

Washington State Aquatic Nuisance Species Management Plan

Prepared by

The Washington Aquatic Nuisance Species Planning Committee
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Table of Contents

Acknowledgments	i
Executive Summary	1
Introduction	2
Non-indigenous Species Authorities and Programs	4
State Authorities and Programs	4
Federal Regulations	5
International Agreements	6
Non-indigenous Species Problems and Concerns in the State of Washington	7
Threatened Impact of Non-indigenous Species	7
Freshwater Animals and Plants	8
Freshwater Animals	8
Freshwater Plants	8
Marine Animals and Plants	9
Priorities for Action	10
Management Actions	11
Objective 1: Coordinate	11
Objective 2: Prevent	11
Objective 3: Eradicate	14
Objective 4: Educate	18
Objective 5: Monitor	25
Objective 6: Conduct Research	32
Objective 7: Legislation	36
Implementation	38
Planned Efforts Implementation Table	39
Future Efforts Implementation Table	50
Strategic Plan	60
Glossary	76
Appendix A: Section 1204 of the National Invasive Species Act of 1996	80

Appendix B: Washington Aquatic Nuisance Species Plan Public Review Information	83
Washington Aquatic Nuisance Species Planning Committee	83
Members	83
Advisors	84
Aquatic Nuisance Species Planning Committee Meeting - April 7, 1998	86
Aquatic Nuisance Species Planning Committee Summary of Comments from April 7, 1998 Meeting	88
 Appendix C: Non-indigenous Species of Washington	 91
Freshwater Animals and Plants	91
Marine Animals and Plants	104
 Appendix D: Non-indigenous Species Authorities and Programs	 110
Regulated Pathways of Introduction for Non-indigenous Species	110
Aquaculture	110
Public Aquaria, the Aquarium Trade, and Plant Nurseries	111
Research Institutions	111
Live and Processed Seafood	111
Ballast Water	111
Washington State Noxious Weed Control Board Classification of Weeds	112
Washington Department of Ecology Aquatic Weeds Program	112
Monitoring and Surveys	112
Research	113
Education and Technical Outreach	113
Funding to Local and State Governments for Aquatic Plant Management Projects	115
Funding Criteria	116
Eradication Projects	116
Current Known Gaps in Washington State Programs	118
Federal Agencies Regulating the Transport of Live Aquatic Products	120
Federal Law Addressing Aquatic Nuisance Species	121
International Instruments Addressing Non-indigenous Species	121
 Appendix E: References	 123

Executive Summary

Aquatic nuisance species (ANS) are a serious problem in Washington. This document is an important step in the coordinated response to the problem and serves as an efficient means of communicating the scope of activities necessary to effectively address the issue. Washington has many ongoing projects to control ANS plants, whereas prevention and control projects for ANS animals are lacking. The purpose of the Washington State Aquatic Nuisance Species Management Plan is to coordinate all ANS management actions currently in progress within Washington, and to identify and provide funding for additional ANS management actions, especially those relating to ANS animals.

State, federal and international ANS authorities and programs are briefly discussed to provide an understanding of our current ability to regulate and manage ANS. The development of a state management plan is called for in Section 1204 of the National Invasive Species Act of 1996 (Appendix A), which provides an opportunity for federal cost-share support for the implementation of state plans. Approval by the National Aquatic Nuisance Species Task Force is also required for a state plan to be eligible for federal cost-share support.

Marine and freshwater nonindigenous species that are known to be present in Washington are listed. Very little is known about the impact of many nonindigenous species and some have a high commercial value. The plan identifies a small number of priority nonindigenous ANS that are considered to be highly detrimental, and worthy of immediate or continued management action. The management actions outlined in this plan concentrate on these priority species.

The goal of this plan is as follows:

By the year 2002, fully implement a coordinated strategy designed to minimize the risk of further ANS introductions into Washington waters through all known pathways; and where practical, stop the spread of ANS already present; and eradicate or control ANS to a minimal level of impact.

The Washington ANS Management Plan is focused on the identification of feasible, cost-effective management practices to be implemented in partnership with tribes, private, and public interests for the environmentally sound prevention and control of ANS. The seven objectives identified in the plan are structured to achieve the goal through the implementation of strategic actions and tasks designed to solve specific problems. The plan will be periodically revised and adjusted based upon the practical experience gained from implementation, scientific research, and new tools as they become available.

The implementation table summarizes the plan's funding from all sources. Existing funds that are dedicated to predominantly ANS plant related tasks totaled \$3,163,482 and requested funds needed to implement primarily ANS animal related tasks totaled \$1,750,000. Implementing the programs outlined in this plan will require a coordinated tribal, Federal, State and private effort, and the dedication of significantly greater funding than is currently available.

Introduction

The introduction of non-indigenous aquatic nuisance species (ANS) into the marine and fresh waters of Washington threatens the ecological integrity of the state's water resources, as well as economic, social, and public health conditions within our state. Because they have few natural controls in their new habitat, ANS spread rapidly, destroying native plant and animal habitat, damaging recreational opportunities, lowering property values, clogging waterways, and impacting irrigation and power generation. The impact of existing ANS on salmonids is poorly understood and the potential impact from the introduction of the zebra mussel is high.

In 1996, freshwater and salt water sport fishing anglers in Washington spent over \$1.3 billion pursuing their sport and created over 16,000 jobs (U. S. Fish and Wildlife Service, 1996). Washington's marine and shellfish fisheries (tribal and non-tribal) yield an estimated \$120 million annually in wholesale value alone (Morris Barker, personal communication). The coordinated efforts contained within this plan are designed to protect the citizens of Washington from the multitude of losses associated with freshwater and marine ANS animals and plants.

This plan focuses on eliminating the threat of accidental ANS introductions. The intentional introduction of nonindigenous species for aquaculture, commercial, or recreational purposes is addressed to insure that these beneficial introductions do not result in accidental ANS introductions, and to improve information sharing among those agencies responsible for regulating intentional introductions.

Washington has the opportunity to prevent or prepare for the introduction of two destructive ANS; the freshwater zebra mussel (*Dreissena polymorpha*) and the salt water European green crab (*Carcinus maenas*). Both are well suited for survival in Washington. States where zebra mussel and green crab are present have reported severe environmental and economic damage resulting from their accidental introduction. Live zebra mussels have been found on boats entering California. The green crab has spread from California to Oregon, and on June 1, 1998 a molt exoskeleton of a green crab was found in Washington's Willapa Bay. Washington must act quickly, and in concert with Canada and our neighboring states, to avoid or reduce major impact from these ANS.

Our state did not act quickly to eradicate the salt water grass (*Spartina alterniflora*) when it first started spreading in Willapa Bay. Today over 5,000 acres of *Spartina alterniflora* exist in Willapa Bay alone, and it continues to spread. Without a major multi-million dollar effort, there will be a continued loss of habitat for many native species of fish, clams, oysters, shorebirds, migratory waterfowl, as well as further impacts to the shellfish aquaculture industry. We must learn from our past mistakes. The coordinated efforts and cooperative funding outlined in this plan can enable us to prevent, eradicate or control new introductions more effectively, before they cause major environmental and economic damage.

The Washington State Aquatic Nuisance Species Planning Committee developed this plan. Members of the planning committee assumed an active role in writing the plan, while advisors reviewed draft plans

and provided guidance. A list of the members and advisors is provided in Appendix B. Washington Department of Fish and Wildlife was the lead agency assigned to coordinate the drafting of the plan and the Washington State Aquatic Nuisance Species Coordinator served as the committee chair. A meeting of the planning committee was convened on April 7, 1998, in Olympia, Washington to review a draft of the plan. A list of attendees along with the organizations they represent, and their general comments on the draft plan are provided in Appendix B.

The Washington Exotic Species Work Group of the Puget Sound–Georgia Basin International Task Force represented an important part of the planning committee. Much of their previous work in creating an implementation plan to address ANS issues in the Puget Sound and Georgia Basin was used in the creation of this plan.

Draft plans were reviewed by the planning committee, and a 30 day public review and comment period. The review process for the State Environmental Policy Act (SEPA), Chapter 43.21 RCW, determined the plan to have no significant environmental impact.

Washington's ANS Management Plan will be reviewed and revised annually, or more frequently if necessary. New ANS threats can arrive unexpectedly. Advances in our knowledge of ANS management techniques could warrant alterations in our management strategies. The specific tasks employed to accomplish our goals and objectives must remain flexible to assure efficiency and effectiveness. This version of the Washington State ANS Plan is a good first step towards identifying and integrating existing ANS programs, and implementing new programs, but future editions will be necessary to fully achieve our goal.

Non-indigenous Species Authorities and Programs

This section provides a brief discussion of non-indigenous species authorities and programs in Washington State, as well as federal law and international agreements. Washington State laws relating to non-indigenous species cannot be discussed without a basic understanding of federal and international authorities. The policies regarding non-indigenous species are controlled and enforced by a network of regulatory agencies and organizations. Not all state and federal laws relating to ANS are included in this section of the plan. A more complete listing of relevant state and federal laws relating to ANS will be compiled by Washington Department of Fish and Wildlife.

State Authorities and Programs

State and local efforts play a large role in controlling the spread of non-indigenous species. States have authority to decide which species can be imported and/or released. However, the United States Constitution vests the power to regulate international and interstate commerce to Congress. Federal law may preempt state law, but states retain almost unlimited power to define which species are imported and/or released. In Washington State, the aquaculture and aquarium trade are regulated at both the state and federal levels, with aquaculture being the most heavily regulated pathway of non-indigenous introductions. Commercial marine vessels are regulated primarily by federal law, as is the governance of ballast water under the National Invasive Species Act of 1996, 16 United States Code Section 4701, et seq. Additional information on regulated pathways of introduction for non-indigenous species can be found in Appendix D.

Washington Animal Programs and Regulations

Currently few state regulations and programs exist concerning the regulation of non-indigenous animals. Washington State regulations addressing the introduction of non-indigenous species include regulations protecting against introduction of the zebra mussel, WAC 232-12-01701 and WAC 232-12-168. WAC 220-77 deals with aquaculture disease control, but it is very pertinent to the exclusion of non-indigenous species that could be accidentally introduced. Additionally, Washington Session Law, Chapter 153, Law of 1998, created legislation for the prevention and control of zebra mussel and green crab.

Washington Plant Programs and Regulations

The Washington State Noxious Weed Control Board

Washington has a strong weed law and local infrastructure (most counties have county noxious weed control boards) to enforce compliance with the weed law (RCW 17.10). Washington's State Noxious

Weed Control Board sets state policy and determines the noxious weed list for the state. Washington's most problematic exotic aquatic species are listed on this list (Available by request from the Washington State Noxious Weed Control Board.).

Washington Department of Agriculture Quarantine List

The Washington Department of Agriculture Quarantine List identifies plants known to be invasive and a detriment to the state's natural resources. This regulation prohibits the sale and transport of these species, and serves to prevent the continued introduction of these problem plants into Washington. Washington's most problematic aquatic plants are listed on the State Quarantine List (available by request from the Washington Department of Agriculture, Plant Services Division).

Washington Department of Ecology Aquatic Weeds Program

The Department of Ecology Freshwater Aquatic Weeds Management Program is a nonregulatory program established in 1991 by the Washington State Legislature. This program offers technical and financial assistance for the management of freshwater aquatic weeds in Washington. Further details of the Aquatic Weeds Program can be found in Appendix D.

Washington Department of Ecology Aquatic Plant Management Program

The Aquatic Plant Management Program of the Washington Department of Ecology is a regulatory, herbicide-permitting program for the management of aquatic plants (both native and noxious). Herbicide permits are issued for control projects based on the control options allowed in two Environmental Impact Statements (EIS) prepared for this program (Noxious Emergent EIS and Aquatic Plant Management EIS).

Current Known Gaps in Washington State Programs

Although these programs are essential for the management of ANS, some gaps in these programs do make them less effective. A description of some of the known gaps and impediments that hinder the implementation of the Washington State Noxious Weed Program, Aquatic Weeds Program, and the Aquatic Plant Management Program are discussed in Appendix D.

Federal Regulations

The current federal effort regarding the management of ANS is a patchwork of laws, regulations, policies, and programs. At least twenty agencies currently work at researching and controlling non-indigenous species. The Federal Agencies Table in Appendix D outlines the responsibilities of a

number of these government agencies and summarizes their current role in the control of introduced species.

Federal laws which apply directly to the introduction of non-indigenous species include the Lacey Act, the Federal Noxious Weed Act, the Federal Seed Act, the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, and the National Invasive Species Act of 1996. (The full text of these laws will not be included in this report, though copies may be requested from the Washington Department of Fish and Wildlife.) The Clean Water Act could have an indirect application to ANS if the discharge of ballast water were considered pollution. The Endangered Species Act could also have indirect application if an ANS was shown to threaten the survival of a federally listed species, such as a salmon.

International Agreements

In addition to state and federal regulations, a number of international agreements address the issue of non-indigenous aquatic species. In the Pacific Northwest, the Washington/British Columbia Environmental Cooperation Agreement of 1992 established the Puget Sound/Georgia Basin Task Force to identify, research, and establish policy priorities in this joint Canadian/American coastal region. The management priorities identified by the task force include minimizing the introduction of exotic species into the shared waters of British Columbia and Washington. The Puget Sound Exotic Species Work Group was formed to study the issue and make recommendations to the task force. Additional international agreements addressing the issue of exotic species may be found in Appendix D.

Of increasing importance on the international level and impacting the national front as well, is the work accomplished by the International Maritime Organization regarding the management and control of ballast water as a major vector for the transport of exotic or non-indigenous species in ocean trade and transport vessels. The most recent International Maritime Organization Resolution passed in November of 1997, sets forth current international guidelines suggested for the control of ballast waters. These guidelines are currently being implemented and coordinated on a national scale via the United States Coast Guard as required under the National Invasive Species Act of 1996, 16 U.S.C.4701, et seq., as implemented via 33 Code of Federal Regulations, part 151).

Non-indigenous Species Problems and Concerns in the State of Washington

A growing number of non-indigenous aquatic plant and animal species have adversely impacted the productivity and biodiversity of Washington's native species, and altered a variety of aquatic ecosystems. Most introductions are the result of human activities. There are many ways organisms may be transported. For example: shipments of live oysters from one area to another can carry oyster predators and diseases; marine organisms can be transported to new waters by attaching to the ship or in its ballast water. Major pathways through which nonnative species are introduced into inland and coastal waterways include aquaculture, aquarium trade, biological control (shoreline stabilization, agricultural uses), transport via vessel fouling and ballast water discharge, recreational boating and fishing, research activities, and movement of nonnative species through channels, canals and locks. Some pathways, such as the aquaculture industry, are currently regulated to minimize the risk of new ANS introductions, while other pathways have developed few or no precautions. Additional information regarding regulated pathways is listed in Appendix D.

Threatened Impact of Non-indigenous Species

Potential threats may be evidenced by the degree of negative impact these species have upon the environment, industry and the economy. Negative impacts include:

- loss of biodiversity;
- threaten ESA listed species like salmon;
- change estuary ecology;
- alterations in nutrient cycling pathways;
- decreased habitat value of infested waters;
- decreased water quality;
- stunted fish populations due to dense biomass of introduced species;
- decreased recreational opportunities;
- economic impact to the shellfish industry;
- increased safety concerns for swimmers;
- decrease in property values;
- fouled water intakes;
- frequently burned out irrigation pumps;
- impacts on power generation;
- increased risk of flooding due to increased biomass in water or clogging lake outlets;
- impeded water flow and interference with efficiency of water delivery systems.

The following two sections on freshwater animals and plants, and marine animals and plants provide information on non-indigenous species and discuss priority species. Draft lists for each category (freshwater and marine) are intended to provide a basis for discussion and further work identifying the presence, distribution, status, and threat of non-indigenous species. They will be updated, maintained, categorized and standardized as new information is received and assimilated.

Freshwater Animals and Plants

Freshwater Animals

A draft list of freshwater non-indigenous animals in Washington is included in Appendix C. The list is incomplete, since little information is available on non-indigenous aquatic animals in Washington. In general, aquatic plants in Washington have received far more research and management attention than ANS animals. Currently, more funding and research is needed regarding the management and control of ANS animals. The freshwater ANS animals which are presently of most concern for Washington include:

Chinese mitten crab (*Eriocheir sinensis*), is considered to be a priority species. In 1997, a single Chinese mitten crab was identified from the lower Columbia River near Portland. This individual specimen was captured on hook and line by a recreational sturgeon angler. A population of mitten crab exists in California, but there have been no other confirmed reports of mitten crab in Washington or Oregon waters to date.

The zebra mussel (*Dreissena polymorpha*) has not been found in Washington waters to date, but is considered to be a priority species because of the degree of impact it imposes once it is introduced, as based on the Great Lakes experience. Live zebra mussels have been found on boats entering California.

More detailed information on these priority species is included in appendix C.

The spiny water flea (*Bythotrephes cederstroemi*), round goby (*Neogobius melanostomus*) and ruffe (*Gymnocephalus cernuus*) are not currently found in Washington. Asian clam (*Corbicula fluminea*), and New Zealand mudsnail (*Potamopyrgus antipodarum*) are found in Washington waters. These species are not considered to be priority species at this time, but they are considered species of concern.

Freshwater Plants

Invasive and aggressive non-indigenous freshwater weeds pose a serious threat to Washington State waters. Many non-indigenous freshwater species are currently present in Washington. Some cause serious problems; the impacts of others are still yet to be determined; while yet another small group of species appears to cause no adverse impacts. The freshwater non-indigenous plant species found in Washington are listed in Appendix C, along with information on pathways of introduction, more detailed information on priority plant species and their impacts.

Eurasian watermilfoil (*Myriophyllum spicatum*), hydrilla (*Hydrilla verticillata*), Brazilian elodea (*Egeria densa*), and Parrotfeather (*Myriophyllum aquaticum*) are priority freshwater submersed species in Washington.

Purple loosestrife (*Lythrum salicaria*), and saltcedar (*Tamarix ramosissima*) are priority freshwater emergent species.

Marine Animals and Plants

A draft list of non-indigenous marine species known or suspected to occur in the shared waters of Washington State and British Columbia, Canada is included in Appendix C. Much remains to be learned about the status and threats posed by these species. The difficulty of identifying field specimens leads to uncertainty about which species should be classified as invaders. The site, date, and mechanism(s) of introduction for most marine non-indigenous species are unknown, as are the extent of their present range and their rate of spread. Little is known about the threats posed by most introduced marine species.

The draft list will be made available to experts on the identification and ecology of marine species for their review and recommendations. These experts, in turn, will be invited to serve as contacts for their areas of expertise. Comments from these experts, and information gathered from further review of the scientific literature will be incorporated into our current information on each species.

The draft list will be posted on the Washington Department of Fish and Wildlife ANS web site. The updated list will allow users to quickly identify which non-indigenous species are known to occur in Washington, and which invaders are likely to arrive in the near future. Given sufficient additional resources, the list can become the centerpiece of an information system linking information on each species, including: its taxonomy, distribution, and ecology in its native and host ranges, the impacts on other regions it has invaded, and a list of experts on its identification, ecology, and control.

The European green crab (*Carcinus maenas*) is a priority marine animal species that may already exist in Washington. The molt exoskeleton of a green crab was discovered in Willapa Bay on June 1, 1998 and live green crab have been found in waters as close as Oregon's Coos Bay. The Japanese oyster drill (*Ceratostoma inornatum*) is a marine animal species of concern that has been introduced into

Washington waters, but will not be specifically addressed in this edition of the state plan due to the Plan's focus on the more urgent threat of the zebra mussel and green crab.

Spartina alterniflora and *Spartina anglica* are priority marine plant species present in Washington and described in Appendix C.

Priorities for Action

The purpose of the Washington State Aquatic Nuisance Species Management Plan is to coordinate all ANS management actions currently in progress within Washington, and to identify and provide funding for additional ANS management actions, especially those relating to priority ANS animals. This plan focuses on the priority species identified below, but the major focus will be to develop and implement new programs designed to prevent or control the introduction of the zebra mussel and European green crab. Washington has many ongoing projects to control ANS plants, whereas prevention and control projects for ANS animals are lacking.

Priority Species

Non-indigenous species considered to be priority species and worthy of immediate or continued management action include:

- European green crab (*Carcinus maenas*);
- zebra mussel (*Dreissena polymorpha*);
- Chinese mitten crab (*Eriocheir sinensis*);
- Eurasian watermilfoil (*Myriophyllum spicatum*);
- hydrilla (*Hydrilla verticillata*);
- Brazilian elodea (*Egeria densa*);
- parrotfeather (*Myriophyllum aquaticum*);
- purple loosestrife (*Lythrum salicaria*);
- saltcedar (*Tamarix ramosissima*);
- smooth cordgrass (*Spartina alterniflora*);
- common cordgrass (*Spartina anglica*).

The management actions outlined herein focus on these priority species. By addressing the pathways of introduction for priority species, the introduction of other lower priority, or perhaps unidentified ANS, may also be prevented, since many share common pathways of introduction.

Management Actions

Goal

By the year 2002, fully implement a coordinated strategy designed to minimize the risk of further ANS introductions into Washington waters through all known pathways; and where practical, stop the spread of ANS already present; and eradicate or control ANS to a minimal level of impact.

Objective 1: Coordinate All ANS Management Programs Within Washington and Collaborate with Regional, National and International ANS Programs.

1A. Problem: Various state agencies within Washington have some ANS management authority. Washington needs an organized and coordinated approach to prevent duplications of effort and gaps in our management. State ANS management efforts need to be synchronized with regional, national and international efforts.

1A1. Strategic Action: Washington Department of Fish and Wildlife will support two management level positions to coordinate all ANS activities, including marine and freshwater, plants and animals. The Washington Department of Fish and Wildlife Warmwater Fish Program has dedicated .5 FTE (\$30,000.00) and funding is requested for the remaining 1.5 FTEs (\$90,000.00).

Objective 2: Prevent the Introduction of New ANS Into Washington Waters.

Education is an important component of this objective and is addressed in Objective 4.

2A. Problem: New introductions of ANS into Washington waters can cause major economic and environmental damage. Prevention is the most cost effective and environmentally sensitive method of eliminating this problem. Washington currently has no coordinated, comprehensive program to prevent new ANS introductions.

2A1. Strategic Action: Coordinate with other states and nations to prevent the spread of ANS into Washington either from or through areas outside of Washington jurisdiction. Washington Department of Fish and Wildlife is requesting \$5,000 to fund travel expenses necessary to implement the following tasks.

2A1a Task: Washington Department of Fish and Wildlife will coordinate participation in regional conferences, in cooperation with Washington Sea Grant, to increase awareness of ANS issues in cooperation with other state agencies.

2A1b Task: Washington Department of Fish and Wildlife will participate in the Western Regional Panel on Aquatic Nuisance Species in cooperation with our state appointed representative on the panel.

2A1c Task: Washington State will participate in the Pacific States Marine Fisheries Commission effort to coordinate and implement regional ANS activities. Washington Department of Fish and Wildlife and Washington Department of Ecology have each dedicated \$2,500 to partially fund the Regional ANS Coordinator.

2A1d Task: Washington Department of Fish and Wildlife will chair the Puget Sound Exotic Species Work Group of the Puget Sound/Georgia Basin International Task Force.

2A1e Task: Washington Department of Fish and Wildlife will request \$5,000 of state funding to support the 100th Meridian Project. This funding will be combined with other federal and state dollars to help stop the spread of zebra mussels past the 100th meridian and into Washington's waters.

2A1f Task: Washington Department of Fish and Wildlife will assist in the distribution of ANS information to tribes within Washington and explore new opportunities to increase tribal awareness and involvement in ANS issues. Each of the 27 federally recognized tribes within Washington will be contacted and provided with support to identify ANS management needs on their lands. Washington Department of Fish and Wildlife is requesting \$5,000 per tribe for a total of \$135,000 to implement this task.

2A1g Task: Washington Department of Fish and Wildlife will support the enhanced use of the Pacific States Marine Fisheries Commission Shellfish Transport Subcommittee (WAC 220-770-040) to facilitate information exchange and to promote uniformity of biological criteria used to regulate invertebrate species movement among Pacific states and British Columbia.

2A1h Task: Washington Department of Fish and Wildlife will consult with the British Columbia Transplant Committee to discuss cooperative measures designed to address concerns arising from the intentional introduction of non-indigenous aquatic species into our shared waters.

2A2. Strategic Action: Washington Department of Fish and Wildlife will appoint chairs to several sub-committees of the Zebra Mussel and Green Crab Task Force (described in strategic action

7A2) and coordinate with each sub-committee. These sub-committees will work with representatives of organizations that have been identified as potential pathways for ANS introductions and other affected groups to identify voluntary or regulatory measures to prevent new ANS introductions. Recommendations from each sub-committee will be completed by December 1, 1998. Washington Department of Fish and Wildlife is requesting \$25,000 to support the sub-committee chairs, organizational expenses and travel for the combined tasks in this strategic action.

2A2a Task: Establish a sub-committee with maritime cargo vessel representatives and other affected groups to prevent further introductions of ANS into Washington's marine waters through all commercial shipping practices, such as ballast water exchange and ANS infested anchor chains.

2A2b Task: Establish a sub-committee with representatives of the recreational boating industry, seaplane associations and other affected groups to prevent further introductions of ANS into Washington waters through these pathways.

2A2c Task: Establish a sub-committee with representatives of Washington boat yards and marinas, the Washington Department of Ecology, and other affected groups to prevent the introduction of ANS, especially zebra mussels, into Washington waters through this pathway.

2A2d Task: Establish a sub-committee with representatives of the aquarium trade, biological supply catalogs, aquatic garden suppliers, aquatic mail order catalogs, plant importers, and other affected groups to prevent further introductions of ANS into Washington waters through this pathway.

2A2e Task: Establish a sub-committee with representatives of the live seafood industry and other affected groups to prevent further introductions of ANS into Washington waters through this pathway.

2A2f Task: Establish a sub-committee with representatives of the aquaculture industry, Washington Department of Fish and Wildlife shellfish biologists and other affected groups to prevent further introductions of ANS into Washington waters through this pathway.

2A3. Strategic Action: As directed by the Washington State Laws of 1998, Chapter 153, Washington Department of Fish and Wildlife shall prepare, maintain and publish a list of all lakes, ponds, or other waters of the state and other states infested with zebra mussels and European green crab. Washington Department of Fish and Wildlife is requesting \$3,000 for printing and miscellaneous expenses needed to implement this task.

Objective 3: Eradicate or Contain New ANS Introductions or Established Populations as Quickly as Possible; Prevent or Slow Their Spread Into Uninfested Areas, and Reduce the Size of Established ANS Populations. The Impact of Management Actions Should Be less than the Impact of the ANS.

3A. Problem: We must be able to rapidly detect new ANS introductions and the spread of established ANS so that emergency response plans can be immediately implemented while the problem species can be eradicated. We also need accurate information about which ANS are present, where they are present, and an estimate of their population numbers and/or densities. This information needs to be made available to appropriate authorities. The success of this objective is dependent upon the implementation of the monitoring efforts described in Objective 5.

3A1. Strategic Action: Survey Washington lakes, rivers, estuaries, wetlands, and coastlines on a periodic basis to establish an accurate assessment of ANS presence and make this data available statewide (see Objective 5 for monitoring and surveying details).

