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EXECUTIVE SUMMARY

Chapter 255, Laws of 1995 designated the Washington State Department of Agriculture (WSDA) as the lead state agency for the eradication of *Spartina* and the control of purple loosestrife. The 1999 Legislature appropriated $818,000 from the Aquatic Lands Enhancement Account (ALEA) to WSDA for these activities in the 2000-01 biennium. As lead agency, WSDA is required to report to the Legislature annually on the progress of these programs. This report fulfills that requirement for 2000.

Spartina **Eradication Program**

Funding the *Spartina* Program

WSDA allocated $718,000 from the appropriated ALEA funding this biennium for *Spartina* eradication statewide.

WSDA Activities

In 2000, the WSDA *Spartina* Eradication Program activities included the following:

- Working collaboratively with stakeholders to update and distribute six regional *Spartina* Management Plans;

- obtaining, providing coverage and meeting public notification requirements of six regional water quality permits;

- providing funding through interagency agreements, personal services contracts and direct cost-share to state and local government agencies and private landowners;

- hiring, equipping and coordinating a crew to treat all infestations in Clallam, Jefferson, Kitsap and King counties, assist the Swinomish and Suquamish tribal communities with control work on their property and work cooperatively with the Washington State Department of Fish and Wildlife (WDFW) on infestations in Willapa Bay as part of the WSDA private costs share program;

- organizing and facilitating the exchange of *Spartina* eradication information through many regional planning and informational meetings; and

- continuing to explore with stakeholders more efficient and cost-effective ways to eradicate *Spartina* including developing, staffing and operating a new *Spartina* eradication machine in Willapa Bay

Summary of 2000 Statewide *Spartina* Eradication Activities

There are ten counties in western Washington with one or more infestation of *Spartina alterniflora*, *Spartina anglica*, or *Spartina patens*. This includes Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Pacific, San Juan, Skagit and Snohomish counties. These infestations are equivalent to approximately 5,000 to 5,500 solid acres of *Spartina* (if all populations were one contiguous meadow) and are spread over more than 20,000 acres of intertidal mudflats. All but approximately 10 solid acres are located in Pacific, Snohomish, Island and Skagit counties. In 2000, WSDA, partner state and federal agencies, local governments, tribal entities, commercial landowners and private landowners treated approximately 1,150 solid acres of *Spartina*. Table 1 summarizes the statewide control effort by county and year for the past four years.

Table 1. Acres of *Spartina* Treated in Washington State – 1997 through 2000

County	*Spartina* Present in 2000	*Spartina* Treated, 1997 - 2000	Treatment Methods
Pacific (Willapa Bay)	Approx. 4,000 solid acres spread over > 15,000 acres	'97 - approx. 742 solid acres '98 - approx. 450 solid acres '99 – approx. 600 solid acres '00 – approx. 800 solid acres	Mow, mow/herbicide, herbicide, seedling removal, mechanically rip
Grays Harbor	Scattered clones and seedlings 0.52 acres in size	'97 – all treated '98 - all treated '99 – all treated '00 – all treated	Mow, mow/herbicide, herbicide, seedling removal
Snohomish	Approx. 460 solid acres spread over > 4,500 acres	'97 - approx. 89 solid acres '98 - approx. 126 solid acres '99 – approx. 90 solid acres '00 – 158 solid acres	mow, mow/herbicide, herbicide, seedling removal, dig
Island	Approx. 250 solid acres spread over >1,000 acres	'97 - approx. 250 solid acres '98 - approx. 160 solid acres '99 - approx. 155 solid acres '00 – 130 solid acres	Mow, mow/herbicide, herbicide, seedling removal
Skagit	Approx. 65 solid acres spread over > 2,000 acres	'97 - approx. 91 solid acres '98 - approx. 57 solid acres '99 – all treated '00 – approx. 60 solid acres	Mow, mow/herbicide, herbicide, seedling removal, dig
Clallam	1 infestation < 0.25 acres in size	'97 - treated twice '98 - treated three times '99 – treated twice '00 – treated three times	Mow/herbicide, dig
Jefferson	14 infestations – approx. 1.0 solid acre total	'97 - all treated '98 - all treated twice '99 – all treated twice '00 – all treated twice	Mow, mow/herbicide, dig, seedling removal
Kitsap	8 infestations - approx. 2.5 solid acres total	'97 - all but 2 tribal sites '98 - all treated '99 – all treated twice '00 – all treated	Mow mow/herbicide, dig, seedling removal
King	1 infestation – single clones and a few seedlings	'97 - monitored '98 – all treated '99 – all treated '00 – all treated twice	Dig
San Juan	Re-growth found at one site. 2 other sites clean for three consecutive years	'97 - all treated '98 - all treated '99 - monitored '00 – all treated	Survey, dig

Willapa Bay Status

At the beginning of the 2000 season, there were approximately 4,000 solid acres of *Spartina* spread over 15-16,000 acres in Willapa Bay. State and federal agencies and private landowners treated approximately 800 solid acres by mowing, digging and/or applying herbicide in 2000. Efficacy varies by control technique but the participating agencies conservatively estimated kill at approximately 300 solid acres based on expert observation. Expansion of the infestation in untreated areas resulted in an overall increase of approximately 12%. This is significantly less than the 20% per year expansion rate experienced between 1994 and 1997.

