

Introduction of Non-Indigenous Aquatic Species Implementation Plan

August 1996



Chesapeake Bay Program

Chesapeake Bay Program

The Chesapeake Bay Program is a unique regional partnership leading and directing restoration of Chesapeake Bay since 1983. The Chesapeake Bay Program partners include the states of Maryland, Pennsylvania, and Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; the U.S. Environmental Protection Agency (EPA), which represents the federal government; and participating citizen advisory groups.

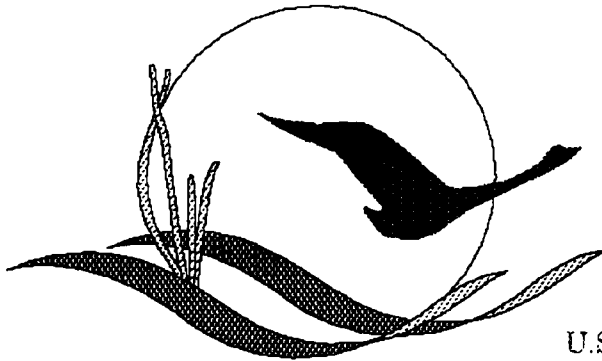
In the *1987 Chesapeake Bay Agreement*, Chesapeake Bay Program partners set a goal to reduce the nutrients nitrogen and phosphorus entering the Bay by 40% by the year 2000. In the *1992 Amendments to the Chesapeake Bay Agreement*, partners agreed to maintain the 40% goal beyond the year 2000 and to attack nutrients at their source--upstream in the tributaries. The Chesapeake Executive Council, made up of the governors of Maryland, Pennsylvania, and Virginia; the mayor of Washington, D.C.; the EPA administrator; and the chair of the Chesapeake Bay Commission, guided the restoration effort in 1993 with five directives addressing key areas of the restoration, including the tributaries, toxics, underwater bay grasses, fish passages, and agricultural nonpoint source pollution. In 1994, partners outlined initiatives for habitat restoration of aquatic, riparian, and upland environments; nutrient reduction in the Bay's tributaries; and toxics reductions, with an emphasis on pollution prevention.

Since its inception, the Chesapeake Bay Program's highest priority has been the restoration of the Bay's living resources--its finfish, shellfish, bay grasses, and other aquatic life and wildlife. Improvements include fisheries and habitat restoration, recovery of bay grasses, nutrient reductions, and significant advances in estuarine science.

Introduction of Non-Indigenous Aquatic Species Implementation Plan

Prepared by

**Exotic Species Workgroup
Living Resources Subcommittee
Chesapeake Bay Program**



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INTRODUCTION

The *Chesapeake Bay Policy for the Introduction of Non-Indigenous Aquatic Species* adopted by the Chesapeake Bay Executive Council in December 1993 (hereafter the Policy) is intended to minimize the economic and/or ecological risks associated with first time introductions of non-indigenous aquatic species to waters of the Chesapeake Bay region. This implementation plan is intended to reflect the language and the intent of the Policy statement:

It shall be the policy of the Jurisdictions in the Chesapeake Bay basin to oppose the first-time introduction of any non-indigenous aquatic species into the unconfined waters of the Chesapeake Bay and its tributaries for any reason unless environmental and economic evaluations are conducted and reviewed in order to ensure that risks associated with the first-time introduction are acceptably low. The signatories to the Adoption Statement are committed to sharing information and to carefully assessing through a joint review process all proposed first-time introductions of non-indigenous aquatic species in the Chesapeake Bay basin. The signatories to the Adoption Statement are also committed to working together to prevent unintentional introductions of non-indigenous aquatic species and to minimize the negative effects of undesired aquatic species within the Chesapeake Bay ecosystem.

Recommendations which are developed through the Policy and this Implementation Plan are advisory, not compulsory, for the watershed jurisdictions. The Policy and its implementation plan are focused on ensuring that all Bay jurisdictions are provided with the best information upon which to base their decisions about introductions, and that all Bay jurisdictions are informed about the decisions of the others with respect to non-indigenous aquatic species.

Definitions

1. **Introductions:** Entry of a non-indigenous non-naturalized species (as defined in the Policy) into a geographic area beyond its historic range or its present naturalized range, as a result of human-mediated activities. This does not include natural migrations or range extensions of a species, or similar events.
2. **Intentional Introduction:** Deliberate release of non-indigenous aquatic species (as defined in the Policy) into the unconfined waters of the Chesapeake Bay watershed.
3. **Unintentional Introduction:** Accidental release of non-indigenous aquatic species into the unconfined waters of the Chesapeake Bay watershed.
4. **Non-indigenous Species:** For the purpose of this document, any aquatic species, as defined in the Policy, that enters or could potentially enter a watershed, as

defined in the Policy, beyond that species' historic range. Hatchery-produced hybrids and genetically engineered organisms are also defined as non-indigenous species, even if the parent species or source organisms are indigenous or naturalized.

5. **Aquatic Nuisance Species:** This Implementation Plan uses the definition developed by the Aquatic Nuisance Species Task Force, which is: "A non-indigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters or commercial, agricultural, aquacultural, or recreational activities dependent on such waters. Aquatic nuisance species include non-indigenous species that occur in inland, estuarine and marine waters and that presently or potentially threaten ecological processes and natural resources."

The Policy focuses primarily on the development of regional guidelines for evaluating the benefits and risks associated with aquaculture, recreational fishing, stock enhancements, biological control, and research activities associated with intentional introductions. In addition, the Policy seeks to reduce the frequency and impact of unintentional introductions into the Chesapeake Bay region through development of a combined program of education, monitoring, ballast water management, and control/eradication measures.

The Policy strives to create a consistent review process which ensures the input of the most recent scientific information and enhances the flow of information between Chesapeake Bay basin jurisdictions in matters involving non-indigenous aquatic species. The effectiveness of such a review process was illustrated by the response of the Exotic Species Workgroup to the proposed introduction of grass carp by Virginia Power into Lake Anna, Virginia (Exotic Species Workgroup 1994). An *ad hoc* panel was formed and met on April 29, 1994 to review the proposal. The panel then submitted a formal recommendation to all parties involved. The subsequent stocking of grass carp in Lake Anna was done in accordance with the panel's recommendations. Input on the recommendations was provided by specialists from Pennsylvania, Maryland, the District of Columbia, Virginia, Texas, Georgia, and Illinois.

The Policy calls for creation of an Implementation Plan that defines protocols and a schedule for achieving the goals set forth in the Policy. The plan addresses five issue areas: aquaculture (private and public aquaculture and stocking), research, monitoring, education, and control. Ballast water, a pathway of introduction identified in the Policy, is being addressed further by the Chesapeake Bay Commission, working with the Chesapeake Bay Program, stakeholders throughout the Bay region, the Coast Guard, the Navy, the U.S. Congress, federal agencies and researchers. They have produced a report summarizing their findings and stating their recommendations for reducing the risk of biological invasion via ballast water release in Chesapeake Bay (Chesapeake Bay Commission 1995). To avoid repetition, ballast water management will not be discussed in this document.

The Implementation Plan particularly focuses on the following aspects of unintentional introduction of non-indigenous aquatic species: (1) identification of introduction pathways; (2) risk assessment for the respective pathways; (3) development of appropriate protocols to minimize the risks associated with the unintentional introduction; and (4) education as a means of preventing unintentional introduction. In addition, this document addresses the need for a regional information base on non-indigenous aquatic species.

Public and Private Aquaculture and Stocking

Private aquaculture in the Chesapeake Bay basin is highly diverse, employing various methods to culture a variety of finfish, shellfish, crustaceans and aquatic plants. The history of private aquaculture relating to food production and stocking in the Chesapeake Bay region dates back to the 17th century, but expansion to the commercial scale is a recent development in the Chesapeake Bay region.