3B. Problem: Washington currently has few emergency response plans in place to quickly address new introductions of ANS, especially emergency response plans for marine and freshwater animals. Small populations of newly introduced ANS are most vulnerable to eradication. Without previously developed plans, new ANS populations can become established while agencies are developing and agreeing upon appropriate eradication measures.

3B1. Strategic Action: Develop emergency response plans for specific ANS known to be an eminent threat to Washington waters. Actions outlined in these emergency response plans, when implemented, will prevent the establishment and spread of these species, or minimize their impacts. The emergency response plans will include elements for permitting, funding, equipment and resources, staffing, and stakeholder input.

3B1a Task: The Washington Department of Fish and Wildlife will coordinate the development of a Zebra Mussel Emergency Response Plan. The Washington Department of Fish and Wildlife will work in cooperation with the United States Army Corps of Engineers Zebra Mussel Research Center on early response eradication strategies. Washington Department of Fish and Wildlife is requesting \$1,000 for miscellaneous expenses to implement this task, along with the establishment of the Zebra Mussel Emergency Response Fund (Task 3B1b), and adequate staffing from Objective 1.

3B1b Task: The Washington Department of Fish and Wildlife will establish and administer a Zebra Mussel Emergency Response Fund. These readily available funds will be used to finance a quick initial response to the introduction of zebra mussels into Washington. Without readily available funds to quickly implement a response plan, an opportunity could be lost to eradicate or control the further spread of zebra mussels. This fund will require a \$50,000 commitment from the U.S. Fish and Wildlife Service and a combined \$50,000 commitment from state, public and private organizations within Washington.

3B1c Task: The Washington Department of Fish and Wildlife will coordinate the development of a Green Crab Response Plan. When green crab are discovered in new waters, managers should have a prearranged plan to facilitate their response. Washington Department of Fish and Wildlife is requesting \$1,000 for miscellaneous expenses to implement this task, along with the establishment of the Green Crab Response Fund (Task 3D1d), and adequate staffing from Objective 1.

3B1d Task: The Washington Department of Fish and Wildlife will establish and administer a Green Crab Response Fund. These readily available funds will be used to finance a quick initial response to the spread of green crabs into Washington. Without readily available funds to quickly implement a response plan, an opportunity could be lost to slow their spread or minimize their impact. This fund will require a \$50,000 commitment from the U.S. Fish and Wildlife Service and a combined \$50,000 commitment from state, public and private organizations within Washington.

3B1e Task: The Washington Department of Fish and Wildlife will coordinate the development of a Mitten Crab Emergency Response Plan. Without readily available funds to quickly implement a response plan, an opportunity could be lost to eradicate or control the further spread of mitten crab. Washington Department of Fish and Wildlife is requesting \$1,000 for miscellaneous expenses to implement this task, along with the establishment of the Mitten Crab Emergency Response Account (Task 3D1f) and adequate staffing from Objective 1.

3B1f Task: The Washington Department of Fish and Wildlife will establish and administer the Mitten Crab Emergency Response Fund to provide funding for the immediate implementation of the Mitten Crab Emergency Response Plan if this ANS is detected in Washington waters. This fund will require a \$50,000 commitment from the U.S. Fish and Wildlife Service and a combined \$50,000 commitment from state, public and private organizations within Washington.

3B1g Task: In partnership with King County and the Cities of Covington and Maple Valley, the Washington Department of Ecology has developed and is implementing an emergency response plan for hydrilla eradication in Washington State. The Washington Department of

Ecology Aquatic Weeds Grant Program funds this task with \$50,000 per year of dedicated funding to King County.

3B1h Task: In partnership with affected county weed control boards, volunteer groups, and others, the Washington Department of Agriculture has developed and is implementing a cordgrass (*Spartina*) plan for the eradication of *Spartina spp.* in isolated areas and the containment/control of *Spartina alterniflora* in heavily infested areas.

3C. Problem: State resources (funding and staff) for ANS management are limited. Existing resources are insufficient to deal with all ANS management problems in Washington. Without resources, action plans cannot be implemented in a timely manner. Early action is imperative to contain and/or eradicate pioneer infestations of ANS.

3C1. Strategic action: Increase existing funding and resources for ANS management and establish new funding and resources.

3C1a Task: During an annual lobbying trip, the Washington State Noxious Weed Control Board will work through the Intermountain Noxious Weed Advisory Council to increase the awareness of noxious ANS weeds in Washington, D. C. and encourage additional federal funding for ANS plants. Washington State Noxious Weed Control Board is requesting \$2,000 for travel expenses to implement this task.

3C1b Task: Washington Department of Fish and Wildlife will explore new ideas for ANS funding with the members of the Zebra Mussel and Green Crab Task Force.

3C2. Strategic Action: Set priorities for the management of existing ANS so that existing local, state, and federal resources can be directed in a cost-effective manner to manage Washington's highest priority ANS.

3C2a Task: The Washington State Noxious Weed Control Board sets state priorities for the management of noxious ANS weeds during the annual development of the Washington State Noxious Weed list. Factors such as statewide distribution of each species are considered when setting management priorities. For instance, Class A weeds, such as hydrilla, are mandated to be eradicated under state law (see Appendix D). Each local weed control board or weed district (most Washington counties have local boards) uses the state list to set their weed management priorities.

3C2b Task: The Washington Department of Ecology sets management and funding priorities for ANS weeds during an annual grant funding cycle when grants are awarded for the management of ANS weeds. High priority weeds in targeted areas receive funding preference.

3C2c Task: The Washington Department of Fish and Wildlife will set priorities for control of green crab, mitten crab, zebra mussels, and other animal ANS during the development of Zebra Mussel and Green Crab Task Force Action Plan and other response plans.

3D. Problem: Established populations of ANS in Washington waters can spread to uninfested waters thereby increasing their potential for economic and ecological damage.

3D1. Strategic Action: Implement strategies (response or management plans) for controlling and/or eradicating pioneer infestations of ANS.

3D1a Task: The Washington Department of Fish and Wildlife and the Washington Department of Ecology will develop a proposal to have an ANS emergency response team on call or under contract. When pioneering infestations from established ANS populations are detected, this team will survey the infestation and determine how extensively it has spread. If determined feasible and allowed under current rules and regulations, the team can take action to eradicate or contain the ANS infestation immediately, using a variety of methods and with appropriate follow-up control measures. Washington Department of Fish and Wildlife and the Washington Department of Ecology are requesting \$100,000 per year to implement this task.

3D1b Task: The Washington Department of Ecology has established an emergency fund that is reserved for the containment/eradication of pioneering infestations of freshwater ANS weeds. This emergency funding is made available to local governments so that immediate control actions can be taken against new infestations of ANS weeds. The Washington Department of Ecology provides dedicated funding of \$100,000 per year to fund this task.

3D2. Strategic Action: Minimize the dispersal of established ANS species in Washington.

3D2a Task: The Washington Department of Agriculture has established a list of ANS plants prohibited for sale and transport in Washington.

3D2b Task: The Washington Department of Fish and Wildlife will coordinate with other agencies to develop guidelines and regulations to ensure the cleaning of water-based equipment such as, plant harvesters, dredges, etc., that may accidentally spread ANS when moved from infested to uninfested waters.

3D2c Task: The Washington Department of Fish and Wildlife will consider developing regulations to quarantine waterbodies (or use barriers) to prevent the spread of zebra mussels or other ANS organisms into uninfested waters (see Objective 7 on ANS law).

3D2d Task: State agencies and others will develop and implement educational strategies designed to prevent the spread of ANS by educating the public and specific groups about ANS transportation pathways (see Objective 4).

3D3. Strategic Action: Manage large populations of established ANS to reduce their size or minimize their expansion.

3D3a Task: The Washington Department of Ecology provides funding to state and local governments for the management/eradication of established populations of ANS weeds using an integrated approach. Private lake groups are encouraged to form funding districts to fund their own eradication/control efforts. The Washington Department of Ecology dedicates approximately \$300,000 per year to fund this task.

3D3b Task: The Washington Department of Fish and Wildlife and others have released (and will continue to release) approved biocontrol agents (insects) for the management of purple loosestrife.

3D3c Task: The Washington Department of Fish and Wildlife has developed an integrated Saltcedar control/eradication plan that will be implemented in 1998 with \$200,000 of dedicated funding from the Washington Department of Ecology Aquatic Weeds Program.

3D3d Task: Land-owning state agencies have prepared and are implementing integrated plans for the control of purple loosestrife and *Spartina*.

3D3e Task: The Washington Department of Fish and Wildlife plans and implements a purple loosestrife control program each year, throughout Washington, on owned and controlled lands and in cooperation with other land management agencies, county weed control authorities and other entities. This is based on integrated pest management principles and uses all control methods applied so they are complementary and most effective. The Washington Department of Fish and Wildlife has dedicated 2.5 FTEs (\$97,000) and \$53,000 annually for operations and equipment to implement this task.

Objective 4: Educate Appropriate Resource User Groups about the Importance of Preventing the Introduction and Spread of ANS, and How Their Harmful Impacts Can Be Reduced.

4A. Problem: Accidental introductions occur through actions such as naively releasing nonnative aquarium plants and animals into natural waters. Currently, public awareness of ANS issues is inadequate to address the problem.

4A1. Strategic Action: Compile, develop, and coordinate the dissemination of educational materials on ANS that will increase public awareness of the ANS problem.

4A1a Task: Washington Sea Grant will develop initial educational materials designed to educate the public in Washington's Puget Sound area about the concept of ANS, problems caused, and ways to help. Products in development include a general educational brochure entitled, *Bio-invasions: Breaching Natural Barriers*, a bio-invasions flyer and poster, pet store flyer, live seafood shipper flyer, and a biological supplier flyer. The project has received \$25,000 in funding through the Puget Sound Water Quality Action Team with funds from the Environmental Protection Agency.

4A1b Task: Washington Sea Grant will develop further publications and displays to increase public awareness of the impacts of ANS and methods of preventing their spread. Washington Sea Grant is requesting \$60,000, plus 1 FTE (\$65,000) to implement this task.

4A1c Task: Washington Sea Grant will prepare ANS fact sheets and wallet ID cards on species of greatest concern. Support for the development of initial materials will be from the Puget Sound Water Quality Action Team as listed in 4A1a. These will include materials on *Spartina*, zebra mussel, hydrilla, Brazilian elodea, fanwort, purple loosestrife, saltcedar, green crab, and Chinese mitten crab. Wallet identification cards will include a color photograph, along with a description of key identifying characteristics. Materials will include a contact number, and information as to where potential sightings can be reported and specimens submitted for final identification. Washington Sea Grant is requesting \$15,000 for additional material development.

4A1d Task: Washington Department of Fish and Wildlife, Washington Sea Grant, Washington State Noxious Weed Control Board, Department of Ecology, Washington Department of Natural Resources, and/or Puget Sound Water Quality Action Team will write quarterly press releases focusing on problems associated with ANS and how to prevent introductions. Press releases will be tied to specific events (e.g., conferences, flowering of purple loosestrife) and distributed to newspapers for general circulation throughout the state.

4A1e Task: Washington Sea Grant will produce public service announcements that introduce the general public to problems associated with ANS and how to prevent their introduction. Washington Sea Grant is requesting \$8,000 to accomplish this task.

4A1f Task: The Washington Department of Natural Resources and Washington Sea Grant, in conjunction with Washington Department of Ecology, Washington Department of Fish and Wildlife and the Washington State Noxious Weed Control Board, will develop an ANS curriculum for schools. The curriculum will emphasize the concept of nonnative invasive species and why they cause damage. Materials will focus on grades 6-12 and would be tied to the

noxious weed curriculum/teacher training that has been developed by Washington State Noxious Weed Control Board and Washington Department of Natural Resources. The information will be shared with teachers at the Washington Department of Natural Resources teacher training workshops. The information will also be used in Washington Sea Grant sponsored marine educators training. Washington Department of Natural Resources, Washington Department of Ecology, Washington Department of Fish and Wildlife, and Washington State Noxious Weed Control Board are requesting a total of \$2,000 in additional funds to implement this task and Washington Sea Grant will require \$10,000 for materials development and teacher education workshop support.

4A1g Task: Adopt a Beach, Washington Water Trails Association, and the Puget Soundkeeper Alliance will conduct training workshops to distribute and disseminate ANS materials in communities throughout Puget Sound.

4A1h Task: The Washington Department of Ecology will continue to maintain and upgrade a web site that contains both technical and non-technical information about ANS weeds. The site has photographs of some species, information about life cycles, ecology, physiology, and management methods. It is found at <http://www.wa.gov.ecology/wq/plants/aquahome.html>. The Washington Department of Ecology has dedicated 0.1 FTE (\$6,000) to this task.

4A1i Task: The Washington Department of Fish and Wildlife has sponsored an educational program on purple loosestrife for six years. This included:

- development and distribution of a brochure;
- production of a publication on how to organize volunteer efforts for purple loosestrife control;
- giving numerous talks and scientific presentations to lake associations, professional entities, and similar groups; and
- preparation of poster presentations at many symposia and other weed control gatherings.

An inventory report sheet was developed and widely distributed with the brochure to encourage looking for and identifying purple loosestrife infestations. This has resulted in a general knowledge of purple loosestrife in Washington and numerous infestation reports from the public. The Washington Department of Fish and Wildlife has dedicated 0.1 FTE (\$6,000) per year to fund this task.

4A1j Task: Washington Department of Fish and Wildlife will coordinate with the Western Regional Panel to establish a zebra mussel information clearinghouse for western states similar to existing clearinghouses in the eastern United States.

4A2. Strategic Action: Develop and distribute educational information targeted at specific pathways of introduction that involve the public.

4A2a Task: Washington Sea Grant will develop a short handout dealing with the spread of ANS via aquarium dumping. The handout, funded by the Environmental Protection Agency (included in Task 4A1a), will be provided to pet stores and aquatic plant nurseries for distribution to their customers. In addition, a coordinating poster will be developed and supplied for display in pet stores and nurseries. Summer interns will be used to distribute the materials and make direct contacts with the business owners. Washington Sea Grant is requesting \$3,000 in additional funding for distribution.

4A2b Task: Washington Department of Fish and Wildlife and Washington Sea Grant will develop a brief insert to be distributed with Washington fishing licenses and boat tax statements. The insert will focus on how fishing and associated activities can contribute to the ANS problem. Washington Department of Fish and Wildlife is requesting \$3,000 to fund this task.

4A2c Task: The Washington Department of Ecology has developed a brochure, "*Nonnative, Invasive Aquatic Plants*," which uses line drawings and text to describe Washington's exotic freshwater species. This brochure, along with a zebra mussel identification card, is being included with information that is handed to each purchaser of a new boat in Washington. The Washington Department of Ecology dedicated \$2,000 to this project.

4A2d Task: Milfoil signs were placed on public boat launches throughout Washington during the late 1980s. The Washington Department of Ecology is updating these signs in 1998. Updated milfoil signs will be placed at boat launches where milfoil is present; Brazilian elodea signs will be placed at boat launches where it is present; and parrotfeather signs will be placed at boat launches where parrotfeather is present. On waterbodies where there are no problem freshwater non-indigenous species, a sign warning boaters to clean all plants off their boats, trailers, and fishing gear, and cautioning people not to dump aquariums will be placed at the boat launches. Washington Department of Fish and Wildlife will work with Ecology to integrate zebra mussel information into new signage. The Washington Department of Ecology has dedicated \$5,000 to this project and is requesting an additional \$12,000 to complete this task.

4A2e Task: Washington Department of Ecology produced a brochure, "*Milfoil—An Aggressive Water Weed*," that advises boaters to remove aquatic plants from trailers, propellers, and fishing gear. Ecology has dedicated \$2,000 for this brochure.

4A2f Task: Washington Department of Fish and Wildlife, Washington Sea Grant, Washington Department of Ecology, Washington State Noxious Weed Control Board, Washington

Department of Agriculture, and the Puget Sound Water Quality Action Team will contribute articles to gardening magazines, newsletters, and newspapers that explain ANS issues and detail existing state quarantines that prohibit the sale of certain aquatic noxious weeds.

4B. Problem: Several industry, research, and agency practices contribute to the introduction of new aquatic nuisance species. Current educational efforts are inadequate to help these groups understand and address the problems.

4B1. Strategic Action: Develop and/or distribute educational materials targeting specific pathways of introduction to appropriate industry, research, and agency groups. Washington Sea Grant will coordinate this effort.

4B1a Task: The U.S. Coast Guard will distribute its newly produced ballast water exchange educational materials to shipping agents.

4B1b Task: Washington Sea Grant will develop a handout that explains how to safely handle, ship, display, and/or store ANS in order to prevent unintentional introductions. The handout will be distributed to live seafood markets or shippers, bait shippers, private laboratories, scientific supply houses, aquaria, and universities. Washington Sea Grant is requesting \$4,000 to accomplish this task.

4B1c Task: Washington Department of Agriculture, in cooperation with the Washington Department of Ecology and Washington State Noxious Weed Control Board, will send a periodic mailing to aquatic nurseries, mail order companies, and pet stores, which details Washington's noxious weed quarantines and explains which plants are prohibited for sale and why. Washington Department of Ecology and the Washington State Noxious Weed Control Board sent the first such mailing in 1995 and dedicate \$1,500 annually to support the cost per mailing.

4B1d Task: Washington Sea Grant will conduct outreach education, including the development and distribution of educational material to the aquaculture industry on ANS. Washington Sea Grant will require \$10,000 to implement this task.

4C. Problem: Resource managers lack information to effectively identify and manage exotic species problems.

4C1. Strategic Action: Distribute identification and management information to resource agency staff.

4C1a Task: Washington Sea Grant, Washington Department of Fish and Wildlife, Washington Department of Natural Resources, Washington State Noxious Weed Control Board, Washington Department of Ecology, Puget Sound Water Quality Action Team, and other agencies will distribute ANS species bulletins and wallet ID cards (see 4A1c) to agency field staff.

4C1b Task: The Washington Department of Ecology is preparing a book, “*Field Identification Guide to Washington’s Aquatic Plants*.” The guide describes 106 freshwater aquatic plants, including line drawings and photographs of most species. The manual will be distributed to agency staff, along with lake groups, to enhance their ability to identify aquatic plants. Early identification of nonnative invasive plants will result in cost-effective management and containment of these infestations. The manual will be available in 1999. Ecology has dedicated \$250,000 to this project.

4C1c Task: Washington Department of Fish and Wildlife, with the assistance of cooperating agencies, will develop an ANS slide library that would be housed with the state ANS coordinator. Slides and prints will be made available to resource agencies as appropriate. Washington Department of Ecology and the Washington State Noxious Weed Control Board have already provided slides of all listed aquatic noxious weeds to county noxious weed control boards.

4C1d Task: Washington Sea Grant will organize a biennial regional ANS workshop for resource managers. The workshop will emphasize identification of new species, as well as sharing information on prevention and control. Washington Sea Grant is requesting \$30,000 to implement this task.

4C1e Task: Washington Department of Fish and Wildlife, in cooperation with the University of Washington and Washington Sea Grant, will develop an ANS web site to be used for sharing information on ANS. The site will include links to other ANS web sites, including the existing Washington Department of Ecology web site, which has both technical and non-technical information on ANS aquatic plants. Washington Sea Grant will require \$10,000 to support the implementation of this task.

4C1f Task: Washington Department of Fish and Wildlife and Washington Sea Grant will develop a list of experts to whom samples can be sent for identification. The list of experts would be published on the ANS web site. This project will complement the existing Washington Department of Ecology Aquatic Plant Identification Service and will include the list of marine taxonomic experts created by Task 5B2a.

4C1g Task: Washington Department of Ecology and Washington State Noxious Weed Control Board will continue to disseminate information about ANS weeds to a variety of groups via presentations about problems species and management methods. Targeted groups include: lake associations, county noxious weed control boards, universities and colleges, state agencies, scientists and managers, nursery industry, and other interested parties. Washington Department of Ecology and Washington State Noxious Weed Control Board will continue to dedicate 0.2 FTE (\$12,000) annually to this task.

4D. Problem: Decision-makers are often unaware of ANS problems and solutions. Their lack of information can cause them to be unwilling to provide support for ANS projects.

4D1. Strategic Action: Develop and provide ANS educational briefings and informational materials to key decision-makers.

4D1a Task: The Washington Sea Grant will organize a biennial field day for legislators and staff. The day will involve a trip to one or more infested sites and highlight the problems caused by the species along with the actions required to eliminate or minimize the problem. Potential legislative solutions will be highlighted. Washington Sea Grant is requesting \$10,000 to support this task.

4D1b Task: The Washington Department of Fish and Wildlife, in conjunction with Washington Department of Ecology, Washington Department of Natural Resources, and Washington State Noxious Weed Control Board, will prepare a biennial summary of ANS projects for members and staff of key legislative committees. The report will detail the current status of ANS in Washington and will highlight successful prevention/control projects.

4D1c Task: The Washington Sea Grant and Washington Department of Fish and Wildlife will use educational materials produced elsewhere (e.g., zebra mussel videos) to educate decision-makers on problems associated with ANS not yet found in Washington. The materials will be used to stress the importance of preventing introduction of these species into Washington.

4D1d Task: Adopt a Beach, Washington Water Trails Association, Puget Soundkeeper Alliance, and Washington Sea Grant will support state agency decision-maker field days by inviting local and regional decision-makers to attend volunteer training workshops throughout Puget Sound.

4D1e Task: U. S. Fish and Wildlife Service will conduct a West Coast conference on the mitten crab to assess their potential for spread, local adaptation, and projected environmental and economic impacts. Washington Sea Grant, along with other organizations, will support this effort.

Objective 5: Monitor Waters That Are Vulnerable to New ANS Introductions and Track the Distribution of Existing ANS Populations.

5A. Problem: Several very damaging ANS are spreading closer to Washington waters. Current efforts to monitor for these species and for some ANS species already present in Washington are inadequate. Economic and environmental damage will be greater without an effective monitoring program to quickly detect new ANS introductions or the spread of those already present.

5A1. Strategic Action: Design and conduct a zebra mussel risk assessment to identify Washington waters that are at risk of a zebra mussel infestation. Prioritize Washington's freshwater systems into areas of high and low risk, and implement appropriate monitoring programs.

5A1a Task: Dr. Sarah Reichard of the University of Washington will coordinate the creation of a zebra mussel risk assessment for Washington lakes, prioritize the lakes, and produce a report on the results. Water samples for the risk assessment will be taken by the Washington Department of Ecology. The University of Washington is requesting \$4,000 to complete this task.

5A1b Task: Based upon the results of the risk assessment, Dr. Linda Chalker-Scott of the University of Washington will coordinate with the Washington Department of Ecology to design and implement a zebra mussel veliger monitoring program for the top 20 high risk lakes. Washington Department of Ecology will take the plankton samples and send them to the University of Washington for veliger analysis. Lower risk lakes will use a less expensive volunteer monitoring program to be organized by Washington Department of Ecology. An annual zebra mussel monitoring report will be produced by the University of Washington and the Washington Department of Ecology. University of Washington and the Washington Department of Ecology are requesting \$30,000 to implement this task.

5A1c Task: Washington Department of Fish and Wildlife will review the U.S. Army Corps of Engineers' zebra mussel risk assessment for the lower Snake and Columbia Rivers and coordinate with the Tribes, Army Corps of Engineers, Bonneville Power Administration, mid-Columbia Public Utility Districts, and other affected parties on the creation and implementation of a zebra mussel monitoring program for these major rivers, possibly linked with the University of Washington and Washington Department of Ecology's effort to monitor Washington lakes (described in Task 5A1b).

5A1d Task: The Washington Department of Ecology, working in conjunction with local volunteer groups, will monitor a subset of low priority lakes, and possibly rivers (identified in Task 5A1a), for zebra mussels. A technology that is simpler and less expensive than veliger

identification will be used, and the information will be made available to appropriate state and federal agencies.

5A1e Task: Washington Department of Fish and Wildlife will encourage neighboring states and provinces to set up zebra mussel monitoring programs in their waters and will track the distribution of zebra mussels in the western U.S. and Canada. The implementation of this task is dependent upon the funding of Objective 1.

5A1f Task: Washington Water Trails Association will develop a zebra mussel volunteer monitoring program for freshwater lakes and rivers designed and targeted towards recreational paddlers in Eastern Washington. This task will be coordinated with 5A1a and 5A1b. Washington Water Trails Association is requesting 0.1 FTE (\$4,000) and \$2,000 for travel and materials to complete this task.

5A2. Strategic Action: Design and conduct a green crab risk assessment to identify Washington waters that are at risk of green crab infestation. Prioritize areas at risk and implement appropriate monitoring programs. The implementation of this strategic action is dependent upon the funding of Objective 1.

5A2a Task: Washington Department of Fish and Wildlife will convene a sub-committee of the Zebra Mussel and Green Crab Task Force to design and support the implementation of a green crab risk assessment and monitoring program. This program will be coordinated with other efforts along the Pacific Coast of North America (e.g., the monitoring aspects of the proposed Pacific *Carcinus* Network (Ruiz and Grosholz, draft)) and will include representatives of Washington Sea Grant, the shellfish industry, tribes, state and federal agencies, the University of Washington, volunteer organizations, and other affected parties. Washington Sea grant will require 0.25 FTE (\$16,250) to support this task. The implementation of this task is dependent upon the funding of Objective 1.

5A2b Task: Adopt a Beach, Washington Water Trails Association, and Puget Soundkeeper Alliance will support and assist Washington Department of Fish and Wildlife in developing a volunteer monitoring program for the green crab based on techniques and data management protocols for the Spartina Watch program. Adopt a Beach, Washington Water Trails Association, and Puget Soundkeeper Alliance are requesting 0.5 FTE (\$20,000) and \$15,000 for program expenses and data mapping to accomplish this task.

5A2c Task: Washington Department of Fish and Wildlife and Washington Sea grant will coordinate with shellfish grower organizations, tribes, and state and local government agencies to organize surveys for green crab along the Washington coast. If the approach proposed by Ruiz and Grosholz is followed, this would involve deploying minnow traps and conducting shore

surveys once per year, probably in August or September. Details of the Washington effort would be coordinated regionally and with the State Task Force, see Tasks 5A2a and 5A2b.

5A3. Strategic Action: Design and conduct a mitten crab risk assessment to identify areas at risk of mitten crab infestation. Prioritize the areas at risk and implement a monitoring program.

5A3a Task: Washington Department of Fish and Wildlife and Washington Sea grant will convene a temporary advisory committee to assess the risks of mitten crab infestations in Washington waters and to design a mitten crab surveillance program. This program will be coordinated with regional efforts (see also mitten crab research tasks under Strategic Action 6A2). Washington Sea Grant will require 0.25 FTE (\$16,250) to support this task.

5A3b Task: Washington Department of Fish and Wildlife will coordinate a mitten crab monitoring program, which may be implemented in part by volunteer monitoring. Washington Department of Fish and Wildlife is requesting \$30,000 to initiate this task.

5A4. Strategic Action: Continue monitoring for the spread of *Spartina*.

5A4a Task: Washington Department of Agriculture will continue to act as the lead agency for statewide *Spartina* coordination, including monitoring and control efforts. The Washington Department of Agriculture dedicates approximately \$50,000 per year to this task, which includes 1 FTE.

