

# Sea Grant and Invasive Aquatic Plants: A National Outreach Initiative

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## ABSTRACT

The National Sea Grant College Program is a NOAA-funded, university-based research and outreach program located in universities in 30 coastal and Great Lake states and Puerto Rico. With a primary mission to “foster the responsible use and protection of coastal and marine resources,” Sea Grant has been funding research and outreach efforts related to invasive aquatic species since the introduction of the zebra mussel to the Great Lakes in the late 1980s brought the issue to national attention. A recently funded national outreach initiative on invasive aquatic plants brings together five Sea Grant programs and a national panel of experts representing research, industry and regulatory agencies to identify invasive aquatic plants of current or potential national or multi-regional significance and to prepare educational materials and programs. The project goal is to reduce invasive aquatic and wetland plant introductions, and enhance early identification of new invasive plant outbreaks by educating water gardeners, riparian landowners and lake associations, landscapers, resource managers and field staff from natural resource protection and land management agencies, and businesses and to promote the use of native aquatic plant species. Through this initiative, with partners both old and new, Sea Grant will help meet the objectives of the National Strategy for Management of Invasive Plants and aid ongoing efforts to slow the spread of invasive aquatic plants.

*Key words:* aquatic weeds, invasive species, wetlands protection and restoration, water gardening.

## INTRODUCTION

Congress created the National Sea Grant College Program (or Sea Grant) in 1966 to “foster the responsible use and protection of the nation’s marine, freshwater and coastal resources”. Mirroring the three-pronged approach of the Land Grant College system on which it was modeled, Sea Grant funds basic and applied research on issues affecting coastal resources, outreach programs to translate and transfer the results of that research to user groups and the general public, and education programs to create an informed public and a new generation of scientifically literate Americans. Sea Grant is a network of 33 programs located in all coastal and Great Lake states, Puerto Rico and the Virgin Islands, and has a distinguished track record of supporting research and outreach concerning invasive, or nonindigenous aquatic nuisance species.

Sea Grant’s national involvement with non-indigenous aquatic nuisance species began with the invasion of the zebra mussel (*Dreissena polymorpha*) into the Great Lakes via ballast water in the late 1980s. Within a year of the official confirmation of zebra mussels in Lake Erie in 1988, Sea Grant programs in all six Great Lake states were funding research and outreach programs related to zebra mussel prevention, control and impact mitigation. Federal funding, distributed competitively via a national call for proposals and a peer review process, came into the network with the passage of the Nonindigenous Species Control Act in 1990. Overall Sea Grant funding for aquatic nuisance species projects has fluctuated between one and three million dollars annually, and a steadily increasing percentage of these funds have been going into research about the basic ecology and potential control mechanisms associated with invasive aquatic plants. Since 1997, 13 projects have addressed invasive plants including purple loosestrife (*Lythrum salicaria*) in the Great Lakes and New England (Shadel and Molofsky 1999), phragmites (*Phragmites australis*) in Connecticut, Rhode Island and Delaware, nori (*Porphyra japonica*) in the Gulf of Maine, giant reed (*Arundo donax*) in California, macroalgae and mangroves in Hawaii, and *Spartina angelica* in Washington and California. Collaborative outreach efforts with other agencies and organizations have covered species including Eurasian watermilfoil (*Myriophyllum spicatum*), purple loosestrife, giant salvinia (*Salvinia molesta*), water chestnut (*Trapa natans*), water hyacinth (*Eichhornia crassipes*), curlyleaf pondweed (*Potamogeton crispus*) and others. Summaries of, and contacts for, these and other invasive species efforts have been compiled in a series of Aquatic Nuisance Species Reports (Ricker 2000) available through the state and national

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Sea Grant offices and publications are also available on the Sea Grant invasive species website, (<http://www.sgnis.org>).

One of the advantages of the Sea Grant network is its ability to react rapidly to developing issues. Research, outreach and educational materials developed by one state program can be rapidly transferred to others for immediate use or adaptation. While the Great Lakes states were the first alerted by the zebra mussel crisis to the issue of ballast water transfer of aquatic species, other Sea Grant programs responded by funding research and prevention programs to delay the introduction of the mussel to their waters for as long as possible. Once public awareness was raised in states where zebra mussels were not already present, outreach and education programs were tailored to address other organisms, including invasive aquatic plants.

