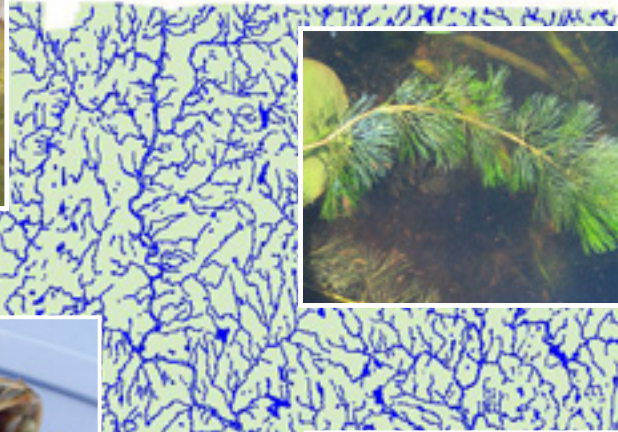


# **CONNECTICUT** *AQUATIC NUISANCE SPECIES* *MANAGEMENT PLAN*



*Connecticut Aquatic Nuisance Species Working Group*

**STATE OF CONNECTICUT  
Department of Environmental Protection**

**CONNECTICUT AQUATIC NUISANCE SPECIES MANAGEMENT PLAN**

Prepared by: **Connecticut Aquatic Nuisance Species Working Group**

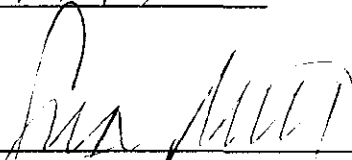
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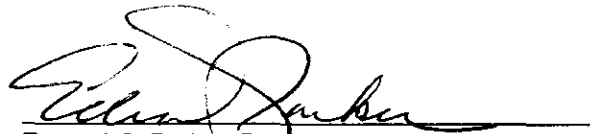
Submitted to: **Federal Aquatic Nuisance Species Task Force**

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# **Executive Summary**

## **Background**

The introduction and spread of aquatic nuisance species (ANS)<sup>1</sup> in the marine and freshwater environments pose a serious threat to the ecology and biodiversity of native ecosystems and to the health and economic interests of the people of the State of Connecticut.

Aquatic invasions pose difficult challenges to natural resource managers. Once established, populations of ANS are self-sustaining. Effective ANS management requires on-going efforts devoted to the prevention of new introductions and to the eradication and/or control of existing populations. Nonindigenous species have the potential to establish and spread rapidly due to a lack of physical or biological constraints and access to effective vectors. The range of ANS impacts is extensive and includes degradation of habitat or ecosystem structure, localized extinction of rare species, spread of pathogens, choking of waterways, clogging of water intakes and wetland systems, fouling of water supplies, and interference with recreational activities such as fishing, boating and swimming.

The Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990 created a Federal ANS Task Force in response to the invasion and subsequent spread of zebra mussels across the U.S. This legislation, as amended by the National Invasive Species Act of 1996, authorized and provided guidance for the development of state aquatic nuisance species management plans. Section 1204 of the Act enables Governors to submit comprehensive plans to the Federal ANS Task Force. Management plans are required to identify activities needed to prevent or control infestations and to reduce associated environmental and public health risks, in an environmentally sound manner. States with approved plans are eligible to request Federal assistance from the US Fish and Wildlife Service for up to 75% of implementation cost. At this time federal funding is limited. However, given the extent of damage caused by ANS, it is reasonable to expect that the availability of Federal ANS funding will increase in the future.

## **Goal of the CT ANS Plan**

To implement a coordinated approach to minimizing the ecological, socioeconomic and public health impacts of aquatic nuisance species in the State of Connecticut.

## **Approach for developing the CT ANS Plan:**

- ◆ Guidance developed by the Federal ANS Task Force was the primary reference (see [http://www.anstaskforce.gov/state\\_guidance.htm](http://www.anstaskforce.gov/state_guidance.htm)). Connecticut plan addresses required elements and is organized as per the Federal guidance document.
- ◆ The federally-approved Massachusetts ANS Plan was used as a guide. Federally-approved plans for Maine, Washington, Oregon and Hawaii were also used as references.
- ◆ The CT ANS Plan was developed by an ANS Steering Committee, ANS Working Group and ANS sub-committees comprised of representatives from state and federal agencies, academic institutions, business and industry.
- ◆ Project management was by the Connecticut Institute of Water Resources and was funded by a grant obtained through the National Sea Grant College Program to CT Sea Grant (CTSG) and CT Department of Environmental Protection (CT DEP).
- ◆ The draft plan was reviewed by faculty members of several Connecticut universities, the U.S. Fish and Wildlife Service Lower Great Lakes Fishery Resources Office, CIPWG (Connecticut Invasive Plant Working Group), IPANE (Invasive Plant Atlas of New England), and by Connecticut state agencies (Department of Environmental Protection (CT DEP), Department of Agriculture (DOA), Department of Public Health (DPH)), and by four members of the Federal ANS Task Force.

<sup>1</sup> A list of acronyms is provided in Appendix G.

- ◆ Public input was sought and obtained by posting the draft plan on several websites (Connecticut Institute of Water Resources (CT IWR), CTSG and CT DEP) and by advertising and holding public meetings.

### **Key Findings:**

- ◆ More than 50 non-native and 40 cryptogenic (uncertain if native) species have been identified in Long Island Sound. Twenty-seven non-native fish species, 24 non-native freshwater plants along with a large and as yet undetermined number of non-native invertebrates inhabit the freshwaters of Connecticut.
- ◆ The rate of new species introductions accelerated during the 20<sup>th</sup> century as greater numbers of aquatic taxa were transported through direct (ex. aquarium trade, bait trade) and indirect (ex. commercial shipping, recreational boating) pathways.
- ◆ ANS were differentiated from other non-native species by evaluating likelihood of introduction and spread, likelihood of establishment and severity of impact.
- ◆ Aquatic invaders frequently affect natural resource health and ecosystem functioning. Specific effects include increased predation, parasitism, competition, and introduction of pathogens.
- ◆ ANS have a large socioeconomic cost including degradation of water quality; impairment of recreational uses, diminished property values, and increased costs of power generation and water supply.
- ◆ Management of established ANS populations is expensive. Examples include efforts to limit impacts of milfoil, fanwort, Asiatic clams, and phragmites. Additional costs associated with recent invaders (e.g., water chestnut, hydrilla and zebra mussels) and potential invaders (e.g., New Zealand mud snail, various pathogens) could be even greater.
- ◆ Some non-native aquatic species have been intentionally introduced, have become widely established, and provide a desirable benefit (e.g. largemouth bass and brown trout introduced to enhance recreational fishing).
- ◆ Existing populations of ANS vary greatly in their impact on aquatic ecosystems and susceptibility to control/management options. Existing ANS populations were categorized as follows:
  - Class 1: Species with limited or incipient populations (e.g., hydrilla, water chestnut, zebra mussels)
  - Class 2: Established species, significant impact, some practical control techniques available (e.g., milfoil, fanwort, phragmites)
  - Class 3: Established species, significant impact, no known effective control (e.g., Asian shore crab, green crab, rusty crayfish, landlocked alewife, mud mat)
  - Class 4: Established species, impacts unclear (e.g., brackish water mussel, flowering rush)
  - Class 5: Potential invaders, impacts expected to be severe (e.g., New Zealand mud snail)
- ◆ Many potentially damaging ANS could easily be introduced into Connecticut waters. Potential invaders were evaluated based on their likelihood of introduction, likelihood of establishment and likelihood of having a significant negative impact. Examples of potentially damaging invaders include giant salvinia, yellow floating heart, snakehead fish, flathead catfish, New Zealand mud snail, European flat oyster, various marine tunicates, and pathogens such as MSX (in oysters) and largemouth bass virus.
- ◆ ANS are typically introduced as an unforeseen consequence of desirable activities. Most common vectors include commercial shipping (ballast water), hull fouling, bait trade, aquarium trade, nursery trade and recreational boating and fishing activity.
- ◆ There are no options for control and eradication once a species becomes established in Long Island Sound.
- ◆ There are some limited options for control or even eradication of ANS in freshwater systems. Early detection, rapid response, monitoring and long-term management are sometimes possible.
- ◆ Federal and CT State laws and regulations generally provide sufficient authority for controlling ANS. However, existing State statutes and regulations are not sufficient to enable rapid response. Enforcement of existing laws needs to be given a higher priority.

- ◆ Staff and programs involved in addressing ANS issues in Connecticut are spread among five federal Agencies, four regional programs, and two state agencies including numerous divisions, offices and programs. Improved communication and coordinated action among federal and state agencies and programs is needed.
- ◆ Continued participation of academia, non-governmental organizations (NGOs), business and industry is critical to the successful implementation of an effective ANS program.

### **Conclusions:**

- ◆ Aquatic Nuisance Species (ANS) are a statewide problem in Connecticut. Rates of introduction are increasing and all varieties of aquatic environments are affected.
- ◆ ANS result in significant ecological, socioeconomic and management costs.
- ◆ ANS lists should not include all non-native species. The term “nuisance” infers that they are non-native to a region or habitat, cause negative impacts, and do not provide an equivalent benefit to society.
- ◆ Introduction and spread of all ANS can be reduced through education and/or regulation. Education, regulation and enforcement are the first and most important lines of defense against the further spread of established ANS and the introduction of new ANS.
- ◆ The highest priority is preventing the introduction of Class 5 species.
- ◆ Control and management efforts should focus on Class 1 and 2 species.
- ◆ The focus for addressing marine ANS must be on interrupting the pathways or vectors and thus preventing new introductions. Education and regulation are key.
- ◆ Management for freshwater ANS can have a broader focus and should include early detection, monitoring, rapid response and on-going management to prevent further spread.
- ◆ Existing laws and regulations pertaining to ANS need to be reviewed and updated periodically.
- ◆ Improved communication and coordination among regulating entities and increased enforcement of existing laws and statutes is needed.
- ◆ Dedicated program staff is needed to coordinate and provide the level of education, regulation, enforcement, rapid response, monitoring, control and management necessary to address ANS issues in Connecticut.
- ◆ Successful implementation of an ANS Plan will require additional and on-going financial support for dedicated staff and coordination. Insufficient funding will result in continued degradation of habitats and increased costs for control.

### **Recommendations:**

Recommendations are organized in eight categories as presented in Section 5 (Objectives, Strategies and Actions, see page 48) and Section 6 (Implementation Table, see page 72). Each of these recommendations has short-term (2 year) and long-term (>2 yr.) components. Short-term components and the necessary resources are identified in the Implementation Table. The timetable for long-term objectives is undetermined and dependent on available resources.

1. **Coordination:** Improve communication and coordination of activities among Federal and State authorities in Connecticut:
  - (a) Hire dedicated ANS staff (see #2a below).
  - (b) Establish an ANS coordinating committee and ad-hoc working groups
  - (c) Maintain and update species and vector lists.
  - (d) Coordinate with other states to address regional ANS issues.
  - (e) Develop an information management system to ensure access to complete and up-to-date ANS information.
2. **Funding:** Secure adequate funding for ANS prevention, control and management:
  - (a) Apply for a Federal ANS grant.
  - (b) Secure additional funding necessary to create a position and support a statewide ANS coordinator.



- (c) Identify and seek additional funding through a variety of sources for specific projects.
3. **Prevention:** Prevent the introduction of additional ANS into Connecticut:
    - (a) Evaluate the specific role of transport vectors in Connecticut and assess introduction risks.
    - (b) Seek greater enforcement of importation/liberation permits.
    - (d) Develop Best Management Practices (BMPs) for industry (shipping, aquaculture, bait, nursery, water supply and pet trade) and research activities involving ANS.
    - (e) Enhance education and outreach efforts to minimize introduction of ANS via recreational boating and fishing
  4. **Detection and Monitoring:** Detect new and monitor existing ANS populations:
    - (a) Train existing staff in ANS identification and incorporate into ongoing monitoring efforts (fisheries, water quality, etc.)
    - (b) Develop monitoring plan, recruit and train volunteers.
    - (c) Evaluate monitoring efforts.
  5. **Control and Rapid Response:** Control the spread of ANS:
    - (a) Develop control and rapid response protocol specific to the State of Connecticut to ensure that resources are applied only where prudent, feasible and cost-effective.
    - (b) Prioritize ANS species based on distribution and realistic potential for control.
    - (c) Evaluate effectiveness of control and adapt control and response actions as necessary.
  6. **Education and Awareness:** Increase public awareness and knowledge of ANS issues in Connecticut:
    - (a) Make ANS-related educational materials readily available to the public.
    - (b) Develop materials specific to Connecticut priority ANS, vectors, pathways and issues, and distribute to key groups (eg. anglers, boaters, pet trade).
    - (c) Disseminate information on control options to organizations involved in ANS management (eg. municipalities, lake associations).
    - (d) Keep state agencies, elected officials, adjacent states, water suppliers, and other industries apprised of ANS issues.
  7. **Research:** Address research needs for ANS in Connecticut:
    - (a) Identify information needs specific to Connecticut.
    - (b) Promote, and facilitate applied research.
    - (c) Develop a strategy for communicating ANS research needs.
  8. **Legislation, Regulation and Policy:** Perform periodic review of ANS related statutes, regulations and policies:
    - (a) Recommend modifications as necessary to address emerging issues.
    - (b) Recommend modifications as dictated by changes in ANS population and/or results of research.
  9. **Priorities for Action:** The following are action items listed in priority order. These were adapted from the above listed recommendations.
    - Hire a statewide ANS coordinator and establish an ANS coordinating committee
    - Develop ANS educational materials and distribute to key groups
    - Enforce importation/liberation regulations for fish, invertebrates, and other organisms
    - Identify, prioritize and secure funding to enable implementation of ANS priorities
    - Develop and implement ANS early detection, monitoring and assessment plans
    - Develop and implement ANS rapid response protocol for Connecticut
    - Evaluate effectiveness of ANS control and adapt control actions as necessary
    - Develop and maintain Connecticut ANS website/portal
    - Identify research priorities for Connecticut ANS
    - Conduct a legislative briefing on ANS issues in Connecticut

# 1. INTRODUCTION

## 1.1. Scope of the ANS Problem in Connecticut

The introduction and spread of aquatic nuisance species (ANS) in the marine and freshwater environments of Connecticut pose a serious threat to the ecology and biodiversity of native ecosystems, and can affect the ecological health and economic interests of the people of the state of Connecticut. These species, which are nonindigenous, have the potential to establish and spread rapidly, due to a lack of physical and biological constraints in the habitats to which they have been introduced. The range of impacts these organisms can have on aquatic systems is extensive, including the loss or degradation of habitat and community structure, the localized or complete extinction of rare and endangered species, the spread of pathogens that impact the health of established species, and the choking of waterways, water intakes, and wetland systems, and negative effects on recreation.

## 1.2. Relationship with other ANS Plans

While the authority and programs outlined in this plan are generally limited to the political boundaries of Connecticut, it is recognized throughout that there is a need for interstate and international cooperation to prevent the introduction and spread of ANS. For example, because Long Island Sound is bordered both by Connecticut and New York, it makes sense to coordinate efforts on marine ANS issues of mutual concern and interest. This coordination will be facilitated by the long-standing federal/bistate partnership known as the Long Island Sound Study, an EPA-directed National Estuary Program. An initial coordinating meeting is planned for 2006, to discuss common goals and concerns, and to determine how priority tasks and strategies of the New York invasive species plan and the Connecticut ANS management plan can be integrated. Research priorities will be discussed, as well as the possible designation of permanent monitoring sites to gauge the status and ecosystem impacts of non-native species.

The Connecticut plan was developed using the approved ANS plans of Massachusetts, Maine, Hawaii along with material from other states which address both freshwater and marine aquatic nuisance species. The plans for Massachusetts and Maine were particularly relevant as these states' species and ecosystems are similar to Connecticut's and they are addressing issues and concerns that are similar to what we are facing in Connecticut.

Currently, an informal network exists among those working on aquatic nuisance plant species. When *Hydrilla verticillata* was found in Maine, the information was circulated at the New England Regional Botanical Advisory Committee, through the New England Wild Flower Society (NEWFS), the Connecticut Invasive Plant Working Group (CIPWG) and the Northeast Invasive Plant Group (NIPGro).

Connecticut is a member state of the Northeast ANS Panel, a regional panel of the Federal ANS Task Force, and participates in semi-annual panel meetings to review and discuss priorities for the region, many of which are reflected in this plan. The NEANS Panel is an important mechanism in facilitating

interstate coordination. Panel meetings help the Northeast states with active ANS plans (Maine, Massachusetts, Vermont and New York), and those states with plans in development (Rhode Island, New Hampshire, Connecticut) to share ideas, expertise, and resources, as well as discuss concerns and priorities with several neighboring Canadian provinces. The interactions further encourage joint efforts on projects, such as a recently initiated Sea Grant-funded vector outreach and education program that has involvement from all of the Northeast states, the development and widespread dissemination of hydrilla watch cards, or the rapid response training workshops held in 2004 and 2005.

Connecticut will seek to address collaboratively any priority issues the NEANS Panel adopts. For example, the Panel is considering whether to adopt as a goal the eradication of hydrilla from all Northeast waters. If such a goal is set, Connecticut will join with the other Northeast states to develop and implement a plan (as resources allow) for achieving that goal. Another on-going regional collaboration is the training of volunteers to identify invasive plants, thereby increasing the number of “eyes” monitoring a wide range of habitats for new aquatic plant introductions.

### **1.3. The Development of the CT ANS Plan (Process and Participants)**

The Connecticut Aquatic Nuisance Species Working Group (the ANS Working Group) was established in February of 2004 to coordinate and enhance efforts for the prevention and management of ANS through the development of this management plan. The Working Group is made up of representatives from state and federal agencies, academic institutions, and industry and community representatives (see Acknowledgments) and has worked to coordinate existing management efforts, identify priority nuisance species to target for prevention and control, and develop specific objectives and actions focused on management, research, and outreach/education. The Working Group was coordinated by a Steering Committee made up of two representatives from the Connecticut Department of Environmental Protection (CT DEP), one representative from the Connecticut Sea Grant College Program, University of Connecticut (CTSG), and one representative from the Connecticut Institute of Water Resources (CTIWR). Funding from the National Sea Grant College Program, the CT DEP, and CTSG facilitated the development of this comprehensive ANS management plan for the State of Connecticut.

Many Working Group members serve on additional committees involved in invasive species management initiatives in Connecticut and the region (described below). Integration of these committees into the ANS Working Group has ensured that management measures outlined in this plan represent a fully coordinated approach.

Comments received from state agencies, subject matter experts and the general public during the development of this document have been an important component of the planning process, and wherever possible, comments received have been incorporated into this plan.

#### **1.3.1. The CT ANS Sub-Committees**

The CT ANS Working Group was divided into three sub-committees to facilitate the development of the plan. The Marine Sub-committee focused on fish, invertebrates, algae and pathogens found in coastal and estuarine communities; the Freshwater Sub-committee on freshwater fish, invertebrates, algae and pathogens found in inland lakes, rivers and streams; and the Plant Sub-committee on freshwater and brackish vascular plants. Each sub-committee met several times and

conferred by email between February 2004 and May 2005 to discuss and develop the content of this plan.

### **1.3.2. Scientific Review Process**

Faculty members of several Connecticut colleges and universities served as members of the ANS Working group. In addition, drafts of this plan were submitted to other academic subject matter experts for review.

### **1.3.3. Public Review Process**

In June 2005, the ANS Working Group steering committee conducted two public meetings on the draft ANS management plan. The meetings were advertised by mail and by e-mail to various listserves, and the draft plan was available electronically on the CTIWR website or by mail from CT DEP. Written comments were also solicited. At each meeting, the plan was discussed and members of the public given an opportunity to speak and ask questions. A summary of comments raised during the public hearings and the explanations provided in response is given in Appendix F.

### **1.3.4. Agency Review Process**

In May of 2005, a draft of this plan was submitted to Mike Goehle of the U.S. Fish and Wildlife Service, Lower Great Lakes Fishery Resources Office for review. Key leaders of the CT DEP also received a draft to review. In late June, a revised draft was submitted to the Federal Aquatic Nuisance Species Task Force for preliminary review. In August of 2005 the ANS Steering Committee met to discuss the public and ANS Task Force comments and make any necessary revisions to the CT ANS plan before sending it to several state agencies for formal review (Department of Environmental Protection, Department of Agriculture, Department of Public Health, Department of Transportation, Office of Policy and Management). Upon receipt of the agencies' comments, the final draft plan was completed. A list of major points raised by the agencies, and responses of the Steering Committee is provided in Appendix E. Upon acceptance by the agencies, the plan was submitted to Governor M. Jodi Rell for her signature.

## 2. PROBLEM DEFINITION AND RANKING

The problem of aquatic invasions poses unique challenges to the management of aquatic systems and the development of policy affecting aquatic environments. Since established populations of aquatic invaders are self-sustaining, resources must be devoted to both the prevention of new introductions and to the control and eradication of existing populations of invaders. The introduction of only a few organisms or, in the case of aquatic plants and algae, a piece or fragment of an organism, can result in the infestation of a water body, watershed, or an entire biogeographic region. These introductions can occur through any number of transport vectors, further complicating preventative measures. The following section highlights some of the major impacts of past introductions, identifies priority pathways by which these species may have been imported, and identifies established and threatening species of greatest concern to Connecticut freshwater and marine water bodies. The discussion and identification of the major problems and concerns outlined below have served as the foundation for the development of detailed Management Objectives and Actions outlined in Section IV.

### 2.1. History and Biogeography of ANS in CT

Aquatic nuisance species are a statewide problem in Connecticut. Rates of introductions (and discovery of introductions) are increasing, and all varieties of aquatic environments are affected. Bisected by the Connecticut River, Connecticut's watershed extends into the states of Massachusetts, Vermont and New Hampshire, as well as Canada. The Connecticut River watershed and seven other major basins [some of which also extend into New York, Massachusetts and Rhode Island, (Fig. 1)], empty into Long Island Sound (LIS), the State's southern border.

Connecticut has an abundance and diversity of freshwater habitats as the State contains approximately 425 major lakes, ponds, reservoirs and impoundments covering more than 56,000 acres, and over 6,500 miles of rivers, streams and brooks. These waters are populated by a variety of native and non-native species. At present, 27 non-native fish species along with a large and yet undetermined number of non-native invertebrates and plants inhabit the freshwaters of Connecticut. Many of the non-native fish species were intentionally introduced to enhance sport fishing opportunities or in response to habitat alterations associated with agriculture and development. Some of these initial introductions date back to the late 1800s (ex: brown trout) whereas others were made in the early-to-mid 1900s (ex: smallmouth and largemouth bass), and some in recent years (walleye were reintroduced and grass carp were introduced late in the 20<sup>th</sup> century). Among other non-native taxa, most introductions to freshwater were associated with the bait trade, aquarium trade, nursery trade and recreational boating and fishing activity. These unintended introductions undoubtedly occurred throughout the 20<sup>th</sup> century with the likelihood and frequency of introductions increasing over time as greater numbers of aquatic taxa were transported.

A good discussion of the history and biogeography of nonindigenous aquatic vascular plants in Southern New England is provided by Les and Mehroff (1999). Eurasian water-milfoil (*Myriophyllum spicatum*), variable leaf water-milfoil (*Myriophyllum heterophyllum*), curly leaved pondweed (*Potamogeton crispus*); purple loosestrife (*Lythrum salicaria*) and phragmites

(*Phragmites australis*) are non-native invasive plants that have become abundant and wide spread in Connecticut over the past 30 years. Fanwort (*Cabomba caroliniana*) was first found in Connecticut in 1937 and has become quite widespread in eastern Connecticut. Because of their widespread abundance in Connecticut, these species are managed with the goals of limiting spread through controlled maintenance. Eradication is highly unlikely to occur, but preventing spread to other water bodies is a priority action. Once established, invasive plant species frequently have long lag times before they begin to have dramatic effects (FICMNEW 2003).

More recent invasive plant arrivals to Connecticut include hydrilla (*Hydrilla verticillata*) in 1989, water chestnut (*Trapa natans*) in 1999, and Brazilian waterweed (*Egeria densa*) in 1992. Currently only a limited number of populations of each of these species have been documented to date. Ongoing aquatic plant survey work will undoubtedly locate additional populations.

Most of Connecticut's aquatic nuisance plants initially arrived here by introductions that escaped from cultivation. Introductions by the nursery trade, aquascaping, and water gardening consumers continue to be an important source of new introductions of non-native invasive plants. Recreational boating and transport of boats throughout the Northeast is another leading method/source of dispersing non-native invasive plants. Legislative and educational efforts have been initiated and more are planned to reduce new introductions and control spread of existing non-native invasive plants.

The LIS estuary was one of the first nationally significant estuaries designated by the U.S. Environmental Protection Agency (EPA), and supports a variety of coastal and marine habitats and organisms. About 110 miles long and 21 miles wide at its widest point, LIS has 600 miles of coastline, almost half of which are in Connecticut. The Sound is unusual in that it is located near the boundary of two biogeographic provinces (the Virginia Province to the south, and the Boreal Province to the north of Cape Cod; Fig. 1). As a result, both coldwater and warm water estuarine and marine species are supported. Ocean water from the Atlantic enters from the eastern end, while significant fresh water inputs are received from the Connecticut, Thames, Quinnipiac, and Housatonic Rivers in Connecticut. The Sound has a second connection to the ocean, through the East and Hudson Rivers/New York Harbor at the Sound's westernmost point.

More than 50 non-native and 40 cryptogenic species have been identified in Long Island Sound (MacLellan 2004; Appendix A, Table A-4). (Cryptogenic species are those species for which not enough information exists to determine their origin; they may be native or non-native.) These species range from the red alga, *Grateloupia turuturu*, recently discovered in September 2004, to the common periwinkle snail, *Littorina littorea*, which has dominated the New England intertidal zone for more than 150 years. Other non-native species include ascidians (tunicates), which foul docks, pilings, and boat hulls, a crab from Asia that dominates the upper intertidal zones, and two oyster diseases (MSX and Dermo).

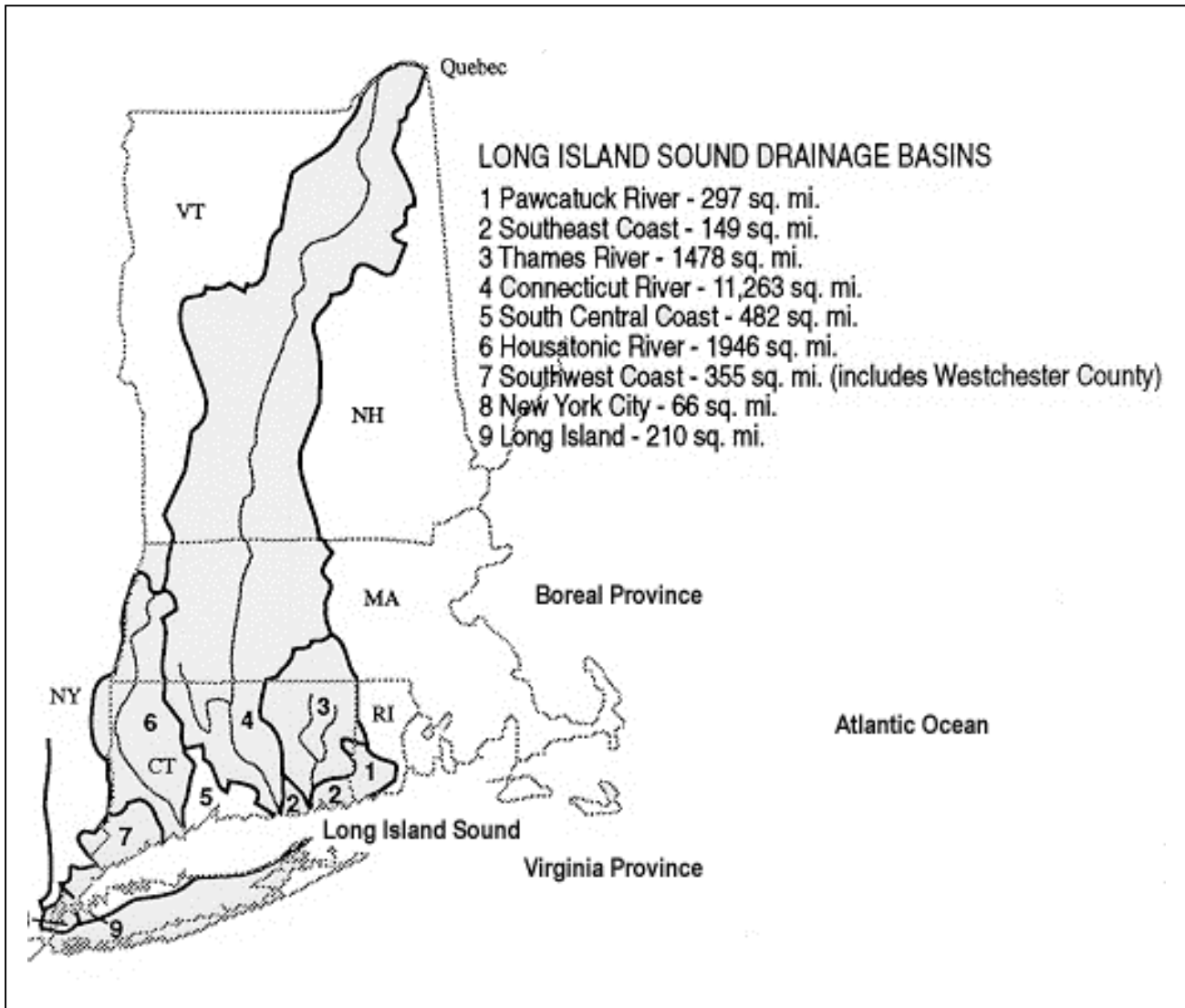


Figure 1. Long Island Sound is situated between the southern border of Connecticut and Long Island, New York. Watersheds and key rivers are marked. (Figure courtesy of the EPA Long Island Sound Study.)

## 2.2. Current and Potential Impacts of ANS in CT

Connecticut currently faces a variety of impacts from aquatic invaders in both fresh and coastal waters, which can have significant and lasting impacts upon natural resource health, economic interests, biodiversity and ecosystem functioning. Current impacts from ANS include:

- ◆ Reduced diversity of native flora and fauna
- ◆ Environmental effects such as predation, parasitism, competition and displacement, introduction of new pathogens, changes in genetic make-up, wildlife habitat alterations and degradation
- ◆ Degradation of water quality
- ◆ Impairment of recreational uses such as swimming, boating, and fishing
- ◆ Economic impacts

- ◆ Increased threats to public health and safety
- ◆ Increased threats to proper functioning and maintenance of power generation and drinking water utilities; increased costs for maintenance and operation
- ◆ Diminished value of properties near aquatic plant-infested lakes and ponds
- ◆ Declines in finfish and shellfish populations due to pathogens (e.g. oyster diseases caused by parasites, MSX and Dermo) or competitive interactions with ANS (e.g., mats of *Didemnum sp.* overgrowing shellfish or shellfish beds)
- ◆ Loss of coastal infrastructure due to habits of fouling and boring organisms
- ◆ Secondary effects may result as by-products of ANS (e.g., recreational development may be seriously hampered as lakeside residents become more concerned about introductions of ANS through recreational activities associated with new boat launches or other fisheries access areas).
- ◆ Resource management agencies may face losing long-standing programs due to ANS arrival, or will have to divert key resources to ANS prevention and control efforts (ex: More than \$3 billion has been spent in the Great Lakes on management and control of zebra mussels).

More detailed information on some of these existing and potential impacts follows.

### **2.2.1. Economic Impacts**

#### **Freshwater and Saltwater Fishing Impacts**

Long Island Sound is an important estuary in the region, serving as spawning, nursery, and feeding grounds for many coastal and estuarine species. These species form the basis of important bi-state commercial and recreational fisheries, which in 1992 were calculated to contribute \$150 million and \$1 billion to local economies, respectively (Altobello 1992). As with most estuaries, the Sound is valued for its recreational, commercial, economic, and aesthetic values. It is sometimes referred to as the “Urban Sea,” as more than 8 million people live within the Sound’s watershed, and more than 20 million people live within an hour’s drive of the shore (Burg 2004). There are more than 600,000 registered boats in Connecticut, and creel surveys support estimates of 450,000 marine anglers fishing in the State (Molnar 2004). The Sound also supports heavy commercial shipping traffic, traveling to ports in New London, New Haven, Bridgeport, and Stamford; some travel up the Connecticut River as far as Hartford.

Freshwater fishing is a popular recreational activity in Connecticut with 254,000 adult anglers (plus ~100,000 youth) making 3.5 million fishing trips and spending \$74 million annually (not including monies spent on boats). Most sought-after fish species include trout (1.5 million trips per year), largemouth and smallmouth bass (1.5 million trips per year), and an assortment of other gamefish and panfish (0.5 million trips per year) (USFWS 2001). Saltwater anglers spend an additional \$68 million annually on recreational fishing in Connecticut (not including monies spent on boats)

Approximately 160,000 freshwater fishing licenses are sold each year providing more than \$3 million in revenue to the State of Connecticut. Additional revenues are generated from sales and excise taxes on freshwater and saltwater fishing equipment, boats and boating equipment, and by taxes on motorboat fuels. ANS alter aquatic habitat, disrupt food chains, and reduce the



growth, survival and abundance of important game fish. Recreational fishing and associated economic activity are similarly affected. Examples include the collapse of trout populations and fisheries in some areas of the western U.S. following the introduction of whirling disease and, more recently, New Zealand mud snails; the potential loss of largemouth bass fisheries following introduction of largemouth bass virus; the potential loss of productivity in off-shore fishing grounds following the introduction of non-native tunicates; and disruption of fishing activity by overgrowth of nuisance aquatic plants such as milfoil, fanwort and hydrilla.

### **Commercial Fishing / Aquaculture Industry Impacts**

Oyster parasites, primarily MSX (*Haplosporidium nelsoni*) and, to a lesser degree, Dermo (*Perkinsus marinus*), caused the commercial oyster aquaculture industry in Long Island Sound to suffer heavy losses in the late 1990s (Sunila et al. 1999). Harvest and market data compiled by the Connecticut Department of Agriculture, Bureau of Aquaculture (CT DA/BA) demonstrates the devastating effects these diseases have had on the 100+-year-old oyster farming industry in Connecticut (David Carey, CT DA/BA, pers. comm.). Annual harvests of oysters averaged more than 686,000 bushels during the period 1991 – 1996. However, after MSX struck in 1997 and 1998, oyster harvests during the period 1997-2002 dropped to an annual average of 119,000 bushels, with a low of 32,000 bushels in 2002. As the harvests plummeted, the overall ex-vessel value of oyster farming also dropped 96% in 10 years, from \$45 million in 1992 to a \$2 million in 2002.

The recent discovery of extensive mats of the colonial tunicate, *Didemnum sp.*, in eastern Long Island Sound is raising concerns about the species' potential impact on shellfish. In one area, the mat covers about a square mile of the seafloor (and its associated biota). Currently, more than 40,000 acres of shellfish grounds are leased in Connecticut waters for the farming of oysters and hard clams, a \$12 million industry in 2003. A number of aquatic nuisance tunicate species also foul aquaculture equipment such as cages, requiring more time and effort to keep the cages clean. The economic impact of these fouling organisms on mariculture operations is currently being investigated by a team of researchers based at the University of Connecticut. European green crabs (*Carcinus maenas*) prey on commercially valuable shellfish resulting in an annual loss of ~\$44 million to the northeast United States and Canada (NEANS Pannel, in press).

In addition to being impacted by ANS, scientists are also examining the potential for shellstock to be a vector for the transport of viable algal cells, particularly those that cause localized harmful algal blooms, from one area to another (S. Shumway, University of Connecticut, personal communication). When available, the results of this work may prompt state and federal regulators of shellfish to review their policies guiding safe shellfish transplants.

