between these two parasites, but the test has not been validated.

QPX – Clams. Tissue histology should be used, but this parasite is patchily distributed within the clam. Examination of two tissue sections, one of which passes through the mantle near the siphons, should be considered. PCR techniques may be promising.

JOD – Low priority. There is no specific test—visual inspection of inner valves is the best current test, but it is not specific for JOD.

Sample size – There is no good science on which to base numbers to be tested when histology is used on different size animals. The use of 50 is adequate for now, because, in addition to testing questions, there is no adequate science base to know what levels of parasite infection constitute a risk of introduction.

Response to Question 2: Design the best, cost effective, scientifically relevant bivalve shellfish pathogen testing and test interpretation system that will:

a. **Allow the interstate transport of bivalve shellfish seed.**
b. **Take into account the levels of pathogens in the source and receiving waters.**
c. **Protect cultured shellfish.**
d. **Protect wild stocks.**

When and where to test? For some pathogens once per year at peak season will provide adequate background information—the best time for a monitoring program. The program should evaluate the presence of pathogens in wild populations. For each pathogen the following flow chart suggests when to test:

Question	Yes	No
Animal Moving ?	Test	N/A
Pathogen at Source ?	Test	Ok with records attached
Pathogen at Destination ?	Ok with records attached	Batch test

Monitoring: Areas at the source and destination should be monitored for disease. This could be expensive and during economic hard times it may be discontinued. The zone concept could help alleviate some expense. Pathologists should establish criteria for the zones, but it is the purview of the industry and regulators to establish the number of zones and their configuration.

There was discussion on what could be certified and whether or not the certificate could be geographically based. The concept would be predicated on a source and destination evaluation of "hot" and "cold" zones—areas where disease is presently very prominent or simply at background levels. If this system cannot be sustained, then the fall back position would be batch testing.

Workgroup 3

Group Leader: Peter Merrill
Recorder: Jack Whetstone

Response to Question 1. Can we develop a recommended standardized set of tests for the pathogens of interest to the states for each bivalve species? Should the tests include life cycle (or production cycle) stage, numbers of organisms required, and the test to be performed? Some possible diseases are:

a. Dermo
b. MSX
c. SSO
d. QPX
e. JOD

Histology is the best test for general screening of a wide variety of diseases, but it is expensive and does not evaluate the whole animal. Histology becomes less sensitive when animal size increases. The Ray/Mackin test should not be used for certification, but is a good test for environmental surveys.

Response to Question 2. Design the best, cost effective, scientifically relevant bivalve shellfish pathogen testing and test interpretation system that will:

a. Allow the interstate transport of bivalve shellfish seed.
b. Take into account the levels of pathogens in the source and receiving waters.
c. Protect cultured shellfish.
d. Protect wild stocks.

There is a need to develop a table that lists the species to be tested and pathogens that should be tested for (see below). Testing protocols should include the size of the animal and an evaluation of the area from which seed are being shipped. A test needs to be done for each species and pathogens need to be evaluated with respect to their historical presence in the area, current background levels and host species being tested.

Source water evaluation (see table below). The responsible individual would decide if a test needs to be done for each box.

Host Species *Name*

Size of Seed	**0.25–2 mm**		**2 – 10 mm**		**10 –25 mm**	
Disease	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Dermo						
QPX						
SSO						
MSX						
JOD						
Others						

If shipment is to occur, a generalized decision chart should be developed to facilitate uniform decisions. Decisions would be based on each species and pathogen, and include information on the presence or absence of the pathogen in the source and receiving area (see table below).

Source Area		**Receiving Area**	
Present	**Absent**	**Present**	**Absent**
	Ship	Allow Shipment	Allow Shipment
Test →	→ Ship	Allow Shipment	Tolerance Level
↓			
Present →	→	Tolerance Level	No Shipment

Tolerance Level = regulatory decision by the responsible agency.