Some examples of highly successful Sea Grant aquatic nuisance species outreach and education efforts that started with the zebra mussel include the International Aquatic Nuisance Species and Zebra Mussel Conference. Originally convened in 1990, it has been held annually and expanded to address all nonindigenous aquatic nuisance species. Both the 1999 and 2000 conferences had sessions specifically addressing invasive aquatic plants. Several Sea Grant-based websites which originally focused on zebra mussels, including the Sea Grant Nonindigenous Species Site (<http://www.SGNIS.org>) and the National Aquatic Nuisance Species Clearinghouse (<http://www.entryway.com/seagrant>), were among the first large-scale invasive species-oriented information sites to link the research community and end-user audiences.

Another use of advanced technology to enhance information transfer has been the Sea Grant/USDA-ES Nationwide Zebra Mussel Training Initiative. Designed to assist inland state resource managers, educators, and resource user groups to prepare for the arrival and mitigate the impacts of zebra mussels, the initiative sought to foster interagency cooperation and participation in state or regional zebra mussel task forces. Over 1600 participants in 48 states and three Canadian provinces saw the Initiative's day-long teleconference and over 1500 attended over 20 multi-day regional workshops in locations around the country. Seventeen state or regional task forces or work groups were established as a result of this initiative and large numbers of participants have expressed concern that most regions are unprepared for the introduction of invasive organisms other than the zebra mussel.

While the species and impacted habitats may vary from region to region, invasions by non-native aquatic and wetland plants are a nationwide problem, particularly since invasive aquatic plants are often overlooked until they are perceived as a nuisance. By then these plants may already have caused irreparable damage to the natural community and be impossible to eradicate (Les 1999). According to Mills et al. (1993), nonindigenous aquatic plants represent the largest group of aquatic nuisance species introduced into the Great Lakes. The State of Florida spends \$15 million annually to hold the line on hydrilla (*Hydrilla verticillata*) (Schardt, pers. comm.), while melaleuca (*Melaleuca quinquenervia*), an ornamental tree, has converted 450,000 acres of southern Florida's herbaceous wetlands to monotypic swamp forest (Randell and Marinelli 1996).

Species native to one portion of continental North America may become invasive when transported to another region.

Cordgrass (*Spartina alterniflora*), introduced to the Pacific Northwest from the Atlantic seaboard in recent years, is out-competing indigenous salt marsh grasses (Antilla et al. 1998) and transforming tidal flats into marsh areas. Cabomba (a.k.a. fanwort, *Cabomba caroliniana*), an aquatic plant native to the southeast, is exhibiting invasive tendencies in northern New England and has been recently reported in the Columbia River in Washington (McFarland et al. 1998). Water chestnut has invaded Lake Champlain (Methe et al. 1993, Crosson and Bove 2001) and the Connecticut River watershed (CT DEP 2001).

Of the characteristics put forth by Randell and Marinelli (1996) that make a plant likely to be invasive, the potential for introduction on a large scale or repeatedly into a new area is of particular importance when considering aquatic and wetland plant problems. Vectors for the spread of invasive aquatic plants include release of aquarium contents by hobbyists, shipment of native and non-native aquatic plants and animals that may contain invasive plants, algae, invertebrate or fish contaminants, and the accidental escape of cultivated plants. There is a growing public demand for attractive plants to use in aquascaping, aquaria, and especially water gardens. A recent article in a water garden trade magazine (Wullschleger 1999), promoting the addition of water garden departments to local garden centers, reported that the market for water gardens in the United States was virtually untapped. Only 0.1 of one percent of U.S. households have a water garden (not including container ponds, fountains or small water features) compared with approximately 15 percent of households in the United Kingdom.

Increased use creates increased opportunity for escape of invasive plants from cultivation. Specific examples include the discovery of hydrilla in Connecticut, apparently as the result of contaminants in ornamental plantings (Les et al. 1997), and the discovery of giant salvinia (*Salvinia molesta*) in 1997 in South Carolina, in 1998 in Texas, Louisiana, and North Carolina, and in 1999 in California, where it had been intentionally introduced as an ornamental water garden plant. *Caulerpa taxifolia*, the "killer algae of the Mediterranean", was recently found in California (Los Angeles Times 10/10/2000). All these species are on the Federal Noxious Weeds list, making them illegal to possess, sell, or distribute in the United States. Seventy-six percent of the aquatic plants that have been introduced into southern New England are such escapees (Les 1999).