### **Water and Power Industry Impacts**

A 1995 survey by New York Sea Grant solicited information on the economic impact of zebra mussels on electric power generation stations, public and private drinking water treatment plants, industrial facilities, navigation lock and dam structures, marinas, hatcheries, and other facilities in the eastern half of the United States and Canada (O'Neill 1996). More than 330 facilities reported zebra mussel-related expenses for the period from 1989 to 1995, exceeding \$69 million, with an average individual expense of about \$200,000 (O'Neill 1996). Nuclear

power plants reported the greatest expenditure, along with drinking water plants and other industries. Golf courses reported the lowest expenditures. Overall, total zebra mussel-related expenditures increased annually, from \$234,000 per year in 1989 to \$17.8 million per year in 1995 (O'Neill 1996). More recently, estimates for the expenditures occurring as a result of zebra mussel monitoring, planning and engineering, preventive measures, retrofitting of equipment or facilities, treatment and control measures, and research, may be approaching \$100 million per year. New England did not contribute data to this survey; however, Connecticut power and water companies were both active in the State's ad hoc zebra mussel task force and allocated resources to monitoring and planning for possible zebra mussel infestations (Balcom 2004).

The Asiatic clam, *Corbicula fluminea*, is a serious biofouler of raw water intake pipes, and has plagued nuclear power plants all over the country. Costs associated with the fouling of Asiatic clams are estimated to be \$1 billion annually (Pimentel et al. 2000). In the lower Connecticut River, personnel found a population of Asiatic clams fouling systems of the now-closed Yankee Atomic Power plant in 1990, and controlled them with continuous low-level chlorination (Balcom 1994).

### **Impacts on Water Quality**

Overabundant populations of landlocked alewife and other planktivorous fish species often reduce water quality and increase the costs of water treatment for water supply companies. Alewives alter water quality via occasional mass die-offs and by size-selective foraging (feeding preferentially on larger-bodied zooplankton). Foraging by alewives shifts zooplankton community size structure and species composition to both smaller individuals and species (Brooks and Dodson 1965, Hutchinson 1971, Warshaw 1972). This often results in an increase in algal biomass due to lower rates of herbivory and faster nutrient cycling by smaller-bodied zooplankton (Carpenter et al. 1985, Carpenter et al. 1993, Jeppesen et al. 1990).

Aquatic plants such as milfoil and fanwort can clog intake pumps, interfere with lake and reservoir management activities and reduce water quality (during plant die-offs). In many reservoirs, chemical treatment of ANS plant species is required annually (Ex. from 1982-2005 \$6 million was spent to control water chestnut in Lake Champlain).

### **Property Value Impacts**

An economic study that investigated the percentage drop in value of waterfront property and public sites on suburban Connecticut lakes with hypothetical declines in water quality showed that conditions that make swimming inadvisable could result in percentage losses in value ranging from 31% - 36% for property owners, and 44% - 65% for users of public sites (Fishman et al. 1998). Aquatic weeds such as Eurasian water milfoil, fanwort, and hydrilla can also block access for boats, swimming and fishing, leading to a concomitant loss in value.

A 2003 University of New Hampshire analysis indicates that infestations of an exotic aquatic weed, specifically variable milfoil (*Myriophyllum heterophyllum*), may reduce lakefront property values by as much as 10-20% as compared to similar properties on uninfested lakes

(Halstead et al. 2003). Another study estimates that annual costs associated with aquatic weeds in the U.S. total \$110 million (Pimentel et al. 2004).

## **2.2.2. Biodiversity and Ecosystem Impacts**

### **Reduced Diversity of Native Flora and Fauna**

Ecosystems have evolved over long periods of time into a system of complex interactions between flora, fauna and microorganisms. When a non-native invasive species enters a particular ecosystem, they disrupt this delicate balance. This disturbance results in degradation of the ecosystem function and displacement of native species. Frequently species diversity is reduced to nearly a monoculture of one non-native invasive species. Not only does this result in a reduction in the number and abundance of native species, but also creates serious threats to endangered and threatened species. Additional assaults/threats to the ecosystem can also result from actions designed to eradicate or control the non-native invasive species.

In addition to economic costs, invasions of non-native species in general can also have ecological costs, as ecosystems move towards homogeneity and local, unique diversity is lost (Ruesink 1998). Introductions of new predators, competitors, diseases, and parasites also threaten the structure and biodiversity of local ecosystems (Carlton and Geller 1993). Many introduced species go unnoticed or are mistaken for native species; later they may be labeled “cryptogenic,” an acknowledgement that their origins are unclear (Carlton and Geller 1993).

Two examples of species that dominate habitats and reduce diversity within an ecosystem are the common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*). *Phragmites* is currently a focus of State of Connecticut management efforts to remove and eliminate it in certain areas; purple loosestrife is undergoing targeted biological control in a few locations as well (University of Connecticut Cooperative Extension System providing volunteers with information on how to properly grow and release *Galerucelia* beetles).

## **2.3. Priority Aquatic Nuisance Species**

Lists of nuisance species that are established in Connecticut waters, or that have the potential to become established in Connecticut have been drafted. Procedures outlined in the ANS Task Force Organism Risk Analysis (ANS Task Force 1996) were generally followed in evaluating status of non-native freshwater species. A formal assessment of the prioritization of marine species is ongoing (see Task 1B2). While the number of species is still being assessed for all habitats, they are significant (Appendix A, Tables A-1 to A-6). Some of the established species listed have not demonstrated invasive characteristics, and therefore are not considered ANS at this time. While complete assessment of the State’s waters has not been undertaken, on-going surveys include annual fisheries inventories of 30 lakes and ponds and 40 to 60 rivers and streams during which presence or absence of ANS is recorded (see ongoing Task 4B2). Aquatic plant surveys are done on both state owned and private water bodies by the CT DEP and the CAES. Three sites in Long Island Sound were included in a rapid assessment of marine ANS conducted in southern New England waters (Pederson et al., 2005). A more comprehensive assessment of marine ANS through

standardized monitoring sites is one of the priority discussion topics for the EPA LISS, New York State and Connecticut.

These draft lists were compiled by the Working Group sub-committees, developed from existing regional lists, input from Working Group members, and other local resources. The species have been prioritized for management action (Section 2.5). Background information on many of the priority species has also been compiled (Appendix B).

A list of marine introduced species in Long Island Sound has been compiled (MacLellan 2005; Appendix A, Table A-4). A group of researchers are currently compiling the Invasive Plant Atlas of New England (IPANE), documenting terrestrial and aquatic non-native plant species in New England. The CT DEP has a fairly extensive database of the locations of invasive aquatic plants and freshwater fish, due to agency surveys and work with local lake associations. Information on non-native invertebrate species in our freshwater lakes and rivers is lacking. Not all species deserve or can have the same management priority. Decisions were made to prioritize the species for management, research, and outreach/education attention (section 2.5).

## **Terminology**

The compilation of species lists came about after much discussion, particularly regarding the use of the terms “invasive” and “aquatic nuisance” species. Botanists regularly employ the term “invasive” when referring to plant species that are undesirable and likely to become problematic in terms of spreading quickly and being difficult to eradicate. Further, the State of Connecticut established an Invasive Plant Council in 2004. Nationally, the term “invasive” includes both aquatic and terrestrial species and has largely replaced the term “nuisance.” Both the Federal Aquatic Nuisance Species Task Force and the National Invasive Species Council define an “invasive species” as one that is having some sort of negative impact. An introduced species that does not have a negative impact is not considered an invasive species and is instead called a non-native species.

During the Working Group’s discussions, the concern was raised that not all introduced species are negative. For example, the CT DEP occasionally introduces non-native species of fish into selected water bodies as a means to enhance recreational fishing opportunities. These fish become established, but are not considered invasive at this time. Further, non-native species are occasionally deliberately introduced as biological control agents for undesirable species, as in the case of purple loosestrife and the *Galerucelia* beetles.

To avoid confusion among the public, the decision was made to universally refer to the species that are the focus of this management effort as aquatic nuisance species (ANS) and not aquatic invasive species (AIS). The term “nuisance” infers that they are non-native to a region or habitat, undesirable and require action, and is the terminology used in the original Act (NANPCA) passed by Congress in 1990.

Another term sometimes used to describe non-native species is “exotic.” Given its both positive and negative connotations and the confusion surrounding its use, the Working Group has chosen not to use this term.

The identification of all aquatic introduced species is on-going. The lists for freshwater and marine species will be continually updated as new information becomes available or new species are discovered in the region. Concomitantly, changes in the focus of management efforts and priorities will likely also occur (Section 2.5).

The lists of freshwater and marine aquatic nuisances (potential and established) in Appendix A are not regulatory, although certain of the species listed are already regulated by the State of Connecticut. For ANS that are already established, the primary management objective is to prevent their spread to additional as-yet-unaffected water bodies. For those ANS not yet found in Connecticut waters, the primary management objective is to minimize the potential for their introduction and establishment.

### **2.3.1. Established ANS Priority Species or Species Groups**

Within and among the sub-committees, discussions were held on the criteria to decide what constitutes an ANS, as the guidance from the Federal ANS Task Force requires that “comprehensive plans must identify and discuss all likely ANS problems, issues, and concerns...and should include instances where...there may not be a consensus about a problem or whether one even exists.” These discussions were occasionally contentious, and some disagreements remain as to which species should be included on the lists; the lists include species that are known introductions and those that are cryptogenic in their origins.

#### **Freshwater and Marine Invertebrates, Vertebrates, and Seaweeds**

The freshwater and marine sub-committees reviewed life history information on both established and potential freshwater and marine non-native vertebrate and invertebrate ANS and their vectors, giving them an initial ranking as “greatest threat,” “modest threat,” or “low threat” accordingly for each of the following criteria. Seaweeds were included in the discussion of marine species (Appendix A, Tables A-1, A-2, A-4, and A-5):

- ◆ Likelihood of introduction or spread (from established areas)
- ◆ Likelihood of establishment
- ◆ Severity of ecological, environmental, or socioeconomic impacts

For both the freshwater and marine sub-committees, general life history characteristics that typically apply to “invasive” species were used as the foundation of the discussions to prioritize the threat of the species, and included the ability to thrive in variety of habitats under a wide range of environmental conditions, high reproductive capacity, rapid growth, and ease of dispersion. In addition, the following broad criteria for priority species designation, as well as any additional criteria determined by each of the sub-committees, were considered during deliberations:

- ◆ Severity of the problem posed to Connecticut by the introduced species.
- ◆ Existing capabilities for management (species for which management options are currently available are given higher priority).
- ◆ Associated costs and benefits of management

The sub-committees conceptually used a process similar to the ANSTF Generic Nonindigenous Aquatic Organisms (GNAO) Risk Analysis Review Process (1996); however, this process will formally become part of the annual review of the priority species lists for both freshwater and marine ANS. An independent review of the prioritization of the marine species is currently being undertaken by a graduate fellow with the EPA Long Island Sound Study, as directed by the Chairs of the Science and Technology Advisory Committee, employing the GNAO Risk Analysis Review Process (see Task 1 B 2). The results of this review will be compared with the species prioritization and management classifications contained in this plan, and will be part of the bi-state/federal discussions focused on ANS in Long Island Sound.

## **Pathogens**

The introduction of pathogens is a major concern, as the protection of the health of Connecticut's aquatic resources, commercial interests, and environmental health are paramount. The major routes of dissemination of these pathogens are through the movement of fish and/or fish gametes (i.e. importation/liberation of fish and/or fish gametes from infected areas/facilities into non-infected areas/facilities), the importation and planting of unapproved shellfish seed, from ballast water discharges, or from natural dispersion from other affected areas over time. For freshwater fish, some of the more targeted game species pathogens, such as largemouth bass virus, could be moved interstate by contaminated boats, i.e. livewells, bilge water, etc. Movement of pathogens associated with aquarium species (*Hexamitosis*) could be accomplished by inadvertent or intentional release of aquarium fish species. For shellfish, concerns are raised not only by the shellfish pathogens themselves, but also by non-native species of shellfish that may serve as reservoirs for other non-native organisms or pathogens. Priority pathogens and their vectors are listed (Appendix A, Table A-6).

## **Aquatic Macrophytes**

Invasive or nuisance freshwater plants have been the focus of significant attention throughout Connecticut due to their widespread impacts on lakes and ponds throughout the state. These species propagate by seed and fragmentation; form dense mats, alter the community structure, and have a negative effect on recreational activities such as boating, fishing, and swimming. Existing control efforts in Connecticut are conducted largely through local initiatives, in collaboration with CT DEP. Lake associations have been particularly active in seeking ways to control or eradicate unwanted aquatic vegetation. Improved detection and rapid response to new invasions and additional public education are priority actions for management of aquatic nuisance plant species.

Priorities for ranking plant species were based on the following:

- ◆ Must be nonindigenous to Connecticut
- ◆ Adequate evidence of naturalization in Connecticut
- ◆ Potential for severity of infestation
- ◆ Difficulty of control; associated costs and benefits of management actions

In addition, species lists from other New England states and New York were reviewed along with their criteria for listing. IPANE data and Federal species lists, publications and programs were also consulted (Appendix A, Table A-3).

Further, this sub-committee established management priorities for site-specific action:

- ◆ New non-native nuisance plant species detected/found in Connecticut
- ◆ New locations of already established non-native nuisance species
- ◆ Populations of already established non-native nuisance species under certain circumstances including: protection of State listed species, protection of significant habitat types

### **2.3.2. Potentially Threatening ANS Priority Species or Species Groups**

In addition to categorizing ANS already established in Connecticut waters, the ANS Working Group also considered non-native aquatic species that have the potential to survive and become established if introduced. The life history and characteristics of these species indicate that there is likelihood that they could survive Connecticut's current climate, or could become established if there was a subtle change in the environment or climate over time that favored them (e.g. localized and sustained warming trend). These species will largely be addressed through introduction prevention measures and educational programs.

## **2.4. Priority Vectors**

A number of inter- and intra-state current and potential pathways or vectors for ANS were identified for Connecticut by the ANS Working Group. A summary of these pathways is provided in Table 1 (page 24), including potential mechanisms for introduction into and dispersal throughout Connecticut. Over time, many of these vectors and pathways will be addressed on many levels, including regulation/policy, legislation, education, and research. This list will also be reviewed and updated over time. Detailed information on these pathways is provided (Appendix C).

## **2.5. Priorities for Action**

Effective management of ANS includes elements of prevention, early detection, rapid response, monitoring and control. The need for and relative importance of these elements varies among different ANS species, vectors and habitats. The success of the State of Connecticut in effectively managing ANS depends on our technical knowledge, the selection of appropriate priorities for action and, ultimately, our ability to garner the resources necessary to implement these actions.

In addition to using education, regulation, and policy to prevent the introduction and spread of ANS, there are management options for many freshwater aquatic nuisance species that allow for control or even eradication. Early detection of new introductions and routine monitoring of existing populations are feasible in most freshwater habitats. However, once a non-native species becomes established in a marine system such as Long Island Sound, the management options for control and eradication are virtually non-existent. Therefore, the focus for addressing marine ANS must be on

<b>Table 1. Potential Mechanisms for Introduction and Dispersal Within Connecticut</b>		
<b>Mechanism Category</b>	<b>Examples</b>	<b>Introduction and/or Dispersal (I, D)</b>
<b>Natural Dispersal (passive and active)</b>	Wind, Currents Water fowl, birds Migratory Fish	I, D I, D I, D
<b>Managed Aquatic Resources</b>	Water Diversions	D
	Fishways	D
<b>Transportation</b>	Commercial Vessels and Recreational Boats (fouling organisms, organisms caught on boat trailers, engines, gear)	I, D
	Hull Fouling Cleaning Activities (organisms removed from boat hulls and washed into water)	I
	Ballast Water and Sediments (planktonic organisms and larvae, adult organisms)	I
	Seaplanes	I, D
<b>Equipment</b>	Dredging equipment	I, D
	Construction	I, D
	Aquatic Weed Harvesters	I, D
	Herbicide applicators	I, D
	Dive and snorkeling gear	I, D
<b>Organism Handlers</b>	Bait Trade/Anglers (release of bait fish, invertebrates, sediments, pathogens from live wells or bait buckets)	I, D
	Aquaculture (target or non-target organisms, pathogens)	I
	Seafood Industry/ Retailers / Restaurants / (live seafood trade)	I
	Seafood Consumers (cultural incentives)	I, D
	Aquarium Industry/Hobbyists (intentional or accidental releases of target or non-target organisms; pathogens)	I
	Garden Industry/Gardeners (target or non-target organisms; pathogens)	I, D
	Research Facilities (target or non-target organisms; pathogens)	I, D
	Stocking Programs (target or non-target organisms; pathogens)	I, D
Bio-control Programs	I, D	

interrupting the pathways or vectors of non-native species and preventing new introductions through education, regulation or policy. Established monitoring sites in various basins of the Sound can also aid in the detection of new species and populations.



The Working Group has identified eight management goals, and developed associated strategies and tasks for each (see Sections 4 and 5 below). The Implementation Table (Section 6) outlines the general timeframe and resources that have been identified to date. From this comprehensive set, twelve action items were selected as our priorities for action.

Recognition of the management constraints, coupled with the resource limitations that currently exist, have guided the prioritization of the management goals in this first version of the Connecticut ANS management plan. The priorities for action listed below will be addressed using a combination of management, education, research, and legislation. Additional information on how and by whom they will be addressed initially is provided in the Implementation Table. In some cases, individual tasks and strategies that have been outlined as important steps towards meeting these priorities have no time or funds associated with them in the Implementation Table (and are listed as TBD or ‘to be determined’). Effort is underway to identify appropriate funding sources to facilitate the activities described.

The following priorities for action have been selected:

1. Hire a statewide ANS coordinator and establish a statewide coordinating committee.
2. Develop ANS educational materials and distribute to key groups.
3. Enforce importation/liberation regulations for fish, invertebrates, and other organisms.
4. Identify, prioritize and secure funding to enable implementation of ANS priorities.
5. Develop and implement statewide early detection, monitoring and assessment plans.
6. Develop and implement a rapid-response protocol for Connecticut.
7. Evaluate effectiveness of ANS control and adapt control techniques as necessary.
8. Develop and maintain Connecticut ANS website/portal.
9. Identify research priorities for Connecticut ANS.
10. Conduct a legislative briefing on ANS issues in Connecticut.

### **Prioritization by Management Classes**

In addition to these 12 identified priorities for action, it is helpful to identify and categorize freshwater and marine nuisance species by their extent of invasion and degree to which they can be controlled, to facilitate the prioritization of management efforts and help focus further research and outreach activities.

The ANS Working Group developed a comprehensive list of current and potential aquatic nuisance species (see Appendix A). Using the criteria and rankings of the sub-committees described in the previous section, the Steering Committee selected a number of these species, and categorized them into management classes using the same delineations utilized in the Washington, Oregon, and Hawaii state ANS management plans, with an addition of a 5<sup>th</sup> class.

These management classes categorize species according to the extent of the invasion and the degree to which current management capabilities can effectively control them and/or prevent further spread. It is expected that the management class species lists will be updated annually. The initial management classifications are:

**CLASS 1: Limited or Incipient Populations**

*Includes species that have limited or incipient populations within Connecticut waters.*

**Primary management actions include:**

- ◆ Rapid response efforts for the eradication of new populations
- ◆ Prevention of further introductions of new populations
- ◆ Prevention of dispersal into new waters
- ◆ Issuance of alerts and educational materials to facilitate detection of new infestations
- ◆ Systematic monitoring of natural waterways to detect additional populations
- ◆ Interruption of possible “export” pathways from Connecticut

<b>Table 2. Management Class 1: Initial Species List</b>	
<b>Freshwater Species</b>	<b>Marine Species</b>
<b>Plants</b>	<b>Vertebrates</b>
<i>Egeria densa</i> (Brazilian water weed)	<i>Pterois volitans/miles</i> (lionfish, vagrant species)
<i>Hydrilla verticillata</i> (hydrilla)	(Action involves education alert – venomous)
<i>Myriophyllum aquaticum</i> (parrotfeather)	
<i>Trapa natans</i> (water chestnut)	
<b>Invertebrates</b>	
<i>Dreissena polymorpha</i> (zebra mussels)	
<b>Pathogens</b>	
Largemouth bass virus	
Infectious salmon anemia	
Plus: Any Class 2 species found in new locations	

**CLASS 2: Established Species, Significant Impact, Some Practical Control Techniques Available**

*Includes species present and established in Connecticut with known impacts (or potential for impact) that may be mitigated or controlled with appropriate management techniques.*

**Primary management actions include:**

- ◆ Prevention of further introductions and dispersal to new waters, including interrupting possible “export” pathways from Connecticut
- ◆ Control of population range
- ◆ Mitigation of impacts (including to species that are rare, threatened or endangered)
- ◆ Resource managers, researchers, and industry representatives working together to find long-term solutions for those species considered to be important for recreation or commercial purposes

**Table 3. Management Class 2: Initial Species List**

<b>Freshwater Species</b>	<b>Marine Species</b>
<b>Plants</b>	<b>Algae</b>
<i>Cabomba caroliniana</i> (fanwort)	
<i>Iris pseudacorus</i> (yellow iris)	
<i>Lythrum salicaria</i> (purple loosestrife)	
<i>Myriophyllum heterophyllum</i> (variable-leaf water-milfoil hybrids)	
<i>Myriophyllum spicatum</i> (Eurasian water-milfoil) (New infestation only)	
<i>Najas minor</i> (eutrophic water-nymph)	
<i>Phragmites australis</i> (common reed, nonindigenous genotypes)	
<i>Potamogeton crispus</i> (curly-leaved pondweed)	
<b>Invertebrates</b>	<b>Invertebrates</b>
<b>Vertebrates</b>	<b>Vertebrates</b>
<i>Tinca tinca</i> (tench)	<i>Cygnus olor</i> (mute swan)

**Class 3: Established species, Significant Impact, No Known Effective or Practical Control Techniques Available**

*Includes species established in Connecticut, with known impacts (or potential for impact), but with no known available effective or appropriately effective management techniques. This category also includes some species that are considered to be so widespread that known control techniques are not feasible.*

**Primary management actions include:**

- ◆ Prevention of further introductions, including interrupting possible “export” pathways from Connecticut
- ◆ Mitigation of impacts (including to species that are rare, threatened or endangered)
- ◆ Further evaluation and research of potential control methods

**Table 4. Management Class 3: Initial Species List**

<b>Freshwater Species</b>	<b>Marine Species</b>
<b>Plants</b>	<b>Algae</b>
<i>Glossostigma cleistanthum</i> (mud mat)	<i>Grateloupia turuturu</i> (Rhodophyta, red alga)
	<i>Codium fragile tomentosoides</i> (green fleece)
<b>Invertebrates</b>	<b>Invertebrates</b>
<i>Orconectes rusticus</i> (rusty crayfish)	<i>Didemnum</i> sp. (compound sea squirt)
<i>Corbicula fluminea</i> (Asiatic clam)	<i>Styela clava</i> (clubbed tunicate)
	<i>Styela canopus</i> (rough sea tunicate)
	<i>Diplosoma listerianum</i> (compound seasquirt)
	<i>Asciidiella aspersa</i> (sea squirt)
	<i>Botrylloides violaceus</i> (orange or red sheathed tunicate)
	<i>Botryllus schlosseri</i> (golden star tunicate)
	<i>Membranipora membranacea</i> (kelp bryozoan)
	<i>Halichondria bowerbanki</i> (bread crumb sponge)
	<i>Hemigrapsus sanguineus</i> (Asian shore crab)
	<i>Carcinus maenas</i> (European green crab)
<b>Vertebrates</b>	<b>Vertebrates</b>
<i>Alosa pseudoharengus</i> (landlocked alewife)	
<i>Cyprinus carpio</i> (carp and koi)	
<i>Dorosoma cepedianum</i> (gizzard shad)	
<i>Carassius auratus</i> (goldfish)	
<i>Ameiurus natalis</i> (yellow bullhead)	
	<b>Pathogens</b>
	<i>Perkinsus marinus</i> (dermocystidium oyster disease)
	<i>Haplosporidium nelsoni</i> (MSX oyster disease)
	<i>Mycobacteria shottsii</i> (mycobacteria)

**Class 4: Established Species, Impacts Unclear**

*Includes species that are established in the waters of Connecticut and may have the potential to cause impacts, but current knowledge is insufficient to determine if control actions are warranted.*

**Primary management actions include:**

- ◆ Prevention of further introductions, including interruption of possible “export” pathways from Connecticut
- ◆ Further research to evaluate their invasive potential and ecosystem effects
- ◆ Continued monitoring of existing populations to determine rate of spread

**Table 5. Management Class 4: Initial Species List**

<b>Freshwater Species</b>	<b>Marine Species</b>
<b>Plants</b>	<b>Algae</b>
<i>Butomus umbellatus</i> (flowering rush)	<i>Porphyra yezoensis</i>
<i>Callitriche stagnalis</i> (pond water-starwort)	<i>Porphyra suborbiculata</i>
<i>Marsilea quadrifolia</i> (European waterclover)	
<i>Myosotis scorpiodes</i> (forget-me-not)	
<i>Nelumbo lutea</i> (American water lotus)	
<i>Rorippa (Nasturtium) microphylla</i> (onerow watercress)	
<i>Rorippa (Nasturtium) nasturtium-aquaticum</i> (watercress)	
<b>Invertebrates</b>	<b>Pathogens</b>
<i>Mytilopsis leucophaeta</i> (brackish water mussel)	<i>Pfiesteria sp. (culata)</i>
<b>Vertebrates</b>	
<i>Amia calva</i> (bowfin)	
<i>Leuciscus</i> (ide or orfe)	
<i>Lepomis gibbosus</i> (green sunfish)	

**Class 5: Potential ANS Invaders, Impacts Expected to be Severe**

*Includes species not yet present in CT waters having high likelihood of introduction and if introduced, expected to have significant biological and/or socio-economic impact.*

**Primary management actions include:**

- ◆ Prevention of introduction to the State of Connecticut

**Table 6. Management Class 5: Initial Species List**

<b>Freshwater Species</b>	<b>Marine Species</b>
<b>Plants</b>	<b>Algae</b>
<i>Salvinia molesta</i> (Giant salvinia)	<i>Undaria pinnatifida</i> (Wakame)
	<i>Sargassum muticum</i> (Asian rockweed)
	<i>Caulerpa taxifolia</i> ((Killer green alga)
<b>Invertebrates</b>	<b>Invertebrates</b>
<i>Potamopyrgus antipodarum</i> (New Zealand mud snail)	<i>Ostrea edulis</i> (European flat oyster)
(Misc. Eurasian mysids)	<i>Crassostrea ariakensis</i> (Suminoe oyster)
	<i>Rapana venosa</i> (Veined Rapa whelk)
<b>Vertebrates</b>	<i>Hemigrapsus pencillatus</i> (Grapsid crab)
<i>Pylodictis olivaris</i> (Flathead catfish)	<i>Eriocheir sinensis</i> (Chinese mitten crab)
<i>Ictalurus furcatus</i> (Blue catfish)	<i>Styela plicata</i> (Asian sea squirt)
Unauthorized bait species.	
	<b>Pathogens</b>
	QPX

### **3. EXISTING AUTHORITIES AND PROGRAMS**

Most of the following text pertaining to international and federal authorities has been taken from the Massachusetts ANS plan. At this time there are no actual gaps in authority, but there are insufficiencies in existing regulations and needs for improved communication and coordinated action which we will be looking at as a part of our long-term plan.

Relevant programs that currently address the ANS problem at the federal, regional, and state level are described briefly in the following paragraphs with emphasis on those that have been active in Connecticut and are necessary to facilitate the implementation of this plan. Where possible, the ANS Working Group has developed management actions based on expansion of the capabilities of these existing programs, particularly at the state and regional level.

A table of relevant laws and regulations can be found in Appendix D.

#### **3.1. International Authorities and Programs**

While international organizations have limited authority in the United States and countries worldwide, organizations such as the International Maritime Organization (below) have taken a lead role in developing policies and guidelines relating to international trade and commerce. Clearly, invasive species management is an international issue, and limiting uncontrolled global transport of ANS will require some reliance on these agencies to shape and implement management strategies.

##### **Global Invasive Species Program (GISP)**

The GISP was established in 1997 to address global threats caused by invasive alien species, and to provide support to the implementation of Article 8(h) of the Convention on Biological Diversity. GISP looks for innovative ways of improving cooperation with existing and new partners in the invasive alien species world, with the aims of minimizing and where possible, eliminating, any form of duplication while maximizing the effectiveness of joint programs, and promoting the sharing of best-practice information. It is an enabling body, focused on effective information exchange and networking mechanisms, one of several significant international efforts to assess the challenges associated with invasive species and develop policies and guidelines (see <http://www.gisp.org>).

##### **International Council for the Exploration of the Sea (ICES)**

This organization coordinates and promotes marine research in the North Atlantic. Advice developed by the ICES is used by 19-member nations to help manage the North Atlantic and adjacent seas. The ICES has a strong interest in biological invasions and has a Working Group on Introductions and Transfers of Marine Organisms and a Study Group on Ballast and Other Ship Vectors. The former working group deals with intentional introductions (e.g., for aquaculture purposes), and, through a risk assessment process and quarantine recommendations, works towards the reduction of unintentional introductions of invasive and deleterious species. The latter study

group focuses on unintentional species introductions from ballast water and hull fouling of ships. The ICES Code of Practice on the Introductions and Transfers of Marine Organisms 2003 gives recommended procedures and practices to reduce the risk of detrimental effects from the intentional introduction and transfer of marine and brackish water organisms. The Code applies to both public (commercial and government) and private (including scientific) interests (see: <http://www.ices.dk>).

#### **The International Maritime Organization (IMO)**

The IMO was established in 1948 to address safety and pollution mitigation measures for the international shipping industry. The United States plays a leadership role on the Marine Environment Protection Committee (MEPC), which is comprised of all 161 Member States, 37 Intergovernmental Organizations, and 61 Non-Governmental Organizations. The MEPC is empowered to consider any matter within the scope of the IMO concerned with prevention and control of pollution from ships, including ballast water management and the transport of ANS. IMO Assembly Resolution A.868 (2) was adopted in 1993 and established international guidelines for the control of ballast water, which served as a model for ballast water management in many countries. In February 2004, a diplomatic conference approved a convention on ballast water management. When formally approved by a sufficient number of countries (with a sufficient amount of the world's shipping tonnage), the Convention will become international law.

#### **United Nations – Food and Agricultural Organization (FAO)**

The United Nations FAO oversees the International Portal on Food Safety, Animal and Plant Health, which facilitates trade in food and agriculture products and provides a single access point for authorized official and national information across sectors of food safety, animal and plant health. Invasive alien species are covered under this program, including contributing to the implementation of the Convention on Biological Diversity. This is one of several significant international efforts to assess the challenges associated with invasive species and develop policies and guidelines.

### **3.2. Federal Authorities and Programs**

At the federal level, no single agency has authority over the management of ANS. Rather, multiple agencies have developed invasive species programs, largely in reaction to severe ANS issues. Effective invasive species management in the United States will require federal agencies to expand existing efforts to deter nonindigenous species introductions through the oversight of international and interstate trade and commerce and associated transport vectors such as commercial shipping and the trade of organisms via mail order and the Internet (Section III).

#### **NANPCA**

The federal government responded to the devastating economic and ecological impacts of the zebra mussel introduction to the Great Lakes by passing the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, PL 101-646). This act (reauthorized and amended as the National Invasive Species Act of 1996) includes a provision for the preparation of State ANS Management Plans (NANPCA, Section 1204) and outlines the following objectives (Section 1002):

- 1) To prevent further unintentional introductions of nonindigenous aquatic species.
- 2) To coordinate federally funded research, control efforts and information dissemination.
- 3) To develop and carry out environmentally sound control methods to prevent, monitor, and control unintentional introductions.
- 4) To understand and minimize ecological damage.
- 5) To establish a program of research and technology development to assist state governments.

Section 1201 of NANPCA establishes the Federal interagency ANS Task Force (ANSTF). The ANS Task Force is charged with coordinating federal aquatic nuisance species management efforts with the efforts of the private sector and other North American interests. The ANS Task Force is responsible for initiating research programs, planning initiatives, and policy direction for the prevention, detection and monitoring, and control of aquatic nuisance species, and operates through regional panels as well as issue-specific working groups that address particularly problematic invaders.

An additional element of NANPCA is the establishment of ballast management regulations. Under Section 1101 of the Act, the U.S. Secretary of Transportation is charged with developing mandatory ballast water guidelines for the Great Lakes (and later for the upper Hudson River). This task was delegated to and completed by the U.S. Coast Guard, the lead federal agency for ballast water management issues. Amendments to NANPCA in 1996 directed the Secretary to extend ballast water management regulations to the remainder of U.S. waters. Developed and implemented by the Coast Guard in July of 1999, the Voluntary National Guidelines applied to waters outside of the Great Lakes Ecosystem. This voluntary program consisted of a suite of ballast water management (BWM) guidelines, and included a requirement that all vessels entering U.S. waters from outside the Exclusive Economic Zone file a BWM report. A third Coast Guard related element of the 1996 amendments was the publication of voluntary guidelines aimed at controlling the spread of ANS through recreational activities (i.e., boating, fishing, SCUBA diving, etc.) The Coast Guard worked with the ANS Task Force to complete these guidelines in December of 2000.

In 2004, the voluntary ballast water (BW) exchange and reporting program became mandatory (Federal Register 2004A, 2004B). All vessels with ballast tanks on all waters of the U.S., regardless of Exclusive Economic Zone (EEZ) entry have mandatory practices they must follow, which regulate where ballast operations can take place, mandate cleaning and maintenance protocols, and require vessel-specific BW management plans (USCG 2004). In addition, all vessels transiting to U.S. waters with ballast water taken on within 200 nautical miles of any coast after operating beyond the U.S. EEZ must conduct mid-water BW exchange prior to entering U.S. waters, retain the BW on board while in U.S. waters, or use a USCG-approved alternative method for treating BW (USCG 2004). There are specific reporting and recordkeeping requirements for all vessels, with penalties for non-compliance (USCG 2004). The specifics of the USCG's BW Management Program are found at <http://www.uscg.mil/hq/g-m/mso/bwm.htm>. All submitted ballast reports are housed within the National Ballast Information Clearinghouse (NBIC) at: <http://invasions.si.edu/nbic/inde.g.html>.

On March 30, 2005, the U.S. District Court for the Northern District of California ruled in Northwest Environmental Advocates (NWEA) et al. v. EPA et al. that ballast water often contains invasive species that can be considered pollutants under the Clean Water Act (CWA). The court also held that EPA exceeded its CWA authority in exempting an entire category of discharges from the National Pollutant Discharge Elimination System (NPDES) permitting program (Water Policy



Report via InsideEPA.com, 10/31/05; 14(22). Currently the EPA and the shipping industry are trying to convince the court to avoid setting any schedules for EPA to establish regulatory requirements on ballast water discharges, while environmentalists and representatives of the Great Lake states are pushing for specific timeframes for interim regulatory controls and final controls.