5A4b Task: County noxious weed boards (Grays Harbor, Pacific, Skagit, Snohomish, Island, and San Juan) will continue to monitor their coastlines for new *Spartina* infestations and serve as a local source for information to the general public. In addition, with the financial assistance of the Washington Department of Agriculture, several counties will hire a *Spartina* coordinator to manage *Spartina* related activities. County noxious weed boards (Grays Harbor, Pacific, Skagit, Snohomish, Island, and San Juan) have dedicated 0.5 FTE (\$15,000) to this task.

5A4c Task: Washington Department of Fish and Wildlife will continue to monitor regions, such as Grays Harbor and North Puget Sound, for new infestation and perform *Spartina* control when pioneering *Spartina* seedlings and clones are found. The Washington Department of Ecology Natural Resource Damage Assessment Fund has dedicated approximately \$7,500 annually and Washington Department of Fish and Wildlife has dedicated approximately \$7,500 annually to this task. This task has 0.5 FTE dedicated by these funds.

5A4d Task: Washington Department of Agriculture, Washington Department of Fish and Wildlife, Washington Department of Natural Resources, and U. S. Fish and Wildlife Service will continue to treat known infestations and monitor areas relatively free of *Spartina* in Willapa

Bay to maintain their weed-free integrity. Washington Department of Agriculture has dedicated approximately \$200,000 annually for Willipa Bay and North Puget Sound control work. Washington Department of Natural Resources has dedicated approximately \$136,000 annually and U. S. Fish and Wildlife Service has dedicated approximately \$137,000 annually for work in Willipa Bay. Washington Department of Fish and Wildlife has dedicated approximately \$140,000 annually for control in Willipa Bay and \$170,000 for North Puget Sound through the Natural Resource Damage Assessment Fund. This task has 9 FTEs dedicated by these funds.

5A4e Task: Adopt a Beach and Washington Water Trails are funded to continue the *Spartina* Watch program at \$50,000 per year through June 1999 from the Washington Department of Agriculture. *Spartina* Watch will provide 100 new volunteers and 200 existing volunteers to map 300 miles of Puget Sound shoreline, focusing on those counties without County Weed Boards. Adopt a Beach also will coordinate removal and eradication projects on pioneering *Spartina* colonies that Washington Department of Agriculture or county weed board staff are not focusing on. Adopt a Beach and Washington Water Trails are requesting \$10,000 in additional funding to map *Spartina* colonies and increase volunteer training.

5A4f Task: Washington Department of Agriculture has designated Adopt a Beach as the lead organization to collect *Spartina* data from all monitoring efforts. Adopt a Beach coordinates with Washington Department of Agriculture and county weed boards to map the distribution and monitoring throughout Puget Sound. If Washington Department of Natural Resources is designated as the Lead mapping agency for *Spartina*, Adopt a Beach will coordinate and share data with Washington Department of Natural Resources to produce and distribute statewide *Spartina* maps.

5A4g Task: The Puget Soundkeeper Alliance will implement the following tasks designed to improve our ability to monitor for the spread of *Spartina* and other marine ANS:

- expose a minimum of 200 water-based volunteers (kayakers & divers) to the issue of aquatic nuisance species through a ½ hour presentation during regularly scheduled training classes;
- deliver written materials on *Spartina* and other species appropriate to this audience;
- provide web site addresses for further information;
- if there is sufficient interest among volunteers, organize a class on exotic species in cooperation with Adopt a Beach and Washington Department of Fish and Wildlife for Soundkeeper trainees and the general public; and
- introduce the issues and web sites to other organizations and encourage them to include the information in their volunteer training efforts.

5A4h. Task: Washington Department of Natural Resources will continue to aerially photograph *Spartina* in Willapa Bay in color infrared. This information is being entered into a Geographical Information System to create maps yielding accurate acreage figures and trends regarding the spread of *Spartina* within that estuary. Washington Department of Natural Resources has dedicated 0.5 FTE (\$30,000) for this task.

5A4i. Task: Washington Department of Fish and Wildlife will continue to aerially photograph portions of North Puget Sound to monitor the efficacy of *Spartina* treatment and to locate new infestations. This information will be entered into a Geographical Information System in the near future. Washington Department of Fish and Wildlife has dedicated \$16,000 for this task.

5A5. Strategic Action: Continue the monitoring of purple loosestrife in Washington's wetlands and shorelines.

5A5a Task: The Washington Department of Fish and Wildlife will continue to survey wetlands, streambanks and lake shores for the occurrence of purple loosestrife. Most owned and control lands have been inventoried once for purple loosestrife and a database established. This information needs to be entered into a Geographical Information System database for ease of manipulation and sharing with other control entities. Monitoring occurs yearly or biennially to note new invasions and changes in existing populations as time allows. Coordination with county weed authorities and other land management agencies occurs annually to encourage work on this species and to share information. Currently Washington Department of Fish and Wildlife dedicates 0.5 FTE (\$35,000) to monitoring and related activities. An additional 0.5 FTE (\$35,000) is requested to allow a more systematic approach to monitoring and the ability to create a Geographical Information System database.

5A5b Task: Washington Department of Fish and Wildlife does extensive monitoring of all ANS weed control work. The current year sites are monitored to determine where incomplete weed control has occurred so they can be retreated. End of season monitoring is done to determine effectiveness of current year's control work. Spring monitoring provides information on strategy effectiveness in actually killing target plants, reducing weed coverage and input into plans for the coming season. Effective ANS weed control must include effective monitoring and constant reevaluation based on this information. This is one step toward the long-term management goal of removing purple loosestrife and replacing it with native species. Washington Department of Fish and Wildlife has dedicated 0.2 FTE (\$12,000) to this task.

5A5c Task: Washington Department of Agriculture, Washington Noxious Weed Control Board, and Washington Department of Ecology will continue efforts toward purple loosestrife population monitoring and control. The Department of Agriculture has purchased boats to facilitate survey work by local weed control personnel, and invested in biological control

research totaling approximately \$60,000. The Washington Department of Ecology has provided grant funding for survey and control projects covering the Yakima River, the lower and mid-Columbia River, Okanogan County and Stevens County. The total amount provided to date is approximately \$200,000.

5A6. Strategic Action: Continue monitoring for freshwater non-indigenous plants in Washington's lakes and rivers.

5A6a Task: The Washington Department of Ecology will continue to survey a subset of Washington lakes and rivers each year to establish baseline data on Washington native aquatic plant species and to detect and map non-indigenous freshwater plants. Non-indigenous plant species targeted include: hydrilla, Eurasian watermilfoil, parrotfeather milfoil, Brazilian elodea, fanwort, and other plants listed in Appendix C. Washington Department of Ecology has dedicated 0.5 FTE (\$35,000) to this task.

5A7. Strategic Action: The Washington Department of Ecology Long-term Marine Waters Monitoring group will design and conduct a plankton (phytoplankton, zooplankton, and larval forms of species e.g., green crab) monitoring and assessment program to identify the current status of exotic plankton introductions in Washington waters (Willapa Bay, Grays Harbor, and Puget Sound). Washington Department of Ecology is requesting \$9,600 for analyses at the University of Washington and 0.1 FTE (\$6,900).

5B. Problem: There is presently no regional mechanism in place for sharing information concerning the occurrence and distribution of nonnative aquatic species or their potential for becoming ANS. Coordination and general nonnative species monitoring is needed for both marine and fresh waters to improve our ability to immediately recognize and respond to invasions.

5B1. Strategic Action: Develop and maintain lists of nonnative species known to occur in Washington.

5B1a Task: Dr. Annette Olson and Dr. Jeff Cordell of the University of Washington will continue to develop and maintain a list of nonnative species known to occur in Washington and neighboring marine waters (included in appendix C). They will also submit this information to the U.S. Geological Service Biological Resource Division for posting on their web site: nas.nfrcg.gov/nas.htm. The University of Washington is requesting \$30,000 to complete this task.

5B1b Task: The Washington Department of Ecology will continue to maintain a list of non-indigenous freshwater aquatic plants known to occur in Washington. As unreported non-

indigenous species are detected, this information will be provided to the U.S. Geological Service Biological Resource Division for posting on their web site.

5B1c Task: Washington Department of Fish and Wildlife will further develop and maintain a list of nonnative freshwater aquatic animal species in Washington and this information will be provided to the U.S. Geological Service Biological Resource Division for posting on their web site.

5B2. Strategic Action: Provide support for the identification of possible ANS or cryptogenic species. Washington Sea grant will provide support for this strategic action.

5B2a Task: Dr. Annette Olson and Dr. Jeff Cordell of the University of Washington and Washington Department of Fish and Wildlife will develop and maintain a list of taxonomic experts to confirm the identity of nonnative marine species. The University of Washington is requesting \$15,000 to complete this task.

5B2b Task: The Washington Department of Ecology will continue to provide an aquatic plant identification service to the public and others. This service is publicized via their web site at <http://www.wa.gov/ecology/wq/plants/plantid.html>. Washington Department of Ecology also provides information about non-indigenous freshwater plants at <http://www.wa.gov/ecology/wq/plants>. The Washington Department of Ecology has dedicated .01 FTE (\$600) to maintain this task.

5B2c Task: Washington Department of Fish and Wildlife will support the development and distribution of identification materials for zebra mussel. The implementation of this task is dependent upon the funding of Objective 1.

5B3. Strategic Action: Make baseline survey and distribution data for ANS available to local, state, and federal governments and other interested parties (see also tasks under Strategic Actions 5A1 through 5A4).

5B3a Task: Dr. Annette Olson and Dr. Jeff Cordell of the University of Washington and parties coordinating green crab, mitten crab, and *Spartina* monitoring efforts will encourage and facilitate the submission of information on marine ANS distribution in Washington State to the U.S. Geological Service Biological Resource Division for posting on their web-site: nas.nfrcg.gov/nas.htm. The University of Washington is requesting \$10,000 to complete this task.

5B3b Task: The Washington Department of Ecology will continue to maintain its centralized database on aquatic plant distribution in Washington. Washington Department of Ecology

publishes distribution data for hydrilla, Brazilian elodea, parrotfeather, and Eurasian watermilfoil on its web site at <http://www.wa.gov/ecology/wq/plants>. The Washington Department of Ecology has dedicated 0.1 FTE (\$6,000) to maintain this task.

5B3c Task: The Washington Department of Ecology will continue to publish an annual monitoring report on the results of yearly surveys on a subset of Washington lakes and rivers for aquatic plants. Each report also summarizes all current known distribution data on Eurasian milfoil, Brazilian elodea, parrotfeather, and hydrilla. These reports are distributed to noxious weed control personnel and other interested parties on request, and the 1997 report will be published on Ecology's web site. The Washington Department of Ecology has dedicated 0.2 FTE (\$12,000) to maintain this task.

5B3d Task: Washington Department of Fish and Wildlife will develop and maintain a centralized database on the distribution of freshwater ANS animals in Washington. The implementation of this task is dependent upon the funding of Objective 1.

Objective 6: Conduct Research on ANS Priority Species in Washington, and Develop Efficient Systems to Disseminate ANS Research Information to the Research and Management Communities.

6A. Problem: Many aspects of ANS introduction and establishment remain poorly understood. Research questions relevant to Washington waters include: what are the precise risks associated with each pathway of introduction, what environmental conditions will be necessary for certain ANS to become established in our waters, what are the likely interactions with native species and impacts on habitats, what are the impacts on our aquaculture industry, and what are the pros and cons of various management options?

6A1. Strategic Action: Identify research needed to protect Washington from the threat of ANS.

6A1a Task: The Washington Department of Ecology will continue to compile and evaluate information on the ecology and management of non-indigenous freshwater plants including attending appropriate scientific or technical conferences.

6A1b Task: The University of Washington, Washington Sea Grant, Washington Department of Ecology, and Washington Department of Fish and Wildlife will monitor the many ongoing research efforts in North America which are attempting to develop mechanisms for controlling zebra mussel populations.

6A1c Task: The Washington Work Group on Exotics in the Puget Sound/Georgia Basin will identify critical information needs to control the introduction of marine non-indigenous species and make recommendations for future research to the Washington Aquatic Nuisance Species Planning Committee.

6A2. Strategic Action: Support or encourage research that improves our ability to identify, predict and prioritize potential ANS introductions. Washington Sea Grant will take the lead in coordinating the implementation of this strategic action.

6A2a Task: Agencies involved in ANS monitoring and management in Washington will support and encourage research to fill priority information needs identified through Strategic Action 6A1.

6A2b Task: Washington Sea Grant will continue to investigate the risks of ANS introductions through shipments of live seafood and the use of ANS for education and research. Washington Sea Grant has dedicated \$122,382 for this two year project.

6A2c Task: Washington Sea Grant investigators Bruce Frost and Jeff Cordell will continue to investigate the effects of the Asian copepod invasions on the Pacific Coast. Washington Sea Grant has dedicated \$195,000 to fund two year of this project.

6A2d Task: Agencies involved in zebra mussel response planning will seek funding and support for West Coast research on early response eradication strategies. Possible funding sources include Bonneville Power Administration and Public Utility Districts. Various research organizations will be considered including Battelle and universities within the region.

6A2e Task: Washington Department of Fish and Wildlife will encourage the Western Regional Panel to compile and evaluate information on the life history characteristics and habitat requirements of the mitten crab, and compare it with west coast conditions to determine areas at risk of establishing populations. U.S. Fish and Wildlife Service is compiling a literature search for green crab, scheduled for completion in September, that should be useful in completing this task.

6A2f Task: Washington Department of Fish and Wildlife will contract with a research organization to document various marine ecological parameters that exist prior to the introduction of green crab. This research will provide the baseline data needed to assess the impact of green crab on our marine ecosystems. One aspect of this effort will be to request that existing nearshore monitoring and research activities assist in the documentation of “pre-green crab conditions” by describing intertidal community structure observed through their studies. Monitoring and research activities to be addressed include, but need not be limited to,

Washington Department of Natural Resources's Puget Sound Ambient Monitoring Program nearshore habitat monitoring; the U.S. Army Corps of Engineers' assessments of mitigation plots for juvenile Dungeness crab in Grays Harbor; Washington Department of Fish and Wildlife's shellfish abundance monitoring; studies at Padilla Bay Research Reserve; monitoring activities at the Port Townsend Marine Science Center and Washington State University/Island County Beach Watchers; and other county and volunteer intertidal and nearshore monitoring efforts. The contractor will use information compiled through these ongoing efforts to compile descriptions of "pre-green crab conditions." Washington Department of Fish and Wildlife is requesting \$30,000 to implement this contract.

6A2g Task: In coordination with federal ANS activities, Washington agencies and scientists will conduct or encourage ecological surveys of Washington waters. Federal efforts need to be defined for Washington waters. At the state level, Washington Department of Natural Resources, University of Washington scientists, and others have made preliminary plans to conduct an ecological survey of docks and floats in Puget Sound in September 1998. Federal/state coordination will be needed to ensure that a reasonable and financially feasible sample of Washington's marine and freshwater are surveyed. The coordination of this task is dependent upon the funding of Objective 1.

6A2h Task: Washington agencies and scientists will support and participate in research on green crab life history and ecology in California. Information needs include: description of location and timing of settlement; adult distribution and habitat use; relationship to vegetation, especially *Zostera japonica* and *Spartina spp.* Washington Sea Grant has dedicated \$142,000 to fund a two-year research project on the effect of green crab on native species.

6A2i Task: Washington Sea Grant will conduct research that improves our ability to minimize the ecological and economic impacts of aquatic nuisance species. Washington Sea Grant funding will be based on individual projects, but could easily require \$200,000 annually for five years to find solutions to this management problem.

6A2j Task: Washington Sea Grant will continue research on the green crab's response to two categories of invertebrate prey, the Dungeness crab and bivalves, and to evaluate the impact of green crab on commercial populations through direct predation or habitat alteration. Washington Sea Grant has dedicated \$143,000 to fund this two-year research project.

6A2k Task: Washington Sea Grant will conduct and synthesize baseline monitoring and research on intertidal community structure and ecosystem relationships on a variety of substrates. This data will provide baseline information that will enable scientists to assess the impact of green crab and other ANS. Washington Sea Grant will require 0.25 FTE (\$16,250) to implement this task.

6B. Problem: Research is needed to develop new eradication/control techniques for ANS and to find more effective ways to use existing techniques.

6B1. Strategic Action: Support and encourage research, both within Washington and at the federal level, to develop new ANS management techniques and to improve existing techniques. Washington Sea Grant will take the lead in coordinating this action.

6B1a Task: The Washington Department of Ecology will continue to fund the University of Washington study on the life cycle of a Eurasian watermilfoil eating weevil (*Euhrychiopsis lecontei*) in Washington State. The Washington Department of Ecology has dedicated \$50,000 per year to fund this study.

6B1b Task: The Washington Department of Ecology will encourage research into the development of biological control insects for Brazilian elodea and parrotfeather milfoil. An apparently effective biocontrol insect is being used to control parrotfeather milfoil in South Africa. This insect must go through United States quarantine procedures before it could be introduced here. The United States Department of Agriculture has a research station in Argentina and is initiating a survey to look for biocontrol insects for water hyacinth. Because water hyacinth and Brazilian elodea share a similar range, with funding, this group could also attempt to locate insects for Brazilian elodea control. The Washington Department of Ecology is requesting \$50,000 per year to fund this study.

6B1c Task: The Washington Department of Ecology and the Washington Department of Fish and Wildlife, in cooperation with other agencies, will identify research designed to determine the impacts of ANS on salmonids in Washington. The coordination of this task is dependent upon the funding of Objective 1.

6B1d Task: The Washington Department of Ecology, in partnership with the Stevens County Noxious Weed Control Board, and the Loon Lake Association, will conduct an evaluation of the effectiveness of the aquatic herbicides 2,4-D on Eurasian watermilfoil in Loon Lake in 1998. Washington Department of Ecology has dedicated \$50,000 to this task.

6B1e Task: Washington State University and Pacific County Conservation District will continue to research the efficacy of selected herbicides and surfactants on *Spartina*. Washington State Commission for Pesticide Registration has dedicated \$12,000 to this task.

6B1f Task: The Washington Department of Fish and Wildlife needs further research on ANS weed control, including purple loosestrife. This includes work on plant life history and ecology to determine the vulnerability to various control strategies. More work is needed on species selective herbicides and additional bio-control organisms. Additional information is needed on

desirable competing vegetation and management techniques to prevent purple loosestrife from invading. Washington Department of Fish and Wildlife is requesting \$50,000 per year to fund university research relating to this task.

6B1g Task: The Washington Department of Fish and Wildlife will identify research needed on the effects of green crab on established native and nonnative, cultured and non-cultured shellfish species, including state shellfish populations. The goal is to develop effective predator control techniques to minimize economic impacts to the shellfish industry and environmental impacts to native species.

6B1h Task: Washington Sea Grant will conduct research to develop new control strategies or eradication techniques for green crab, and other ANS. Washington Sea Grant funding will be based on individual projects, but could easily require \$200,000 annually for five years to find solutions to this management problem.

6B1i Task: The Sustainable Ecosystem Institute will conduct an impact assessment of the green crab on the shellfish industry. The study will identify key sites most likely to be impacted by green crab, evaluate their potential impacts on commercially important species, and develop mitigation measures to reduce impact. The Sustainable Ecosystem Institute is requesting \$51,500 to implement this study.

Objective 7: Legislation for Washington State ANS Rules and Regulations to Ensure that our Legislation Efficiently Promotes the Prevention and Control of ANS in Coordination with Federal Regulations.

7A. Problem: ANS law is a new and rapidly evolving field. Washington State laws must adapt as we improve our knowledge of ANS issues. The regulatory authority and financial support afforded by integrated state and federal legislation can enable our society to avoid or minimize environmental and economic damage from ANS. Current state ANS regulations have been enacted to address specific problems, but no effort has been made to comprehensively review Washington ANS laws.

7A1. Strategic Action: Review the laws governing ANS in Washington for gaps and overlaps, compare them to other state and federal ANS laws, and recommend changes to improve our ability to protect Washington waters from the introduction and spread of ANS.

7A1a Task: Washington Department of Fish and Wildlife will commission one, or possibly two, law student(s) to conduct a review of Washington's ANS law and offer suggestions for improvement. Washington Department of Fish and Wildlife is requesting 1,000 hours of law student time at \$15.00 per hour to complete this task.

7A2. Strategic Action: Washington State Laws of 1998, Chapter 153 directs the Washington Department of Fish and Wildlife to create a Zebra Mussel and Green Crab Task Force. The Task Force shall:

- (1) develop recommendations for legislative consideration including: (a) control methods; (b) inspection procedures; (c) penalties; (d) notification procedures; and (e) eradication and control techniques;
- (2) for each threat, identify the primary pathways of introduction, options for regulating each pathway, and if possible, a recommended method of pathway control. These methods of control shall include details on which entity would be responsible for implementation;
- (3) for each recommended mechanism of pathway control, identify the estimated costs of implementing a state program, including ideas of funding sources; and
- (4) provide recommendations for structuring and funding a state program that monitors the detection and spread of these species.

When making recommendations, the Task Force shall emphasize working in a coordinated fashion with existing state, federal, and international programs.

The Task Force shall invite participation from all groups affected by the proposed pathway control measures, including representatives of aquaculture, recreational boating, seaplane operations, maritime cargo vessels, retail and wholesale aquariums, shellfish growers, marinas, and small boat harbors.

Washington Department of Fish and Wildlife shall also seek the participation of the University of Washington, Washington Department of Ecology, Washington Department of Agriculture, Washington Department of Transportation, Washington Department of Natural Resources, and Washington State Patrol. Appropriate federal interests shall also be invited to participate, including the United States Coast Guard, the United States Department of Agriculture, and the United States Fish and Wildlife Service.

The Task Force final recommendations shall be provided to the Legislature by December 1, 1998.

7A2a Task: Washington Department of Fish and Wildlife will chair and coordinate the creation of the Zebra Mussel and Green Crab Task Force. Recommendations from the Task Force will be provided to the Legislature by December 1, 1998. The Washington State Legislature has dedicated \$45,000 to fund this task.

Implementation

The following implementation tables are designed to summarize how the various management actions identified in this plan will be implemented.

The Planned Efforts Implementation Table summarizes the past and current funding allocated to each action or task.

The Future Efforts Implementation Table lists the estimated funding needed for future years (FY 2000 through 2003).

The Strategic Plan is designed to show how, when and who will evaluate or monitor the success of each objective, strategic action or task.

Planned Efforts Implementation Table

**Washington ANS Management Plan
Planned Efforts Implementation Table**

Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Recent Efforts (\$000/FTEs)			Planned Efforts				
					FY96		FY97	FY98-99		REQUESTED		
					\$	FTE	\$	FTE	\$ (000)	FTE	\$ (000)	FTE
	Descriptive Title/Brief Summary											
SA 1A1	Support two management level positions to coordinate all ANS activities.	WDFW USFWS	WDFW WDFW		0 0	0 0	15 0	0 0	0 0	0 0	0 0	0 0
SA 2A1	Coordinate with other states and nations	USFWS	WDFW		0	0	0	0	0	0	0	0
2A1a	Coordinate participation in regional conferences		WDFW		0	0	0	0	0	0	0	0
2A1b	Participate in the Western Regional Panel		WDFW		0	0	0	0	0	0	0	0
2A1c	Participate in the PSMFC regional activities	WDFW WDOE	PSMFC PSMFC		0 0	0 0	0 0	0 0	0 0	2.5 2.5	0 0	0 0
2A1d	Chair the Puget Sound Exotic Species Work Group		WDFW		0	0	0	0	0	0	0	0
2A1e	Support the 10 th Meridian Project.	WDFW	USFWS		0	0	0	0	0	0	0	5
2A1f	Increase Tribal involvement	USFWS	WDFW		0	0	0	0	0	0	0	135
2A1g	Enhance use of the PSMFC Shellfish Transport Subcommittee.		WDFW		0	0	0	0	0	0	0	0
2A1h	Consult with the British Columbia Transplant Committee on the intentional introduction of non-indigenous aquatic species.		WDFW		0	0	0	0	0	0	0	0
SA 2A2	Coordinate sub-committees of the ZMGCTF.	USFWS	WDFW		0	0	0	0	0	0	0	25
2A2a	Establish a sub-committee on commercial shipping practices.		WDFW		0	0	0	0	0	0	0	0
2A2b	Establish a sub-committee on recreational boats and seaplanes.		WDFW		0	0	0	0	0	0	0	0
2A2c	Establish a sub-committee on boat yards and marinas.		WDFW		0	0	0	0	0	0	0	0

- = unknown

Key to Abbreviations:

- AAB - Adopt-A-Beach; BPA - Bonneville Power Administration; Comm - commercial; INWAC - Inter-mountain Noxious Weed Advisory Council; PCCD - Pacific County Conservation District; PSA - Puget Soundkeeper Alliance; PSMFC - Pacific States Marine Fisheries Commission; PS - Puget Sound; PSWQAT - Puget Sound Water Quality Authority Team; PUD - Public Utility District; Rec - recreational; Repr - representatives; USACE - U. S. Army Corps of Engineers; USDOA - U. S. Department of Agriculture; USGS - U. S. Geological Services; UW - University of Washington; WA - Washington; WDFW - Washington Department of Fish and Wildlife; WDNR - Washington Department of Natural Resources; WDOA - Washington Department of Agriculture; WDOE - Washington Department of Ecology; WDOE AWP - Washington Department of Ecology Aquatic Weed Program; WESWG - Washington Exotic Species Work Group; WSCPR - Washington State Commission for Pesticide Registration; WSF - Washington State Ferries; WSG - Washington Sea Grant; WSL - Washington State Legislature; WSNWCB - Washington State Noxious Weed Control Board; WWT A - Washington Water Trails Association; ZMGCTF - Zebra Mussel and Green Crab Task Force

Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Recent Efforts (\$000/FTEs)				Planned Efforts				
					FY96		FY 97		FY98-99		REQUESTED		
					\$	FTE	\$	FTE	\$ (000)	FTE	\$ (000)	FTE	
2A2d	Establish a sub-committee on the aquarium trade, biological supply catalogs, aquatic garden suppliers, aquatic mail order catalogs, and plant importers.		WDFW		0	0	0	0					
2A2e	Establish a sub-committee on the live seafood industry.		WDFW		0	0	0	0					
2A2f	Establish a sub-committee on the aquaculture industry with WDFW shellfish biologists.		WDFW		0	0	0	0					
SA 2A3	Publish a list of waters infested with zebra mussels and European green crab.	USFWS	WDFW		0	0	0	0					3
SA 3A1	Survey Washington lakes, rivers, estuaries, wetlands, and coastlines for ANS.				0	0	0	0					
SA 3B1	Develop emergency response plans.				0	0	0	0					
3B1a	Develop a Zebra Mussel Emergency Response Plan.	USFWS	WDFW		0	0	0	0					1
3B1b	Establish and administer a Zebra Mussel Emergency Response Fund.	State, and private USFWS	WDFW WDFW	WA State, public, & private orgs.	0	0	0	0					50 50
3B1c	Develop a Green Crab Emergency Response Plan.	USFWS	WDFW		0	0	0	0					1
3B1d	Establish and administer the Green Crab Emergency Response Fund.	State, and private USFWS	WDFW WDFW	WA State, public, & private orgs.	0	0	0	0					50 50
3B1e	Develop a Mitten Crab Emergency Response Plan.	USFWS	WDFW		0	0	0	0					1

Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Recent Efforts (\$000/FTEs)				Planned Efforts				
					FY96		FY 97		FY98-99		REQUESTED		
					\$	FTE	\$	FTE	\$ (000)	FTE	\$ (000)	FTE	
	Descriptive Title/Brief Summary												
3B1f	Establish and administer the Mitten Crab Emergency Response Fund.	State, and private. USFWS	WDFW WDFW	WA State, public, & private orgs.	0 0	0 0	0 0	0 0				50 50	
3B1g	Developed and implementing an emergency response plan for hydrilla eradication.	WDOE	King County	The Cities of Covington and Maple Valley	50	.05	50	.05			50	.05	
3B1h	Developed and implementing a cordgrass eradication plan.	WDOA	WDOA	county weed boards	-	-	-	-					
SA 3C1	Increase existing funding for ANS management				0	0	0	0					
3C1a	Increase the awareness in Washington, D. C. of noxious ANS weeds and encourage additional federal funding.	USFWS	WSNWCBCB		0	0	0	0				2	
3C1b	Explore new ways to fund zebra mussel and green crab programs.	WDFW	WDFW		0	0	0	0					
SA 3C2	Set priorities for the management of existing ANS to manage WA's highest priority ANS.				0	0	0	0					
3C2a	Sets state priorities for the management of noxious ANS weeds.	WSNWCBCB	WSNWCBCB		0	0	0	0					
3C2b	Sets management and funding priorities for ANS weeds.	WDOE	WDOE		0	0	0	0					
3C2c	Set priorities for control of the green crab, the mitten crab, the zebra mussels, and other animal ANS.	WDFW	WDFW		0	0	0	0					

Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Recent Efforts (\$000/FTEs)				Planned Efforts				
					FY96		FY 97		FY98-99		FY98-99		
					\$	FTE	\$	FTE	DEDICATED \$ (000)	FTE	REQUESTED \$ (000)	FTE	
	Descriptive Title/Brief Summary												
SA 3D1	Implement strategies for controlling and/or eradicating pioneer infestations of ANS.					0	0	0	0				
3D1a	Develop a an ANS emergency response team.	USFWS	WDFW WDOE			0	0	0	0				100
3D1b	Established an emergency fund reserved for the containment/eradication of pioneering infestations of freshwater ANS weeds.	WDOE	Various			100	-	100	-			100	
SA 3D2	Minimize the dispersal of established ANS.												
3D2a	Established a list of prohibited ANS plants	WDOA	WDOA			0	0	0	0				
3D2b	Develop guidelines and regulations to ensure the cleaning of water-based equipment that may unintentionally spread ANS.	WDFW	WDFW			0	0	0	0				
3D2c	Consider developing regulations to quarantine waterbodies to prevent the spread of ANS.	WDFW	WDFW			0	0	0	0				
3D2d	Develop strategies to educate the public and specific groups to prevent the spread of ANS.	State agencies	State agencies			0	0	0	0				
SA3D3	Manage large populations of established ANS.												
3D3a	Funding state and local governments to manage established ANS weeds.	WDOE	State & local			300	0.3	300	0.3			300	0.3
3D3b	Released (and will continue to release) approved biocontrol agents (insects) for the management of purple loosestrife.	WDFW	WDFW	others		-	-	-	-				
3D3c	Developed an integrated saltcedar control/eradication plan.	WDOE AWP	WDFW			0	0	0	0			200	
3D3d	Prepared and implementing plans to control purple loosestrife and cordgrass.	state agencies	state agencies			-	-	-	-				

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Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Recent Efforts (\$000/FTEs)			Planned Efforts FY98-99		
					FY96		FY 97		FY98-99	
					\$	FTE	\$	FTE	DEDICATED \$ (000)	FTE
3D3e	Descriptive Title/Brief Summary Implements a purple loosestrife control program.	WDFW	WDFW		150	2.5	150	2.5	150	2.5
SA 4A1	Produce educational materials to increase public awareness of the ANS problem.									
4A1a	Develop educational materials.	PSWQAT EPA	WSG		0	0	0	0	25	
4A1b	Publish a general education brochure on ANS.	WSG	WSG		0	0	0	0		125
4A1c	Prepare ANS fact sheets and wallet ID cards.	USFWS	WSG		0	0	0	0		15
4A1d	Write quarterly press releases	Various	Various		0	0	0	0		
4A1e	Produce public service announcements	USFWS	WSG		0	0	0	0		8
4A1f	Develop an ANS curriculum for schools.	USFWS	WVNR	Various	0	0	0	0		12
4A1g	Conduct training workshops.	AAB, WWTA, PSA	AAB, WWTA, PSA		0	0	0	0		
4A1h	Maintain a web site on ANS weeds.	WDOE	WDOE		0	0	6	.06	6	0.1
4A1i	Educational program on purple loosestrife	WDFW	WDFW		6	.06	6	.06	6	0.1
4A1j	Coordinate establishment of zebra mussel info clearinghouse for western states	WDFW	WRP		0	0	0	0		
SA 4A2	Develop educational information on pathways.				0	0	0	0		
4A2a	Develop a handout on aquarium dumping.	USFWS	WSG		0	0	0	0		3
4A2b	Develop an insert on for anglers on ANS.	USFWS	WDFW		0	0	0	0		3
4A2c	Developed a brochure on aquatic plants.	WDOE	WDOE		0	0	0	0	2	.05
4A2d	ANS signs will be placed at boat launches .	WDOE USFWS	WDOE WDOE	WDFW	0	0	0	0	5	
					0	0	0	0		12

- = Unknown

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Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Recent Efforts (\$000/FTEs)				Planned Efforts				
					FY96		FY 97		FY98-99		FY98-99		
					\$	FTE	\$	FTE	DEDICATED \$ (000)	FTE	REQUESTED \$ (000)	FTE	
	Descriptive Title/Brief Summary												
4A2e	Produced a brochure on Water Weeds.	WDOE	WDOE			0	0	0	0	2			
4A2f	Contribute articles on ANS issues.	Various	Various			-	-	-	-				
SA 4B1	Develop educational materials on pathways					0	0	0	0				
4B1a	Distribute newly produced ballast water info.	USCG	USCG			-	-	-	-				
4B1b	Develop a handout for seafood markets, etc.	USFWS	WSG			0	0	0	0				4
4B1c	Mailing on ANS to aquatic nurseries.	WDOE & WSNWCB	WDOA	WDOE & WSNWCB		1.5	-	1.5	-	1.5			
4B1d	Conduct outreach education	WSG				0	0	0	0				10
SA 4C1	Distribute management info. to agency staff.					0	0	0	0				
4C1a	Distribute ANS bulletins and wallet ID cards.	Various	Various			0	0	0	0				
4C1b	Prepare a book on non-native invasive plants.	WDOE	WDOE			0	0	0	0	250	.3		
4C1c	Develop an ANS slide library.		WDFW	Various		0	0	0	0				
4C1d	Organize a biennial regional ANS workshop.	USFWS	WSG			0	0	0	0				30
4C1e	Develop an ANS Web site.	WDFW, UW	WDFW			0	0	0	0				10
4C1f	Publish a list of experts for ID purposes.	WDFW	WDFW	WDOE		0	0	0	0				
4C1g	Presentations about ANS weeds.	WDOE & WSNWCB	WDOE & WSNWCB			12	.2	12	.2	12	0.2		
SA 4D1	Develop ANS educational briefings.					0	0	0	0				
4D1a	Organize a biennial field day to infested site(s).	WSG				0	0	0	0				10
4D1b	Prepare a biennial summary of ANS projects.	Various	WDFW	Various		0	0	0	0				
4D1c	Use educational materials to stress prevention.		WDFW			0	0	0	0				
4D1d	Volunteer training workshops in Puget Sound.	Various	Various			0	0	0	0				
4D1e	Conduct a workshop on the mitten crab.	USFWS	WSG			0	0	0	0				

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Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Recent Efforts (\$000/FTEs)			Planned Efforts FY98-99				
					FY96		FY 97		FY98-99			
					\$	FTE	\$	FTE	DEDICATED \$ (000)	FTE	REQUESTED \$ (000)	FTE
SA 5A1	Descriptive Title/Brief Summary											
5A1a	Zebra mussel risk assessment & monitoring.					0	0	0	0			
5A1b	Report on zebra mussel risk assessment.	USFWS	UW	WDOE		0	0	0	0			4
5A1c	Implement zebra mussel monitoring.	USFWS	UW/ WDOE			0	0	0	0			30
5A1d	Coordinate zebra mussel monitoring program.	Various	WDFW	Various		0	0	0	0			
5A1e	Monitor low priority lakes for zebra mussels.	WDOE	WDOE	Various		0	0	0	0			
5A1f	Encourage neighboring states and provinces.	WDFW	WDFW			0	0	0	0			
5A2	Develop a zebra mussel volunteer monitoring.	USFWS	WWTA			0	0	0	0			6
5A2a	Green crab risk assessment & monitoring.											0.1
5A2b	Convene a sub-committee on green crab risk assessment and monitoring.	Various	WDFW	Various		0	0	0	0			16.25
5A2c	Support and assist in developing a volunteer monitoring program for the Green Crab.	USFWS	Various	WDFW		0	0	0	0			35
5A3	Surveys for green crab along WA's coasts.	Various	WDFW WSG	Various		0	0	0	0			
5A3a	Mitten crab risk assessment & monitoring.					0	0	0	0			
5A3b	Convene a sub-committee on mitten crab risk assessment and monitoring	Various	WDFW WSG			0	0	0	0			16.25
5A4	Coordinate a mitten crab monitoring program.	USFWS	WDFW			0	0	0	0			30
5A4a	Continue monitoring for <i>Spartina</i> .											
5A4b	State-wide <i>Spartina</i> coordination.	WDOA	WDOA			50	1	50	1			1
	Monitor coastline for <i>Spartina</i> infestations.	Various	Various			15	0.5	15	0.5			0.5

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Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Recent Efforts (\$000/FTEs)			Planned Efforts FY98-99			
					FY96		FY 97		FY98-99		
					\$	FTE	\$	FTE	DEDICATED \$ (000)	FTE	REQUESTED \$ (000)
5A4c	Monitor regions for <i>Spartina</i> control.	WDOE, WDFW	WDFW		5	0.2	15	0.5	15	0.5	
5A4d	Treat <i>Spartina</i> in Willapa Bay.	Various	Various		590	9	760	16	783	16	
5A4e	Continue the <i>Spartina</i> Watch Program.	WDOA, USFWS	Various		20		30		50		
5A4f	Volunteer monitoring for <i>Spartina</i> .	WDOA	AAB	Various	0	0	0	0			
5A4g	Volunteer monitoring for <i>Spartina</i> and ANS.	Various	PSA		0	0	0	0			
5A4h	Aerially photograph <i>Spartina</i> in Willapa Bay.	WDNR	WDNR		-	-	20	-	30	0.5	
5A4i	Aerially photograph <i>Spartina</i> in Puget Sound.	WDFW	WDFW		-	-	14	-	16		
SA 5A5	Monitor for purple loosestrife.										
5A5a	Monitor for purple loosestrife.	WDFW, USFWS	WDFW	Various	-	-	35	0.5	35	0.5	
5A5b	Monitoring after control work.	WDFW	WDFW	Various	0	0	0	0			35
5A5c	Continue efforts toward purple loosestrife population monitoring and control	WDFW	WDFW	WDFW	12	0.2	12	0.2	12	0.2	
SA 5A6	Monitor for freshwater non-indigenous plants.	WDOA	WSNWCB		-	-	-	-	200		
5A6a	Survey and map ANS freshwater plants.	WDOE	WDOE		35	0.5	35	0.5	35	0.5	
SA 5A7	Design and conduct a plankton monitoring and assessment program	USFWS	WDOE		0	0	0	0			16.5
SA 5B1	Develop lists of non-native species.										
5B1a	Update list of marine non-native species.	USFWS	UW	USGS	0	0	0	0			30
5B1b	Update list of plant non-native species.	WDOE	WDOE		0	0	0	0			
5B1c	Update list of animal non-native species.	WDFW	WDFW		0	0	0	0			

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Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Recent Efforts (\$000/FTEs)				Planned Efforts				
					FY96		FY 97		FY98-99		FY98-99		
					\$	FTE	\$	FTE	\$ (000)	FTE	REQUESTED \$ (000)	FTE	
	Descriptive Title/Brief Summary												
SA 5B2	Provide support for the ID of possible ANS.		USGS										
5B2a	Update a list of taxonomic experts.	USFWS	UW	WDFW	0	0	0	0	0	0	0	15	
5B2b	Provide an aquatic plant ID service.	WDOE	WDOE		-	-	0.6	0.01	0.01	0.01	0.01		
5B2c	Provide ID materials for zebra mussel.	WDFW	WDFW		0	0	0	0	0	0			
SA 5B3	Make survey and distribution data available.												
5B3a	Send marine ANS info. to USGS for web-site.	USFWS	UW	Others	0	0	0	0	0	0	0	10	
5B3b	Maintain database on aquatic plant distribution.	WDOE	WDOE		-	-	6	0.1	6	0.1	0.1		
5B3c	Publish annual monitoring report.	WDOE	WDOE		-	-	12	0.2	12	0.2	0.2		
5B3d	Develop centralized database on ANS animals.	WDFW	WDFW		0	0	0	0	0	0			
SA 6A1	Evaluate info to protect WA from ANS.												
6A1a	Compile info. on non-indigenous plants.	WDOE	WDOE		0	0	0	0	0	0			
6A1b	Monitor research efforts for zebra mussel.	Various	Various		0	0	0	0	0	0			
6A1c	ID critical info needs to control the introduction of marine non-indigenous species.	WESWG	WESWG		0	0	0	0	0	0			
SA 6A2	Support research to stop ANS introductions.												
6A2a	Support research on priority information needs.	Various	Various		0	0	0	0	0	0			
6A2b	Research risk from shipment plants to Pacific Northwest estuaries.	WSG	UW		-	-	-	-	122.4	-			
6A2c	Research effects of Asian copepod.	WSG	UW		-	-	-	-	195	-			
6A2d	Support research on early response eradication.	Various	Agencies		0	0	0	0	0	0			
6A2e	Encourage info. evaluation on mitten crab risk.	WDFW	WDFW		0	0	0	0	0	0			
6A2f	Contract a research org. to document ecology prior to the introduction of green crab.	USFWS	WDFW	Various	0	0	0	0	0	0		30	

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Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Recent Efforts (\$000/FTEs)				Planned Efforts				
					FY96		FY 97		FY98-99		FY98-99		
					\$	FTE	\$	FTE	\$ (000)	FTE	REQUESTED \$ (000)	FTE	
	Descriptive Title/Brief Summary												
6A2g	Conduct or encourage ecological surveys.	Various	Various	Various	-	-	-	-	-	-	-	-	-
6A2h	Support research on green crab in CA.	WSG			0	0	0	0	142				
6A2i	Conduct research to minimize ANS impact.	WSG			-	-	-	-	-	-	-	200	
6A2j	Conduct research on impact of green crab	WSG			-	-	-	-	143				
6A2k	Baseline monitoring and research on intertidal community structure and substrate ecosystem relationships	WSG			0	0	0	0				16.25	.25
SA 6B1	Support research on ANS management.												
6B1a	Study Eurasian watermilfoil eating weevil.	WDOE	UW		50	-	50	-	50				
6B1b	Development biological control insects for Brazilian elodea and parrotfeather milfoil.	USFWS	USDOA		0	0	0	0					50
6B1c	ID research on impacts of ANS on salmonids.	WDFW, WDOE			0	0	0	0					
6B1d	Evaluate effectiveness of herbicides 2,4-D on Eurasian watermilfoil.	WDOE	WDOE	Various	0	0	0	0	50				
6B1e	Research selected herbicides on <i>Spartina</i> .	WSCPR	WSU PCCD		-	-	12	-	12				
6B1f	Research on ANS weed control.	USFWS	WDFW		0	0	0	0					50
6B1g	Identify research on green crab control	WDFW	WDFW		0	0	0	0					
6B1h	Conduct research to control green crab.	USFWS	WSG										200
6B1i	Conduct impact assessment of green crab on the shellfish industry.	USFWS	SEI										51.5
SA 7A1	Review Washington ANS laws to improve.												
7A1a	Commission law student to review WA's ANS law.	USFWS	WDFW	UW	0	0	0	0					15
SA 7A2	Create the ZMGCTF.	Various	WDFW	Various									
7A2a	Chair and coordinate the ZMGCTF.	WSL	WDFW		0	0	0	0	45				
	Totals								3,164	124.11		1,750	4.45

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Future Efforts Implementation Table

**Washington ANS Management Plan
Future Efforts Implementation Table**

Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Funding		Future Needs (\$000)													
					Ded.	Req.	FY 00		FY 01		FY 02		FY 03							
							\$	FTE	\$	FTE	\$	FTE	\$	FTE						
	Descriptive Title/Brief Summary																			
SA 1A1	Support two management level positions to coordinate all ANS activities.	WDFW USFWS	WDFW WDFW			*	*	30 90	0.5 1.5	30 90	0.5 1.5	30 90	0.5 1.5	30 90	0.5 1.5	30 90	0.5 1.5			
SA 2A1	Coordinate with other states and nations	USFWS	WDFW				*	5		5				5						5
2A1a	Coordinate participation in regional conferences		WDFW																	
2A1b	Participate in the Western Regional Panel		WDFW																	
2A1c	Participate in the PSMFC regional activities	WDFW WDOE	PSMFC PSMFC			*	*	2.5 2.5		5 5		5 5		5 5		5 5				5 5
2A1d	Chair the Puget Sound Exotic Species Work Group.		WDFW																	
2A1e	Support the 100 th Meridian Project.	WDFW	USFWS				*	5		5		5		5						5
2A1f	Increase tribal involvement	USFWS	WDFW				*	135		135		135		135						135
2A1g	Enhance use of the PSMFC Shellfish Transport Subcommittee.		WDFW																	
2A1h	Consult with the British Columbia Transplant Committee on the intentional introduction of non-indigenous aquatic species.		WDFW																	
SA 2A2	Coordinate sub-committees of the ZMGCTF.	USFWS	WDFW				*	25		25		25		25						25
2A2a	Establish a sub-committee on commercial shipping practices.		WDFW																	
2A2b	Establish a sub-committee on recreational boats and seaplanes.		WDFW																	
2A2c	Establish a sub-committee on boat yards and marinas.		WDFW																	

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Num.	Tasks/Actions	Fund Source	Imple. Entity	Coop. Organ.	Funding	Future Needs (\$000/FTEs)												
						Ded. Req.	FY 00	FY 01	FY 02	FY 03	\$	FTE	\$	FTE	\$	FTE		
	Descriptive Title/Brief Summary																	
2A2d	Establish a sub-committee on the aquarium trade, biological supply catalogs, aquatic garden suppliers, aquatic mail order catalogs, and plant importers.		WDFW															
2A2e	Establish a sub-committee on the live seafood industry.		WDFW															
2A2f	Establish a sub-committee on the aquaculture industry, with WDFW shellfish biologists.		WDFW															
SA 2A3	Publish a list of waters infested with zebra mussels and European green crab.	USFWS	WDFW		*	3	3	3	3	3								
SA 3A1	Survey Washington lakes, rivers, estuaries, wetlands, and coastlines for ANS.																	
SA 3B1	Develop emergency response plans.																	
3B1a	Develop a Zebra Mussel Emergency Response Plan.	USFWS	WDFW		*	1	1	1	1	1								
3B1b	Establish and administer a Zebra Mussel Emergency Response Fund.	State, and private	WDFW	WA State, public, & private orgs.	*	50	50	50	50	50								
		USFWS	WDFW		*	50	50	50	50	50								
3B1c	Develop a Green Crab Emergency Response Plan.	USFWS	WDFW		*	1	1	1	1	1								
3B1d	Establish and administer the Green Crab Emergency Response Fund.	State, and private	WDFW	WA State, public, & private orgs.	*	50	50	50	50	50								
		USFWS	WDFW		*	50	50	50	50	50								
3B1e	Development a Mitten Crab Emergency Response Plan.	USFWS	WDFW		*	1	1	1	1	1								
3B1f	Establish and administer the Mitten Crab Emergency Response Fund.	State, and private	WDFW	WA State, public, & private orgs.	*	50	50	50	50	50								
		USFWS	WDFW		*	50	50	50	50	50								

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Num.	Tasks/Actions		Fund Source	Imple. Entity	Coop. Organ.	Funding		Future Needs (\$000/FTEs)										
						Ded.	Req.	FY 00		FY 01		FY 02		FY 03				
								\$	FTE	\$	FTE	\$	FTE	\$	FTE			
3B1g	Developed and implementing an emergency response plan for hydrilla eradication.		WDOE	King County	The Cities of Covington and Maple Valley													
3B1h	Developed and implementing a cordgrass eradication plan.		WDOA	WDOA	county weed boards													
SA 3C1	Increase existing funding for ANS management																	
3C1a	Increase the awareness in Washington, D. C. of noxious ANS weeds and encourage additional federal funding.		USFWS	WSNWC														
3C1b	Explore new ways to fund zebra mussel and green crab programs.		WDFW	WDFW														
SA 3C2	Set priorities for the management of existing ANS to manage WA's highest priority ANS.																	
3C2a	Sets state priorities for the management of noxious ANS weeds.			WSNWC														
3C2b	Sets management and funding priorities for ANS weeds.			WDOE														
3C2c	Set priorities for control of the green crab, the mitten crab, the zebra mussels, and other animal ANS.			WDFW														
SA 3D1	Implement strategies for controlling and/or eradicating pioneer infestations of ANS.																	
3D1a	Develop a an ANS emergency response team.		USFWS	WDFW WDOE			*	100	100	100	100	100	100	100	100	100	100	100

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Num.	Tasks/ Actions Descriptive Title/Brief Summary	Fund Source	Imple. Entity	Coop. Organ.	Funding		Future Needs (\$000/FTEs)							
					Ded.	Req.	FY 00		FY 01		FY 02		FY 03	
							\$	FTE	\$	FTE	\$	FTE	\$	FTE
3D1b	Established an emergency fund reserved for the containment/eradication of pioneering infestations of freshwater ANS weeds.	WDOE			*		100	100	100	100	100	100		
SA 3D2	Minimize the dispersal of established ANS.													
3D2a	Established a list of prohibited ANS plants		WDOA											
3D2b	Develop guidelines and regulations to ensure the cleaning of water-based equipment that may unintentionally spread ANS.		WDFW											
3D2c	Consider developing regulations to quarantine waterbodies to prevent the spread of ANS.		WDFW											
3D2d	Develop strategies to educate the public and specific groups to prevent the spread of ANS.		State agencies											
SA3D3	Manage large populations of established ANS.													
3D3a	Funding state and local governments to manage established ANS weeds.	WDOE	State & local		*		300	300	300	300	300	300		
3D3b	Released (and will continue to release) approved biocontrol agents (insects) for the management of purple loosestrife.	WDFW	WDFW	others										
3D3c	Developed an integrated saltcedar control/eradication plan.	WDOE AWP	WDFW		*		200	200	200	200	200	200		
3D3d	Prepared and implementing plans to control purple loosestrife and cordgrass.	state agencies	state agencies											
3D3e	Implements a purple loosestrife control program.	WDFW	WDFW		*		150	150	150	150	150	150	150	2.5
SA 4A1	Produce educational materials to increase public awareness of the ANS problem.													
4A1a	Develop educational materials.	PSWQAT EPA	WSG											

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Num.	Tasks/Actions		Fund Source	Imple. Entity	Coop. Organ.	Funding		FY 00		FY 01		FY 02		FY 03	
						Ded.	Req.	\$	FTE	\$	FTE	\$	FTE	\$	FTE
4A1b	Publish a general education brochure on ANS.		WGS	WGS				125	1	125	1	125	1	125	1
4A1c	Prepare ANS fact sheets and wallet ID cards.		USFWS	WGS				5		5		5		5	
4A1d	Write quarterly press releases		Various	Various											
4A1e	Produce public service announcements		USFWS	WGS				8		8		8		8	
4A1f	Develop an ANS curriculum for schools.		USFWS	WDNR	Various			12		12		12		12	
4A1g	Conduct training workshops.		AAB, WWTA, PSA	AAB, WWTA, PSA											
4A1h	Maintain a web site on ANS weeds.		WDOE	WDOE				6	0.1	6	0.1	6	0.1	6	0.1
4A1i	Educational program on purple loosestrife		WDFW	WDFW				6	0.1	6	0.1	6	0.1	6	0.1
4A1j	Coordinate establishment of zebra mussel info clearinghouse for western states		WDFW	WRP											
SA 4A2	Develop educational information on pathways.														
4A2a	Develop a handout on aquarium dumping.		USFWS	WGS				3		3		3		3	
4A2b	Develop an insert on for anglers on ANS.		USFWS	WDFW				3		3		3		3	
4A2c	Developed a brochure on aquatic plants.		WDOE	WDOE				2	.05	2	.05	2	.05	2	.05
4A2d	ANS signs will be placed at boat launches.		WDOE	WDOE	WDFW			5		5		5		5	
4A2e	Produced a brochure on Water Weeds.		USFWS	WDOE				12		12		12		12	
4A2f	Contribute articles on ANS issues.		WDOE	WDOE				2		2		2		2	
SA 4B1	Develop educational materials on pathways		Various	Various											
4B1a	Distribute newly produced ballast water info.		USCG	USCG											
4B1b	Develop a handout for seafood markets, etc.		USFWS	WGS				4		4		4		4	
4B1c	Mailing on ANS to aquatic nurseries.		WDOE & WSNWCB	WDOA	WDOE & WSNWCB			1.5		1.5		1.5		1.5	
4B1d	Conduct outreach education		WGS					10		10		10		10	

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Num.	Tasks/Actions		Fund Source	Imple. Entity	Coop. Organ.	Funding		Future Needs (\$000/FTEs)										
	Descriptive Title/Brief Summary	Req.				Ded.	FY 00		FY 01		FY 02		FY 03					
							\$	FTE	\$	FTE	\$	FTE	\$	FTE				
SA 4C1	Distribute management info to agency staff.																	
4C1a	Distribute ANS bulletins and wallet ID cards.		Various	Various														
4C1b	Prepare a book on non-native invasive plants.		WDOE	WDOE														
4C1c	Develop an ANS slide library.			WDFW	Various													
4C1d	Organize a biennial regional ANS workshop.		USFWS	WSG		*		30										30
4C1e	Develop an ANS Web site.		WDFW, UW	WDFW		*		3										3
4C1f	Publish a list of experts for ID purposes.		WDFW	WDFW	WDOE													
4C1g	Presentations about ANS weeds.		WDOE & WSNWCB	WDOE & WSNWCB		*		12	0.2	12	0.2	12	0.2	12	0.2	12	0.2	12
SA 4D1	Develop ANS educational briefings.																	
4D1a	Organize a biennial field day to infested site(s).		WSG			*				10								10
4D1b	Prepare a biennial summary of ANS projects.		Various	WDFW	Various													
4D1c	Use educational materials to stress prevention.			WDFW														
4D1d	Volunteer training workshops in Puget Sound.		Various	Various														
4D1e	Conduct a workshop on the mitten crab.		USFWS	WSG														
SA 5A1	Zebra mussel risk assessment & monitoring.																	
5A1a	Report on zebra mussel risk assessment.		USFWS	UW	WDOE		*		4									4
5A1b	Implement zebra mussel monitoring.		USFWS	UW/ WDOE		*		30										50
5A1c	Coordinate zebra mussel monitoring program.		Various	WDFW	Various													
5A1d	Monitor low priority lakes for zebra mussels.		WDOE	WDOE	Various													
5A1e	Encourage neighboring states and provinces.		WDFW	WDFW														
5A1f	Develop a zebra mussel volunteer monitoring.		USFWS	WWTA		*		6	0.1	6	0.1	6	0.1	6	0.1	6	0.1	6
SA 5A2	Green crab risk assessment & monitoring.																	
5A2a	Convene a sub-committee on green crab risk assessment and monitoring.		Various	WDFW	Various	*		16.25	0.25	16.25	0.25	16.25	0.25	16.25	0.25	16.25	0.25	16.25