State and federal agencies have eradicated *Spartina* within specific locations in Willapa Bay. Beginning in the 1999 control season, the participating agencies redefined their Willapa Bay *Spartina* Management Strategy and began focussing their resources on a finite number of geographical areas. The participating agencies tailored their roles and responsibilities to the unique resources and expertise they possess, allowing them to maximize their productivity and reduce redundancy and inefficiency. This partnership continued into 2000 with specific geographical areas targeted for a variety of reasons including ecological and commercial value. Coordinating *Spartina* management efforts on a regional basis in Willapa Bay allowed the participating agencies to achieve more effective *Spartina* control than the individual entities could have accomplished alone.

If the funding remains at the same level next biennium the agencies will continue to focus on a finite number of locations. Specifically, they will work to prevent infestation expansion on ecologically important sites and on sites that are currently *Spartina* free. However, the overall infestation will continue to expand and displace native habitat exponentially.

Grays Harbor Status

Grays Harbor landowners and managers continue to be concerned about potential large-scale invasion of *Spartina* due to the magnitude of the problem in Willapa Bay. WDFW treated all known *Spartina* infestations in Grays Harbor in 2000. However, a late season funding shortfall prevented a complete aerial survey of the bay. It is possible there were isolated infestations that grew untreated this year.

If the funding remains at the same level next biennium, WSDA and partners will put strong emphasis on preventing *Spartina* establishment in Grays Harbor County. Specifically, the agencies will conduct aerial surveys and treat all known *Spartina* each year.

Puget Sound and Hood Canal Status

The estimated area of *Spartina* within Puget Sound and Hood Canal in 1997 was approximately 1,000 solid acres spread over more than 8,000 acres. Estimates compiled during the 1999 control season by WSDA and partners indicated the solid acres of *Spartina* had been reduced to

approximately 900 or by 10%. WSDA and partners continued to make significant progress in Puget Sound in 2000. Specific accomplishments by county are summarized below.

Snohomish County
All known *Spartina* infestations within Port Susan were treated and the first substantial effort to treat the largest infestation in Puget Sound (south Skagit Bay) began. Isolated *Spartina* infestations on LeQue Island and along the Stillaguamish River were also substantially reduced and the Warm Beach region was maintained *Spartina* free.

Island County
All known *Spartina* infestations on Whidbey Island were treated and many sites, including Deer Lagoon and Cultus Bay, are being brought close to eradication. Also, a large seed producing meadow located in Livingston Bay (Camano Island) was treated for the first time.

Skagit County
With the exception of a large infestation discovered on Samish Island at the end of the season, all known *Spartina* in Skagit County was treated. Many sites are now being maintained free of *Spartina* through surveys and seedling digs.

Clallam, Jefferson, Kitsap, King and San Juan counties
All known *Spartina* infestations within Clallam, Jefferson, Kitsap, King and San Juan counties were treated in 2000. With exception of tribal lands, all sites are virtually *Spartina* free and can be maintained that way with yearly surveys and seedling digs. Two out of three sites in San Juan County previously infested with *Spartina* are now considered eradicated (three consecutive years without *Spartina*).

If the funding remains at the same level next biennium, WSDA and partners will prioritize and treat small "outlier" infestations and prevent *Spartina* establishment in regions that are generally *Spartina* free. This level of funding would not be adequate to prevent expansion and seed production at the three largest (each more than 200 solid acres) infested sites located in Snohomish County (south Skagit Bay and LeQue Island) and Island County (Triangle Cove).

New Developments and Challenges

Shellfish Glyphosate Residue Study
In October 1998, the Environmental Protection Agency (EPA) informed WSDA that further evidence was needed to demonstrate the rates specified in the Washington State Special Local Needs registration of the herbicide Rodeo® for *Spartina* eradication would not result in residues in excess of the established tolerance for glyphosate in shellfish.

With WSDA serving as project sponsor, the University of Washington (UW) School of Aquatic and Fisheries Sciences conducted a study titled *Tissue Residues of Glyphosate and Aminomethyl Phosphonic Acid (AMPA) in Shellfish Associated with Application of Rodeo® to Control Spartina alterniflora*. The study was done in compliance with Good Laboratory Practices (GLP)

standards. The Washington Pesticide Registration Commission, USFWS, Monsanto Chemical Co., WDFW, WSDA and UW all contributed funding and other support to the study.

