State of Washington

Department of Fish and Wildlife

2007-09 Tunicate Management Plan

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February 2008

Citation:

Pleus et al, 2008

Pleus, A., L. LeClair, J. Schultz, and G. Lambert. 2008. 2007-09 Tunicate Management Plan. Washington State Department of Fish and Wildlife. Aquatic Invasive Species Unit. In coordination with the Tunicate Response Advisory Committee. February.

Cover photo by Allen Pleus - Larry LeClair holding *Didemnum vexillum* encrusted feather duster worm casings from Docton Park Marina eradication action.

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1. INTRODUCTION

The Washington Department of Fish & Wildlife (WDFW) is charged by the state legislature to prevent the introduction or spread of prohibited and unlisted aquatic animal or plant species[1]. This effort supports priority WDFW fish and wildlife, public, funding, competence and science goals (Appendix A). The WDFW Aquatic Nuisance Species (ANS) Unit is tasked with implementation of these regulations and other legislative directives.

The Tunicate Management Plan (TMP) has been developed in response to a widespread agreement among the ad hoc Tunicate Response Advisory Committee (TRAC) that invasive non-native tunicates pose a substantial threat to Washington's environmental, economic, and social health. Based on this recognition, the governor authorized $250,000 in emergency and supplemental funding for 2006 and 2007. Funding for the 2007-09 biennium, for which this TMP is directed, comes from the governor's budget of $500,000 to the Puget Sound Partnership. WDFW has contracted $300,000 of this funding to lead state management efforts in assessing the ongoing risks and implementing strategies for controlling or eradicating already established populations.

TRAC is was originally established by the Puget Sound Action Team and is made up of representatives from state and federal agencies, tribal governments, environmental groups, and affected industry stakeholders (Appendix B). The TMP is built on an adaptive management structure and a collaborative approach to addressing invasive species. The TMP is one of many WDFW management plans developed, or in development, by the ANS Unit as part of its overall strategic plan (Appendix C). The basis of all ANS management plans is six unit goals including:

1) Prevent the introduction of new ANS;
2) Control, contain, or eradicate established ANS populations;
3) Predict and detect new or recurring ANS;
4) Coordinate / collaborate in state, regional, national, and international ANS processes;
5) Promote public education and volunteer opportunities; and
6) Promote biodiversity and restoration.

The TMP is structured with this chapter describing the problem being faced and the current status of invasive tunicates in state waters. The second chapter provides the best available science regarding the target species and tools for preventing introductions and managing known populations. The third chapter lays out the 2007-09 priority objectives and tasks under each unit sub-goal. The rest of the chapters provide information on the department's management infrastructure. The TMP is considered an adaptive document where knowledge gained will be incorporated back into the plan and utilized as best available science and management tools. A new TMP is produced biennially unless new information requires earlier revisions.

[1] RCW 77.12.020

1.1. Problem Definition

The problem of non-native tunicates can be defined in three parts including invasive concern, invasive pathways, and affected state agencies and stakeholders. The combination of these parts provides a comprehensive overview of why WDFW has developed this management plan.

1.1.1 Invasive Concern

There are seven non-native tunicates currently reported as established to some degree in state waters (Table 1). Three of these are of primary invasive concern to WDFW resource managers and local stakeholders and are the focus of this management plan. The regulatory definition of invasive[2] is a plant species or a non-native animal species that either: (a) causes or may cause displacement of, or otherwise threatens, native species in their natural communities; (b) threatens or may threaten natural resources or their use in the state; (c) causes or may cause economic damage to commercial or recreational activities that are dependent upon state waters; or (d) threatens or harms human health. The remaining four are of secondary invasive concern as they have not demonstrated a high invasive threat, but are being monitored within the context of the management plan.

Table 1. List of seven non-native tunicate species considered invasive (priority) or potentially invasive (secondary) in Washington State waters.

Scientific Name	Common Name	Invasive Level
Styela clava	Club tunicate	Priority
Ciona savignyi	Transparent tunicate	Priority
Didemnum vexillum	Colonial tunicate	Priority
Botrylloides violaceus	Chain tunicate	Secondary
Botryllus schlosseri	Golden star tunicate	Secondary
Molgula manhattensis	Sea grape tunicate	Secondary
Ciona intestinalis	Vase tunicate	Secondary

Risk to Native Species and Natural Communities

Tunicates are evolutionarily advanced invertebrate marine animal organisms. The species listed above are documented prolific spawners capable of rapid territorial expansions when introduced to regions outside their native range. Once established, these tunicates can displace most native organisms by out-competing them for food and space, and potentially by consuming the spawn or larvae of other marine species. The presence of non-native tunicates can lead to profound disruptions of naturally functioning ecosystems by altering species interactions, nutrient cycling, and energy flow (Carlton 2001). Disruptions to the natural biological and physical processes of marine communities often leads to decreased biological diversity on local scales and increased ecosystem homogenization over much larger geographic scales (Ruesink 1998). Marine resource management strategies in Washington rely primarily on natural production to maintain and restore populations. Natural production of native species is heavily dependent on the biodiversity afforded through the structure, function, and integrity of undisturbed ecological systems.

[2] RCW 77.08.010(49)

Risk to Natural Resources

Based on our review of the data, we assume that specific state natural marine resources of highest concern include: Marine Protected Areas (MPAs); salmonids; geoduck and other shellfish and crustacean wildstock; and rockfish.

In Puget Sound, a network of MPAs has been established with the primary objective of providing localized protection of biological diversity, critical habitat, and to enable the process of ecological succession. The effectiveness of the state's MPAs as valuable conservation and management tools are threatened by invasive tunicates disrupting the natural balance of those marine communities. MPAs are used worldwide for conserving natural and cultural marine resources. These areas provide refuge for species population segments, non-consumptive recreational opportunities, baseline information sources from unexploited populations, and presumed biological replenishment to nearby non-protected areas.

Salmonids are part of an actively managed billion-dollar commercial and recreational fishing industry. Many stocks are threatened and endangered. Large populations of invasive tunicates would indirectly affect salmonids through disruption of the food chain at both the planktonic and food fish levels, and the removal of nearshore habitat that provides protection from predators. A reduction of food at the planktonic scale threatens both filter-feeder food fish and juvenile salmonid fish. Reduced food fish will in turn threaten adult salmonid fish populations

Geoduck (*Panopea abrupta*), sea urchins (*Stronglyocentrotus droebachiensis* and *S. franciscanus*), sea cucumbers (*Parastichopus californicus*), and Dungeness crabs are actively managed sub-tidal shellfish and crustacean resources that form the basis of a multimillion-dollar commercial and recreational industry in Puget Sound, the San Juan Islands, and the Strait of Juan de Fuca. Geoduck and other in-faunal bivalve clams are vulnerable to smothering caused by the benthic carpeting effect of large colonies of invasive tunicates, particularly *C. savignyi* and *Didemnum vexillum*. Sea urchins, sea cucumbers and Dungeness crabs are benthic grazers that feed primarily on algae and detritus on both hard and soft substrate.

Rockfish are actively managed game fish with populations on the decline in Puget Sound. These fish are threatened from invasive tunicates by substrate over-dominance that reduces the amount of food available to these and other benthic feeding animals and limits available substrate for egg-laying invertebrates and demersal fishes.

Risk to Commercial and Recreational Resources

Washington is the top producer of farmed clams, oysters and mussels in the U.S. and many consider its shellfish production to be the most technologically advanced in the world. Invasive tunicates have severely impacted shellfish aquaculture facilities in other parts of the world by smothering shell stock and overburdening harvest equipment, often resulting in devastating financial losses to the industry (LeBlanc et al. 2007; Lambert and Lambert 2003; Lambert 2001). Given these impacts to aquaculture enterprises elsewhere in the world, Washington's aquaculture industry is considered highly vulnerable to the effects of invasive tunicates (LeBlanc et al. 2007, Bullard et al. 2007a, Forrest 2007).

The unique geographic advantages Puget Sound affords to the maritime trades industry also makes it particularly susceptible to introductions of non-native marine plants and animals from ballast water and hull-fouling pathways. Dense infestations of invasive tunicates on docks, watercraft hulls, and other floating structures can add weight and surface area that may result in increased susceptibility to storm and water damage, and mitigation efforts can lead to increased maintenance and operation costs. The state's natural advantages are derived from its 12 marine cargo terminals and internationally known deep draft ports of Seattle and Tacoma. The Ports of Seattle and Tacoma are world-class facilities that move a combined cargo volume ranking them the second largest container load center in the Western Hemisphere and the eleventh largest in the world. These Puget Sound ports connect Washington and the interior and eastern United States markets to Asian markets. The region also houses dozens of public and private marina and boatyard facilities.

Aquatic shorelines, both public and private, form a cornerstone of Washington's cultural, social, and economic identity. Countless thousands are drawn to the region's marine environment and the aesthetic and recreational opportunities it affords. Eco-tourism is a burgeoning industry in Washington and is heavily dependant on the presence of undisturbed native habitat and wildlife viewing opportunities. Fouling of nearshore marine habitat by non-native tunicates may result in decreased recreational opportunities by hampering access to tidelands, decreasing wildlife and habitat viewer enjoyment, and reducing recreational shellfish harvest opportunities.

Risk to Human Health

There are no known human health concerns regarding invasive tunicates.

1.1.2 Discovery & Introduction Pathways

The primary pathway for introduction from outside our state waters is believed to be hull fouling from trans-oceanic vessels and ballast water discharge from coastal vessel traffic. The primary pathways for spread within state waters are believed to be hull fouling on recreational and commercial watercraft and the movement of contaminated aquaculture products or growing equipment.

The club tunicate *Styela clava*, the transparent tunicate *Ciona savignyi*, and the colonial tunicate *Didemnum vexillum.* (Figure 1) were each first discovered in Washington in 1998 (*C. savignyi* and *S. clava* in Cohen et al. 1998; *D. sp.* in Lambert 2006). *Ciona savignyi* is native to the northeast Asian Pacific coast and has spread throughout the north Pacific (Cohen et al. 1998). It is believed to have reached Puget Sound either as adults attached to ships arriving from the northeast Asian ports, and potentially as larvae discharged with ballast water into Puget Sound (Cohen et al. 1998). *Styela clava* is also native to northeast Asia and is now known to occur in temperate waters throughout the world. Researchers suspect that it was transported to Puget Sound on the hulls of recreational watercraft arriving from Canada (Puget Sound Action Team 2007; Lambert 2003). *Didemnum vexillum*. is distributed worldwide; however, the taxonomic status of *D. vexillum*. found in Washington waters is not clear, thus its origin and relationship to *D. vexillum.* found elsewhere in the world remains uncertain (Bullard et al. 2007a). It is believed that the *D. vexillum.* found in Washington is probably native to Japan and was likely introduced

into state waters along with imported oyster seed in (G. Lambert, personal communication). *Didemnum vexillum.* has carpeted expansive areas of the Georges Bank in recent years and has caused considerable concern among fisheries managers over potential impacts to groundfish and shellfish stocks in that region (Valentine et al. 2007a).

Figure 1. Three non-native tunicates of primary concern in Washington State showing typical growth habits in Puget Sound. Photos by Janna Nichols (*S. clava* and *C. savignyi*) and Rhoda Green (*D. sp.*).

The remaining four non-native species (*Botrylloides violaceus, Botryllus schlosseri, Molgula manhattensis*, and *Ciona intestinalis*) are of secondary invasive concern (Figure 2). *Botrylloides violaceus* and *B. schlosseri* (star tunicates) have been established in Washington for more than 40 years and their occurrence is widespread throughout Puget Sound (Lambert 2005a; Lambert 2005b). *Molgula manhattensis* (sea grape) was first found in Washington in Oakland Bay near the southern end of Puget Sound in 1998 (Cohen et al. 1998) and was later found in 2000 in Willapa Bay on the outer coast (Cohen et al. 2001). It has not since been discovered anywhere else in Washington. Two individual *C. intestinalis* have been found in Puget Sound (Sinclair Inlet) - one each in 2000 and 2006 (Lambert 2006); however, to date, no additional animals have been seen.

None of these four tunicate species are perceived as posing an imminent threat to native species, the aquaculture industries, or the wildstock shellfish harvest industries at this time. They have not shown tendencies to over-dominate substrates when present and their occurrence is either very rare or, when pervasive, their presence at any single location appears to be ephemeral. Nevertheless, some of these species have caused significant environmental and economic damage elsewhere. For instance, a rapid infestation of *C. intestinalis* in Marlborough Sound, New Zealand, is estimated to have cost that region's shellfish industry ten million dollars in lost production (Forrest 2007), and both *C. intestinalis* and *B. schlosseri* have had detrimental impacts on aquaculture facilities in Nova Scotia (Cayer 1999).

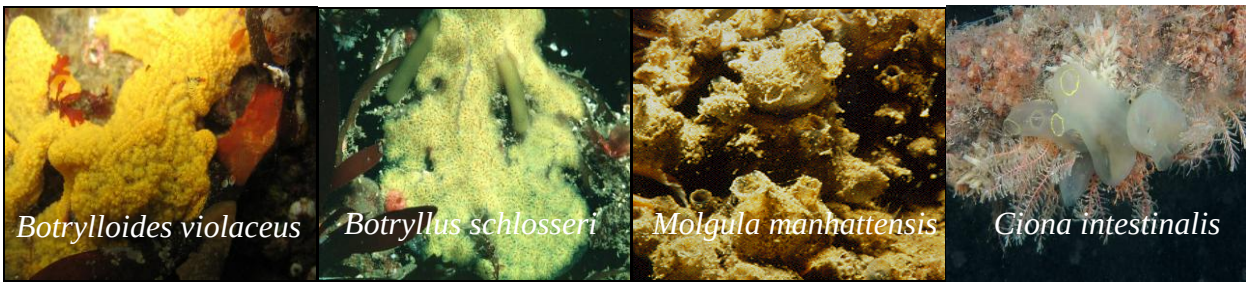

Figure 2. Four non-native tunicates of secondary invasive concern in Washington State showing typical growth habits in Puget Sound. Photos by J. Nichols (*B. violaceus*), B. Picton (*B. schlosseri*), M. de Kluijver (*M. manhattensis*), and K. Hiscock (*C. intestinalis*).