Other Issues:

There was general agreement that eyed larvae present minimal risk unless a receiving area is known to be free of a pathogen that is in the source water area. With this exception it should be acceptable to ship directly from a hatchery that is certified.

A mechanism for pre-certification of a hatchery with treated water should be developed. Once raw water is added to the system, the hatchery/nursery could be certified if a schedule of sampling is available—a process that needs further work, but should be developed.

States are the responsible party for base level monitoring.

There is no need to test seed bivalves for *Vibrio*.

General Session Summary

Following presentations by the three breakout groups, there was general agreement that each arrived at similar conclusions with minor differences in approaches to testing. As the discussion continued, it was suggested that some issues should be brought to a vote to determine the position of the workshop participants.

There was **unanimous** support for the following positions:

Vibrio testing is unnecessary for seed transport. *Vibrio* bacteria are ubiquitous in the marine/estuarine environment and there is no distribution data to base any decision. For shellfish seed transport it is of no regulatory concern. *Vibrio* is a human health issue and testing should be confined to the organisms entering the human food chain.

A letter of support to the Northeast Regional Aquaculture Center must be developed for the Smolowitz/Ford/Ragone-Calvo proposal "Health Management Guidelines for Shellfish Culture in the Northeast." NRAC should be asked to expedite this proposal, as written, through whatever process is appropriate. (*Editor's note: A letter from Dr. John Kreauter to Dr. Tom Jamir, Director, NRAC was promulgated on February 25, 2002, see Appendix 5).*

Base level monitoring forms the basis for any shellfish disease program. States need to work on identifying the mechanisms to do this and incorporate information from existing programs. Monitoring should lead to establishment of a zoning system. Careful consideration should be given to developing a mechanism (with appropriate assurances of private sector rights), for maintaining information currently being requested in batch testing. This information could be the basis for certification programs and can augment state monitoring.

Other Issues on which there appeared to be general consensus, but were not voted upon.

Don't use the term "disease free" in health certifications. Certification simply assures that a particular protocol was followed and the results of the test are provided.

A shellfish disease database could be put on a web site that allowed only selected individuals in each state to access.

There needs to be a "decision tree" for agency action in varying situations to guide individuals in making as informed decisions as possible. This decision process needs criteria for establishing acceptable tolerance levels based on the source and destination of the shipment and present and historic pathogen/host relationships in both export and import areas. Whether or not this is called a "tolerance level" or "threshold" for shipping (or denying shipping), there is a lack of uniformity within the scientific community and between states regarding how to proceed.

Establishment of zones for geographic reference is strongly encouraged. This method could save states significant time, effort and economic resources while providing a higher level of protection than is afforded by current methods. The concept is based on identifying zones for monitoring and surveillance that include hatchery, nursery and grow-out activity and presence or absence of pathogens in natural stock. Criteria for zones need to be established by a regional or national group. Establishing zones is not

considered the purview of the regional/national group, but should be a state responsibility.

The ISSC/NSSP model is a possible mechanism for states to use for developing a seed testing and transport program. This implies testing by states to establish zones similar to public health management areas (approved, prohibited, conditional etc.). The process should provide guidelines that include testing (perhaps establishing higher levels of testing in some areas), but allowing for administrative closures in areas without appropriate testing. A group consisting of industry, state, federal representatives and scientists, should establish basic criteria. The proposed model would allow for continued updates and refinements based on the best available information, discussion and decision-making.

More information is needed on the epidemiology of the host/parasite/disease transmission relationship before the ISSC/NSSP model or other process is utilized as a basis for seed shipment decisions. Whether additional scientific investigation or better collation of existing information is required will depend on the specifics in each case. This work could be incorporated into the zone model, using sentinel organisms, populations, etc.

There exists a need to focus on broodstock at the hatchery level. Some form of quarantine may be desirable for certification processes and could be done for closed systems. Unfortunately, there is no mechanism for establishing compliance.