The study was conducted in spring and summer 2000 at the Batelle Pacific Northwest Laboratories in Sequim, Washington. Based on this research, UW researchers reported that higher application rates specified on the 1998 Washington label for *Spartina* control would "…not likely result in tissue concentrations of glyphosate that exceed the current tolerance for edible tissue (3.0 ppm wet weight)." The UW researchers also reported their results were consistent with several other recent studies which found "…primary concerns associated with the control of *Spartina* in Willapa Bay and other West Coast estuaries are not related to chemical or other control strategies and their non-target effects, but to the continued spread of the exotic grass and the subsequent loss of mud flats, eel grass (Zostera japonica), and high elevation salt marsh."

Mechanical Control of *Spartina*

WSDA researched, purchased, re-fabricated and operated a new *Spartina* eradication machine in October and November 2000. An Otter Remote Access Tracked Vehicle (Otter) was equipped with a rear-mounted subsoil-ripping implement and used in Willapa Bay and Puget Sound to rip and shred *Spartina* roots.

In 30 hours of machine time, WSDA treated approximately five solid acres in Willapa Bay and two solid acres in Puget Sound. Efficacy one month after treatment appears to be near one hundred percent at the majority of treated sites, with the exception of extremely dense clones in Willapa Bay and mounded dredge spoil sites in Puget Sound. These infested sites will require substantially more power to rip apart than the Otter possesses in its current configuration. WSDA will begin using the machine again in March 2001 after making some mechanical modifications this winter.

Biological Control of *Spartina*

In May 2000, state and federal permits were issued to the University of Washington's Olympic Natural Resource Center (ONRC) to allow release of the planthopper *Prokelisia marginata* as a biological control agent to combat *Spartina alterniflora* in Willapa Bay.

A University of California-Davis researcher brought a starter population of 1,500 parasite-free and disease-free *Prokelisia* to Washington in June. The insects were initially introduced to Willapa Bay *Spartina* within cages in a green-house located at the Pacific Coast Cranberry Research Foundation facility in Long Beach, Washington.

After the insects had multiplied to sufficient numbers in the green-house, an ONRC Biological Control Specialist placed 1,500 insects in two cages at three sites in Willapa Bay the first week of August. Additional releases of 750 insects per cage were made the second week of September.

Between September 26 and 28, the ONRC Biological Control Specialist opened the cages and released the insect into the environment in Willapa Bay. As of November 15, the insects had survived a couple of frosts and the outlook for winter survival was good.

North Puget Sound Permit Appealed

The North Puget Sound water quality permit was appealed on July 23, 1999 by several groups opposed to herbicide use. Grounds cited in the appeal included procedural matters and concerns over adherence to federal statutes, particularly the Clean Water Act. A stay was also requested.

The Pollution Control Hearings Board denied the petition for stay on October 7, 1999 and eventually the entire appeal, granting Summary Judgment in favor of WSDA and the Washington Department of Ecology (DOE) January 26, 2000. However, the process consumed substantial WSDA staff time, directly affecting the *Spartina* eradication program statewide in 1999 and 2000.

Recommendations for the Future

Through its efforts and the efforts of the involved counties, federal and state agencies, tribes, homeowner associations, private landowners and others, WSDA has demonstrated that *Spartina* eradication is feasible. Results to date include reducing the overall Puget Sound infestation by 10% from 1997 to 1999, preventing *Spartina* establishment in Grays Harbor, and eradicating populations of *Spartina* at select sites in Willapa Bay. However, at current funding levels, it could take decades to eradicate *Spartina* in Puget Sound and we will never eradicate this habitat destroyer in Willapa Bay. Though we eradicated approximately 300 solid acres of *Spartina* in Willapa Bay in 2000, we estimate the overall infestation will increase from approximately 4,000 solid acres to close to 4,500 by the start of the next control season due to expansion of the untreated areas.

Strategies for eradicating *Spartina* have evolved over time with treatment efforts each year being built on the results of the previous years' effort. Equipment to access and treat *Spartina* has also evolved. The agencies now use airboats to transport equipment and personnel, large-scale amphibious mowing machines to stop seed production, small tracked vehicles to shred and rip apart isolated infestations, high pressure spray systems to treat large clones and fringes of meadows, and volunteers, landowners and students to dig seedlings. Because of these new tools and our experiences the past few years, we feel more than ever that it is possible to eradicate *Spartina* from Washington State provided adequate resources are available.