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Num.	Tasks/Actions		Fund Source	Imple. Entity	Coop. Organ.	Funding		Future Needs (\$000/FTEs)							
	Descriptive Title/Brief Summary	Req.				Ded.	FY 00		FY 01		FY 02		FY 03		
							\$	FTE	\$	FTE	\$	FTE	\$	FTE	
SA 5A7	Design and conduct a plankton monitoring and assessment program		USFWS	WDOE				16.5	0.1	16.5	0.1	16.5	0.1	16.5	0.1
SA 5B1	Develop lists of non-native species.														
5B1a	Update list of marine non-native species.		USFWS	UW	USGS			30		30		30		30	
5B1b	Update list of plant non-native species.		WDOE	WDOE											
5B1c	Update list of animal non-native species.		WDFW	WDFW											
SA 5B2	Provide support for the ID of possible ANS.			USGS											
5B2a	Update a list of taxonomic experts.		USFWS	UW	WDFW			15		5		5		5	
5B2b	Provide an aquatic plant ID service.		WDOE	WDOE		*		0.6	.01	0.6	.01	0.6	.01	0.6	.01
5B2c	Provide ID materials for zebra mussel.		WDFW	WDFW											
SA 5B3	Make survey and distribution data available.														
5B3a	Send marine ANS info. to USGS for web-site.		USFWS	UW	Others			10		10		10		10	
5B3b	Maintain database on aquatic plant distribution.		WDOE	WDOE		*		6	0.1	6	0.1	6	0.1	6	0.1
5B3c	Publish annual monitoring report.		WDOE	WDOE		*		12	0.2	12	0.2	12	0.2	12	0.2
5B3d	Develop centralized database on ANS animals.		WDFW	WDFW											
SA 6A1	Evaluate info to protect WA from ANS.														
6A1a	Compile info. on non-indigenous plants.		WDOE	WDOE											
6A1b	Monitor research efforts for zebra mussel.		Various	Various											
6A1c	ID critical info needs to control the introduction of marine non-indigenous species.		WESWG	WESWG											
SA 6A2	Support research to stop ANS introductions.														
6A2a	Support research on priority information needs.		Various	Various											
6A2b	Research risk from shipment plants to Pacific Northwest estuaries.		WSG	UW		*				122.382				122.382	
6A2c	Research effects of Asian copepod.		WSG	UW		*				195				195	
6A2d	Support research on early response eradication.		Various	Agencies											
6A2e	Encourage info. evaluation on mitten crab risk.		WDFW	WDFW											

Num.	Tasks/Actions		Fund Source	Imple. Entity	Coop. Organ.	Funding		Future Needs (\$000/FTEs)							
	Descriptive Title/Brief Summary					Ded.	Req.	FY 00		FY 01		FY 02		FY 03	
								\$	FTE	\$	FTE	\$	FTE	\$	FTE
6A2f	Contract a research org. to document ecology prior to the introduction of green crab.		USFWS	WDFW	Various		*	30		30		30		30	
6A2g	Conduct or encourage ecological surveys.		Various	Various	Various										
6A2h	Support research on green crab in CA.		WSG				*			142					142
6A2i	Conduct research to minimize ANS impacts.		WSG				*	200		200		200		200	
6A2j	Conduct research on impacts of green crab.		WSG				*			143				143	
6A2k	Baseline monitoring and research on intertidal community structure and substrate ecosystem relationships.		WSG				*	16.25	0.25	16.25	0.25	16.25	0.25	16.25	0.25
SA6B1	Support research on ANS management.														
6B1a	Study Eurasian watermilfoil eating weevil.		WDOE	UW			*	50		50		50		50	
6B1b	Development biological control insects for Brazilian elodea and parrotfeather milfoil.		USFWS	USDOA			*	50		50		50		50	
6B1c	ID research on impacts of ANS on salmonids.		WDFW, WDOE												
6B1d	Evaluate effectiveness of herbicides 2,4-D and triclopyr on Eurasian watermilfoil.		WDOE	WDOE	Various		*	50		50		50		50	
6B1e	Research selected herbicides on <i>Spartina</i> .		WSCP	WSU PCCD			*	12		12		12		12	
6B1f	Research on ANS weed control.		USFWS	WDFW			*	50		50		50		50	
6B1g	Identify research on green crab control		WDFW	WDFW											
6B1h	Conduct research to control green crab.		USFWS	WSG			*	200		200		200		200	
6B1i	Conduct impact assessment of green crab on shellfish industry.		USFWS	SEI			*	60		70		80		90	
SA 7A1	Review Washington ANS laws to improve.														
7A1a	Commission law student to review WA's ANS law.		USFWS	WDFW	UW		*	15							
SA 7A2	Create the ZMGCTF.		Various	WDFW	Various										
7A2a	Chair and coordinate the ZMGCTF.		WSL	WDFW											

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Washington ANS Strategic Plan Table

Washington ANS Strategic Plan - through September '99

Program Name: Washington State Aquatic Nuisance Species (ANS) Management Plan

Mission Statement: To serve as responsible stewards of Washington by protecting and preserving the land and resources from the degrading impacts of aquatic nuisance species.

Objective #1: Coordinate all ANS Management Programs within Washington and Collaborate with Regional, National, and International ANS Programs.

Outcome Measure(s) for Objective #1: Coordinated Local, Regional, and National Management Strategy.

	By Whom	By When	Progress/Status Report
Strategic Action 1A1	WDFW	ongoing	Annual report

Objective #2: Prevent the Introduction of New ANS Into Washington Waters.

Outcome Measure(s) for Objective #2: No New Introductions of Problem ANS Species/Populations

	By Whom	By When	Progress/Status Report
Strategic Action 2A1			
Task 2A1a	WDFW	7/1/98	Final report 12/1/98
Task 2A1b	WDFW	7/1/98	Final report 12/1/98
Task 2A1c	WDFW	7/1/99	Final report 12/31/99
Task 2A1d	WDFW	ongoing	Meeting summaries to all members. Annual work plan.
Task 2A1e	WDFW	ongoing	\$5,000 Annual Funding Contribution
Task 2A1f	WDFW	ongoing	Periodic Mailings/Meetings

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Washington ANS Strategic Plan - through September '99

Program Name: Washington State Aquatic Nuisance Species (ANS) Management Plan

		WDFW	12/98	Annual Meetings/Reports
Task 2A1g	Support the enhanced use of the PSMFC Shellfish Transport Subcommittee to facilitate info. exchange and promote uniformity to regulate invertebrate species movement among Pacific states and British Columbia.	WDFW	ongoing	Attend Annual Meetings
Task 2A1h	Consult with the BC transplant committee to address intentional introductions of non-indigenous aquatic species into shared waters.	WDFW	7/1/98	Standing Sub-committees
Strategic Action 2A2	Appoint chairs to sub-committees of the ZMGCTF.	WDFW	7/1/98	Final Report, 12/1/98
Task 2A2a	Establish a sub-committee with maritime cargo vessel reps and other affected groups.	WDFW	7/1/98	Final Report, 12/1/98
Task 2A2b	Establish a sub-committee with representatives of recreational boating industry, seaplane associations, and other affected groups.	WDFW	7/1/98	Final Report, 12/1/98
Task 2A2c	Establish a sub-committee with reps of Washington boat yards and marinas, WDOE, and other affected groups.	WDFW	7/1/98	Final Report, 12/1/98
Task 2A2d	Establish a sub-committee with representatives of the aquarium trade, biological supply catalogs, aquatic garden suppliers, aquatic mail order catalogs, plant importers, and other affected groups.	WDFW	7/1/98	Final Report, 12/1/98
Task 2A2e	Establish a sub-committee with representatives of the live seafood industry and other affected groups.	WDFW	7/98	Final Report, 12/1/98
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Washington ANS Strategic Plan - through September '99

Program Name: Washington State Aquatic Nuisance Species (ANS) Management Plan				
Task 2A2f	Establish a sub-committee with representatives from the aquaculture industry, WDFW shellfish bios, and other affected groups.	WDFW	7/1/98	Final Report, 12/1/98
Strategic Action 2A3	Prepare, maintain, and publish a list of all lakes, ponds, or other waters in Washington and other states infested with zebra mussels and European green crab.	WDFW	9/1/98	Final Report 12/1/98
Objective #3: Eradicate or Contain New ANS Introductions or Established Populations As Quickly As Possible; Prevent or Slow Their Spread Into Uninfested Areas, and Reduce the Size of Established ANS Populations. The Impact of Management Actions Should be Less Than the Impact of the ANS.				
Outcome Measure(s) for Objective #3: No Range Expansion of Existing ANS Species/Populations .				
	What Will Be Done	By Whom	By When	Progress/Status Report
Strategic Action 3A1	Survey Washington waters.	WDFW WDOE	ongoing	Annual Report.
Strategic Action 3B1	Set priorities for the management of existing ANS.	All Agencies	12/1/98	Annual Report.
Task 3B1a	Develop a Zebra Mussel Emergency Response Plan.	WDFW	ongoing	Annual Report Plan.
Task 3B1b	Establish and administer a Zebra Mussel Emergency Response Fund.	WDFW	ongoing	Emergency Response Plan/Annual Report.
Task 3B1c	Develop a Green Crab Emergency Response Plan.	WDFW	7/1/98	Annual work plan
Task 3B1d	Establish and administer the Green Crab Emergency Response Fund	WDFW	12/1/98	Emergency Response Plan/Annual Report
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Washington ANS Strategic Plan - through September '99

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Task 3B1e	Coordinate the development of a Mitten Crab Emergency Response Plan.	WDFW	7/1/98	Emergency Response Plan/Annual Report
Task 3B1f	Establish and administer the Mitten Crab Emergency Response Fund.	WDFW	12/1/99	Emergency Response Plan/Annual Report
Task 3B1g	Implementing an emergency response plan for hydrilla eradication in Washington.	WDOE	Done	Emergency Response Plann/Annual Report
Task 3B1h	Implementing a cordgrass (<i>Spartina</i>) plan for eradication	WDOA	Done	Emergency Response Plann/Annual Report
Strategic Action 3C1	Develop and implement strategies (response plans) for controlling pioneer infestations.			
Task 3C1a	Develop a proposal for ANS SWAT team.	WDFW WDOE	12/31/98	SWAT Team Proposal.
Task 3C1b	Explore new ideas and ANS funding with members of the Zebra Mussel and Green Crab Task Force.	WDFW	7/1/98	Final Report 12/1/98.
Strategic Action 3C2	Minimize ANS dispersal.			
Task 3C2a	Established a list of ANS plants prohibited	WDOA	ongoing	List of prohibited plants (updated monthly)
Task 3C2b	Coordinate with other agencies to develop guidelines and regulations for the cleaning of water-based equipment.	WDFW	7/1/98	Final Report 12/1/98.
Task 3C2c	Consider developing regulations to quarantine waterbodies.	WDFW	ongoing	Final Report 12/1/98.
Strategic Action 3D1	Implement strategies for controlling/eradicating pioneer infestations of ANS.			
Key to Abbreviations:	<p>AAB - Adopt-A-Beach; BPA - Bonneville Power Administration; Comm - commercial; INWAC - Intermountain Noxious Weed Advisory Council; LLA - Loon Lake Association; PSA - Puget Soundkeeper Alliance; PSMFC - Pacific States Marine Fisheries Commission; PS - Puget Sound; PSWQAT - Puget Sound Water Quality Authority Team; PUD - Public Utility District; Rec - recreational; Reps - representatives; SCNWCB - Stevens County Noxious Weed Control Board; SEI - Sustainable Ecosystem Institute; USACE - U. S. Army Corps of Engineers; USGS - U. S. Geological Services; UW - University of Washington; WA - Washington; WDFW - Washington Department of Fish and Wildlife; WDNR - Washington Department of Natural Resources; WDOA - Washington Department of Agriculture; WDOE - Washington Department of Ecology; WSF - Washington State Ferries; WSG - Washington Sea Grant; WSNWCB - Washington State Noxious Weed Control Board; WWTA - Washington Water Trails Association; ZMGCTF - Zebra Mussel and Green Crab Task Force</p>			

Washington ANS Strategic Plan - through September '99

Program Name: Washington State Aquatic Nuisance Species (ANS) Management Plan				
Task 3D1a	Develop a proposal to have an ANS emergency response team on call or under contract.	WDFW WDOE	12/31/99	Legislative Proposal
Task 3D1b	Established an emergency fund that is reserved for the containment/eradication of pioneering freshwater ANS weeds.	WDOE	Done	Annual Report
Strategic Action 3D2	Minimize the dispersal of established ANS species in Washington.			
Task 3D2a	Established a list of ANS plants prohibited for sale and transport in Washington.	WDOA	Done	Publication
Task 3D2b	Coordinate to develop guidelines and regs. to ensure cleaning of water-based equipment.	WDFW	12/99	State Regulation
Task 3D2c	Consider developing regs to quarantine waterbodies to prevent the spread of zebra mussels or other ANS.	WDFW	12/99	State Regulation
Task 3D2d	Develop and implement educational strategies designed to prevent the spread of ANS.	All agencies	12/99	Publications
Strategic Action 3D3	Manage large populations of established ANS to reduce their size or minimize their expansion.			
Task 3D3a	Provides funding to state/local governments for the management/eradication of established populations of ANS weeds using an integrated approach.	WDOE	ongoing	Annual work plan
Task 3D3b	Releasing approved biocontrol agents (insects) for the management of purple loosestrife.	WDFW	12/98	State Regulation
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Washington ANS Strategic Plan - through September '99

Program Name: Washington State Aquatic Nuisance Species (ANS) Management Plan

Task 3D3c	Developed an integrated Saltcedar control/eradication plan to be implemented in 1998.	WDFW	7/1/98	Control/Eradication Plans
Task 3D3d	Prepared and implementing integrated plans for the control of purple loosestrife and cordgrass.	Land-owning state agencies	12/31/99	State Lands Control Plan/Report
Task 3D3e	Plan and implement a purple loosestrife control program each year throughout Washington.	WDFW	ongoing	Annual Work Plan

Objective #4: Educate Appropriate Resource User Groups on the Importance of Preventing the Introduction and Spread of ANS, and How Harmful Impacts Can Be Reduced.

Outcome Measure(s) for Objective #4: Comprehensive Public Education Program

	What Will Be Done	By Whom	By When	Progress/Status Report
Strategic Action 4A1	Compile, develop, and coordinate the dissemination of educational materials to increase public awareness.			
Task 4A1a	Prepare a 1 to 2 page fact sheet on ANS for the general public.	WSG	ongoing	Publication
Task 4A1b	Develop two traveling displays.	WSG	12/98	Displays
Task 4A1c	Prepare ANS fact sheets and wallet ID cards on species of greatest concern.	WSG WDFW	12/99	ID cards

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Washington ANS Strategic Plan - through September '99

Program Name: Washington State Aquatic Nuisance Species (ANS) Management Plan				
Task 4A1d	Write quarterly press releases focusing on problems associated with ANS.	WDFW WSNWCBCB WDOE PSWQAT	ongoing	Quarterly press releases
Task 4A1e	Produce public service announcements.	WSG	12/99	PSAs
Task 4A1f	Develop an ANS curriculum for schools.	WDNR WSNWCBCB WDFW	12/99	School curriculum
Task 4A1g	Conduct training workshops.	AAB WWTA PSA	ongoing	Training plan and course
Task 4A1h	Maintain web site on ANS weeds.	WDOE	ongoing	Web site
Task 4A1i	Sponsor an educational program on purple loosestrife for six years.	WDFW	ongoing	Workshops
Task 4A1j	Establish zebra mussel info. clearing house.	WDFW	12/99	Clearinghouse
Strategic Action 4A2	Develop and distribute educational information targeted at specific pathways.	WDFW	12/98	Publications
Task 4A2a	Develop a short handout dealing with the spread of ANS via aquarium dumping.	WSG	12/98	Publication
Task 4A2b	Develop a brief insert to be dist. with WA fishing licenses and boat tax statements.	WDFW	12/98	Publication
Task 4A2c	Developed a brochure on non-native invasive aquatic plants.	WDOE	12/99	Publication
Task 4A2d	Updating milfoil signs.	WDOE	12/98	Signs
Task 4A2e	Produced a brochure on milfoil.	WDOE	ongoing	Publication
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Washington ANS Strategic Plan - through September '99

Program Name: Washington State Aquatic Nuisance Species (ANS) Management Plan			
Task 4A2f	Contribute articles that explain ANS issues.	WDFW WDOE WSNWCBCB WDOA PSWQAT	ongoing Four major activities/year
Strategic Action 4B1	Educational materials targeting specific pathways.		
Task 4B1a	Distribute newly produced ballast water exchange educational materials.	USCG	12/98 To all shipping concerns
Task 4B1b	Develop a handout that explains how to safely handle ANS.	WSG	12/98 Publication
Task 4B1c	Send a periodic mailing to aquatic nurseries, mail order companies, and pet stores.	WDOA WDOE WSNWCBCB	ongoing Two mailings/year
Task 4B1d	Conduct outreach education.	WSG	12/99 Cooperative Extension Program.
Strategic Action 4C1	Distribute ID and management information to resource agency staff.	WDFW	Ongoing Annual Ordering
Task 4C1a	Distribute ANS species bulletins and wallet ID cards to agency field staff.	WDFW WDNR WSNWCBCB WDOE PSWQAT	12/99 100% coverage
Task 4C1b	Preparing a book, "Field Identification Guide to Washington's Aquatic Plants."	WSG	12/99 Publication
Task 4C1c	Develop an ANS slide library.	WDFW	12/99 Slide library
Task 4C1d	Organize a biennial regional ANS workshop for resource managers.	WSG	12/99 Biennial workshop
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Washington ANS Strategic Plan - through September '99

Program Name: Washington State Aquatic Nuisance Species (ANS) Management Plan

Task 4C1e	Develop an ANS web site.	WDFW UW	12/98	Web site
Task 4C1f	Develop a list of experts.	WDFW UW	12/98	List of resource experts
Task 4C1g	Continue to disseminate info re ANS weeds to targeted groups.	WDOE WSNWC B	ongoing	Periodic Mailings
Strategic Action 4D1	Provide informational materials to key decision-makers.			
Task 4D1a	Organize an annual or biennial field day for legislators and staff.	WSG	12/98	Annual field day
Task 4D1b	Prepare biennial summary of ANS projects for key legislative committees.	WDFW WDOE WDNR WSNWC B	ongoing	Annual Legislative report
Task 4D1c	Use educational materials produced elsewhere to educate decision-makers.	WDFW	ongoing	Information Exchange
Task 4D1d	Support state agency decision-maker field days.	AAB, WWTA, PSA	ongoing	Annual Field Day
Task 4D1e	Conduct a workshop on mitten crab.	WSG	12/99	Workshop
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Washington ANS Strategic Plan - through September '99

Program Name: Washington State Aquatic Nuisance Species (ANS) Management Plan

Objective #5: Monitor Waters That Are Vulnerable to New ANS Introductions and Track the Distribution of Existing ANS Populations. Outcome Measure(s) for Objective #5: Early Detection of New ANS Introductions to Minimize Impacts.

	What Will Be Done	By Whom	By When	Progress/Status Report
Strategic Action 5A1	Conduct a zebra mussel risk assessment.			
Task 5A1a	Coordinate the creation of a zebra mussel risk assessment.	UW	12/99	ZM Risk Assessment Report
Task 5A1b	Implement a zebra mussel veliger monitoring program.	UW WDOE	12/98	Veliger Monitoring Program Annual Report
Task 5A1c	Review the USACE's zebra mussel risk assessment.	WDFW	12/98	Final ZM Risk Assessment Report
Task 5A1d	Survey lakes for zebra mussels.	WDOE	ongoing	Annual report
Task 5A1e	Encourage neighboring states to set up zebra mussel monitoring programs.	WDFW PSMFC	12/99	Annual meeting
Task 5A1f	Develop a Zebra Mussel volunteer monitoring program for freshwater lakes and rivers targeted toward paddlers in E. WA.	WWTA	12/99	Incident/Trip Reports
Strategic Action 5A2	Conduct a green crab risk assessment. Prioritize areas at risk and implement appropriate monitoring programs.			
Task 5A2a	Support the implementation of a green crab risk assessment and monitoring program.	WDFW	12/99	Completed Risk Assessment report
Task 5A2b	Coordinate green crab monitoring.	WDFW WSG	12/98	Monitoring plan
Task 5A2c	Volunteer monitoring for green crab.	Growers	12/99	Monitoring plan
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Strategic Action	Task	Description	WDFW	12/99	Completed Risk Assessment Report
5A3	5A3a	Conduct a mitten crab risk assessment. Convene a mitten crab advisory committee.	WDFW WSG	12/00	Committee
5A3	5A3b	Coordinate mitten crab monitoring.	WDFW	12/00	Monitoring plan
5A4	5A4a	Continue monitoring for the spread of <i>Spartina</i>	WDOE WDOA	Ongoing	Monitoring plan
5A4	5A4a	Continue <i>Spartina</i> Watch.	WDOA	Ongoing	Publication
5A4	5A4b	Monitor for the spread of <i>Spartina</i> and other marine ANS.	PSA	Ongoing	Annual Report
5A4	5A4c	Map the distribution of <i>Spartina</i> .	WDNR	Ongoing	Annual Distribution Map
5A4	5A4d	Continue to treat against <i>Spartina</i> in Willapa Bay	WDOA WDFW WDNR USFWS	Ongoing	Annual Control Plan
5A4	5A4e	Continue the <i>Spartina</i> watch program	AAB WETA	6/99	Incident/Trip Reports
5A4	5A4f	Collect <i>Spartina</i> data from all monitoring efforts	WDOA	Ongoing	Data Clearinghouse/Annual Reports
5A4	5A4g	Implement tasks designed to improve ability to monitor for the spread of <i>Spartina</i> and other marine ANS	PSA	12/98	Monitoring Plan
5A4	5A4h	Continue to aerially photograph <i>Spartina</i> in Willapa Bay	WDNR	Ongoing	Annual Distribution Map
5A4	5A4i	Continue to aerially photograph portions of non-tidal Puget Sound for <i>Spartina</i> treatment and new infestations	WDFW	Ongoing	Annual Distribution Map
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Strategic Action 5A5	Continue monitoring for the spread of purple loosestrife.				
Task 5A5a	(Need info.)	WDFW	Ongoing	Annual Report/Distribution Maps	
Task 5A5b	Extensive monitoring of all ANS weed control work	WDOE	Ongoing	Annual Report	
Task 5A5c	Purple loosestrife population monitoring and control.	WDOA WSNWCBC WDOE	Ongoing	Annual Report	
Strategic Action 5A6	Continue monitoring for the spread of ANS plants.				
Task 5A6a	Monitor Distribution of ANS.	WDOE	Ongoing	Annual Report/Distribution Maps	
Strategic Action 5A7	Design and Conduct a plankton monitoring and assessment program to identify the current status of exotic plankton introductions in Washington waters.	WDOE	7/1/99	Annual Work Plans/Reports	
Strategic Action 5B1	Maintain a list of non-native species.	WDFW	12/1/99	Final Report	
Task 5B1a	Maintain list of non-native species known to occur in WA and neighboring marine waters.	UW	12/99	Distribution maps	
Task 5B1b	Maintain a list of non-indigenous plants.	WDOE	ongoing	Distribution maps	
Task 5B1c	Further development and maintenance of a list of nonnative aquatic animal species	WDFW	ongoing	USGS Web site	
Strategic Action 5B2	Support for identification of ANS.				
Task 5B2a	Maintain a list of taxonomic experts.	UW WDFW	12/99	List of experts	
Task 5B2b	Continue to provide an aquatic plant ID service.	WDOE	Ongoing	Extension Program	
Task 5B2c	Support the development and dist. of ID materials for zebra mussel	WDFW	Ongoing	Clearinghouse	
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Strategic Action 5B3	Distribute data on ANS.				
Task 5B3a	Submit distribution data to USGS.	UW	12/99	Report to USGS	
Task 5B3b	Maintain distribution info. on plant ANS.	WDOE	ongoing	Maps	
Task 5B3c	Publish annual monitoring report.	WDOE	ongoing	Annual report	
Task 5B3d	Develop and maintain a centralized database on the dist of freshwater ANS animals in WA.	WDFW	12/99	Database Updated Annually	
Objective #6: Conduct Research on ANS Priority Species in Washington, and Develop Efficient Systems to Disseminate ANS Research Information to the Research and Management Communities.					
Outcome Measure(s) for Objective #6: Effective and Coordinated Research Program for ANS					
	What Will Be Done	By Whom	By When	Progress/Status Report	
Strategic Action 6A1	Evaluate info on ANS.				
Task 6A1a	Compile info on plant ANS.	WDOE	ongoing	Species reports	
Task 6A1b	Monitor research.	WDFW	ongoing	Annual report	
Task 6A1c	Identify info needed for Puget Sound.	PSWQAT	12/00	Status report	
Strategic Action 6A2	Encourage research that improves our ability to ID and prioritize potential threats.				
Task 6A2a.	Support research.	All	ongoing	Annual research needs section - Annual report	
Task 6A2b	Investigate the risks of ANS introductions from shipment of coastal or marine plants.	UW	12/99	Status report	
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Task 6A2c	Investigate the effects of Asian copepod.	UW	12/00	Status report
Task 6A2d	Develop a mechanism for eradicating zebra mussel populations.	WDFW	12/01	Research reports
Task 6A2e	Evaluate info on life history of mitten crab.	WDFW	12/98	Research proposal
Task 6A2f	Contract a research organization to document ecology prior to the introduction of green crab.	WDOE UW	12/00	Risk assessment
Task 6A2g	Conduct and encourage ecological surveys.	WDOE UW	12/99	Clearinghouse
Task 6A2h	Support research on green crab in California.	WSG	ongoing	Verbal/written report
Task 6A2i	Conduct research to minimize ANS impacts.	WDOE	12/00	Status report
Task 6A2j	Conduct research on impact of green crab.	WSG	12/99	Research reports
Task 6A2k	Conduct & synthesize baseline monitoring and research on intertidal community structure and ecosystem relationships on substrates.	WSG	12/2000	Database
Strategic Action 6B1	Support and encourage research, both within WA and at the federal level to develop/improve ANS management techniques.			
Task 6B1a	Continue to fund the UW study on life cycle of a Eurasian watermilfoil eating weevil in Washington.	WDOE	ongoing	Final Report
Task 6B1b	Encourage research into the development of biological control insects for Brazilian eloda and parrotfeather milfoil.	WDOE	7/98	Research reports
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Task 6B1c	Identify research designed to determine the impacts of ANS salmonids in Washington.	WDFW	12/2000	Annual work plan
Task 6B1d	Conduct an evaluation of the effectiveness of the aquatic herbicides 2, 4-D, on Eurasian watermilfoil in Loon Lake in 1998.	WDOE SCNWCBCB LLA	7/99	Research report
Task 6B1e	Continue to research the efficacy of selected herbicides and surfactants on <i>Spartina</i> .	WSU PCCD	ongoing	Research report
Task 6B1f	Further research on ANS weed control.	WDFW	12/98	Research review
Task 6B1g	Identify research needed on green crab control.	WSG	12/98	Research funding proposal
Task 6B1h	Conduct research to control green crab.	WSG	12/98	Research funding proposal
Task 6B1i	Conduct an impact assessment of the green crab on the shellfish industry	SEI	12/1/98	Final report
Objective #7: Review and Revise Washington State ANS Rules and Regulations to Ensure That Our Legislation Efficiently Promotes the Prevention and Control of ANS in Coordination with Federal Regulations.				
Outcome Measure(s) for Objective #7: Comprehensive ANS Regulations				
	What Will Be Done	By Whom	By When	Progress/Status Report
Strategic Action 7A1	Review the laws governing ANS.			
Task 7A1a	Commission law students to conduct a review of WA's ANS law.	WDFW UW	12/98	Final report
Strategic Action 7A2	Create a ZMGCTF.	WDFW	7/98	Task Force
Task 7A2a	Coordinate the creation of the ZMGCTF.	WDFW	7/98	Task Force
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Glossary

Accidental introduction: an introduction of non-indigenous aquatic species that occurs as the result of activities other than the purposeful or intentional introduction of the species involved, such as the transport of non-indigenous species in ballast water or in water used to transport fish, mollusks, or crustaceans for aquaculture or other purposes.