In developing programs for seed inspection we need to include a mechanism for evaluating other invertebrates being moved with the seed. This is especially critical for seed moving between zoogeographic zones—i.e. non-native species. The importance of movement of other "non-target" species not tested for pathogens needs further scientific evaluation.

The issue of harmful algal blooms (HABS) was discussed concerning moving shellfish from an area with an active bloom to an area without a bloom. Given prior movement of shellfish shipments up and down the east coast, there was general agreement that introduction was probably not a major issue, but that caution should be used if there was an active bloom. As with pathogens, the source, destination, present and historic conditions should be considered. HABs were concluded to be a best management practice issue and the HAB group should establish a means of notifying states when and where blooms are occurring.

Workshop participants wanted to insure that seed transfer was placed in perspective with other sources of inter and intrastate transport of pathogens, other organisms, and the historic record. Other living organisms are being moved in and out of estuaries on a regular basis—in ballast water, on the hulls of tankers, barges, freighters and in sport fishing vessels. In addition:

- Bait for fishing can cause significant movement of bivalves, crustaceans and fish (and their associated biota) in both live and frozen forms.
- Live markets for shellfish adults move significant quantities of organisms without testing for pathogens and there are times when these adults are placed in waters of the receiving state without permission.
- Billions of hatchery-reared seed have been moved and there is **no** evidence that seed of host species native to the area have caused any introductions.

Lastly, state regulators in particular believed there should be continued meetings and discussions. Regulators are particularly concerned that the impetus for this workshop be allowed to continue.

The workshop recognized that each of the three functional areas (regulators, industry members and scientists) **need to improve communications.**

- **Scientists** need a mechanism to provide information in the form of "recommendations".
- **State regulators** need to coordinate their testing protocols.
- **Industry** needs mechanisms to present a unified voice on critical coastal and regional issues.

Hatchery/Nursery Operations - Sources for Potential Problems

Hatchery

Stage	Source	Disease Potential	Disease Origin	Transmission Potential to Product	Transmission Potential -Local	Product
Broodstock	Local	High	Local	Moderate to Low	None	Eggs and Sperm
Broodstock	Imported	High	Stock Source Area	Moderate to Low	Low	Eggs and Sperm
Eggs and Sperm	Broodstock-Local	Low	Local	Very Low	None	Larvae
Eggs and Sperm	Broodstock-Imported	Low	Stock Source Area	Very Low	Low	Larvae
Larvae	Broodstock-Local	Low	Local	Very Low	None	Eyed Larvae or Set
Larvae	Broodstock-Imported	Low	Stock Source Area & Local	Very Low	Very Low	Eyed Larvae or Set
Larvae	Local	Low	Local	Very Low	None	Eyed Larvae or Set
Larvae	Imported	Low to Moderate	Stock Source Area & Local	Very Low	Low	Eyed Larvae or Set
Eyed Larvae or Set	Broodstock-Local	Low	Local	Very Low	None	Set to 1mm
Eyed Larvae or Set	Broodstock-Imported	Low	Stock Source Area & Local	Very Low	Very Low	Set to 1mm
Eyed Larvae or Set	Local - Larvae	Low	Local	Very Low	None	Set to 1mm
Eyed Larvae or Set	Imported -Larvae	Low to Moderate	Stock Source Area	Very Low	Low	Set to 1mm

Disease Potential = Potential for contamination of local waters

Nursery

Stage	Source	Disease Potential	Disease Origin	Transmission Potential to Product	Transmission Potential -Local	Transmission Potential - Export	Product
Set to 1mm	Broodstock-Local	Low to Moderate	Local	Moderate	None	Low to Moderate	1mm Seed
Set to 1mm	Broodstock-Imported	Low to Moderate	Stock Source Area & Local	Moderate	Very Low	Low to Moderate	1mm Seed
Set to 1mm	Local - Larvae	Low to Moderate	Local	Moderate	None	Low to Moderate	1mm Seed
Set to 1mm	Imported -Larvae	Low to Moderate	Stock Source Area	Moderate	Low	Low to Moderate	1mm Seed
1mm to 15 mm	Broodstock-Local	Moderate to High	Local	NA	None	High	Seed
1mm to 15 mm	Broodstock-Imported	Moderate to High	Local	NA	Very Low to None	High	Seed
1mm to 15 mm	Local - Larvae	Moderate to High	Local	NA	None	High	Seed
1mm to 15 mm	Imported -Larvae	Moderate to High	Stock Source Area & Local	NA	Very Low	High	Seed