WSDA has requested an additional $1,480,000 for *Spartina* eradication statewide during the 2001-2003 biennium. The WSDA proposal expands on the current successful cooperative efforts in Puget Sound and Grays Harbor and brings new mechanized eradication tools to the efforts in Willapa Bay. WSDA and its partners learned a key lesson from past large-scale mowing work; severely disrupting *Spartina* roots kills it. This concept has been tested and proved on a small scale by the WSDA Otter machine and WSDA is aware at least one company, based out of

Lawrence, Kansas, that is willing to enter into a performance based contract for large-scale *Spartina* eradication using a similar method.

The WSDA proposal would provide funding to eradicate all known infestations of *Spartina* in Puget Sound, Hood Canal and Grays Harbor over a period of four years and begin the first real reduction in Willapa Bay, eradicating nearly a quarter of the 4,000 plus solid acres of *Spartina* in the first two years. Specifically, the WSDA proposal provides funding to:

- Double the current Interagency Agreement dollar amounts and work plans in Skagit, Island and Snohomish counties.

- Double the current Interagency Agreement dollar amount and work plan with WDFW for eradication of the outlying *Spartina* clones in Willapa Bay and Grays Harbor.

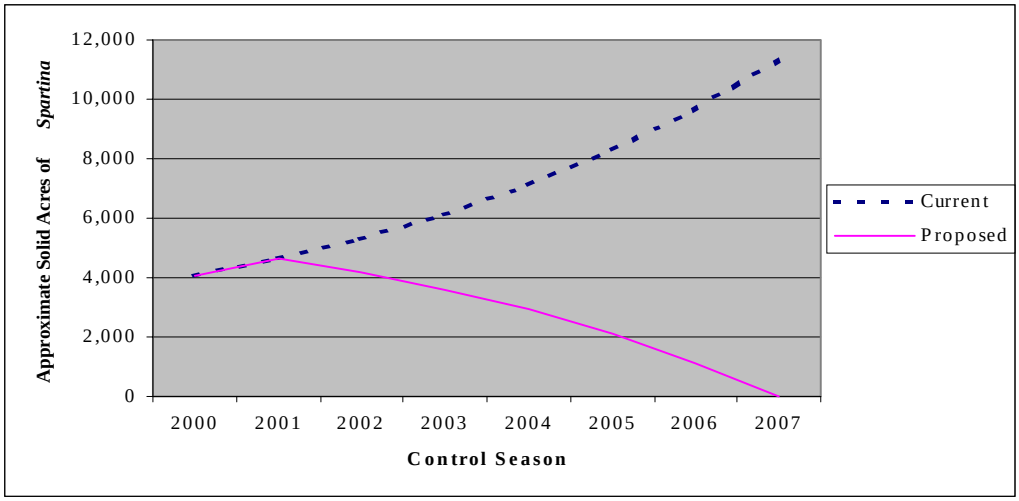
- Hire, equip and support four *Spartina* crew members six months each year for *Spartina* eradication work in Clallam, Jefferson, Kitsap, Mason, Thurston, Pierce and King counties. This crew will also be responsible for survey of Whatcom and San Juan counties and for coordinating cooperative treatment of *Spartina* infestations on tribal property.

- Purchase, equip, staff and operate two remote access tracked vehicles equipped with sub-soiler implements to use for ripping *Spartina* root mass.

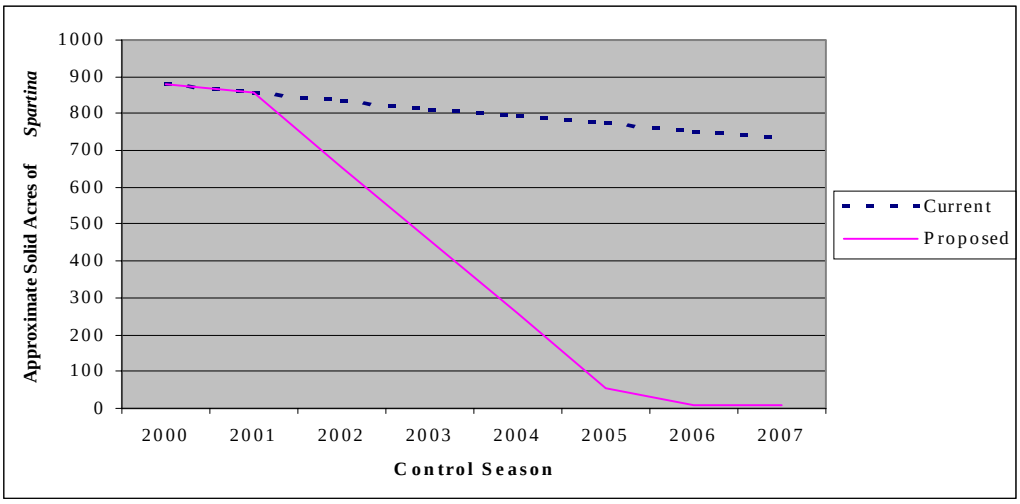
- Contract for large-scale mechanical eradication of 1,000 acres of solid *Spartina* meadows in Willapa Bay each year.