Sales of invasive aquatic plants have proliferated as the result of mail-order catalogues and on-line sales through Internet resources. Many of the companies selling these plants demonstrate at least ignorance of, and frequently total disregard for, state and federal laws and environmental responsibility. On-line retailers commonly advertise three federal listed noxious aquatic weeds: miramar weed (*Hygrophila polysperma*), ambulia (*Limnophila sessiliflora*), and oxygen weed (*Lagarosiphon major*), or other invasive aquatic species which may be legal in their state but prohibited in others, such as purple loosestrife (*Lythrum salicaria*). A review of mail order catalogs from 30 businesses by Minnesota Department of Natural Resources revealed that 96% of the 700 taxa available for sale were exotic and that two-thirds of the 29 plants on the federal and state "restricted" lists were available for sale (Perleberg 1998).

In addition to horticultural/gardening vectors, a growing focus on coastal, wetland, and lake shorefront habitat restoration at local, state and national levels presents another risk for invasive plant introduction or proliferation (Olem and Flock 1990, Kier (William M.) Associates 1995, Save the Sound, Inc. 1998, Henderson et al. 2001). Without clear guidance on choosing appropriate native species for re-vegetation, coupled with an understanding of watershed linkages and the need for monitoring programs to identify and facilitate early eradication of undesirable species, invasive aquatic, wetland and shoreland plants can become established, negate restoration efforts, and potentially spread to other water bodies.

Much information already exists about aquatic plant identification and management (Pieterse and Murphy 1989, Borman et al. 1997, Prescott 1980, Washington Department of Ecology 2001), aquatic and wetland restoration methods and case histories, and native and invasive plant lists for the different regions of the country. The world's largest collection of this kind of published information is available at the University of Florida's Center for Aquatic and Invasive Plants, as APIRS, the Aquatic, Wetland and Invasive Plant Information Retrieval System. However, this information is mostly in the form of scientific papers and reports; most of it is neither easily accessible to nor easily understood by the many resource managers, landowners, students, and public advocacy groups who need it. If this information was made more easily available and understandable, then resource managers might be more able to succeed in controlling, managing and otherwise restoring infested areas, and also be more likely to prevent spread of invasive aquatic plants into uninfested areas.

Many government agencies and non-governmental organizations, including regional Exotic Pest Plant Councils, the Aquatic Plant Management Society, the Native Plant Society, USDA APHIS and Cooperative Extension, and The Nature Conservancy, have been working on invasive aquatic plant issues. Information reaching the public generally mentions only a few of the most obvious aquatic and wetland invasive species such as Eurasian watermilfoil, water hyacinth and purple loosestrife.

Many of Sea Grant's projects in the area of nonindigenous aquatic plants do not rely on high-tech tools like websites or teleconferences. Rather they take advantage of the expertise of Sea Grant's many skilled outreach educators and communicators to create high-quality educational materials and programs that effectively reach key target audiences. Examples can be simple and widely applicable, as with the business-sized information cards, stickers, and waterproof posters for boat launches that provide simple tips for preventing the spread of invasive plant and animals, or the humorous video for boaters featuring the beloved postman (Cliff Klavin) from "Cheers", or they can be very carefully targeted to key user groups. One current project is applying Hazard Analysis Critical Control Point (or HACCP) principles, normally associated with food safety, to the baitfish and aquaculture industries as an innovative way to reduce the risk of including invasive aquatic plants (or invertebrates or fish) as contaminants in products shipped around the country or the world. Another project is creating local wetland stewards by developing materials that allow 4-H groups to undertake purple loosestrife biological control projects throughout the Great

Lakes region. Up to 100 loosestrife-infested wetlands will be inoculated with 4-H reared natural enemies over the next two years and potentially hundreds to thousands of sites in the years thereafter.

Having recognized, through the zebra mussel experience, the effectiveness of targeted outreach and education efforts in slowing the spread of invasive species, Sea Grant has now funded a national outreach initiative focusing on invasive aquatic and wetland plants. There is a great need for concerted and coordinated efforts at the state, regional, and national levels to: (1) educate extension agents, regulatory and environmental agency field personnel about the threat and how to recognize the most invasive, noxious weeds being sold and distributed; (2) educate and foster environmental responsibility within the ornamental aquatic and wetland plant nursery and water garden industries; (3) provide a stimulus for these industries to develop and cultivate desirable native species, or non-native species proven to be non-invasive, as alternatives to certain invasive, exotic pest plants; and (4) educate plant users (gardeners, professional landscapers, and other land management groups) on the dangers of introducing invasive aquatic and wetland plants and how to choose attractive native alternatives, thus reducing the demand for invasive species and increasing demand for native species. As in past aquatic nuisance species outreach efforts, Sea Grant is working in concert with state agencies and nonprofit organizations, through existing networks and programs, to maximize and make consistent the outreach message to the public and targeted interest groups.