Public aquaculture facilities and stocking programs associated with such facilities (inside and outside of the basin) provide support for sport and commercial fishery interests of the Bay region. Under special situations public and private aquaria provide a refuge for endangered species, where propagation techniques can be tested. The goal of such programs is preservation and eventual reintroduction of the species into its native habitat or other suitable natural habitat.

Research

The jurisdictions of Delaware, the District of Columbia, Maryland, New York, Pennsylvania, Virginia, and West Virginia recognize the value of research involving non-indigenous aquatic species in the Chesapeake Bay basin and strive to develop guidelines to minimize the potential ecological and economic risks posed by research-related intentional and unintentional introductions to the region.

Although the rate of introductions of non-indigenous aquatic species through the research pathway is less than other pathways, as acknowledged in the Policy (CBP 1993, Appendix B, p. 24), precautions should be taken to reduce risks associated with use of non-indigenous aquatic species in any endeavor. Researchers should consistently employ reasonable precautions when working with non-indigenous aquatic species using guidelines already available as examples of appropriate precautions (Implementation Plan, Appendix B).

Monitoring

Extensive monitoring has been underway in the Chesapeake Bay Basin for many years, although only in recent years have such efforts been expanded to include non-indigenous aquatic species. In

1989, the Monitoring Subcommittee of the Chesapeake Bay Program published the results of an extensive survey of current monitoring programs in the six-state Chesapeake Bay basin. This *Chesapeake Bay Basin Monitoring Program Atlas* (CBP 1989) details state, federal, municipal, and citizen monitoring efforts, including 79 biological and 112 water and air quality monitoring programs.

In determining methods to monitor aquatic nuisance species, the establishment of multi-jurisdictional *ad hoc* committees to develop monitoring protocols has been extremely effective, as shown by the success of the zebra mussel monitoring program. The Susquehanna River Basin Task Group, an *ad hoc* group created in 1991 by the Exotic Species Workgroup, developed a method for monitoring zebra mussels based upon available information, monitoring constraints, and concerns of participants (Exotic Species Workgroup 1993). Considerable research into the monitoring of zebra mussels and other non-indigenous aquatic species has been funded by both United States Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) under the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990. Information relating to monitoring methods is available from the Aquatic Nuisance Species Task Force and other groups.

The use of consistent monitoring protocols throughout the Chesapeake Bay basin is recommended and encouraged. Monitoring programs already established may need to be modified to include aquatic nuisance species.

Controls

Historically, the control of aquatic nuisance species has not been discussed or undertaken until a non-indigenous aquatic organism was discovered in a new geographic area and environmental alterations became apparent. Although professionals in water quality and other resource-related fields are now better informed and attempting to fill in this gap, education of the general public is not at the level necessary to effectively aid in the implementation of controls.

With respect to the control of pathogens, implementation falls under the jurisdiction of state and federal human health, animal health and agricultural agencies. Efforts to establish a regional policy regarding pathogens associated with aquatic species and their transfers are on-going, outside the Chesapeake Bay Program. For example, there is a fish health policy in development funded through the Northeastern Regional Aquaculture Center, United States Department of Agriculture. Currently, jurisdictional policies apply.

Education

Education represents a method of control through prevention strategies directed at aquaculture, fisheries management, the aquarium trade and research. Education contributes to the uniformity of

monitoring methods and the selection of safe and appropriate controls. The value of education in preventing the unintentional introduction of non-indigenous aquatic species is underscored by the emphasis placed on education in the Aquatic Nuisance Species Task Force Report (1994) to Congress: *Findings, Conclusions, and Recommendations of the Intentional Introductions Policy Review*. This report recommends that federal agencies support education and extension programs that increase awareness of non-indigenous aquatic species including risks, enforcement and appropriate uses. In addition, it is recommended that federal and other agencies support the development of national clearinghouses for educational materials to support outreach programs.

PUBLIC AND PRIVATE AQUACULTURE, AND STOCKING PROGRAMS

The interests of the developing aquaculture industry, existing programs for stock enhancement and the need to protect natural resources can be addressed by developing programs to identify current aquaculture and stocking practices in the basin. Guidelines are needed to minimize the potential risks. Such an approach will entail identifying species used in public and private aquaculture, identifying and evaluating culture systems, and identifying the potential risks associated with stocking processes.

Implementation Tasks

- I. Identify all those aquatic species currently approved for public and private aquaculture or stocking and the conditions under which each may be cultured or stocked at the present time in each jurisdiction of the Chesapeake Bay basin.**
 - a. Every regional agriculture and fishery agency will be asked to contribute a list of those aquatic species currently approved for public and private aquaculture and used in stocking programs for their jurisdictions. As stated in the Policy, these species will be considered as approved for that jurisdiction (CBP 1993, p.4). Each jurisdiction will also provide a list of any aquatic species whose importation is prohibited in that jurisdiction.
 - b. The Exotic Species Workgroup will compile the individual lists and provide a complete multi-jurisdictional compilation of lists to each of the Chesapeake Bay jurisdictions.
- II. Identify and provide to all Bay jurisdictions a list of routes of entry into the Chesapeake Bay Basin of aquatic species used in aquaculture and stocking.**
 - a. The agricultural and fisheries agencies of each jurisdiction will be asked to provide a list to the Exotic Species Workgroup. Each list will identify the routes of entry for aquatic species used in aquaculture and stocking into and between the tributary watersheds of that jurisdiction, as identified in the Policy.
 - b. The Exotic Species Workgroup will provide a multi-jurisdictional compilation of the individual jurisdictional lists to all Bay jurisdictions.
- III. A multi-jurisdictional group will evaluate the risks associated with each defined route of entry and establish suggested guidelines or protocols to minimize the risks.**

- a. The Exotics Species Workgroup will select and work cooperatively with a group of specialists (agricultural, fishery and one risk assessor) from the public and private sectors and Policy signatory agencies.
- b. The Exotics Species Workgroup and the group of specialists will assess activities (e.g. those from the bait-fish industry, stock enhancement programs, and the aquarium and pet trade) with regard to associated risks and assign them with appropriate documentation or verification through historical and scientific evidence.

The multi-jurisdictional group will consider approaches to minimize risk levels for each activity. As an end-product of that consideration, the group should define sets of protocols to minimize risk that will be applied such that the potential for introduction of non-indigenous aquatic species will be minimized. The group will consider:

- i. The defined risk.
 - ii. The significance of the activity to the region's interests (economic and resource).
 - iii. Procedures to reduce risk that are most effective and economical.
 - iv. Cost to both the jurisdiction and private sector for applying protocols.
 - v. Uniformity of application. It is recognized that different technologies to fulfill intent may be preferred under different conditions, and that new technologies may be developed.
- c. A document, stating the risk of unintentional introduction of non-indigenous aquatic species for each activity and the suggested protocols for minimizing risk of introduction, will be produced by the Exotics Species Workgroup. After review and approval by the Living Resources Subcommittee, the document will be distributed to the various signatory jurisdictions.

RESEARCH

Development and adoption of specific research protocols should be consistent with, but not identical to, the process outlined for Public and Private Aquaculture and Stocking (see p. 6). The various uses of non-indigenous aquatic species for research should be identified, risks associated with those uses assessed and specific protocols developed and implemented.

Guidelines for handling non-indigenous aquatic species in research already exist to control both intentional and unintentional introductions. These have been developed by regional, national and international groups. As called for in the Policy, such guidelines were evaluated in the development of this Implementation Plan. Two particular guidelines, which are summarized in Appendix B, were evaluated for their applicability to other non-indigenous aquatic species and to *in situ* situations: the guidelines of the International Council for the Exploration of the Sea (ICES), for minimizing disease and parasites associated with first-time introductions; and the *Protocols for Conducting Research on Nonindigenous Mussels of the Genus Dreissena in the Chesapeake Bay Basin* (Exotic Species Workgroup 1993).

The generation of a set of research protocols, which will be standard for all non-indigenous aquatic species research, needing only minimal additions for each species, is addressed by the following implementation tasks.