Graphs 1 and 2 show WSDA *Spartina* acreage projections for Willapa Bay and Puget Sound/Grays Harbor with and without additional funding. These scenarios assume other participating state and federal agencies continue to allocate same levels of resources for *Spartina* eradication in the future.

Graph 1. Willapa Bay Projected Solid Acres of *Spartina* with/without additional funding



Graph 2. Puget Sound/Grays Harbor Projected Solid Acres of *Spartina* with/without additional funding



With no additional funding, we project the ability of *Spartina* to spread in Willapa Bay will overrun efforts to eradicate it. It will increase dramatically from an estimated 4,600 solid acres at the end of FY01 to more than 11,000 solid acres at the end of FY07. In Puget Sound and Grays Harbor, we will eradicate *Spartina* at a rate of 2.5% per year with a minimal reduction in solid acres from an estimated 850 acres at the end of FY01 to 730 acres at the end of FY 07.

Purple Loosestrife Control Program

Funding the Purple Loosestrife Program

WSDA allocated $100,000 from the appropriated ALEA funding this biennium for purple loosestrife control statewide.

WSDA 2000 Activities

WSDA purple loosestrife activities for 2000 included obtaining a statewide water quality permit to allow herbicide treatment throughout the state. WSDA issued coverage under this permit to 46 individuals and agencies this year. More than 2,000 acres were treated for purple loosestrife infestations this year under the WSDA permit. More than 300 acres of other noxious weed species that are also covered under the permit were treated as well. WSDA staff issued permits for manual control projects to allow movement of plants to disposal sites as is required by WAC 16-752-400.

WSDA cooperates with other federal, state and local agencies to address the issue of purple loosestrife in Washington State. WSDA, WDFW and the United States Bureau of Land Management work together to control purple loosestrife and *Spartina* on public lands in Skagit County. WSDA partnered with WDFW and the Stevens County Noxious Weed Control Board

to treat all the purple and wand loosestrife sites on Loon Lake in Stevens County. WSDA continued to enhance county noxious weed control board activities by purchasing equipment, and allowing use of equipment, such as small boats and canoes, to survey and control purple loosestrife infestations and to distribute biological control organisms. In 2000 WSDA also purchased herbicide, boat-mounted sprayers, and biological control collection and distribution equipment. WSDA has also facilitated hand removal projects by purchasing "weed wrenches", hand clippers, plastic bags, and paid for disposal of plants in landfills.

WSDA continued to contract with Washington State University to raise, collect and release biological control agents for purple loosestrife in Washington State. Several thousand insects were raised and released on purple loosestrife infestations in 2000. These biological control agents had a significant impact on the purple loosestrife in many areas including the Winchester Wasteway area in Grant County. The impact in this area is especially visible as hundreds of acres of loosestrife plants show significant feeding damage from the beetles. WSDA cooperates with the Washington State Noxious Weed Control Board (WSNWCB), WDFW, the Bureau of Reclamation and the Columbia Basin Irrigation Project to facilitate collection and redistribution of *Galerucella* beetles from the Winchester Wasteway area in Grant County to other parts of the state. More than 40 federal, state and local agencies participated in the project in 2000. WSDA, WSNWCB, WDFW, the King County Noxious Weed Control Board and the University of Washington cooperated in a project to raise bio-control agents on the U.W. campus. These bio-agents were then released on purple loosestrife infestations in King County. WSDA took the lead in forming a statewide noxious weed biological control working group in 2000. This group coordinates releases statewide of bio-control agents including purple loosestrife agents.

SPARTINA ERADICATION PROGRAM

Introduction

Spartina, commonly known as cordgrass, is a noxious weed that severely disrupts native saltwater ecosystems, alters fish, shellfish and bird habitat and increases the threat of floods. Three different species of *Spartina* have been introduced to western Washington and all pose essentially the same problems and eradication challenges.

Spartina alterniflora is a species native to the East Coast of North America. It was introduced to Willapa Bay in the late 1800's when it was used as packing material for the shipment of east-coast oysters to the Bay. According to the Washington State Department of Natural Resources (DNR) estimates, there were approximately 4,000 solid acres of *Spartina* spread over more than 15,000 total acres of mudflats in Willapa Bay in 2000. Figure 1 *(see p. 31)* shows *Spartina alterniflora* taking over a mudflat in Willapa Bay. In Puget Sound, *Spartina alterniflora* is known to exist in Skagit County within Padilla Bay, Clallam County within Sequim Bay and Jefferson County within Bywater Bay. It was intentionally introduced by a landowner in Puget Sound sometime in the 1960's in an attempt to stabilize shorelines. *Spartina alterniflora* has also been discovered at several locations within Grays Harbor and along the lower reaches of the Copalis River. Less than 10 solid acres of *Spartina alterniflora* are present in Skagit, Clallam, Jefferson and Grays Harbor counties combined.