Federal programs dealing with nonindigenous species that existed prior to the passage of NANPCA are largely related to interstate and international transport of known pest flora and fauna and the protection of valuable horticultural, aquacultural, or endangered species. These laws include:

- ◆ **The Lacey Act of 1900 (and amendments):** The Lacey Act establishes a permitting process administered by the U.S. Fish and Wildlife Service regulating the importation and interstate transport of vertebrates, mollusks, and crustacea that are "injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States." The Secretary of the Interior maintains the Injurious Species List.
- ◆ **The Federal Seed Act of 1939 (and amendments):** This act prohibits the importation of seeds of unknown type and origin by ensuring the purity and proper labeling of seed imports.
- ◆ **The Endangered Species Act of 1973 (and amendments):** The Endangered Species Act can be used to authorize the eradication or control of ANS in the case that a listed species is threatened by the invader's presence or spread.
- ◆ **The Plant Protection Act of 2000 (superseded the Noxious Weed Act of 1974).** The Plant Protection Act gives the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) the authority to prohibit the importation and interstate transportation of species included on the Noxious Weed List developed by the USDA. In cooperation with state agricultural departments, APHIS annually designates priority agricultural pest species for annual intensive monitoring efforts.
- ◆ **The Animal Health Protection Act.** Enables USDA APHIS to conduct programs to protect livestock, including "farmed" aquatic animals, against pests and diseases.

The most recent invasive species initiative developed at the federal level came in February of 1999 with Executive Order 13112. This order establishes the National Invasive Species Council, a federal interagency organization charged with the biennial development of a National Invasive Species Management Plan.

## **Federal Programs and Activities**

In addition to the regulations outlined in the above legislation, several government agencies have recognized the severity of the invasive species problem, and have adopted the management and control of invasive species as priority program areas.

### **Aquatic Nuisance Species Task Force**

This intergovernmental organization is dedicated to preventing and controlling aquatic nuisance species, and implementing the Nonindigenous Aquatic Nuisance Species Prevention and Control Act of 1990, the mandates of which were expanded with the passage of the National Invasive Species Act (NISA) in 1996. The Task Force is co-chaired by the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration. It coordinates governmental efforts dealing with ANS in the United States with those of the private sector and other North American interests, through regional panels and issue specific committees. Ten federal agency representatives

and 12 ex officio members comprise the Task Force. Among its responsibilities, the Task Force reviews state management plans to address aquatic nuisance species, and helps facilitate access to federal funds for implementation of these plans, once approved.

The ANSTF has also created species-specific national management plans for the green crab, *Carcinus maenas*, and the Chinese mitten crab, *Eriocheir sinensis*, as well as a draft plan for *Caulerpa*, a protocol for researchers investigating aquatic invasive species, and the Generic Nonindigenous Aquatic Organisms (GNAO) Risk Analysis Review Process.

<http://www.anstaskforce.gov>.

### **U.S. Department of Agriculture (USDA)**

The U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Plant Protection and Quarantine (PPQ) program manages the Cooperative Agricultural Pest Survey (CAPS). Through the CAPS Program, surveys are conducted to detect or delimit exotic plant pests: insects, terrestrial and aquatic weeds, and diseases that are not known to occur in the U.S. or have been recently introduced through U.S. ports of entry or other pathways. CAPS surveys and other monitoring activities strive to protect agriculture and natural resources and to prevent economic losses. Individual state monitoring programs are directed by a state survey committee, which is made up of representatives from state agencies and scientific institutions. The state survey committee reviews an APHIS-recommended list of potential pests (the Noxious Weed List), and chooses one or more for annual surveillance efforts. Target species may include weeds, plant diseases, insects, and other invertebrates. APHIS also cooperates with the US Customs Service to limit the import of specified plant pests and their hosts into the country. The CAPS State Survey Committee in Connecticut serves as an advisory group for CAPS survey activities in the state. Committee members meet several times per year to provide input on upcoming exotic pest surveys, discuss survey results and share relevant information on pest occurrences in Connecticut. Pest distribution data from surveys and other sources provided by State Survey Committee members is submitted to a national database. This information is available for retrieval upon request. CAPS pest detection surveys are conducted for a number of aquatic nuisance pests, including hydrilla and giant salvinia.

Under the Plant Protection Act and the Animal Health Protection Act, APHIS sets policy and provides scientific support regarding the prevention of intentional or unintentional introductions. The U.S. Department of Homeland Security (DHS) conducts the port-of-entry inspections.

### **U.S. Army Corps of Engineers**

The Army Corps of Engineers (ACOE) maintains an aquatic weed program. Authorized under various iterations of the Water Resources Development Act, it includes research on control methods as well as a matching grant program for control of aquatic weeds.

### **U.S. Coast Guard**

The Coast Guard implements and enforces the USCG Ballast Water Management Program (<<http://www.uscg.mil/hq/g-m/mso/bwm.htm>>; see NANPCA above).

### **National Ballast Water Information Clearinghouse**

This is the repository for ballast water reports <<http://invasions.si.edu/nbic/index.html>>. The database is linked to the Smithsonian's Marine Invasions Research Lab. The website includes three ways to submit ballast water management reports, a way to search ballast reports, and other program information. Each year, the results of the ballast water reporting program are vetted and released to the public in a congressional report.

### **U.S. Environmental Protection Agency, Long Island Sound National Estuary Program**

The EPA Long Island Sound Office was established to support the Long Island Sound Study (LISS), a National Estuary Program focused on protecting and restoring the health of the Sound, and to implement the LISS Comprehensive Conservation and Management Plan (CCMP). Developed and approved by the States of Connecticut and New York and the EPA, the CCMP identifies specific commitments and recommendations for actions to improve water quality, protect habitat and living resources, and educate and involve the public. One issue highlighted by the CCMP is the negative effect that introduced species have had by preying upon or competing with sensitive species in this region. A goal of the LISS is to implement management actions that will enhance prospects for a healthy ecosystem with balanced and diverse populations of indigenous flora and fauna. The LISS administers grants that can be used for invasive species education and research.

The 2003 Long Island Sound Agreement, which builds upon the goals of the CCMP, called for the LISS to develop a list of the non-native species in Long Island Sound (Appendix A, Table A-4).

### **U.S. Fish and Wildlife Service (USFWS)**

The USFWS has traditionally been the lead in dealing with invasive species at the federal level and is co-chair of the Federal ANS Task Force, providing technical assistance to states in developing invasive species control plans. A national public awareness campaign directed at recreational boaters and fishermen, Stop the Aquatic Hitchhikers!, is administered by the USFWS. The USFWS has been active in ANS management activities in Massachusetts and Connecticut through the Silvio O. Conte National Wildlife Refuge Invasive Plant Control Initiative. In addition to these activities, the USFWS administers grants that can be used for invasive species management.

### **U.S. Geological Survey (USGS)**

The USGS has acknowledged its role in nonindigenous species management in a White Paper on Invasive Species, in which the goal of developing new strategies for the prevention, early detection, and prompt eradication of new invaders is identified. The USGS further identifies information management and documentation of invasions as a priority for the agency. In keeping with this objective, the USGS has developed and maintains an extensive, spatially referenced database of nonindigenous species, which is accessible via the Internet (<http://nas.er.usgs.gov/>). The USGS is a cooperative partner with Invasive Plant Atlas of New England.

### **National Invasive Species Council**

Established in 1999, the Council is an inter-departmental council that helps to coordinate and ensure complementary, cost-efficient and effective federal activities regarding invasive species. The

Council Co-Chairs are the Secretaries of Agriculture, Commerce, and the Interior. The Secretaries of State, Defense, Homeland Security, Treasury, Transportation, Health and Human Services, and the administrators of the Environmental Protection Agency, U.S. Agency for International Development, U.S. Trade Representative, and the National Aeronautics and Space Administration are also members of the Council. The Council works with the Invasive Species Advisory Committee (ISAC), which was established to advise the federal government on the issue of invasive species and to act as representatives of the many stakeholders. Stakeholders represent states organizations, industry, conservation groups, scientists, academia, and other interests. ISAC has been instrumental in writing the National Invasive Species Council Management Plan (see <http://www.invasivespecies.gov>).

#### **National Oceanic and Atmospheric Administration (NOAA), Department of Commerce**

The National Oceanic and Atmospheric Administration (NOAA) serves as a co-chair of the federal ANSTF, along with the USFWS. NOAA, the USFWS and the Maritime Administration of the U.S. Department of Transportation have jointly sponsored research into the development of new technologies for ballast water treatment.

#### **NOAA National Ocean Service, National Estuarine Research Reserves, National Marine Sanctuaries**

The NOAA National Ocean Service (NOS) has sponsored survey work for baseline data in marine and coastal areas. In addition to general survey work, NOAA's National Estuarine Research Reserves (NERRs) and National Marine Sanctuaries have participated. NOS has also set up a comprehensive list of taxonomists to help with identification of unfamiliar species in marine and estuarine areas covering everything from protists through fish, and has sponsored integrated assessments of particular species (e.g., lionfish, tunicates).

#### **NOAA Sea Grant**

NOAA Sea Grant or the National Sea Grant College Program was established in 1966 to foster research, outreach, and education for the promotion of sustainable development of coastal regions. It operates as a federal partnership with state universities in all coastal and Great Lake states (see Connecticut Sea Grant under Section 3.4 State Programs - Universities). Sea Grant has played an active national role in supporting research on invasive species issues in the United States; information on these projects can be found at <[www.sgnis.org](http://www.sgnis.org)>. The Sea Grant network has assumed the primary role for national extension and education about aquatic invasive species in collaboration with many partners through projects such as the National Aquatic Nuisance Species Clearinghouse, the National Zebra Mussel Training Initiative, sponsorship of many conferences and workshops, participation in national public awareness campaigns such as the USFWS / NOAA Sea Grant / Pet Industry Joint Advisory Council's Habitattitude™. Educational materials are located at <[www.seagrants.umn.edu/education/ais\\_guide.pdf](http://www.seagrants.umn.edu/education/ais_guide.pdf)>

### **3.3. Regional Authorities and Programs**

#### **Northeast Regional Panel of the Federal Aquatic Nuisance Species Task Force**

Section 1203 of the National Aquatic Nuisance Prevention and Control Act of 1990 directs the Federal ANS Task Force to encourage the development and use of regional panels to:

- 1) Identify priorities for each region with respect to aquatic nuisance species.
- 2) Make recommendations to the Task Force regarding education, monitoring (including inspection), prevention, and control of nuisance species.
- 3) Coordinate, whenever possible, other aquatic nuisance species program activities in each region.
- 4) Develop an emergency response strategy for federal, state, and local entities for stemming new invasions of aquatic nuisance species in the region.
- 5) Provide advice to public and private individuals and entities concerning methods of preventing and controlling aquatic nuisance species infestations.
- 6) Submit an annual report to the Task Force describing activities within the region related to aquatic nuisance species prevention, research, and control.

The Federal ANS Task Force recognized the Northeast Panel in July of 2001. It includes state, federal and regional government representatives, as well as non-government organizations from the states of New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine, and the Canadian provinces of Nova Scotia, New Brunswick, and Quebec. Once formally recognized by the federal ANS Task Force, each regional panel becomes eligible for limited funding for implementation.

The Panel's Mission is to protect the marine and freshwater resources of the Northeast from invasive ANS through commitment and cohesive coordinated action. The goals of the Panel are:

- 1) to prevent the introduction, establishment, and dispersal of invasive ANS in the Northeast,
- 2) to control the spread of invasive ANS already introduced into the Northeast, and
- 3) to mitigate the harmful ecological, economic, social, and public health impacts associated with the introduction, establishment, or spread of invasive ANS in the Northeast.

The Panel currently has active sub-committees addressing Policy and Legislation; Science and Technology; Communications, Education, and Outreach; and Ballast Water.

#### **Silvio O. Conte National Fish and Wildlife Refuge Invasive Plant Control Initiative**

The Silvio O. Conte National Fish and Wildlife Refuge developed an Invasive Plant Control Initiative in response to the threat to natural diversity posed by invasive plant species. This initiative examines the problem of invasive plants from a regional perspective and identifies tasks that will enhance the capability within the region to address identified issues.

In cooperation with a number of partners, the Refuge used a grant from the National Fish and Wildlife Foundation to develop a strategic plan discussing the state of the issue, outlining future actions for the

Connecticut River Watershed and Long Island Sound, and recommending funding for high priority invasive plant control projects in 1998.

As part of the initiative, a partnership of federal, state, municipal, business and non-profit groups formed to control water chestnut (*Trapa natans*), a recent invader to the watershed. Components of the strategy include mechanical harvesting of the source population and organizing volunteers to monitor water bodies for satellite populations within the watershed, hand-pulling them when found.

The ANS Working Group has incorporated actions in the Connecticut ANS Plan that address needs identified in the Connecticut River Watershed/Long Island Sound Strategic Plan including the development of priority species lists, education of specific stakeholders regarding the invasive plants problem, and coordination of resources within and across New England States. The ANS Working Group will continue to work with proponents of the Invasive Plant Control Initiative to ensure that management efforts in the Connecticut River Watershed are coordinated with state and regional initiatives.

### **The New England Invasive Plant Group (NIPGro)**

In keeping with its invasive plant management priorities, the Silvio O. Conte Refuge has taken the lead in the establishment and administration of the New England Invasive Plant Group (NIPGro). NIPGro is a networking link among the organizations and agencies involved with terrestrial and freshwater aquatic invasive plant issues in the region. Priorities of the group include:

- 1) Minimizing new introductions to the region by instituting an early warning and response system.
- 2) Using the NIPGro network to exchange information, share educational materials, identify research needs, and establish links with researchers.
- 3) Developing standardized criteria for creating priority species lists.
- 4) Coordinating control efforts.

### **Invasive Plant Atlas of New England**

Funding from the U.S. Department of Agriculture is supporting the development of an Invasive Plant Atlas of New England <IPANE; <http://invasives.eeb.uconn.edu/ipane/>>, which will be the foundation of an early warning and response system for the region. The University of Connecticut is overseeing the Atlas work, assisted by the New England Wild Flower Society. Connecticut and the Northeast Regional Panel will work closely with NIPGro on various ANS management issues, and, in particular, on the sharing and organization of invasive species distribution information.

### **New England Wild Flower Society (NEWFS)**

NEWFS is an independent, non-profit, member-supported organization whose purpose is to promote the conservation of temperate North American plants through horticulture, education, research, habitat preservation and conservation advocacy. The organization devotes time and effort to educate the public on issues regarding invasive species plants and conduct projects to control invasive plant species in sensitive habitats throughout New England.

### 3.4. State Authorities and Programs

#### Connecticut Department of Environmental Protection (CTDEP)

- **CTDEP Internal Invasive Species Committee**

This committee is made up of representatives from 12 divisions within the DEP. The Committee discusses and develops policy statements, species status assessments and coordinates and prioritizes the Department's actions related to management, education and training related to invasive species issues.

- **CTDEP Bureau of Natural Resources**

- **Inland Fisheries Division**

The Inland Fisheries Division manages the state's freshwater fishery resources to provide sustainable fish populations and public benefit. Inland and diadromous fish populations are managed through stocking, adjusting harvest, population manipulation and habitat preservation and enhancement. The Division reviews and comments on permit applications for development, water diversion and habitat alteration that affect aquatic habitat and associated riparian zones, provides technical assistance, and conducts habitat enhancement projects. The Division also conducts public awareness and educational programs to promote an understanding and appreciation of fishing, aquatic resources and habitat. Programs, regulations and activities relevant to ANS include:

- ◆ **Importation/liberation of aquatic vertebrates and invertebrates:** The importation, possession or liberation/stocking of live fish (and eggs) and invertebrates is prohibited without a permit (26-55, General Statutes of Connecticut (GSC)). The Inland Fisheries Division reviews and issues these permits (26-55-1, RCSA). CT DEP's Wildlife Division has primary responsibility for reptiles and amphibians. With several exceptions, importation and possession of common aquarium species are exempt from the permit requirement. By enacting regulations, the Division also issues a list of fish species whose possession or importation into the state is prohibited.
- ◆ **Grass carp.** Possession of diploid (fertile) grass carp is prohibited (26-55a, GSC). Possession/liberation of certified sterile grass carp as an aquatic macrophyte management tool is allowed only with a permit (26-55-1(i), RCSA). All ponds are inspected by fisheries biologists to determine the appropriateness of stocking and to ensure that escapement can be prevented
- ◆ **Habitat restoration and alteration.** The Division reviews and comments on permit applications for use of aquatic herbicides and provides technical assistance concerning related fish and fish habitat issues as needed. Staff also provide site-specific guidance and technical assistance for non-chemical management/restoration of aquatic systems.
- ◆ **Biological surveys.** The Division surveys a number of lakes, ponds, rivers and streams each year. Problem species are identified and their status monitored.
- ◆ **Education and public outreach.** The Division provides information about ANS to anglers and the general public. The primary vehicle for distribution of information is a two-page spread in the CT Angler's Guide (regulations booklet issued annually). Fishing tournament organizers also receive ANS information (included with their copies of approved permits).
- ◆ **Control of aquatic flora and fauna.** Although rarely used, CT DEP does have statutory authority (26-22, GSC and Sec. 26-142a-12) to remove undesirable plants or animals from the waters of the state when such measures are in the interest of fisheries management.
- ◆ **Sale of Bait.** Under Section 26-45 of the GSC the CT DEP regulates the sale of bait and requires dealers to obtain a license.

### Marine Fisheries Division

The Marine Fisheries Division manages the state's marine fishery resources to provide sustainable fish and lobster populations and public benefit. Marine fish populations are managed through population manipulation and habitat preservation and enhancement. The Division also conducts public awareness to promote an understanding and appreciation of fishing, aquatic resources and habitat.

- ◆ **Sale of Bait:** Under Section 26-45 of the GSC the CT DEP regulates the sale of bait and requires dealers to obtain a license.
- ◆ **Importation/liberation of aquatic vertebrates and invertebrates:** The importation, possession or liberation/stocking of live fish (and eggs) and invertebrates is prohibited without a permit (26-55, General Statutes of Connecticut (GSC)). The Inland Fisheries Division administers and issues permits for marine species in consultation with the Marine Fisheries Division (26-55-1, RCSA).
- ◆ **Biological surveys:** The Division performs seine and trawl surveys of Long Island Sound each year. Potential problem species are identified and their status monitored.
- ◆ **Education and Public Outreach:** The Division provides information about ANS to anglers and the general public. The primary vehicle for distribution of information is a two-page spread in the CT Angler's Guide (regulations booklet issued annually) and the CT DEP marine fisheries web site.
- ◆ **Control of aquatic flora and fauna:** Although rarely used, CT DEP does have statutory authority (26-22, GSC) to remove undesirable plants or animals from the waters of the state when such measures are in the interest of fisheries management.

### Wildlife Division

The control of the invasive aquatic plant *Phragmites australis* has been a major component of recent wetland restoration efforts conducted by the Wildlife Division's Wetlands Habitat and Mosquito Management (WHAMM) Program. Since 1995, control efforts have been conducted on over 1,000 acres of phragmites monocultures. The WHAMM Program uses its own specialized low-ground pressure equipment or hires qualified contractors to spray herbicide (Glyphosate) in the fall and then mow (mulch) the dead phragmites stems. Most of this work has been conducted in tidal wetlands on the lower Connecticut River and along the coast. This method has been effective in controlling phragmites, but it is costly and inefficient. Typically, the herbicide treatment must be repeated over three successive years and current regulations allow only spraying from the ground. In the future, the Wildlife Division hopes to amend regulations to allow aerial application of herbicides for phragmites, which would result in fewer chemicals applied to the wetlands and reduce costs by 90%. Also, the WHAMM Program plans on investigating new alternative herbicides for phragmites control.

The Wildlife Division hopes to soon participate in Atlantic Flyway-wide efforts to reduce the population of mute swans (*Cygnus olor*), an invasive aquatic species documented to have deleterious impacts to aquatic ecosystems. Connecticut is the only state with substantial numbers of swans that has not already initiated some form of mute swan population control. The CT DEP has the legal authority to reduce the population of swans, but has not yet exercised it.



## **Geological and Natural History Survey**

Survey staff have conducted aquatic plant inventories of state access lakes, ponds, and river coves since 1993. This work provides baseline information on the submersed aquatic vegetation. Resulting information is used to update the CT Natural Diversity Database of state endangered species records, document occurrences of invasive plant species, and to assist in aquatic plant management recommendations and decision-making. The first documented population of water chestnut (*Trapa natans*) in Connecticut was found during these surveys. In addition, Survey staff has assisted in preparation of the state list of invasive plant species and provides input to the Invasive Plant Council.

- **CT DEP Bureau of Outdoor Recreation**

### **Boating Division**

The Department of Environmental Protection, Boating Division has taken several steps to help prevent the spread of ANS in Connecticut's waters. Information and warning signs have been posted at all State boat launches and private marinas, as required, explaining the ANS issue and concerns. These signs inform boaters and anglers of the potential for transport of these organisms by boats, trailers and tackle, and what steps to take to prevent accidental introduction. In addition, between Memorial Day and Labor Day, CT DEP Boating Education Assistants travel to the State launches to educate the public on this important matter. The Division also has publications they use to increase knowledge about ANS concerns. An Aquatic Nuisance Species brochure is being produced for boaters. Also, an additional page of ANS information has been published in the very popular CT Boater's Guide. Under the State's mandatory boater education course and certification program, the course textbook has an expanded section on ANS. Through these effective programs, CT boaters and anglers are quickly learning about aquatic nuisance species and the recommended actions they can take to prevent further spread.

- **CT DEP Bureau of Materials Management and Compliance Assurance**

### **Pesticides Program**

The Pesticide Program regulates pesticides that are or could be used to control some aquatic nuisance species. The program also reviews applications and issues site-specific permits for the use of chemicals in state waters to control aquatic organisms. There is an exemption from the permit requirement for normal or emergency operations of the Department of Environmental Protection, Department of Public Health, or water supply utilities. The Pesticide Program also licenses persons who apply pesticides, including aquatic pesticides. Staff members from the program participate in discussions about control of aquatic nuisance species to provide expertise on benefits and risks of pesticides used to control such species.

- **CT DEP Bureau of Water Protection and Land Reuse**

### **Lakes Management Program**

The Lakes Management Program provides technical assistance and administers state funding for aquatic plant management. The primary program for funding aquatic plant management is "Grants to Improve Water Quality of Lakes Used for Public Recreation" pursuant to Section 22a-339a of the

Connecticut General Statutes. The grants may fund the development of aquatic plant management programs and the capital equipment necessary for implementation. The grants may not fund annual operation and maintenance costs. Private lakes and ponds that do not provide access for the general public are not eligible for grants. The grant program requires the municipality to provide a 25% match for studies and a 50% match for implementation of control measures.

- **CT DEP Office of Long Island Sound Programs**

The Office of Long Island Sound Programs (OLISP), which administers the State of Connecticut's Coastal Zone Management Program, has had an active role in the water chestnut harvesting program since 1999, when the invasive weed was first discovered in the state. OLISP has served as the project leader within CT DEP for five consecutive years, and hired a seasonal employee in the summer of 2003 exclusively for the harvesting program. The intern's primary duties were searching bodies of water throughout the state that could potentially contain water chestnut, and removing it where it was found. The intern also created a GIS database to keep a record of which waterways were searched, track new and existing populations, and log other critical details.

OLISP has also taken the lead in coordinating with CT DEP staff and other volunteers to help eradicate the plant from Connecticut's waterways. A canoe, paddles, life vests and other equipment were purchased using funds from our EPA – Long Island Sound Study budget to be used in the water chestnut harvesting program. This was a cooperative project with help from the USFWS Silvio O. Conte Refuge, the Hockanum River Linear Park Committee, and the Two Rivers Magnet School.

New populations of water chestnut were discovered in or the near the Connecticut River during the summers of 2004 and 2005. As a result, efforts to search previously unexplored coves and tributaries of the Connecticut River for more undiscovered water chestnut populations was increased in 2005 and 2006.

### **Connecticut Agricultural Experiment Station**

The Connecticut Agricultural Experiment Station (CAES) is researching ways to control nuisance aquatic plants, map their distribution and document the water conditions where they are likely to occur. Studies are being conducted on control with herbicides and the effects of these products on non-target plants. Water samples from treatment sites are being tested for herbicides to determine how concentrations change with time, where the herbicide moves and what concentrations are necessary to achieve control with minimal impacts on desirable plants. Water from nearby wells is often tested to determine if aquatic herbicides can contaminate groundwater. Studies on the effectiveness of mechanical removal by methods including, hydroraking and cutting are also in progress. A continuing statewide surveillance and mapping program of aquatic vegetation was begun in 2004. Thirty-two lakes were surveyed and mapped using global positioning system technology and geographic information software. Reference plants are being obtained from each water body and are being cataloged at CAES and the University of Connecticut. Water chemistry data is being gathered from each lake to assess the preferences of nuisance plants and determine the potential for other lakes to become infested.

## CT Department of Agriculture

The Connecticut Department of Agriculture is the lead state agency responsible for commercial horticulture as well as shellfish and aquaculture. The Department of Agriculture is represented on the Invasive Plant Council.

- **Bureau of Aquaculture**

- ◆ **Shellfish Sanitation:**

1. This program is required to assure safe shell fishing areas for commercial and recreational harvesting, protection of public health, and to maintain certification and compliance with the U.S. Food and Drug Administration's National Shellfish Sanitation Program.
2. The Bureau performs coastal sanitary surveys along Connecticut's 250 mile shoreline and monitors shellfish growing areas in Long Island Sound for the protection of public health by collecting and testing seawater and shellfish meat samples in order to determine levels of bacteria, toxins, and paralytic shellfish poisoning.
3. The Bureau, in response to sanitary survey results, posts areas closed to shell fishing, performs hydrographic dye dilution studies, performs environmental investigations, prepares memorandum of understanding for conditional shell fishing areas, reviews applications for shellfish harvest operations, and initiates emergency closures.
4. The Bureau is responsible for the sanitary inspection and certification of shellfish dealers involved in harvesting, shucking, depuration, repacking and reshipping of fresh and frozen oysters, clams, and mussels. All shellfish processing and handling operations are inspected at least twice a year as required by FDA. Harvesting boats, vehicles, facilities, equipment, product handling procedures and record keeping are checked for compliance and operational licenses are reviewed and appropriate action taken.
5. The Bureau assists other state, municipal, and federal health officials in investigating food-borne illnesses, product recall, and embargo.

- ◆ **Laboratory:** Tests and analyses performed by the laboratory include bacterial levels in seawater and shellfish, various contaminants, marine biotoxin analysis, and shellfish and fish pathology.

- ◆ **Shellfish Habitat Management & Restoration:**

1. Program provides a mechanism for shellfish aquaculturalists to obtain underwater lands in Long Island Sound for the purpose of planting, cultivating, and harvesting shellfish and serves as a foundation for the State's multi-million dollar shellfish industry.
2. Bureau provides for the cultivation and propagation of shellfish through the management and restoration of state-owned natural clam and oyster beds. The continued availability of shellfish is critical to the stability and growth of commercial and recreational shellfishing. The Bureau issues Natural Bed and Conch Harvest licenses, sets corner markers, plants cultch, maintains spawning stock, monitors predators and diseases, and makes assessments of natural disaster impacts.

- ◆ **Aquaculture Development and Coordination:**

1. This program is responsible for planning and coordinating aquaculture development including development and oversight of legislation, review of NPDES and Coastal Zone applications, liaison between industry and the regulatory community, promotion, marketing technology transfer and assistance, communications, and addressing issues of regional and national concern.

## **Connecticut State Legislature, CT Invasive Plant Council**

The Connecticut State Legislature authorized the formation of the Invasive Plant Council (IPC) in 2003, and has included 21 aquatic plant species on its list of 81 plants banned between 2003 and 2005. The Council will also be studying how a ban on sale of plants can be implemented to extend to mail order or Internet sales. The current proposal to the state includes a funding recommendation to provide for money needed to publish and distribute the list of invasive and potentially invasive plants as adopted by the Council. It also recommends that funds be provided to the CT DEP to extend its Emergency Rapid Response Plan to eliminate/control new infestations of invasive species. Additional legislation may be sought (if needed) to authorize the Connecticut Agricultural Experiment Station (CAES) to inspect nurseries and water garden outlets for invasive aquatic plants and sale of invasive plants that may be recommended and approved for banning. The IPC has recommended that the legislature authorize the Department of Agriculture to inspect pet stores for sale of invasive aquatic plants.

## **Connecticut Invasive Plant Working Group (CIPWG)**

The Connecticut Invasive Plant Working Group (CIWPG) is a statewide organization whose members represent more than 100 affiliations. The mission of the Connecticut Invasive Plant Working Group is to gather and convey information on the presence, distribution, ecological impacts and management of invasive plant species, including aquatic invasive species; to promote the use of native or non-invasive ornamental alternatives throughout Connecticut; and to work cooperatively with researchers, conservation organizations, government agencies, the green industries, and the general public to identify and manage invasive species pro-actively and effectively.

## **Private/Quasi-public Utilities**

- **Water Utilities**

There are currently no programs in place for industry-wide protocols and policies regarding aquatic nuisance species for water utilities in Connecticut. Water utilities within the state that utilize surface water supplies should communicate regularly with such agencies as CTSG and CT DEP in order to keep informed of the known aquatic nuisance species which might adversely effect their river and reservoir water supply sources. In the event that an aquatic nuisance species is recognized as having the potential for creating significant problems for Connecticut's drinking water suppliers, the Source Water Protection Committee of the Connecticut Section of the American Water Works Association (CTAWWA) will serve as a clearinghouse for information regarding detection monitoring and control methods. The Source Water Protection Committee can be reached via the CTAWWA website at [www.ctawwa.org](http://www.ctawwa.org).

## **Universities**

- **Connecticut Sea Grant College Program, NOAA National Sea Grant / University of CT**

Connecticut Sea Grant has been a leader for aquatic invasive outreach and education efforts in Connecticut since 1991, coordinating the ad hoc state Zebra Mussel Task Force, producing the Northeast regional newsletter, *Aquatic Exotics News*, and co-sponsoring two Northeast regional conferences on

nonindigenous aquatic nuisance species held in Connecticut in 1995 and in Vermont in 1997. Connecticut Sea Grant is an active member of the Northeast Regional ANS Panel, serving on the Communication, Education and Outreach and Ballast Water sub-committees, was a participant in the National Zebra Mussel Training Initiative, and has produced signs, fact sheets, poster, website <[www.seagrants.uconn.edu/LISinvasives.htm](http://www.seagrants.uconn.edu/LISinvasives.htm)> and a video on various ANS including zebra mussels, aquatic weeds, and introduced species in LIS. Connecticut Sea Grant, along with CT DEP, secured the National Sea Grant funding that served as the impetus for the development of this management plan for Connecticut.

There are a number of researchers in Connecticut who are conducting research on aquatic invasive species, addressing vectors and pathways, ecological impacts, control and eradication, and monitoring and assessment. Among the universities and colleges involved are:

**The University of Connecticut:** Departments of Ecology and Evolutionary Biology, Marine Sciences, Pathobiology and Veterinary Science, and Natural Resource Management and Engineering; and **Williams College – Mystic Seaport:** Maritime Studies Program, where Dr. James T. Carlton, renowned international expert on aquatic invasive species is based.

### **3.5. Local Authorities and Programs**

#### **Connecticut Federation of Lakes**

The Connecticut Federation of Lakes (CFL) is a private non-profit organization dedicated to the care, management and improvement of Connecticut lakes. One of the CFL's primary objectives is to help stop the spread of aquatic nuisance plants in Connecticut water bodies through public education and coordination. The CFL has sponsored numerous workshops and conferences aimed at increasing public understanding and awareness of the threat that aquatic nuisance plants represent to Connecticut recreational water bodies. The CFL helped initiate and supported enactment of State legislation banning the sale and transport of invasive aquatic weeds in Connecticut. Recently in cooperation with the Connecticut Agricultural Experiment Station the CFL is sponsoring a series of seminars in locations across the State designed to train lake volunteers who can serve as local "weed watchers" and to improve the capacity for early identification of invasive aquatics in Connecticut. The CFL and the Experiment Station are also cooperating to establish a system for tracking and recording the spread of aquatic nuisance plants. The CFL supports creation of a statewide system to respond rapidly and effectively to new infestations of aquatic nuisance plants in Connecticut.

#### **Municipal Shellfish Commissions**

Shellfisheries not within the area of the state, as defined by state statute, are within the jurisdiction and control of the towns in which they are located. Shellfish Commissions may lease grounds for commercial purposes, and/or establish and maintain grounds for recreational shell fishing. They issue shell fishing permits, regulate quantities harvested, enforce local shellfish regulations, and work to ensure cultivation, enhancement, and restoration of shellfish grounds within their jurisdiction, in conjunction with the CT Department of Agriculture and the CT Department of Environmental Protection.

### **Harbor Management Commissions**

A Harbor Management Commission may be established by any municipality having within its limits navigable waters (as defined by state statute). Members may include representatives of various commissions including planning, zoning, conservation, shellfish, and flood control. Harbormasters serve as ex officio members. Among the responsibilities of this commission include the development of a harbor management plan, and the implementation of the plan following review and acceptance by the State of Connecticut. Waters within the territorial limits of the municipality and below the mean high water are under the jurisdiction of the Commission.

## 4. GOALS

*The overarching goal of the Connecticut Aquatic Nuisance Species Management Plan is to implement a coordinated approach to minimizing the ecological and socio-economic impacts of aquatic nuisance species in the State of Connecticut.*

In order to address this goal, specific actions will be undertaken that will be focused on a key set of objectives. These are listed below, and described more fully in Section 5.

### **Objectives of the CT ANS Management Plan**

1. Coordinate the activities of the various authorities.
2. Secure adequate funding and staff to implement management objectives
3. Prevent the introduction of ANS into CT
4. Detect new and monitor existing occurrences of ANS in CT
5. Control the spread of ANS in CT
6. Increase public awareness and knowledge
7. Address research needs
8. Introduce legislation / adopt regulations

## 5. Objectives, Strategies, and Actions

NOTE: Priority = High Priority Action or Standard Priority Action (Standard Priority items are less important than High Priority items); Funding / FTE = Known (FTE and funding source and amount indicated) or TBD (unidentified at present, to be determined)

### Objective 1: Coordination

#### 1 A Establish Coordinating Entities

Current ANS management efforts in Connecticut have not been fully coordinated amongst various state agencies, CT DEP units, academic institutions, businesses and NGOs. Effective and efficient implementation of ANS control strategies will require improved coordination via dedicated staff. It will also require that the ANS effort cross program and divisional boundaries.

##### 1 A 1 Establish Coordinating Committee

A permanent ANS Coordinating Committee should be established, composed of representatives of authorities and programs in CT dealing with ANS, as well as representatives of constituency groups likely to be affected by such programs. This group will meet at least annually to review priority species and sites for management and research, and to coordinate overall species control efforts. The CT DEP and CTSG Steering Committee members will recommend to the Commissioner of Environmental Protection appropriate individuals for committee membership. (Cooperators = CT DEP & CTSG; paid FTEs)

**Priority:** High

**Funding:** CT DEP <\$2K; CTSG <\$1K; Staff time commitments from agencies/institutions represented on Coordinating Committee

**FTE:** CT DEP <0.1; CTSG <0.1

##### 1 A 2 Establish and Hire Statewide Coordinator

A full-time, statewide ANS coordinator position should be established, as a CT DEP employee. The statewide coordinator will be responsible for coordinating the broader efforts of agencies and other programs undertaken to achieve the management plan's goal and objectives, including the establishment of ad hoc working groups as needed, some of which are indicated in the tasks described below. (Position to be fully/partially supported by USFW State management plan funds) This process will take 5 people approximately 30 days total to hire the coordinator.

**Priority:** High

**Funding:** \$86,762 (\$46,898 salary; 60% fringe \$28,139; overhead 25% of salary \$11,725 (~75% or \$66,000 USFWS and USFWS ANS; ~25% match CT DEP funds); 3-5% increase per year

**FTE:** 1/year



## **1 B Coordinate Within Connecticut**

Coordination of Connecticut ANS management activities, given the current allocation of limited resources for ANS management, will require the on-going designation of priority species. As this plan is implemented and monitoring efforts enhanced, improved knowledge of ANS distribution and impacts will be used to continually update management priorities. Many of the tasks described below are already in progress, as part of this plan development.