Implementation Tasks

- I. **Identify and classify the kinds of research that could result in the movement of new non-indigenous aquatic species** into, within or through the Chesapeake Bay basin.
 - a. Components of the Chesapeake Bay scientific community, e.g., Smithsonian Estuarine Research Center, Virginia Institute of Marine Sciences, Chesapeake Biological Laboratory, Academy of Sciences, universities and the STAC, will be asked to provide the Exotic Species Workgroup a list of on-going and planned research activities, as well as a summary of completed research projects.
 - b. The Exotic Species Workgroup will provide a compilation of the individual lists to the jurisdictions.
 - c. New types of research will be added to this list as they are developed.
- II. **Evaluate the risks of introduction** of a non-indigenous aquatic species from each research activity.

- a. An *ad hoc* panel will be formed to evaluate the risks associated with each kind of research. The panel will consist of a group of scientists representing each signatory, as well as one risk assessor.
- b. The aforementioned risk assessment information, generated and documented by the *ad hoc* panel, will be made available by the Exotic Species Workgroup for the development of protocols, as described in the following section. Such information will be made available to all interested parties, including universities, public and private research facilities, management agencies in each jurisdiction, STAC, and the public.

III. **Develop protocols for minimizing identified risks** for each research activity, following federal guidelines for biocontainment facilities.

- a. A group of scientists, including participants of the workgroup discussed above, and managers from resource agencies, invited from every Bay jurisdiction, will identify methods of reducing risks associated with research activities.
- b. These methods of reducing risks associated with research activities will be summarized by the Exotic Species Workgroup and made available to all interested parties, including universities, public and private research facilities, management agencies in each jurisdiction, STAC, and the public.

MONITORING

Any program dealing with non-indigenous aquatic species invasions will require a monitoring element. Existing monitoring programs in the Chesapeake Bay drainage should be reviewed for their effectiveness in detecting non-indigenous aquatic species, and in tracking populations and distributions of aquatic nuisance species.

In inter-jurisdictional waters such as the Chesapeake Bay basin, it is important that compatible protocols be used by the jurisdictions to monitor non-indigenous aquatic species in order to ensure comparability of results. When consistent protocols are developed by consensus -- as with zebra mussel monitoring protocols in the Susquehanna River basin -- the probability of regional cooperation is increased.

Inter-jurisdictional communication is also essential in developing effective monitoring programs for non-indigenous aquatic species in the Chesapeake Bay basin. Currently the Pennsylvania Department of Environmental Protection (PA DEP) serves as the clearinghouse for zebra mussel monitoring in the Susquehanna River basin. Establishing a regional clearinghouse for other aquatic nuisance species will serve to encourage information exchange, thus maximizing monitoring efforts.

Implementation Tasks

- I. **Review existing Chesapeake Bay basin monitoring programs** to determine whether changes should be recommended that address non-indigenous aquatic species. Although these programs focus on indigenous aquatic species, they may provide early detection information on non-indigenous aquatic species as well.
 - a. In coordination with the Monitoring Subcommittee, as necessary, the Exotic Species Workgroup will update the monitoring information in the 1989 Chesapeake Bay Program publication, *Chesapeake Bay Basin Monitoring Program Atlas*.
 - b. The Exotic Species Workgroup will distribute copies of such an update to interested parties.
 - c. A list of experts within the region who are available for both the verification and identification of specimens thought to be non-indigenous aquatic species will be developed by the Exotic Species Workgroup. This list will be supplied to the regional non-indigenous aquatic species coordinator and, when feasible, maintained on the World Wide Web, accessed via the Chesapeake Bay Program's homepage. Until such time as this position is filled, the list would be supplied to the Chesapeake Bay Program Office, whose staff will refer any inquiries to the

appropriate expert. A toll-free number for the Chesapeake Bay Program will include provisions for such inquiries.

- d. When a non-indigenous aquatic species is identified from a sample taken from a location thought to be outside the range or accepted culture system of that non-indigenous aquatic species, the information will be sent to the Exotics Species Workgroup. The Workgroup will evaluate these findings and forward such information to each jurisdiction, as necessary. They may decide to distribute that information to the director of each potentially affected agency in each jurisdiction. A literature search may be initiated on the species and its effects on ecosystems. Information thus gained may lead to its designation as an aquatic nuisance species.

II. **Develop and implement a program to allow for the creation of clearinghouses for monitoring information** relating to non-indigenous aquatic species. This program will alert all jurisdictions to a change in distribution of non-indigenous aquatic species in a timely manner. Relevant information will be circulated to all jurisdictions.

- a. A full-time regional non-indigenous aquatic species coordinator is desirable to facilitate the implementation of monitoring tasks, education and other components of this implementation plan. Should the position of a full-time coordinator be established, the role of the individual species-specific clearinghouses would be transferred to that person, with each Policy signatory designating a representative to serve as a liaison.

The responsibilities of such a full-time regional non-indigenous aquatic species coordinator would include the following: (1) coordinating any existing non-indigenous aquatic species clearinghouse within the region; (2) preparing and distributing annual reports on monitoring efforts for aquatic nuisance species; (3) providing for the verification of specimen identification as needed or identification of unidentified specimens collected within the region; and (4) maintaining a list of experts within the region who are available for both the verification and identification of specimens.

- b. Designation of a non-indigenous aquatic species as an aquatic nuisance species requires consensus of the Bay jurisdictions.
- c. When a non-indigenous aquatic species is identified as an aquatic nuisance species, the regional non-indigenous aquatic species coordinator will be responsible for disseminating monitoring information on that species within the Chesapeake Bay basin. Until such time as this position is filled, a lead agency will be chosen from the Exotic Species Workgroup and designated as the clearinghouse coordinator for that particular aquatic nuisance species. The clearinghouse coordinator will be

responsible for disseminating pertinent monitoring information on that species within the Chesapeake Bay basin.

- d. All jurisdictions within the Chesapeake Bay basin will submit monitoring information relating to an aquatic nuisance species to the regional non-indigenous aquatic species coordinator, or the appropriate clearinghouse in a standard format to be determined by the Exotic Species Workgroup. Data will also be submitted by each jurisdiction to the Exotic Species Data Base of the National Biological Service in Gainesville, Florida.
- e. Brief annual reports of monitoring activities and findings relating to an aquatic nuisance species will be prepared and distributed by the regional non-indigenous aquatic species coordinator or the clearinghouse agency to cooperating agencies and interested parties.

III. Develop and implement, as necessary, programs that encourage the use of consistent monitoring protocols throughout the Chesapeake Bay basin for aquatic nuisance species, consistent with the actions specified in the Policy. Existing monitoring programs should be evaluated to determine adequacy for compatibility, comprehensiveness, and consistency. Jurisdictions are requested to report findings from on-going monitoring programs and research related to the aquatic nuisance species to the Exotic Species Workgroup annually.

- a. After a non-indigenous aquatic species has been designated as an aquatic nuisance species, each Policy signatory will designate a current member of the Exotic Species Workgroup to an *ad hoc* committee, which will be chaired by the clearinghouse coordinator, to determine appropriate regional monitoring methods for that species.
- b. Develop monitoring protocols for the aquatic nuisance species:
 - I. Define vulnerable areas and environmental tolerances of the aquatic nuisance species.
 - ii. Request input from all recognized monitoring groups.
 - iii. Evaluate compatibility of existing monitoring programs for monitoring of the aquatic nuisance species.
 - iv. Determine appropriate regional monitoring protocols for aquatic nuisance species.

A brief comment period will be provided for those groups or individuals unable to attend protocol development meetings.

CONTROLS

Control strategies can be divided into two categories, preventative measures and treatment controls. Preventative measures provide a proactive approach to controlling non-indigenous aquatic species introductions, including strategies such as deep ocean ballast water exchange, education, legislation and permitting processes. Treatment controls are typically reactive in nature including strategies such as chemical, thermal, and biological controls, ultraviolet radiation, and oxygen deprivation.