East Coast State Health Certification Requirements

State	Health Certification Requirements		*Crassostrea virginica* Specific pathogen tests					*Mercenaria mercenaria* Specific pathogen tests			Genetic Requirements	Hatchery approval	On-site inspections	Advance notice	Permit duration
	Minimum sample size each batch	Approved shellfish pathologist	Dermo	MSX	SSO	JOD	Vibrio	Dermo	QPX	Vibrio	(Yes/No)	(Yes/No)	(Yes/No)		
Florida	50	veterinarian	yes(1)	yes	no	no	no(4)	yes (1)	yes	no(4)	yes	yes	yes	7 days	BMP(14)
Georgia	50	yes	yes	yes	no	no	yes	yes	yes	yes	no	yes	yes	7 days	365 days
South Carolina	50	yes	yes(1)	yes	yes	yes	no	yes (1)	yes	no	no	yes (2)	yes (3)	7 days	30 days
North Carolina	30	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	30 days	negotiable
Virginia	60	yes	yes	yes	no	no	no	yes	yes	no	no	no	no	10 days	30-60 days (5)
Maryland	30-60	yes	yes	yes	yes (6)	no (7)	no	yes	yes	no	no	no	no	variable	open
Delaware	35-100	yes	yes (1)	yes	yes	yes (8)	no	yes (1)	yes	no	no	yes	no	no	30 days
New Jersey	n/a (11)	n/a	yes	yes	no	no	no	no	no	no	no	no	no	n/a	n/a
New York	30	yes	yes	yes	no	yes	yes	no	yes	yes	no	yes	no	14 days	negotiable (9)
Connecticut	30	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes	yes	14 days	365 days
Rhode Island	variable (10)	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	n/a	n/a	5 days	none
Massachusetts	50	yes	yes(1)	yes	yes	yes	no	yes (1)	yes	no	no	yes (2)	no	negotiable	365 days
New Hampshire															
Maine	variable	yes (12)	yes	yes	yes	yes	no	yes	yes	no	no	yes	no (13)	negotiable	variable

Comments:

SC (1) - Ray's fluid thioglycollate method or body burden
SC (2) - annual calendar year hatchery approval for closed systems only, does not require on-site inspections of seed
SC (3) - for nursery product exposed to open estuarine waters
FL (4) - Not a requirement for health certification, but submissions may be voluntarily screened by laboratory protocol voluntarily screened by laboratory protocol
VA (5) - A new test is required every 30 days for oysters; 60 days for clams; receipt of new test results require a new permit letter
MD (6) - Coastal bays only
MD (7) - No imports permitted from JOD areas
DE (8) - not specifically requested, but covered by histological exam
NY (9) - no product accepted south of NY
RI (10) - decision of shellfish pathologist
NJ (11) - no specific certification requirements other than Dermo and MSX for C. virginica
ME (12) - must be approved by exporting state or Canada
ME (13) - depuration only
FL (14) - Permits are not issued; duration is based on annual certification, compliance with best management practices and lease provisions

Appendix 3.