### **1 B 1 Develop/Review Listing Protocols**

The Statewide Coordinator should convene an ad hoc committee to develop protocols to follow for making additions and deletions to the priority ANS, vector, management site and research priorities lists. Protocols will be reviewed by the ANS Coordinating Committee annually or as needed. The ANS Task Force Risk Analysis Review Process for classifying generic nonindigenous aquatic organisms (ANSTF 1996) will be employed to review current species classifications and all future species classifications and listings. We estimate the effort involved as ad hoc, 15 people, one day each; Coordinating Committee – less than .1 FTE. Initial lists have been developed for this plan by the CT ANS Working Group, and their effort is reflected in 2006 figures.

**Priority:** High

**Funding:** < \$1K/year (Misc. – refer to Coordinating Committee 1A1 and USFWS ANS/CT DEP for statewide coordinator 1A2)

**FTE:** <0.1/year

### **1 B 2 Develop/Review ANS Lists & Management Classes**

The CT ANS Working Group, working with the IPC, state agencies and other ANS related organizations and industries, developed the initial lists of established and potential ANS in this plan. The Statewide Coordinator will establish one or more ad hoc committees to develop lists of species requiring further evaluation and a list recommending additional species to be banned. ANS lists will be reviewed and updated by the Coordinating Committee annually or as needed. The ANS Task Force Risk Analysis Review Process for classifying generic nonindigenous aquatic organisms (ANSTF 1996) will be employed to review current species classifications and all future species classifications and listings.

**Priority:** High

**Funding:** < \$1K/year (Misc. – refer to Coordinating Committee 1A1 and USFWS ANS/CT DEP for statewide coordinator 1A2)

**FTE:** <0.1/year

In 2005-2006, the EPA LIS Fellow for Connecticut is undertaking an independent review of the prioritization of marine ANS, employing the ANSTF Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process. The results of this independent analysis will be compared to the plan, and modifications to the management classifications will be made as necessary, as part of the discussions between the EPA, Connecticut and New York regarding collaborative management of ANS in LIS.

**Priority:** High

**Funding:** EPA LISS through grant to CTSG (\$20K)

**FTE:** .25 graduate fellow in 2005-2006

### **1 B 3 Develop/Review Vector Lists**

The CT ANS Working Group, working with the IPC, state agencies and other ANS related organizations and industries, developed the initial lists of priority vectors for established and potentially established ANS. Vector lists will be reviewed and updated annually or as needed.

**Priority:** High

**Funding:** < \$1K/year (Misc. – refer to Coordinating Committee 1A1 and USFWS ANS/CT DEP for statewide coordinator 1A2)

**FTE:** <0.1/year

### **1 B 4 Develop/Review Site List**

The Coordinating Committee, with input from the ad hoc committee composed of representatives from the IPC, state agencies and other ANS related organizations in CT, will develop an initial list of priority sites for management action. Site lists will be reviewed and updated annually or as needed.

**Priority:** Standard

**Funding:** < \$1K/year (Misc. – refer to Coordinating Committee 1A1 and USFWS ANS/CT DEP for statewide coordinator 1A2)

**FTE:** <0.1/year

### **1 B 5 Develop Research Priorities**

The Coordinating Committee, with input from the IPC, state agencies and other ANS related organizations in CT will develop, annually update, and make known a list of research priorities.

**Priority:** High

**Funding:** < \$1K/year (Misc. – refer to Coordinating Committee 1A1 and USFWS ANS/CT DEP for statewide coordinator 1A2)

**FTE:** <0.1/year

### **1 B 6 Evaluate ANS Program**

The Statewide Coordinator, in conjunction with the ANS Coordinating Committee, will be responsible for overseeing the overall progress of the ANS management activities as outlined in the plan, prepare an annual progress report and outline budget needs and priorities.

**Priority:** High

**Funding:** < \$1K/year (Misc. – refer to Coordinating Committee 1A1 and USFWS \ ANS/CT DEP for statewide coordinator 1A2)

**FTE:** <0.1/year

## **1 C Coordinate Beyond Connecticut**

ANS management is a regional issue and not confined by political boundaries. Formal mechanisms for interstate, national and international coordination will be necessary to limit new introductions and the spread of established ANS populations. Coordination with appropriate regional/national entities will be undertaken as appropriate.

### **1 C 1 Coordinate within the Northeast Region**

Connecticut is actively represented on the Northeast Regional ANS Panel through the participation of several appointed members. Continued participation on the Panel will ensure better coordination with state and federal agencies and industry representatives to address ANS issues of mutual concern, and heightened awareness of regional priorities. More efficient use and sharing of available resources and expertise is facilitated via participation in the Northeast Regional ANS Panel.

**Priority:** High

**Funding:** CT DEP (~\$1K/year); CTSG (~\$1.5K/year) for two meetings

**FTE:** CT DEP (6 days /year); CTSG (8-10 days/year)

### **1 C 2 Coordinate with LIS Management Organizations**

Connecticut should partner with the EPA Long Island Sound Study (LISS) and New York State to address ANS in Long Island Sound. Leadership is being undertaken by the Chairs of the bi-state LISS Science and Technology Advisory Committee and the USFWS liaison to the LISS. A joint meeting was held in 2006, and the CT LISS Graduate Fellow has been tasked to work on reviewing the prioritization of marine ANS. The goal is to review the NYS Invasive Species Plan and the CT ANS Management Plan, identify common objectives, and develop the means for addressing these objectives.

**Priority:** High

**Funding:** EPA LISS <\$1K/year; NYS DEC <\$1K/year; CT DEP OLISP <\$1K/year; CTSG/EPA <\$1K/year 2005, 2007 and on; 2006 \$17K)

**FTE:** <1/year each except 2006 CTSG/EPA .25 graduate fellow

## **1 D Develop Information Management System**

Connecticut ANS distribution information is currently housed in multiple databases and formats, making comprehensive assessments of introduction and the spread of established populations difficult or impossible. A framework for collecting and assessing monitoring/detection information will be developed. Data management as it relates to ANS distribution in Connecticut watersheds and in the Northeast region will be improved.

### **1 D 1 Conduct Information Needs Analysis**

The compatibility of existing databases relevant to ANS management should be assessed and gaps in needed information identified.

**Priority:** High

**Funding:** <\$1K (USFWS ANS / CT DEP; Misc.)  
**FTE:** <0.1

### **1 D 2 Develop and Maintain EDMA Information Management System**

Develop a CT DEP ANS EDMA (Early Detection, Monitoring and Assessment) database to track the locations of all ANS. Additional information for each ANS location will include: monitoring dates, observation notes, management actions, date conducted, results of actions taken with respect to ANS will be completed. Data from IPANE, the CT Agricultural Experiment Station and CT scientific collections (UCONN, Yale) will be incorporated. An ACCESS database currently in development by Bureau of Natural Resources staff (CT DEP) will serve as a prototype. Funding for the dedicated staff who will be required to establish and maintain this database needs to be identified.

**Priority:** High

**Funding:** TBD ~\$45,000 development (2008); TBD maintenance thereafter

**FTE:** TBD

### **1 D 3 Develop Experts Database**

Develop a contact list of local experts to be consulted for species identifications/confirmations, notified of occurrences, and assist in development of early detection and rapid response plans.

**Priority:** High

**Funding:** Misc. (USFWS ANS, CT DEP, CAES, IPANE, NEANS, NOAA)  
<\$1K/year each

**FTE:** <0.1/year each

## **Objective 2: Funding**

Secure adequate funding and staff to implement the ANS management plan. The successful implementation of the CT ANS plan will require both on-going financial support for a core program as well as targeted support for specific plan tasks. CT DEP will conduct the initial activities required to identify and acquire funding for the core program. Once this program is in place, additional funds will be sought by the statewide coordinator, ANS Coordinating Committee, and appropriate ad-hoc groups.

### **2 A Fund Core Program**

The successful implementation of the CT ANS management plan hinges upon the existence of a full-time coordinator, with an appropriate budget to support coordination activities. The tasks described below relate to identifying and requesting funds for the statewide coordinator and his or her program.

#### **2 A 1 Identify and Secure Core Funds**

Identify potential sources of core program funding, including the USFWS, submit budget requests and /or proposals and secure funding to support a statewide coordinator.

**Priority:** High  
**Funding:** CT DEP and CTSG TBD  
**FTE:** CT DEP 0.2 /year; CTSG <0.1/year

## **2 B Fund Plan Components**

Specific actions outlined in the management plan may be funded through targeted grants or other fundraising activities. One of the first activities of the statewide coordinator and the Coordinating Committee will be to identify and pursue funding opportunities for specific ANS management tasks outlined as priorities but currently without identified funding sources.

### **2 B 1 Identify Opportunities and Secure Funding**

Identify sources and seek funding for both the core program and specific ANS plan components. Potential sources include: federal agencies and programs, WHIP grants, DEP general funds and Conservation Fee Funds (funding or support), possible redirect of ANS fines to the State Conservation Fund, possible boating registration fee, landowner incentive program, NGOs and affected industries (such as power, nurserymen's, chemical companies, green industries, lake associations), and grants to local municipalities and organizations for ANS control (lakes and ponds restoration).

**Priority:** High  
**Funding:** USFWS ANS / CT DEP TBD; Misc. TBD  
**FTE:** 0.2/year CT DEP; Misc. TBD

## **Objective 3: Prevention**

Introduction and spread prevention are critical elements of the ANS management plan, to prevent, eliminate or reduce the number of new introductions in Connecticut waters. In many cases, once a nuisance species becomes established, it is difficult or impossible to eradicate, at least without costly and time-consuming effort. For many of the following strategies and actions, prevention programs based on the HACCP principles of identifying significant risks and putting monitored control measures in place to prevent, eliminate, or reduce those risks have been developed by other Sea Grant programs and the USFWS.

### **3 A Assess and Minimize Introduction Risks**

Connecticut faces the risk of species introductions that have proven to be damaging in other Northeast states or regions. Development of a methodology for evaluating the risk of introduction of these species will be necessary to identify and implement species-specific preventative measures. A better understanding of the specific role various transport vectors play in ANS introduction and spread in Connecticut and the region is needed to determine the best ways to interrupt those vectors. Careful study of species introductions through these vectors, followed by efforts to communicate with related industry representatives and regional panels, will be a critical first step in reducing ANS transport.

### **3 A 1 Assess Introduction Risks**

Sub-committees of the ANS Coordinating Committee will evaluate the risk of the introduction and spread of priority species or major taxa, and annually revise the priority vector list. Information related to topics such as research needs, species movements, and risky handling practices will be sought.

**Priority:** High

**Funding:** USFWS ANS / CT DEP <\$1K/year; Misc. sources <\$1K/year

**FTE:** <0.1/year

### **3 B Minimize Industry Introductions**

Effective management of ANS requires that industries that may serve as vectors of transport or introductions be involved in ANS prevention efforts. In coordination with industry representatives, Best Management Practices will be developed that will minimize introductions of invaders through priority transport vectors. This will involve assessing industrial vectors, prioritizing management needs, assessing existing BMP information and developing any new material that is needed. As needed, ad hoc groups will be established of representatives from industries identified as potential pathways for introduction. These groups should identify priority preventative strategies and educational needs

#### **3 B 1 Enforce CT DEP Importation/Liberation Regulations**

Seek to elevate priority for oversight and enforcement of importation, possession, and liberation (live release) permit regulations for live fish (and eggs), invertebrate, and vertebrate species. Ensure that reported violations are reported to law enforcement staff. Coordinate response actions with law enforcement personnel.

**Priority:** High

**Funding:** State of Connecticut (CT DEP) TBD

**FTE:** 0.2/year (mostly existing staff time)

#### **3 B 2 Minimize Aquaculture / Hatchery Introductions**

CT DA/BA, and CT DEP will review and strengthen (as necessary) protocols in place to prevent the introduction of new, non-target and/or pathogenic species via intentional releases or escapees from agriculture facilities or hatcheries.

**Priority:** High

**Funding:** CT DEP <\$1K/year; CTDA <\$1K/year

**FTE:** <0.1/year each

Ensure that pathology expertise is available to cover all aquatic habitats.

**Priority:** High

**Funding:** TBD, as needed

**FTE:** TBD, as needed

CTSG will offer ANS Hazard Analysis and Critical Control Points (HACCP) training for managers of CT aquaculture facilities, baitfish farms, and fish hatcheries using the training materials developed by Sea Grant (Gunderson and Kinnunen (eds.) 2001), to help identify critical pathways through which ANS or non-target aquatic species could enter baitfish and aquaculture operations, and put measures in place to prevent the inadvertent transfer of these species to new areas (see also Action 3 B 3).

**Priority:** Standard

**Funding:** CTSG staff time / workshop cost borne by participants

**FTE:** 1 week in FY07 AND 1 week in FY09

### **3 B 3 Minimize Bait Industry Introductions**

Elevate priority for oversight and enforcement of existing bait industry regulations. Using a list of Connecticut bait retailers, CT DEP and CTSG will investigate and document the species and sources of baits sold commercially for angling. As collaborators on a federally-funded grant to the Northeast Sea Grant programs, CTSG and CT DEP will participate in surveying bait dealers throughout the Northeast to determine why alternative packing materials are not commonly used and provide them with information about ANS and accessible sources of non-marine packing materials. Further, working with bait dealers, messages will be designed (or modified) for distribution with commercially-sold bait, or for printing directly on the bait packages. Following completion of this two-year project, CT DEP may develop guidance and/or regulations for the disposal of unused bait species, and will review all statutes and regulations related to importation/liberation and make recommendations for improvement if needed. Enforcement of any newly developed statutes/regulations should be given a high priority.

**Priority:** Standard

**Funding:** CTSG via grant from NSGO (\$18,105 over 2 yrs); CT DEP (\$8,010 over 2 yrs); USFWS ANS / CT DEP <\$1K/year

**FTE:** CTSG <0.1; CT DEP <0.1 (2 wks/yr); <0.1/year

CTSG will offer ANS HACCP training for managers of CT aquaculture facilities, baitfish farms, and fish hatcheries using the training materials developed by Sea Grant (Gunderson and Kinnunen (eds.) 2001), to help identify critical pathways through which ANS or non-target aquatic species could enter baitfish and aquaculture operations, and put measures in place to prevent the inadvertent transfer of these species to new areas (see also Action 3 B 2).

**Priority:** Standard

**Funding:** CTSG staff time / workshop cost borne by participants

**FTE:** 1 week in FY07 AND 1 week in FY09

### **3 B 4 Minimize Nursery and Pet Trade Introductions**

The ANS Coordinating Committee will establish a subcommittee with trade representation to develop a strategic plan and guidelines for limiting the introduction of potentially invasive species through the pet trade, aquarium, aquascaping and water garden trade. The resources of the national public awareness campaign, Habitattitude™, will be utilized fully to help raise public awareness of the importance of properly disposing of unwanted pets and aquarium plants. (Habitattitude™ was developed by the USFWS, NOAA Sea Grant, and the Pet Industry Joint Advisory Council; CT Sea

Grant is a partner and has the campaign materials). Issues to be *considered* by this committee include: identification of CT retailers of water garden and aquascaping supplies, the import and sale of potentially invasive fish and invertebrate species, the import and sale of potentially invasive plant species and organisms that may be transported with these species, proper labeling and species identification of plant and animal species sold by pet stores and water garden suppliers, inspections of pet stores and water garden suppliers for priority ANS, best management practices for the disposal of diseased or unwanted organisms (Habitattitude™) and wastewater, restricting the sale of water garden invasive plants, nursery inspections that look for invasive species, and enforcement of current regulations regarding banned sales of certain aquatic plants.

A mailing list of all pet stores in Connecticut has been compiled. Letters from the CT DEP were sent to all stores on the list in summer 2005 reminding them of prohibited species.

The IPC promoted the passage of a list of prohibited nuisance plants that includes aquatic species.

**Priority:** Standard

**Funding:** TBD

**FTE:** TBD

### **3 B 5 Minimize Supplier Introductions**

Prevent new introductions of ANS to freshwater and marine systems through aquatic organism supply companies. CT DEP will identify biological supply houses that ship live organisms to Connecticut. A sub-committee of the ANS Coordinating Committee will make recommendations to the Federal ANS Task Force on limiting introductions into Connecticut through the Internet trade. A sub-committee of the ANS Coordinating Committee will work to identify industry representatives and coordinate on the development of shipping and disposal guidelines. Increase administrative efforts to ensure that biological supply houses are complying with Connecticut's Importation/Liberation regulations.

**Priority:** Standard

**Funding:** No action planned through 2009

**FTE:** No action planned through 2009

### **3 B 6 Minimize Mechanical Weed Harvesting Introductions**

CT DEP will provide information to local commissions, lake groups, and contractors on the need to carefully and stringently clean and dry weed-harvesting equipment. CT DEP will provide model contract language that can be used by groups and individuals when hiring contractors for weed-harvesting services to minimize the chances that weed-harvesting activities serve as a vector for aquatic plant introductions.

**Priority:** Standard

**Funding:** CT DEP <\$1K/year

**FTE:** CT DEP <0.1/year

### **3 C Minimize Recreation Introductions**



Prevent new introductions of ANS via recreational boating and fishing (both boat- and shore-based) through expanded educational efforts and strict enforcement of existing laws.

On-going education and outreach efforts will be enhanced and expanded to help control the spread of fouling organisms, aquatic weeds, non-native baitfish, and fish releases to unaffected water bodies via recreational boaters and anglers. Connecticut has a law that requires the removal of plant fragments from boats and trailers.

### **3 C 1 Minimize Recreational Boating and Fishing Introductions**

CT DEP (Boating Division) will update and maintain existing signage relating to boat and trailer ANS transport at all ponds, boat ramps, and shoreline public access points in Connecticut. ANS educational materials will continue to be distributed to members of lake and pond associations, to boaters and anglers through boater education courses, and via the Clean Boater and Clean Marinas programs. The CT DEP Boating and Fisheries Divisions will develop a pamphlet detailing the potential transport of ANS with boats and their trailers for distribution with boater registration forms and/or commercial fishing licenses. Materials from the USFWS/Federal ANSTF Stop Aquatic Hitchhikers! national public awareness campaign will be utilized on various signs and included in pamphlets and guides (CT Sea Grant is a partner and has access to the campaign materials). In summer 2005, CT DEP piloted an inspection program for recreational boats which included potential ANS introductions. CT DEP Inland Fisheries Division will inform all anglers regarding the proper handling and disposing of bait in its annual Angler's Guide.

**Priority:** Standard

**Funding:** CT DEP <\$1K/year; SCRWA TBD; USFWS ANS/CT DEP <\$1K

**FTE:** CT DEP <0.1/year; SCRWA <0.1 /year; USFWS ANS/CT DEP <0.1/year

CT Sea Grant has NOAA Sea Grant funding to develop and carry out an extension program directed at reducing/minimizing the risk of introductions by hull fouling of privately-owned vessels, particularly those that move between winter and summer ports. Information on the risks of introductions caused by fouled hulls, hull cleaning options, anti-fouling coatings, and local/regional regulations will be developed as part of a Northeast Sea Grant regional collaboration.

**Priority:** Standard

**Funding:** \$18,105 over 2 years (2006-2007) (NSGO via grant to CTSG)

**FTE:** <0.1/year

### **3 C 2 Increase Awareness and Enforcement of ANS Boating Regulations**

Evaluate ability to increase resources devoted to ANS boating regulation enforcement (i.e., increased staff or staff priorities). Encourage alternative means of educating boaters about ANS regulations and promoting compliance. Develop CT DEP policy statement for internal operations.

**Priority:** Standard

**Funding:** TBD

**FTE:** TBD

### **3 D Minimize Introductions by Education and Research**

Prevent new introductions of ANS by aquatic research facilities and public aquaria. Freshwater research facilities often hold nonindigenous organisms for experimental and display purposes. Maintenance of these live species often requires the exchange of water with the natural environment, providing the opportunity for the release of these species, which may have microscopic life history stages. Furthermore, experimentation with live nonindigenous organisms may be conducted in the natural environment, requiring careful controls to prevent their release or escape.

#### **3 D 1 Promote Established Research Protocols**

The Federal ANSTF has a research protocol (<http://www.anstaskforce.gov/resprot.htm>); ANSTF 1994, currently being updated) with which any Connecticut researcher working with ANS should be familiar. A link to this protocol will be included on the Connecticut website. The NEANS Panel is also reviewing research protocols and any protocol adopted will also be reviewed and made available to researchers via the website.

**Priority:** Standard

**Funding:** None required

**FTE:** <0.1/year

#### **3 D 2 Develop Aquaria BMPs**

The ANS Coordinating Committee will work with Connecticut public aquaria to develop best management practices for treatment of wastewater and release of unwanted organisms from public aquaria and freshwater research facilities.

**Priority:** Standard

**Funding:** TBD for Coordinating Committee and Statewide Coordinator; <\$1K/year for SCRWA

**FTE:** TBD for Coordinating Committee and Statewide Coordinator

### **3 E Minimize Water Resource Management Introductions**

Prevent new introductions of ANS to freshwater systems through water resources management projects (such as water transport, dredging, fishways, herbicide applicators, etc.). Fish passage systems have the potential of passing ANS upstream where passage didn't previously exist. Water resource projects could also create new avenues of stream flow with the same potential. Commercial aquatic site management activities have the potential to transport ANS.

#### **3 E 1 Assess Upstream Passage Risk**

An ad hoc group will work with the CT DEP fish passage coordinating committee to study the potential for upstream passage (i.e. dam removals, fishways) by ANS and recommend preventative actions.

**Priority:** Standard

**Funding:** CT DEP Fish Passage Coordinating Committee <\$1K/year; CT IWR / Yale University \$30K/year for 2006, 2007

**FTE:** CT DEP Fish Passage Coordinating Committee <0.1/year; CT IWR / Yale 1/year for 2006, 2007, 2008.

### **3 E 2 Assess Water Project Risk**

An ad hoc group will examine the potential impacts of water resource projects (such as diversions, construction, etc. ) for distributing ANS and recommend preventative actions.

**Priority:** Standard

**Funding:** TBD

**FTE:** TBD

## **Objective 4: Detection and Monitoring**

Detect new and monitor existing occurrences of ANS in CT.

### **4 A Strategizing Early Detection, Monitoring & Assessment (EDMA)**

Effective management of invaders will require the expansion of monitoring efforts that have been limited by lack of staff time and monetary resources. A coordinated Early Detection, Monitoring and Assessment (EDMA) plan to monitor for new introductions and the spread of ANS in Connecticut coastal and freshwater systems is a critical element of this plan. The strategy must envelop both early detection of new infestations as well as monitoring of known populations, address right of access to properties to aid in early detection, and develop a standard reporting protocol. Resources will be focused on priority vectors and species identified by the Coordinating Committee.

#### **4 A 1 Develop EDMA Strategic Plan**

The Coordinating Committee in conjunction with the Statewide coordinator will evaluate existing and potential efforts related to early detection, monitoring, and assessment (EDMA). CT DEP will continue on-going monitoring in support of fisheries management and water quality initiatives. CT DEP will seek funding to expand the annual coverage of this monitoring program and its effectiveness in documenting the distribution of non-indigenous organisms. Activities will include prioritizing EDMA needs and developing EDMA protocols. For Long Island Sound, the establishment of reference sites in LIS basins for long-term monitoring will be considered in collaboration with the U.S. EPA Long Island Sound Study and the State of New York.

**Priority:** High

**Funding:** Misc. Sources – Coordinating Committee <\$1K/each in 2007; USFWS ANS / CT DEP (Statewide Coordinator) <\$2K/year in 2008 & 2009

**FTE:** Coordinating Committee <0.1 each in 2008; Statewide Coordinator <.2/ year in 2008 & 2009

### **4 B Implement Monitoring Program**

#### **4 B 1 Develop and Train New Monitors**

Identify potential groups or organizations willing and able to conduct monitoring. CT Agricultural Experiment Station has established a pilot "Weedwatchers" Program in conjunction with the CT Federation of Lakes to train people on monitoring lakes and ponds for non-native invasive plant species. Other potential groups may include: water company monitors, lake association monitors and resident monitors who live near potentially invaded sites or water bodies and are willing to undertake training and monitor their sites, providing an early detection network. Develop training programs for inspectors/monitors that includes species identification and reporting protocols.

**Priority:** Standard

**Funding:** CTAES / CFL \$2K in 2006 & TBD thereafter; USDA (IPANE) \$3K/year for 2006, 2007 & 2008; CT DEP <\$1K/year from 2007 on.

**FTE:** CTAES / CFL .2 in 2006 & TBD thereafter; USDA (IPANE) <1/year for 2006, 2007 & 2008; CT DEP <0.1/year from 2007 on

#### **4 B 2 Conduct and Evaluate Monitoring**

CT DEP will continue on-going efforts to monitor fish populations. In the process they will monitor sites for new ANS and spread of existing ANS populations. Targeted efforts may be undertaken where non-indigenous aquatic species are impacting native species, especially where they co-exist with state listed rare species. Existing staff will be trained in ANS identification and reporting protocol. Other monitoring efforts will be initiated and coordinated by the Statewide Coordinator working in conjunction with the Coordinating Committee, or by public/private utilities.

**Priority:** High

**Funding:** Aquarion Water Co. \$10K/year ongoing; UFWWS (not ANS) / CT DEP BNR ~\$500K/year for ongoing fisheries monitoring including invasives; Dominion Power / Millstone Environmental Laboratory ~\$400K/year ongoing; SCRWA \$31.2k in 2005; \$15.8K in 2006; \$26.9K in 2007; \$15.9K in 2008; USDA (IPANE) \$3K/year 2005, 2006 & 2007, CTAES <\$1K / year in 2005, TBD thereafter

**FTE:** Aquarion (undetermined); CT DEP BNR 5.2 /year; Dominion **TBD**; SCWRA (undetermined); IPANE <1/year for 2005, 2006 & 2007; CTAES <0.1 in 2005, TBD thereafter

### **Objective 5: Control and Rapid Response**

Control the spread of ANS in CT and respond to new infestations as appropriate.

#### **5 A Develop CT Control Recommendations**

Allocation of limited resources for ANS management will require the on-going designation and re-evaluation of priority species and sites, as well as an on-going commitment to the use of cost-effective control strategies. As this plan is implemented and monitoring efforts enhanced, improved knowledge of ANS distribution and impacts must be used to continually update management priorities. Invasive species will be prioritized to reflect the distribution of the species and the realistic potential for control. Species that have high invasive potential but are not widely established in Connecticut will be given a high priority for intervention to prevent their spread.

Established species, even if invasive, will of necessity receive a lower priority for direct action, although efforts to prevent further spread will continue.

#### **5 A 1 Develop Control Guidelines for Connecticut**

Develop control guidelines and recommendations, specific to the State of Connecticut, to ensure that control resources are applied only to feasible, cost-effective management projects. Encourage integrated management options.

**Priority:** Standard

**Funding:** USFWS (ANS) / CT DEP TBD; Ad hoc committee TBD

**FTE:** CT DEP (Statewide Coordinator) <0.1/ year from 2008 onward; Ad hoc committee TBD

#### **5 A 2 Develop Rapid Response Protocols**

An ad-hoc committee will develop taxa-specific response protocols for the control and potential eradication of newly detected priority invaders (in many cases eradication will not be possible). This protocol will include specification of appropriate biological, chemical, and physical controls where necessary. Priority will be given to infestations that are not yet widespread or otherwise established. The protocol should also specify taxa-specific responses, procedures to determine the geographic extent of new infestations, recommendations for on-going management as well as post-management monitoring schedules. This protocol may specify appropriate biological, chemical, and physical controls where necessary. The ad-hoc committee should also make recommendations on statutory and regulatory changes that are necessary to implement effective rapid response (see 8B1 on page 70). The general procedures should include: 1) Assemble the RR team, 2) review resources, options, and legal authorities, 3) review control protocols, 4) consult stakeholders, 5) develop control plan, 6) obtain funding and permits as necessary, 7) implement control actions, and 8) monitor the effectiveness of control efforts.

**Priority:** High

**Funding:** USFWS (ANS) / CT DEP TBD; Ad hoc committee TBD

**FTE:** CT DEP (Statewide Coordinator) <0.1/ year from 2008 onward; Ad hoc committee TBD

### **5 B Implement Rapid Response Protocols**

Once established, aquatic nuisance species may be impossible to completely eradicate. Removal of any ANS will require a coordinated protocol for immediate response and eradication of the species of concern. The ANS Coordinating Committee will implement taxa-specific response protocols for the control and potential eradication of newly detected priority invaders (in many cases eradication will not be possible).

#### **5 B 1 Conduct Taxa / Site-Specific Rapid Response**

Conduct taxa and/or site-specific rapid response for newly detected populations. Improve and expand on-going rapid response efforts for water chestnut, hydrilla, and phragmites, with input from ad hoc committees.

**Priority:** High

**Funding:** USFWS (NEWFS) \$3k in 2005; CT DEP hydrilla program \$3,997 in 2005; CT DEP phragmites program \$98,400 in 2005; DucksUnlimited (with DEP supervision) \$220,000 in 2005. TBD thereafter.

**FTE:** USFWS (NEWFS) .2 in 2005; CT DEP water chestnut program 850 hours staff time, river surveys, volunteers, USFWS and their volunteers in 2006. TBD thereafter.

## **5 C Control Established ANS**

Maintenance control of established ANS populations will be necessary to preserve the recreational and biodiversity value of aquatic environments already infested. State funds, when available, will be concentrated on public waters that have high use and a high potential for controlling ANS for more than a very short time period.

### **5 C 1 Develop Site-Specific Control Plans**

Develop site-specific maintenance control plans for established populations of ANS and provide technical assistance to others (e.g. lake associations) to develop maintenance control plans. Develop or provide technical assistance for site-specific restoration plans if the reintroduction of beneficial native or naturalized species is needed. Continue to develop and implement site-specific control plans for phragmites. Develop site specific control plans for mute swans in conjunction with Atlantic flyway-wide efforts.

**Priority:** Standard

**Funding:** CT DEP \$4,669 in 2005; \$9,175 in 2006; TBD thereafter; Aquarion Water Co., \$ undetermined

**FTE:** undetermined for 2006; TBD thereafter; Aquarion .15/year

## **5 D Evaluate Control Effectiveness**

The effectiveness of ANS control efforts often goes unmonitored following implementation. Refinement of existing techniques and development of new management measures will require that the effectiveness of various control technologies are documented and reported to appropriate user groups.

### **5 D 1 Evaluate Effectiveness of Control Actions**

Develop and implement protocol to evaluate control actions. Any project to control aquatic nuisance plant species undertaken by the CT DEP will involve post-control monitoring and follow-up to assure that the control goals have been met. Weed control projects in public lakes that require pesticide permitting usually have post-application monitoring requirements as well. Smaller efforts in private water bodies do not usually receive the same level of scrutiny unless the plant being controlled is a recent invader with a high control priority (e.g., hydrilla). Control techniques may need to be modified if monitoring indicates that they are not effective.

**Priority:** Standard

**Funding:** USFWS (ANS) / CT DEP (Statewide Coordinator) TBD; Permittees TBD

**FTE:** TBD

## **Objective 6: Education**

Increase public awareness of ANS issues.

### **6 A Facilitate Access to ANS Resources**

Education of the general public and resource managers regarding threats from ANS and the preventative measures necessary to limit the introduction and spread of aquatic invaders to Connecticut will be continued and expanded. Access to the myriad resources, information, and general ANS-related educational materials for teachers and students, industry, agencies, legislators, and agency staff will be facilitated.

#### **6 A 1 Develop ANS Website/Portal for CT**

CTSG will develop and maintain a CT ANS resource web site/portal, with input from the Coordinating Committee on content. The site will serve as the primary information site on CT ANS Coordinating Committee activities and the CT ANS plan implementation. There will be contact information, a field reporting form to submit observation of potential new ANS sightings, periodic updates, timely ANS news releases, and a calendar of events. Well-organized links to regional sites and federal, state, NGO websites, lake management sites and sites with ANS resources will be included. The ANS web site will be linked to other invasive plant, aquatic and environmental websites, including the Connecticut Invasive Plant Working Group (CIPWG), the Invasive Plant Atlas of New England (IPANE), the Long Island Sound marine invasives website, and the Northeast ANS Panel website, etc. CT DEP / CTSG will also develop a web page that gives background information on the ANS Coordinating Committee and its activities, identifies priority invasive species concerns in the region, and communicates information housed in the ANS Database.

**Priority:** High

**Funding:** NOAA CTSG / State of CT

**FTE:** <0.1 (CTSG)

#### **6 A 2 Enhance, Utilize Existing ANS Educational Products**

Appropriate materials and resources available through the regional panels, the Federal ANS Task Force, Sea Grant programs, and other entities will be reviewed and shared with interested parties. Where appropriate, existing materials will be adapted for distribution via fishing tournaments, training courses, boat inspections, workshops and meetings.

**Priority:** Standard

**Funding:** <\$1K each

**FTE:** <0.1 each (CTSG, CT DEP, CIPWG, etc.)

#### **6 A 3 Develop CT ANS Overview Presentations**

The Statewide ANS Coordinator will develop one or more presentations outlining the ANS problem in CT, general species of concern, common pathways or vectors, etc., and describing potential

management approaches. These presentations will be made available for use by the ANS Coordinating Committee and also through the website.

**Priority:** Standard

**Funding:** USFWS (ANS) / CT DEP <\$1K

**FTE:** <0.1 (CT DEP Statewide Coordinator)

## **6 B Distribute Targeted Educational Products**

Assistance from the general public will be necessary to limit the spread of ANS and for effective monitoring of priority invaders. The diffuse nature of the ANS problem and the wide variety of transport vectors requires resource managers, industry representatives, and the general public to be informed about potential pathways of introduction and spread. Targeted educational materials specific to CT designated priority ANS, pathways, and issues will be developed/adapted from existing resources, and distributed.

### **6 B 1 Coordinate ID Card Dissemination**

Sea Grant will encourage the NEANS Panel Communication, Education & Outreach Committee to produce a variety of regional ANS watch cards and will distribute them within Connecticut to agency officials, aquatic resource managers, and the interested public.

**Priority:** Standard

**Funding:** NEANS Panel

**FTE:** <0.1 each (CTSG & CT DEP)

### **6 B 2 Revise & Update Guides and Provide Training**

CT DEP will annually revise and update ANS information included in the Angler's Guide, Boaters' Guide, and Hunting and Trapping Guides, and will provide information on ANS during boater education courses and aquatic resource education courses, and as part of the Clean Boater and Clean Marina programs.

**Priority:** Standard

**Funding:** CT DEP ~\$20K/year

**FTE:** 0.3/year

### **6 B 3 Maintain, Improve Boat Launch Signage**

Expand postings concerning ANS at boat launches. Develop and print informative signs to post on state and town boat launches with ANS identification information, instructions for the removal of aquatic vegetation from boats, penalties for non-compliance, and who to contact to report ANS. CT DEP / CTSG will incorporate the USFWS/ANSTF Stop Aquatic Hitchhikers! educational campaign materials in future signage for boaters and anglers.

**Priority:** Standard

**Funding:** CTSG <\$1K in 2006; CT DEP <\$1K/year

**FTE:** CTSG <0.1 in 2006; CT DEP <0.1/year



#### **6 B 4 Develop Reporting Contact Lists**

Identify primary public contacts for ANS observations for the public (one each for macrophytes, freshwater vertebrates & invertebrates, marine organisms). Contact information will be readily available (including on CT ANS web site), publicized, and updated as needed. Contacts should also be able to accept samples.