1.1.3. Affected State Agencies and Stakeholders

The following are Washington State agency roles in this response.

Washington Department of Fish and Wildlife responds to, controls and attempts to eradicate non-native animals. Historically, WDFW has not had sufficient resources to effectively respond to the presence of non-native marine animals. Initial efforts to control the spread of non-native tunicates relied largely upon public awareness campaigns and the use of volunteer divers to remove tunicates from a small number of sites.

Washington Department of Natural Resources (WDNR) is the state aquatic lands steward, and is charged with ensuring that state trust lands are managed and protected in the best public interest. They must determine that lease opportunities are not adversely affected by pollution or other threats including non-native species and responds to non-native species found on state-managed submerged lands.

Washington Department of Ecology (WDE) may authorize the use of chemicals and biocides in water to kill invasive plants and animals. Last year, the department issued emergency waivers to control the non-native colonial tunicate *D. sp.* at Edmonds Underwater Park.

The Puget Sound Partnership (PSP) coordinates and supports interagency efforts to contain, stop the spread of, and attempt the eradication of non-native animals in the Puget Sound region. These control and eradication efforts are consistent with the priorities of the PSP to protect critical areas that provide important ecological functions, and to restore degraded habitat.

The Aquatic Nuisance Species Committee (ANSC) consists of representatives from WDFW, WDE, WDNR, Washington Department of Agriculture (WSDA), the Washington Department of Health, the Washington State Patrol, the Washington noxious weed control board, and Washington Sea Grant Program. Pursuant to RCW 77.60.130, the committee encourages participation from other stakeholder groups and places special emphasis on preventing the introduction and spread of aquatic nuisance species.

The Tunicate Response Advisory Committee (TRAC) is comprised of federal, state, tribal, industry, academic experts, and citizen stakeholders. It convenes periodically to discuss and formulate non-native tunicate management strategies for Washington State.

The Invasive Species Council (ISC) exists under the Recreation and Conservation Office to provide policy, direction, planning, and coordination for non-native species in Washington. Its membership currently includes representatives from six Washington state entities and two counties.

1.2. Present Status

Limited rapid visual assessment (RVA) non-native species surveys have been conducted in Washington since 1998. The primary objective of these RVA's has been to collect information on the geographic distribution and relative abundance of non-native marine and estuarine aquatic species in general (both plants and animals) and of tunicates specifically, including the three non-native tunicates deemed to pose the greatest threat to the environment and industry (Cohen et al. 1998, Cohen et al. 2001, Lambert 2007, WDFW unpublished data).

In 1998 and 2000, a multi-institutional team of investigators conducted synoptic surveys for non-native aquatic species throughout Puget Sound and adjacent inland marine waters (1998); and regionally focused synoptic surveys in Elliot Bay, Totten and Eld Inlets, and Willapa Bay (2000)(Cohen et al. 1998, 2001). The 1998 survey examined 23 primary sites as well as nine secondary sites, all within the greater Puget Sound region. Non-native tunicates were identified from at least ten of those sites. Non-native tunicates were also reported from an undisclosed number of sites in the appendix to Cohen et al. 1998. The 2000 survey examined 27 sites over three regions and non-native tunicates were found in each region.

In 2003 and 2004 the Olympic Coast National Marine Sanctuary (OCNMS), as part of a geographically broad-scale multi-agency effort to evaluate the presence of non-native aquatic species in and near marine sanctuaries, surveyed sites on the outer coast of the Olympic Peninsula and Padilla Bay in northern Puget Sound. Results from those surveys showed that, coast wide, non-native tunicates comprised more than 50% of the species richness for their member taxon and nearly 50% within the OCNMS (deRivera et al. 2005).

In fall of 2005, as part of an ongoing effort to assess Washington's geoduck stocks, WDFW biologists conducted geoduck surveys in southern Hood Canal near the mouth of the Tahuya River and discovered several large patches of *C. savignyi.* Concurrently, WDFW fish biologists conducting routine fish stock assessment surveys nearby also found C. savignyi to be abundant on both artificial substrate (tire reef) and on natural sand and cobble substrate. Follow-up reconnaissance dives by WDFW biologists in the fall of 2006 noted the continued presence of *C. savignyi* at the same locations; however, their abundance had much diminished since the 2005 observations. In the spring of 2007, additional dives were conducted in the region and very few individuals were found. During the fall of 2007, surveys were conducted along most of the same geoduck transects from which *C. savignyi* were reported in 2005 and no *C. savignyi* were seen. This region had previously been surveyed for geoduck in 1995 and the presence of *C. savignyi* was not noted at that time (WDFW, unpublished data). Geoduck biologists are concerned with the potential impacts large populations of non-native tunicates may have on Washington's lucrative geoduck industry (Sizemore and Blewett, 2006).

In spring of 2006, a private consultant under contract to WDFW (contract #06-1197) conducted a survey of 41 sites throughout greater Puget Sound, including most of the region's major marinas and shellfish aquaculture facilities, to determine the distribution of *S. clava, C. savignyi*, and *D.* sp. (Lambert 2006). In 2005, subsequent to the first confirmed sighting in 1998 at Blaine and Semiahmoo marinas, *S. clava* was found and determined to be abundant at Pleasant Harbor (Erin

Grey, University of Chicago, personal communication). Results from the 2006 survey suggest that it has since remained confined to those three locations and is not showing signs of rapid territorial expansion. The survey results do, however, suggest a trend toward continued proliferation and broader geographic coverage for *C. savignyi* and *D. sp.*

In the summer of 2007, a geographically broad-ranged RVA of 24 Washington marinas and five non-marina sites in Puget Sound and adjacent marine waters was conducted by WDFW. Results from these surveys confirmed the continued presence of *S. clava* at Blaine, Semiahmoo, and Pleasant Harbor marinas. Additionally, *C. savignyi* was observed at two Puget Sound marinas – Des Moines and Elliot Bay. *Didemnum vexillum.* was not observed at any of the sites surveyed (WDFW unpublished data).

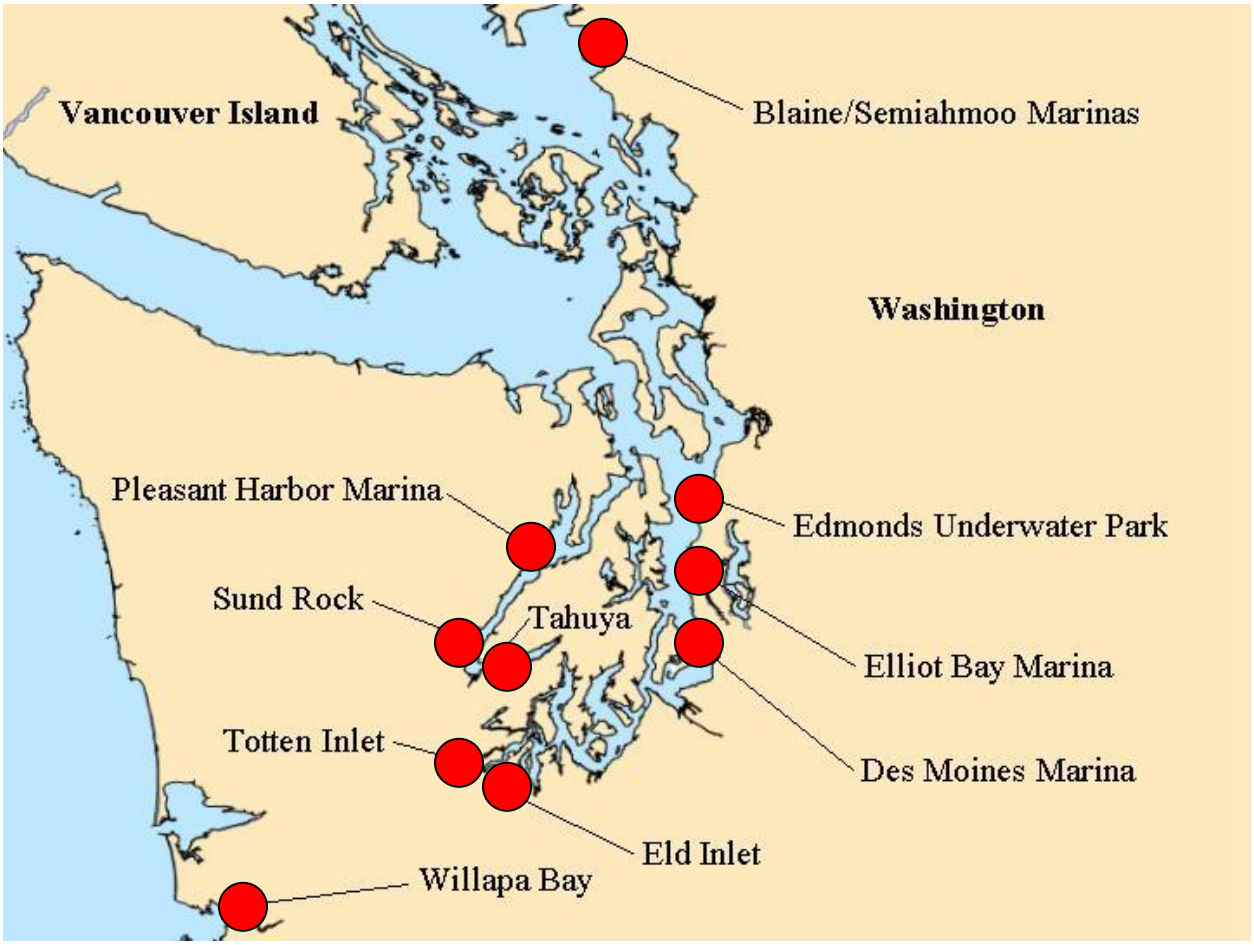

Figure 3. Map of western Washington and locations of documented non-native tunicate sightings.

Numerous accounts, both confirmed and unconfirmed, from recreational divers suggest a growing presence of non-native tunicates throughout Washington's inland marine waters. There has been some success within the recreational dive community to organize volunteer efforts to remove non-native tunicates from some of the most popular dive sites. For instance, in fall of 2006, members of the Washington SCUBA Alliance and the Reef Environmental Education

Foundation organized an effort to remove most *C. savignyi* from Sund Rock, a popular Hood Canal dive site; and in 2004, recreational divers under the guidance of Edmunds Underwater Park officials, removed or destroyed all known patches of *D. sp.* from the park. To date, no further infestations of non-native tunicates have been noted from either of those sites, which suggests that highly localized control efforts may be prove effective.

2. TUNICATE SCIENCE & MANAGEMENT TOOLS

The WDFW Tunicate Management Plan is based on the best available biological science and management tools available worldwide. The plan will incorporate new knowledge as it becomes available and collaborate with regional, national, and international scientists and management agencies to fill critical gaps in knowledge. As this knowledge increases, it will also be used to revise or refine the risks invasive tunicates pose to Washington State.

2.1. Overview of Tunicate Life History, Biology, and Ecology

All tunicates belong to the phylum Chordata. The tunicates of present invasive concern are members of the subphylum Urochordata (or Tunicata) and are also known as sea squirts. The term "tunicate" is in routine use among resource agencies and the local media and unless otherwise noted, tunicate as used in this document, refers only to those members of the Urochordata subphylum. The term is derived from the leathery or fibrous outer coating, comprised primarily of cellulose that forms a protective tunic around the animal's internal organs. Cellulose is a substance frequently found in the cell walls of plants but is rarely found in animals.

In total, there are approximately 3000 species of tunicates worldwide (Brusca and Brusca 2003) including approximately 60 that are native to Washington (Kozloff 1987). They are not known to occur in freshwater and are widely distributed throughout the marine environment. As adults, non-pelagic tunicates are sessile filter feeders (Petersen 2007) that are often confused with sea sponges. Sea sponges are evolutionarily primitive; they lack muscles, nerves, and organs, and unlike tunicates, show no signs of movement when disturbed. Although adult tunicates share little in common with most other chordates, larval tunicates do feature many of the same structural characteristics found during the early life history phases of other chordates. Tunicates are most vulnerable to predation during the larval phase or just after settlement and have few known predators as adults (Osman and Whitlatch 2004). Many tunicates produce noxious chemical compounds that deter predation on older animals. Detailed species accounts for the seven non-native tunicates known to occur in Washington are listed in Appendix D (a-g).

The larvae of most tunicates resemble a tadpole and are able to swim by means of a tail. They have a primitive spinal chord known as a notochord and a well-developed nervous system. Although they have a rudimentary stomach, larvae are not known to feed. Most larvae are photopositive when first hatched, then become photonegative just prior to settlement. As the larvae mature, they settle and metamorphose into sedentary adults. The larvae of non-native tunicates found in Washington tend to settle on hard substrates in shaded locations where wave

action is limited. They are not known to recruit to high-energy environments such as those that occur along the outer Washington coast or the highly exposed shorelines of Washington's inland marine waters. Generally, most tunicates are found in shallow waters, but some are known to occur at great depths. Tunicates are easily killed by desiccation and thus are rarely found in the intertidal zones. Although most tunicates are capable of surviving a wide range of temperatures, they have little tolerance for low salinities. They prefer salinities greater than 25 parts per thousand (ppt) and there are no known species capable of surviving prolonged exposures to salinities of less than 20 ppt.

During metamorphosis the notochord and tail is lost, as is the ability to move, and much of the nervous system degenerates. One theory of vertebrate origin proposes that an animal larval form, such as that of the tunicate, developed the ability to reproduce, whereby some of the anatomical features of the early life history phase such as the notochord were conserved and evolved into modern vertebrate structures, a phenomenon known as paedomorphosis (Garstang 1894, Berrill 1955, Lacalli and West 1993, Lacalli 1995).