In many cases there may not be a specific target organism for which a preventative measure is implemented. A preventative measure will generally preclude the entry of most, if not all, non-indigenous aquatic species where it is applied. The implementation of preventative measures should have little if any effect on the existing environmental conditions in the area intended to be protected. The use of effective preventative measures should eliminate, or at least delay, the need for specific treatment controls. The potentially high economic and ecological costs associated with some introductions of non-indigenous aquatic species suggest placing prevention as a high priority. Although prevention may only delay an inevitable introduction, these activities are warranted. During the interim, advances in treatment control technology may better equip industry and the public to combat detrimental impacts. To achieve success, prevention programs must be environmentally acceptable, comprehensive and practical. They must also account for occupational safety, include short and long-term goals, and provide an acceptable cost/benefit ratio. Implementation of preventative programs requires support and cooperation from federal and multi-jurisdictional state, private, and public organizations.

Treatment controls to eradicate or limit specific populations of non-indigenous aquatic species typically take advantage of various life stages based on vulnerability. For example, younger life stages such as larvae may be less tolerant to chemical or thermal treatments, therefore requiring lower dosages to eliminate large numbers, or fish that congregate on spawning shoals concentrate the population in an area for effective treatment. Knowledge of environmental tolerances and life history characteristics of the targeted species is critical for effective treatment controls, indicating the need for research on species expected to pose a threat to Chesapeake Bay waters. Utilizing this type of species-specific information, treatment is intended to impact only the targeted species; however, this is seldom the case. Often other species are impacted directly by the treatment or indirectly by subsequent alterations in environmental conditions.

Whatever the control options chosen, when a species becomes an aquatic nuisance species, findings of the monitoring groups should be reported annually to the Exotics Species Workgroup to guide revision and improvement of control strategies.

Implementation Tasks

When the Exotic Species Workgroup agrees that there is an imminent threat of an aquatic nuisance species entering the Chesapeake Bay watershed, the following shall be done:

- I. **The Exotic Species Workgroup will form a small *ad hoc* committee**, which will consist of representatives from each signatory, at-risk facilities, jurisdictional regulatory agencies, and resource management agencies.
- II. **The *ad hoc* committee will identify and summarize sensitive components of facilities and ecosystems at risk.**
- III. **The *ad hoc* committee will evaluate and/or develop environmentally sound preventative and treatment control strategies as needed.** This will be done in consultation with regulatory agencies and water users in each jurisdiction, ensuring that any recommended control strategies are in accordance with jurisdictional and federal water quality standards. As needed, information will be supplied to regulatory agencies.
- IV. **The *ad hoc* committee will prepare a report** that summarizes its findings and recommendations. The report will be submitted to the Living Resources Subcommittee for review.

EDUCATION AND INFORMATION

The importance of public awareness of non-indigenous aquatic species to protection of the Chesapeake Bay ecosystem should not be underestimated. In today's world market community, the probability of introducing species is increased. Introductions may occur either intentionally or unintentionally. Intentional introductions occur when there is a planned and approved stocking of a species, such as hybrid striped bass. Unintentional introductions occur through accidental actions such as naively releasing non-native aquarium plants and animals into natural waters or discharging ballast water containing non-indigenous species into the Bay.

Currently, education of the public about existing and possible future problems associated with non-indigenous aquatic species and the challenges society may face in controlling them is inadequate. Although the importance of educating the entire public, young and old, is recognized, special emphasis is being given to the leaders of today (politicians and other government officials) and the education of students, as the leaders of tomorrow.

Numerous public awareness materials have been developed by both public and private sources. Sea Grant programs, through the Mid-Atlantic Sea Grant Network, have produced fact sheets, brochures, ID cards and guides for zebra mussel outreach efforts. In addition, Virginia Sea Grant has published a curriculum on the zebra mussel. Similarly, Louisiana Sea Grant currently publishes a curriculum and accompanying video on non-indigenous aquatic species intended for the middle school level, grades 6-8. Examples of successes in the development of non-indigenous aquatic species educational materials already exist and were the result of prioritization and funding by Sea Grant (zebra mussel) and National Science Foundation (nutria, water hyacinths).

Many informal and formal education outlets exist, including public nature centers, nature organizations/societies, teacher-oriented agencies such as departments of education, teacher centers, science teacher associations, and offices of information and education run by state agencies. These outlets should be used as a means of reaching larger numbers of individuals.

As public awareness increases, opportunities must be put in place to allow the public to help identify and resolve any exotic species issues. Initially, one of the most important roles of the public is with citizen long-term monitoring for exotic species that currently, or in the future, threaten the Bay's resources. Additionally, active public participation in groups with the technical expertise to respond to the introductions of non-indigenous aquatic species will be invaluable. The citizens of the Chesapeake Bay Watershed, when properly educated and organized, can become part of the solution to many of the Bay's problems. Education and information efforts by the Exotic Species Workgroup will be coordinated with the Communications Subcommittee.

Implementation Tasks

- I. **Compile, develop, and coordinate the dissemination of educational materials** on non-indigenous aquatic species. The following tasks will be completed by the Exotic Species Workgroup:
 - a. Develop a prioritized list of non-indigenous aquatic species for education purposes. Priorities should be based on such factors as the potential magnitude of ecological, economical, or environmental health impacts, likelihood of successful infestations of the Chesapeake Bay drainage and the "expected time of arrival". The Exotic Species Workgroup will work with agencies involved in environmental monitoring to develop a list of non-indigenous aquatic species that could become a problem in the Chesapeake Bay basin. This list will be used for the development of educational materials.
 - b. Develop a list of existing educational materials, including concerns and benefits.
 - c. Seek funding to prepare brochures and various other materials for informal and formal educational use.
 - d. Develop fact sheets on each aquatic nuisance species detailing natural history and possible or known habitat effects. In addition, prepare fact sheets for important routes of entry, including aquaculture and the aquarium industry. Update existing fact sheets when new information becomes available.
 - e. Initiate printed materials such as posters, curricular guides, and wallet cards, to increase public awareness.
 - f. Produce a video that describes aquatic nuisance species and their habitat impacts. Distribute the video to public, private and governmental organizations, including the news media.
- II. **Educational materials will be made available for use by signatories and other interested groups**, with coordination provided by the Exotic Species Workgroup.
 - a. Develop a library of slides on non-indigenous aquatic species, their natural history, and habitat impacts. Eventually these materials will be made available in a CD ROM format.
 - b. Provide seminars on non-indigenous aquatic nuisance species for managers and other interested parties. The Exotic Species Workgroup should ensure that presentations are developed and speakers are available to fulfill such requests.

- c. Assign persons within the Exotic Species Workgroup to serve as contacts for educational efforts for each of the signatories.

III. Utilize public forums, whenever, possible to educate residents and water users.

- a. A regional display on aquatic nuisance species should be developed for use at public facilities or activities. The display needs to be housed centrally and a schedule kept for use/distribution or multiple displays made available.
- b. Workshops should be developed that focus on identifying resource issues and monitoring techniques. These need to be available for agency personnel, nature center staff, and private citizens.
- c. Citizen monitoring programs for aquatic nuisance species should be initiated and linked to existing programs such as the Citizens' Water Quality Monitoring Program, in collaboration with the Monitoring Taskgroup of the Exotic Species Workgroup.

IV. Coordinate programs to provide relevant information about non-indigenous aquatic species and their potential effects on native flora and fauna.

- a. Seek funding to initiate a region-wide symposium on non-indigenous aquatic species for agency managers, wildlife and fishery professionals, and researchers to discuss possible or known effects.
- b. For individual aquatic nuisance species, it is important to identify stakeholder groups and agencies most likely to be affected by a successful species invasion of the Chesapeake Bay drainage. Identification of pertinent user groups and agencies will help focus education and public awareness efforts. An integrated approach to aquatic nuisance species management is more likely if a number of concerned parties can be encouraged to interact from the onset. Specialized workshops and training may be especially valuable to educate key personnel with respect to particular species' invasions.