Eastern US State Contacts for Interstate Shellfish Importations

Florida
Mark Berrigan, Bureau Chief
Bureau of Aquaculture Development
Division of Aquaculture
FL Department of Agriculture and Consumer Services
1203 Governor's Square Blvd, 5th Floor
Tallahassee, FL 32301
850-488-4033
berrigm@doacs.state.fl.us

Georgia
Brooks Good
Coastal Resources Division
Georgia Department of Natural Resources
One Conservation Way, Suite 300
Brunswick, GA 31520-8687
912-262-3109
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South Carolina
Bill Anderson
Office of Fisheries Management
South Carolina Department of Natural Resources
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843-953-9395
843-953-9386 - fax
andersonb@mrd.dnr.state.sc.us

North Carolina
Craig Hardy
Resource Enhancement Section
North Carolina Division of Marine Fisheries
Department of Environmental Resources
P.O. Box 769
Morehead City, NC 28577-0769
252-762-7021
252-726-9128 – fax
Craig.Hardy@ncmail.net

Virginia
Jim Wesson
Fisheries Management Division
Virginia Marine Resources Commission
2600 Washington Avenue, 3rd Floor
Newport News, VA 23607
757-247-2200
Jwesson@mrc.state.va.us

Maryland
Tamara O'Connell, Permits Coordinator
Fisheries Service, B-2
Maryland Department of Natural Resources
Tawes State Office Building
580 Taylors Avenue
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410-260-8323
tloconnell@dnr.state.md.us

Delaware
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302-739-4782
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New Jersey
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New Jersey Department of Environmental Protection
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609-748-2040
609-748-2032 - fax
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New York

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Bureau of Marine Resources
205 North Belle Mead Road
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631-444-0483
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Connecticut

John Volk, Director
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Massachusetts Division of Marine Fisheries
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New Hampshire

Sandy Falicon
Importation Permits
New Hampshire Fish and Game Department
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603-271-3511
603-271-1438 – fax
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Maine

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Appendix 4.

East Coast Shellfish Pathologists

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Dr. Eugene M. Burreson
Director for Research and Advisory Services
Virginia Institute of Marine Science
P.O. Box 1346 (for mail)
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Gloucester Point, VA 23062 USA
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**Perkinsus marinus* assays only

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Appendix 5.

RUTGERS COOPERATIVE EXTENSION

NEW JERSEY AGRICULTURAL EXPERIMENT STATION

East Coast Shellfish Hatchery and Nursery List 2002

Gef Flimlin
Marine Extension Agent

Each year, shellfish growers search for seed suppliers. Some suppliers mail out seed price catalogues annually. This publication is designed to identify shellfish seed suppliers from along the East Coast of the United States and Canada so that there might be a better link between the shellfish farmers and the shellfish seed suppliers.

Some of the shellfish seed suppliers listed here raise seed for their own use. Others are solely research hatcheries for a University or State. Regardless, this first attempt at identifying the industry suppliers can be used by many interested people to assist and inform the suppliers in numerous ways.

The list has been reviewed numerous times by people in every state listed. If there is an omission, it has not been intentional. This list will be updated in the future. If there are any suppliers who have not been included, they should contact the author for inclusion in the next publication. If someone is using this list and cannot reach a business because the pertinent information has changed or is incorrect, please send a note, email, or call (contact information at the end). If a new hatchery comes on line, please urge them to contact me. This is done as a service to the industry, please help keep information current.

Finally, this information by no means suggests a recommendation about the quality of the products or services that these seed suppliers produce, and should by no means, be construed as an advertisement for any of these companies by either the author or Rutgers University.

Connecticut

Bear Neck Shellfish - OY
Contact: Richard N. Seiden
36 Green Street
Milford, CT 06460
Phone - 203-882-9822

Mohegan Aquaculture - OY
Contact: Dr. Paul D. Maugle
5 Crow Hill Road
Uncasville, CT 06382
Phone - 860-826-6129
e-mail - pmaugle@moheganmail.com

Moank Aquaculture Cooperative - OY, HC, BS
Contact: Jim Markow, Stuart Mattison
100 Main St.
Noank, CT 06340
Phone - 860-460-4558
Fax - 631-765-1808