The adult body plan is simple, consisting of essentially a tunic-covered sack with incurrent and excurrent siphons through which water enters and exits (Figure 3). The water is propelled by the directional movement of tiny cilia that circulate water and food through the body cavity. Some species of tunicates are known to circulate as much as 200 liters of water in a single day. Food particles are filtered from the water by adherence to a mucous sheet that is produced by a structure known as the endostyle. The food-laden mucous is periodically retracted into the stomach whereby the food is digested and waste is evacuated, via an intestine, through the excurrent siphon.

Reproduction may be either asexual through budding, or sexual. In the latter case, the tunicate is hermaphroditic, possessing both male and female reproductive organs and is usually self-sterile. Most non-native tunicates in Washington are believed to have a protracted spawning season that may last from early spring to late fall (e.g. *S. clava*) (Lambert 2006).

Washington's non-native tunicates consist of two generalized body types – colonial and solitary. Colonial tunicates may be further subdivided into social tunicates, which are colonies of individual animals connected by a common basal stolon; or compound tunicates, which are colonies of deeply connected animals that share a common tunic and excurrent opening (e.g. *B. violaceus, B. schlosseri, D. sp.*). Colonial tunicates are encrusting or mat-forming and may cover expansive areas of substrate. Some colonial tunicates such as *D. sp*. may exhibit a variety of growth and color morphologies (Cohen 2005, Bullard et al. 2007a). Fertilization and embryonic development takes place inside the adult colony and the embryos may be retained inside the colony for up to a month. The brooding period for *B. schlosseri* is about 1 week and may be up to four weeks or more for *B. violaceus*, and *D. sp*. The larvae, once released, are free-swimming and remain in the plankton for a very short period of time, often only minutes, before settling and undergoing metamorphosis. Once metamorphosis is completed, colonial tunicates proliferate by budding genetically identical zooids that form colonies, which may persist for several years.

Solitary tunicates (e.g. *C. intestinalis, C. savignyi, S. clava* and *M. manhattensis*) occur individually and although they may form dense clumps of individuals, they do not share fused

body structures as is common in colonial types. Solitary tunicates attach to the substrate by means of a small disk at the posterior end of the body. The disk may be attached to the anterior end of the body via a narrow peduncle, giving the animal a goblet shape (e.g. *S. clava*). Tunicates exhibiting this form are often referred to collectively as stalked-tunicates. Solitary tunicates are broadcast spawners, whereby gametes are released into the surrounding water and fertilization and embryonic development takes place in the plankton outside the body. The embryos undergo rapid development and may form free-swimming larvae in less than 24 hours and the larvae remain viable for only one to two days. Thus the potential for long distance dispersal via larval drift is limited. Most species of solitary tunicates do not survive for more than one to two years.

For a detailed summary of tunicate biology and life history see Van Name (1945).

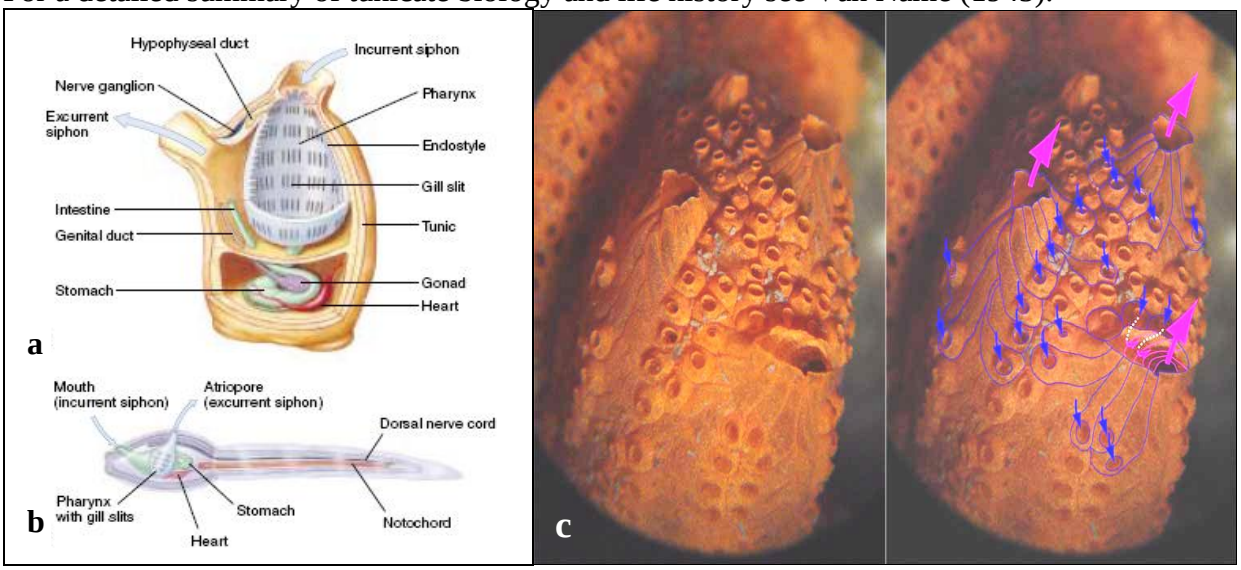

Figure 4. a) Anatomy of a typical solitary adult tunicate. Water enters the body cavity through the incurrent siphon and is filtered for food before being expelled through the excurrent siphon. b) Larval or "tadpole" life history phase showing the notochord (a primitive backbone) and the dorsal nerve chord, both of which degenerate during metamorphosis to the adult life history phase. From Romer, A. S. 1964. *The Vertebrate Body.* W. B. Saunders. Philadelphia. c) A typical mature colonial tunicate showing a shared tunic and multiple incurrent siphons (blue arrows) which are always greater in number than the excurrent siphons (pink arrows).

2.2. Field Management Methods

There are two general categories of tools currently used in the field to control the spread of non-native tunicates - mechanical and chemical. Mechanical tools include active removal or destruction of the animals by hand or through the use of equipment such as high-pressure water jets, scraping or suction devices, desiccation, and asphyxiation/starvation. Chemical tools use toxic substances or induced changes to the physical properties of the water caused by altering temperature, pH, or salinity (Coutts 2002, Coutts 2005, Coutts 2006, Forrest 2007). Another category that has been used to control or eliminate other non-native species, but is not currently considered for non-native tunicate control, is the use of biological tools, including the introduction of living organisms such as parasites, disease agents, and predators (Fisher et al. and references therein 1999).

2.2.1. Mechanical Methods

Washington Department of Fish and Wildlife has thus far tested three mechanical methods for the removal of invasive tunicates from docks and watercraft hulls: removal-by-hand, pressure washing, and asphyxiation/starvation. These and other mechanical methods are described below. Each method has limitations and can be used only in certain instances and on specific types of structures.

Removal-by-hand

Based on local application, the removal-by-hand method appears to work well on floating structures with firm surfaces such as docks, buoys, and watercraft hulls. It is a labor-intensive and time-consuming process and it is not effective at removing all tunicates. It remains, however, one of the few proven effective control methods. The results from one survey showed that divers using the removal-by-hand method effectively reduced the presence of *S. clava* on infested docks from a nominal density of about 3.5 individuals per 24 cm^2 to less than 2 individuals per 24 cm^2 (Erin Grey, University of Chicago, personal communication). Removal-by-hand requires transporting the animals from the water to an off-site terrestrial disposal area in order to eliminate the potential for redistribution through gamete dispersal, reattachment of whole animals, or asexual budding from tissue fragments. This removal method is highly selective and therefore, among the least destructive to neighboring plants and animals. Thus far, large-scale removal-by-hand efforts have focused on solitary tunicates. Mat forming colonial tunicates may respond favorably to this method of control, but the method has not yet been attempted in large-scale applications.

Underwater hydraulic pressure washing

Using pressurized water is highly effective at removing nearly all living organisms from a surface; however, it can only be used on non-deteriorated surfaces made from concrete, metal, or other materials capable of withstanding high-pressure jets without compromise to structural or aesthetic integrity, and when the treatment will not result in the release of pollutants (e.g. creosote) into the water. Pressure washing can be time-consuming and labor intensive.

Containment of the resulting biological debris is difficult and may lead to further spread through gamete dispersal, reattachment of whole animals, or asexual budding from tissue fragments.

Asphyxiation/Starvation

This method uses sheets of plastic or other materials to completely wrap infested structures. The objective is to lethally deprive organisms under the sheet of oxygen and/or food. The State of Hawaii has had limited success using the method to eradicate invasive corals from several marinas. Researchers in New Zealand have experienced some success with localized control of *Didemnum vexillum.* using this technique. Washington Department of Fish and Wildlife tested this method and found that the technique does not appear to work very well for various reasons but primarily because it is difficult to completely seal structures from the outside environment, and wrapping odd shaped structures can be cumbersome and time-consuming.

Desiccation

This method entails removal or elevation of the fouled structure or equipment from the water to allow sufficient time to kill the tunicates through desiccation. It may also be used in combination with hydraulic pressure washing or scraping, during or after desiccation. It is highly effective; however, removing some kinds of structures from the water and locating suitable space for storage during the drying period can be costly and logistically challenging.

Suction

This method uses suction through a hose created by venturi or surface pump to remove objects or sediment from the seabed or underwater structures. It is widely employed in underwater archeology, salvage, and construction. The intake hose may be configured to cover wide swaths of substrate or, by narrowing the intake orifice; suction may be applied to a very limited area, thus enabling the removal of small objects from confined or odd shaped structures. It is currently being used to control non-native algae from Hawaiian reefs. This method has not been attempted for non-native tunicate control in Washington, but warrants testing.

Ultra violet (UV) irradiation

Diver observations made during tunicate surveys at local marinas suggest that some species of non-native tunicates, particularly *C. savignyi*, may preferentially inhabit substrates that receive limited exposure to sunlight. For instance, vessels berthed under covered slips appeared to be more heavily infested with *C. savignyi* than vessels occupying uncovered slips on the same dock. Research conducted by Olah (2001) provides evidence that UV irradiation is harmful to adult *C. savignyi*, but that the early life history phases are resistant to harmful UV effects. Increased UV irradiation, administered either through artificial means, or by manipulating or positioning structures to increase exposure to natural light, may prove helpful for controlling some non-native tunicates but these methods have not yet been developed or tested.

2.2.2. Chemical Application Methods

Substances that are either very caustic or very acidic have proven effective at controlling the spread of tunicates over small areas. These types of chemical treatment are not selective and tend to kill or injure nearly all of the plants and animals within a treatment area. Cellulose-specific digesting or binding agents may form the basis for the development of tunicate specific pesticides. Cellulose or cellulose-like materials comprise much of the tunicate body mass and these materials are not normally found in other animals, thus chemical agents that selectively destroy or compromise cellulitic structures may prove lethal to tunicates while minimizing impact to other nearby animals. This method has not been explored, but warrants investigation. The introduction of any chemicals into the aquatic environment is highly regulated and the appropriate permits must be obtained prior to the use of any chemical treatment. Application methodologies must be developed that maximize exposure to the target biota while minimizing risk and exposure to personnel.

2.2.3. Biological Control Methods

Tunicates have few known predators and most predation occurs during the larval stage or very shortly after settlement and metamorphosis. Biological control of non-native tunicates has not yet been attempted. The use of biological tools to control or eradicate non-desired species has a long and contentious history (Messing and Wright 2006). Success stories are few and there are many well-known case studies that illustrate the potential for disastrous consequences to the environment, industry, and human health following the introduction of foreign predators or pathogens. One method of biological control that has been effective for some species while being relatively environmentally benign is the use of induced sterility through genetic manipulation. This usually involves some form of selective breeding of captive animals and reintroduction into the wild and is not likely to be feasible for tunicates. Biological control for non-native tunicates will only be considered as a last resort when other more practicable means of control have been exhausted and the consequences of continued proliferation of the target species are dire.

2.2.4. Integrated

An integrated approach employs any combination of the above control methods.

2.3. 2007-09 Management Priorities

2.3.1. Styela clava *containment and eradication*

Prevent and eradicate known populations of Styela clava from spreading to other areas in Puget Sound. To date, confirmed infestations of *S. clava* have been identified at three marinas: Pleasant Harbor Marina located near the northern end of Hood Canal (first reported in 2005); and Blaine and Semiahmoo Marinas located near the city of Blaine at the U.S./Canada border (first reported in 1998). *Styela clava* is currently characterized as abundant at Pleasant Harbor and Blaine Marinas. Thus far, the most effective control measure at these locations has been removal

by hand using SCUBA equipped personnel. A joint effort between WDFW and the Skokomish Indian Tribe was mounted in the spring of 2007 to hand remove *S. clava* from the hulls of moored vessels at Pleasant Harbor Marina; and during the summer of 2007, a private dive service was contracted by WDFW to hand remove *S. clava* from moored vessels at Blaine and Semiahmoo Marinas. Given the high potential for rapid range expansion via anthropagenic transport, its potential detrimental impact on local aquaculture facilities, and its apparent confinement to a small number of sites, this species is considered a high control priority. Washington Department of Fish and Wildlife will continue to employ the removal-by-hand method at least annually at each of the aforementioned locations. Removals will take place during those times of the year when it is judged that the tunicates are least reproductively active so as to minimize the potential for gamete dispersal during the removal process.

2.3.2. Seek reclassification by rule for non-native tunicates

All non-native tunicates are classified by statute as "unlisted aquatic animal species" in accordance with subsection 8(d) of RCW 77.12.020. The WDFW Aquatic Nuisance Species (ANS) Unit is charged with preventing the introduction of unlisted aquatic animal species into Washington waters. Currently, regulatory authority is limited to subsection 6 of RCW 77.15.253, which states that:

> "A person is guilty of unlawful release of an unlisted aquatic animal species if he or she releases an unlisted aquatic animal species into state waters without requesting a commission designation under RCW 77.12.020".