Aquatic nuisance species: a plant or animal species that threatens the diversity or abundance of native species, the ecological stability of infested waters, or commercial, agricultural, aquacultural, or recreational activities dependent on such waters. (Note: for the purposes of the State management plans, reference to an aquatic nuisance species will imply that the species is non-indigenous.)

Baitfish: fish species commonly sold for use as bait for recreational fishing.

Ballast water: any water and associated sediments used to manipulate the trim and stability of a vessel.

Control: limiting the distribution and abundance of a species.

Cryptogenic species: A species that may or may not be indigenous to an area.

Ecological integrity: the extent to which an ecosystem has been altered by human behavior; an ecosystem with minimal impact from human activity has a high level of integrity; an ecosystem that has been substantially altered by human activity has a low level of integrity.

Ecosystem: the biological organisms in an ecological community and the non-living factors of the environment.

Environmentally sound: methods, efforts, actions, or programs to prevent introductions or to control infestations of ANS that minimize adverse environmental impacts. The impact of management actions should be less than the impact of the ANS.

Eradicate: the act or process of eliminating an aquatic nuisance species.

Exotic: (same as non-indigenous) any species or other variable biological material that enters an ecosystem beyond its historic range, including such organisms transferred from one country to another.

Federal consistency: the requirement under the Coastal Zone Management Act that stipulates that federal actions that are reasonably likely to affect land or water use or natural resources of the coastal zone be consistent with the enforceable policies of a coastal state's federally approved coastal

management program (CMP). A coastal state reviews the federal action to determine if the proposed action will be consistent with the CMP.

Intentional introduction: all or part of the process by which a non-indigenous species is purposefully introduced into a new area.

Non-indigenous species: any species or other variable biological material that enters an ecosystem beyond its historic range, including such organisms transferred from one country to another.

Pioneer infestation: A small ANS colony that has spread to a new area from an established colony.

Priority species: An ANS that is considered to be a significant threat to Washington waters and is recommended for immediate or continued management action to minimize or eliminate their impact.

Watershed: an entire drainage basin including all living and nonliving components.

Appendices and References

Appendices

Appendix A

Section 1204 of the National Invasive Species Act of 1996

SEC. 1204. STATE AQUATIC NUISANCE SPECIES MANAGEMENT PLANS.

(a) STATE OR INTERSTATE INVASIVE SPECIES MANAGEMENT PLANS.--

(1) IN GENERAL.-- After providing notice and opportunity for public comment, the Governor of each State may prepare and submit, or the Governors of the States and the governments of Indian Tribes involved in an interstate organization, may jointly prepare and submit--

(A) a comprehensive management plan to the Task Force for approval which identifies those areas or activities within the State or within the interstate region involved, other than those related to public facilities, for which technical, enforcement, or financial assistance (or any combination thereof) is needed to eliminate or reduce the environmental, public health, and safety risk associated with aquatic nuisance species, particularly the zebra mussel; and

(B) a public facility management plan to the Assistant Secretary for approval which is limited solely to identifying those public facilities within the State or within the interstate region involved for which technical and financial assistance is needed to reduce infestations of zebra mussels.

(2) CONTENT.-- Each plan shall, to the extent possible, identify the management practices and measures that will be undertaken to reduce infestations of aquatic nuisance species. Each plan shall--

(A) identify and describe State and local programs for environmentally sound prevention and control of the target aquatic nuisance species;

(B) identify Federal activities that may be needed for environmentally sound prevention and control of aquatic nuisance species and a description of the manner in which those activities should be coordinated with State and local government activities;

(C) identify any authority that the State (or any State or Indian Tribe involved in the interstate organization) does not have at the time of the development of the plan that may be necessary for the State (or any State or Indian Tribe involved in the interstate organization) to

protect public health, property, and the environment from harm by aquatic nuisance species;
and

(D) a schedule of implementing the plan, including a schedule of annual objectives, and enabling legislation.

(3) CONSULTATION.--

(A) In developing and implementing a management plan, the State or interstate organization should, to the maximum extent practicable, involve local governments and regional entities, Indian Tribes, and public and private organizations that have expertise in the control of aquatic nuisance species.

(B) Upon the request of a State or the appropriate official of an interstate organization, the Task Force or the Assistant Secretary, as appropriate under paragraph (1), may provide technical assistance in developing and implementing a management plan.

(4) PLAN APPROVAL.-- Within 90 days after the submission of a management plan, the Task Force or the Assistant Secretary in consultation with the Task Force, as appropriate under paragraph (1), shall review the proposed plan and approve it if it meets the requirements of this subsection or return the plan to the Governor or the interstate organization with recommended modifications.

(b) GRANT PROGRAM.--

(1) STATE GRANTS.-- The Director may, at the recommendation of the Task Force, make grants to States with management plans approved under subsection (a) for the implementation of those plans.

(2) APPLICATION.-- An application for a grant under this subsection shall include an identification and description of the best management practices and measures which the State proposes to utilize in implementing an approved management plan with any Federal assistance to be provided under the grant.

(3) FEDERAL SHARE.--

(A) The Federal share of the cost of each comprehensive management plan implemented with Federal assistance under this section in any fiscal year shall not exceed 75 percent of the cost incurred by the State in implementing such management program and the non-Federal share of such costs shall be provided from non-Federal sources.

(B) The Federal share of the cost of each public facility management plan implemented with Federal assistance under this section in any fiscal year shall not exceed 50 percent of the cost incurred by the State in implementing such management program and the non-Federal share of such costs shall be provided from non-Federal sources.

(4) ADMINISTRATIVE COSTS.-- For the purposes of this section, administrative costs for activities and programs carried out with a grant in any fiscal year shall not exceed 5 percent of the amount of the grant in that year.

(5) IN-KIND CONTRIBUTIONS.-- In addition to cash outlays and payments, in-kind contributions of property or personnel services by non-Federal interests for activities under this section may be used for the non-Federal share of the cost of those activities.

(C) ENFORCEMENT ASSISTANCE.-- Upon request of a State or Indian Tribe, the Director or Under Secretary, to the extent allowable by law and in a manner consistent with section 141 of title 14, United States Code, may provide assistance to a State or Indian Tribe in enforcing an approved State or interstate invasive species management plan.

Appendix B

Washington Aquatic Nuisance Species Plan

Public Review Information

Washington Aquatic Nuisance Species Planning Committee

Members

Bishop, Wendy Sue
Washington Department of Agriculture
Olympia, WA

Matthews, Evan
Adopt-A-Beach
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Civille, Janie
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Mumford, Tom
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Cook, Anita
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Hamel, Kathy
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Smith, Kirk
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Toba, Derrick
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Woodley, Chris
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Advisors

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Shoreline, WA

Senator Ken Jacobsen
Washington State Senate
Seattle, WA

Senator Bob Oke
Washington State Senate
Port Orchard, WA

Representative Bill Thompson
House of Representatives
Everett, WA

Carol Jolly
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Roberta M. Gunn
Puget Soundkeeper Alliance
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Aitkin, Kevin
U. S. Fish and Wildlife Service
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Taylor Shellfish Farms
Shelton, WA

Armstrong, John
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Habitat Management Program
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Carlsborg, WA

Cooper, Diane

Griffith, Jim
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The Dalles, OR

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Denver, CO

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Fox Island, WA

Johnson, Eric
Washington Public Ports Association
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Kirby, Grant
Northwest Indian Fisheries Commission
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Canadian Department of Fisheries & Oceans
Vancouver, British Columbia - Canada

Murphy, Tom
Bonneville Power Administration
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Newbry, Ron
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Sytsma, Mark
ANS Regional Coordinator
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Aquatic Nuisance Species Planning Committee Meeting - April 7, 1998

List of Attendees

Aitkin, Kevin
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Aquatic Nuisance Species Planning Committee Summary of Comments from April 7, 1998 Meeting

Objective 1 - Prevent New Introductions

- Green crab and mussels—May need two different groups involved
 - ANS: sub-committees for different issues
- Is there a mechanism for new species invading?
 - Needs to be developed
- The intent is not to curtail industries, but to curtail risky activities
- List of locations means existing locations
- Is there a monitoring program for all elements—compliance tracking?

Objective 2 - Eradicate or Reduce Existing ANS

- Funding—How about the Corps of Engineers?
- Is there a quarantine process?
- Is there a need to change legislation to get permits faster?
- Involve the Tribes
- Concerned about pesticides for green crab

- Will all Tribes be able to participate or one Tribal representative?
- Acceptable level vs zero tolerance level—can this be put into law?
- Focus on convincing stakeholders to be involved BEFORE crisis develops
 - Minimize potential backlash
- Draw on the experience of those in industries in other states

Objective 3 - Prevent or Slow Spread

- Who's going to do work?
- People need to be funded for work
 - Some work is funded now—some gaps present
- Past predator position was cut from Washington Department of Fish and Wildlife Shellfish Section
- Are there industry groups working on this?
 - May reduce funding needs for state

Objective 4 - Education

- Get other industries to recognize economic impact
- Make sure schools are aware of the problem and in there

Objective 5 - Monitoring

- They may be able to survey areas when they are there for something else.
- Enforcement—Washington Department of Fish and Wildlife has made it a priority to not fire officers
 - Twelve will be lost with loss of BPA \$s
- Make response plan by genus
 - Other ways to be generic, but effective—e.g., green timber from the orient
- Order of the objectives
 - First three are generic—others could fall under the first three

Objective 6 - Research

- Sea Grant has ongoing work -
 - green crab
 - copepods
- Is there work on biocontrols on animals?
 - CA work—has not found something specific enough

- Pest risk analysis—how does something become an ANS?

Objective 7 - Law

- Leave \$ for enforcement
- Must be financial incentives to obey the law

Objectives 4, 5, 6, and 7-

- Coordinate with other states/British Columbia

PSMFC; CA, OR, WA, AK, ID

What about including federal laws? Outside three miles, etc.?

Need Volunteer to review list of laws when available.

Appendix C

Non-indigenous Species of Washington

Freshwater Animals and Plants

List of Non-indigenous Freshwater Animal Species

Common name	Species name
Amphibians	
Bull Frog	<i>Rana catesbeiana</i>
Green Frog	<i>Rana clamitans</i>
Fish	
American Shad	<i>Alosa sapidissima</i>
Arctic Grayling	<i>Thymallus arcticus</i>
Atlantic Salmon	<i>Salmo salar</i>
Black Bullhead	<i>Ictalurus melas</i>
Black Crappie	<i>Promoxis nigromaculatus</i>
Blue Catfish	<i>Ictalurus furcatus</i>
Bluegill Sunfish	<i>Lepomis macrochirus</i>
Brook Trout	<i>Salvelinus fontinalis</i>
Brown Bullhead	<i>Ictalurus nebulosus</i>
Brown Trout	<i>Salmo trutta</i>
Channel Catfish	<i>Ictalurus punctatus</i>
Common Carp	<i>Cyprinus carpio</i>
Flathead Catfish	<i>Pylodicticis olivaris</i>
Golden Trout	<i>Salmo aquabonita</i>
Goldfish	<i>Carassius auratus</i>
Grass Carp	<i>Ctenopharyngodon idella</i>
Grass Pickerel	<i>Esox americanus</i>
Green Sunfish	<i>Lepomis cyanellus</i>
Lahontan Cutthroat Trout	<i>Oncorhynchus clarki henshawi</i>
Lake Trout	<i>Salvelinus namaycush</i>
Lake Whitefish	<i>Coregonus clupeaformis</i>
Largemouth Bass	<i>Micropterus salmoides</i>
Mosquito Fish	<i>Gambusia affinis</i>
Norther Pike	<i>Esox lucius</i>
Pumpkinseed Sunfish	<i>Lepomis gibbosus</i>
Rock Bass	<i>Ambloplites rupestris</i>
Smallmouth Bass	<i>Micropterus dolomieu</i>
Striped Bass	<i>Marone saxatilis</i>
Tadpole Madtom	<i>Noturus gyrinus</i>
Tench	<i>Tinca tinca</i>
Tiger Musky	<i>Esox hybrid</i>
Walleye	<i>Stizostedion vitreum</i>
Warmouth	<i>Lepomis gulosus</i>
White Crappie	<i>Promoxis annularis</i>
Yellow Bullhead	<i>Ictalurus natalis</i>
Yellow Perch	<i>Perca flavescens</i>

Invertebrates

Asian Clam	<i>Corbicula fluminea</i>
Asiatic clam	<i>Corbicula sp.</i>
Big-ear radix	<i>Radix auricularia</i>
Chinese Mitten Crab	<i>Eriocheir sinensis</i>
Chinese mysterysnail	<i>Cipangopaludina chinensis malleata</i>
Japanese mysterysnail	<i>Cipangopaludina japonicus</i>
Mimic lymnaea	<i>Pseudosuccinea columella</i>
New Zealand Mud Snail	<i>Potamopyrgus antipodarum</i>

Reptiles

Common Slider	<i>Trachemys scripta</i>
Snapping Turtle	<i>Chelydra serpentina</i>

Descriptive Information on Freshwater Animal Priority Species

Chinese Mitten Crab (*Eriocheir sinensis*)

General Information: The Chinese mitten crab is native to estuaries and rivers along the coasts of Korea and Southern China, from the Yellow Sea to south of Shanghai. It is a catadromous species, migrating to coastal estuaries in the fall to mate, spawn, and die. Females are capable of producing from 250,000 to over one million eggs, which hatch the following spring. The larvae develop through six planktonic stages. After the final larval molt, the juvenile crabs settle to the bottom, and soon after that begin to move upstream, spending most of their adult life in freshwater.

The mitten crab is known to migrate great distances, readily moving overland to avoid obstructions like dams and irrigation diversions. In Europe, they have been reported to swarm by the millions over canal and stream banks onto shore, sometimes wandering onto city streets and even into houses. The mitten crab digs burrows into levees that weaken and eventually cause these structures to fail. They also clog water intake and diversion screens, and would probably have major implications for hydroelectric and irrigation projects in the Columbia River Basin if they were to become established there. Their impact on native fish and wildlife species in North America is not yet known, but it is suspected that they would compete with and prey on many species of native finfish and shellfish.

North American/Washington Distribution: The Chinese mitten crab has been reported sporadically from various sites in North America this century. A number of individuals have been reported from the Great Lakes area as early as 1965. They have not expanded in this region, however, because salt water is required for reproduction. A single individual was collected from the lower Mississippi River in 1987, but there have been no reports of populations establishing in that area to date.

The first reports of mitten crab on the west coast of North America came from shrimp fishers in the south end of San Francisco Bay in the early 1990s. By 1994, breeding populations had been observed

at various locations in the bay, and they are currently found in very large numbers throughout San Francisco Bay and the Sacramento and San Joaquin River systems.

In 1997, a single Chinese mitten crab was identified from the lower Columbia River near Portland. This individual specimen was captured on hook and line by a recreational sturgeon angler. There have been no confirmed reports of mitten crab being found in any other Washington water to date.

Pathways of Introduction: The most likely pathway for introduction of the Chinese mitten crab into western North America is from the release of untreated ballast water from Asian or European cargo ships. The reported introductions into the Great Lakes area were almost certainly the result of ballast water, since all reported occurrences came from major port cities along Lake Erie.

The other North American introductions described earlier were also likely the result of ballast water discharge, however, there is another important pathway that could be responsible for their introduction at any or all of these sites. That is the intentional introduction of the mitten crab for its food value. In 1986, the California Department of Fish and Game found Chinese mitten crab available for sale in a number of Asian food markets in San Francisco and Los Angeles at prices ranging from \$12.50 to \$14.50 per pound. Although the importation of live mitten crab was banned in California in 1987 and from the United States in 1989, the high price they command encourages smuggling. The U. S. Fish and Wildlife Service has reported intercepting numerous shipments of live mitten crab in recent years at the San Francisco, Los Angeles, and Seattle airports.

A third pathway for the introduction of mitten crab into Washington would be with a shipment of live shellfish from Asia or San Francisco Bay that was contaminated with crab larvae.

Other Management Considerations: The catadromous life history of the Chinese mitten crab offers some protection from rapid ocean dispersal. Since the species resides primarily in estuaries and rivers, it is less likely that larvae will be carried by ocean currents to adjacent estuaries as rapidly as some marine ANS like the green crab. On the other hand, this species has an unusual ability to migrate great distances, sometimes over land, increasing the possibility of contaminating adjacent watersheds.

Zebra Mussel (*Dreissena polymorpha*)

General Information: The zebra mussel is a small freshwater bivalve mollusk native to the drainage basins of the Caspian, Black, and Aral seas of eastern Europe. Unlike native North American mussels, the zebra mussel has free-floating, planktonic larvae that can remain in the water column for up to four weeks before setting. This unique life history characteristic allows the larvae (veligers) to be transported for long distances in water currents, and for them to remain viable in standing water, such as that found in boat bilges and bait buckets for long periods of time. This characteristic facilitated their rapid expansion in western Europe in the 1800s and in North America in the last decade.

Zebra mussels have also demonstrated unusual adaptive ability when it comes to attachment substrate and colonization characteristics. They readily attach to any hard surface including natural objects like rock, gravel, coarse sand, aquatic vegetation, even other shellfish, and to manmade surfaces such as concrete, plastic, metal, and fiberglass. They form dense colonies of up to 75,000 individuals per square meter in areas where food is readily available. As a result, zebra mussels pose a significant clogging threat to any water conveyance structure including water intake and diversion screens at hydroelectric dams, agricultural, municipal and industrial water supplies, and fish hatcheries. They are also known to have serious impacts on fishways and navigation locks.

An adult zebra mussel is relatively small, reaching an average size of only about five centimeters. Their average life span is three to five years, but individuals can live up to 10 years. They often reach sexual maturity in their first year of life, and spawn continuously when water temperature exceed 55 degrees. Each female is capable of producing up to one million eggs per year. Zebra mussels require good water quality, a plentiful supply of phytoplankton, and calcium levels above 25 ppm. Under these conditions, they can dramatically alter the ecosystem, eliminating native mussels and grazing most of the available plankton from the water column, severely altering the food chain and depressing populations of many culturally, recreationally and commercially important fish and wildlife species.

North American/Washington Distribution: The initial introduction of zebra mussels into North America is believed to have occurred in Lake St. Clair (Great Lakes Basin) sometime between 1986 and 1988. The most likely source of introduction being the discharge of freshwater ballast from an inland-based cargo ship trading in Europe. They have now become firmly established in all of the Great Lakes as well as the Mississippi, Hudson, Ohio and other major river drainages in twenty eastern states and two Canadian provinces, all east of the Continental Divide.

Zebra mussels have not yet become established in any water west of the Continental Divide to our current knowledge. California has inspected boats at agricultural border inspection stations since 1993, and have reported at least eleven incidences to date of zebra mussels being transported on the hulls of large boats being transported into the state from the Great Lakes region.

There were unconfirmed reports of zebra mussels being observed by workers at two large Lake Washington boat yards in 1997. As a result of an investigation of these reports, it was determined that there is an active boat resale market operating for large vessels purchased from the Great Lakes which are hauled by truck to Lake Washington for resale. Several subsequent inspections of these vessels, and the surrounding lake bottom in 1997 did not produce any documented evidence of zebra mussel presence. However, based on these reliable reports, it is possible that Lake Washington has already been exposed to contamination by zebra mussels.

Pathways of Introduction: The most probable path of introduction for zebra mussels into Washington is either from adult mussels attached to the hull of boats transported from affected areas in

the east, or from larvae found in untreated bilge water in these transported vessels. Since adult zebra mussels can live out of the water for up to four days, and veligers remain free-floating and almost undetectable in any water source for up to four weeks, it is very possible for live mussels to be transported from a freshwater port in the east to a freshwater port in Washington. The Columbia River and Lake Washington are the two most likely locations for such an introduction.

Another important pathway for a possible zebra mussel introduction is from the importation of live aquatic organisms, principally fish and plants, from affected areas. Grass carp and a number of other fish species, including tropical aquarium species, are commonly imported into Washington from eastern states. The aquatic gardening industry also imports a significant number of aquatic plants. Zebra mussel adults or veligers are potential “hitchhikers” with these shipments.

Other potential vectors for zebra mussels include a direct ballast water introduction at a freshwater port facility, or an intentional introduction. Because of their effectiveness at filtering large quantities of water, there may be a temptation by some to use the zebra mussel to improve water clarity in lakes with large algal blooms resulting from non-point pollution.

Other Management Considerations: In the east, where zebra mussels have become established, they have been responsible for hundreds of millions of dollars in damage to all types of water dependant uses. They have been responsible for dramatic and irreversible changes to native ecosystems, resulting in the near extinction of some native species and a dramatic shift in the abundance and distribution of others.

A risk assessment completed by Washington Department of Fish and Wildlife in 1994 shows that zebra mussels would thrive in many Washington waters if they were introduced. The Columbia River and Lake Washington, two incredibly important environmental and economic waterways in this state, would both support heavy infestations of zebra mussels. The Columbia River, in particular, with its many dams, water diversions, pump screens, navigation locks, fishways, fish screens and hatcheries would be devastated by zebra mussel populations like those already observed in other regions of North America.

List of Non-indigenous Freshwater Plants

Common Name	Scientific Name	Habitat	WSNWCB Status	WDOA Status
<u>Plants that are currently causing problems in Washington</u>				
Brazilian Elodea	<i>Egeria densa</i>	Submersed species	State listed noxious weed	On the Prohibited List
Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	Submersed species	State listed noxious weed	On the Prohibited List
Fanwort	<i>Cabomba caroliniana</i>	submersed species	State listed noxious weed	Proposed for Prohibited List
Fragrant waterlily	<i>Nymphaea odorata</i>	Floating leaved in shallow water		
Garden Loosestrife	<i>Lysimachia vulgaris</i>	Wet areas and along shorelines	State listed noxious weed	Proposed for Prohibited List
Giant Hogweed	<i>Heraceum mantegazzianum</i>	Grows in wet areas	State listed noxious weed	On the Prohibited List
Hydrilla	<i>Hydrilla verticillata</i>	Submersed species	State listed noxious weed	On the Prohibited List
Indigo Bush	<i>Amorpha fruticosa</i>	Grows along stream corridors	State listed noxious weed	On the Prohibited List
Japanese Knotweed	<i>Polygonum cuspidatum</i>	Wet areas	State listed noxious weed	
Parrotfeather	<i>myriophyllum aquaticum</i>	Mat-forming emergent grows along lake and river shorelines	State listed noxious weed	On the Prohibited List
Purple Loosestrife	<i>Lythrum salicaria</i>	Wet areas, freshwater to brackish wetlands	State listed noxious weed	On the Prohibited List
Reed Canary Grass	<i>Phalaris arundinacea</i>	Wet areas from freshwater wetland, streambanks, wet meadows	State listed noxious weed	
Saltcedar	<i>Tamarix spp.</i>	Wet areas	State listed noxious weed	
Swollen Bladderwort	<i>Utricularia inflata</i>	Floating species with no roots		
Wand Loosestrife	<i>Lythrum vargatum</i>	Wet areas, wetlands	State listed noxious weed	On the Prohibited List
Water primrose	<i>Ludwigia hexapetala</i>	Mat-forming emergent species		
Water Starwort	<i>Callitriche stagnalis</i>	Submersed to emergent plant		
Yellow Floating Heart	<i>Nymphoides peltata</i>	Floating leaved in shallow water		
Yellow Iris	<i>Iris pseudacorus</i>	Emergent along lake and river shorelines		

List of Non-indigenous Freshwater Plants

<u>Common Name</u>	<u>Scientific Name</u>	<u>Habitat</u>	<u>WSNWCB Status</u>	<u>WDOA Status</u>
<u>Plants with Apparent Limited Distribution and Weedy Potential</u>				
Bur Arrowhead	<i>Sagittaria rigida</i>	emergent – wet areas	Not currently listed	Not currently listed
Cattail	<i>Typha angustifolia</i>	emergent, shoreline plant	Not currently listed	Not currently listed
Fiddle Grass	<i>Epilobium hirsutum</i>	shorelines, muddy soils	Not currently listed	Not currently listed
Flowering Rush	<i>Butomus umbellatus</i>	shorelines	Not currently listed	Not currently listed
Slender Arrowhead	<i>Sagittaria graminea</i>	emergent – wet areas	Not currently listed	Not currently listed
<u>Species of Concern Being Sold in Washington, But Not Established in the Wild</u>				
Asian Anacharis	<i>Egeria najas</i>	submersed species (sold as an aquarium plant)	Not currently listed	Not currently listed
Water Hyacinth	<i>Eichornia spp.</i>	floating plant with dangling roots (sold as an aquatic garden plant)	Not currently listed	Not currently listed
<u>Introduced Plant Species, But Not Causing Problems</u>				
Black Nightshade	<i>Solanum nigrum</i>	shorelines – wet areas	Not currently listed	Not currently listed
Bulbous Rush	<i>Juncus bulbosus</i>	shallow water	Not currently listed	Not currently listed
Climbing Nightshade	<i>Solanum dulcamara</i>	shorelines – wet areas	Not currently listed	Not currently listed
Common Forget Me Not	<i>Myosotis scorpioides</i>	wet areas	Not currently listed	Not currently listed
Curly Leaf Pondweed	<i>Potamogeton crispus</i>	submersed	Not currently listed	Not currently listed
Marsh Pepper	<i>Polygonum hydropiper</i>	shorelines	Not currently listed	Not currently listed
Pennywort	<i>Lysimachia nummularia</i>	wet areas - shorelines	Not currently listed	Not currently listed
Tapegrass	<i>Vallisneria americana</i>	(intentionally introduced for habitat)	Not currently listed	Not currently listed
Water Cress	<i>Nasturtium officinale</i>	cold water streams	Not currently listed	Not currently listed
Wild Rice	<i>Zizania aquatica</i>	emergent	Not currently listed	Not currently listed
WDOA - Washington Department of Agriculture; WSNWCB - Washington State Noxious Weed Control Board				

Descriptive Information on Freshwater Plant Priority Species

Eurasian Watermilfoil (*Myriophyllum spicatum*)

The first herbarium record of *Myriophyllum spicatum* in Washington is from Lake Meridian in King County, collected in the mid 1960s. In the mid 1970s, *M. spicatum* was recognized as a problem by the state when the British Columbia Ministry of the Environment notified Washington officials that Eurasian watermilfoil was present in the Okanogan chain of lakes in British Columbia. In spite of the placement of fragment barriers, Eurasian watermilfoil moved downstream into Lake Osoyoos (straddles the Canadian/Washington border), into the Okanogan River and eventually to the Columbia River.