**Priority:** High

**Funding:** Misc. <\$1K in 2008 (Coordinating Committee)

**FTE:** <0.1/year

#### **6 B 5 Develop New Educational Products**

As needed, develop new or adapt existing educational materials (fact sheets, booklets, etc.). Make available on the ANS web site.

**Priority:** Standard

**Funding:** NSGO CTSG \$19K in 2006 and \$21K in 2007; USDA (IPANE) \$3K in 2006; TBD

**FTE:** CTSG (see Tasks 3B4, 3B5, 3C1) <.1 in 2006 & 2007; IPANE <1 in 2006; TBD

#### **6 B 6 Disseminate Pet Trade, Aquarium, Aquascaping, and Water Garden Industry Educational Materials**

Participate in promoting locally the USFWS / ANSTF Habitattitude™ campaign materials to discourage the release of aquatic animals and plants into Connecticut waters and to promote responsible and proper disposal of unwanted organisms, as opportunities arise. Educational / branding materials are already being distributed nationwide to pet retailers. (Can use in similar fashion to the brochure developed by Mass Bays Program, “Don’t Release Exotic Species”, distributed to 60 pet retailers with assistance of Fish Mart.)

**Priority:** Standard

**Funding:** N/A

**FTE:** minimal

#### **6 B 7 Develop Portable Display on Vectors**

Develop portable display(s) targeting landscapers, home gardeners and aquaria (retail and hobbyist) for use at public meetings, major shows and fairs. Include color photos, descriptive information for ANS, and contact information.

**Priority:** Standard

**Funding:** TBD

**FTE:** UCONN Cooperative Extension <0.1 in 2008

#### **6 B 8 Develop Live Seafood Industry Educational Materials**

Develop / distribute educational materials regarding the potential for ANS introductions via the handling of live seafood. CT Sea Grant is participating in a two-year regional educational and

outreach program addressing a number of ANS vectors, including live seafood. Materials developed as part of this collaboration, under the leadership of NY and RI Sea Grant programs will be distributed to the seafood industry within CT via CTSG.

**Priority:** Standard

**Funding:** NOAA Sea Grant to NY Sea Grant \$38.5K over two years (2005-2007)

**FTE:** CTSG <0.1/year in 2007

## **6 C Develop Educational Materials on Control Methods**

Organizations involved in ANS management should be made aware of the full range of options for control of established populations, including mechanical, chemical, biological, and other control techniques. The CT DEP continues to identify and evaluate control methods for aquatic invasive plants. Some methods, such as pesticides and herbicides, require regulatory approval and permits. This registration and permitting process provides an avenue for evaluation of the use of herbicides to control invasive plants. Non-pesticide methods, such as harvesting or hand pulling are not closely regulated. The CT DEP lakes program provides information on all methods of weed control to lake associations and others interested in vegetation control, and CT DEP guidebooks on lake and weed management are provided to the public upon request. Existing materials need to be assessed, and new materials developed if necessary.

### **6 C 1 Compile, Assess & Distribute Control Information**

Compile and assess information detailing available control techniques and technologies for the management of freshwater priority invaders. Use information to develop flowchart of control options to aide local communities in their decision-making.

**Priority:** High

**Funding:** CT DEP TBD; USFWS (ANS) / CT DEP TBD

**FTE:** CT DEP <0.1; Statewide Coordinator >.1 /year

### **6 C 2 Train Control Personnel**

CT DEP will train municipalities and watershed groups in techniques for the control of invasive species, utilizing materials such as that available through the U.S. ACOE on control methods for aquatic plants.

**Priority:** Standard

**Funding:** TBD, starting in 2009

**FTE:** TBD

## **6 D Develop Government Educational Materials**

Appropriate legislators, legislative staff and state regulatory agency staff should receive ANS material or briefings to ensure they have current knowledge about the issue, how it affects Connecticut, and the progress being made towards successful implementation of the CT ANS management plan.

### **6 D 1 Update Legislators and Staff on ANS**

Provide periodic updates on key ANS issues in CT to legislators, legislative staff and other agency staff as appropriate. In particular, brief members of the General Assembly's Environment Committee annually.

**Priority:** Standard

**Funding:** USFWS (ANS) / CT DEP <\$1K/year

**FTE:** Statewide Coordinator <0.1/year

### **6 D 2 Inform Relevant Agency Staff**

Periodic email communications to identified agency staff providing updates, new observations, etc., to be funneled through the Statewide Coordinator.

**Priority:** Standard

**Funding:** USFWS (ANS) / CT DEP <\$1K/year

**FTE:** Statewide Coordinator <0.1/year

## **6 E Develop Industry Educational Materials**

Representatives of industries that pose the risk of ANS transport may be unaware of the problems associated with ANS introductions and existing options for prevention and management. Targeted educational materials should be developed / shared with these stakeholders.

### **6 E 1 Identify and Develop Industry Educational Materials**

The statewide coordinator will work with sector-specific, ad-hoc committees to identify the ANS educational needs of individual industries and to develop periodic and timely news releases.

**Priority:** Standard

**Funding:** TBD as need or opportunity arises

**FTE:** TBD as need or opportunity arises

## **6 F Develop Public Educational Products**

Much of the general public is unaware of the problems caused by ANS. A mechanism for rapid, widespread release of information must be developed to facilitate communication and to keep the public apprised of key events, progress, and new programs and regulations.

### **6 F 1 Issue ANS News Releases**

The Coordinating Committee will work with member agencies and organizations and the Statewide Coordinator to coordinate and facilitate the issuance of news releases on the general topic of ANS (including economic costs), specific species of interest/concern, progress of the plan implementation, research results, breaking events, and other important ANS news.

**Priority:** High/Standard

**Funding:** minimal

**FTE:** USFWS (ANS) / CT DEP <0.1/year; CTSG <0.1/year

## **Objective 7: Research**

Address research needs.

### **7 A Promote ANS Research to Address Identified Needs**

As ANS populations change in size and distribution and new ANS are introduced to CT, management priorities and research needs will change. Effective management will require that research priorities are re-evaluated periodically and that scientists and managers in the region are aware of the priorities and are encouraged to address them.

#### **7 A 1 Develop Research Strategy**

The ANS Coordinating Committee will develop a strategy for communicating ANS research needs to the scientific community and research supporters. The strategy will encourage monitoring research, and development of biological controls for ANS in the state and regionally. Research priorities will include evaluation of potential non-target impacts from the release of biological control measures.

**Priority:** Standard

**Funding:** USFWS (ANS) / CT DEP <\$1K/year; Misc. <\$1K/year

**FTE:** Statewide Coordinator <0.1/year; Coordinating Committee <0.1/year

#### **7 A 2 Review Research Annually**

The ANS Coordinating Committee will solicit input on identified research needs from state and federal agencies (including the Federal ANSTF, National Sea Grant, and the U.S. EPA Long Island Sound Study), regional organizations such as the NEANS Panel, Connecticut industries and utilities, local community groups such as lake associations, and NGOs. Research priorities will be re-assessed annually.

**Priority:** Standard

**Funding:** USFWS (ANS) / CT DEP <\$1K/year; Misc. <\$1K/year

**FTE:** Statewide Coordinator <0.1/year; Coordinating Committee <0.1/year

#### **7 A 3 Facilitate Funding of Targeted Program Research**

Increase awareness among researchers of potential funding options and sources (federal, private, local) for ANS investigations by circulating notices of requests for proposals in a timely manner. A listserv of Connecticut researchers interested in aspects of ANS will be maintained by the Statewide Coordinator.

**Priority:** Standard

**Funding:** USFWS (ANS) / CT DEP <\$1K/year; Misc. <\$1K/year

**FTE:** Statewide Coordinator <0.1/year; Coordinating Committee <0.1/year

#### 7 A 4 Secure Funding for ANS Research

Seek to link research needs with available funding opportunities; promote potential funding sources and encourage proposal submissions. Support research into the economic impact of ANS in Connecticut. Support vector monitoring and species-specific research and outreach. Support research evaluating the magnitude of introductions through vectors such as hull fouling, ballast water, internet trade, pet trade, nursery, water garden and aquascaping trades, aquaculture and commercial hatcheries. Support experimental management projects using integrated control actions and evaluate effectiveness of actions. Control of established populations of ANS continues to be costly and labor intensive in most, if not all cases. Limiting the spread of priority ANS will require continued development of cost-effective and far-reaching control technologies, evaluation of potential short-term and long-term impacts of the controls (e.g., herbicide use) on public health and ecosystem function. Support the development of improved technology for monitoring the spread of nonindigenous organisms. Current research projects:

##### ECONOMIC *Effect of invasive fouling organisms on mariculture operations*

**Priority:** Standard

**Funding:** NSGO to University of Connecticut (Whitlatch, Shumway et al.) \$298K federal and \$149K match over 2 years (2005-2007)

**FTE:** 43 months over 2 years

##### VECTOR *Hull fouling of recreational boats as a vector*

**Priority:** Standard

**Funding:** NSGO and non-federal match to University of Connecticut (Whitlatch, Osman & Balcom) \$284 K federal and \$170K match over 2 years (2003-2005)

**FTE:**

##### SPECIES-SPECIFIC *Impacts and Spread of Grateloupia turuturu in Long Island Sound*

**Priority:** Standard

**Funding:** CTSG to University of Connecticut (Yarish et al.) \$120K in federal and non-federal funds in 2006; \$117K in federal and non-federal funds in 2007

**FTE:**

##### CONTROL *SCRWA*

**Priority:** Standard

**Funding:** <\$1K/year

**FTE:** undetermined

### **Objective 8: Legislation, Regulation and Policy**

Introduce legislation and / or adopt regulations as necessary to address aquatic nuisance species.

#### **8 A Assess Existing Authority**

Currently, Connecticut's authority to prohibit the import/liberation of potentially harmful vertebrate and invertebrate species is incomplete. State authority to restrict the introduction of specific aquatic species designated as threats to the ecology and economy of Connecticut must be thoroughly reviewed and evaluated.

#### **8 A 1 Compile and Review Interstate / National / International Authority**

Compile and review of interstate, national and international authority to prohibit introductions of ANS. Utilize existing resources such as the website [www.invasivespecies.gov/laws/fedacts\.shtml#la](http://www.invasivespecies.gov/laws/fedacts\.shtml#la) for information on federal acts, as summarized by the National Invasive Species Council, and the summary of Northeast state regulations as gathered by Policy and Legislation Committee of the NEANS Panel.

**Priority:** Standard

**Funding:** USFWS (ANS) / CT DEP <\$1K in 2008 and 2010

**FTE:** Statewide Coordinator <0.1 in 2008 and 2010

#### **8 A 2 Assess CT Authority**

CT DEP will assess Connecticut's existing authority to prohibit the introduction and transport of ANS designated as priorities by the ANS Working Group.

**Priority:** Standard

**Funding:** CT DEP <\$1K in 2008 and 2010; USFWS (ANS) / CT DEP <\$1K in 2008 and 2010

**FTE:** CT DEP <0.1/year; Statewide Coordinator <0.1/year

### **8 B Develop Legislative Recommendations**

As invasive species management evolves in Connecticut, additional legislative or regulatory needs may become apparent. General recommendations for additional state and federal legislative needs to minimize impacts from invasive species will be developed as necessary. Work with the existing legislative invasive plant council to develop and implement legislation.

#### **8 B 1 Evaluate Legislative and Regulatory Needs**

The ANS Coordinating Committee will biennially evaluate statewide legislative and regulatory needs based on the results of implementation efforts outlined in the ANS Management Plan.

Example: Rapid Response protocols developed in 5A1 and 5A2 are likely to require new statutes or regulations.

**Priority:** Standard

**Funding:** Misc. (Coordinating Committee) <\$1K in 2009 and 2011; USFWS (ANS) / CT DEP <\$1K in 2009 and 2011; IPC <\$1K in 2009 and 2011

**FTE:** Coordinating Committee <0.1 in 2009 and 2011; Statewide Coordinator <0.1 in 2009 and 2011; Invasive Plant Council <0.1 in 2009 and 2011

## **8 B 2 Evaluate / Support Funding Legislation**

Review options developed by other states for dedicated funding for ANS management activities. Consider legislative funding options for providing seed money for selected ANS management actions in Connecticut. Participate in efforts to evaluate / draft federal legislation increasing support for state ANS programs (e.g., International Association of Fish and Wildlife Agencies IAFWA))

**Priority:** Standard

**Funding:** Misc. (Coordinating Committee) <\$1K/year; USFWS (ANS) / CT DEP <\$1K/year

**FTE:** Coordinating Committee <0.1/year; Statewide Coordinator <0.1/year

## 6. IMPLEMENTATION TABLE

Task ID	Task Name	Funding Source	Implementing Entities	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					2006 CY	2007 CY	2008 CY	2009 CY	2010 CY	2011 CY
<b>1</b>	<b>Coordination</b>									
<b>1A</b>	<b>Establish Coordinating Entities</b>									
1A1	Establish Coordinating Committee	CT DEP	CT DEP	CTSG	N/A	N/A	< \$2K / < .1	N/A	N/A	N/A
		CTSG	CT DEP	CT DEP	N/A	N/A	< \$1K / <.1	N/A	N/A	N/A
1A2	Establish and Hire Statewide Coordinator	USFWS (ANS) / CT DEP	CT DEP	Steering Committee	N/A	N/A	\$93,892 / 1	\$96,709 / 1	\$99,610 / 1	\$102,598 / 1
<b>1B</b>	<b>Coordinate Within Connecticut</b>									
1B1	Develop/Review Listing Protocols	MISC	CTSG / CT DEP	ANS Working Group	< \$1K / <.1	N/A	N/A	N/A	N/A	N/A
		MISC	CT DEP	Ad Hoc Committee	N/A	N/A	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1
		MISC	CT DEP	Coordinating Committee	N/A	N/A	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1
1B2	Develop/Review ANS Lists and Management Classes	Misc.	CTSG / CT DEP	ANS Working Group	< \$1K / <.1	N/A	N/A	N/A	N/A	N/A
		EPA LISS / CTSG	CTSG	EPA LISS	\$10K / .25	N/A	N/A	N/A	N/A	N/A
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1
		MISC	CT DEP	Coordinating Committee	N/A	N/A	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1
1B3	Develop/Review Vector Lists	MISC	CTSG / CT DEP	ANS Working Group	< \$1K / <.1	N/A	N/A	N/A	N/A	N/A
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1
		MISC	CT DEP	Coordinating Committee	N/A	N/A	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1	< \$1K / <.1



Task ID	Task Name	Funding Source	Implementing	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
1B4	Develop/Review Site List	MISC	CT DEP	Ad Hoc Committee	N/A	N/A	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1
		MISC	CT DEP	Coordinating Committee	N/A	N/A	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1
1B5	Develop Research Priorities	MISC	CT DEP	Coordinating Committee	N/A	N/A	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1
1B6	Evaluate ANS Program	MISC	CT DEP	Coordinating Committee	N/A	N/A	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1	< \$1K / <0.1
<b>1C</b>	<b>Coordinate Beyond Connecticut</b>									
1C1	Coordinate with Northeast Region	CTSG	CTSG	NEANS Panel	\$1.5K / <0.1	\$1.5K / <0.1	\$1.5K / <0.1	\$1.5K / <0.1	\$1.5K / <0.1	\$1.5K / <0.1
		USFWS (ANS) / CT DEP	Statewide Coordinator, CT DEP NEANS panel rep	NEANS Panel	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
1C2	Coordinate with Long Island Sound Management Organizations	EPA	EPA LISS	CT DEP, CTSG, NYS DEC	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
		CT DEP OLISP	EPA LISS	NYS DEC, EPA LISS, CTSG	N/A	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
		CTSG	EPA LISS	CT DEP, NYS DEC, EPA LISS	\$17K / .25	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
		NYS DEC	EPA LISS	CT DEP, EPA LISS, CTSG	N/A	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1	<\$1K / <0.1
<b>1D</b>	<b>Develop Information Management System</b>									
1D1	Conduct Information Needs Analysis	MISC	CT DEP	Coordinating Committee	N/A	N/A	<\$1K / <0.1	N/A	N/A	N/A
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K / <0.1	N/A	N/A	N/A
1D2	Develop & Maintain Early Detection, Monitoring & Assessment (EDMA) Information Management System	TBD	CT DEP	IT person, IPANE, USFWS, Statewide Coordinator, Coordinating Committee	N/A	N/A	\$45K / .5	TBD	TBD	TBD

Task ID	Task Name	Funding Source	Implementing	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
1D3	Develop Experts Database	USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1
		TBD	CTAES	CTAES	N/A	N/A	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1
		FED	IPANE	IPANE	N/A	N/A	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1
		USFWS (ANS) / NOAA	NEANS	NEANS	N/A	N/A	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1
<b>2</b>	<b>Funding</b>									
<b>2 A</b>	<b>Fund Core Program</b>									
2A1	Identify and Secure Core Funds	TBD	CT DEP	CTSG	N/A	TBD / 0.2	TBD / 0.2			
		TBD	CTSG	CT DEP	N/A	TBD / <0.1	TBD / <0.1			
<b>2 B</b>	<b>Fund Plan Components</b>									
2B1	Identify Opportunities and Secure Funding	MISC	CT DEP	Ad Hoc Committee	TBD	TBD	TBD	TBD	TBD	TBD
		MISC	CT DEP	Coordinating Committee	TBD	TBD	TBD	TBD	TBD	TBD
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	TBD / 0.2	TBD / 0.2	TBD / 0.2	TBD / 0.2
<b>3</b>	<b>Prevention</b>									
<b>3 A</b>	<b>Assess and Minimize Introduction Risks</b>									
3A1	Assess Introduction Risks	MISC	CT DEP	Coordinating Committee	N/A	N/A	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1
		MISC	CTSG / CT DEP	ANS Working Group	<\$2K / <0.1	N/A	N/A	N/A	N/A	N/A
<b>3B</b>	<b>Minimize Industry Introductions</b>									
3B1	Enforce CT DEP Importation / Liberation Regulations	CT DEP	CT DEP		N/A	TBD / 0.2	TBD / 0.2	TBD / 0.2	TBD / 0.2	TBD / 0.2
3B2	Minimize Aquaculture / Hatchery Introductions	CT DEP	CT DEP	CT DA	N/A	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1
		CT DA / BA	CT DA/BA	CT DEP	N/A	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1
		CTSG	CTSG	CT DEP, CT DA/BA, industry	N/A	\$1.5K/<0.1	N/A	\$1.5K/<0.1	N/A	N/A

Task ID	Task Name	Funding Source	Implementing	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
3B3	Minimize Bait Industry Introductions	USFWS (ANS) / CT DEP	CT DEP		N/A	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1
		CT DEP	CT DEP	CTSG, Northeast Sea Grant programs, bait dealers & retailers	N/A	\$4K/ <0.1	\$4K/ <0.1	N/A	N/A	N/A
		NSGO	CTSG	CT DEP, Northeast Sea Grant programs, bait dealers & retailers	N/A	\$9K/ <.1	\$9K/ <.1; see 3B2	N/A	see 3B2	N/A
3B4	Minimize Nursery and Pet Trade Introductions	MISC	CT DEP	Ad Hoc Committee	N/A	N/A	/ <0.1	/ <0.1	/ <0.1	/ <0.1
		MISC	CT DEP	Coordinating Committee, pet trade	N/A	TBD	TBD	TBD	TBD	TBD
		MISC	CT DEP	Invasive Plant Council	N/A	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	TBD	TBD	TBD	TBD	TBD
3B5	Minimize Supplier Introductions	MISC	CT DEP	Coordinating Committee	N/A	N/A	N/A	N/A	<\$1K/ <0.1	<\$1K/ <0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	N/A	N/A	<\$1K/ <0.1	<\$1K/ <0.1
3B6	Minimize Mechanical Weed Harvesting Introductions	MISC	CT DEP	CT DEP, local commissions	N/A	N/A	<\$1K/ <0.1	TBD	TBD	TBD
<b>3C</b>	<b>Minimize Recreation Introductions</b>									
3C1	Minimize Recreational Boating and Fishing Introductions	NSGO	CTSG	rec. boating industry, CT DEP, Northeast Sea Grant programs, marine trades, local marinas	N/A	\$9K/ <0.1	\$9K/ <0.1	TBD	TBD	TBD
		SCRWA	SCRWA		<0.1	<0.1	<0.1	TBD	TBD	TBD
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K/ <0.1	TBD	TBD	TBD
		CT DEP	CT DEP	CTSG, rec. boating industry, marine trades, local marinas	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1/	<\$1K/ <0.1/	<\$1K/ <0.1
3C2	Increase Awareness & Enforcement of ANS Boating Regulations	TBD	CT DEP		N/A	TBD	TBD	TBD	TBD	TBD
<b>3D</b>	<b>Minimize Introductions by Education and Research</b>									
3 D 1	Promote Established Research Protocols		CT DEP	Coordinating Committee, NEANS, Statewide Coordinator, CTSG	N/A	N/A	/ <0.1	/ <0.1	/ <0.1	/ <0.1
3 D 2	Develop Aquaria BMPs	MISC	CT DEP	Coordinating Committee, Statewide Coordinator	N/A	N/A	TBD	TBD	TBD	TBD

Task ID	Task Name	Funding Source	Implementing	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
<b>3E Minimize Water Resource Management Introductions</b>										
3 E 1	Assess Upstream Passage Risk	CT DEP	CT DEP	CT DEP Inland Fisheries Fish Passage Coordinating Committee	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		CT IWR / Yale University	Yale Univ.	CT DEP, Rogers Lake Authority	\$30K / 1	\$30K / 1	N/A	N/A	N/A	N/A
3 E 2	Assess Water Project Risk	CT DEP	CT DEP	CT DEP Permit Review	N/A	N/A	N/A	N/A	TBD	TBD
		MISC	CT DEP	Ad hoc Committee	N/A	N/A	N/A	N/A	TBD	TBD
<b>4 Detection and Monitoring</b>										
<b>4 A Strategize Early Detection, Monitoring and Assessment</b>										
4A1	Develop EDMA Strategic Plan	MISC	CT DEP	Coordinating Committee	N/A	N/A	<\$1K/<0.1	N/A	N/A	N/A
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$2K/ 0.2	<\$2K/ 0.2	TBD	TBD
<b>4B Implement Monitoring Program</b>										
4B1	Develop and Train New Monitors	MISC	CTAES	CTAES, CFL	\$2K / 0.2	TBD	TBD	TBD	TBD	TBD
		USDA	IPANE	NEWFS	\$3K/ <1	\$3K/ <1	\$3K/ <1	TBD	TBD	TBD
		CT DEP	CT DEP		N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
4B2	Conduct and Evaluate Monitoring	Aquarion	Aquarion		\$10K/	\$10K/	\$10K/	\$10K/	\$10K/	\$10K/
		CT DEP BNR / USFWS	CT DEP BNR		~\$500K/ 5.2	~\$500K/ 5.2	~\$500K/ 5.2	\$500K/ 5.2	\$500K/ 5.2	\$500K/ 5.2
		Dominion	Dominion		~\$400K	~\$400K	~\$400K	TBD	TBD	TBD
		SCRWA	SCRWA		\$15.8/	\$26.9/	\$15.9/	TBD	TBD	TBD
		USDA	IPANE	NEWF	\$3K/ <1	\$3K/ <1	N/A	N/A	N/A	N/A
		MISC	CTAES	CTAES	TBD	TBD	TBD	TBD	TBD	TBD
<b>5 Control and Rapid Response</b>										
<b>5 A Develop CT Control Recommendations</b>										
5A1	Develop Control Guidelines for Connecticut	USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	/ <0.1	/ <0.1	/ <0.1	/ <0.1
		MISC	CT DEP	Ad Hoc Committee	N/A	N/A	TBD	TBD	TBD	TBD
5A2	Develop Rapid Response Protocols	USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	/ <0.1	/ <0.1	/ <0.1	/ <0.1

Task ID	Task Name	Funding Source	Implementing	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
					<\$1K/ <0.1	<\$1K/ <0.1	TBD	TBD	TBD	TBD
		MISC	CT DEP	Ad Hoc Committee	<\$1K/ <0.1	<\$1K/ <0.1	TBD	TBD	TBD	TBD
<b>5B</b>	<b>Implement Rapid Response Protocols</b>									
5B1	Conduct Taxa / Site-Specific Rapid Response	CT DEP	CT DEP	volunteers, USFWS, Ducks Unlimited	<\$1K/ <0.1	<\$1K/ <0.1	TBD	TBD	TBD	TBD
		USFWS	NEWFS	NEWFS		N/A	N/A	N/A	N/A	N/A
<b>5C</b>	<b>Control Established ANS</b>									
5C1	Develop Site-Specific Control Plans	CT DEP	CT DEP	CT DEP-SEP (Invasive Species Account)	\$9.2K/	TBD	TBD	TBD	TBD	TBD
		Aquarion	Aquarion	Aquarion	/ 0.15	/ 0.15	/ 0.15	/ 0.15	/ 0.15	/ 0.15
<b>5D</b>	<b>Evaluate Control Effectiveness</b>									
5 D 1	Evaluate Effectiveness of Control Actions	USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	TBD	TBD	TBD	TBD
		MISC	Permittees	Permittees	N/A	TBD	TBD	TBD	TBD	TBD
<b>6</b>	<b>Education</b>									
<b>6 A</b>	<b>Facilitate Access to ANS Resources</b>									
6A1	Develop/Maintain ANS Website/Portal for CT	CTSG	CTSG	CT DEP, others	N/A	/ <0.1	/ <0.1	TBD	TBD	TBD
6A2	Enhance, Utilize Existing ANS Educational Products	CTSG	CTSG	CT DEP, others	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		CT DEP	CT DEP	CTSG, others	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		MISC	UConn	CIPWG	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		USDA	IPANE		<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
6A3	Develop CT ANS Overview Presentations	USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
<b>6B</b>	<b>Distribute Targeted Educational Products</b>									
6B1	Coordinate ID Card Dissemination	USFWS (ANS) / NEANS	CT DEP, CTSG	MISC.	TBD	/ <0.1	/ <0.1	/ <0.1	/ <0.1	/ <0.1
6B2	Revise & Update Guides and Provide Training	TBD	CT DEP	CT DEP Volunteers	\$20K / 0.3	\$20K / 0.3	\$20K / 0.3	\$20K / 0.3	\$20K / 0.3	\$20K / 0.3
6B3	Maintain, Improve Boat Launch Signage	CTSG	CTSG	CT DEP	<\$1K/ <0.1	N/A	N/A	N/A	N/A	N/A
		CT DEP	CT DEP	CTSG	/ <0.1	/ <0.1	/ <0.1	/ <0.1	/ <0.1	/ <0.1
6B4	Develop Reporting Contact Lists	MISC	CT DEP	Coordinating Committee	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1

Task ID	Task Name	Funding Source	Implementing	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
6B5	Develop New Educational Products	USDA	IPANE	NEWFS	\$3K / < 1	N/A	N/A	N/A	N/A	N/A
		NSGO	CTSG	CT Sea Grant	\$19K, see tasks 3B4, 3B5, 3C1	\$21K, see tasks 3B4, 3B5, 3C1	TBD	TBD	TBD	TBD
		MISC	UCONN	CIPWG	N/A	TBD	TBD	TBD	TBD	TBD
6B6	Disseminate Pet Trade, Aquarium, Aquascaping, and Water Garden Industry Educational Materials	CTSG	CTSG, Pet trade Industry Assoc., CT NLA, CIPWG, USFWS, ANSTF, NOAA Sea Grant	Local pet trade retailers, CT NLA, CIPWG, USFWS, ANSTF, NOAA Sea Grant	/ < 0.1	TBD	TBD	TBD	TBD	TBD
6B7	Develop Portable Display on Vectors	MISC	UCONN	CIPWG	N/A	N/A	/ < 0.1	N/A	N/A	N/A
6B8	Develop Live Seafood Industry Educational Materials	NSGO	NY Sea Grant and RI Sea Grant	Northeast SG programs including CTSG	\$18.6K /	\$19.9K / (< 0.1 CTSG)	TBD	TBD	TBD	TBD
<b>6C</b>	<b>Develop Educational Materials on Control Methods</b>									
6C1	Compile, Assess & Distribute Control Information	CT DEP	CT DEP		TBD / < 0.1	TBD / < 0.1	TBD / < 0.1	TBD / < 0.1	TBD / < 0.1	TBD / < 0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	/	/ > 0.1	/ > 0.1	/ > 0.1	/ > 0.1	/ > 0.1
6C2	Train Control Personnel	USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	N/A	TBD	TBD	TBD
<b>6D</b>	<b>Develop Government Educational Materials</b>									
6 D 1	Update Legislators and Staff on ANS	USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
6 D 2	Inform Relevant Agency Staff	USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1	< \$1K / < 0.1
<b>6E</b>	<b>Develop Industry Educational Materials</b>									
6 E 1	Identify and Develop Industry Educational Materials	TBD	TBD	TBD	N/A	TBD	TBD	TBD	TBD	TBD
<b>6F</b>	<b>Develop Public Educational Products</b>									
6F1	Issue ANS News Releases	CTSG	CTSG		N/A	/ < 0.1	TBD	TBD	TBD	TBD
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	/ < 0.1	TBD	TBD	TBD
<b>7</b>	<b>Research</b>									

Task ID	Task Name	Funding Source	Implementing	Cooperating Organizations	Current and Planned Funding (Dollars/FTE)					
<b>7 A</b>	<b>Promote ANS Research to Address Identified Needs</b>									
7A1	Develop Research Strategy	MISC	CT DEP	Coordinating Committee	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
7A2	Review Research Annually	MISC	CT DEP	Coordinating Committee	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
7A3	Facilitate Funding of Targeted Program Research	MISC	CT DEP	Coordinating Committee	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
7A4	Secure Funding for ANS Research	NSGO, non-federal match	University of CT	Smithsonian Environmental Research Center, FL Sea Grant, CTSG	\$222K / ~2	\$226K / ~2	N/A	N/A	N/A	N/A
		NSGO & non-federal match	University of CT	Smithsonian Environmental Research Center, CTSG	\$454K 2003-2005					
		CTSG + non-federal match	University of CT	SUNY Purchase, CTSG	\$120k/	\$117k /	N/A	N/A	N/A	N/A
		SCRWA	SCRWA		<\$1K/	<\$1K/	<\$1K/	<\$1K/	TBD	TBD
<b>8</b>	<b>Legislation, Regulation and Policy</b>									
<b>8 A</b>	<b>Assess Existing Authority</b>									
8A1	Assess Interstate / National / International Authority	USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K/<0.1	N/A	<\$1K/<0.1	N/A
8A2	Assess Connecticut Authority	CT DEP	CT DEP		N/A	N/A	<\$1K/<0.1	N/A	<\$1K/<0.1	N/A
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	<\$1K/<0.1	N/A	<\$1K/<0.1	N/A
<b>8B</b>	<b>Develop Legislative Recommendations</b>									
8B1	Evaluate Legislative & Regulatory Needs	MISC	CT DEP	Coordinating Committee	N/A	N/A	N/A	<\$1K/<0.1	N/A	<\$1K/<0.1
		USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	N/A	<\$1K/<0.1	N/A	<\$1K/<0.1
		MISC	IPC		<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/ <0.1	<\$1K/<0.1	N/A	<\$1K/<0.1
8B2	Evaluate / Support Funding Legislation	USFWS (ANS) / CT DEP	CT DEP	Statewide Coordinator	N/A	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1
		MISC	CT DEP	Coordinating Committee	N/A	N/A	N/A	<\$1K/<0.1	<\$1K/<0.1	<\$1K/<0.1

## **7. PROGRAM MONITORING AND EVALUATION**

Following submission of this management plan to the Federal ANS Task Force, the ANS Coordinating Committee will generate the first annual work plan based on tasks identified above. Successes of the plan will be evaluated each year by the Coordinating Committee based both on progress in meeting the plan objectives as well as successful implementation of identified tasks. Due to the difficulty in assigning quantitative measures of progress towards these goals, the ANS Coordinating Committee will evaluate plan implementation based primarily on the completion of specific tasks identified for each year (see Implementation Table). Results of the evaluation will be summarized in an annual report that will include:

1. A qualitative description of progress towards each of the objectives
2. A complete list of tasks identified in the previous year's work plan, budgetary needs identified for each, resources procured, and resources expended.
3. Designation of the implementation status (full, partial, or not implemented) of each task identified in the previous year's work plan and a brief justification of the designation.
4. A summary of resource requirements to achieve full implementation of tasks listed as partially or not implemented.

Evaluation of annual work plans will play a major role in directing activities for the following years, as well as restructuring tasks identified in the original plan. Work plans for upcoming years will be produced concurrently with each annual program evaluation document.



## Glossary\*

\*Many of the definitions below have been taken from Massachusetts Invasive Plant Working Group [2003].