Washington Department of Fish and Wildlife is working with TRAC in an attempt to gain support among members to change the classification of all non-native tunicates to "prohibited aquatic animal species", as defined in subsection 8(a) of RCW 77.12.020. This would add to the regulatory tools needed to control the spread of non-native tunicates in Washington by making it unlawful to possess, purchase, or sell non-native tunicates; or to import, propagate, transport, or release non-native tunicates into Washington waters except as provided under RCW 77.15.253. Further, a prohibited classification would enable WDFW to designate, by rule, state waters as "infested" under the provisions of RCW 77.12.875, and thus facilitate the design and implementation of rapid response plans and control measures to contain or eradicate non-native tunicates from designated waters as outlined in RCW 77.12.878.

Some TRAC members remain concerned that strengthening WDFW's regulatory authority over non-native tunicates may result in costly restrictions to the operation of aquacultural and other marine facilities, and they maintain that voluntary compliance will provide an effective means of control. It is the opinion of the ANS Unit that added regulatory discretion would lead to more effective control and they have elected to move forward with reclassifying non-native tunicates as prohibited by statute; however, they will continue to work cooperatively with stakeholders in an effort to minimize the impact of the added authority to industry and to explore mitigation options in the event that substantial impacts occur.

2.3.3. Identify, classify, and demarcate infested waters

Provided the ANS Unit is successful in acquiring a prohibited listing under subsection 8(a) of RCW 77.12.020 for one or more of the three proposed non-native tunicates, specific water bodies may be subsequently identified and demarcated using visually identifiable water (e.g. permanent floating or fixed aids to navigation) and land features. These defined water bodies may then be considered for an "infested state waters" designation under RCW 77.12.875, and rapid response plans implemented as per RCW 77.12.878. Washington Department of Fish and Wildlife will evaluate locations for containment and control potential through an infested listing designation based on one or more of the following: 1) the abundance, distribution, and type of non-native tunicates within a location; 2) the location's insularity from other areas that are not infested, but have the potential for infestation owing to the presence of suitable habitat and environmental conditions; 3) the potential for anthropogenic dispersion away from the location; and 4) the location's proximity to aquaculture growing facilities or wildstock harvest areas.

2.3.4. Acquire necessary permits for the use of chemical control

The deliberate introduction of chemicals into the aquatic environment is regulated under the state-administered National Pollutant Discharge Elimination System (NPDES) program. This includes any introduction that affects the normal chemical composition of the receiving water body including, but not limited to, salinity and temperature. Washington Department of Ecology administers the NPDES program and is currently cooperating with WDFW to create a single broad-spectrum permit that would enable the testing and use of a wide variety of chemical compounds that may prove effective at controlling the spread of non-native tunicates. Pesticide use in Washington is regulated through WSDA. A Washington State Experimental Use Permit (WSEUP) may be obtained through WSDA for the purposes of small-scale testing and localized control, subject to NPDES program approval. Having a broad-spectrum NPDES permit in place will expedite the WSEUP process and enable the use of chemical control measures to be more readily incorporated into rapid response planning when judged necessary.

2.3.5. Restrict introduction pathways

Watercraft hull fouling, short voyage ballast water discharge, and aquaculture product transport, particularly oyster seed, are potential introduction vectors for non-native tunicates in Washington. Successful production of locally produced hatchery seed for the aquaculture industry has eliminated the need to import wildstock seed from the western Pacific and today nearly all oyster seed in the U.S. is of domestic hatchery origin. Domestically derived culture stock, along with more restrictive regulations over live shellfish transport and importation, as well as improved ballast water management practices, have likely reduced or eliminated the threat from overseas introductions. Presently, the greatest threats include proliferation by natural production of already established colonies, and local transport on watercraft hulls and aquaculture growing equipment. Preventive measures will focus on containment of already established colonies through field control, statutory regulation as described in 1.7.2 and 1.7.3, and through stakeholder outreach and education focusing on anthropogenic transport mechanisms.

3. GOALS, OBJECTIVES, & TASKS

The overall goals of this inaugural 2007-09 management plan for non-native tunicates in Washington are to: 1) Prevent the introduction of new ANS; 2) Control, contain, or eradicate established ANS populations; 3) Predict and detect new or recurring ANS; 4) Coordinate / collaborate in state, regional, national, and international ANS processes; 5) Promote public education and volunteer opportunities; and 6) Promote biodiversity and restoration. Goals are presented below with the objectives and tasks required to meet them.

3.1 Prevent Introduction of New ANS

3.1 A Objective: Establish best management practices.

Task 1: Aquaculture BMP

Task 2: Marina BMP

3.1 B Objective: Develop Protocol(s) for Rapid Investigative Response to Newly Reported Non-Native Tunicate Sightings.

Task 1: Establish prioritization criteria for rapid investigative response

Task 2: Itemize protocols, equipment, materials, etc to conduct rapid investigative response.

Task 3: Assemble and maintain necessary logistical support items for rapid mobilization to, and expert in-field verification of, reported infestations.

Task 4: Develop protocols for land/material ownership access and liability.

Task 5: Short term: Develop cooperative agreements with non-Agency consultants to provide rapid expert taxonomic identification of putative non-native tunicates.

Task 6: Create an archive of voucher specimens and ethanol preserved tissue samples for morphologic and molecular identifications

Task 7: Long-term: Develop in-house capability for rapid expert taxonomic identification of putative non-native tunicates including the use of molecular diagnostic techniques.

3.1 C Objective: Develop Strategies for Rapid Field Control Response(s).

Task 1: Develop prioritization criteria for implementation of field control methods.

Task 2: Itemize equipment, materials, permits, etc to conduct rapid response for various scenarios.

Task 3: Build and maintain a field-ready multi-agency rapid response personnel team and logistical support equipment.

Task 4: Develop protocols for land/material ownership access and liability.

Task 5: Long-term: Establish standardized application protocols for select field control methods.

3.1 D Objective: Conduct Periodic Post Rapid field Control Response Assessments to Evaluate Effectiveness of Field Control Methods.

Task 1: Re-implement appropriate field control methods as needed to achieve long-term control.

Task 2: Compile information into adaptive management portion of management plan

3.2 Control, Contain, or Eradicate Established ANS Populations

3.2 A Objective: Develop statewide containment, control, and eradication action plans. **(**Where a large campaign is needed to manage & rapid response not effective.)

Task 1: Establish standard action plan protocols, equipment, materials, etc.

Task 2: Eradication – Dockton Harbor

Task 3: Containment - Vessel Hull- Styela clava Spring removal. Conduct annual contracted removal-by-hand efforts at Pleasant Harbor, Blaine, and Semiahmoo marinas.

Task 4: 2009 Pleasant Harbor eradication. Coordinate with current and future owners of Pleasant Harbor Marina to capitalize on potential *S. clava* control opportunities that may arise through reconstruction of the marina facilities.

3.2 B Objective: Determine 2009-11 budget for this goal by June 08

3.2 C Objective: Create Management Options by Statutory and Regulatory Authority as Needed to Reduce introductions by pathways and to Broaden Field Control Options

Task 1: Review other state/country regulations

Task 2: Investigate reclassification of invasive tunicates and designating areas as infested waters by Washington Administrative Code.

Task 3: Work with Department of Ecology to develop NPDES permit.

3.2 D Objective: Annual Report (June 08 and 09) sections on non-agency management activities

3.2 E Objective: Long-term: Compile, develop and document protocols and standards for identification, control, contain, and eradication methods

3.2 G Objective: Develop and implement adaptive management process to assess successes and learn from mistakes.

3.3 Predict and detect new or recurring ANS threats and risks through research and monitoring

3.3 A Objective: Survey a minimum of 50 high risk sites for presence/absence

3.3 B Objective: Short term: Map all surveyed sites including historic data

Task 1: Compile, assess and document locations into GIS format

3.3 C Objective: Post all information on WDFW web page

3.3 D Objective: Implement a research and monitoring program

Task 1: Establish service contracts for key tunicate specialists/advisory science panel

Task 2: Compile and conduct research on risks to natural, state and private resources

Task 3: Conduct research on introduction pathway risks

Task 4: Develop and implement monitoring plans by pathway

Task 5: Monitor ecological succession at field control sites to determine field control response effectiveness.

3.3 E Objective: Improve Monitoring Capabilities.

Task 1: Establish and conduct periodic surveys of non-native tunicate index sites.

Task 2: Conduct annual Remotely Operated Vehicle surveys of select aquaculture facilities and other identified situations.

Task 3: Improve geographic assessment by creating a central database and GIS mapping system of verified non-native tunicate sightings to identify non-native tunicate management regions and catalogue infestations by region.

3.3 F Objective: Conduct Quantitative Research Directed Toward Evaluating Non-Native Tunicate Field Control Methods and Impacts.

Task 1: Design and conduct experiments to quantify the effectiveness of field control methods and to evaluate relative cost to benefit advantages.

Task 2: Design and implement quantified measures of localized distribution and abundance.

Task 3: Design and conduct controlled experiments to identify limiting factors for settlement and proliferation.

Task 4: Design and conduct controlled experiments to measure impacts to aquaculture and wildstock shellfish industries.

Task 5: Design and conduct experiments to quantify the impact of non-native tunicates to native marine communities on naturally formed substrates.

Task 6: Design and conduct experiments to quantify the impact of field control methods to native marine communities on naturally formed and artificial substrates.

3.3 G Objective: Develop and implement adaptive management process to continually assess the risks of invasive tunicates to state waters.

Task 1: Dispersal mechanisms and models

Task 2: Ecological functions

Task 3: Limiting factors and predicted ranges

Task 4: Reproduction potential and modes

3.4 Coordinate/cooperate in state, regional, national, and international ANS processes

3.4 AObjective: Coordinate/cooperate on state Tunicate Response Advisory Committee

Task 1: Re-establish TRAC under the department by charter

Task 2: Facilitate state agency caucus in coordination of interagency issues

Task 3: Assess/integrate TRAC 2007 Invasive Tunicate Response Plan

Task 4: Recommendations for development of 2009-11 biennial budget

Task 5: Participate as lead on developing and implementing management plan

3.4 B Objective: Coordinate/cooperate on state Invasive Species Council

Task 1: Support WDFW policy lead

Task 2: Participate on Coordination subgroup

3.4 C Objective: Coordinate/cooperate on state ANS Committee

Task 1: Participate as Vice-Chair and members

3.4 D Objective: Coordinate/cooperate with other Pacific coast states.

3.4 E Objective: Coordinate/cooperate with ANS Task Force Western Regional Panel

3.4 F Objective: Coordinate/cooperate with the North American Agreement on Environmental Cooperation (NAAEC) Commission.

3.4 G Objective: Coordinate/cooperate with Canada and other relevant countries.

Task 1: Develop and implement management ties with British Columbia and relevant countries.

Task 2: Develop and implement research and monitoring ties with British Columbia and relevant countries.

3.5 Promote Public Education and Volunteer Opportunities on ANS Issues

3.5 A Objective: Conduct interim education outreach by introduction pathway

3.5 B Objective: Post infested waters

3.5 C Objective: Coordinate/develop broad-scale tunicate education campaign

3.5 D Objective: Coordinate/develop targeted tunicate education campaigns by primary pathways

3.5 E Objective: Coordinate/develop DFW web site as education and resource tool

3.5 F Objective: Coordinate/develop volunteer opportunities

3.5 G Objective: Develop a broad-scale tunicate education campaign through mailings, public postings, WDFW Outreach and Education Program events, and representation at relevant public forums (e.g. marine sporting events, boat shows, fishing derbies, etc.).

3.5 H Objective: Develop directed education efforts toward primary introduction and potential transport pathways (e.g. marine facilities operators, aquaculturists, recreational and commercial watercraft, etc.).

3.5 I Objective: Develop an informational, user friendly, WDFW web site to keep the public informed of potential risks and voluntary control measures.

3.5 J Objective: Develop a reporting mechanism for citizen sightings of non-native tunicates.

3.6 Promote biodiversity and restoration

3.6 A Objective: Compile/conduct research on effects of control, contain, and eradication management approaches on native species biodiversity Natural substrate/benthic communities

3.6 B Objective: Compile, communicate and coordinate with state Biodiversity Council

4. MEET SPECIFIC LEGISLATIVE OR FUNDING DIRECTIVES

4.1 Conduct Phase 2 of 2006 legislative supplemental budget

4.2 Meet directives of governor's 2007-09 PSP tunicate funding

4.3 Meet directives of RCW 77.12.879 regarding recreation boating introduction pathways

5. AUTHORITIES

5.1 Acts

5.2 RCWs & WACs

5.3 Other

6. PERSONNEL, BUDGETS & CONTRACTING

6.1 Personnel required for management plan

6.2 Current and forecasted budget for 2007-09

6.3 Current and forecasted contracting activities for 2007-09

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8. APPENDIX

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APPENDIX A

WDFW Strategic Plan Goals
2007-09 Biennium

FISH AND WILDLIFE GOAL:

ACHIEVE HEALTHY, DIVERSE AND SUSTAINABLE FISH AND WILDLIFE POPULATIONS AND THEIR SUPPORTING HABITATS

PUBLIC GOAL:

ENSURE SUSTAINABLE FISH AND WILDLIFE OPPORTUNITIES FOR SOCIAL AND ECONOMIC BENEFIT

FUNDING GOAL:

ENSURE EFFECTIVE USE OF CURRENT AND FUTURE FINANCIAL RESOURCES IN ORDER TO MEET THE NEEDS OF WASHINGTON STATE'S FISH AND WILDLIFE RESOURCE FOR THE BENEFIT OF THE PUBLIC

COMPETENCE GOAL:

IMPLEMENT PROCESSES THAT PRODUCE SOUND AND PROFESSIONAL DECISIONS, CULTIVATE PUBLIC INVOLVEMENT AND BUILD PUBLIC CONFIDENCE AND AGENCY CREDIBILITY

SCIENCE GOAL:

PROMOTE DEVELOPMENT AND RESPONSIBLE USE OF SOUND AND OBJECTIVE SCIENCE TO INFORM DECISION-MAKING

APPENDIX B: Tunicate Response Advisory Committee Charter

Date: May 6, 2008

Lead Contact	Allen Pleus, WDFW Aquatic Nuisance Species (ANS) Coordinator
Funding	Indirect WDFW Staffing, Volunteer Stakeholder Participation

Oversight	WDFW Director or Director's Designee
Membership	The director may make appointments to the work group from the names provided by the entities identified in this section including: ❑ Department of Ecology ❑ Department of Natural Resources ❑ Department of Agriculture ❑ Department of Parks and Recreation (invited) ❑ Department of Health ❑ Puget Sound Partnership ❑ Washington Sea Grant ❑ Tribes ❑ Federal agencies including PSMFC, USFWS, USEPA, NOAA/NMFS, USCG, USGS, USDA, USFS, NPS and USACE. ❑ Conservation & Environmental Groups ❑ Academic Institutions (invited) ❑ Representatives from industries that may either be affected by the introduction of tunicate species or that may serve as a pathway for their introduction ❑ Coordination Points of Contact This does not require participation by any entity listed or preclude others from participating in and contributing to the TRAC process.
Objectives	The Tunicate Response Advisory Committee (TRAC) is established to advise the department with the implementation of the governor's 2007-09 Puget Sound Recovery Plan and Chapter 77.12.879 RCW including, but not limited to: (1) Work closely with the state Invasive Species Council to secure a coordinated and integrated state response; (2) Develop and implement the Tunicate Species Management Plan; (3) Provide science-based recommendations and technical information; (4) Determine if and when it is necessary or advisable to adjust laws, rules or guidance; (5) Advise the department on developing and implementing legislation and rules; (6) Advise the department on reporting tunicate issues and information (7) Enhance the predictability and stability of the process so that stakeholders can anticipate and prepare for change; and (8) Work with regional and national tunicate regulators to strive for a coordinated and integrated response. The TRAC will also build upon the February 2007 report to the legislature titled, "Washington State's Response to an Invasion of Non-Native Tunicates." Formal recommendations will be provided in writing to the department.