At the same time as Eurasian watermilfoil was moving into central Washington from British Columbia, an infestation was reported in Lake Washington, a large, heavily-used lake near Seattle in King County, Washington. The pathways of initial introduction are unknown, but we suspect that Eurasian watermilfoil was introduced to Lake Meridian and the British Columbia lakes by the discarding of the contents of an aquarium. From established populations in British Columbia, water movement carried Eurasian watermilfoil into central Washington. We believe that recreational boaters transported Eurasian watermilfoil into Lake Washington from nearby Lake Meridian.

Thirty years later, Eurasian watermilfoil continues to spread and has moved into most of the major river systems in Washington and into many popular recreational lakes. The major mode of movement after the original introductions is by recreational boating. New infestations of milfoil are often reported at boat ramp sites. Milfoil locations in western Washington closely follow the Interstate 5 corridor and milfoil continues to find its way into new sites each year.

Because of its widespread distribution and mat-forming growth habit, milfoil is considered to be the most problematic freshwater invasive plant in Washington. It costs the federal, state, local governments, private industry, and lake and river property owners millions of dollars each year for control and for dealing with other impacts caused by Eurasian watermilfoil. Since the Eurasian watermilfoil infestation, dam operators now spend thousands of dollars each year cleaning fragments from the trash racks of dams on infested rivers.

Eurasian watermilfoil has been eliminated from some previously infested lakes by treating the entire lake with the aquatic herbicide Sonar. Overstocking a lake with triploid grass carp may also lead to the eradication of Eurasian watermilfoil, although this method is not recommended because it also results in the elimination of many native species.

Eurasian watermilfoil is a Class B weed on the State Noxious Weed List and is on the Washington Department of Agriculture Quarantine List.

Life Cycle of Eurasian Watermilfoil: Although Eurasian watermilfoil produces many seeds, these do not appear to be an important mode of reproduction for this species. Instead, Eurasian watermilfoil, like the other exotic submersed species discussed in this report, reproduces efficiently and rapidly via the formation of fragments. Any fragment containing a node can grow into a new plant. Fragments can be produced through wind and wave action and by boating and other water activities. At certain times of the year, Eurasian watermilfoil also produces autofragments (easily abscised plant parts with dangling roots). A plant with autofragments can shatter into hundreds of viable plant parts. Each fragment will disperse, sink, and if in a suitable location take root and form a new plant. Eurasian watermilfoil also reproduces through the production of stolons.

Eurasian watermilfoil reproduces extremely rapidly and can completely colonize an infested lake within one to three years after the original introduction. We find that Eurasian watermilfoil tends to initially “ring” the lake with plants at the three to nine feet depth. Over time, the other depths are colonized depending on water clarity, although wave action generally prevents Eurasian watermilfoil from colonizing very shallow areas.

Eurasian watermilfoil has a broad tolerance for a wide variety of environmental conditions and grows well in moderately alkaline eastern Washington lakes and equally well in the soft water lakes of western Washington. Eurasian watermilfoil grows very well in nutrient-poor lakes such as Lake Chelan in central Washington, but will also grow in moderately to nutrient-enriched waterbodies. If water levels recede, Eurasian watermilfoil can form terrestrial plants that can survive a few weeks until water levels rise. Eurasian watermilfoil has been observed growing in water 45 feet deep in pristine Lake Chelan.

In the mild western Washington conditions, Eurasian watermilfoil generally overwinters in an evergreen state. In the harsher eastern Washington climate, Eurasian watermilfoil tends to die back to the fleshy rootcrowns each winter. In spring, Eurasian watermilfoil starts growing rapidly toward the water surface. As it nears the surface, it forms lateral shoots. The formation of lateral shoots tends to shade out native species and allows Eurasian watermilfoil to form large monotypic stands. In both climates, Eurasian watermilfoil has generally reached the water surface by early July, forming dense tangled mats of vegetation on or near the surface. It flowers in July sending up flower spikes that are pollinated by wind. The seeds do not appear to be particularly viable in Washington waters. Eurasian watermilfoil also forms autofragments at certain times of the year, and fragments are continually produced via wind and wave action and by boating activities.

Eurasian watermilfoil, like other submersed species, can be readily spread between waterbodies on boats. Often plants remain on boat trailers, motors, or fishing gear and when boaters or fishers move between lakes or waterbodies these plants enter the new waterbody.

Hydrilla (*Hydrilla verticillata*)

Monecious *Hydrilla verticillata* was discovered in Pipe Lake and Lake Lucerne in King County in May 1995. When discovered, the population of hydrilla was well established throughout these lakes. The two lakes are connected via a narrow channel so there appears to have been only one original introduction. Because there is a patch of hybrid waterlilies (*Nymphaea spp.*) in the lake, we suspect that hydrilla was introduced as a contaminant on the waterlily rhizomes.

This is the northernmost introduction of hydrilla in North America and the only known introduction of this species in the Pacific Northwest. Surveys of nearby lakes show that hydrilla is confined to this location within King County. Annual statewide surveys from 1994 have not detected other hydrilla populations in Washington. Both Pipe Lake and Lake Lucerne are privately owned lakes. There is no public access and only electric motors are allowed. We believe these factors help keep hydrilla confined to this lake system.

Because of problems caused by hydrilla elsewhere in the United States, Washington State and King County initiated an eradication program for hydrilla. To date, the project has cost several hundred-thousand dollars. Hydrilla is proving more difficult to manage than Eurasian watermilfoil, because in addition to propagating via fragmentation, it also reproduces through the formation of subterranean turions (tubers), overwintering buds called turions, and by seed (potentially, but not considered to be an important mode of reproduction). The tubers appear to be long-lived in the sediment. There was hydrilla germination from tubers after three years of herbicide treatment. The lakes were treated with the aquatic herbicide Sonar in 1995, 1996, and 1997, and we anticipate the project continuing for several years until eradication is achieved and we find no more hydrilla for at least three years.

Hydrilla is a Class A weed on the State Noxious Weed List and it is on the Washington Department of Agriculture Quarantine List.

Brazilian Elodea (*Egeria densa*)

Egeria densa is best known as anacharis, a South American species that is a widely sold aquarium plant. There are records of Brazilian elodea from Long Lake, Kitsap County from the early 1970s. We do not know if it was present in Washington prior to that date. In 1997, Brazilian elodea was known from 15 locations, all within western Washington. Because of the pattern of distribution within the state, we believe that most introductions occurred when aquarium contents were discarded into lakes. Some introductions probably also occurred from boat transport from an infested lake into an uninfested waterbody. Because all Brazilian elodea plants in the United States are male, reproduction occurs primarily through the formation of fragments and also by rhizome spread. Brazilian elodea also can form hardened-overwintering structures on the ends of rhizomes, making this plant resistant to herbicide treatment.

Brazilian elodea grows very densely, filling the water column with vegetation and displacing native species. Economic impacts are mainly to lake residents and local and state governments as control costs. Up to several hundred–thousand dollars per year is spent on managing the growth of this problematic species. Although resistant to herbicide treatment, Brazilian elodea is a preferred forage species for triploid grass carp. Brazilian elodea appears to have been eradicated in Silver Lake, Cowlitz County by triploid grass carp.

Brazilian elodea is a class B weed on the State Noxious Weed List and it is on the Washington Department of Agriculture Quarantine List.

Parrotfeather (*Myriophyllum aquaticum*)

Myriophyllum aquaticum or parrotfeather milfoil is a South American species that has been extensively sold throughout the United States as an aquatic garden plant and also as an aquarium plant. Parrotfeather has extremely attractive emergent vegetation that makes it a desirable water garden plant. There are herbarium records for parrotfeather as early as 1944 in southwestern Washington. We suspect that parrotfeather was introduced as a garden plant and escaped via flooding or by being deliberately planted. Its current distribution is confined to western Washington. It has been known to overwinter in winter climates more harsh than eastern Washington, so it could survive if introduced there.

Parrotfeather grows as a sprawling mat in shallow water or muddy banks and has up to a foot of bright green emergent growth from tough rhizomes. It forms dense monotypic stands and alters water chemistry. Because all parrotfeather plants in the United States are female, parrotfeather does not reproduce by seed. It, too, forms viable fragments and also spreads via its tough rhizomes. It is very resistant to herbicide treatment and is not palatable to triploid grass carp. Parrotfeather has infested drainage canals in southwestern Washington and diking districts spend about \$100,000 per year managing its growth. Parrotfeather is a potential threat to the extensive irrigation canals in eastern Washington.

Parrotfeather is a class B weed on the State Noxious Weed List and is on the Washington Department of Agriculture Quarantine List.

Descriptive Information on Freshwater Emergent Plant Species

Purple Loosestrife (*Lythrum salicaria*)

Purple loosestrife (*Lythrum salicaria*) is classified on the Washington State Noxious Weed List as a Class B Designate species and is on the Washington Department of Agriculture Quarantine List. Control is designated in all areas of Washington except a small part of central Grant County. Purple loosestrife is a large perennial plant, which grows in and along water bodies, wetlands and areas with

high watertables in many counties throughout Washington. It is very dominant, forming monocultures and displacing desirable wetland species. It grows six to ten feet tall from a woody root crown, produces ten to fifty stems, many purple flowers during July to September, more than one million very small seeds per plant, and dies back to the root crown in late fall. Purple loosestrife does not produce rhizomes but readily re-sprouts from its woody root crown and larger broken off root fragments. It has little tolerance for overhead shade from trees, one of its few weaknesses. Being an attractive plant it has sometimes been transplanted by gardeners. However, the current Washington Department of Agriculture quarantine on movement of seed or plant material will help eliminate this problem.

Dense stands of purple loosestrife have very little or no wildlife value, displace desirable habitat features, and may reduce shallow water habitats for fish. They also nearly eliminate shoreline recreational values. Once established, this plant is very difficult to eliminate.

Purple loosestrife can invade even undisturbed herbaceous plant communities. It usually gets established as one plant and maintains at this level for two to five or more years. During this time it builds a seed bank in adjacent soil. When unknown conditions occur, it will start spreading, and in a few years can occupy most sites, where adapted, in a given area. Once established as a large stand, soil seed reserves quickly accumulate. This assures continuation of an infestation for at least six years, even with active control of seedlings and adult plants, and no additional seed production. Seed transport can occur in water, become attached to animals, birds, boats, trailers, people or anything that moves through an area when seeds are being cast. Seeds have no mechanical attachment mechanism, but are very tiny and adhere easily to wet surfaces.

Purple loosestrife can also spread vegetatively by broken off plant parts. Any live stem or part of a stem has the ability to sprout roots and top growth from each node, if it lands in a moist environment. These can quickly develop new plants (e.g., farther down stream in an uninfested area). Plant parts can also be carried on boat, trailers or other vehicles. However, this is not so likely as with true aquatic weed species.

Control is usually done with "Rodeo" herbicide from early summer to early fall. This herbicide is effective with full plant coverage. Selectivity can be achieved by application to maintain adjacent desirable plants. Mowing can be used, but is usually not possible in shoreline or wet land situations. Bio-control may be successful with use of three insects specific to this species including: *Nanophyes sp.* a flower feeding weevil, *Hylobius sp.* a root boring weevil, and *Hylobius sp.* a leaf feeding beetle. *Hylobius* has been effective in Grant County, Washington and in western Oregon.

Saltcedar (*Tamarix ramosissima*)

Saltcedar is an aggressive multi-stemmed shrub or small tree (5 to 20 feet tall) growing along stream banks, wetlands, or areas with a high watertable. It produces very small, scale like leaves, which are deciduous. Flowering starts in May or June, with seed production quickly following. Reproduction is mostly by very tiny seeds, that could be wind blown or carried by birds or animals. New plants can

start vegetatively from broken off branches which fall in a moist environment. Root sprouting is also common, particularly if the main shoots are damaged. Seedlings usually sprout at the waters edge or in saturated soil. They grow slowly at first, but become very competitive with existing vegetation.

Once established, saltcedar is a high water user and its roots can follow water to great depths. It has been known to reduce stream flows and dry up springs and wetlands. This characteristic gives it an additional competitive advantage over other established plants.

Saltcedar has a very high tolerance for soil salinity. It also takes up salts, which pass through the plant, and are secreted by leaves on to the soil under the canopy spread. This increases surface salinity, often beyond competing or understory vegetation tolerance. This and other strong competitive advantages result in mono-culture stands of saltcedar, greatly reducing wildlife habitat values.

Saltcedar has spread extensively throughout the southwest United States along river and stream channels, lake shores and similar areas, where it eliminates diverse riparian plant communities, including trees and understory plants. This greatly lowers wildlife habitat values of areas which should support high species diversity and abundance. In Washington, saltcedar is currently established only in a limited area in parts of Grant, Adams, Franklin, and Benton Counties.

Saltcedar is classified on the Washington State Noxious Weed List as a Class C Weed. This is likely to be re-evaluated to a B-Designate species, where it currently occurs in the south central Columbia Basin.

Marine Animals and Plants

Non-indigenous Marine Species of Washington State and British Columbia, Canada

Division or Phylum	Scientific name Common name	Natural range	Reference
<u>Plant List</u>			
Angiosperm	<i>Spartina alterniflora</i> smooth cordgrass	NW Atlantic	a
Angiosperm	<i>Zostera japonica</i> Japanese eelgrass	Japan	a, b
Chlorophyta	<i>Codium fragile tomentosoides</i> dead man's fingers	Japan	a
Diatomacea	<i>Pseudonitzschia australis</i>	Australasia	a
Phaeophyta	<i>Sargassum muticum</i> Japanese weed	Japan	a, b
Rhodophyta	<i>Gelidium vagum</i>	NW Atlantic	a, b
Rhodophyta	<i>Lomentaria hakodatensis</i>	Japan	a, b
<u>Animal List</u>			
Annelida (Oligochaeta)	<i>Limnodriloides monotheucus</i>	NW Atlantic	#, a
Annelida (Oligochaeta)	<i>Paranis frici</i>	Black and Caspian Seas	#, a
Annelida (Oligochaeta)	<i>Tanais spp.</i>	?	c
Annelida (Oligochaeta)	<i>Tubificoides apectinatus</i>	N Atlantic	#, a
Annelida (Polychaeta)	<i>Capitella capitata</i>	?	c
Annelida (Polychaeta)	<i>Capitella spp</i>	N Atlantic? Pacific?	W #, a
Annelida (Polychaeta)	<i>Heteromastus filiformis</i>	NW Atlantic	a
Annelida (Polychaeta)	<i>Hobsonia florida</i>	?	c
Annelida (Polychaeta)	<i>Pionosyllis uraga</i>	N Atlantic	a, b
Annelida (Polychaeta)	<i>Polydora cornuta</i> (=ligni) mudworm	N Atlantic	a, b
Annelida (Polychaeta)	<i>Pseudopolydora kemp</i>	Indian Ocean? NW Pacific?	a
Annelida (Polychaeta)	<i>Pygospio elegans</i>	?	c
Annelida (Polychaeta)	<i>Streblospio benedicti</i>	Atlantic	a, b, c
Annelida (Polychaeta)	<i>Tharyx tessalata</i>	Atlantic	a, b
Arthropoda (Amphipoda)	<i>Ampithoe valida</i>	NW Atlantic	a
Arthropoda (Amphipoda)	<i>Chelura terebrans</i>	Atlantic	a
Arthropoda (Amphipoda)	<i>Corophium acherusicum</i>	Atlantic	a

Non-indigenous Marine Species of Washington State and British Columbia, Canada

Division or Phylum	Scientific name Common name	Natural range	Reference
Arthropoda (Amphipoda)	<i>Corophium insidiosum</i>	N Atlantic	a, c
Arthropoda (Amphipoda)	<i>Grandidierella japonica</i>	?	c
Arthropoda (Amphipoda)	<i>Melita nitida</i>	NW Atlantic	a
Arthropoda (Copepoda)	<i>Mytilicola orientalis</i>	W Pacific	a, b
Arthropoda (Copepoda)	<i>Nippoleucon hinumensis</i>	?	c
Arthropoda (Cirripedia)	<i>Balanus improvisus</i> bay barnacle	N Atlantic	a
Arthropoda (Decapoda)	<i>Exopalaemon modestus</i>	China, Korea, Russia?	a
Arthropoda (Decapoda)	<i>Homarus americanus</i> American lobster	Atlantic	b
Arthropoda (Isopoda)	<i>Limnoria tripunctata</i> gribble	Atlantic	a, b
Bryozoa	<i>Bowerbankia gracilis</i> creeping bryozoan	NW Atlantic?	#, a
Bryozoa	<i>Cryptosula pallasiana</i>	N Atlantic	a
Bryozoa	<i>Schizoporella unicornis</i>	NW Pacific	a
Chordata (Fish)	<i>Salmo salar</i> Atlantic salmon	Atlantic	a, b
Chordata (Tunicata)	<i>Ciona intestinalis</i>	N Atlantic	a
Chordata (Tunicata)	<i>Styela clava</i>	N China to Okhotsk Sea	#, a
Cnidaria (Anthozoa)	<i>Haliplanella luciae</i> orange-striped green anemone	Japan	a, b
Cnidaria (Hydrozoa)	<i>Cordylophora caspia</i> freshwater hydroid	Black and Caspian Seas	a
Cnidaria (Hydrozoa)	<i>Ectopleura crocea</i> (=Tubularia crocea)	NW Atlantic	a
Cnidaria (Hydrozoa)	<i>Gonothyraea clarki</i>	N Atlantic	#, a
Cnidaria (Hydrozoa)	<i>Obelia spp.</i>	N Atlantic	#, a
Cnidaria (Hydrozoa)	<i>Sarsia tubulosa</i> (=Syncoryne minabilis)	N Atlantic	a
Cnidaria (Scyphozoa)	<i>Aurelia "aurita"</i> moon jelly	NW Pacific	#, a
Kamptozoa	<i>Barentsia benedeni</i>	Europe	#, a
Mollusca (Bivalvia)	<i>Corbicula fluminea</i> Asian clam	China, Korea, Japan	a

Non-indigenous Marine Species of Washington State and British Columbia, Canada

Division or Phylum	Scientific name Common name	Natural range	Reference
Mollusca (Bivalvia)	<i>Crassostrea gigas</i> Japanese oyster (a) Pacific oyster (b)	Japan	a, b
Mollusca (Bivalvia)	<i>Crassostrea virginica</i> Eastern oyster (a) American oyster (b)	NW Atlantic	a, b
Mollusca (Bivalvia)	<i>Gemma gemma</i>	?	b
Mollusca (Bivalvia)	<i>Musculista senhousia</i> Japanese mussel	Japan, China	a, b
Mollusca (Bivalvia)	<i>Mya arenaria</i> softshell clam	N Atlantic	a, b
Mollusca (Bivalvia)	<i>Mytilus complex</i> blue mussel	N Atlantic	b
Mollusca (Bivalvia)	<i>Nuttallia obscura</i> dark mahogany clam	Japan? Korea?	a, b
Mollusca (Bivalvia)	<i>Petricola pholadiformis</i> false angelwing	NW Atlantic	a
Mollusca (Bivalvia)	<i>Teredo navalis</i> naval shipworm	Atlantic	a, b
Mollusca (Bivalvia)	<i>Trapezium liratum</i> Japanese trapezium	NW Pacific	a, b
Mollusca (Bivalvia)	<i>Venerupis philippinarum</i> Japanese littleneck clam	W Pacific	a, b
Mollusca (Gastropoda, Opisthobranchia)	<i>Cumanotus beaumonti</i> polyp aeolis	NW Atlantic	#, a
Mollusca (Gastropoda, Prosobranchia)	<i>Batillaria cumingi</i>	?	b
Mollusca (Gastropoda, Prosobranchia)	<i>Batillaria zonalis</i> (=atramentaria) Japanese false cerith	NW Pacific	a
Mollusca (Gastropoda, Prosobranchia)	<i>Cecina manchurica</i>	NW Pacific	a
Mollusca (Gastropoda, Prosobranchia)	<i>Ceratostoma inornatum</i> Japanese oyster drill	NW Pacific	a, b
Mollusca (Gastropoda, Prosobranchia)	<i>Crepidula fornicata</i> Atlantic slipper	NW Atlantic	a, b
Mollusca (Gastropoda, Prosobranchia)	<i>Crepidula plana</i> e. white slipper shell	NW Atlantic	a

Non-indigenous Marine Species of Washington State and British Columbia, Canada

Division or Phylum	Scientific name Common name	Natural range	Reference
Mollusca (Gastropoda, Prosobranchia)	<i>Nassarius obsoletus</i> (= <i>Ilyanassa obsoleta</i>) Eastern mud snail	NW Atlantic	a, b
Mollusca (Gastropoda, Prosobranchia)	<i>Nassarius fraterculus</i> Japanese nassa	NW Pacific	a
Mollusca (Gastropoda, Prosobranchia)	<i>Ocenebra inornata</i> (=japonica) Japanese hornmouth	Japan	a, b
Mollusca (Gastropoda, Prosobranchia)	<i>Potamopyrgus antipodarum</i> New Zealand mud snail	New Zealand	a
Mollusca(Gastropoda, Prosobranchia)	<i>Purpura clavigera</i>	?	b
Mollusca (Gastropoda, Prosobranchia)	<i>Urosalpinx cinerea</i> Atlantic oyster drill	NW Atlantic	a, b
Mollusca (Gastropoda, Pulmonata)	<i>Myosotella myosotis</i> (=Ovatella)	Europe?	a
Platyhelmenthes (Turbellaria)	<i>Pseudostylochus ostreophagus</i>	Japan	a, b
Porifera	<i>Cliona spp.</i> boring sponge	N Atlantic?	#, a
Porifera	<i>Halichondria bowerbanki</i> Bowerbank's halichondria	N Atlantic	a, b
Porifera	<i>Microciona prolifera</i> red beard sponge	NW Atlantic	a, b

Species present in Kozloff(1987) and probably established in NW, but locality requires further confirmation.

- a Ruiz, G. M. and Hines, A. H. 1997. The risk of non-indigenous species invasion in Prince William Sound associated with oil tanker traffic and ballast water management: pilot study. Prepared for the Regional Citizens' Advisory Council of Prince William Sound, P.O. Box 3089, Valdez, Alaska 99686. 47 pp plus figures and tables. Table 1 includes only those exotics identified in the NW region (Washington and British Columbia) from table _ of Ruiz and Hines (1997).
- b Jamieson, Glen. Exotics noted for BC waters. Not exhaustive.
- c Zipperer, Victoria Teresia. 1996. Ecological Effects of the Introduced Cordgrass, *Spartina alterniflora*, on the Benthic Community Structure of Willapa Bay, Washington. Master's Thesis, University of Washington, School of Fisheries.

Descriptive Information on Marine Plant Priority Species

Smooth Cordgrass (*Spartina alterniflora*)

Spartina is a large (2 to 5 feet tall) rhizomatous grass which grow in saltwater tide flats and estuaries. This plant has tall coarse culms and leaves that die back to the root crown each winter. It often gets established as a single seedling and expands vegetatively in a distinctive circular clone. Smooth Cordgrass produces little seed with relatively low viability. Seed distribution probably occurs through

transport by water or birds to new locations. It is classified by the Washington State Noxious Weed List as a B, B–Designate species.

This plant is native to the eastern coast of both North and South America. It has become established along some Pacific coastlines in North America, where it becomes an aggressive dominant plant. It grows in mud, sand, and cobble substrates, in areas where tides move in and out each day. No species from the *Spartina* genus are native to the Washington coast.

Smooth Cordgrass grows in tideflats where little or no vegetation normally occurs. There is little competition to the establishing seedlings. As they develop into circular clones, roots and top growth collect and stabilize silt moving by tidal action. This raises the clone's elevation above the adjacent tideflat. As a number of clones began to merge into one large cordgrass meadow monoculture, the amount of silt collected is enough to change that site into high meadow. When this occurs site conditions are changed dramatically taking out native eelgrass and eliminating highly productive tideflats. This takes reduces habitat for shore birds and wading birds, waterfowl, fish and other wildlife dependent on food produced in nonvegetated intertidal areas

Largest infestations of this species occurs in Willapa Bay in Pacific County. In adjacent Grays Harbor Bay some seedlings and small clones have been found and treated. This area has no know infestations now, but will require constant monitoring to ensure cordgrass is not allowed to establish here.

Common Cordgrass (*Spartina anglica*)

This species of cordgrass is a rhizomatous, perennial, with stout culms and narrow leaves. It may grow from one foot to over three feet tall on various substrates from clay or muck to sandy sites. Common cordgrass is a hybrid which has resulted from the crossing of *S. maritima* and *S. alterniflora*, so its form is variable, but it produces viable seeds. It occurs on tideflats, in estuaries and river mouths, and along other saltwater shorelines. Monocultures develop rapidly from established plants by extension of rhizomes, eliminating other desirable species like eelgrass. It often gets started on inter-tidal areas where no other native vegetation occurs, so little competition available to limit this plants spread.

It is native to the east coast of both North and South America, but has been planted widely as shoreline stabilization and livestock forage along the coasts of England, New Zealand, and in other areas.

Common cordgrass is a very efficient silt collector of tidally moved material. Gently sloping tideflats can quickly be turned into upland sites, which eliminates the production of invertebrates and other food sources for fish, waterfowl, shore and wading birds, and other wildlife. When these meadows form, it also affects water flow patterns of other plant communities, further changing their habitat values.

Spartina anglica is classified on the Washington State Noxious Weed List as a Class B–Designate species in Whatcom, Skagit, Snohomish, and Island Counties. It may be found in other counties which front on saltwater areas.

Descriptive Information on Marine Animal Priority Species

European green crab (*Carcinus maenas*)

General Information: The European green crab (*Carcinus maenas*) is a small shore crab (adults measure about 3" across) whose native distribution is along the coasts of the North and Baltic Seas. Although known by the common name of green crab, the shell (carapace) color can vary from dark, mottled green to orange or red, with yellow patches on the dorsal carapace. The crab is an able and effective forager—capable of learning and improving upon its food gathering skills. Studies have shown that the green crab is quicker and more dexterous than most crabs, and can open bivalve shells in more ways than other crabs. One adult crab reportedly can eat forty half-inch clams each day and can devour crabs as large as itself. Green crabs also prey on numerous other organisms—making these crabs potential competitors for the food sources of native fish and bird species.