V. Seek necessary support to develop a regional on-line computer library of materials concerned with non-indigenous aquatic species and a library of materials in each jurisdiction for hard copy access. The following efforts by the Exotic Species Workgroup will be coordinated with the Chesapeake Bay Program's Communications Subcommittee.

- a. The Workgroup, working with Communications Subcommittee through the Chesapeake Bay Homepage Team, will develop technical and nontechnical public information on current and potential non-indigenous aquatic species. The materials

should be evaluated and updated periodically by the Workgroup. Information should include professional, lay, and curricular materials.

- b. Develop a CD ROM program that contains all the known materials on non-indigenous aquatic species and distribute to public libraries, natural resource agencies in each jurisdiction, nature centers, and schools.
- c. Develop in service training and curricular materials on non-indigenous aquatic species for teachers.
- d. Jurisdictional agencies, working with Sea Grant, University systems and interested parties, should develop and foster public programs for formal education K-12.

VI. **Develop collaborative forums** to present a diversity of viewpoints when there is disagreement over a non-indigenous aquatic species.

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IMPLEMENTATION PLAN MATRIX

Protection of our natural ecosystem from uncontrolled introductions and proliferation of non-indigenous aquatic species is a many-sided problem. Because of funding and staffing restraints, implementation of the recommendations outlined in the previous sections will take place in two phases. The recommendations which need to be implemented immediately to maintain our present ecosystem throughout the Bay jurisdictions and lay the groundwork for future action.

Implementing Tasks	Lead Group or Agency	Schedule for Completion
<i>Public and Private Aquaculture and Stocking</i>		
I.a. Identify and provide a list of those aquatic species currently approved for public and private aquaculture and used in stocking programs within each jurisdiction. Also provide a list of any aquatic species that are prohibited from that jurisdiction.	EXS Workgroup with the Agriculture and Fisheries Agencies for each jurisdiction	Sept. 1996
b. Provide a multi-jurisdictional compilation of the individual lists to the Policy signatories.	EXS Workgroup	Oct. 1996
II.a. Identify and provide a list of routes of entry into the Chesapeake Bay basin of aquatic species used in aquaculture and stocking. Routes into and between the watersheds will be provided to the Exotic Species Workgroup.	Agriculture and Fisheries Agencies of each jurisdiction	Sept. 1996
b. Provide multi-jurisdictional compilation of individual lists to the Policy signatories.	EXS Workgroup	Oct. 1996
III.a. Select a group of specialists (agriculture, fisheries, and one risk assessor) from the signatory jurisdictions and private sectors to evaluate risk associated with identified activities.	EXS Workgroup	July 1996

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| b. | Assess risks and assign each activity with appropriate documentation through historic and scientific evidence. Establish suggested protocols to minimize risks associated with each activity. | EXS Workgroup | July 1997 |
| c. | Produce a document stating the risk of each activity for inadvertent introduction of non-indigenous aquatic species and the suggested protocols for minimizing risk of introduction. | EXS Workgroup | Dec. 1997 |

Research

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|---------|--|--|-----------------|
| I. a. | Develop a list of on-going and planned research activities that could result in the movement of new non-indigenous species, in consultation with the scientific community of the Chesapeake Bay basin. | EXS Workgroup and STAC | October 1996 |
| b. | Provide the list developed under I. a. to all Chesapeake Bay jurisdictions. | EXS Workgroup and STAC | February 1997 |
| c. | Add new types of research to this list as they are developed. | EXS Workgroup and STAC | as needed |
| II. a. | Evaluate the risks of introduction of non-indigenous species from each kind of research activity. | EXS Workgroup and STAC
(<i>ad hoc</i> panel) | August 1997 |
| b. | Risk assessment information will be made available for the development of protocols. This information will be distributed to all Chesapeake Bay jurisdictions, STAC, and other interested parties. | EXS Workgroup
(<i>ad hoc</i> panel) | to be announced |
| III. a. | Identify methods of reducing risks associated with research activities, with the assistance of scientists and managers invited from each Bay jurisdiction. | EXS Workgroup
(<i>ad hoc</i> panel) | to be announced |

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| b. | Summarize these methods of reducing risks associated with research activities and distribute to Universities, private and public research facilities, management agencies in each jurisdiction, STAC, and the public. | EXS Workgroup | to be announced |
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Monitoring

*** indicates tasks for the regional non-indigenous aquatic species coordinator*

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|--------|--|---|----------------|
| I. a. | Review existing Chesapeake Bay basin monitoring programs to determine whether changes should be recommended which address non-indigenous aquatic species. | EXS Workgroup and Monitoring Workgroup | September 1996 |
| b. | Provide that review to all interested parties. | EXS Workgroup | November 1996 |
| c. | Develop a list of experts for verification and identification of specimens thought to be non-indigenous aquatic species. ** | EXS Workgroup | November 1996 |
| d. | When a new non-indigenous aquatic species is identified in the watershed, available information on the finding will be distributed to the director of each potentially affected agency in each jurisdiction. | State coordinator of monitoring program | on-going |
| II. a. | Facilitate monitoring and education tasks by creating a full-time position for a non-indigenous aquatic species coordinator. | ESX Workgroup | when possible |
| b. | Designate an aquatic nuisance species by consensus of the Bay jurisdictions. | ESX Workgroup | as required |
| c. | When an aquatic nuisance species is identified, the regional non-indigenous aquatic species coordinator will disseminate monitoring information for that species within the Chesapeake Bay basin. Until a regional coordinator is hired, a | EXS Workgroup in collaboration with the signatory jurisdictions | as required |

lead agency will be chosen by the EXS Workgroup as clearinghouse coordinator for a particular aquatic nuisance species. **

d.	Submit monitoring information relating to aquatic nuisance species to the designated clearinghouse.**	All Policy Signatory Jurisdictions	as required
e.	Prepare and distribute brief annual reports of monitoring activities and findings related to any aquatic nuisance species.**	Clearinghouse coordinator	Dec. 1996
III.a.	Form an <i>ad hoc</i> committee after a non-indigenous aquatic species has been identified as an aquatic nuisance species.	EXS Workgroup	as required
b.	Develop monitoring protocols for that aquatic nuisance species.	EXS Workgroup	as required

Controls

I.	An <i>ad hoc</i> committee with representatives from each signatory, at-risk facilities, jurisdictional regulatory agencies, a resource management agencies will be formed.	EXS Workgroup	as required
II.	Identify and summarize sensitive components of at-risk facilities and ecosystems.	EXS Workgroup (<i>ad hoc</i> committee)	as required
III.	Evaluate and/or develop environmentally sound preventative and treatment control strategies.	EXS Workgroup (<i>ad hoc</i> committee)	as required
IV	Prepare a report summarizing the above findings and recommendations.	EXS Workgroup (<i>ad hoc</i> committee)	as required