<b>aquaculture</b>	Cultivation, grow-out or distribution of organisms to final end-customer for stocking, liberation, or as food. Includes commercial hatcheries.
<b>aquarium / aquaria</b>	Water-filled container in which fish or other aquatic animals and often plants are kept; a place for the public display of aquatic animals and plants
<b>aquascaping</b>	The practice of using aquatic and wetland plants to landscape in and around water. Its main purpose is to beautify, but aquascaping can also attract <u>wildlife</u> . Aquascaping may be used to beautify natural and man-made lakes and water retention ponds, water gardens, or freshwater and brackish-water aquaria.
<b>aquatic</b>	All animals or plants as well as pathogens or parasites of aquatic animals and plants totally dependent on aquatic ecosystems for at least a portion of their life cycle.
<b>aquatic nuisance species</b>	A nonindigenous 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; a species that is non-native to a region or habitat, undesirable and requires action.
<b>ballast water</b>	Water taken on by ships to help maintain stability during transit of ocean or coastal waters. As ships take on or off-load cargo, they fill their ballast tanks or discharge from the tanks thousands to millions of gallons of water. Ballast water is considered a significant vector for the transport and introduction of non-native species worldwide.
<b>biologic potential</b>	The ability of a species to increase its number, either sexually and/or asexually.
<b>cryptogenic species</b>	Based on available information, it is unclear whether an organism is of native or non-native origin.
<b>cultch</b>	Dry shell, usually oyster, that is deposited on oyster grounds prior to the spawning season to provide suitable substrate to attract settling larval oysters. This technique is used to enhance the success of the spawning season.
<b>cultivar</b>	A cultivated variety of a plant species
<b>early detection</b>	a comprehensive, integrated system of active and passive surveillance to find and verify the identity of new invasive species as early as possible, when eradication and control are still feasible and less costly. It may be targeted at areas where introductions are likely and/or sensitive ecosystems. . (from Review of Systems for Early Detection and Rapid Response- National Invasive Species Council, 2002)
<b>enzootic</b>	Affecting or peculiar to animals of a specific area or limited district; analogous to the term "endemic" used to describe human diseases.
<b>epiphytes</b>	Plants that grow on other plants but are not parasitic, producing their own food through photosynthesis.
<b>established</b>	A species occurring as a reproducing, self-sustaining population in an open ecosystem, i.e. in waters where the population is able to migrate or be transported to other waters.
<b>exotic</b>	Foreign or non-native organism; also refers to things that may be different in ways that are striking or fascinating
<b>indigenous species</b>	Otherwise a species that occurs natively in Connecticut. Indigenous species often have a pre-colonial presence (pre 1500) or have arrived in the region more recently without the aid of human intervention, Synonymous with native species.
<b>integrated pest management</b>	Developing a response to pest problems with the most effective least-risk option (IPM Almanac website). When dealing with invasive species, an example of integrated management is using chemical/herbicide for initial control and then continuing control efforts using weed harvesting or hand harvesting.
<b>intensively managed habitats</b>	Intensively managed habitats are habitats or land systems where management efforts and investments of time, money and labor occur frequently. Examples include manicured lawns, landscaped grounds, gardens, roadsides or agricultural lands for crops or livestock.
<b>introduced species</b>	Non-native species or nonindigenous species; a species that has successfully established in a new habitat to which it was introduced, intentionally or inadvertently
<b>invasive species</b>	A non-native species whose introduction to minimally managed systems does or is likely to cause economic or environmental harm or harm to human, animal or plant health. by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. (Under this definition all synonyms, species, subspecies, varieties, forms, and cultivars of that species are included unless proven otherwise by a process of scientific evaluation).
<b>minimally managed habitats</b>	Habitats where management efforts and investments of time, money and labor are infrequent or non-existent; may have been intensively managed for anthropogenic reasons at one time in their history. In some cases, management may be more intense for conservation purposes and is primarily aimed at preserving elements of biological diversity such as imperiled species or critical natural communities. Minimally managed

	habitats are similar to “natural areas” but the distinction is made in order to remove bias, misconceptions or ambiguities that surround the term “natural area.”
<b>natural plant community</b>	A natural plant community is an association or assemblage of plant species that repeatedly occur together in reoccurring patterns in a specific type of habitat. This assemblage can be characterized by dominant species and biological properties. A natural plant community implies a minimally managed situation where all or most of the species that make up the assemblage are indigenous to the defined area.
<b>naturalized species</b>	A non-indigenous taxon that occurs without the aid and benefits of cultivation in Connecticut. Further, it implies two biological points: it freely and regularly reproduces in the wild, sexually or asexually, and occurrences persist over time.
<b>non-indigenous species</b>	A species that is non-native within Connecticut. A species may be indigenous to North America but nonindigenous in Connecticut. Synonymous with non-native species.
<b>occurrence</b>	Existing example of a species on the landscape.
<b>rapid response</b>	a systematic effort to eradicate, contain or control invasive species while infestations is still localized. It may be implemented in response to new introductions or to isolated infestations of previously established, non-native invasive species. Preliminary assessment and subsequent monitoring may be part of the response. (from Review of Systems for Early Detection and Rapid Response- National Invasive Species Council, 2002)
<b>spatial gaps</b>	This term is used in reference to the ability of a species to disperse away from existing occurrences. The concept of crossing spatial gaps is used to distinguish those species that can disperse over discontinuities and become established elsewhere from species that spread across a habitat only by continual, uninterrupted growth.
<b>water garden trade</b>	Retailers of aquatic plants or organisms for use in water gardens or aquaria, or for aquascaping
<b>waters of the state</b>	“all tidal waters, harbors, estuaries, rivers, brooks, watercourses, waterways, wells, springs, lakes, ponds, marshes, drainage systems, and all other surface or underground streams, bodies or accumulations of water, natural or artificial, public or private, which are contained within, flowthrough, or border upon this state or any portion thereof.” (CGS 22a-423)

## Appendix A. Listings of Known Non-Native ANS and Potential ANS in Connecticut

**Table A-1. Established Freshwater Vertebrate and Invertebrate ANS in Connecticut**

Most likely transport vectors and current threat level (1 = greatest threat, 2 = modest threat, 3 = low threat). \*See Table 1, Section 2.4, for more detailed information/listing of vectors.

SPECIES	LATIN NAME	VECTORS	LIKELIHOOD OF INTRODUCTION / SPREAD	LIKELIHOOD OF ESTABLISHMENT	SEVERITY OF IMPACT
<b>Freshwater Vertebrates</b>					
Landlocked Alewife	<i>Alosa pseudoharengus</i>	Bait trade/ anglers, fishways, water diversions, stocking programs	1	1	1
Tench	<i>Tinca tinca</i>	Bait trade/anglers	1	1	1
Bowfin	<i>Amia calva</i>	Bait trade/anglers, aquaculture, aquarium industry/hobbyists	2	2	3
Ide or Orfe	<i>Leuciscus idus</i>	Bait trade/anglers	3	3	3
Goldfish	<i>Carassius auratus</i>	Aquarium trade/hobbyists	1	1	2
Common Carp and Koi	<i>Cyprinus carpio</i>	Aquarium trade/hobbyists	1	1	2
Gizzard shad	<i>Dorosoma cepedianum</i>	Bait trade/ anglers, fishways, water diversions, stocking programs	2	2	1
Green sunfish	<i>Lepomis gibbosus</i>	Bait trade/anglers, aquaculture	2	2	3
Yellow bullhead	<i>Ameiurus natalis</i>	anglers, aquaculture	1	1	2
<b>Freshwater Invertebrates</b>					
Zebra mussel	<i>Dreissena polymorpha</i>	Commercial and recreational vessels, bait trade/anglers, equipment (dredges, aquatic weed harvesters, construction)	2	2 (1996)	1
Asiatic clam	<i>Corbicula fluminea</i>	Commercial & recreational boats, bait trade/anglers, aquarium industry/hobbyists, equipment (dredges, construction, aquatic weed harvesters)	2	2 (1990)	2
Brackish water mussel	<i>Mytilopsis leucophaeta</i>	Commercial & recreational boats, bait trade/anglers, aquarium industry/hobbyists, equipment (dredges, construction, aquatic weed harvesters)	3	2	2
Rusty crayfish	<i>Orconectes rusticus</i>	Bait trade/anglers, aquaculture, aquarium industry/hobbyists, research facilities, stocking programs	1	1	2

**Table A-2. Potentially Threatening Freshwater Vertebrate and Invertebrate ANS in Connecticut**

Most likely transport vectors and current threat level (1 = greatest threat, 2 = modest threat, 3 = low threat). \*See Table 1, Section 2.4, for more detailed information/listing of vectors.

SPECIES	LATIN NAME	VECTORS	LIKELIHOOD OF INTRODUCTION / SPREAD	LIKELIHOOD OF ESTABLISHMENT	SEVERITY OF IMPACT
<b>Freshwater Vertebrates</b>					
Snakeheads	<i>Channa sp.</i>	Bait trade/anglers, seafood industry, retailers, restaurants	2	2	1
Black Carp	<i>Mylopharyngodon piceus</i>	Aquaculture	3	2	2
Silver carp	<i>Hypophthalmichthys molitrix</i>	Aquaculture	3	2	2
Bighead carp	<i>Hypophthalmichthys nobilis</i>	Aquaculture	3	2	2
Crucian carp	<i>Carassius carassiu</i>	Aquaculture	3	2	2
Grass carp diploid	<i>Ctenopharyngodon idella</i>	Aquaculture	2	3	2
Rudd	<i>Scardinius erythrophthalmus</i>	Bait trade/anglers	2	2	2
Round goby	<i>Neogobius melanostomus</i>	Comm. & rec. boats, bait trade/anglers	2	1	1
Tube-nose goby	<i>Proterorhinus marmoratus</i>	Comm. & rec. boats, bait trade/anglers	3	1	2
Eurasian ruff	<i>Gymnocephalus cernuus</i>	Comm. & rec. boats, bait trade/anglers	3	3	3
Gars	<i>Lepisosteidae</i>	Aquaculture	3	3	3
Walking catfish	<i>Clarias batrachus</i>	Aquaculture	3	3	3
Hybrid striped bass	<i>Morone saxatilis X Morone americana</i>	Aquaculture	2	2	2
Piranha	<i>Pygocentrus spp. and Serrasalmus spp.</i>	Aquarium industry/hobbyists	3	3	3
Flathead catfish	<i>Pylodictis olivaris</i>	Aquaculture	2	1	1
Unauthorized aquarium fish sp.		Aquarium industry/hobbyists	1	2	2
Unauthorized bait fish sp.		Aquaculture	1	1	1
Transgenic fish sp.		Aquaculture	2	3	2
Blue catfish	<i>Ictalurus furcatus</i>		2	1	1
Sturgeon sp.	<i>Acipenser sp</i>	Aquarium industry	1	2	1
<b>Freshwater Invertebrates</b>					
Quagga mussel	<i>Dreissena bugensis</i>	Comm. & rec. boats, bait trade/anglers	3	2	1
Spiny water flea	<i>Bythotrephes longimanus &amp; cederstroemi</i>	Comm. & rec. boats, bait trade/anglers	2	2	2
Fishhook water flea	<i>Cercopagis sp.</i>	Comm. & rec. boats, bait trade/anglers	2	2	1
New Zealand mud snail	<i>Potamopyrgus antipodarum</i>	Rec. boats, bait and anglers	2	1	1
Misc., amphipods		Comm. & rec. boats	3	2	1
Chinese mitten crab	<i>Eriocheir sinensis</i>	Live seafood, bait trade/anglers	3	2	2
Misc. isopods					
Eurasian mysids					1
Misc. aquarium invertebrate sp.		Aquarium industry/hobbyists			
Spiny water flea	<i>Bythotrephes longimanus &amp; cederstroemi</i>	Comm. & rec. boats, bait trade/anglers	2	2	2

**Table A-3. Freshwater Inland Invasive Plants**

Established and potentially threatening freshwater invasive plants in Connecticut, most likely transport vectors and current threat level (1 = greatest threat, 2 = modest threat, 3 = low threat). Year in parentheses indicates when species banned by State of Connecticut. \*See Table 1, Section 2.4, for more detailed information/listing of vectors.

SPECIES	LATIN NAME	VECTORS	LIKELIHOOD OF INTRODUCTION / SPREAD	LIKELIHOOD OF ESTABLISHMENT	SEVERITY OF IMPACT
<b>Established Freshwater Aquatic Invasive Plants</b>					
Brazilian waterweed (2003)	<i>Egeria densa</i>	Waterfowl, birds, water currents, recreational boating, equipment, bait trade anglers, aquarium industry/hobbyists, garden industry gardeners & research	1	Established Only from limited sites to date	2
Hydrilla (2003)	<i>Hydrilla verticillata</i>	See first listing	1	Established Only from limited sites to date	1
Parrotfeather (2005)	<i>Myriophyllum aquaticum</i>	See first listing	2	Established Only from limited sites to date	2
Water chestnut (2003)*	<i>Trapa natans</i>	See first listing	1	Established	1
Fanwort (2003)	<i>Cabomba caroliniana</i>	See first listing	1	Established	1
Yellow Iris (2005)	<i>Iris pseudacorus</i>	Garden industry gardeners	2	Established	3
Purple Loosestrife (2005)	<i>Lythrum salicaria</i>	Garden industry Gardeners	1	Established	1
Variable-leaf Water-milfoil hybrids (2003)	<i>Myriophyllum heterophyllum</i>	Waterfowl, birds, water currents, recreational boating, equipment, bait trade anglers	1	Established	1
Eurasian Water-milfoil (2003)	<i>Myriophyllum spicatum</i>	Waterfowl, birds, water currents, recreational boating, equipment, bait trade anglers	1	Established	1
Brittle or Eutrophic Water-nymph (2005)	<i>Najas minor</i>	See first listing	2	Established	2
Common Reed, nonindigenous genotypes (2005)	<i>Phragmites australis</i>	Seeds	1	Established	1
Curly-leaved Pondweed (2003)	<i>Potamogeton crispus</i>	See first listing	2	Established	2
Flowering Rush (2005)	<i>Butomus umbellatus</i>	Garden industry Gardeners Water currents	3	Established Only from limited sites to date	3
Pond Water-starwort (2005)	<i>Callitriche stagnalis</i>	Waterfowl, birds, water currents, recreational boating, equipment	3	Established Only from limited sites to date	3
Mud Mat	<i>Glossostigma cleistanthum</i>	Waterfowl, birds, water currents, recreational boating, equipment	2	Established	2
European Waterclover (2005)	<i>Marsilea quadrifolia</i>	Garden industry Gardeners	3	Established Only from limited sites to date	3

Forget-Me-Not (2005)	<i>Myosotis scorpiodes</i>	Garden industry Gardeners	3	Established	3
American Water Lotus (2005)	<i>Nelumbo lutea</i>	Garden industry Gardeners	3	Established Only from limited sites to date	3
Onerow Watercress/ Yellow cress (2005)	<i>Nasturtium microphylla</i>	Garden industry Gardeners	3	Established	3
Watercress (2005)	<i>Nasturtium officinale</i>	Garden industry Gardeners	3	Established	3
<b>Potentially Threatening Freshwater Aquatic Invasive Plants</b>					
Common Water-Hyacinth	<i>Eichhornia crassipes</i>	Garden industry Gardeners	2	2	2
Yellow Floating Heart (2005)	<i>Nymphoides peltata</i>	Garden industry Gardeners	2	2	2
Giant Salvinia (2005)	<i>Salvinia molesta</i>	Waterfowl, birds, water currents, recreational boating, equipment, bait trade anglers, Garden industry	1	2	1

**Table A-4. Long Island Sound Non-Native Species List**

Comprehensive list of species in Long Island Sound (LIS) that are known to be introduced, are cryptogenic in their origins, or are considered to be potentially invasive, although they are not established in LIS at this time. It should be considered a work in progress. Note that *not all of these species are considered to have invasive characteristics* that would cause them to be considered aquatic nuisances.

Introduced Species in Long Island Sound							
Common Name	Kingdom	Phylum/Division	Class	Order	Family	Genus and Species	Reference
Spirobid worm	Animalia	Annelida	Polychaeta	Canalipalpata	Serpulidae	<i>Janua pagenstecheri</i>	Carlton (2003); USDA (2003)
Barnacle, little gray barnacle	Animalia	Arthropoda	Cirripedia	Thoracica	Chthamalidae	<i>Chthamalus fragilis</i>	Carlton (2003); USDA (2003)
Barnacle	Animalia	Arthropoda	Cirripedia	Thoracica	Balanidae	<i>Balanus amphitrite</i>	Carlton (2003); USDA (2003)
True bug	Animalia	Arthropoda	Insecta	Heteroptera	Lygaeidae	<i>Chilacis typhae</i>	Carlton (2003); USDA (2003)
Amphipod	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Amphipoda	Aoridae	<i>Microdeutopus gryllotalpa</i>	Carlton (2003); USDA (2003); MIT Sea Grant (2004)
Amphipod	Animalia	Arthropoda (subphylum: Crustacea)	Malacostraca	Amphipoda	Gammaridae	<i>Gammarus daiberi</i>	Carlton (2003); USDA (2003)
Skeleton shrimp	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Amphipoda	Caprellidae	<i>Caprella mutica</i>	Carlton (2003); USDA (2003); MIT Sea Grant (2004)
Gribble	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Isopoda	Limnoriidae	<i>Limnoria tripunctata</i>	Carlton (2003); USDA (2003)
Isopod	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Isopoda	Janiridae	<i>Ianiropsis spp.</i>	Carlton (2003); USDA (2003); MIT Sea Grant (2004)
Asian shore crab	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Decapoda	Grapsidae	<i>Hemigrapsus sanguineus</i>	Kraemer (2003); Carlton (2004); Fofonoff et al. (2003); MIT Sea Grant (2004)
European shore crab, green crab	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Decapoda	Portunidae	<i>Carcinus maenas</i>	Carlton (2003); USDA (2003); MIT Sea Grant (2004)
Maritime earwig	Animalia	Arthropoda (Subphylum: Hexapoda)	Insecta	Dermaptera	Carcinophoridae	<i>Anisolabis maritima</i>	Carlton (2003); USDA (2003)
Compound sea squirt	Animalia	Chordata	Ascidiacea	Aplousobranchia	Didemnidae	<i>Didemnum sp.</i>	Carlton (2003); USDA (2003)
Tunicate	Animalia	Chordata	Ascidiacea	Aplousobranchia	Didemnidae	<i>Didemnum vexillum</i>	Carlton (2003); USDA (2003)
Sea squirt, Asian tunicate, clubbed tunicate	Animalia	Chordata	Ascidiacea	Stolidobranchia	Styelidae	<i>Styela clava</i>	Carlton (2003); USDA (2003); MIT Sea Grant (2004)
Rough sea tunicate	Animalia	Chordata	Ascidiacea	Stolidobranchia	Styelidae	<i>Styela canopus (Styela magalhaensis)</i>	Carlton (2003); USDA (2003); MIT Sea Grant (2004)
Compound sea squirt	Animalia	Chordata	Ascidiacea	Enterogona	Didemnidae	<i>Diplosoma listerianum</i>	Kraemer (2003); Carlton (2003)
Sea squirt	Animalia	Chordata	Ascidiacea	Phlebobranchia	Asciidiaceae	<i>Asciidiella aspersa</i>	Kraemer (2003); Carlton (2003)
Orange or red-sheathed tunicate	Animalia	Chordata	Ascidiacea	Stolidobranchia	Styelidae	<i>Botrylloides violaceus</i>	Kraemer (2003); Carlton (2003); MIT Sea Grant (2004)
Golden star tunicate, compound sea squirt	Animalia	Chordata	Ascidiacea	Phlebobranchia	Botryllidae	<i>Botryllus schlosseri</i>	Carlton (2003); MIT Sea Grant (2004)
Mute swan	Animalia	Chordata	Aves	Anseriformes	Anatidae	<i>Cygnus olor</i>	Carlton (2003); USDA (2003)
Orange-striped sea anemone	Animalia	Cnidaria	Anthozoa	Actiniaria	Diadumene	<i>Diadumene lineata</i>	Carlton (2003); USDA (2003); MIT Sea Grant (2004)
Hydroid	Animalia	Cnidaria	Hydrozoa	Hydroida	Clavidae	<i>Cordylophora caspia</i>	Carlton (2003); USDA (2003)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Alcyoniidae	<i>Alcyonidium spp.</i>	Carlton (2003); USDA (2003); MIT Sea Grant (2004)

Kelp bryozoan	Animalia	Ectoprocta	Gymnolaemata	Cheilostomata	Membraniporidae	<i>Membranipora membranacea</i>	Carlton (2003); USDA (2003)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Cheilostomata	Bugulidae	<i>Bugula neritina</i>	Carlton (2003); USDA (2003)
Entoproct	Animalia	Kamptozoa (Entoprocta)	Kamptozoa	Pedicellinida	Barentsiidae	<i>Barentsia benedeni</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Atlantic rangia clam, wedge clam	Animalia	Mollusca	Bivalvia	Veneroida	Macluridae	<i>Rangia cuneata</i>	Carlton (2003); USDA (2003)
False mussel, brackish water mussel	Animalia	Mollusca	Bivalvia	Veneroida	Dreissenidae	<i>Mytilopsis leucophaeta</i>	Hyatt (2003); Carlton (2003); USDA (2003)
Zebra mussel	Animalia	Mollusca	Bivalvia	Veneroida	Dreissenidae	<i>Dreissena polymorpha</i>	Carlton (2003); USDA (2003)
Bartsch shipworm	Animalia	Mollusca	Bivalvia	Myoida	Teredinidae	<i>Teredo bartschi</i>	Carlton (2003); USDA (2003)
Periwinkle	Animalia	Mollusca	Gastropoda	Neotaenioglossa	Littorinidae	<i>Littorina littorea</i>	Carlton (2003); USDA (2003)
Eel nematode, swim-bladder nematode	Animalia	Nemata	Secernentea	Camallanida	Anguillicolidae	<i>Anguillicola crassus</i>	Carlton (2003); USDA (2003)
Sponge	Animalia	Porifera	Demospongiae	Halichondrida	Halichondriidae	<i>Halichondria bowerbanki</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Green Fleece	Plantae	Chlorophyta	Chlorophyceae	Caulerpales	Codiaceae	<i>Codium fragile tomentosoides</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004), Yarish (2003)
Centric diatom	Plantae	Bacillariophyta	Bacillariophyta	Coscinodiscales	Coscinodiscaceae	<i>Coscinodiscus wailesii</i>	Carlton (2003); USDA (2003)
Centric diatom	Plantae	Bacillariophyta	Coscinodiscophyceae	Thalassiosirales	Thalassiosiraceae	<i>Thalassiosira punctigera</i>	Carlton (2003); USDA (2003)
Diatom	Plantae	Bacillariophyta	Coscinodiscophyceae	Triceratales	Eupodiscaceae	<i>Odontella sinensis</i>	Carlton (2003); USDA (2003)
Common reed, phragmites	Plantae	Magnoliophyta	Liliopsida	Cyperles	Poaceae	<i>Phragmites australis</i>	Kraemer (2003); Mehrhoff et al. (2003); Carlton (2003); Fofonoff et al. (2003)
Purple loosestrife	Plantae	Magnoliophyta	Magnoliopsida	Myrtales	Lythraceae	<i>Lythrum salicaria</i>	Mehrhoff et al. (2003); Hyatt (2003); USDA (2003)
Red alga	Plantae	Rhodophyta	Rhodophyceae	Bangiales	Bangiaceae	<i>Porphyra suborbiculata</i>	Carlton (2003); USDA (2003); Broom et al. (2002); Neefus et al. (2005)
Red alga	Plantae	Rhodophyta	Rhodophyceae	Bangiales	Bangiaceae	<i>Porphyra yezoensis</i>	Broom et al. (2002); Neefus et al. (2005)
Red alga	Plantae	Rhodophyta	Rhodophyceae	Bangiales	Bangiaceae	<i>Porphyra katadaii</i>	Broom et al. (2002); Neefus et al. (2005)
Red alga	Plantae	Rhodophyta	Rhodophyceae	Nemaliales	Bonnemaisoniaceae	<i>Bonnemaisonia hamifera</i>	Carlton (2003); USDA (2003)
Red alga	Plantae	Rhodophyta	Rhodophyceae	Ceramiales	Ceramiaceae	<i>Antithamnion pectinatum (or nipponicum)</i>	Carlton (2003); USDA (2003)

Red alga (filamentous)	Plantae	Rhodophyta	Rhodophyceae	Ceriales	Rhodomelaceae	<i>Neosiphonia harveyi</i> (J. Bailey) M.-S. Kim, H.-G. Choi, Guiry & G.W. Saunders	Carlton (2003); USDA (2003), MIT Sea Grant (2004); Choi et al. 2001
Red alga	Plantae	Rhodophyta	Rhodophyceae	Cryptonemiales	Dumontiaceae	<i>Dumontia contorta</i>	Carlton (2003); USDA (2003)
Red alga*	Plantae	Rhodophyta	Rhodophyceae	Cryptonemiales	Cryptonemiaceae	<i>Grateloupia turuturu</i>	Carlton (2003); USDA (2003); Yarish (2004)
Dermocystidium oyster disease	Protista	Myxomycota	Phycomycota	Saprolegniales	Saprolegniaceae	<i>Perkinsus marinus</i>	Carlton (2003); USDA (2003)
MSX oyster disease	Protista	Protozoa	Haplosporea	Haplosporida	Haplosporidiidae	<i>Haplosporidium nelsoni</i>	Carlton (2003); USDA (2003)
Quahog parasite X	Protista	Labyrinthulomycota					



Cryptogenic Species In Long Island Sound							
Scale worm, twelve-scaled worm	Animalia	Annelida	Polychaeta	Aciculata	Polynoidae	<i>Lepidonotus squamatus</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Scale worm, fifteen-scaled worm	Animalia	Annelida	Polychaeta	Aciculata	Polynoidae	<i>Harmothoe imbricata</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Skeleton shrimp	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Amphipoda	Caprellidae	<i>Caprella penantis</i>	Carlton (2003); USDA (2003)
Skeleton shrimp	Animalia	Arthropoda (Subphylum: Crustacea) Malacostraca	Malacostraca	Amphipoda	Caprellidae	<i>Caprella equilibra</i>	Carlton (2003); USDA (2003)
Isopod	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Isopoda	Janiridae	<i>Jaera marina</i>	Carlton (2003); USDA (2003)
Isopod	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Isopoda	Scyphacidae	<i>Armadiloniscus ellipticus</i>	Carlton (2003); USDA (2003)
Tanaid	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Tanaidacea	Tanaidae	<i>Tanis dulongii</i>	Carlton (2003); USDA (2003)
Tanaid	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Tanaidacea	Pseudozeuxidae	<i>Leptocheilia savignyi</i> ( <i>Leptocheilia dubia</i> )	Carlton (2003); USDA (2003)
Sea squirt, sea vase	Animalia	Chordata	Ascidiaceae	Phlebobranchia	Cionidae	<i>Ciona intestinalis</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Compound sea squirt	Animalia	Chordata	Ascidiacea	Aplousobranchia	Didemnidae	<i>Didemnum lutarium</i>	Carlton (2003); Fofonoff et al. (2003)
Hydroid	Animalia	Cnidaria	Hydrozoa	Hydroida	Campanuliriidae	<i>Opercularella lacerata</i>	Carlton (2003); USDA (2003)
Hydroid	Animalia	Cnidaria	Hydrozoa	Hydroida	Sertulariidae	<i>Dyamena pumila</i>	Carlton (2003); USDA (2003)
Hydroid	Animalia	Cnidaria	Hydrozoa	Hydroida	Campanuliriidae	<i>Campanularia spp.</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Hydroid	Animalia	Cnidaria	Hydrozoa	Hydroida	Campanuliriidae	<i>Obelia bidentata</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Hydroid	Animalia	Cnidaria	Hydrozoa	Hydroida	Campanuliriidae	<i>Obelia dichotoma</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Hydroid	Animalia	Cnidaria	Hydrozoa	Hydroida	Campanuliriidae	<i>Obelia longissima</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Hydroid	Animalia	Cnidaria	Hydrozoa	Hydroida	Campanuliriidae	<i>Obelia geniculata</i>	Carlton (2003); USDA (2003)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Nolellidae	<i>Anguinella palmata</i>	Carlton (2003); USDA (2003)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Vesiculariidae	<i>Bowerbankia gracilis</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Vesiculariidae	<i>Bowerbankia imbricata</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Bugulidae	<i>Bugula stolonifera</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Bugulidae	<i>Bugula simplex</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Electridae	<i>Electra crustulenta</i>	Carlton (2003); USDA (2003)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Electridae	<i>Electra pilosa</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Membraniporidae	<i>Conopeum reticulum</i>	Carlton (2003); USDA (2003)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Cryptosulidae	<i>Cryptosula pallasiana</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Bryozoan	Animalia	Ectoprocta	Gymnolaemata	Ctenostomata	Aeteidae	<i>Aetea anguina</i>	Carlton (2003); USDA (2003)
Sea slug	Animalia	Mollusca	Gastropoda	Nudibranchia	Tergipedidae	<i>Tenelia adspersa</i>	Carlton (2003); USDA (2003)
Sponge	Animalia	Porifera	Pharetonida	Sycetrida	Sycettidae	<i>Scypha spp.</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Sponge	Animalia	Porifera	Pharetonida	Leucosoleniida	Leucosoleniidae	<i>Leucosolenia spp.</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
SSO (Seaside organism)	Animalia	Protozoa	Haplosporea	Haplosporida	Haplosporidiidae	<i>Haplosporidian</i>	USDA (2003)

Rhizopod protist	Protista	Protozoa	Filosia	Aconchulinida	Gromiidae	<i>costalis</i>	
						<i>Gromia oviformis</i>	Carlton (2003); USDA (2003)
Cyanobacteria	Monera	Cyanophycota	Cyanophyceae	Stigonematales	Mastigocladaceae	<i>Brachytrichia quoyii</i>	Carlton (2003); USDA (2003)
Green alga	Plantae	Chlorophycota	Chlorophyceae	Cladophorales	Cladophoraceae	<i>Cladophora sericea</i>	Carlton (2003); USDA (2003), MIT Sea Grant (2004)
Ciliate	Protista	Ciliophora	Cilitea	Peritrichida	Vorticellidae	<i>Zoothamnium spp.</i>	Carlton (2003); USDA (2003)
Ciliate	Protista	Ciliophora	Cilitea	Peritrichida	Vorticellidae	<i>Vorticella spp.</i>	Carlton (2003); USDA (2003)
Ebridian flagellate	Protista	Opalozoa			Ebriopsidae	<i>Hermisinum adreaticum</i>	Carlton (2003); USDA (2003)
Lobster paramoeba						<i>Neoparamoeba pemaquidensis</i>	
Sea squirt, sea grapes	Animalia	Chordata	Ascidiacea	Stolidobranchia	Molgulidae	<i>Molgula manhattensis</i>	Carlton (2003); USDA (2003); MIT Sea Grant (2004)

Potentially Invasive Species							
Chinese mitten crab	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Decapoda	Grapsidae	<i>Eriocheir sinensis</i>	USDA (2003); NYDEC (2003)
Veined rapa whelk	Animalia	Mollusca	Gastropoda	Neogastropoda	Muricidae	<i>Rapana venosa</i>	USDA (2003); NYDEC (2003)
Edible oyster, European flat oyster	Animalia	Mollusca	Bivalvia	Ostreoida	Ostreidae	<i>Ostrea edulis</i>	Carlton (2003); USDA (2003)
Naval shipworm	Animalia	Mollusca	Bivalvia	Myoida	Teredinidae	<i>Teredo navalis</i>	Carlton (2003); USDA (2003)
Grapsid crab	Animalia	Arthropoda (Subphylum: Crustacea)	Malacostraca	Decapoda	Grapsidae	<i>Hemigrapsus penicillatus</i>	
Asian tunicate	Animalia	Chordata	Ascidiaceae	Stolidobranchia	Styelidae	<i>Styela plicata</i>	USDA (2003)
Lionfish, zebrafishes, common lionfish, devil firefish (vagrants)	Animalia	Chordata	Osteichthyes	Scorpaeniformes	Scorpaenidae	<i>Pterois volitans/miles</i> <i>Pterois volitans</i> <i>Pterois miles</i>	Carlton (2003); USDA (2003)
Wakame (coldwater invasive kelp)	Plantae					<i>Undaria pinnatifida</i>	Yarish (2003)
Asian rockweed	Plantae	Phaeophycophyta	Phaeophyceae	Fucales	Sargassaceae	<i>Sargassum muticum</i>	USDA (2003); Yarish (2003)
Pfiesteria spp.	Plantae	Pyrrophyphyta	Dinophyceae	Dinomoebales	Pfiesteriaceae	<i>Pfiesteria spp.</i>	USDA (2003)
Brown tide	Protista		Pelagophyceae	Pelagomonadales		<i>Aureococcus anophagefferens</i>	Carlton (2003)

**Table A-5 Priority Established and Potentially Threatening Marine ANS**

Includes most likely transport vectors and current threat level (1 = greatest threat, 2 = modest threat, 3 = low threat). \*See Table 1, Section 2.4, for more detailed information/listing of vectors.

SPECIES	LATIN NAME	VECTORS	LIKELIHOOD OF INTRODUCTION / SPREAD	LIKELIHOOD OF ESTABLISHMENT	SEVERITY OF IMPACT
<b>Marine Vertebrates</b>					
Lionfish	<i>Pterois volitans/miles</i> <i>Pterois volitans</i> <i>Pterois miles</i>	Wind, currents	3	3 (seasonal or vagrant)	3
Mute Swan	<i>Cygnus olor</i>		1	Established	1
<b>Marine Invertebrates</b>					
European flat oyster	<i>Ostrea edulis</i>	aquaculture, wind/currents, seafood industry/retailers/restaurants, comm. & rec. boats, ballast water	1	1	2
Suminoe Oyster	<i>Crassostrea ariakensis</i>	Wind/currents, comm. & rec. boats, hull cleaning, aquaculture, seafood industry/retailers/restaurants	2	1	1
Veined Rapa whelk	<i>Rapana venosa</i>	Comm. & rec. boats, ballast water, seafood industry/retailers/restaurants	2	1	1
Green Crab	<i>Carcinus maenas</i>		1	Established	2
Asian shore crab	<i>Hemigrapsus sanguineus</i>		1	Established	1
Grapsid crab	<i>Hemigrapsus pennicillatus</i>	Ballast water, wind/currents, bait trade/anglers	2	1	2
Tunicate	<i>Didemnum sp.</i>	Wind/currents, comm. & rec. boats, hull cleaning, ballast water, seafood industry, research facilities	1	Established	1
Clubbed Tunicate	<i>Styela clava</i>	Wind/currents, comm. & rec. boats, hull cleaning, ballast water	1	Established	1
Rough Sea Squirt	<i>Styela canopus</i>	Wind/currents, comm. & rec. boats, hull cleaning, ballast water	2	2	
Asian Sea squirt	<i>Styela plicata</i>	Wind/currents, comm. & rec. boats, hull cleaning, ballast water	2	2	1
Compound Sea Squirt	<i>Diplosoma listerianum</i>	Wind/currents, comm. & rec. boats, hull cleaning, ballast water	1	Established	1
Sea squirt	<i>Ascidella aspersa</i>	Wind/currents, comm. & rec. boats, hull cleaning, ballast water	1	Established	2
Orange or red-sheathed tunicate	<i>Botrylloides violaceus</i>	Wind/currents, comm. & rec. boats, hull cleaning, ballast water	1	Established	1
Golden-Star Tunicate	<i>Botryllus schlosseri</i>	Wind/currents, comm. & rec. boats, hull cleaning, ballast water	1	1	1
Red alga	<i>Porphyra yezoensis</i>		2	Established	2
Red alga	<i>Porphyra suborbiculata</i>		2	Established	2
Kelp Bryozoan	<i>Membranipora membranacea</i>	Comm. & rec. boats, hull cleaning, ballast water	1	Established	2
<b>Marine Algae</b>					
Red Alga	<i>Grateloupia turuturu</i>	Wind/currents, comm. & rec. boats, hull cleaning, ballast water, shellfish	1	Established	2
Green Alga, Killer green algae	<i>Caulerpa taxifolia</i>	Aquarium industry/hobbyists, hull cleaning, ballast water	3	3	3
Wakame (invasive kelp)	<i>Undaria pinnatifida</i>	hull cleaning, ballast water	3	2	1
Asian rockweed	<i>Sargassum muticum</i>	hull cleaning, ballast water, bait industry	3	3	3
Green Fleece	<i>Codium fragile tomentosoides</i>		1	Established	3

**Table A-6. Aquatic Nuisance Species – Fish and Shellfish Pathogens**

<b>Pathogen Species -</b>	<b>Affected CT Fish/Shellfish<sup>1</sup></b>	<b>Likely Host Organisms</b>	<b>Most Likely Vectors</b>
<b>Viral</b>			
Infectious Salmon Anemia	ats	anadromous ATS and eggs	Commercial/Government transfers
Viral Hemorrhagic Septicemia Virus	rbt,bnt,ats,bkt,np	fish and salmonid eggs	Commercial/Government transfers
Infectious Hematopoietic Necrosis Virus	kok,ats,bkt,bnt	salmonid fish and eggs	Commercial/Government transfers
Infectious Pancreatic Necrosis Virus	bkt,bnt,rbt	fish/salmonid eggs/crus/moll	Commercial/Government transfers
Channel Catfish Virus	cc	channel catfish	Commercial catfish transfers
<i>Herpesvirus salmonis</i> (Type 1 and 2)	kok,rbt	salmonid fish and eggs	Commercial/Government transfers
Largemouth bass virus	lmb	largemouth bass	Commercial transfers/Club tournaments
Salmon Sarcoma Virus	ats	ats	Commercial/Government transfers
Spring viremia	ca, cm	Cyprinids	Pet trade –koi and ornamentals
<b>Pathogen Species – Bacterial</b>			
<i>Edwardsiella tarda</i>	cc,lmb,sb,f,rbt	fish/aq inverts/marine+fresh	commercial fish transfers
Enteric septicemia ( <i>Edwardsiella ictaluri</i> )	cc,wc,bb,yb,bkb	catfish species/tilapia	Commercial catfish transfers
Hitra disease ( <i>Vibrio salmonicida</i> )	ats,rbt	marine ats and rbt	Commercial/Government transfers
Bacterial Kidney disease ( <i>R. salmoninarum</i> )*	all salmonids	salmonid fish and eggs	Commercial/Government transfers
Enteric Redmouth ( <i>Y. ruckeri</i> )*	rbt,bkt,bnt,ats,kok,we	all salmonids	
Fish TB ( <i>Mycobacteria shottsii</i> )	Marine fish spp., anglers	saltwater, sediments, fish	Handling diseased fish (e.g. striped bass)
Cyanobacteria	Striped bass		
<b>Pathogen Species - Parasitic</b>			
Ceratomyxosis ( <i>C. shasta</i> )	rbt,ats,bnt,bkt	salmonid fish	Commercial/Government transfers
Asian Tapeworm ( <i>B. acheilognathi</i> )	gc, cyprinids, bass?	Primarily cyprinids	Commercial Grass carp/bait fish transfers
Proliferative Kidney disease	rbt,ats,bnt,np	salmonid fish	Commercial/Government transfers
Hexamitosis		young salmonids, fish	Commercial/Government/Aquarium transfers
Whirling disease ( <i>M. cerebralis</i> )*	bkt,rbt	all salmonids	Commercial/Government transfers
Proliferative Gill disease	cc	channel catfish	Commercial transfers
MSX ( <i>Haplosporidium nelsoni</i> )*	Eastern oyster	Shellfish seed sources	shellfish to shellfish
Derma ( <i>Perkinsus marinus</i> )*	Eastern oyster	Shellfish seed sources	shellfish to shellfish
QPX, Quahog Parasite X	Hard clams	micro and macro algae, detritus	Molluscs in culture
Lobster paramoeba ( <i>Neoparamoeba pemaquidensis</i> )*	American lobster	water column, sediments	Cryptogenic species
Eel nematode ( <i>Anguillicola crassus</i> )	American eel	American eel	Commercial

\*These pathogens have occurred or do occur in CT and continue to pose a threat to cultured and wild stocks of fish and shellfish in the state.