The recent arrival of the green crab on the west coast United States is cause for concern. The green crab has already invaded numerous coastal communities outside of its native range, including South Africa, Australia, and both coasts of North America. An able colonizer and efficient predator, this small shore crab has the potential to significantly alter any ecosystem it invades. It has been blamed for the collapse of the soft-shell clam industry in Maine.

Distribution: The Atlantic coasts of Europe and northern Africa, from Norway and the British Isles south to Mauritania. Occupies protected rocky shores and cobbles to sandflats and tidal marshes. Lives in a wide range of salinities (5-30 ppt) and temperatures (5-30° C).

North American/Washington Distribution: First seen in San Francisco Bay in 1989, the green crab has been moving northward to Humboldt Bay, California. Live specimens have been found recently in Coos Bay, Oregon.

Other Management Considerations: The green crab feeds on many organisms, including clams, oysters, mussels, marine worms, and small crustaceans. Since it can also prey on juvenile crabs and shellfish, a northward spread to the Washington coast and Puget Sound could put our Dungeness crab, clam, and oyster fisheries at risk, and the green crab may compete with native fish and bird species for food. In Bodega Bay, California, a significant reduction in population abundance of clam and native shore crab is already evident since the arrival of the green crab in 1993. In addition, the green crab is an intermediate host to a marine worm that can harm the health of local shore birds.

Appendix D

Non-indigenous Species Authorities and Programs

Regulated Pathways of Introduction for Non-indigenous Species

Aquaculture

Historically, culture of finfish and shellfish served as a primary path for both the intentional and unintentional introduction of non-indigenous species. Intentional introductions of the Pacific oyster to the Washington coast early in the century brought several unwanted species introductions including the oyster drill and (*Spartina*) cordgrass. Cultured nonnative species can also escape from captivity. The aquaculture industry is now heavily regulated to minimize introductions, and is the most heavily regulated pathway of non-indigenous species introductions.

Statutes are implemented through the Washington administrative Code (WAC) by the Washington Department of Fish and Wildlife. Most regulations concern aquaculture disease; a few address deleterious exotics (both plants and animals); proposals for the importation of non-indigenous species are subject to the State Environmental Policy Act (SEPA).

The Washington Department of Fish and Wildlife Hatcheries Program uses passive and active approaches to prevent the importation of pests or disease along with intentional introductions of finfish to Washington State. Prior to any import or transfer of finfish a transport application must be completed and approved by a Director designee (“Director”). This permit allows the agency to critique the health history of the fish and also to provide any operational constraints after the transfer or import occurs. This procedure is codified in Revised Code of Washington (RCW) 75.08.285, Prevention and Suppression of Diseases and Pests. The Director may prohibit the introduction, transportation, or transplanting of food fish, shellfish, organisms, material, or other equipment which, in the Director’s judgment, may transmit any disease or pests affecting food fish or shellfish.

Additionally, RCW 77.12.020 allows for the classification of wildlife; if the director determines that an introduced species of the animal kingdom, not native to Washington, is dangerous to the environment or wildlife of the state, the Director may request its designation as deleterious exotic wildlife. The Commission may also designate deleterious wildlife. The Hatcheries Program also participates in the Pacific Northwest Fish Health Protection Committee; this organization has adopted guidelines for the control of fish pathogens. Additionally, the Washington Department of Fish and Wildlife has participated in the preparation of the publication, “*Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State, October 1997.*”

Public Aquaria, the Aquarium Trade, and Plant Nurseries

Wholesale importers, culture facilities, wholesale and retail pet stores, and nurseries transport and sell nonnative fresh and saltwater plants, fish, and invertebrates. The release or escape of specimens into the wild by the industry and the hobbyist aquarium owner has led to unwanted introductions. The common goldfish, for example, has become a nuisance species in eastern Washington. These species are regulated by Washington Department of Fish and Wildlife for invertebrates and fish and by the Washington Department of Agriculture for plants. Public aquarium facilities must be approved by the Washington Department of Fish and Wildlife. The sale of aquatic plants requires a nursery license.

Research Institutions

Private and public research laboratories, schools, and aquariums use nonnative species for testing, teaching, and research. Accidental release of specimens can occur when strict protocols for animal management are not followed or when protocols do not exist. Specimens may also be intentionally released or may escape. The Washington Administrative Code that applies to public aquaria and the aquarium trade also applies to research institutions. Public and private institutions are required to obtain a permit for invertebrate exotic species introductions, and controls are required on effluent release.

Live and Processed Seafood

Packing materials for live seafood such as seaweed and seawater, contain a number of living organisms and provide an opportunity for species introductions when unused product, packing materials and shipping containers are disposed of improperly. Live organisms either in or on live seafood may pose an additional threat. Shellfish in tanks are subject to Washington Department of Fish and Wildlife regulation while those on ice are not. An administrative code prohibits the release of shellfish or their holding water and the Washington Department of Fish and Wildlife inspects holding areas for edible shellfish.

Ballast Water

Ballast discharge and hull fouling are two ways boats and ships can introduce organisms. Ballast water can contain aquatic plants, animals, and pathogens. Marine vessels take on and discharge millions of tons of ballast water daily in ports and harbors around the world. The discharge of ballast water is considered a major pathway for aquatic introductions because of the high volume of water carried as ballast. The governance of ballast water is regarded as a federal matter by Washington State, as regulated under 16 United States Code Section 4701, et seq., as implemented via 33 Code of Federal Regulations, part 151(1998).

Washington State Noxious Weed Control Board Classification of Weeds

Within the Washington State Noxious Weed Control Board, Washington weeds are classified as follows:

Class A weeds have a limited distribution in Washington. The statewide goal for these species is eradication.

Class B weeds are weeds that are established in some regions of Washington, but are of limited distribution or not present in other regions of the state. Because of the differences in distribution, treatment of Class B weeds varies between regions of the state. In regions where a Class B weed is unrecorded or of limited distribution, prevention of seed production is required. In these areas, the weed is a Class B–designate, meaning it is designated for mandatory control. In regions where a Class B species is already abundant or widespread, control is a local option. In these areas, the weed is a Class B–non–designate, with containment, gradual reduction, and prevention of further spread being the chief goals.

Class C weeds may be characterized as already widely established in Washington or of special interest to the state’s agricultural industry. Placement on the list allows counties to enforce control if locally desired. Other counties may choose to provide education or technical consultation.

A Monitor List of nonnative species is also maintained. While there is no legal or regulatory aspect to the monitor list, information collected about the weed once it is placed on the Monitor List may be used to justify its future classification as a Class A, B, or C weed.

Washington Department of Ecology Aquatic Weeds Program

Monitoring and Surveys

The Washington Department of Ecology has been active in surveying Washington water bodies for aquatic plants since 1994. The purpose for monitoring these water bodies is to assess the aquatic plant communities, develop an aquatic plant species list for each waterbody, and to look for and document the presence of freshwater non-indigenous plants. Since 1997, about 250 lakes and rivers throughout the state have been surveyed. Because aquatic weeds are generally spread by boating activities, those water bodies with public boat launching facilities are targeted for surveys. At each site all plants are identified to the lowest taxonomic group possible, a subjective density value is assigned to each plant, the sediment is described, and water visibility (Secchi disk depth), and alkalinity data are collected.

Efforts are concentrated on the aquatic plants listed as noxious weeds by the Washington State Noxious Weed Control Board. There are also other nonnative species of concern that are being monitored. These are plants that have apparently been introduced as ornamentals and subsequently escaped into Washington waters. Because many plants that become problem weeds experience a lag time during which the population builds and adapts to the environment, these species are being monitored for expansion and invasive tendencies (see species list).

When pioneering colonies of invasive species are noted during a survey, the local government (usually county weed board staff and county staff) and lake residents are contacted with this information. Often a public meeting is arranged and the locals are urged to apply for grant funds to remove the invading species when it is in the first stages of invading a new waterbody.

Details of the plant surveys and other activities are summarized in the Aquatic Plant Technical Assistant Program reports from 1994, 1995, and 1996.

Research

The Washington Department of Ecology is providing funding to the University of Washington to evaluate the efficacy of using a Eurasian watermilfoil eating weevil (*Euhrychiopsis lecontei*) to control milfoil in Washington State. The University is conducting surveys on water bodies in Washington to determine the distribution and abundance of *E. lecontei* in the state. They are also researching the factors that determine the distribution and abundance of this insect in Washington.

The Washington Department of Ecology encourages and partners with federal agencies for research projects in Washington waters. The Army Corps of Engineers conducted research into the efficacy of triclopyr, an aquatic herbicide, in removing Eurasian watermilfoil in flowing waters and selected Washington's Pend Oreille River as their test site.

Education and Technical Outreach

The following educational materials dealing with freshwater exotic species and/or the management of these species have been produced by the staff of the Aquatic Weeds Program for general education purposes:

- *A Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plans* (this book walks lake residents and others through the steps needed to develop an integrated aquatic plant management plan).
- *Aquatic Plant Control* (a brochure that discusses the methods used to control aquatic plants).
- "*Nonnative, Invasive Aquatic Plants*" (a brochure that uses line drawings and descriptions to describe some of Washington's exotic freshwater species). This brochure, along with a zebra mussel identification card, is being included with information that is handed to each purchaser of a new boat in Washington.

- “*Milfoil—An Aggressive Water Weed*” (a brochure about milfoil that advises boaters to remove aquatic plants from trailers, propellers, and fishing gear and provides some information about milfoil in Washington).
- Parrotfeather Milfoil; Brazilian Elodea (*Anacharis*); Hydrilla; Characteristics of the *Hydrocharitaceae* (packet of information that was sent to pet stores and nurseries to educate their staff about these aquarium and aquatic nursery plants).
- *How to Prepare Aquatic Plants for Mailing* (a fact sheet that tells the public and others how to mail aquatic plants to Ecology for identification).
- Washington State Nonnative Aquatic Plant Workshop (proceedings of a statewide workshop about nonnative aquatic plants including plan elements).
- *Milfoil - The Unwelcome Guest* (a video about Eurasian watermilfoil in Washington).
- *Eurasian Watermilfoil Orientation and Identification* (a video about Eurasian watermilfoil identification in Washington).
- Slide sets and herbarium specimens for invasive nonnative aquatic plants (provided to county weed board staff and others).
- Aquatic Plant Technical Assistance Reports - 1994, 1995, 1996 Activity Reports and maps of lake and river surveys, technical outreach activities) .
- Field Identification Guide to Washington’s Aquatic Plants (in-preparation).

The Field Identification Guide to Washington’s Aquatic Plants describes one hundred and six freshwater aquatic plants. There are line drawings and photographs of most species. Rare and endangered aquatic species and invasive nonnative species are highlighted. Ecology and other resource agencies are encouraging lake groups to survey their lakes each year to detect invasions of nonnative species like Eurasian watermilfoil and purple loosestrife. Having an aquatic plant identification manual available will give lake groups, weed board staff, and local and state agency staff the ability to identify aquatic plants. Early identification of nonnative invasive plants will result in cost-effective management and containment of these infestations.

- Aquatic Plant Web Site – The Washington Department of Ecology maintains information, both technical and non-technical, about aquatic plants on their web site. Many of their publications are available online. Visit their site at <http://www.wa.gov/ecology/wq/plants/aquahome.html>.
- Boat Launch Signs – Milfoil signs were placed on public boat launches throughout Washington during the late 1980s. In 1998, these signs are being updated. Updated milfoil signs will be placed at boat launches where milfoil is present; Brazilian elodea signs will be placed at boat launches at sites where it is present. On water bodies where there are no problem freshwater non-indigenous species, a sign warning boaters to clean all plants off their boats, trailers, and fishing gear and cautioning people not to dump aquariums will be placed at the boat launches.

The following technical assistance and technical outreach activities are ongoing:

- Plant Identification Service – Washington Department of Ecology staff identify aquatic plants sent in to the Department from the public and others. Early identification of problem species often leads to their eradication and/or containment.
- Pet stores and Nurseries Education Campaign - In early 1996, the Washington Department of Ecology acting in concert with the Washington State Noxious Weed Control Board and Washington Department of Agriculture, launched an education campaign for the owners and managers of pet stores, aquarium shops, and plant nurseries. The purpose of this campaign was to educate owners/managers about what species of aquatic plants are prohibited and why the sale of these plants is so problematic for Washington lakes and rivers. The Washington Department of Agriculture now requires each pet store to obtain a plant nursery license. This allows Agriculture's nursery inspectors to inspect plants in both pet stores and nurseries and to enforce Washington's aquatic weed quarantine laws. We anticipate that by enforcing Washington's quarantine laws, we will help prevent new introductions of Parrotfeather milfoil and Brazilian elodea to Washington waters. This education campaign needs to continue.
- Workshops, conferences, presentations – Staff routinely give talks about freshwater non-indigenous species to lake groups, universities and institutions of higher learning, nursery groups, pesticide applicator groups, and at state, regional, and national conferences. Staff are active participants in state, regional, and national lake and aquatic plant organizations. Also much technical assistance is provided during one-on-one conversation with the general public about non-indigenous species.

Funding to Local and State Governments for Aquatic Plant Management Projects

The Washington Department of Ecology provides grants to state and local governments to help control non-indigenous aquatic weeds. Grant projects must address prevention and/or control of freshwater, invasive, nonnative aquatic plants. The types of activities funded include:

- planning (development of an integrated aquatic plant management plan);
- education, monitoring, implementation of integrated vegetation plans;
- pilot/demonstration projects; and
- surveillance and mapping projects.

Grants are awarded on an annual basis, and grant people experienced with aquatic plant management evaluate the applications. Generally about \$300,000 is available during each annual funding cycle. An additional \$100,000 per year is available on a year-round basis for early infestation grants. The purpose of early infestation grants is to provide immediate financial assistance to local or state governments to eradicate or contain a pioneering invasion of a nonnative freshwater aquatic plant.

In water bodies with well-established populations of nonnative, freshwater invasive aquatic plants, the development of an integrated aquatic plant management plan is required before grants can be awarded for implementation (control or eradication projects).

Funding Criteria Include: The presence of a nonnative freshwater plant, the environmental and economic impacts of the problem plant(s) on the ecosystem, the likelihood of the problem plant to spread to other water bodies, statewide significance of the project, and the degree that the project will benefit the public.

Under the grant program a number of eradication/management projects for freshwater non-indigenous species have been funded.

Eradication Projects

The Washington Department of Ecology is currently funding a hydrilla eradication project in partnership with King County and also the new cities of Covington and Maple Valley. Because this is the first known population of hydrilla in the Northwest, aggressive action has been taken to attempt its eradication. During the summers of 1995, 1996, and 1997, the entire 73-acre Pipe/Lucerne Lake system was treated with the systemic aquatic herbicide fluridone (brand name Sonar®). During the summer of 1997, hydrilla could still be found growing at a density of up to six plants per square meter in patches within the littoral zones of the lakes. Some tubers are still germinating in June 1998, although the tuber density has been markedly reduced since 1995. *Monoecious hydrilla* tubers (the variety of hydrilla in Washington) can remain viable in the laboratory for up to four years and they may last longer in cool water environments. Herbicide treatments will continue until hydrilla is not detected for three years following the last treatment.

Several Washington lakes have undergone treatment efforts aimed at eradicating other noxious aquatic weeds. Below are some lakes where the targeted weed has not been observed for at least two years post treatment.

Surfside Lake, Pacific County (37 acres) – In 1992 triploid grass carp were stocked to manage Eurasian watermilfoil. The year after treatment no submersed aquatic plants could be found, and visits in 1994 and 1997 also showed a lack of submersed vegetation. The project was privately funded, but surveyed with state staff.

Goss Lake, Island County (47 acres) - In 1994 the whole lake was treated with fluridone for Eurasian watermilfoil eradication. Surveys of the lake's littoral zone in 1995 and 1996 showed no evidence of Eurasian watermilfoil regrowth. There were no reports of milfoil in the lake in 1997. The Washington Department of Ecology in partnership with Island County and the Goss Lake residents funded the project.

Silver Lake, Cowlitz County (2,300 acres) – In 1992 triploid grass carp were stocked to control Brazilian elodea and Eurasian watermilfoil. By the summer of 1994, almost no submersed vegetation remained in the lake. Subsequent annual surveys showed no regrowth of submersed species. The project was funded by the Washington Department of Ecology in partnership with Cowlitz County and the Silver Lake residents.

Killarney Lake, King County (31 acres) – At one time this lake had a well established population of Eurasian watermilfoil. For many years the lake was privately treated with Sonar® (partial lake treatments) and Eurasian watermilfoil was considered to have been eradicated by the lake residents. Lake surveys in 1995 and 1996 by King County staff confirmed that Eurasian watermilfoil is no longer present in this lake. Herbicide treatments were funded privately. Surveys were funded by Washington Department of Ecology in partnership with King County and Lake Killarney residents.

Steel Lake, King County (40 acres) – The lake was treated with fluridone in 1994 to eradicate Eurasian watermilfoil. Subsequent surveys in 1996 showed no Eurasian watermilfoil and it was not reported in 1997. Herbicide treatment was funded privately. The surveys were funded by Washington Department of Ecology in partnership with the City of Federal Way and Steel Lake residents.

Carlisle Lake, Lewis County (29 acres) – The lake was treated with fluridone in 1994 to eradicate Eurasian watermilfoil. As of 1997, there is no Eurasian watermilfoil in the lake. This project was funded by Washington Department of Ecology in partnership with the Lewis County Conservation District.

Long Lake, Thurston County (330 acres) – The lake was treated with fluridone in 1991. In the two years following the treatment, remaining milfoil plants were mechanically removed or controlled through the placement of bottom barriers or diver hand removal. In 1994, there were no milfoil plants in the lake. In 1995 milfoil appeared to have been reintroduced into the lake at the boat launch. Subsequently, divers continue to hand pull this small population and have kept it from reinvading the lake, although there have continued to be further new introductions of milfoil into the lake. This project was funded by Washington Department of Ecology in partnership with Thurston County, Long Lake residents, and the United States Army Corps of Engineers.

There are also a number of other lake groups either planning for milfoil eradication or in the first or second year after treatment. These include:

- Island Lake, Mason County;
- Lake Wilderness, King County;
- The Little Pend Oreille Chain of Lakes, Stevens County;
- Lake Sacheen, Pend Oreille County;

- Lake Twelve, King County;
- Lake Shoecraft, Snohomish County;
- Lake McMurry, Skagit County; and
- Campbell Lake, Skagit County.

Current Known Gaps in Washington State Programs

We are funding plant control projects for *Egeria densa* (Lake Limerick, Big Lake) and *Myriophyllum aquaticum* (Chehalis River), but have not had much success in eradicating these species once they enter a lake system. We have funded several projects for purple loosestrife control along Yakima River, Columbia River, Okanogan River, and Waitts Lake.

Currently much more funding is needed in order to prepare for the invasion of the ANS in the animal category, specifically, funding for the green crab and the zebra mussel invasion. In addition to funding, public education of the problem is seen as a critical need as well.

Gaps in the Washington State Noxious Weed Law

Under state weed law, management of weeds is dependent upon land ownership. Most of Washington's lakebeds are owned by the "state," but it is impossible to easily determine who the "state" is and no state agency wants to take responsibility for the ownership of lakebeds. Even if land ownership were determined, the funding needed to control all aquatic plant species would be tens of millions of dollars per year. Therefore, unlike most terrestrial species where land ownership is readily determined and control can be mandated, in most cases the ownership of the aquatic beds remains a mystery.

Gaps in the Aquatic Weeds Program

- The Aquatic Weeds Program is limited to funding projects in water bodies with public boat launching facilities. Sometimes an infestation of a noxious species in a private waterbody threatens downstream water bodies. The State Legislature needs to change the law to allow the Washington Department of Ecology to fund control work in these private waters to protect downstream public waters.
- The low level of funding available for aquatic plant management projects limits the number of projects.

- Grant projects are selected for funding based on who applies for grants, rather than where the dollars should be best targeted to contain or eradicate infestations based on distribution or other factors.
- Grants are not the best way to deal with early infestations of noxious aquatic weeds. Rapid and repeated fragmentation of these species is extremely effective in spreading them quickly throughout the waterbody. Ideally a team of divers under contract, could be mobilized to remove pioneering colonies immediately upon discovery of the new infestation rather than relying on local governments applying to Ecology for grant funding.

Gaps in the Aquatic Plant Management Program

There is currently a lack of funding and staff to evaluate new herbicides, to review new information on existing herbicides, to evaluate other management products, and to revise the state Environmental Impact Statements. State residents are not able to legally use many new aquatic plant management tools because the state operates its permitting program using out of date Environmental Impact Statements. Currently, Washington allows the use of four herbicides: copper compounds (algae control), endothall (contact herbicide for submersed species), glyphosate (emergent plants only), and fluridone (systemic herbicide for submersed species). Other products are not covered under the Environmental Impact Statements.

Washington is especially handicapped by not having an effective spot treatment systemic herbicide for the control of pioneer colonies of plants like Eurasian watermilfoil. Diver hand pulling and placement of bottom barriers often is not effective or possible when milfoil infestations are more than 5–acres in size. Yet, fluridone is not effective for spot treatment and is also extremely expensive to use.

Federal Agencies Regulating the Transport of Live Aquatic Products

Federal Agencies Regulating the Transport of Live Aquatic Products (Olson and Linen 1997).

	Restrict Movement Into U.S.	Restrict Interstate Movement	Regulate Product Content or Labeling
Plants	APHIS	APHIS	APHIS
	DOD	AMS	AMS
	Customs DEA		
Fish	FWS	FWS	FWS
	Customs USCG		
Invertebrates	APHIS	APHIS	FWS
	FWS	FWS	
	ARS		
	FWS		
	PHS		
	Customs USCG		

List of abbreviations and descriptions of authority (Olson and Linen 1997)

Organization	Description
APHIS	The Animal and Plant Health Inspection Service, U.S. Department of Agriculture, has broad mandates related to the importation and interstate movement of exotic species, under the Federal Plant Pest Act, the Plant Quarantine Act, and several related statutes. The primary concern is species that pose a risk to agriculture. Restricts the movements of agricultural pests and pathogens into the country by inspecting, prohibiting, or requiring permits for the entry of agricultural products, seeds, and live plants and animals. Restricts interstate movements of agricultural plant pests and pathogens by imposing domestic quarantines and regulations. Restricts interstate transport of noxious weeds under the Federal Noxious Weed Act.
AMS	The Agricultural Marketing Service, U.S. Department of Agriculture, works closely with states in regulating interstate seed shipments. Regulations require accurate labeling and designation of "weeds" or "noxious weeds" conforming to the specific state's guidelines.
ARS	The Agricultural Research Service, U.S. Department of Agriculture, the research branch of USDA, conducts and funds research on the prevention, control, or eradication of harmful exotic species often in cooperation with APHIS. Projects include aquaculture techniques and disease diagnosis and control.
DEA	The Drug Enforcement Agency restricts imports of a few non-indigenous plants and fungi because they contain narcotics substances.
DOD	The Department of Defense has diverse activities related to non-indigenous species. These relate to its movements of personnel and cargo and management of land holdings. Armed forces shipments are not subject to APHIS inspections. Instead, the DOD uses military customs inspectors trained by APHIS and the Public Health Service.
FWS	The Fish and Wildlife Service, U.S. Department of the Interior, has responsibility for regulating the importation of injurious fish and wildlife under the Lacey Act. Maintains a limited port inspection program. In 1990, FWS inspectors inspected 22 percent of the wildlife shipments at international ports of entry. Interstate movement of state-listed injurious fish and wildlife is a federal offense and therefore potentially subject to FWS enforcement. Also provides technical assistance related to natural resource issues and fish diseases to state agencies and the private sector (aquaculture in particular). Helps control the spread of fish pathogens.
NOAA and NMFS	The National Oceanic and Atmospheric Association and National Marine Fisheries Service, U.S. Department of Commerce, inspect imported shellfish to prevent the introduction of non-indigenous parasites and pathogens. Cooperative agreements with Chile and Australia; Venezuela has requested a similar agreement.
PHS	The Public Health Service, U.S. Department of Health and Human Services, regulates entry of organisms that might carry or cause human disease.
Customs	Customs Service, U.S. Department of the Treasury. Customs personnel inspect passengers, baggage, and cargo at U.S. ports of entry to enforce the regulations of other federal agencies. They inform interested agencies when a violation is detected and usually detain the suspected cargo for an agency search.

List of abbreviations and descriptions of authority (Olson and Linen 1997)

Organization	Description
USCG	The Coast Guard, U.S. Department of Treasury, was given certain responsibilities under the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, relating to preventing introductions (mostly dealing with ballast water exchange).

Federal Law Addressing Aquatic Nuisance Species

The Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990

The Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 created the Interagency Aquatic Nuisance Species Task Force. This group is required to develop a program to prevent, monitor, and control unintentional introductions of exotic species. Many of the agencies that in some way regulate the introduction of species are represented on this task force.

The National Invasive Species Act of 1996

The National Invasive Species Act of 1996 re-authorizes and amends the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 (the “Zebra Mussel Act”). It expands the scope of the Act beyond the zebra mussel and ballast water and begins to “address introductions and infestations of [non-indigenous aquatic] species that may be as destructive as the zebra mussel.” To this end, the Act authorizes a Western Regional Panel to identify priorities for the western region; develop emergency response strategies for stemming new invasions; and advise public and private sectors concerning the prevention and control of exotic species. Furthermore, the Act advises state and Tribal governments to prepare invasive species management plans and provides for ecological surveys to study species attributes and patterns of invasions.

Finally, the National Invasive Species Act of 1996 authorizes U.S. spending \$1.25 million to “fund research on aquatic nuisance species prevention and control in San Francisco Bay and the Pacific Coast.”

The expanded scope of the National Invasive Species Act of 1996 demonstrates that federal efforts to control the transport and accidental release of exotic species are becoming more stringent. Concern over the disastrous spread of the zebra mussel has heightened public awareness of the issue and, as a consequence, government regulations are likely to become more developed in coming years.

International Instruments Addressing Non-indigenous Species

Additional International Agreements Addressing Non-indigenous Species include:

- The General Agreement on Tariffs and Trade (GATT) in which Article XX(b) acknowledges the need for parties to protect themselves from harmful exotic species. This article legitimizes trade

restraints, such as quarantine regulations, that are necessary to protect the life or health of humans, animals, or plants;

- The International Plant Protection Convention (1972), covering agricultural pests;
- The International Convention on Biological Diversity (signed 1993, but not yet ratified by the U.S. Senate) which contains a provision to control, eradicate, or prevent the introduction of those alien species that threaten ecosystems, habitats, or species;
- The Convention on the Law of the Sea, the sole multinational convention with provisions specific to marine introductions. The U.S. has not signed this agreement.
- The United Nations Conference on Environment and Development (UNCED 1992) (a/k/a “Agenda 21”) “Protection of the Oceans, All Kinds of Seas, Including Enclosed and Semi-enclosed Seas, and Coastal Areas and The Protection, Rational Use and Development of Their Living Resources.”

Furthermore, there are a number of bilateral or multilateral treaties that indirectly affect exotic species, including:

- The Convention Concerning the Protection of World Cultural and Natural Heritage (1973);
- The Convention on International Trade in Endangered Species (1975);
- The Convention on Wetlands of International Importance (1985) (especially involved with waterfowl habitat);
- The Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere (1942).

Appendix E

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