Deliverables	Minimum deliverables include: • Annual reports to Puget Sound Partnership by June 30 with accomplishments and recommendations. • Tunicate Species Management Plan

Process & Reporting	The ANS Coordinator or Assistant Coordinator will communicate department priorities and participate as a non-members to provide facilitation and limited staffing services. The committee will follow the process and reporting set forth below: (i) The committee will be composed of self-nominated lead participants for each identified membership entity. Lead members may designate an alternate. (ii) The committee will meet on at least a quarterly basis or more frequently as needed to address work plan needs. (iii) The committee will adopt procedures, as necessary and practical, by which it will establish guidance and instructions for committee members to provide consistency and transparency in its actions. (iv) Any proposed committee actions must be noted in the next meeting's agenda and sent out to the group at least two weeks prior to the meeting. Written comments from members addressing the action will be incorporated into the meeting discussion if they are unable to attend. (v) The committee will strive for consensus: 1. Where consensus is achieved, the committee will forward its recommendation(s) to the implementing member agency(s) or other cooperating organization(s). 2. Where consensus is not achieved after reasonable discussion, the committee may - table the issue until a later date; forward options, as developed by its supporting members, to the ISC or other appropriate forum for consideration; or drop the issue. 3. Members agree to work in good faith to resolve conflicts through (1) and (2) above before seeking outside resolution. (vi) Technical work groups may be formed by charter to develop draft deliverables or recommendations for consideration by the whole committee. (vii) Implementation of all actions developed by the committee shall be through the department or other cooperating organizations as directed by the department. (viii) Members will participate without compensation or per diem unless otherwise allowed by consensus.

End Date	June 30, 2009 with options for renewal.

APPENDIX C

WDFW ANS Unit
Strategic Plan 2007-2009
For
Washington State

4. Management Infrastructure
- 4.1. Authorities
- 4.2. Budget & Contracting
- 4.3. Personnel
  - 4.3.1. Coordinator
  - 4.3.2. Assistant Coordinator
  - 4.3.3. Biologist(s)
  - 4.3.4. Ballast Water Inspector(s)
  - 4.3.5. Database Analyst
  - 4.3.6. Enforcement Officer(s)
  - 4.3.7. Project Technician(s)
  - 4.3.8. Office Staff
  - 4.3.9. Interdepartmental Services
  - 4.3.10. Projected Personnel Needs
- 4.4. Equipment

5. ANS Coordination

5.1. Local/Regional
- 5.1.1. Puget Sound Partnership
- 5.1.2. Tribal Consortiums and Governments
- 5.1.3. Local Governments
- 5.1.4. Volunteer Organizations

5.2. **Statewide**
- 5.2.1. Invasive Species Council
- 5.2.2. Aquatic Nuisance Species Committee
- 5.2.3. Ballast Water Work Group
- 5.2.4. Tunicate Response Advisory Committee
- 5.2.5. Other Groups and Committees

5.3. National
- 5.3.1. ANSTF Western Regional Panel
- 5.3.2. 100th Meridian
- 5.3.3. Western Governor's Association
- 5.3.4. General West Coast Coordination

5.4. International
- 5.4.1. Georgia Basin/Puget Sound Task Force

6. Appendix
- 6.1. Glossary
- 6.2. RCW Authorities
- 6.3. WAC Authorities
- 6.4. 2007-09 Work Plan
- 6.5. Standard reporting elements and formatting conventions

APPENDIX D

Species Accounts

a. *Styela Clava* (Herdman, 1881)

Taxonomy
Phylum Chordata, Subphylum Urochordata (Tunicata), Class Ascidiacea, Order Stolidobranchia, Family Styelidae.

Growth Habit
Solitary. Adults may reach up to 16 cm in length overall. They are covered by a leathery brown-ridged tunic with tubercles around the incurrent and excurrent siphons. The posterior attachment point is connected to the main body by a slender peduncle.

Life history, feeding and predation, physiology including limiting factors of viability
For a recent summary see Clarke and Therriault (2006). *Styela clava* is a free-spawning hermaphrodite with a life span of from 2-3 years. It may reach sexual maturity in 2-3 months but maximum size may be attained in 5-6 months during the warmest times of the year. In southern California *S. clava* reproduces year-round but in the Pacific Northwest spawning occurs from about May or June to the end of October. In Prince Edward Island, Canada, it has been determined that spawning occurs only at or above 15^{o}C. A lower temperature limit to spawning has not been determined for Pacific Northwest populations. Embryos develop in less than 24 hours into non-feeding, swimming larvae with a functional larval viability of 1-4 days. Invertebrate grazers such as gastropods and flatworms feed on small newly settled juveniles but there are no known predators of adults (Osman and Whitlatch 2004).

Native and non-native range; pathways of local distribution
Native to the Western Pacific. It was described in 1881 from dredged specimens off Kobe, Japan. Its native range probably includes Russia, Japan, Korea, and northern China. *Styela clava* is cultivated and consumed in South Korea, where it is called "mideuduck". It has spread worldwide in temperate waters, including but not limited to the UK, the east and west coasts of Canada and the U.S., New Zealand, and Australia (Davis and Davis 2004, Eno et al. 1997). The most likely vectors of transport include watercraft hulls and sea chests (ballast water intakes). Historically, it may also have been introduced on contaminated imported oysters. In southwest British Columbia it is abundant at numerous marinas, especially on Vancouver and neighboring islands, and fouls oyster long-line culture in small numbers (Lambert 2003; Dr. T. Therriault, Canada Department of Fisheries and Oceans, Nanaimo, B.C., personal communication).

Habitat preferences
In its native range it is found subtidally on hard substrates but worldwide it is most commonly found on artificial surfaces in harbors: floating docks, pilings and associated structures, and boat hulls of moored vessels. In eastern Canada, especially Prince Edward Island, where it appeared in large numbers in 1999, it heavily fouls cultured mussels.

b. *Ciona savignyi* (Herdman, 1882)

Taxonomy
Phylum Chordata, Subphylum Urochordata (Tunicata), Class Ascidiacea, Order Phlebobranchia, Family Cionidae.

Growth Habit
Solitary. May reach up to 12 cm in length. It attaches to firm substrate at the posterior end and is somewhat uniformly tubular from posterior to anterior. The tunic is translucent, with incurrent and excurrent siphon openings located at the anterior end of body in a V-shaped pattern. White, yellow, or red pigment flecks are distributed randomly on the body wall and are visible through the tunic.

Life history, feeding and predation, physiology including limiting factors of viability
Ciona savignyi is a free spawning hermaphrodite with a life span of about one year or less. Embryos hatch in less than 24 hours as swimming non-feeding larvae with a functional larval viability of 24-48 hrs. Sexual maturity may be reached in 6 weeks during the warmest times of the year. In California, *C. savignyi* spawns year-round, but in the Pacific Northwest there is probably a winter non-spawning period during the coldest months. Much of the life history summarized for *C. intestinalis* below, and in Carver et al. 2003 and 2006a is applicable to *C. savignyi*.

Native and non-native range; pathways of local distribution
Native to Japan. Introduced on the North American Pacific coast from Washington to southern California. It is not known to be present on the east coasts of Canada or the U.S., or in Europe. *Ciona savignyi* is abundant at some subtidal sites in British Columbia and has spread rapidly in recent years (A. Lamb, Vancouver Public Aquarium, Vancouver, B.C., personal communication); it is not known whether these occurrences represent one or more anthropogenic introductions or whether they are natural range extensions from northeast Asia. There are two old records of *C. savignyi*: one from Alaska 1903 (a single specimen was found in the shallow subtidal), and a single specimen from a floating dock in southern B.C. in 1937 (Hishino and Nishikawa 1985). See Lambert 2003 for other Pacific Northwest sitings. Local spreading is probably via fouling of watercraft hulls and/or sea chests (ballast water intakes). It is not known to foul Washington shellfish aquaculture facilities or products, thus is not likely to have spread by the movement of aquaculture stock or growing equipment. It may have been introduced into Washington from California via hull fouling. DNA sequencing is underway to determine the relationship of local populations to those found elsewhere.

Habitat preferences
Like most tunicates, *C. savignyi* prefers hard substrates including, but not limited to, bedrock and cobble. It is among the first colonizers of cleared surfaces.

c. *Didemnum vexillum.*

Taxonomy
Phylum Chordata, Subphylum Urochordata (Tunicata), Class Ascidiacea, Order Aplousobranchia, Family Didemnidae.

Growth Habit
Colonial. Tan or pale orange encrusting colonies, sometimes extended into long lobes that are easily dislodged. Microscopic calcium carbonate stellate spicules in superficial layer of tunic but not dense. Colony appearance may be confused with encrusting sponges, or orange forms of *Botrylloides violaceus*, but the internal anatomy and microscopic zooids are very different.

Life history, feeding and predation, physiology including limiting factors of viability
Like all colonial tunicates, once the tadpole larva settles it buds asexually to produce a colony of many thousands of individual tiny zooids all of which are genetically identical and embedded in a common tunic. The zooids are tiny, about 2 mm in size. Fertilization is internal, and the embryos develop in the basal part of the tunic for several weeks before being released as swimming tadpoles with a very short motile period of minutes to hours before settling. The zooids are filter feeders preferring very small particles ranging from 1- ~20 µm. Invertebrate grazers may eat significant numbers of newly settled individuals, filter feeders may eat larvae, but there are few predators on adult colonies. Asexual reproduction is also known to occur by fragmentation of pieces of adult colony that drift away, settle, and grow (Bullard et al. 2007b). Large sea stars have been observed on subtidal *Didemnum vexillum*. in southern British Columbia with cleared areas indicating probably predation (See photos on the website listed below). Didemnid species are known to produce noxious biochemicals that deter predation by most invertebrate and fish species (Lambert 2005, under review). Life span is typically one season, with colonies dying back during the winter months (Valentine et al. 2007b); however, colonial tunicates may not completely die back, with parts of the colony reverting to a resting state that regrows in the spring (Berrill 1950), so some colonies may survive for more than one year.

Native range and non-native range; pathways of local distribution
The native origin of *D. vexillum.* is not known but suspected to be Japan; DNA sequencing of samples worldwide is currently being carried out to determine potential originating source(s). Its present range includes northern France, the Netherlands, Ireland, New Zealand, and the northeastern coasts of Canada and the U.S. including ~140 km^2 of the Georges Bank, and from British Columbia to southern California (Bullard et al. 2007a, http://woodshole.er.usgs.gov/project-pages/stellwagen/didemnum/index.htm, Daniel and Therriault 2007). Vectors of transport are not known but importation of contaminated Japanese oysters is a likely possibility. Also, sea chests (ballast water intakes) and watercraft hulls; the latter is most likely an important vector for short-distance spreading between harbors (Wasson et al. 2001, Lambert and Lambert 2003). It is also possible that colony fragments could be transported in ballast water. Fragmentation of colonies caused by dredging for scallops on the Georges Bank, with reattachment of the fragments, has been implicated in the colonization of large areas of the Georges Bank (Bullard et al. 2007a). *Didemnum* vexillum. is a significant fouler of longline oyster culture in B.C., Canada, and large colonies fall off when the oysters are

lifted out of the water (personal communication from various oyster growers). Benthic patches of the tunicate cover hundreds of square meters under and nearby many B.C. oyster farms (see photos on website listed above).

Habitat preferences

Didemnum vexillum. colonies exhibit a wide variety of morphological variants that range from long, ropey or beard-like colonies that commonly hang from hard substrates such as docks, lines, and ship hulls; to low, undulating mats with short surficial appendages that encrust and drape rocky seabeds (pebbles, cobbles, boulders, and rock outcrops) (Bullard et al. 2007b). *Didemnum vexillum*. is a cool-water species, capable of survival from about 1-24^{o}C (Valentine et al. 2007b) and prefers salinity levels above 28 ppt (G. Lambert, Seattle, Washington, personal communication). It is a primary colonizer on cleared surfaces but commonly overgrows other fouling organisms such as solitary tunicates and mussels. On the Georges Bank offshore from New England, it now covers over 140 km^2 of gravel bottom, blanketing some areas by 50-90%, smothering infauna, and preventing bottom feeding fish from finding food.

d. *Botrylloides violaceus* (Oka, 1927)

Taxonomy
Phylum Chordata, Subphylum Urochordata (Tunicata), Class Ascidiacea, Order Stolidobranchia, Family Styelidae.