This two-year project will address outreach needs associated with the identification and control of invasive aquatic plants in the field, and the problem of distribution through the aquatic plant industry tied to the growth of home water gardening, stormwater management and aquatic, wetland, and shoreline restoration efforts. The outreach products have common themes and are complementary in nature, but address distinct audiences. Specific objectives of this proposal include: 1) Identify invasive aquatic and wetland plant species of current or future national or regional concern. A national panel of experts representing the aquatic plant industries, government and researchers has been assembled to assist in this process and to review all products for technical accuracy. 2) Develop educational materials on the identification, environmental impacts, and management of the targeted plants. 3) Organize state and regional workshops for training environmental and regulatory agency personnel in the identification and management of the targeted plants. 4) Partner with the Cooperative Extension System, environmental and regulatory agencies, state nursery associations and businesses and other non-profit organizations to educate plant users about the problems caused by using invasive plants in water gardens, aquascaping, lake renovation, and wetland creation/mitigation, and the potential alternatives to their use.

This integrated effort will enable the Sea Grant network to develop new partnerships and strengthen old ones with agencies, organizations and industry involved in outreach and research involving invasive, nonindigenous aquatic plants. We will produce and distribute a much-needed, easy-to-use field guide to the most prominent and noxious inva-

sive aquatic plants for industry, natural resource managers, field technicians and enforcement agents, facilitating rapid plant identification which could lead to earlier control or eradication. Educational materials for audiences ranging from the backyard water gardener to communities faced with restoring shoreline or “aquascaping” stormwater management ponds will provide information on invasive plant species to avoid, guidelines on choosing appropriate plant species and techniques to ensure the success of the (re)vegetation effort, and tips on proper disposal of unwanted plants that will help reduce the use and spread of invasive, native and non-native aquatic plants. Aquatic plant nurseries and retailers will be provided with information on suitable native or non-native but non-invasive alternative species to grow and promote for environmentally friendly water gardening. A searchable website will be developed and maintained for use by the aquatic plant industry, natural resource managers, field technicians, researchers, enforcement agents, landscapers, as well as individuals involved in restoration projects, as an inexpensive, comprehensive and non-technical source of information on the most noxious, invasive aquatic plants.

These combined efforts will increase awareness of the problems associated with invasive aquatic and wetland plants which hopefully will result in a decrease in the cultivation, distribution, and planting and accidental release of undesirable species, and a reduction in the chances for serious environmental damage resulting from their escape into coastal and inland waters and wetlands. This decreased demand for invasive species should simultaneously encourage a shift toward ornamental nursery production of desirable, noninvasive species to replace the undesirable species for use in these areas. These outputs complement the objectives of the National Strategy for Invasive Plant Management outlined in the Federal Interagency Committee for Management of Noxious and Exotic Weeds (FICMNEW) publication *Pulling Together* (1998). Education of consumers should reduce demand for invasive species, also reducing their spread. The new website and identification guides will aid in early identification and control of new or spreading infestations. The website and educational efforts will also aid compliance with laws and regulations by clarifying aquatic plant nomenclature so that plants being sold under different names in different regions can be identified as a single species, making consumers, growers and distributors aware that they are dealing with federal and state regulated materials.

Water resources and their associated ecosystems are key components of both the national environment and economy. The complex nature of aquatic nuisance species management makes communicating this issue to the general public, one of the major potential vectors for invasive species spread, a serious challenge. As part of the Sea Grant mission to foster responsible use and protection of aquatic resources, we seek to elevate public awareness of the issues of invasive aquatic plant impacts to the level at which significant changes in attitude and appropriate actions for prevention and control will occur. This outreach effort will strengthen ongoing educational and outreach efforts of the Aquatic Plant Management Society and its chapters, the national, regional and state Exotic Pest Plant Councils and Invasive Species Councils, and the efforts of federal and state natural resource agencies nationwide.

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