**<sup>1</sup>Warm water**  
cc – channel catfish  
bb – brown bullhead  
bkb – black bullhead  
yb – yellow bullhead  
wc – white catfish  
lmb – largemouth bass  
ca - carp  
cm – cyprinid minnows

**Cool water**  
np – northern pike  
we – walleye  
sb - striped bass  
f – flounder

**Cold water**  
ats – Atlantic salmon  
rbt – rainbow trout  
bkt – brook trout  
bnt – brown trout  
kok – kokanee salmon

**Miscellaneous**  
crus - crustaceans  
moll - molluscs

## Appendix B. Descriptions of Selected Species Identified as ANS or Potential ANS

This section provides additional information in the species identified in Chapter 2 as being aquatic nuisance species in Connecticut, as well as those species considered to be potentially invasive, although they are not yet established in Connecticut. Note that detailed information is not provided for every species listed at this time.

### Management Class 1: Limited or Incipient Populations

Includes species with known impacts (or potential for impacts) that have limited or incipient populations within state waters, and any Class 2 species found in new locations.

#### Marine Algae

##### ***Grateloupia turuturu* (formerly *Grateloupia doryphora*), Rhodophyta, red alga**

This red alga can grow up to several meters in length, smothering out resident flora like the red alga, *Chondrus crispus* (commonly known as Irish moss). It is currently found throughout Narragansett Bay, and at Montauk Point, Long Island, NY (Villalard and Harlin 2001; Harlin and Villalard 1998; Villalard and Harlin 1997) and was discovered in eastern Long Island Sound off the Connecticut coast in September 2004 (John Swennerton, Millstone Environmental Laboratory, pers. comm., Sept. 2004; C. Yarish, University of Connecticut, email communication October 2004). Vectors include boat hulls, ballast water (spores), shellfish and humans.

#### Marine Vertebrates

***Pterois volitans/miles*, Lionfish:** These are two closely related species or subspecies native to the Indo-Pacific oceans. The fin spines of these fish deliver a very painful sting that can be life threatening. They were observed by divers off eastern Florida as early as 1994, and appear to be spreading geographically and increasing in abundance (Hare and Whitfield 2003). Juveniles that are smaller than the specimens carried by the tropical fish trade have been seen off the southern shore of Long Island. The appearance of these small fish at these locations and elsewhere indicates that adults in the Atlantic are spawning, and that the larvae are dispersing from the spawning sites in the southeastern US. These fish are not able to tolerate winter temperatures and so will be present in the region's waters only as small juveniles. Specimens have been reported in lobster traps in eastern Long Island Sound. It is uncertain whether these specimens originated from aquarium releases or from spawning of the invasive population. The growth of the invasive population may have ecosystem effects and is likely to cause envenomation incidents.

#### Freshwater Invertebrates

***Dreissena polymorpha*, Zebra mussels:** Water quality data has been utilized to determine the invasion potential of zebra mussels in Connecticut (Murray et al. 1993). Using calcium ion concentration in surface waters to predict potential habitat and invasion rates, Murray et al. (Murray et al. 1993) classified Connecticut's fresh waters into zones of potential zebra mussel threat. They determined that the Housatonic River drainage basin and its associated hard water lakes in western Connecticut, which run along a limestone valley, are most likely to support and sustain a population of zebra mussels. In 1998, a sustainable population of zebra mussels was found in East Twin Lake,

Salisbury, a water body that has the highest calcium levels of all lakes in Connecticut (Balcom 2004). The Connecticut River is considered to be the easternmost water body in Connecticut that could support zebra mussels, even though the calcium levels are less than optimal (10-12 mg/L). Other water bodies with marginal *Dreissena* habitat are located in the southwestern and south-central parts of the state (Murray et al. 1993). Primary vectors include boats, boat trailers, boating equipment, live wells, and bait buckets.

#### Freshwater Inland Plants

***Egeria densa*, Brazilian waterweed:** A native of South America, *Egeria densa* is a popular aquarium plant that first was reported in a Connecticut pond in 1992. The species can become very abundant, reproducing primarily through fragmentation and dominating shallow waters. It is closely related to two *Elodea* spp. native to Connecticut and can easily be confused with them. *Elodea* produces leaves in whorls of three, whereas *Egeria* produces whorls of four leaves.

***Hydrilla verticillata*, Hydrilla:** A native of Asia, *Hydrilla* has been invasive in the United States since 1960 and was first collected in Connecticut in 1989. Among all invasive aquatic plants, *Hydrilla* may represent the most serious threat to Connecticut ponds and lakes. The plant is extremely aggressive, spreading quickly and outcompeting native species and even other invasive species. *Hydrilla* reproduces by fragmentation as well as producing turions and tubers in the sediment and is very difficult to eradicate. It is easily confused with native *Elodea* spp. and with *Egeria densa*. *Hydrilla* produces leaves in whorls of five although whorls of 4-8 can be found; *Elodea* produces whorls of three leaves, and *Egeria* produces whorls of four leaves.

***Myriophyllum aquaticum*, Parrotfeather:** A native of South America, this plant has been popular in water gardens because of its distinctive blue-green color. It produces both submersed and emerged leaves, although the submersed leaves are usually lost. The shoots emerge above the surface of the water. The plant has been collected in few Connecticut locations, but it over winters in the Northeast and so may represent a threat to the state's water bodies. This species spreads rapidly by vegetative fragmentation or turion dispersal and forms dense monocultures, outcompeting native aquatic plants. *Hydrilla* looks like *Elodea* spp. but the leaves are toothed and typically have more than three leaves in each whorl. Roots to the bottom, to depths of 30 feet and produces tubers that can re-grow after 5-6 years. Tolerant of wide range of environmental conditions, *Hydrilla* has low light requirements and thrives in both low and high nutrient waters. Control/eradication is

very difficult and expensive. Dense infestations can affect water quality and impede water flow and recreation.

***Trapa natans*, Water chestnut:** Water chestnut is an annual species that grows rooted but produces floating-leaved rosettes on the surface of the water. Plants reproduce both by producing seeds and by spreading clonally, producing daughter rosettes. It can spread very rapidly to cover the entire surface of water bodies and can be very difficult to eradicate. A native of Eurasia, water chestnut was first documented in Connecticut in 1999. This plant is difficult to see at very low densities and can be easily overlooked. The plant can rapidly colonize shallow areas of

lakes and calm rivers, forming dense mats that choke waterbodies, out-compete native vegetation, and reduce oxygen levels. A rooted plant, water chestnut has both floating and submersed leaves, although the submersed leaves drop off soon after formation. Floating leaves form a rosette up to 1 ft in diameter. The fruit is a woody nut with four sharp barbed spines, which can remain viable for more than 5 years. This plant is native to Europe, Asia, and Africa. Hand or mechanical harvesting of plants works well because the plant is an annual. Harvesting should be done before plants set and drop seeds.

## **Management Class 2: Established, Potential for Impact, Some Control Techniques Available**

Includes species present and established in Connecticut with known impacts (or potential for impacts) that may be mitigated or controlled with appropriate management techniques. This category includes species that are approved for import and managed under other regulations for commercial or recreational purposes, but may still have known or potential impacts on native species, ecosystems, or the human use of these ecosystems.

### **Coastal and Freshwater Inland Plants**

***Phragmites australis*, Common Reed:** Invading both fresh and brackish marshes, *Phragmites* forms dense monocultures, displacing native vegetation and reducing habitat value of many wetland systems (Crow and Helquist, 2000). *Phragmites* can impede access to water bodies and completely clog channels and drainage ditches. Removal is by mechanical harvesting, application of herbicides, or restoration of natural hydrology, and is difficult and costly. Both native and non-native genotypes exist in Connecticut; it is believed that the non-native strains exhibit the invasive, nuisance tendencies.

***Lythrum salicaria*, Purple Loosestrife:** This now prolific wetland species was introduced as early as 1824 in New England and Canada, likely escaping from flower gardens (Crow and Hellquist, 2000). This plant, now listed as prohibited for nursery sales in Connecticut by the Invasive Plant Council, is dispersed via seeds, and forms dense stands that overwhelm all other plant species in many freshwater and brackish wetlands (Hellquist, 2001; IPC 2004). While its presence reduces the ecological value of wetland systems, purple loosestrife serves as an important pollen source for bees and commercial beekeeping operations. Currently, management efforts are focused on experimental biological control and are led by the University of Connecticut Cooperative Extension System. Control of this species will require continued monitoring and research into biological control effectiveness and elimination of sales through nurseries in the Northeast.

***Cabomba caroliniana*, Fanwort:** A very aggressive fresh water plant with opposite, finely segmented leaves with small white emergent flowers. It is widely distributed in eastern CT and appears to be spreading west in the state. This species is very resistant to control; at this time fluridone is the only known effective treatment.

***Myriophyllum spicatum*, Eurasian water-milfoil:** Eurasian water-milfoil was first reported in Connecticut in 1979. Although it occurs throughout the state, it is most frequently found in the alkaline waters of the western part of the state. A native of Europe and Asia, the species can become very abundant, forming dense mats on the surface of the water, interfering with recreation and displacing native plants. The species spreads through fragmentation, and managing the species can be expensive.

***Myriophyllum heterophyllum* hybrids, Variable-leaf water-milfoil:** This species is native to the southern United States and has occurred in Connecticut since 1936, especially in the southeast part of the state. Variable-leaf milfoil produces long stems that rise to the surface of the water and can form mats of vegetation. It reproduces primarily through fragmentation. A hybrid of *M. heterophyllum* and *M. laxum*, another southern species, also is invasive in Connecticut, and the two can be distinguished from each other only with great difficulty.

***Potamogeton crispus*, Curly leaf pondweed:** Curly-leaf pondweed is a native of Asia, Europe and Africa. Since arriving in Connecticut since the 1930's, it has become one of the most common invasive plants in the state. It is broadly tolerant of ecological conditions, occurring in oligotrophic and eutrophic waters of ponds, lakes, marshes, ditches, canals, streams and rivers. It can occur in water more than 5 m deep and can form dense stands, inhibiting growth of native plants and interfering with recreational activities. Curly leaf pondweed is unusual in that it dies back by mid-summer after producing vegetative turions, which sprout in September. New plants remain small, growing slowly through the winter before becoming large in the spring.

***Najas minor*, Brittle water-nymph:** A native of Europe, Asia and Africa, *Najas minor* was introduced to the United States in 1934 and spread quickly, as it has through Connecticut since arriving in the 1980s. The species was found in more than 30% of 32 lakes surveyed in 2004. Unlike most aquatic plants, *Najas minor* is an annual species, reproducing through production of large numbers of small seeds, which are eaten by waterfowl. Because waterfowl distribute spread the seeds widely, it will be difficult to prevent the spread of this species.

***Iris pseudacorus*, Yellow iris:** This perennial species is native to Europe, Asia and Africa. It has been planted in the United States since the mid-1800s and quickly escaped from cultivation. It can form large clonal populations, displacing native plants in wetlands and on the edges of lakes and rivers.

## Freshwater Invertebrates

***Corbicula fluminea*, Asiatic Clam:** The Asiatic clam, a freshwater mollusk, broods its larvae in its gills, releasing them into the water column as post-larval juveniles with the ability to resist downstream transport by currents (Balcom 1994). The clams and their larvae can be drawn into intake pipes and the live animals or empty shells and body tissues obstruct water flow through condenser tubes, intake screens, valves, and service water (fire protection) systems (Balcom 1994). These clams inhabit parts of the Connecticut River and have also been found in several Connecticut lakes.

## Management Class 3: Established, But No Known Effective Controls

Includes species established in Connecticut, with known impacts (or potential for impact), but with no known available effective or appropriately effective management techniques.

## Marine Algae

***Codium fragile tomentosoides*, Green Fleece or Deadman's Fingers, Oyster Thief:** A green seaweed with one or several thick upright branches arising from a spongy basal disk. The branches are dichotomous and in general 15-20 cm long and 3-10 mm in diameters, but branches up to 1 m long have been recorded. The fronds are normally annual; they disappear in winter to grow again from the perennial basal disk in spring. This invasive subspecies seems to reproduce only parthenogenetically. Along the U.S. eastern seaboard, it occurs from North Carolina to Nova Scotia, first appearing in 1957. *C. fragile* ssp. *tomentosoides* is among the most invasive seaweeds in the world. It derives at least one of its common names from its propensity to attach to bay scallops and oysters. Inhabiting both estuarine and marine shores, it is tolerant of a wide range of environmental conditions (temperature, salinity, irradiance). It can occur both subtidally and intertidally. On NW Atlantic shores it is primarily subtidal, but in recent years it has expanded its distribution into the low intertidal zones. Juveniles of *C. fragile* ssp. *tomentosoides* are inhibited by high irradiances at high temperatures, while the adult thalli are not affected by high irradiance. Therefore, high irradiance may restrict the distribution and abundance of juvenile phases, but the adult thalli, once established may be able to persist. *C. fragile* ssp. *tomentosoides* is not an attractive food to most generalized grazers, although *C. fragile* ssp. *tomentosoides* is frequently covered with epiphytes, which generally modify grazers' preferences. In many localities it appears that ssp. *tomentosoides* is not able to displace algal populations, however, once established, it prevents native species from re-establishing. First reported in New York in 1957 (Carlton 1992).

## Freshwater Inland Plants

***Glossostigma cleistanthum*, Mud Mat:** Recently this species has turned up on salt to brackish intertidal shores along the CT River, and inland in freshwater reservoirs. Additional inventory work needs to be done to determine the extent of the species in CT. It is a small plant that resembles *Limosella subulata*, Mudwort which is a native species in CT.

## Pathogens

***Perkinsus marinus*, (Dermocystidium oyster disease:** Lethal to the Eastern oyster, Dermo was first documented in Long Island Sound in 1990. Transmitted from oyster to oyster, the infection is usually caused by parasites released from dead oysters. It is a slow killing disease, suppressed by low salinities and low temperatures. At high temperatures,

mortality rates can be very high. As with MSX, eradication of this pathogen is likely impossible. Minimizing contamination will require careful screening of oyster seed, approval of sources, and monitoring of existing oyster growing areas.

***Haplosporidium nelsoni*, MSX oyster disease:** Lethal to Eastern oyster, *Crassostrea virginica*, this parasitic disease was first described in LIS oysters in 1968, but was not documented by the State until 1998. The disease is transmissible from oyster to oyster but the infection pathway is unknown. The parasite is suppressed by low salinities and low temperature; mortality rates of oysters can be very high.

Eradication is impossible, although shellfish harvests can be managed around the disease.

***Neoparamoeba pemaquidensis*, Lobster Paramoeba:** This parasitic paramoeba was discovered in the nervous tissues of dead and dying American lobsters, *Homarus americanus*, in 1999 as the lobster resource in Long Island Sound suffered a significant mortality event (Mullen et al 2005). It has subsequently been found in water and sediment samples from Long Island Sound and while it is known to have been present in LIS before the lobster die-off, its origin is cryptogenic.

**Mycobacteria:** Of special concern is the occurrence of mycobacteria in marine finfish. Species of Mycobacterium cause disease in over 160 species of saltwater and freshwater fish. Mycobacteriums are ubiquitous in the environment, surviving in water, sediment or fish species. *Mycobacteria shottsii*, first reported in 1997 in Chesapeake Bay, is an epizootic, chronic wasting disease, similar to tuberculosis (TB) in humans. It is a slowly developing chronic disease, taking two or more years to develop. While the disease itself is confined to the internal organs, with external sores and lesions, its symptoms include emaciation, exophthalmia, lordosis, hemorrhagic and dermal ulcerative lesions or loss of scales. This organism also has the potential to infect humans who handle diseased fish, especially when infected areas come into contact with open wounds. The severity of the disease to humans is related to age. There is no known cure for this disease in fish. (David Molnar, email communication, 21 June 2004).

## Marine Invertebrates

### Ascidians (Tunicates)

Also called tunicates or sea squirts, ascidians are encrusting organisms that are able to rapidly colonize marine substrates as solitary organisms or in colonies. Impacts of these organisms include competition with native species for suitable substrate, direct impacts to organisms on which they

settle and attach, consumption of planktonic larval forms of other species including oysters, and fouling of vessels and coastal infrastructure (docks, hulls, lines, pipes, traps, etc.). Seven nonindigenous species of tunicates have been documented in Long Island Sound, predominantly east of the Connecticut River: *Styela clava*, *Styela canopus*, *Diplosoma listerianum*, *Asciidiella aspersa*, *Botryllus schlosseri*, *Botrylloides violaceus*, and *Didemnum* sp. Concern has been raised by these tunicates' ability to rapidly spread over vast geographic areas. *Styela* and *Botrylloides* were documented to have spread from Connecticut to Maine in fewer than 10 years (Whitlatch et al. 2003). Research into means of transport and control technologies will be necessary to manage impacts from these organisms. The compound sea squirt, *Didemnum* sp. was discovered in eastern Long Island Sound in 2002 (Whitlatch 2004). It is a highly invasive colonial tunicate that alters marine habitats and threatens to interfere with fishing, aquaculture, and other coastal and offshore activities. The first documentation of this species in offshore waters occurred in 2003 when researchers found an extensive and dense mat of the animals on the northern edge of Georges Bank, about 160 miles off Cape Cod (NOAA News Online 2003). The 6.5 sq. mile mat of sea squirts, at a depth of 135 feet, is covering the hard sea bottom and the organisms that live there. In coastal waters of New England and California, *Didemnum* fouls coastal structures and seabeds. In New Zealand, an infestation by a similar tunicate threatened green mussel aquaculture operations in 1991 (NOAA News Online 2003). This species of tunicate reproduces both sexually and asexually. While the larvae are fragile and short-lived, fragments of the mats can float and reattach to a hard surface somewhere else. The sea squirts also exude a noxious substance that discourages predation and fouling of the mat (NOAA News Online 2003)

**Membranipora membranacea, Lace Bryozoan:** Initially settling on kelp where it forms flat colonies, this species is a calcareous bryozoan whose growth weakens the alga and causes it to break. The lace bryozoan has contributed to the declines of kelp beds in the Gulf of Maine since the early 1990s, facilitating colonization by another invader, *Codium fragile* ssp. *tomentosoides*. The introduction of these organisms has caused declines in available habitat for

important finfish such as juvenile cod, the green sea urchin (*Strongylocentrotus droebochiensis*), and numerous invertebrate species (Scheibling, 2001).

**Hemigrapsus sanguineus, Asian Shore Crab:** The Asian shore crab, first found in Long Island Sound in 1993, is now the dominant crab species in the rocky intertidal zone, with densities exceeding 100 crabs m<sup>-2</sup> (Lohrer 2000). Researchers surmise that it most likely did not competitively displace resident crabs from the Sound's rocky intertidal habitat, but instead appears to occupy a habitat that is marginal to and/or underutilized by other resident species, very similar to its native habitat of cobble and boulders (Lohrer et al. 2000; Lohrer 2000). Densities of green crab recruits and juveniles have declined in the rocky intertidal of Long Island Sound, as the numbers of *Hemigrapsus* have increased (Lohrer 2000). The Asian shore crab is tolerant of a wide range of physical conditions and is an opportunistic omnivore feeder with a large reproductive capacity, producing several broods per year of >40,000 eggs per brood (Lohrer et al. 2000). The crab can readily consume juvenile bivalves (hard clams, soft-shell clams, oysters, and blue mussels less than < 20mm in shell length), as well as tiny snails, worms, crabs, barnacles, and red (*Chondrus crispus*) and green algae (*Enteromorpha* spp.) (Brousseau et al. 1999; Lohrer et al. 2000; Lohrer and Whitlatch 1997).

**Carcinus maenas, European Green Crab:** The green crab was introduced to the western shores of the Atlantic more than 150 years ago. In Connecticut, it is currently sold for bait, providing some economic benefit. However, the green crab has been blamed for the collapse of the soft-shell clams resource in New England and the maritime provinces of Canada, and more recently has caused losses as high as 50% in Manila clam stocks in California (Lerner and Heimowitz, 2000). Once quite abundant in Long Island Sound, this introduced species has been replaced by the Asian shore crab as the most abundant crab species in Long Island Sound. Nevertheless, should Connecticut develop a soft-shell clam industry in the future, the green crab would pose a predatory threat, and therefore remains a priority species.

## Management Class 4: Established, Impacts Unclear

Includes species that are established in the waters of Connecticut and may have the potential to cause impacts, but current knowledge is insufficient to determine if control actions are warranted.

### Freshwater Inland Plants

**Marsilea quadrifolia, Water-shamrock; European watercress:** A native of Europe, this aquatic fern has occurred in Connecticut since 1860 and is now found in several lakes and ponds. It has not spread aggressively but can over winter and remains a concern. It produces floating leaves and some that rise above the water.

**Nelumbo lutea, American water lotus:** A native of Southern states, water lotus produces large yellow flowers, which are raised out of the water, as are the large leaves. The plant reproduces by seeds, which can remain viable in the sediment for many years.

**Rorippa microphylla and Rorippa nasturtium, Watercress:** Watercress is sold in grocery stores and has been introduced into wetlands and streams by people who grow it for use in cooking and salads. The two species are difficult to distinguish from each other. Both are native of Europe, the Middle East and Africa, and both are potentially invasive in Connecticut. *R. nasturtium* has been found in all the states of the United States except for North Dakota and Hawaii, and it occurs in several locations in Connecticut. It can grow very rapidly, and seeds remain viable for several years. *R. microphylla* has been found in scattered locations throughout New England.

### Pathogens

**Pfiesteria:** Cysts of Pfiesteria have been found in LIS, however, no outbreaks have occurred to date.



## Management Class 5: Potential AIS – Not Yet Established in Connecticut

Includes category species or species groups of concern that have the potential for introduction or have been documented in Connecticut but **are not reproducing, self-sustaining populations**. Concern for these species is based on the invasive characteristics displayed by these species in areas with similar environmental conditions, and those species with viable pathways for introduction into Connecticut.

### Freshwater Invertebrates

***Eriocheir sinensis*, Chinese Mitten Crab:** Native to China, this species is easily identified by its conspicuous furry “mittens” on each claw. It has spread throughout parts of Europe, and was found in San Francisco Bay in 1992. Individuals have also been reported in Lake Erie, and along the Louisiana coast. This crab inhabits the bottoms and banks of freshwater rivers and estuaries. As sexual maturity occurs, the crabs begin migrating toward coastal waters where spawning occurs. Main source of food is submerged vegetation. Proficient at burrowing, mitten crabs can weaken earthen retaining walls and collapse riverbanks. This species is one intermediate host of lung flukes in Asian.

***Potamopyrgus antipodarum*, New Zealand Mud Snail:** This snail is a parthenogenic livebearer, with high reproductive potential. Reported densities range from 100,000 – 750,000/m<sup>2</sup>, causing them to choke out native species in a river and comprise the vast majority of the invertebrate biomass. They are reported in the U.S. (Montana, Wyoming, California, Idaho, Utah), Lake Ontario, Europe and Australia. (USGS Florida Integrated Science Center, Montana State University)

### Freshwater Vertebrates

***Ctenopharyngodon idella*, Grass Carp:** In the 1960s, the U.S. began to culture the grass carp, an herbivorous fish native to China, for biological control of rooted aquatic vegetation. Since then, the fish has escaped from containment facilities to invade the surrounding aquatic habitats. The grass carp is now found in all 48 contiguous states of the US. Populations in CT and many states consist exclusively of triploid fish and are not self-sustaining. Though the grass carp has successfully decreased populations of certain aquatic invasive macrophytes, it is not selective in its feeding and is capable of destroying all of the plant life where it has been introduced, including native species.

***Pygocentrus spp.* and *Serrasalmus spp.*, Piranha spp.:** The popularity of piranha as aquarium fish has resulted in their introduction to many U.S. states including Connecticut (populations not established). Though these fish are not likely to survive winters in the Northeast, these species are renowned as voracious predators. Sale and possession of this species is still legal in several Northeastern states, and it is readily available via the Internet trade. It is hoped that the Pet and Aquarium Trade Industry’s Habitattitude™ campaign, promoting the proper disposal of unwanted fish, will help reduce the release of unwanted piranhas into local waters.

***Scardinius erythrophthalmus*, Rudd:** Originally imported from Europe in the late 1800s as baitfish, this species has since been found in freshwater and estuarine habitats in at least 20 states, including most of the Northeastern United States. Reproducing populations of rudd have been found in the lower Charles River in Boston, Massachusetts. Dispersal appears to be through interstate traffic from the bait and aquaculture industries rather than new European

imports. The impact of the rudd is largely unknown, but it is able to hybridize with the native golden shiner.

***Clarias batrachus*, Walking Catfish:** This fish first escaped from a Florida aquarium fish farm in the mid-1960s. It has since invaded the entire southern region of Florida and has also been found in Connecticut (populations not established), California, Georgia, Massachusetts, and Nevada. An extremely opportunistic species that will feed on any available food source, the walking catfish is also readily available through Internet web sites as an aquarium fish.

### Freshwater Inland Plants

***Eichhornia crassipes*, Common Water-Hyacinth:** native to South America, this plant reproduces vegetatively by short runner stems that radiate from the base of the plant to form new plants as well as by seed. Plants have been found in a few water bodies in CT and are believed to have been deposited by people who were growing the plants in water gardens.

***Nymphoides peltata*, Yellow Floating Heart:** The small heart shaped floating leaves of this plant resemble our native floating heart. However, the flowers of the invasive plant are yellow.

***Pistia stratiotes*, Water lettuce:** A floating plant native to South America, used as a pond ornamental. Under optimal conditions, these plants can double its population size in less than three weeks. Water lettuce often forms large expanses of dense, impenetrable floating mats, adversely affecting boating and fishing activities, flood control, and wildlife. This plant is not yet known to be able to over winter in CT, but with evidence of climatic warming we need to monitor the status of this species.

### Marine Algae

***Undaria pinnatifida*, Wakame, Asian kelp, Apron ribbon vegetable:** This large Asian coldwater brown kelp is currently found along the U.S. west coast, Japan, and New Zealand. If it is introduced to the northwest Atlantic, it has the potential to displace the native sugar kelp, *Laminaria saccharina*. This could change the benthic community and ecosystem structure. This seaweed can reach an overall length of 1-3 meters, and has both macroscopic and microscopic stages. It is harvested from both natural and cultured populations in its native Asia, and sold for its commercial food value as a flavoring for miso soup, among other uses. Worried about native shellfish populations, New Zealand spent \$500,000 to eradicate the alga when it was found on the wooden hull of a Korean vessel traveling in New Zealand waters. *Undaria pinnatifida* is considered a highly invasive species, and it is listed as one of 100 world’s worst invasive alien species (UICN). This alga possesses five features that make it a highly successful invasive species: 1) its behavior as an opportunistic weed and its ability to rapidly colonize new or disturbed substrata and artificial floating structures; 2) its occurrence in dense, vigorous stands on benthic shores, forming a thick canopy

over the subordinate biota; 3) its occupancy of a wide range of shores varying in exposure; 4) its extensive vertical distribution, from low tide level down to 15 m in suitably clear waters; 5) the extended period of reproductive spore formation and release observed in introduced populations). *Undaria pinnatifida* is tolerant to a wide range of environmental conditions (temperature, salinity, irradiance). It tolerates a wide range of irradiance from full sunlight in the low intertidal to very low levels in the silty waters of harbors. It grows in a wide range of wave exposure from sheltered marinas to the open coast and extends vertically from the low intertidal to 18 m depth. *Undaria* can grow on any hard natural or man-made surface. To date, there is no evidence that non-native *Undaria* populations have displaced native algae, however it does not show a devastating effect on the native ecosystem as other invasive algae, but ecological studies are yet scarce. Transport vectors include humans, shell stock shipping, ballast water, and ship hulls (Murray et al., in press).

#### ***Caulerpa taxifolia*, Green Alga (Chlorophyta;**

**Mediterranean strain):** The Mediterranean strain of *C. taxifolia* has become highly invasive in Europe, Australia and California. Accidentally released, this green alga now covers the bottom for miles of coastline off France, Italy, Greece, Monaco, and Croatia, overgrowing native plants and animals at an average rate of expansion of 50 km per year (Vroom and Smith 2001-Hawaii plan). Clean-up efforts in California have exceeded \$6 M). This is a potential species of concern for Connecticut, particularly if the region undergoes an extended warming trend. The ANSTF has drafted a management plan for *Caulerpa*. *C. taxifolia* is listed on the Federal List of Noxious Weeds.

***Sargassum muticum*, Asian Seaweed:** This Asian species of seaweed was introduced intentionally, and is now found in Europe and the west coast of the U.S. It dominates the low littoral communities and upper subtidal regions, and has a smothering or crowding effect. It may be spread by the bait industry.

### **Pathogens**

**QPX, Quahog Parasite Unknown:** This recently recognized disease agent in hard clams, *Mercenaria mercenaria*, is not yet named. It is caused by a member of phylum Labyrinthulomycota, a group of microorganisms that live in marine and estuarine environments on micro and macro algae and detritus (National Academy of Sciences 2004). Sometimes pathogenic, it is associated with mortality of mollusks in captivity or under culture, particularly in more northern culture areas (Ford 2001). QPX outbreaks appear to be caused by an enzootic parasite, which may cause no obvious problems in its resident hosts, but is highly pathogenic to non-local stocks of same species (National Academy of Sciences, 2004). Currently, its range extends from New Brunswick, Canada, where it was first documented in 1960, to New Jersey and Virginia where it has been found within the last five years (Ragone et al. 1997).

### **Marine Invertebrates**

***Crassostrea ariakensis*, Suminoe Oyster:** As the populations and harvests of the native Eastern oyster, *Crassostrea virginica*, have dropped to all-time lows, the states of Virginia and Maryland are seeking ways to restore the oyster industry in the Chesapeake Bay. The possibility of introducing the Suminoe oyster is being considered because limited laboratory tests on sterile Suminoe oysters have shown that the non-native species grows faster and does not appear affected by Dermo or MSX (Blankenship 2004). Studies show that *C. ariakensis* has rapid growth, high

survival and low infection rates after exposure to *H. nelsoni* and *P. marinus* in various Virginia waters (National Academy of Sciences 2004). Current unknowns include how will *C. ariakensis* react in the Bay, will an introduction succeed, and if and how the Suminoe oyster and Eastern oyster might compete for space and food (Blankenship 2004). Two reviews of existing data have been conducted by the National Academy of Sciences in 2003 (National Academy of Sciences 2004) and the Chesapeake Bay Program's Scientific and Advisory Committee in February 2004 (Blankenship 2004). Researchers noted that an introduction of *C. ariakensis* into the Bay would "likely to be irreversible" and that it is inevitable that *C. ariakensis* will spread beyond the Bay. Scientists are concerned that even if *C. ariakensis* is not directly affected by the oyster diseases MSX and Dermo, they might act as a reservoir or a sink for those diseases (Blankenship 2004). Further cause for concern is that *C. ariakensis* was recently found to be affected by one or more previously unknown species of the parasite, *Bonamia*, by researchers at VIMS (*Bay Journal* 2004). These species are implicated in the massive die-off of *C. ariakensis* oysters in an aquaculture experiment in North Carolina in 2003 (*Bay Journal* 2004). Additional questions include how the parasites spread to and from the Suminoe oyster, and it can survive in low salinity as well as high salinity (*Bay Journal* 2004). Vectors include humans, boat hulls, and currents.

***Rapana venosa*, Veined Rapa Whelk:** This predatory gastropod was first found in 1998, in the Virginia waters of the lower Chesapeake Bay near Hampton Roads (Mann and Harding, 1998). The snail is a predator of bivalve mollusks. Even at a young age, rapa whelks are able to consume mussels, oysters, razor clams, and young hard clams, and will prey on increasingly larger sizes of oysters and hard clams as they mature (Harding et al. 2003). The rapa whelk's native range includes the East China Sea to the Yellow Sea to the Sea of Japan; the snail was most likely introduced into Chesapeake Bay through ballast water discharge (Harding et al. 2003). The rapa whelk begins to reproduce in its first year, producing millions of larval snails. This is in contrast to the native predatory gastropods, the channeled and knobbed whelks, which begin reproducing after seven years and only produce 100s of offspring each year (Harding et al. 2003). The rapa whelk's thick shell makes it essentially safe from predators at a shell length of 100-120 mm, while the native snails have thinner shells and are subject to predation throughout their lives (Harding et al. 2003). This species prefers salinities greater than 15 ppt, and can inhabit environments with water temperatures ranging from 4° to 30° C; requiring several weeks to a few months at temperatures between 18° – 20° C in order to reproduce (Harding et al. 2003) VIMS researchers predict that these snails could survive in coastal waters from southern Florida to north of Cape Cod, including Long Island Sound (Harding et al. 2003).

***Styela plicata*:** A big Asian tunicate species, it grows to be about 3" long and golf ball size, and is a biofouling organism. It is currently found on the U.S. west coast and in Chesapeake Bay.

## Appendix C. Description of Pathways and Vectors for ANS in Connecticut

This section provides a more detailed description of the various key vectors for ANS into (and out of) Connecticut.

### Natural Vectors

Spreading of aquatic nuisance species can occur naturally. Planktonic larvae can move with water currents, as can fragments of various aquatic weeds and seaweed spores. However, some natural vectors pose a far lesser risk; for example, one study shows that it is very unlikely that waterfowl serve as a primary transport vector for zebra mussel larvae (Johnson and Padilla 1996).

### Managed Aquatic Resources

**Research Equipment:** Researchers moving from one water body to another without thoroughly cleaning and drying boats, nets, trailers, and other equipment may inadvertently spread non-native nuisance species. Equipment used to collect biological and physical data for studies of aquatic ecosystems may be difficult to decontaminate. Protocols for sampling need to be developed so that non-native nuisance species are not introduced by agencies, institutions, and consultants when collecting data. All water quality monitoring programs and projects involving data collection funded by EPA require a Quality Assurance Project Plan. A similar plan that prevents non-native nuisance species from being transported by research programs, based on HACCP principles, could be included for monitoring projects receiving state or federal funds. Such a plan would reduce the probability of spreading ANS and demonstrate to the public that the environmental professionals are leading by example.