Growth Habit
Colonial. Colonies are formed of meandering, often irregularly formed oval networks of zooids. Though any one colony is all one color, different colonies may exhibit different color morphs including orange, dark or light purple, tan, yellow, etc. and may be up to 20 cm or more in diameter. It is a conspicuous fouler due to its bright colors, but does not show tendencies to over-dominate substrates when present.

Life history, feeding and predation, physiology including limiting factors of viability
Botrylloides violaceus is a colonial tunicate; thus once the tadpole larva settles it buds asexually to produce a colony of many thousands of individual tiny zooids all of which are genetically identical, all embedded in a common tunic and arranged in meandering systems. Embryos are brooded in the tunic and take 4-5 weeks to mature. Larvae are large for a colonial species: the body is about 1.2 mm in diameter and easily recognizable by the 24-32 lateral ampullae. Mature larvae are released from about May-October depending on water temperature. The larvae typically spend less than 24 hours in the water column before attaching head-down onto a firm surface. Life span of an individual colony is probably only a few months but difficult to ascertain due to the presence of multiple generations in the same colony and the ability of related colonies to fuse (summarized in Carver et al. 2006b). Invertebrate grazers eat many newly settled juveniles (Osman and Whitlatch 2004). See Osman and Whitlatch 2004, Carver et al. 2006b and references contained therein for a number of studies on the life history of this species.

Native range and non-native range; pathways of local distribution
Native to Japan. Introduced worldwide in cool waters of the northern hemisphere, especially harbors, marinas, and many aquaculture sites, including but not limited to Europe, the northeastern coast of the U.S., northeastern Pacific from Alaska to Baja, Mexico, and Russia (Lambert 2003). It has not been confirmed as introduced in the southern hemisphere. Many identifications of non-native botryllids as *B. leachi* outside the U.S. may be *B. violaceus*. The most likely vectors of transport include watercraft hulls, sea chests (ballast water intakes), and importation of contaminated shellfish for aquaculture. Short distance spreading is likely by recreational watercraft (Wasson et al. 2001, Lambert and Lambert 2003).

Habitat preferences
Like most tunicates, it prefers hard substrates. May be a primary colonizer on cleared surfaces but is a significant fouler on solitary tunicates, mussels, tubeworms and other biota on marina floats and other artificial surfaces, and farmed oysters and mussels. Prefers a salinity range of from 28-32 ppt but can tolerate brief exposures to lower and higher salinities. Preferred temperature range is from 8-25 C.

e. *Botryllus schlosseri* (Pallas, 1774)

Taxonomy
Phylum Chordata, Subphylum Urochordata (Tunicata), Class Ascidiacea, Order Stolidobranchia, Family Styelidae.

Growth Habit
Colonial. Zooids are arranged in star-shaped systems with a shared tunic, giving the species the common name "star tunicate". It exhibits many color morphs; however, all zooids within a colony are the same color. Black, white, or orange are the most common colors found in Washington. Most colonies are flat and encrusting, though the orange variety is known to form pendulous lobes in still waters. Individual *B. schlosseri* zooids are usually 2.5-5 mm in length, system clusters range from 5-10 mm in diameter, and colonies are typically 10 cm or less across (Cohen 2005). Each zooid possesses its own incurrent siphon while all zooids within a colony share a single, large common excurrent siphon.

Life history, feeding and predation, physiology including limiting factors of viability
Life history is somewhat similar to *B. violaceus* but life span of individual zooids is shorter, larvae are much smaller, and embryos are brooded in the zooids rather than in the tunic. *Botryllus schlosseri* is a sessile hermaphrodite and reproduction includes a sexual and an asexual component. Sexual reproduction involves the release of male gametes into the water followed by uptake in the incurrent siphons of nearby colonies and internal fertilization of eggs (Phillippi et al. 2004). Asexual reproduction involves a synchronized budding process that occurs on an approximately weekly basis to increase the size of the colony until it becomes large enough to reproduce sexually. Internal gestation and development to a free-swimming "tadpole" larval stage is followed by release to the water column and a short (up to 24-36 hours) planktonic duration that is probably capable of only local (1-10 km) dispersal (Berrill 1950, 1975, Hiscock 2007). Nearby genetically related colonies may fuse with one another when they come into contact, resulting in larger "chimera" (made up of genetically distinct individuals) colonies that may reach sexual maturity more rapidly than smaller non-fused colonies. Sexual maturity in field populations in Monterey, CA was attained in 49 days, corresponding to 7 asexual replication cycles (Chadwick-Furman and Weissman 1995, Salem Sound Coastwatch undated). Reproductive seasonality appears to be variable across the species' distribution range.

Botryllus schlosseri is a suspension feeder and its diet includes suspended phytoplankton, zooplankton and suspended organic matter (Millar 1971, NIMPIS 2002). Invertebrate grazers eat many newly settled juveniles (Osman and Whitlatch 2004), but there are few known predators of adults, though various invertebrate species such as flatworms, crustaceans, and gastropods have been reported to feed on *B. schlosseri* colonies (Cohen 2005).

Harms and Anger (1983) report barnacles and mussels as among the most important space competitors with *B. schlosseri*.

See Carver et al. 2006b and http://www.sms.si.edu/IRLSpec/index.htm for recent biological and distribution overviews.

Native range and non-native range; pathways of local distribution
Native to northern Europe, it is now considered established worldwide in cool waters of both hemispheres. Ruiz et al. (2000) indicate that the first records of *B. schlosseri* on the east coast of

North America date to 1841 in Massachusetts, while the earliest reported occurrence in the Gulf of Mexico appears to be 1921. On the west coast of the U.S., the earliest reports of *B. schlosseri* include reports from San Francisco Bay dating to the mid 1940s, San Diego Bay and Mission Bay dating to the early 1960s, and from a Puget Sound oyster farm in the late 1960s or early 1970s. Broader distribution up and down the Pacific coast of North America from British Columbia to Mexico was documented starting in the mid-1990s (Lambert and Lambert 1998, Cohen 2005). The species has been introduced in other parts of the world as well, and can now be found in Australia (since 1905), Tasmania and New Zealand (since 1928), Japan, and Hong Kong.

The most likely vectors of transport include watercraft hull fouling, sea chests (ballast water intakes), and importation of contaminated shellfish for aquaculture or market. Short distance spreading is likely by recreational watercraft (Wasson et al. 2001, Lambert and Lambert 2003).

Habitat preferences

Prefers hard substrates in protected habitats such as harbors and shallow embayments. Usually overgrows solitary tunicates, bivalves, tubeworms, algae and other fouling biota on marina floats and associated structures, as well as cultured bivalves. Hiscock (2007) indicates *Botryllus schlosseri* is relatively euryhaline, tolerating salinities ranging from 18-40 ppt.

f. *Molgula manhattensis* (De Kay, 1843)

Taxonomy
Phylum Chordata, Subphylum Urochordata (Tunicata), Class Ascidiacea, Order Stolidobranchia, Family Molgulidae.

Growth Habit
Solitary. Globular in shape, the adults may reach 2-4 cm in diameter. The tunic is opaque, usually gray or greenish-blue in color, and covered with very fine hair like fibrils that trap sediment such as sand grains and shell fragments, thus often obscuring the presence and form of the animals. Though not mat-forming, it often occurs in dense clusters. It is an early colonizer of recently cleared habitat and is resistant to the competitive effects of epifaunal organisms (Otsuka and Dauer 1982). In hard clam (*Mercenaria mercenaria*) aquaculture nursery facilities, *M. manhattensis* settling out of the water column often restrict clams from burrowing and feeding properly, eventually killing.

Life history, feeding and predation, physiology including limiting factors of viability
Molgula manhattensis is a free spawning hermaphrodite, the embryos hatch in less than 24 hours as swimming non-feeding short-lived larvae with a functional larval viability of 24-48 hrs. The larvae are gregarious settlers, which results in the establishment of large masses. The life span is probably 1 year or less. Invertebrate grazers eat many newly settled juveniles (Osman and Whitlatch), but there are no known predators of adults. They tolerate and may prefer lower salinities (28-30 ppt) than other non-native tunicates, though they are capable of survival in salinities higher and lower than this level. They tolerant of a wide range of temperatures - from 2-4^{o}C to 28^{o}C. It is able to survive low dissolved oxygen levels, as often occurs in polluted harbors, and thus has the potential for major restructuring of marine communities during and after hypoxic events (Jewett et al. 2005).

Native range and non-native range; pathways of local distribution
The native range includes the northeastern U.S. (Haydar 2007). It has been introduced worldwide in temperate waters including Japan, Europe, Australia, and the west coast of North America from Baja, Mexico to Vancouver Island, Canada.

Habitat preferences
It prefers hard substrates in very protected waters such as harbors and marinas. It is often found attached to bedrock, boulders, cobble, and shells at depths ranging from intertidal to 90 m or more.

g. *Ciona intestinalis* (Linnaeus, 1767)

Taxonomy
Phylum Chordata, Subphylum Urochordata (Tunicata), Class Ascidiacea, Order Phlebobranchia, Family Cionidae.

Growth Habit
Solitary. Appearance is similar to *C. savignyi* but siphons are closer together, the tunic of older individuals is thicker, and a red spot is usually present at the anterior end of the sperm duct (visible through the translucent tunic between the siphons).

Life history, feeding and predation, physiology including limiting factors of viability
Similar to *C. savignyi*. For review see Carver et al. 2006a. Life span may be one year or less in warmer waters but 1-2 years in cold waters. Sexual maturity may be reached in only 6 weeks during summer in warm waters. In southern California, *C. intestinalis* breeds year-round but in the NW there is probably a winter non-breeding period during the coldest months. Free spawning hermaphrodite, embryos hatch in less than 24 hours as swimming non-feeding short-lived larvae, with a functional larval viability of 24-48 hrs. In Nova Scotia rock crabs are known to eat *C. intestinalis* (Carver et al. 2003).

Native range and non-native range; pathways of local distribution
Ciona intestinalis is one of the most widely distributed ascidians in the world (Cohen and Carlton 1995). It is believed to be native to northern Europe but is now found in temperate waters worldwide including the northeastern U.S., eastern Canada, California to Baja, Japan, Australia, New Zealand, South Africa, and South America. There are no confirmed records of occurrence in British Columbia or Alaska. It is a common fouler of artificial structures in harbors, and on cultured bivalves and aquaculture growing equipment. The most likely vectors for transport include hull fouling, sea chests, and importation of contaminated shellfish for aquaculture.

Habitat preferences
Like most tunicates, it prefers hard substrates. It is a primary colonizer on cleared surfaces and a significant fouler of oyster and mussel farms and salmon pens.

APPENDIX E

Relevant Washington State Statutes

RCW 77.12.020

Wildlife to be classified.

(1) The director shall investigate the habits and distribution of the various species of wildlife native to or adaptable to the habitats of the state. The commission shall determine whether a species should be managed by the department and, if so, classify it under this section.

(2) The commission may classify by rule wild animals as game animals and game animals as fur-bearing animals.

(3) The commission may classify by rule wild birds as game birds or predatory birds. All wild birds not otherwise classified are protected wildlife.

(4) In addition to those species listed in RCW 77.08.020, the commission may classify by rule as game fish other species of the class Osteichthyes that are commonly found in fresh water except those classified as food fish by the director.

(5) The director may recommend to the commission that a species of wildlife should not be hunted or fished. The commission may designate species of wildlife as protected.

(6) If the director determines that a species of wildlife is seriously threatened with extinction in the state of Washington, the director may request its designation as an endangered species. The commission may designate an endangered species.

(7) If the director determines that a 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 designate deleterious exotic wildlife.

(8) Upon recommendation by the director, the commission may classify nonnative aquatic animal species according to the following categories:

(a) Prohibited aquatic animal species: These species are considered by the commission to have a high risk of becoming an invasive species and may not be possessed, imported, purchased, sold, propagated, transported, or released into state waters except as provided in RCW 77.15.253;

(b) Regulated aquatic animal species: These species are considered by the commission to have some beneficial use along with a moderate, but manageable risk of becoming an invasive species, and may not be released into state waters, except as provided in RCW 77.15.253. The commission shall classify the following commercial aquaculture species as regulated aquatic animal species, and allow their release into state waters pursuant to rule of the commission: Pacific oyster (Crassostrea gigas), kumamoto oyster (Crassostrea sikamea), European flat oyster (Ostrea edulis), eastern oyster (Crassostrea virginica), manila clam (Tapes philippinarum), blue mussel (Mytilus galloprovincialis), and suminoe oyster (Crassostrea ariankenisis);

(c) Unregulated aquatic animal species: These species are considered by the commission as having some beneficial use along with a low risk of becoming an invasive species, and are not subject to regulation under this title;

(d) Unlisted aquatic animal species: These species are not designated as a prohibited aquatic animal species, regulated aquatic animal species, or unregulated aquatic animal species by the commission, and may not be released into state waters. Upon request, the commission may determine the appropriate category for an unlisted aquatic animal species and classify the species accordingly;

(e) This subsection

(8) does not apply to the transportation or release of nonnative aquatic animal species by ballast water or ballast water discharge.

(9) Upon recommendation by the director, the commission may develop a work plan to eradicate native aquatic species that threaten human health. Priority shall be given to water bodies that the department of health has classified as representing a threat to human health based on the presence of a native aquatic species.

[2002 c 281 § 3; 1994 c 264 § 53; 1987 c 506 § 13; 1980 c 78 § 13; 1969 ex.s. c 18 § 1; 1955 c 36 § 77.12.020. Prior: 1947 c 275 § 12; Rem. Supp. 1947 § 5992-22.]

RCW 77.12.875

Prohibited aquatic animal species — Infested state waters.