Education

**** indicates tasks for the regional coordinator, when the position is funded.**

I. a.	Develop a prioritized list of non-indigenous aquatic species for educational purposes. **	EXS Workgroup	August 1996
b.	Develop a list of existing education materials on non-indigenous aquatic species	EXS Workgroup	on-going (dependent on funding)
c.	Seek funding to prepare materials for educational use.	EXS Workgroup	on-going
d.	Develop fact sheets.	EXS Workgroup	on-going
e.	Develop printed educational materials such as posters, curricular guides and wallet cards.	EXS Workgroup	on-going
f.	Produce a video.	EXS Workgroup	March 1997
II. a.	Develop a library of slides on non-indigenous aquatic nuisance species, their natural history, and habitat impacts for agency use and eventual inclusion in a CD ROM format. **	EXS Workgroup	ongoing
b.	Provide seminars on non-indigenous aquatic species. Ensure that speakers are available to fulfill presentation requests. **	EXS Workgroup	ongoing
c.	Assign specific Exotic Species Workgroup members to serve as contacts for educational efforts.	EXS Workgroup	Feb. 1997
III. a.	Develop a regional display on aquatic nuisance species for use at public facilities or activities. **	EXS Workgroup	dependent on funding

	b.	Develop short workshops that focus on identifying resource issues and monitoring techniques. **	EXS Workgroup	dependent on funding
	c.	Initiate citizen monitoring programs for aquatic nuisance species and link to existing programs, in cooperation with the Monitoring Taskgroup of the Exotic Species Workgroup. **	EXS Workgroup	March 1997
IV	a.	Seek funding for a region-wide symposium on non-indigenous aquatic species.	EXS Workgroup	dependent on funding
	b.	Identify pertinent stakeholder groups and agencies for educational targeting.	EXS Workgroup	dependent on funding
V.	a.	Provide technical and nontechnical information on current and possible non-indigenous aquatic nuisance species in the Chesapeake Bay basin, working with the Chesapeake Bay Homepage Team. **	EXS Workgroup/ Ches. Bay Homepage Team	dependent on funding
	b.	Develop a CD ROM program that contains materials on non-indigenous aquatic nuisance species and distribute to public libraries, nature centers, schools and natural resource agencies in each jurisdiction. **	EXS Workgroup	dependent on funding
	c.	Develop in service training for teachers on non-indigenous aquatic species. **	EXS Workgroup	dependent on funding
	d.	Develop and foster programs for formal education, grades K-12. **	EXS Workgroup/ Interested parties	dependent on funding
VI.		Develop collaborative forums to present a diversity of viewpoints when there is disagreement over a non-indigenous aquatic species.	EXS Workgroup	as required

APPENDIX A

SUMMARY OF EXISTING REGULATIONS GOVERNING THE INTRODUCTION OF NON-INDIGENOUS AQUATIC SPECIES IN THE CHESAPEAKE BAY BASIN

The *Chesapeake Bay Policy for the Introduction of Non-Indigenous Aquatic Species* is intended to be consistent with the federal Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990. Many of the definitions are taken from the federal documents.

Federal Policy

Since the Lacey Act of 1901 (18 U.S.C. 42), some limited regulation of specific non-indigenous aquatic species has been vested in the federal government. Although the federal role was expanded somewhat by Presidential Executive Order 119087 (May 24, 1977), the federal role remained relatively limited through the 1980's.

The Lacey Act also provides an intergovernmental mechanism for the development of a cooperative national program to reduce the risks of or prevent the unintentional introduction and dispersal of non-indigenous aquatic species that may be nuisances; ensure prompt detection of the presence of and monitor changes in the distribution of non-indigenous aquatic species; and control established aquatic nuisance species in a cost-effective, environmentally sound manner.

Regional Policy

The only regional policy for non-indigenous aquatic species that has been developed in the Chesapeake Bay basin was issued by the Chesapeake Bay Commission.

- The Chesapeake Bay Commission unanimously adopted the following policy statement on May 8, 1992:

It is the policy of the Chesapeake Bay Commission to oppose the introduction of non-native species into the Chesapeake Bay watershed for any reason unless comprehensive environmental and economic impact studies are conducted and thoroughly evaluated in order to ensure that risks associated with the introduction are minimized. Proposals for the introduction of non-native species should be subjected to an extensive review process that provides for ample peer review by the Exotic Species Workgroup and others prior to the final decision-making process.

- A letter sent by the Chesapeake Bay Commission to the resource management agencies in Pennsylvania, Maryland, the District of Columbia and Virginia stated that the management of

non-native species anywhere within the Chesapeake Bay watershed should be pursued on a regional rather than a state-by-state or species-by-species basis and urged each jurisdictional agency to "weigh the position of the Chesapeake Bay Commission in any pertinent policy decision or action."

- *Chesapeake Bay Policy for the Introduction of Non-Indigenous Aquatic Species* adopted in December 1993 by the Chesapeake Bay Program.
- A Ballast Water Resolution was drafted by the Chesapeake Bay Commission in January 1995.

Policies of the Chesapeake Bay Watershed Jurisdictions

Individual Bay basin jurisdictions have regulations pertaining to the introduction of non-indigenous or non-native aquatic species.

Delaware

In Delaware, triploid grass carp became a legal method of aquatic weed control beginning January 1, 1990. Permits are issued to private pond owners meeting a set of criteria, including: escape prevention; demonstrated need for aquatic plant control; the aquatic plants in question are known targets of the grass carp; the carp must be triploid and stocked at a controlled rate; the state must have access to the pond for evaluation; the pond must not contain rare, threatened or endangered plants or animals, and must not be in any designated natural area or a freshwater marsh wetland. The grass carp must be certified as triploid by the USFWS or by another agency approved by the Delaware Division of Fish and Wildlife.

Other laws governing the introduction of aquatic species exist for oysters and aquaculture. Written permission from the state agency is needed to bring live oysters or seed oysters into the state and place them in Delaware waters. Permits are needed for aquaculture of any species. A facility to be used for restricted species (black bass, grass carp, hybrid striped bass, and all non-native species of finfish and shellfish) must have Delaware Department of Natural Resources and Environmental Control approval. The walking catfish is prohibited.

Anyone wishing further information on Delaware regulations is referred to regulation 2112 for material on oysters, the memorandum of understanding between the Department of Natural Resources and Environmental Control and the Department of Agriculture (May, 1992), and the grass carp policy (January, 1990; revised 1993).

District of Columbia

The District of Columbia has rules that establish guidelines for the management of fisheries and wildlife resources. These guidelines and procedures provide for implementation of the Water Pollution Act of 1984, which mandates protection of aquatic animals and plants and the restoration and preservation of aquatic life in the District's waters for aesthetic enjoyment,

recreation and industry. The purpose of these rules is to ensure that the District's fisheries and wildlife resources are properly managed and protected.

With regard to the introduction of non-indigenous aquatic species, the guidelines are simple and clear.

Section 1503.1, Prohibited Activities:

It shall be unlawful to do any of the following:

- a) Introduce any species of fish or other aquatic organism not indigenous to the District of Columbia into the waters of the District of Columbia.

Maryland

In Maryland, the Tidewater and Fish, Heritage and Wildlife Administrations of the Department of Natural Resources (DNR) regulate the introduction of non-indigenous aquatic species (Code of Maryland Regulations). With regard to one non-indigenous mollusk species, the zebra mussel (*Dreissena polymorpha*), a section of the regulations pertaining to shellfish, (COMAR 08.02.08.02) states: "Except as permitted by the Secretary of Natural Resources, a person may not import into the state or possess any living life stage or reproductive products of mussels of the genus *Dreissena*." For other species of shellfish taken from waters outside the waters of the state, a person may not import or possess any of these species within Maryland, unless they first obtain a permit from DNR. This section of the regulation goes on to say that "the Department shall issue a permit if presented with proof satisfactory to the Department that the shellfish will not be harmful to Maryland shellfish." For these regulations, the term shellfish includes live oysters, seed oysters, oyster shells, live hard-shell clams, live soft-shell clams, and clam shells.

In COMAR 08.02.11.05K, the term "indigenous fish species" is defined by Maryland as "any fish species that naturally occurs in, or has been artificially introduced into, the waters of the state, and has established self-sustaining populations for at least ten years." To protect fish populations in the non-tidal waters of the state, a person may not introduce into the non-tidal waters, or import or possess for introduction, any live fish not indigenous to the non-tidal waters of the state without first obtaining a permit. A permit will not be granted until satisfactory proof is provided by the applicant that the specific fish intended to be imported will be free of any communicable disease at the time of importation and will not be harmful to the native flora and fauna in the non-tidal waters.