Spartina patens is present at only one known location in Washington State, at Dosewalips State Park in Jefferson County. It was first discovered at this site in the early 1990's and its method of introduction is not known. During the 2000 control season, Washington State Department of Agriculture (WSDA) staff found and treated approximately 15 small clumps. Figure 2 *(see P. 31)* shows the largest of the *Spartina patens* clumps found in 2000.

Spartina anglica is present in Skagit, Snohomish and Island counties. It has also been found in San Juan, King, Kitsap and Jefferson counties. Figure 3 (*see p. 31*) shows *Spartina anglica* colonizing a mud-bar in Kitsap County. It was intentionally introduced into Puget Sound in the early 1960's at a farm located on the eastern shore of Port Susan Bay, three miles south of Stanwood, Washington. The purpose of the original introduction was for dike stabilization and potential forage for cattle grazing on the bay. The hybrid vigor of *Spartina anglica* is amazing. An employee from the former Washington State Department of Game first observed *Spartina anglica* in Port Susan prior to 1979. At that time its estimated total area was less than 15 acres. In 1999, there were approximately 900 solid acres of *Spartina* spread over more than 8,000 total acres throughout Puget Sound and Hood Canal.

In all, there are ten counties in western Washington with one or more infestations of either *Spartina alterniflora, Spartina anglica or Spartina patens*. These include Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Pacific, San Juan, Skagit and Snohomish counties. *Spartina* infestations range from one *Spartina* colony (or clone) measuring approximately two feet in diameter in Clallam County to more than 4,000 solid acres (if contiguous) spread

throughout Willapa Bay in Pacific County. All totaled, *Spartina* infests approximately 5,000 to 5,500 solid acres spread over more than 20,000 total acres.

Spartina spreads quickly and is extremely difficult to eradicate. Successful eradication involves essentially four steps. Those steps are:

1) Preventing an existing infestation from producing seed;

2) Containing an existing infestation to a site (particularly important given *Spartina's* high rate of vegetative spread);

3) Treating for several consecutive years with a variety of treatment methods including mowing, applying herbicides, mechanically ripping and hand pulling or a combination of these methods; and

4) After successful eradication is achieved, monitoring the area and removing new seedlings to assure no re-establishment occurs.

Basic Program Components

Chapter 255, Laws of 1995 designated WSDA as the lead state agency for the eradication of *Spartina*. As lead agency, WSDA has coordinated the development of strategies and management plans for eradicating *Spartina*, streamlined regulatory process requirements by obtaining "umbrella" water quality permits, provided resources to state and local government and private landowners, and explored with its partners more efficient and cost-effective ways to eradicate *Spartina*.

The WSDA *Spartina* program has several basic components including budget, county activities, cost share activities, water quality permits and management plans. These components are detailed in this section of the report.

Budget

WSDA allocated $718,000 of its appropriation from the Aquatic Lands Enhancement Account (ALEA) for *Spartina* activities this biennium. Table 2 illustrates how WSDA is using these funds. The table shows actual expenditures for FY00 and projected expenditures for FY01.

Table 2. Budget Activity by Area – FY00 and FY01

($718,000 total - $ in thousands)

	Puget Sound/Oly. Peninsula		Willapa Bay		Total	
Activity	*FY00*	*FY01*	*FY00*	*FY01*	*FY00*	*FY01*
WSDA Coordination and control activities	$102	$92	$92	$152	$194	$244
Survey (Adopt-A-Beach)	$20	0	0	0	$20	0
Purchased Services					$133	$105
- Skagit	$20	$20				
- Island	$25	$25				
- Snohomish	$25	$25				
- Swinomish Tribe	$3	$5				
-WDFW (Pacific County)			$30	$30		
- Residue Study	$15		$15			
Direct Cost Share	$2	$0	$14	$6	$16	$6
TOTAL	$212	$167	$151	$188	**$363**	**$355**

Notes for Table 2:

1. WSDA Coordination and Control Activities: These expenses include agency administrative expenses, salaries and benefits, travel, attorney fees, public notification expenses and other goods and services such as rent, insurance, supplies, equipment, communication, bond fees and training. Actual expenses were higher for Puget Sound in FY00 due to unanticipated attorney fees. Also, projected Willapa Bay FY01 expenditures are higher than FY00 actual expenditure because WSDA is developing, staffing and running a new mechanical eradication tool in Willapa Bay.
2. Survey (Adopt-A-Beach): WSDA wrote a two-year contract this biennium for Adopt-A-Beach to continue to coordinate volunteer *Spartina* surveys and private landowner cooperative digs throughout Puget Sound and Hood Canal. Due to organizational funding and staffing problems, Adopt-A-Beach is unable to fulfill the contract requirements in FY01.
3. Purchased Services: WSDA wrote two-year contracts this biennium for county work crews in Skagit, Island and Snohomish counties. WSDA also wrote Interagency Agreements for the WDFW to conduct work in Pacific County and for the Swinomish Tribal Community to conduct work on their property in Skagit County. The Residue Study reflects money allocated to support research relevant to Rodeo®.
4. Direct Cost Share: These amounts include only money paid to landowners as reimbursement for equipment/supplies in exchange for their labor. More landowners are choosing an alternative form of cost-share in FY01 whereby they reimburse WSDA for supply costs in exchange for us doing the work.