(1) The commission may designate by rule state waters as infested if the director determines that these waters contain a prohibited aquatic animal species.

(2) The commission, in consultation with the department of ecology, may designate state waters as infested if it is determined that these waters contain an invasive aquatic plant species.

(3) The department shall work with the aquatic nuisance species committee and its member agencies to create educational materials informing the public of state waters that are infested with invasive species, and advise them of applicable rules and practices designed to reduce the spread of the invasive species infesting the waters.

[2002 c 281 § 5.]

RCW 77.12.878

Infested waters — Rapid response plan.

(1) The director shall create a rapid response plan in cooperation with the aquatic nuisance species committee and its member agencies that describes actions to be taken when a prohibited aquatic animal species is found to be infesting a water body. These actions include eradication or control programs where feasible and containment of infestation where practical through notification, public education, and the enforcement of regulatory programs.

(2) The commission may adopt rules to implement the rapid response plan.

(3) The director, the department of ecology, and the Washington state parks and recreation commission may post signs at water bodies that are infested with aquatic animal species that are classified as prohibited aquatic animal species under RCW 77.12.020 or with invasive species of the plant kingdom. The signs should identify the prohibited plant and animal species present and warn users of the water body of the hazards and penalties for possessing and transporting these species. Educational signs may be placed at uninfested sites.

[2002 c 281 § 6.]

RCW 77.12.879

Aquatic invasive species prevention account — Aquatic invasive species prevention program for recreational and commercial watercraft — Enforcement program — Check stations — Training — Report to the legislature.

(1) The aquatic invasive species prevention account is created in the state treasury. Moneys directed to the account from RCW 88.02.050 must be deposited in the account. Expenditures from the account may only be used as provided in this section. Moneys in the account may be spent only after appropriation.

(2) Funds in the aquatic invasive species prevention account may be appropriated to the department to develop an aquatic invasive species prevention program for recreational and commercial watercraft. Funds must be expended as follows:

(a) To inspect recreational and commercial watercraft;

(b) To educate general law enforcement officers on how to enforce state laws relating to preventing the spread of aquatic invasive species;

(c) To evaluate and survey the risk posed by recreational and commercial watercraft in spreading aquatic invasive species into Washington state waters;

(d) To evaluate the risk posed by float planes in spreading aquatic invasive species into Washington state waters; and

(e) To implement an aquatic invasive species early detection and rapid response plan. The plan must address the treatment and immediate response to the introduction to Washington waters of aquatic invasive species. Agency and public review of the plan must be conducted under chapter 43.21C RCW, the state environmental policy act. If the implementation measures or actions would have a probable significant adverse environmental impact, a detailed statement under chapter 43.21C RCW must be prepared on the plan.

(3) Funds in the aquatic invasive species enforcement account created in RCW 43.43.400 may be appropriated to the department and Washington state patrol to develop an aquatic invasive species enforcement program for recreational and commercial watercraft. The department shall provide training to Washington state patrol employees working at port of entry weigh stations on how to inspect recreational and commercial watercraft for the presence of aquatic invasive species. The department is authorized to require persons transporting recreational and commercial watercraft to stop at check stations. Check stations must be plainly marked by signs, operated by at least one uniformed fish and wildlife officer, and operated in a safe manner. Any person stopped at a check station who possesses a recreational or commercial watercraft that is contaminated with aquatic invasive species is exempt from the criminal penalties found in RCW 77.15.253 and 77.15.290, and forfeiture under RCW 77.15.070, if that person complies with all department directives for the proper decontamination of the watercraft and equipment.

(4) The department shall submit a biennial report to the appropriate legislative committees describing the actions taken to implement this section along with suggestions on how to better fulfill the intent of chapter 464, Laws of 2005. The first report is due December 1, 2007.

[2007 c 350 § 3; 2005 c 464 § 3.]

RCW 77.15.250

Unlawful release of fish, shellfish, or wildlife — Penalty — Unlawful release of deleterious exotic wildlife — Penalty.

(1)

(a) A person is guilty of unlawfully releasing, planting, or placing fish, shellfish, or wildlife if the person knowingly releases, plants, or places live fish, shellfish, wildlife, or aquatic plants within the state, and the fish, shellfish, or wildlife have not been classified as deleterious wildlife. This subsection does not apply to a release of game fish into private waters for which a game fish stocking permit has been obtained, or the planting of fish or shellfish by permit of the commission.

(b) A violation of this subsection is a gross misdemeanor. In addition, the department shall order the person to pay all costs the department incurred in capturing, killing, or controlling the fish, shellfish, aquatic plants, or wildlife released or its progeny. This does not affect the existing authority of the department to bring a separate civil action to recover costs of capturing, killing, controlling the fish, shellfish, aquatic plants, or wildlife released or their progeny, or restoration of habitat necessitated by the unlawful release.

(2)

(a) A person is guilty of unlawful release of deleterious exotic wildlife if the person knowingly releases, plants, or places live fish, shellfish, or wildlife within the state and such fish, shellfish, or wildlife has been classified as deleterious exotic wildlife by rule of the commission.

(b) A violation of this subsection is a class C felony. In addition, the department shall also order the person to pay all costs the department incurred in capturing, killing, or controlling the fish, shellfish, or wildlife released or its progeny. This does not affect the existing authority of the department to bring a separate civil action to recover costs of capturing, killing, controlling the fish, shellfish, or wildlife released or their progeny, or restoration of habitat necessitated by the unlawful release.

[2001 c 253 § 32; 1998 c 190 § 31.]

RCW 77.15.253

Unlawful use of prohibited aquatic animal species — Penalty.

(1) A person is guilty of unlawful use of a prohibited aquatic animal species if he or she possesses, imports, purchases, sells, propagates, transports, or releases a prohibited aquatic animal species within the state, except as provided in this section.

(2) Unless otherwise prohibited by law, a person may:

(a) Transport prohibited aquatic animal species to the department, or to another destination designated by the director, in a manner designated by the director, for purposes of identifying a species or reporting the presence of a species;

(b) Possess a prohibited aquatic animal species if he or she is in the process of removing it from watercraft or equipment in a manner specified by the department;

(c) Release a prohibited aquatic animal species if the species was caught while fishing and it is being immediately returned to the water from which it came; or

(d) Possess, transport, or release a prohibited aquatic animal species as the commission may otherwise prescribe.

(3) Unlawful use of a prohibited aquatic animal species is a gross misdemeanor. A subsequent violation of subsection (1) of this section within five years is a class C felony.

(4) A person is guilty of unlawful release of a regulated aquatic animal species if he or she releases a regulated aquatic animal species into state waters, unless allowed by the commission.

(5) Unlawful release of a regulated aquatic animal species is a gross misdemeanor.

(6) A person is guilty of unlawful release of an unlisted aquatic animal species if he or she releases an unlisted aquatic animal species into state waters without requesting a commission designation under RCW 77.12.020.

(7) Unlawful release of an unlisted aquatic animal species is a gross misdemeanor.

(8) This section does not apply to:

(a) The transportation or release of organisms in ballast water;

(b) A person stopped at an aquatic invasive species check station who possesses a recreational or commercial watercraft that is contaminated with an aquatic invasive species, if that person complies with all department directives for the proper decontamination of the watercraft and equipment; or

(c) A person who has voluntarily submitted a recreational or commercial watercraft for inspection by the department and has received a receipt verifying that the watercraft has not been contaminated since its last use.

[2007 c 350 § 5; 2002 c 281 § 4.]

RCW 77.60.130

Aquatic nuisance species committee.

(1) The aquatic nuisance species committee is created for the purpose of fostering state, federal, tribal, and private cooperation on aquatic nuisance species issues. The mission of the committee is to minimize the unauthorized or accidental introduction of nonnative aquatic species and give special emphasis to preventing the introduction and spread of aquatic nuisance species. The term "aquatic nuisance species" means a nonnative aquatic plant or animal species that threatens the diversity or abundance of native species, the ecological stability of infested waters, or commercial, agricultural, or recreational activities dependent on such waters.

(2) The committee consists of representatives from each of the following state agencies: Department of fish and wildlife, department of ecology, department of agriculture, department of health, department of natural resources, Puget Sound partnership, state patrol, state noxious weed control board, and Washington sea grant program. The committee shall encourage and solicit participation by: Federally recognized tribes of Washington, federal agencies, Washington conservation organizations, environmental groups, and representatives from industries that may either be affected by the introduction of an aquatic nuisance species or that may serve as a pathway for their introduction.

(3) The committee has the following duties:

(a) Periodically revise the state of Washington aquatic nuisance species management plan, originally published in June 1998;

(b) Make recommendations to the legislature on statutory provisions for classifying and regulating aquatic nuisance species;

(c) Recommend to the state noxious weed control board that a plant be classified under the process designated by RCW 17.10.080 as an aquatic noxious weed;

(d) Coordinate education, research, regulatory authorities, monitoring and control programs, and participate in regional and national efforts regarding aquatic nuisance species;

(e) Consult with representatives from industries and other activities that may serve as a pathway for the introduction of aquatic nuisance species to develop practical strategies that will minimize the risk of new introductions; and

(f) Prepare a biennial report to the legislature with the first report due by December 1, 2001, making recommendations for better accomplishing the purposes of this chapter, and listing the accomplishments of this chapter to date.

(4) The committee shall accomplish its duties through the authority and cooperation of its member agencies. Implementation of all plans and programs developed by the committee shall be through the member agencies and other cooperating organizations.

[2007 c 341 § 59; 2000 c 149 § 1.]

WAC 232-12-016

Nonnative aquatic species.

The following provisions apply to nonnative aquatic species except nonnative species in ballast water, which are provided for in chapter 220-77 WAC. The definitions of invasive species, prohibited aquatic animal species, regulated aquatic animal species, unregulated aquatic animal species, unlisted aquatic animal species and aquatic plant species as used in this section are the same as in RCW 77.08.010.

(1) Request for designation of unlisted aquatic animal species prior to release. Unlisted nonnative aquatic animal species must be reviewed and designated for classification by the commission as either regulated aquatic animal species or unregulated aquatic animal species prior to approval for release into state waters. A request for classification of an unlisted nonnative aquatic animal species shall be treated as a petition to amend WAC 220-12-090, and made on the OFM-01 form. Upon receipt of a petition, the department shall initially classify the species as a prohibited species until the review is complete. In addition to the OFM-01 form, a person requesting classification must provide the following information in order to present a complete request for designation for classification:

(a) Common and scientific name, reason for release, source of the animals proposed for release, and number of animals proposed for release.

(b) Native range of the species, assessment of potential positive and negative impacts of the release, citation of available scientific literature on release of the species in other nonnative locales, known potential for displacement of native species, hybridization with or predation upon native species, and disease or parasite transmission.

(c) Estimate of technical and economic feasibility of eradicating or controlling spread of the species once it is introduced into state waters.

(2) Provisions applying to prohibited aquatic animal species.

(a) Zebra mussels: It is unlawful to import live aquatic organisms, including plants, for release into state waters from any state or Canadian province east of the Continental Divide without each importation being accompanied by a zebra mussel-free certificate issued by the department and signed by the supplier of the aquatic organisms. The original receiver in the state of Washington of the shipment of aquatic organisms is required to retain the zebra mussel-free certificate for two years. Secondary receivers, while in possession of live aquatic organisms, are required to retain invoices or other records showing who was the original receiver.

(b) Scientific research or display: The director may authorize, by prior written permit, a person to possess prohibited aquatic animal species for scientific research or display, provided:

(i) Specimens are confined to a secure facility, defined as an enclosure that will prevent the escape or release of prohibited aquatic animal species into a natural watercourse, and specimens are inaccessible to wildlife or other animals that could transport prohibited aquatic animal species.

(ii) Specimens are not transferred to any other facility without written approval by the director or designee.

(iii) All zebra mussels are incinerated or chemically preserved at the conclusion of the project, and the enclosure, holding waters and all equipment are disinfected. All other prohibited aquatic animal species must be killed at the conclusion of the project and either chemically preserved or disposed of in a landfill.

(iv) The permittee provides an annual report to the department, no later than January 31 of the following year, on a form provided by the department, describing the number, size and location of prohibited aquatic animal species enclosures and general nature of the research.

(c) Monitoring and control programs: The director may authorize persons working within the scope and supervision of a department-sponsored monitoring and control program to capture, possess and destroy prohibited aquatic animal species, provided:

(i) The persons have completed a mandatory training program and are certified by the department;

(ii) The persons have a permit authorized by the director or designee in possession;

(iii) All prohibited aquatic animal species are disposed of in accordance with the monitoring and control program; and

(iv) Participants submit a report to the department within thirty days of any monitoring or control activity in accordance with the specifications outlined in the monitoring and control program.
(d) Capture of prohibited species in state waters. Prohibited aquatic animal species that are captured in state waters and not immediately returned to the water from which they were captured must be killed before removing the prohibited aquatic animal species from within the riparian perimeter of the body of water.

(e) It is lawful to possess dead vertebrate prohibited aquatic animal species taken from state waters, and it is lawful to possess chemically preserved nonvertebrate prohibited aquatic animal species from any source. No permit is required for possession under this subsection.

(f) Prohibited aquatic animals held in commercial and personal possession prior to classification. A person who possessed a prohibited aquatic animal species prior to the time the species was classified as prohibited may continue to hold the animal or animals for the life of the animals, provided:

(i) The person must maintain proof of possession prior to the classification.

(ii) The animals may not be transferred to another owner within the state.

(iii) The person must comply with all provisions of this section.

(iv) The animals must be prevented from reproducing, or if prevention is impracticable, the progeny must be destroyed.

(3) Infested waters.

(a) The following bodies of waters are infested with invasive aquatic plants or prohibited aquatic animal species. In these waters:

(i) It is unlawful to use aquatic animals from these waters for bait in the infested waters or any other waters.

(ii) All aquatic vegetation must be removed from lines, nets, motors, and all other equipment when the equipment is removed from the infested waters.