The provisions of the Maryland regulations in COMAR 08.02.11.05K that deal with importation and possession do not apply to fish for use in laboratories and exhibitions, or for use as pets. Any fish not indigenous to the waters of the State shall be held only in aquaria and other indoor facilities from which escape into the waters of the state is impossible. Hence, except for the specific provision directed at zebra mussels, Maryland does not prohibit nor is a permit required for the importation of non-indigenous species for research purposes, provided the species are confined indoors and cannot escape into state waters.

Maryland also has regulations (COMAR 08.02.14) pertaining to non-native fish and aquatic plant species related to aquaculture. The stated purpose of these regulations is "to encourage the orderly development of an aquaculture industry in Maryland, while ensuring that aquaculture operations do not adversely impact upon the state's wild stocks of fish." In this section of the regulations, the phrase "non-native" species means "a species of fish that is not native or naturalized..." A native species means "any species of fish which historically has lived, grown, and reproduced in Maryland's waters." A naturalized species means "any species of fish which, though not indigenous to Maryland, has acclimated, or adapted to life in Maryland's waters so that the species has been documented as having lived, grown, and reproduced in Maryland for more than ten years."

Any person who wishes to engage in aquaculture in Maryland (the commercial rearing of fish or aquatic plant species listed in COMAR 08.02.14.07) must first obtain a permit from DNR. A permit will not be issued if the proposed aquaculture activity will adversely affect wild stocks of fish; result in the release of non-native species into Maryland waters, except in confined water such as ponds where there are safeguards to prevent escape; or result in the contamination of native or naturalized species of fish or their ecosystem. A facility that is permitted to culture non-native and hybrid finfish in non-tidal waters may not discharge its effluent directly or indirectly into Maryland without approved treatment. Maryland also requires that imported hybrid or non-native finfish shall be certified by an authority acceptable to DNR to be free of known, infectious disease that have the potential to contaminate native or naturalized fish or aquatic plants.

Anyone wishing further information on Maryland regulations is referred to the Code of Maryland: Title 08, Subtitle 02, Chapters 08, 11 and 14; and the Natural Resources Articles, Sections 4 and 10, Annotated Code of Maryland.

New York

In New York, importation and stocking of triploid (sterile) grass carp became legal for the purpose of pond vegetation control in 1990. Requirements for the pond into which the triploid grass carp were to be introduced were very strict: 5 acres or less in size, having no inlets or outlets to or from other waters, lying wholly within the boundaries of lands privately owned or leased by the individual authorizing the treatment, harboring no species of wildlife, fish, shellfish, crustacea or plants of special concern, threatened or endangered, not contiguous to a New York State regulated freshwater wetland. Effective March 12, 1993, New York is allowing the stocking of triploid grass carp in ponds with inlets or outlets to other waters, provided that the ponds are not impoundments or natural ponds on a permanent stream or a source of a permanent stream as designated by the most recent U.S. Geological Survey or New York State Department of Transportation quadrangle covering the permit application site.

In May, 1991, New York added section 11-0507-4 to the environmental conservation law. It now reads: No person shall intentionally liberate zebra mussels (*Dreissena polymorpha*) into any waters of the state. No person shall buy, sell, or offer to buy or sell, or intentionally possess or

transport zebra mussels except under a license or permit. Zebra mussels, except those lawfully held pursuant to a license or permit, may be destroyed by any person at any time.

The regulations about wildlife and fish require permits for placing fish or fish eggs in the waters of the state, or for willfully liberating wildlife. Permits are also required to possess, transport, import or export species of live native or non-native wildlife or fish where such actions would present a danger to the health or welfare of people in the state, and individual or indigenous fish or wildlife populations. Licenses are required to collect, possess or sell fish, wildlife, shellfish, crustacea and aquatic insects, and the Department has the power to make regulations to protect the animals from cruelty, disease or undue discomfort and to protect the public from attack or contamination. Fish or shellfish which hinder the propagation of food fish or shellfish may be removed by the state, or by an individual permitted by the state, in any manner the state may prescribe from public or private waters.

Anyone wishing further information on New York regulations is referred to the environmental conservation law 11-0507, 11-0511, 11-0515, and 11-0517, and the 1991 amendment regarding zebra mussels. Also see the New York State Department of Environmental Conservation, Division of Fish and Wildlife Policy on triploid grass carp use (revised 3/12/93).

Pennsylvania

Pennsylvania Department of Agriculture: Under Act 66 of 1993, the Pennsylvania Department of Agriculture has the authority to regulate the health of all domestic animals, including those wild or semi-wild animals held in captivity. The Commonwealth interprets "animal" to include all fish, invertebrates, and other members of the taxonomic Animal Kingdom. The Department of Agriculture is seeking a consolidation of all Pennsylvania animal health statutes into a new "Domestic Animal Act." Once this legislation is enacted, the Department will work with the Pennsylvania Fish and Boat Commission to draft and promulgate any necessary fish health regulations.

Pennsylvania Fish and Boat Commission: The Pennsylvania Fish and Boat Code of 1980 (Act 1980-175, Title 30, Pennsylvania Consolidated Statutes, 30 Pa.C.S. §§ 101 *et seq.*) provides authority for the Pennsylvania Fish and Boat Commission to promulgate general and specific regulations about fish and fishing in Pennsylvania. The following provisions apply:

30 Pa. C.S. § 102 defines "fish," when used as a noun, to include all game fish, fish bait, bait fish, amphibians, reptiles and aquatic organisms.

30 Pa. C.S. § 2102(a) authorizes the Fish and Boat Commission to make such general and special regulations as it deems necessary and appropriate concerning fish and fishing in the waters of Pennsylvania, the protection, preservation and management of fish and related matters.

30 Pa. C.S. § 2102(c) authorizes the Commission to make regulations concerning the transportation or introduction of, or importation into or within this Commonwealth or exporting of fish, the selling, offering for sale or purchase of fish or the disturbing of fish in their natural habitat.

30 Pa. C.S. § 2904 authorizes the Executive Director, with the approval of the Commission, to require permits for taking, catching, killing, possession, introduction, removal, importing, transporting, exporting or disturbing any fish in Pennsylvania waters. The Commission may set fees for the permits and make rules and regulations concerning the issuance and provisions of the permits.

30 Pa. C.S. Chapter 33 contains requirements for artificial propagation licenses and provides that no person may artificially propagate any fish in Pennsylvania without a license issued by the Fish and Boat commission (30 Pa. C.S. § 3312). In addition, this chapter requires licenses or permits for live fish dealers and for transportation of live fish in Pennsylvania.

Title 58. Pennsylvania Code contains regulations promulgated by the Pennsylvania Fish and Boat Commission.

Chapter 71, "INTRODUCTION OF FISH INTO COMMONWEALTH WATERS" subsection 71.3 (b), provides for the issuing of limited propagation license subject to additional restrictions. These are used to permit non-indigenous fish species to closed system aquaculture.

Chapter 73, "TRANSPORTATION OF LIVE FISH INTO THE COMMONWEALTH" subsection 73.1 (a) states "No species of fish may be transported into this Commonwealth from another state, province, or country and liberated in any watershed of the Commonwealth without previous written permission for the Fish and Boat Commission. Nor may any species of fish be transferred from any water within the Commonwealth into any other drainage of the Commonwealth where this particular species is not always present without prior written consent from the Fish and Boat Commission. Inspection for species composition or presence of disease, or both, will be required at the discretion of the Fish and Boat Commission on all lots of fish transported into the Commonwealth."

References to grass carp in Chapters 71 and 73 have been changed by Fish and Boat Commission action which provided for the issuing of permits for the use of triploid grass carp in Pennsylvania beginning January 1, 1994.

A new section, 71.7 became effective on January 1, 1994. Under 71.7(a) it states: "As a limited exception to the prohibition of grass carp (white amur) in this Commonwealth, it is the policy of the Commission to permit triploid grass carp, certified by the United States Fish and Wildlife Service (USFWS) and procured from a producer participating in the USFWS

certification program, to be introduced into Commonwealth waters and imported and transported into this Commonwealth in accordance with this section."