County Activities

In 2000, WSDA continued to allocate funding, labor and equipment for *Spartina* work crews in those counties with the majority of the infestations. WSDA allocated these resources by way of Interagency Agreements with the Skagit, Island and Snohomish county noxious weed control boards and the Washington State Department of Fish and Wildlife (WDFW) in Pacific County. The highest priority infestations were those on private property where landowners requested work crew assistance from WSDA. WSDA staff conducted field audits throughout the control season and facilitated coordination meetings periodically to assure contract priorities were being adequately addressed.

Cost Share Program

As directed by RCW 17.26.007, WSDA offered limited financial assistance to private landowners for *Spartina* control and eradication in 2000. Table 3 describes how WSDA provided this assistance.

Table 3. 2000 WSDA Cost Share Options

Eradication/Control Method	WSDA Contribution	Landowner Contribution
County work crews mow and/or apply herbicide	WSDA grants county funds to treat priority areas in '00 control season	Must treat once in '00 season or agree to pay herbicide expenses
Direct cost share - Landowner applies herbicide	100% of herbicide and adjuvant	100% labor & equipment
Direct cost share - Landowner covers or digs up infestation	100% of pre-approved materials	100% labor
Direct cost share - Landowner uses WSDA pre-approved contractor	50% of contractor cost	50% of contractor cost

Because private landowners overwhelmingly requested the services of the county work crews, WSDA allocated the majority of cost share funding for this option (i.e. Interagency Agreements). However, WSDA provided approximately $6,000 in direct cost share to landowners in Willapa Bay during the 2000 season.

Water Quality Permits

Prior to the 1997 control season, WSDA applied for and negotiated the terms of six area-wide three-year water quality permits. These permits allow the use of the herbicide Rodeo® and surfactants (R-11, X-77, LI-700) in the waters of Willapa Bay, Grays Harbor, the Straits of Juan de Fuca/Pacific Ocean, Hood Canal, southern Puget Sound and northern Puget Sound from June 1 through October 31 for *Spartina* control. The Department of Ecology (DOE) issued five of the permits for three years, or through the 2000 control season. Due to typographical errors and other misunderstandings, the other permit, for North Puget Sound, was issued for one year, expiring after the 1998 control season. DOE issued WSDA a new North Puget Sound permit for the 1999/2000 control seasons, terms of which were somewhat different from the permits for other areas.

WSDA granted coverage under the permits to qualified applicants. In 2000, 28 applicants requested coverage under one or more of the WSDA permits. These applicants included federal, state and county agencies, commercial applicators and private landowners. Applicants who met the permit terms received a packet containing a *Spartina*-specific Pesticide Application Record form, a WSDA flier on Herbicide Application Recommendations, the applicable permit(s) and a general flier on *Spartina*. Table 4 summarizes the permit coverage WSDA granted in 2000.

Table 4. 2000 Permit Coverage by Waterbody

Waterbody	2000 Permitted Applicators
Willapa Bay	19
Grays Harbor	11
Northern Puget Sound	20
Hood Canal	11
Strait of Juan de Fuca	10
Southern Puget Sound	10

The water quality permits required WSDA to notify all residents potentially affected by herbicide applications. WSDA accomplished this notification by conducting a mass mailing to more than 46,000 residents in western Washington in May 2000. WSDA staff, in conjunction with the county noxious weed board coordinators, also posted all public access points along selected shorelines prior to any herbicide applications and published legal notices in relevant county newspapers each month during the control season.

Management Plans

In the winter and spring of 2000, WSDA staff worked with the county noxious weed control board coordinators, staff from the WDFW, Washington Department of Natural Resources (DNR), the United States Fish and Wildlife Service (USFWS), tribal communities, and private landowners, to prepare six regional *Spartina* management plans. These management plans correspond to the areas covered under the six permits issued by Ecology. The management plans provide information on the effects of *Spartina* to the intertidal ecology of these areas, describe previous control efforts/results, and outline the control strategy for the coming year. Copies of 2000 plans are available by contacting the WSDA Statewide *Spartina* Eradication Program Coordinator. WSDA will update all management plans prior to the 2001 control season.