(iii) It is unlawful to transport water from these bodies of water, and bait containers, live wells, and bilges must be emptied before leaving the riparian perimeter of the body of water, except:

(A) Water may be transported in emergencies, such as a fire emergency.

(B) Water may be withdrawn and used under a water appropriation or public waters work permit issued by the department of ecology.

(b) List of infested waters:

Adams County: Herman and Hutchison lakes.

Chelan County: Chelan, Cortez, Domke, Fish, Roses and Wapato lakes.

Clallam County: Sutherland Lake.

Clark County: Battleground, and Lacamas lakes, Klineline Pond, Caterpillar Slough, Columbia River adjacent to Ridgefield National Wildlife Refuge.

Columbia, Franklin and Walla Walla counties: Herbert G. West Lake, Snake River.

Cowlitz County: Kress and Silver lakes, Soho and Willow Grove sloughs.

Ferry County: Twin Lake.

Franklin County: Kahlotus and Sacajawea lakes, Scooteney Reservoir, Snake River.

Grant County: Babcock Ridge, Banks, Billy Clapp, Burke, Caliche, Canal, Corral, Corral Southwest, Moses, Priest Rapids, Quincy, Stan Coffin, Warden, and Windmill lakes, unnamed potholes at Dodson Frenchman and Frenchman Hills Nos. 1 through 4, Evergreen and Potholes reservoirs, Rocky Ford Creek and Winchester Wasteway.

Grays Harbor County: Duck and Failor lakes, Grays Harbor.

Island County: Crockett and Lone lakes.

Jefferson County: Crocker and Leland lakes.

King County: Alice, Angle, Bass, Desire, Fenwick, Geneva, Green, Killarney, Lucerne, Meridian, Nielson (Holm), Otter (Spring), Phantom, Pine, Pipe, Sammamish, Sawyer, Shadow, Shady, Spring, Steel, Twelve, Union, Washington, and Wilderness lakes.

Kitsap County: Buck, Horseshoe, Long, Mission, Square, Tahuya, and Wye lakes.

Kittitas County: Lavendar and Mattoon lakes.

Klickitat County: Celilo, Horsethief, and Spearfish lakes, Columbia River.

Lewis County: Carlisle, Mayfield, Plummer, and Riffe lakes, Swofford Pond, Chehalis and Cowlitz rivers and the Interstate Avenue Slough.

Mason County: Isabella, Island, Limerick, Mason, Spencer, and Trails End (Prickett) lakes.

Okanogan County: Conconully, Green, Osooyoos, Palmer, Pearrygin, and Whitestone lakes, Okanogan River.

Pacific County: Black, Island, Loomis, and O'Neil lakes, Willapa Bay.

Pend Oreille County: Davis, Diamond, Fan, Horseshoe, Mashall, Nile, and Sacheen lakes, Little Spokane and Pend Oreille rivers.

Pierce County: Bay, Clear, Harts, Hidden, Ohop, Rapjohn, Spanaway, Tapps, and Whitman lakes.

San Juan County: Sportsman Lake.

Skagit County: Beaver, Big, Campbell, Clear, Erie, Heart, Mcmurray, and Sixteen lakes.

Skamania County: Coldwater and Drano lakes, Columbia River.

Snohomish County: Goodwin, Meadow, Nina, Roesiger, Shoecraft, Silver, Stevens, and Swartz lakes.

Spokane County: Eloika, Liberty, Long, Newman, and Silver lakes.

Stevens County: Black, Deep, Gillette, Heritage, Loon, McDowell, Sherry, Thomas, and Waitts lakes, Long Lake Reservoir.

Thurston County: Capitol, Hicks, Long, Munn, Scott, and Ski lakes, Black and Chehalis rivers.

Wahkiakum County: Columbia River and Brooks Slough.

Walla Walla County: Snake River.

Whatcom County: Terrell and Whatcom lakes.

Whitman County: Bryan and Lower Granite lakes, Snake River.

Yakima County: Buena, Byron, Dog, and Freeway (Rotary) lakes, unnamed ponds at 12N - 19E - 20, Yakima River.

(4) Aquaculture provisions. It is unlawful to fail to comply with the following provisions regarding aquaculture and waters containing prohibited aquatic animal species or invasive aquatic plant species.

(a) When a natural body of water is designated by rule as infested, ongoing aquaculture operations in that body of water are restricted from transferring product, equipment or associated materials until such time as the operator of the aquaculture operation submits to the department a plan to prevent the spread of invasive aquatic plants and prohibited aquatic animal species, and has received approval from the department of such plan.
(b) Artificial water basins found to be infested with prohibited aquatic animal species are required to have the water sterilized before continuing aquaculture operations, and any private sector cultured products in such waters must be killed before sale or transfer.

(c) By permit from the department, water from bodies of water infested with invasive aquatic plants may be used in artificial water basins for aquaculture, provided that the water is treated to eliminate invasive aquatic plants prior to use.

(5) Violations of this section involving invasive aquatic animal species is punishable under RCW 77.15.253.

(6) Violations of this section involving invasive aquatic plants is punishable under RCW 77.15.290.

[Statutory Authority: RCW 77.12.047. 04-01-096 (Order 03-312), § 232-12-016, filed 12/16/03, effective 1/16/04; 02-19-007 (Order 02-223), § 232-12-016, filed 9/5/02, effective 10/6/02.]

APPENDIX C

FY 2009-2011

PROPOSED BIENNIUM BUDGET

Contract/Project Summary

TITLE:	Invasive Species Tunicate Response
WDFW NUMBER:	07-1571
PERIOD:	07/01/2007 to 06/30/2009
CONTRACTOR:	Puget Sound Partnership
CONTRACTOR CONTACT:	Kevin Anderson (360)725-5452
CONTRACT TYPE:	Receivable
CONTRACT SUB TYPE:	Interagency
STAFF TYPE:	WDFW
PROJECT GROUP:	Aquatic Invasive Species
PROJECT TYPE:	-
NUMBER OF AMENDMENTS:	1
WDFW MANAGER:	Allen Pleus (360)902-2724
CFDA NUMBER:	-
AWARD NUMBER:	-
RFQQ/RFQ/RFP/IFB NUMBER:	-

SUMMARY PROJECT DESCRIPTION:
Manage invasive tunicate species in Puget Sound region including control, contain, eradicate, research and monitor actions.

PROJECT STATEMENT OF WORK:
There are seven species of non-native tunicates currently found in Washington coastal and Puget Sound marine waters. Three of these tunicate species are of high invasive concern including the club tunicate *Styela clava*, the transparent tunicate *Ciona savignyi*, and the colonial tunicate *Didemnum vexillum.* Four other species of moderate invasive concern include *Botrylloides violaceus, Botryllus schlosseri, Molgula manhattensis* and *Ciona intestinalis.* All species, except for *Ciona intestinalis*, are known to have established and continuing populations and meet the biological definition of invasive. However, more information is needed to assess the potential or actual environmental, economic, and human health harm of these species and their pathways of introduction and spread.

Previous management actions and data assessments by WDFW show that the extent of invasive tunicate population distribution is significant with 57 out of 102 sites[3] having from one to four of the seven known species present. Of the 57 sites, 28 have at least one of the three priority invasive tunicate species. The increase in known scale of the infestation has also underscored the need to increase staffing from 1.23 to 4.0 FTE with the addition of a new Tunicate Lead, changing the second biologist/diver from a 0.23 to a 1.0 FTE, and adding a Scientific Technician position.

A new Lead position is necessary to effectively develop and implement the Tunicate Management Plan and manage assigned staff. This has become a full-time duty that cannot be sustained under current staffing levels. The Lead would be the ANS Unit's invasive tunicate

[3] Additional site data available, but not yet entered

point person and would provide overall coordination and management of the other Tunicate unit science staff, contracts, and budget. They would be the department's representative on the TRAC to ensure that the department is in close communication with all stakeholders. Two full time biologist/divers are necessary for safety, efficiency, and workload. A full-time Scientific Technician is also necessary for dive and boat assistance, data recording and entry, and help in managing extensive equipment, supplies, and materials.

Tasks

The 2007-2009 Puget Sound Partnership (PSP) budget specifies that these funds will be used for the four tasks listed below. The Tunicate Response Advisory Committee (TRAC) has also proposed long-term goals and these are identified by PSP task. WDFW will use the funding to make progress towards these tasks and goals through development and implementation of a statewide Tunicate Management Plan.

Task 1. Implement methods to control and eradicate tunicates

a) **Develop and implement a long-term strategy to contain and eradicate tunicates; and**
b) **Implement measures to minimize the spread of invasive tunicates.**

Task 2. Conduct surveys

a) **Identify current locations of other non-native tunicates including Ciona and Didemnum; and**
b) **Implement a long-term strategy for ongoing monitoring of invasive tunicates**

Task 3. Conduct a "Keep Your Hull Clean" outreach campaign for recreational boaters

PSP is intending to take the lead on Task #3 and WDFW would provide advisory and limited implementation support as available.

Task 4. Meet expectations as outlined in the attached PSP Performance Agreement.

Task 5. Remove invasive tunicates during presence/absence surveys where populations are small and do not require additional support or substantive time to accomplish.

Task 6. Conduct rapid response eradication actions where small new infestations are found in critical habitat areas such as Marine Protected Areas.

Deliverables

Three deliverables will be provided to PSP. One is a final tunicate management plan and two are in the form of department annual reports (6/08 and 6/09):

1) 2009-2011 Tunicate Management Plan. A final biennial management plan. Due - January 1, 2009.

2) Tunicate Management Plan Annual Report. Including work completed per PSP Performance Agreement and recommendations for future management operations. Due - June 1, 2008.

3) Tunicate Management Plan Annual Report. Including work completed per PSP Performance Agreement and recommendations for 2009-2011 biennial management operations. Due - June 1, 2009.

Performance Agreement between Puget Sound Partnership and Washington Department of Fish and Wildlife

Background:

1. The reason for a performance agreement – to satisfy:
    a. Contractual requirements of the Puget Sound Partnership.
    b. Making progress towards legislative objectives.
2. Implements or addresses
    a. The Aquatic Nuisance Species (ANS) Management Plan by minimizing ANS introductions; stopping ANS from spreading; and eradicating or controlling ANS to minimize impacts.
    b. Puget Sound Recovery Plan by protecting and preventing loss of habitat; restoring habitat functions and values; protecting ecosystem biodiversity; and building and sustaining capacity for action.
    c. WDFW Tunicate Management Plan

Goal:

The purpose of this performance agreement is to develop and continue implementing a statewide tunicate management plan that incorporates unfinished elements of the 2006-2007 Interagency Invasive Species Rapid Response Plan. Unfinished elements relate to the following long-term goals in the interagency plan:

1. Eradicate known populations of the invasive tunicate *Styela clava*.
2. Identify the current locations of all non-native tunicate species and develop a long-range strategy to contain and eradicate tunicates from these areas.
3. Develop a long-term strategy for ongoing monitoring of non-native tunicates and implement measures to minimize their spread.

Objectives:

The objectives of this agreement are to:

1. Conduct a baseline survey of representative locations in Puget Sound for invasive tunicate presence/absence.
2. Identify the pathways for introduction and spread of invasive tunicates to prevent new introductions.
3. Contain invasive Styela clava in Pleasant and Blaine harbors by annual removal from vessel hulls.
4. Develop a plan and budget for eradicating known populations of invasive tunicates in at least one marina/harbor location.
5. Develop and begin implementation of a long-term monitoring plan.

Expectations:

Puget Sound Partnership (PSP) expects the Department of Fish and Wildlife to:

1. Consult with the state agency Tunicate Response Caucus and the stakeholder Tunicate Response Advisory Committee (TRAC) at key points during the implementation of this agreement.
2. Participate in a mid-project review by PSP of the project's performance and results and make mid-course adjustments, as needed.
3. Involve stakeholders and seek to build strong and effective public/private partnerships to research, monitor, control, contain, and eradicate invasive tunicates.
4. Keep resource agencies, the legislature, and the public apprised of the progress on the project and any unforeseen barriers to progress.

Outcomes and results:

WDFW, in consultation with the state Tunicate Response Caucus and the Tunicate Response Advisory Committee (TRAC), must:

1. Develop a statewide tunicate management plan that includes a priority system for managing invasive tunicates to include eradication objectives, maximizes the use of limited resources, and that identifies long-term strategies.
2. Implement a research and monitoring program for non-native tunicates.
3. Identify potential pathways of introduction and spread, and strategies to implement, or the need for further study. .
4. Survey a minimum of 100 'high risk areas' such as marinas, boat cleaning areas, and shellfish growing areas for the presence or absence of invasive tunicates. Gather and compile historic and new tunicate survey data from outside sources.

5. Map locations of infestations, and make this information available to the legislature, resource agencies, and the public.
6. Post all management plans, management methods, and reports on the WDFW web page for public access.
7. Prepare cost estimates by June 30, 2009 of additional work needed to successfully eradicate invasive tunicates within Puget Sound.

Annual review:

WDFW must prepare annual tunicate management plan reports on progress and performance by June 1, 2008 and 2009, respectively.

By June 1, 2008 and 2009, WDFW should meet with the TRAC to discuss performance, identify what worked and what didn't, and seek advice to improve performance and accomplish results.

WDFW should post annual reports on the agency web page.

Project Budget: Object Detail

Object	Sub Object	Direct	Indirect @ 25.87%	Total Cost
A–Salaries	4.0 FTE	$393,912	$101,905	$495,817
B-Employee Benefits	4.0 FTE	$112,848	$29,194	$142,042
E-Goods and Services	EA-Supplies & Materials	$40,000	$10,348	$50,348
E-Goods and Services	EE-Repair, Alterations, and Maintenance	$8,400	$2,173	$10,573
E-Goods and Services	ER-Other Purchased Services	$100,000	$25,870	$125,870
E-Goods and Services	EZ-Other Goods & Services	$2,500	$647	$3,147
G-Travel		$16,000	$4,139	$20,139

Object Detail Total: $847,936