Virginia

In Virginia, regulations pertaining to non-indigenous species are administered by the Department of Game and Inland Fisheries (freshwater species) and under the Virginia Marine Resources Commission (saltwater species). Under regulation VR325-01-2 (Virginia Department of Game and Inland Fisheries), Section 1, it is unlawful to take, possess, import, cause to be imported, export, cause to be exported, buy, sell, offer for sale or liberate within the Commonwealth any wild animal unless otherwise specifically permitted by law or regulation. Section 4 of this code specifies that a special permit is required and may be issued by the department, if consistent with the department's fish and wildlife management program, to import, possess, or sell those non-native (exotic) animals listed in pages 200-202 of the 1993 edition of the Virginia Game, Inland Fish and Boat Laws and Regulations document. Under regulation 28.2-825 (Virginia Marine Resources Commission), it is unlawful to import any fish, shellfish or crustacea with the intent of placing such organisms into the waters of the Commonwealth unless the organism is coming from an approved list of states and waters, and unless it is on an approved species list. If the species or source is not on the approved lists, the person desiring to import may notify the Commissioner of Marine Resources and receive written permission.

Anyone wishing further information on Virginia regulations is referred to the Virginia Department of Game and Inland Fisheries regulation VR325-01-2, and the Virginia Marine Resources Commission regulation 28.2-825.

West Virginia

In West Virginia, a fish importation permit allows an individual to import and haul native game, food, and sport fishes. However, the introduction of exotic fishes or those not native to this state is strictly prohibited. All persons must be legally licensed to propagate or sell fish, amphibians or other forms of aquatic life. Those persons legally entitled to propagate and sell fish, amphibians and other forms of aquatic life are also allowed to transport such beyond the limits of the state. All imported wildlife shall be subject to inspection by authorized agents of the department and such inspections may include biological examinations and the removal of a reasonable sample of fish or eggs for such purposes.

Permits to import triploid grass carp may be obtained if a pond owner has the pond inspected by proper state personnel, follows the required application process and orders the fish from an approved producer of certified triploid grass carp. Only triploid grass carp may be imported under any circumstances. A certificate issued by the USFWS is required from their authorized point of origin.

Anyone wishing further information on West Virginia regulations is referred to Chapter 20 of the Code of West Virginia and the annual fishing regulations.

APPENDIX B

OVERVIEWS OF PROTOCOLS ALREADY IN PLACE FOR INTENTIONAL INTRODUCTIONS AND REDUCTION OF UNINTENTIONAL INTRODUCTIONS BY RESEARCH PATHWAY

Intentional Introductions

Intentional introductions for research purposes will follow guidelines modeled after the ICES Code of Practice 1990 and the *Protocols of Conducting Research on Nonindigenous Mussels of the Genus Dreissena in the Chesapeake Bay Basin* (Exotic Species Workgroup 1993), hereafter referred to as the *Dreissena* Protocols.

The protocols developed by the International Council for Exploration of the Sea (ICES Code of Practice 1990) are used as a prototype for the section on intentional introductions. These protocols, developed for intentional introductions, are outlined here.

- I. **A request for an intentional introduction will be submitted by the principal investigator to the appropriate jurisdiction** at least 90 days in advance of the proposed introduction. This request will consist of a research proposal or scope of work that includes:
 - a. Objectives of research, including justification for using this particular species, as opposed to alternative species (resident or non-indigenous).
 - b. Summary of information on species proposed for introduction, including known life history, reproductive capacity, geographic distribution, habitat utilization, physical (e.g., temperature and salinity) requirements, predators, competitors, prey, associated organisms (especially parasites, pathogens, and diseases), and ecological role in its native community. It is understood that such information may be very limited for many species.
 - c. Proposed plan of introduction, including information on life stage(s), numbers, source (geographic origin and culture or stocking method), disease history and disease certification when available, location(s) of introduction, and any alteration of reproductive capacity (e.g., triploid or single-sex populations). This should include a plan for initial introduction on a limited scale (see II.d. below).
 - d. Estimated risks of introduction, including likelihood of invasion and probable effects (economic and ecological) should an invasion occur. This assessment should incorporate what is known about the target species in its native or

naturalized range and should consider potential interactions with local populations and communities.

- II. **If after appropriate review by an *ad hoc* panel (as described in the Policy) the intentional introduction is permitted, the following procedure should be used when jurisdictional review (as described in the Policy) provides approval for intentional release following quarantine:**
- a. **Brood stock establishment:** A brood stock should be established under quarantine conditions (see Unintentional Introductions below) to allow adequate evaluation of its health status. It is preferable to use early life stages to establish brood stock, as prevalence of parasites usually increases with size and age.
 - b. **Testing of brood stock and progeny:** The brood stock and progeny should be tested routinely for evidence of associated organisms (especially parasites and pathogens). If associates are found in progeny, these may not be introduced into unconfined waters.
 - c. **Isolation of F1 progeny:** The progeny should be isolated from brood stocks to reduce the possibility of transferring associated organisms from adults to brood.
 - d. **Initial introduction:** If progeny show no evidence of associated organisms, an introduction can proceed on a limited scale to assess ecological interactions with resident community. Because even limited introductions may result in successful and rapidly expanding populations, additional safeguards are recommended for initial introductions, such as use of triploid organisms or single sex groups.
 - e. **Isolation of hatchery:** All hatchery procedures should maintain quarantine conditions (as in *Dreissena* Protocol referenced below) to prevent unintentional introductions, limiting all introductions to a controlled and approved pathway(s), as described in the research proposal.
 - f. **Study and progression of introduction:** An evaluation of the initial introduction should be reported to the appropriate jurisdiction. After examining results, the jurisdiction will decide whether the introduction can proceed. As the introduction proceeds, identification information should be made available to monitoring groups to facilitate their ability to detect escapement. Assessment of the population size, distribution and its impact should be reported routinely to the appropriate jurisdiction, which will dictate the frequency and scope of such assessment. This information will be available to other jurisdictions.

Unintentional Introductions from Research

Following protocols developed by the federal Aquatic Nuisance Species Task Force, the Exotic Species Workgroup prepared *Protocols for Conducting Research on Nonindigenous Mussels of the Genus Dreissena in the Chesapeake Bay Basin* (1993). These are used here as a prototype for reducing the risk of unintentional release during research on all non-indigenous aquatic species.

We adhere to the general precautionary principals included in the *Dreissena* Protocols to prevent unintentional release of non-indigenous aquatic species from research, as well as other, activities.

- I. **Notification of relevant jurisdiction by principal investigator by submitting proposal or scope of work to appropriate agency** (which will submit copy to the Exotic Species Workgroup of the Living Resources Subcommittee). The proposal should include the following:
 - a. Objectives of research, including a brief description of species being studied and their origin(s), and justification for using this species.
 - b. Summary of information on species proposed for introduction, including life history, reproductive capacity, habitat utilization, ecological role and status in native habitat and other introduced areas if available, an estimate of potential habitat range extension, physical (e.g., temperature and salinity) requirements, predators, competitors, prey, and associated organisms. It is recognized that such information may be limited for some species.
 - c. Detailed description of research, including estimated numbers of organisms, transportation procedures of organisms to research facilities, tracking when mailings are involved, description of research facilities (including drawings), names and qualifications of project personnel.
 - d. Detailed description of wastewater treatment, including water flow from research facilities, decontamination methods, and proximity of nearby bodies of water (streams, lakes, estuaries, ocean) including if the facility is in or in proximity to the flood plain.
 - e. Detailed description of proposed containment/confinement facilities, including site security, posted signs, treatment of research equipment and holding facilities, personnel responsible for maintenance and operation, and training on handling and protocols.
 - f. Detailed description of plans for termination after study and emergency termination (in case of hurricane, fire, flood or other catastrophe).

- II. **Site visit of research facility** by appropriate agency is recommended and can be arranged upon request of agency to ensure conformity to protocols.