Riverpoint Shellfish, LLC - OY, HC
Contact: Phil Bohannan, Manager
311 Chaffinch Island Road
Guilford, CT 06437
Phone - 203-458-9227

Yankee Oyster Project - OY
Contact: Phil Curcio
P.O. Box 4058
East Norwalk, CT 06855
Phone - 203-854-5330
Fax - 203-866-1318

US Department of Commerce - OY, HC, BS
Contact: Dr. Tony Calabrese, Director
National Marine Fisheries Service Lab
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Phone - 888-252-6735

Cedar Key Raceways - HC, N
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The Clam Bed, Inc. - HC
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Cole's Clam Nursery - HC, N
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Pellican Inlet Aquaculture Center - HC
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Taylor Sea Food - BS
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Wampanoag Aquinnah Shellfish Hatchery - HC, OY
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Acknowledgements

The author sincerely thanks the Cooperative Extension and Sea Grant Extension Agents on the Atlantic and Gulf Coasts for their assistance in compiling this information. Not one held back help and all willingly provided updates and reviews. Those readers starting in the shellfish culture business should contact their extension agents or specialists to seek information about the culture process if they have any questions. In coastal counties, look in the Government pages of the phone book for Cooperative Extension or Extension Service, and those offices should be able to give you appropriate direction.

I must also thank Barbara Wingender, at the Ocean County Extension Center, for her continued help in organizing the data contained in this publication.

For corrections, more information, or to add a new hatchery, contact:

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Key to Symbols

BS..... Bay Scallops, *Argopecten irradians*
H ..... Hatchery (Public)
HC .... Hard Clams, *Mercenaria mercenaria*
M ..... Mussel, *Mytilus edulis*
N ..... Nursery
OY .... Oyster, *Crassostrea virginica*
PH ..... Private Hatchery
R ..... Research
SC ..... Soft Clam, *Mya arenaria*
SS ..... Sea Scallops, *Placopecten magellanicus*
SU ..... Surf Clams, *Spisula solidissima*

Appendix 6.

Haskin Shellfish Research Laboratory

Institute of Marine and Coastal Sciences
Rutgers University
6959 Miller Avenue, Port Norris, New Jersey

February 25, 2002

Dr. Tom Jamir, Director
NRAC
University of Mass. Dartmouth
North Dartmouth, MA 02747

Dear Tom:

I have been asked to prepare this letter by the organizing committee of the Eastern United States Interstate Shellfish Seed Transport Workshop. This workshop was organized to provide a forum for exchange of information and views on the movement of bivalve seed along the East and Gulf Coasts and what testing and certifications should accompany this movement. I am enclosing a copy of the Statement of Objectives and Agenda.

There were over 50 individuals attending the meeting and they included shellfish and fish pathologists, state regulators, shellfish producers, extension agents and other academics. As the meeting progressed it became apparent to many participants that many of the issues raised by the regulatory and industry members could be approached by an existing proposal. I hasten to add that, although Roxanna, Susan and Lisa were present, this proposal was brought to the attention of the workshop by individuals who had submitted reviews to NRAC.

At the final session there was a unanimous support for the Smolowitz, Ford, Ragone Calvo proposal. The general feeling was that the participants—both from the industry and regulators—didn't want to have this effort become bogged down in a lengthy process and delay implementation.

The Eastern United States Interstate Shellfish Seed Transport Workshop organizing committee and the assembled participants unanimously request that the proposal entitled: Health Management Guidelines for Shellfish Culture in the Northeast, be expedited as written, through whatever process NRAC and its board considers appropriate.

On behalf of the organizing committee and participants, thank you for your consideration of our request.

Sincerely

John N. Kraeuter, Ph.D.
Organizing Committee Member

CC: NRAC Board Chair
NRAC TIAC Chair
Karen Rivara

Phone (856) 785-0074 x131 Fax (856) 785-1544 Email Kraeuter@hsrl.rutgers.edu

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