**Weed Harvesting Equipment:** Use of commercial weed harvesting equipment is common in Connecticut. Most lake communities and private property owners do not have the need or the means to own weed harvesting equipment so contractors are hired to remove vegetation. Weed harvesters and hydrorakes are often employed to control existing populations of non-native nuisance plants such as Eurasian and variable water-milfoil or fanwort, all of which are widespread throughout Connecticut. Weed harvesting equipment consists of cutting bars, conveyor belts, gears, and other parts that become thoroughly entangled with plants when cutting and carrying vegetation, making removing all plant fragments from the machine difficult. Rather than suspend use of a machine during the busy recreational season, contractors may move harvesting equipment from one lake to the next without adequate time to decontaminate and dry equipment before entering another water body. Plant materials detaching from harvesting equipment represents a serious threat and may be responsible for much of the spreading to date of non-native nuisance aquatic plants in Connecticut. Protocols for cleaning weed harvesting equipment, based on HACCP principles to minimize the risk of spreading aquatic weeds between water bodies must be developed.

### Transportation Vectors

**Commercial Shipping:** Commercial shipping is often considered the most important means of unintentional introductions of ANS to coastal and estuarine waters of the

United States and worldwide (Thresher 2000). The steady rise of global commerce, increased shipping activities, and shorter transport times suggest that the threat of introductions through this pathway is likely increasing. To date, the shipping industry has dominated the field of ANS research in the United States.

**Ballast Water:** Shipping vessels commonly fill and release ballast tanks with seawater from harbors as a means of stabilizing loads. Research clearly indicates that live marine organisms ranging from plankton to adult fish are regularly transported and released via this pathway (Burke 2001; Cohen and Carlton 1995). New US Coast Guard regulations were promulgated in 2004 in lieu of the relatively low compliance with the voluntary ballast water exchange guidelines [compliance was ~30% in the Northeast (Pederson 2003)], making ballast water exchange and reporting mandatory. All vessels equipped with ballast tanks operating on U.S. waters must implement mandatory ballast water management (USCG 2004; Federal Register 2004). Vessels entering U.S. waters after operating beyond the EEZ must meet additional requirements, and all vessels are required to keep records and report their ballasting operations whenever entering a U.S. port (USCG 2004; Federal Register 2004).

Although Connecticut recognizes the threat from ballast water discharge, ports in the State may receive relatively little ballast water as compared to other major ports in the US due to local trade patterns. Connecticut may actually be a net exporter of ballast water. According to U.S. Maritime Administration data, two Connecticut ports, New Haven and Bridgeport, ranked 55<sup>th</sup> and 86<sup>th</sup> respectively, among the 100 leading U.S. coastal, Great Lakes, and inland ports in terms of short tons in 2000 (Pederson 2003). Concern over new ANS introductions to Connecticut through ballast water discharge, limited knowledge of current ballast water practices, and questions regarding the effectiveness of ballast water exchange point to the following needs:

- ◆ Assessment of the vessel types & ports of origin of ships currently using Connecticut ports
- ◆ Assessment of the compliance rate with USCG ballast water regulations among vessels using CT ports.
- ◆ Risk assessments of threats posed by different shipping facilities in Connecticut.
- ◆ More awareness of ANS by the shipping community.

LIS is a heavily utilized water body for the transit of commercial vessels, including oil tankers, cruise ships, freighters, barges, and U.S. Navy submarines. The USCG reporting requirement will provide the data necessary to better understand the implications this vector holds for LIS. ***While this CT plan does not currently include a strategy or tasks addressing ballast water in deference to the new USCG regulations, the vector will be reexamined in the future and may be addressed in future revisions.***

The Ballast Water Sub-Committee of the Northeast Regional ANS Panel is working towards the development of a MOU among the Northeast states and Canadian provinces that will address sensitive areas that should be 'no discharge' or 'no pickup' zones, delineates alternative exchange sites, addresses the treatment of sediments in NOBOBs (vessels with no ballast on board), and improves reporting and communication within the region (J. Pederson, MIT Sea Grant, personal communication May 18, 2004).

**Hull Fouling:** Hull fouling is a significant source of ANS introductions (Thresher 2000). Organisms attached to hulls of commercial or privately owned vessels can survive for extended periods. Introductions of these species can occur as they are dislodged inadvertently or during hull cleaning, or if they happen to spawn in a port. Increased awareness of the threats posed by transported fouling organisms by commercial shipping will be necessary to minimize introductions through this pathway. On-going studies show that the hulls of privately owned boats moving between summer and winter ports along the eastern seaboard can also serve as a vector for aquatic species (Whitlatch et al. 2003; Whitlatch 2004). Preliminary work examining more than 60 boat hulls in marinas in Fort Lauderdale and Fort Pierce, Florida, Beaufort, North Carolina, Mystic, Connecticut, and Newport, Rhode Island revealed a range of hull conditions, from clean to heavily fouled. Hull cleaning methods, particularly in-water or near water, where organisms can be washed into the water, could facilitate new introductions as well.

## Recreational Activities

**Boating and Fishing:** Lakes, ponds, and coastal waters of Connecticut provide recreational opportunities for a large population of boaters. The transportation of boats and their trailers between water bodies presents a risk of introduction through hull fouling, entanglement on boat engines and trailers, and water discharge from live wells and bait buckets (Hellquist 2001; Thresher 2000). The use of recreational boats for fishing poses the additional risk of the release of imported bait species or species that serve as hosts for nonindigenous organisms.

In Connecticut, with a few exceptions, the concern about the spread of zebra mussels from other states and infested areas in Connecticut is by overland dispersion as opposed to downstream transport and dispersal of planktonic larvae within connected bodies of water, which can occur more rapidly (Kraft and Johnson 2000). An evaluation of the rates of zebra mussel dispersal to inland lakes separated from source populations by dispersal barriers was conducted for lakes in Indiana, Michigan, and Wisconsin over a three-year period (Kraft and Johnson 2000). The researchers found that lakes with surface areas less than 100 ha had lower infestation rates than larger lakes, and that regional conditions also affected the colonization rates, which ranged from 0% to 12% per year among the three states (Kraft and Johnson 2000). The priority vector for overland dispersal is the movement of recreational boats transported from lake to lake on trailers.

Three lakes in western Connecticut – Lake Candlewood, Lake Zoar, and Lake Lillinonah are part of the Housatonic River drainage basin. These lakes are utilized to generate hydroelectric power through dams and an aqueduct that feeds Candlewood Lake. Based on water chemistry and high popularity among boaters and fishermen from Connecticut as well as from other states, these three lakes are considered “high risks” for zebra mussel introductions (Balcom and Rohmer 1994). A 1994 survey by Balcom and Rohmer assessed the awareness of zebra mussels by boaters or fishermen using the lakes, and assessed their boat use patterns. Fishermen (95%) had the highest awareness of zebra mussels and three-quarters knew that their boats and fishing activities could be a means for spreading zebra mussels (Balcom and Rohmer 1994). Pleasure boaters and jet ski operators were far less aware of the mussels and how they can be spread. The between-uses “drying out” periods for boats and jet skis ranged from two to eight days on average, although some boats were used on different water bodies on the same day (Balcom and Rohmer 1994). Most fishermen surveyed were not using live bait.

Recreational boats are also vectors for aquatic weed fragments – on lines, trailers and equipment. This vector has been addressed formally by a new regulation passed in 2003. Prior to that, educational efforts focused on providing information about the proper cleaning of boats before leaving any launch areas, using various tools such as CTSG, posters and signs, stickers, cards inserted in boat registration renewal notices, and alerts included in the annual CT DEP boating and fishing guides.

## Organism Handlers

A coalition of scientists from MIT Sea Grant, Williams College, Northeastern University, and Smith College assessed the risk of introduction through a variety of potential pathways including seafood companies, aquaculture facilities, bait shops, pet stores, public aquaria, marine research facilities, and wetland restoration efforts (Weigle et al. 2005 in press). The research team developed a database of companies and organizations involved in the transport and trade of both native and nonindigenous organisms and distributed a survey to industry representatives to determine the type, quantity, and frequency of nonindigenous species imports and exports. The survey also inquired about the industry specific handling techniques that could result in ANS introductions. HACCP principles could be applied to develop appropriately protective handling techniques.

**Bait Industry/Recreational Fishing:** The shipment of live organisms, such as marine worms, into (and out of) the state for use as bait may serve as pathways of introduction through their release (Weigle et al. 2005 in press). Packing materials are often comprised of plant or algal matter that harbor additional organisms which may become established if they are discarded into nearby water bodies with the packing materials. Another example is the purchase and use of the Asiatic clam, *Corbicula fluminea*, as bait. These clams are known in the aquarium trade as “pygmy” or “gold” clams. Whole discarded clams released by fishermen or private aquarists into lakes or rivers may become established if the right conditions prevail. The popularity of this species as a food item among some cultures could also lead to intentional introductions (Balcom 1994). Researchers believe it likely that green crabs were introduced into San Francisco Bay about 1989 (and the marine snail, *Littorina saxatilis*, in 1992) when seaweed such as the brown alga *Ascophyllum nodosum* – used to pack either live lobsters or bait worms, and harboring green crabs and other unknown organisms – was discarded in the Bay (Cohen et al. 1995; Carlton 2000).

**Shellfish Waste Disposal:** Shells and other unwanted materials discarded following shellfish processing (shucking) might harbor shellfish pathogens or live epiphytes. Disposal of this material in or near a water body could result in unwanted introductions as well as other types of water quality impairment, depending on the origin of the shellfish.

**Live Seafood Market:** The risk of introduction to local northeast Pacific environments of nonindigenous marine and estuarine bivalve species commercially available as live seafood has been shown to be significant (Chapman et al. 2003). Of 24 nonindigenous marine and estuarine species that were commercially available, 11 have established, self-sustaining populations in northeast Pacific environments (Chapman et al. 2003). While the use of non-native species for culturing purposes is weighed based on concerns over the potential escape and establishment of these species in the wild, displacing or corrupting native species, the import of live seafood for commercial markets does not receive this same consideration. The viability of the seafood species was tested by looking at their competence to feed (Chapman et al. 2003).

In addition to the introduction of the nonnative species themselves, concerns are also raised about what parasites, diseases, and other organisms these non-native species could be harboring. The Communications, Education, and Outreach Sub-committee of the Northeast Regional ANS Panel is planning to investigate and address ANS concerns connected to the live seafood market through educational materials as part of its 2004-2005 work plan (A. Smagula, NH Department of Environmental Services, personal communication May 17 2004). Connecticut will make use of these materials when they become available.

**Bivalve Wet Storage:** Holding of shellfish in flow-through systems subjects the surrounding surface waters to pathogens and other organisms that may be contained in discharged waters, if proper pre-cautions are not in place to treat the water before discharging it. Packing and transport of shellfish in algal or plant material also poses the risk of introductions through the improper disposal of packing materials (Weigle et al. 2005 in press).

**Creation of New Fisheries:** Several introductions of aquatic invaders in the United States, such as the Chinese mitten crab (*Eriocheir sinensis*) on the west coast, and the Northern snakehead (*Channa argus*) in the Northeast, may have resulted from the intentional release of species that constitute commercially valuable fisheries in other countries (Whitlatch et al. 1995; USFWS 2003). Seafood suppliers and commercial and recreational fishers, unaware of detrimental impacts resulting from their introduction, may be tempted to release these species into local aquatic systems to establish a self-sustaining population that can be harvested for consumption, pointing to the need for additional educational efforts specific to this pathway. Chapman et al. (2003) note that "improved assessments of the live seafood trade as a potential mechanism for introductions of nonindigenous species are needed", including the "development of measures to limit introductions" and "screening of imported species for invasiveness". There are people who would sooner release live seafood into the ocean as eat them, or may intentionally introduce them to start a new fishery without being aware that permits are required and unlikely to be issued for that purpose.

**Aquaculture:** Like the seafood industry, aquaculture is an important and growing sector of the Connecticut economy. It will likely continue to grow as commercial fishermen seek new opportunities in the face of increasing constraints on wild harvests. Shellfish farming has been occurring in LIS for more than 100 years and currently about 70,000 acres of leased shellfish grounds are in cultivation in Connecticut state waters. While intensive culture of both finfish and shellfish reduces environmental impacts resulting from the harvest of wild stocks, concerns related to water quality impairment, growth and distribution of pathogens, escape of nonindigenous species, and genetic dilution indicate the need for careful planning for this industry. The following are examples of mechanisms for nonindigenous species introductions through intensive aquaculture operations:

**Shellfish Seed Import:** Increasingly, due to poor natural sets of oysters and clams in Long Island Sound, shellfish seed are commonly grown in local hatcheries or purchased from approved out-of-state hatcheries. The CT Department of Agriculture, Bureau of Aquaculture regulates the species of shellfish that may be imported for aquaculture in Connecticut and the sources of those shellfish. The Atlantic States Marine Fisheries Commission (ASMFC) has set up a protocol for movement of shellfish as well. The restrictions in place are to minimize the likelihood of introducing non-native species of shellfish and any associated pathogens or parasites. There is the potential for the import of shellfish

pathogens and other organisms associated with shellfish, such as boring organisms, from out of state. Enhanced culture of local seed stocks in Connecticut, and an enhanced capacity to identify and manage shellfish diseases will be necessary to minimize the loss of shellfish due to these threats.

**Use of Cultch:** The Eastern oyster, *Crassostrea virginica*, needs a clean, hard surface on which to settle and attach, and is particularly attracted to oyster shell. Placement of clean, dry **cultch** (shells) in grow-out areas attracts settling juveniles of the Eastern oyster (*Crassostrea virginica*). The Department of Agriculture has a program to purchase shell or other cultch material for deposit on State shellfish beds to enhance the natural set of oysters (currently suspended due to budget constraints) (D. Carey, DA/BA, personal communication December 14, 2005). Concerns have been raised over the source and proper disinfections of cultch material and the potential transport of shellfish pathogens or other associated nonindigenous species, and could be addressed through a HACCP plan.

**Finfish Culture:** Growth and maintenance of finfish in open systems such as raceways, flow-through tanks, and net pens could expose surrounding aquatic systems to pathogens associated with cultured fish populations. Cultured fin and shellfish sometimes represent imported or altered genetic stocks that are selected for maximum growth or some other desirable trait (i.e., shell shape and color, faster growing). Cultured stocks are usually at a disadvantage in competing with wild populations. However, interbreeding may dilute the wild genetic pool, making offspring more poorly adapted to life in natural systems. Safeguards must be in place to prevent releases of organisms from land-based or marine-based aquaculture systems to prevent threats to the marine resources of the State.

**Aquarium/Water Garden Trade:** Nonindigenous marine and freshwater organisms can be introduced accidentally or purposefully after being imported for use in public or private aquaria and water gardens (Carlton 2001; Crow and Hellquist 2000). The CT DEP prohibits the sale of most freshwater fish that can over-winter in the wild in temperate climates<sup>2</sup>. However, freshwater macrophytes available through these industries are often native to temperate regions, and are selected due to their ability to thrive under adverse environmental conditions. Of additional concern is the mislabeling of imported organisms, particularly aquatic plants, which may then be confused with native or innocuous species and released.

Currently, Connecticut's authority to monitor and regulate sales of invasive plants and invertebrates through the aquarium and water garden trades is unclear or non-existent. Pet store inspections currently focus on animal health and safety.

**Aquascaping:** Recently, two infestations of Hydrilla have been attributed to aquascaping. Aquascaping is the designing and planting of aquatic vegetation in water bodies for landscaping, permit compliances, and resources management purposes. Aquascaped water bodies differ from water gardens in that the water body is much larger, existed prior to the aquascaping, and does not have a bottom liner. In many cases, aquascaping is done with native vegetation; however, native plant stock used for aquascaping can come from locations where non-native invasive plants such as hydrilla are common. Fragments of non-native plants can attach to native plant stock as hitchhikers and become introduced to a water body when the

native stock is planted. Even with Connecticut's new regulations restricting sale and transport of some non-native invasive plants, aquascaping is not considered in the legislation and represents another pathway for introduction of nuisance species to Connecticut.

## Research

**Research and Supply:** Marine and freshwater species can be ordered from research and education supply companies around the world through catalogue or Internet web sites. While these organisms are generally supplied for research and education purposes, multiple companies supply species for use in home aquaria. Few organism suppliers, including marine labs and research facilities, require documentation of use and handling practices prior to shipping. Connecticut has limited capacity to monitor and regulate the import of these species, particularly those that are obtained through mail order or via the Internet. Control of introductions via

this pathway is likely a federal responsibility, though states can play a role by ensuring that providers carefully monitor their shipments and provide recommendations for care and handling. Once organisms are delivered, improper handling techniques may result in the release of nonindigenous imports. Both lab and field routines present the opportunity for accidental or purposeful release through wastewater discharge, disposal of unwanted organisms, poorly contained studies, etc. At least one invasion has been documented in Massachusetts via this pathway (Whitlatch et al. 1995).

The Marine Biological Laboratory, Woods Hole, is currently developing guidelines for both distribution and handling of nonindigenous organisms. Through the implementation of this plan, Connecticut and the Northeast Regional ANS Panel will undertake steps to ensure that such management practices are considered for implementation by research facilities and laboratories maintaining and distributing live aquatic organisms in the region.

## Appendix D. Table of Existing Agreements, Laws and Regulations

Scope	Year	Identification Code	Title	Description
International	1993, 2004	A.868(2)	IMO Assembly Resolution, Convention on Ballast Water Management	Establishes international guidelines for the control of ballast water; approved convention on ballast water management (February 2004).
Federal	1990	NANPCA, PL 101-646	The Nonindigenous Aquatic Nuisance Prevention and Control Act	Ballast water management, recreational activity guidelines, state management plans.
Federal	1996	PL 104-332, 110 Stat. 4073, 10/26/96	National Invasive Species Act	Amended and broadened the 1990 act.
Federal	1999	PL 106-53	Water Resources Development Act	Authorizes the ACOE aquatic weed program that conducts research on control methods and provides a matching grant program for control of aquatic weeds.
Federal	1900	16 USC 701	The Lacey Act	Established a permitting process administered by the USFWS regulating the importation and transport of vertebrates, mollusks, and crustacea.
Federal	1939	7 USC 1551-1611	The Federal Seed Act	Requires proper labeling of seed imports.
Federal	2002	PL 101-171	Animal Health Protection Act	Enables USDA APHIS to conduct programs to protect livestock, including "farmed" aquatic animals, against pests and diseases.
Federal	1973	16 USC 1531-1544	The Endangered Species Act	Can be used to authorize eradication or control of ANS in some cases.
Federal	2000	PL 106-224	The Plant Protection Act	Superseded the Noxious Weed Act of 1974. Gives Federal Secretary of Agriculture authority to designate plants as noxious weeds by regulation, and prohibit the movement of all such weeds in interstate or foreign commerce except under permit, also provides for authority to inspect, seize and destroy products and quarantine areas.
Federal	1972	33 USC 1251 et seq.	Clean Water Act	Washington state plan states that this act could potentially be relevant if ballast water is considered pollution.
State		General Statute 22-11f	Licensing of aquaculture operation. Regulations. Control of importation and cultivation of nonnative plants or animals.	Dept of Agriculture, in consultation with CT DEP, shall adopt regulations concerning aquaculture facilities and operation and requires that regulations provide that aquaculture operations shall not adversely contaminate or impact wild stocks of aquatic plants, animals or their natural habitats.
State		General Statute 22-11g	Release from aquaculture systems	Prohibits the release of water, plants, animals or other material from any land based aquaculture system.
State		General Statute 22a-339g	Control of nonnative invasive plant species	CT DEP shall make recommendations and take appropriate control of nonnative invasive plants, prepare education material to distribute and prepare & maintain list of nonnative plant species.
State		General Statute 22a-66z	Permits for use of pesticides in state waters	CT DEP may issue permits for use of chemicals in waters of the state to control aquatic vegetation, fish populations or other aquatic organisms. Fee required for permit.
State		General Statute 26-22	Control of aquatic flora and fauna	CT DEP may use chemical, electrical or mechanical means to remove undesirable plants or animals from waters of the state for the purpose of increasing production of food for fish or for other fisheries interests
State		General Statute 26-55	Permit for importing, possessing, or liberating fish, wild birds, wild quadrupeds, reptiles, and amphibians	No person shall import or introduce into the state, or possess or liberate any live fish, wild bird, wild quadruped, reptile or amphibian unless a permit has been obtained from Commissioner of CT DEP.
State		General Statute 26-55a	Possession of diploid grass carp	Allows for the possession of diploid grass carp if introduced before June 1989 and CT DEP Fisheries was notified.
State		General Statute 26-119	Use of explosives or poisons	Prohibits the use of explosives for taking fish.

State		General Statute 26-149	Commercial hatcheries	A permit is required for a person to operate a commercial hatchery for an annual fee. Sets protocols for operation.
State		General Statute 26-224	Deposit of injurious substances in tidal waters or on oyster ground. Penalty.	Sets fine of \$200 or imprisonment for knowingly depositing any starfish, periwinkle or infected shellfish in tidal waters or on oyster beds.
State		General Statute 26-224a	Depositing of shellfish in tidal waters. Regulations.	Requires Dept of Agriculture to adopt regulations that set forth standards and procedures for the depositing of shellfish imported from outside the state to prevent the introduction of harmful parasites, diseases and pests.
State		General Statute 26-237a	Deposit of cultch material on state shellfish beds	Dept of Agriculture program will purchase shell or cultch material for deposit on state shellfish beds, also can purchase management supplies, material and spawn oyster stock.
State	2003	Public Act 03-136; Sect 15-180 Sect 15-140 Sect 26-8	An Act Concerning Invasive Plants	Establishes an Invasive Species Council that will undertake actions such as: develop a program to educate the public, merchants and consumers of aquatic and land based plants; annually publish & update a list of invasive plants; may make recommendations to the General Assembly re: import, export, retail sale or wholesale of any invasive plants; conduct or recommend research. This act also prohibits the transport of aquatic vegetation on boats and trailers and sets a fine of \$100 per plant. Bans import, sale, purchase, cultivation or possession of 7 aquatic plants (curly leaved pondweed, fanwort, Eurasian water-milfoil, variable water-milfoil, water chestnut, egeria and hydrilla), with a maximum fine of \$100.
State	2004	Public Act 04-203	An Act Concerning Fines for Banned Invasive Plants	Raises the number of banned plants to 81, including 22 aquatic and wetland plants. Sets fine for violation of Public Act 03-136 at \$100 maximum per plant.



## ***Appendix E. Agency Comments and Review***

Comments received from various agency staff were editorial in nature and were addressed in the plan document.

## ***Appendix F. Public Comments and Review***

### **Summary of Public Comments and Explanatory Statement for Draft Connecticut Aquatic Nuisance Species Management Plan**

Public Notice: The following actions were taken to inform the public of the draft plan and to gather, evaluate and respond to public comment.

- 1) A News Release announcing the availability of the draft plan and opportunities for public review and comment was sent out to all radio, TV and print media on June 16, 2005 (copy attached).
- 2) The draft ANS plan was made available on the Connecticut Institute of Water Resources web site as announced in the News Release. Hard copies were made available by contacting the Connecticut Department of Environmental Protection Inland Fisheries Division as announced in the News Release.
- 3) Announcements of the draft plan and public meetings were sent to all Connecticut Newspapers in two consecutive Weekly Fishing Reports dated June 15, 2005, and June 21, 2005.
- 4) News Release was e-mailed to all members of the ANS working group with instructions to electronically forward.
- 5) News Release was e-mailed to the Connecticut Federation of Lakes with instructions to electronically forward to all members.
- 6) News Release was e-mailed to all members of the Connecticut Invasive Plant Council.
- 7) News Release was e-mailed to all persons on the Connecticut Sea Grant electronic distribution list, as well as those on the Long Island Sound Watershed Alliance listserv.
- 8) News Release was posted on the Connecticut Institute of Water Resources (CTIWR) web site and was e-mailed to all persons on the CTIWR electronic distribution list.
- 9) Members of the CT DEP Fisheries Advisory Council and the CT DEP Conservation Advisory Council were sent electronic copies of the News Release.
- 10) The Department held two public meetings on the draft plan on June 29, 2005, (in Burlington) and on June 30, 2005 (in Old Lyme), and accepted written comments through July 14, 2005. What follows is a summary of the comments received along with the Steering Committee's responses to such comments including revisions to the draft text.

### **General Comments Supporting the Proposed ANS Plan:**

Comments: The general need for an Aquatic Nuisance Species management plan was supported by six people who spoke at the public meetings and by two people who sent in comment letters. Each of these individuals brought site-specific and/or species-specific concerns to the attention of the ANS Steering Committee.

Explanation: The ANS Steering Committee agrees with the public comment that a plan is needed to deal with problems caused by aquatic nuisance species. Specific concerns brought to the attention of the ANS Steering Committee are addressed below.

### **General Concerns Regarding the Proposed ANS Plan:**

**Comment:** Three speakers commented that the draft ANS plan should provide greater detail on how specific ANS problems are going to be addressed. The speakers were concerned about the effects of invasive plants on individual water bodies and wanted the plan to provide information on how these types of problems were going to be handled. The speakers were looking for details on funding and actions to be taken.

**Explanation:** The ANS Steering Committee believes it is beyond the initial scope of this plan to provide detail on control and management measures for specific ANS problems. Agency resources are currently insufficient. An ANS Coordinator is needed before detailed planning can proceed. Rather, the draft plan should provide direction and serve as a working document to ensure constant progress in addressing priority ANS problems and to ensure that detailed planning for site and species specific problems is undertaken.

### **Specific Comments Regarding the Proposed ANS Plan:**

**Comment:** One person commented about a problem with milfoil and pondweed in Rogers Lake and requested a consensus on treatment. The speaker wanted consensus recommendations among options that included hydroraking, harvesting, and herbicides, and requested an education piece that addresses all of the above.

**Explanation:** The CT DEP has a publication that provides information on most of these options. However, there is clearly no best method of treatment that fits all locations and circumstances. The draft ANS plan aims to ensure that the public is provided with thorough and timely input on ANS problems and options. This issue is addressed via Objective 6-C (Develop Education on Control Methods). To further address this need the ANS Steering Committee will add a task (6C3) entitled “Assemble and distribute education materials on control options.”

**Comment:** Three people commented about a problem with an overgrowth of vegetation in Wequetequock Cove, Stonington that is interfering with boating and fishing and, in the opinion of the speakers, is having an effect on fish and shellfish production. The speakers wanted an explanation of what is causing the problem and wanted something done to address the problem.

**Explanation:** This problem is believed to involve a native algal species (*Cladophora*) and may be caused by localized nutrient enrichment and/or sedimentation and shallowing. The ANS Steering Committee will refer this issue to the CT DEP Office of Long Island Sound.

**Comment:** Two people commented about a problem with milfoil, fanwort and other weeds in Anderson Pond (also known as Blue Lake). They requested information on the long-term effects of chemical herbicides. They also requested that the cost of the herbicides be partly subsidized by the State.

**Explanation:** The draft ANS plan aims to ensure that the public is provided with thorough and timely input on ANS problems and options including chemical herbicides. This issue is addressed via Objective 6-C (Develop Education on Control Methods). To further address this need the ANS Steering Committee will add a task (6C3) entitled “Assemble and distribute education materials on control options.” The ANS Steering Committee believes that the issue of funding for specific lake treatment efforts is beyond the initial scope of this plan. Efforts to obtain adequate funding to implement the Core ANS Program are outlined in concept in Objective 2 (Funding) and in tasks 2A1 (Identify and Secure Core Funds) and 2B1 (Identify and Expand ANS Funding).

**Comment:** One speaker commented that the State needs to consider helping lakes that have state boat launches since boats can bring in many problem species. Speaker felt that the state should provide financial support for treating ANS problems in such waters.

**Explanation:** The draft ANS plan recognizes the need for additional enforcement and additional education to reduce the threat of ANS introduction via recreational boating (task 3C1: Minimize Recreational Boating and Fishing Introductions). To further address this need the ANS Steering Committee will add a task (3C2) entitled “Increase Enforcement of ANS Boating Regulations.” The ANS Steering Committee believes that the issue of funding for specific lake treatment efforts is beyond the initial scope of this plan. Efforts to obtain adequate funding to implement the Core ANS Program are outlined in concept in Objective 2 (Funding) and in tasks 2A1 (Identify and Secure Core Funds) and 2B1 (Identify and Expand ANS Funding).

**Comment:** One speaker commented that the system in the draft plan for classifying ANS species needs to consider that many non-native species get established at low levels, lie dormant for years, and then, due to unknown factors, undergo a population expansion and become a problem. The speaker cited two Connecticut species as examples (tench and bowfin). The speaker emphasized the need to respond quickly when we see new species coming into the state. He also cautioned that we might not always know which species are going to have a significant impact. It was suggested that we err on the side of getting rid of unwanted exotics sooner rather than later. This will help prevent Class 1 species from becoming Class 2 species.

**Explanation:** The ANS Steering Committee agrees with these comments. The plan seeks to implement rapid response measures for a variety of species that are similar to efforts currently underway to eradicate water chestnut and hydrilla. The draft plan recognizes the need for enhanced monitoring and rapid response as per Objective 5 (Control and Rapid Response) and tasks 5A2 (Develop Rapid Response Protocol) and 5B1 (Conduct Taxa/Site-Specific Rapid Response). Available resources will determine the number of species and habitats that can be addressed by rapid response actions. Efforts to obtain adequate funding to implement the Core

ANS Program are outlined in concept in Objective 2 (Funding) and in tasks 2A1 (Identify and Secure Core Funds) and 2B1 (Identify and Expand ANS Funding).

**Comment:** Two people sent in letters commenting about an overgrowth of grasses in tidal areas of Greenwich Cove that is interfering with boating, swimming and fishing. The authors did not request any immediate action or any specific changes to the draft ANS Plan.

**Explanation:** The ANS Steering Committee is unaware of the species involved or if localized nutrient enrichment and/or sedimentation and shallowing are involved. The ANS Steering Committee will refer this issue to the CT DEP Office of Long Island Sound.

Draft Aquatic Nuisance Species Management Plan Available for Public Review and Comment  
(Press Release issued by CT DEP June 16, 2005)

**Public Meetings to be held on 6/29 and 6/30**

The Connecticut Department of Environmental Protection (CT DEP) and Connecticut Sea Grant have jointly announced public meetings to gather comment on a Draft Aquatic Nuisance Species (ANS) Management Plan. **Meetings will be held at 7:00 PM on Wednesday, June 29, at the Sessions Woods Wildlife Management Area in Burlington and at 7:00 PM on Thursday, June 30, at the CT DEP Marine Headquarters in Old Lyme.** Comments may also be submitted in writing and will be accepted until July 14, 2005. Copies of the Draft ANS plan and an Executive Summary will be available as of June 22 and can be obtained through the CT Institute of Water Resources web site ([www.ctiwr.uconn.edu](http://www.ctiwr.uconn.edu)) or by calling the CT DEP Inland Fisheries Division (860-424-3474).

“The introduction and spread of aquatic nuisance species pose a serious threat to the ecology and biodiversity of our ecosystems and to the health and economic interests of the people of the State of Connecticut,” said CT DEP Deputy Commissioner David K. Leff. The ANS plan lists potential invaders along with over 100 different non-native species already present in the marine and fresh waters of Connecticut. “The impacts of ANS include degradation of habitat, spread of pathogens, choking of waterways, clogging of water intakes, fouling of water supplies and interference with recreational activities such as fishing, boating and swimming,” said Leff. The draft plan identifies nuisance species and vectors, and provides recommendations for preventing introductions and for effective monitoring and control of established populations. Gathering public comment is a required step in the process of developing a final plan that can be approved by the State and submitted to the United States Fish and Wildlife Service as a prerequisite for obtaining federal funds to address ANS issues.

The draft ANS plan was prepared by a diverse working group headed by Connecticut Sea Grant, the Department of Environmental Protection and the Institute of Water Resources located at the University of Connecticut. The working group also included representatives from academia, State and Federal government agencies, lake associations, water companies, the nursery industry and the aquarium/pet trade industry.

MEETING LOCATIONS::

June 29, 7:00 pm

Sessions Woods Wildlife Management Area and Conservation Education Center:  
341 Milford Street (Route 69)  
Burlington, CT 06013

Directions: Sessions Woods WMA and Conservation Education Center is located on Route 69, about three miles south of Route 4 in Burlington and three miles north of Route 6 in Bristol.

June 30, 7:00 pm

CT DEP Marine Headquarters:  
333 Ferry Road  
Old Lyme, CT 06371

Directions: From the North or West: Take 91 south or 9 south to 95. Head east on 95 North to exit 70. Take a right at end of exit onto Shore road (Rte 156). Go approximately 0.5 mile and take a right onto Ferry Road. Follow Ferry Road to the end where it enters the driveway of Marine HQ.

From the East: Take 95 South (heading west) to exit 70. Go straight through first two lights. At third light, take left onto Route 156. Follow above directions from 156.

Meeting will be in Conference Room B – go past the main building entrance, bear left around building and proceed back to 2<sup>nd</sup> building in the rear of main building.

Written comments should be mailed to:

CT DEP Inland Fisheries Division  
Attn: ANS Comments  
79 Elm Street, Hartford CT 06106  
or e-mailed to [dep.inland.fisheries@po.state.ct.us](mailto:dep.inland.fisheries@po.state.ct.us)

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## Appendix G. Acronym List

Acronym	Definition
ANS	Aquatic Nuisance Species
ANSTF	Aquatic Nuisance Species Task Force (federal)
APHIS	Animal and Plant Health Inspection Service
ASMFC	Atlantic States Marine Fisheries Commission
CAES	Connecticut Agricultural Experiment Station
CFL	Connecticut Federation of Lakes
CIPWG	Connecticut Invasive Plant Working Group
CT DA	Connecticut Department of Agriculture
CT DA/BA	Connecticut Dept. of Agriculture, Bureau of Aquaculture
CT NLA	Connecticut Nursery and Landscape Association
CTSG	Connecticut Sea Grant, University of Connecticut
CT DEP	Connecticut Department of Environmental Protection
CT DEP BNR	Connecticut Department of Environmental Protection, Bureau of Natural Resources
DHS	U.S. Department of Homeland Security
DOT/ CT DOT	Connecticut Department of Transportation
DPH/ CT DPH	Connecticut Department of Public Health
EEB	Department of Ecology and Evolutionary Biology, University of Connecticut
EDMA	Early Detection, Monitoring and Assessment
EPA	U.S. Environmental Protection Agency
FDA	U.S. Food and Drug Administration
GSC	General Statutes of Connecticut
HACCP	Hazard Analysis and Critical Control Points
IAFWA	International Association of Fish and Wildlife Agencies
IPANE	Invasive Plant Atlas of New England
IPC	Invasive Plant Council (CT)
ISAC	Invasive Species Advisory Committee (ISAC)
IWR/ CT IWR	Connecticut Institute of Water Resources
LIS	Long Island Sound
LISS	Long Island Sound Study (EPA National Estuary Program)
NANPCA	Nonindigenous Aquatic Nuisance Prevention and Control Act
NEANS Panel	Northeast regional Aquatic Nuisance Species Panel
NERR	National Estuarine Research Reserve
NIPGro	New England Invasive Plant Group
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRCS	Natural Resource Conservation Service
NRME	Department of Natural Resource Management and Engineering, University of Connecticut
OLISP	CT DEP Office of Long Island Sound Programs
RCSA	Regulations of Connecticut State Agencies
SCRWA	South Central Regional Water Authority
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey



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## **Additional Resources**

[www.algae.uconn.edu](http://www.algae.uconn.edu)

A digital database of the seaweeds in Long Island Sound; includes both herbarium sheets and images

<http://www.algae.base.org>

World's largest database of seaweeds, maintained by the National University of Ireland, Galway