Program Results by Geographic Area

Willapa Bay

This waterbody includes the mouth of Willapa Bay, Willapa Bay, and all the rivers, streams and creeks that feed into the Bay.

Extent of the Infestation in Willapa Bay

There are different ways to measure and quantify the *Spartina* infestation in Willapa Bay. The first step in analyzing the extent of infestation is to calculate the solid acres of *Spartina*. DNR created Geographical Information System (GIS) layers for these calculations using color infrared aerial photography. This mapping method accounts for *Spartina* patches larger than three feet in diameter. Seedlings and one to two-year-old clones are not included in these numbers. Using these maps, DNR determined that in 1994 there were approximately 2,025 solid acres of *Spartina* (if contiguous) and 3,250 in 1997. This indicates a 60% increase in solid *Spartina* throughout

Willapa Bay over those three years, or approximately 20% per year. Using this calculated expansion rate and conservative estimates of acres killed by the eradication effort, DNR estimates there were more than 4,000 solid acres of *Spartina* present in the Bay at the beginning of the 2000 season.

The next step is to calculate the affected acres of *Spartina*. Ongoing analysis is being conducted by DNR to arrive at this figure. This will be accomplished by taking the solid acreage figures and essentially adding the space between those infestations. Field observations will also be used in this analysis to help compensate for the undetectable patches of *Spartina* (smaller than three feet in diameter). Past inventory efforts and expert estimations indicate that the affected acres for the 1997 *Spartina* infestation are thought to be on the order of 12,000 to 15,000 acres. Willapa Bay contains approximately 47,000 acres of intertidal mud flats. Using the numbers for 1997, an estimated 25%-32% of the Willapa Bay intertidal area was infested with some level of *Spartina*.

DNR took infrared aerial photographs of the Willapa Bay region in September 2000 and acreage calculations from these photos will be available next year.

Roles and Responsibilities of Participating State and Federal Agencies in 2000
In 2000, the participating agencies tailored their *Spartina* eradication roles and responsibilities to the unique resources and expertise they possessed, allowing them to maximize productivity while reducing redundancy and inefficiency. The following list outlines the role each agency played in Willapa Bay during the 2000 control season.

- **WSDA** – Provided permitting and public notification support, funding to WDFW, herbicide for cooperative effort and cost-share assistance to private landowners, conducted eradication activities with WDFW crews on private cost-share sites on the Peninsula, researched and developed a new mechanical eradication tool.

- **DNR** – Coordinated the ground control and crew operations in south Bay, conducted control work on Natural Area Preserves and maintenance sites, managed the infrared aerial photography and mapping program, conducted control work on private cost-share sites on the Peninsula, contributed substantial herbicide to WDFW for work in north Bay and supported the biological control research.

- **WDFW** – Coordinated the ground control and crew operations in north Bay, participated in control operations in south Bay and at maintenance sites, conducted control work with WSDA on private property as part of the cost-share program and supported the biological control research program.

- **USFWS** – Operated the Quality Machine (an amphibious flail mower), provided a base of operations for participating agencies, and provided an airboat to DNR.

Highlights of the 2000 Season in Willapa Bay

In 2000, the agencies prioritized and treated specific geographic areas as follows:

I. Maintenance Sites: Control work at these sites was done to maintain the relatively "*Spartina*-free" integrity of the sites. This was either in an area where past control work reduced the infestation down to low levels or in regions where new infestations were just establishing. These sites generally consisted of scattered clones and seedlings over a wide geographic area. Eradication activities typically included seedling removal and spot herbicide treatments.

II. Primary Sites: At primary sites, 100% of the *Spartina* populations received treatment and, in most cases, follow-up treatment. The primary sites were kept to a number and acreage that made it possible for cooperating agencies to achieve their goals in respect to their budget, time and prevailing permit restrictions. Herbicide applications, mowing and physical removals were all done extensively at these sites.

III. Secondary Sites: Secondary sites were designated for control of seed set and included measures to reduce and contain growth such as large-scale mowing with the amphibious mower. The locations of these sites were typically near and of direct impact to the primary sites and/or maintenance sites. The goal for secondary sites was to suppress seed set in order to avoid re-infestation of adjacent sites. This work was also done to prepare these areas for future upgrade to primary site status.

IV. Tertiary Site: This site was located where control had been conducted in the past and where continued control was warranted because of ecological significance, financial investment and public support. Work was done at this site in an attempt to maintain its current integrity.

V. WSDA/Private Landowner Cost-Share Sites: The WSDA Cost-Share Program allows private landowners to actively participate in *Spartina* control with financial/resource assistance from WSDA, WDFW and/or DNR. To get the most benefit from limited resources, the agencies focussed assistance on the Peninsula in Willapa Bay.

VI. Non Listed Sites: Treatment was done at these sites when working at higher prioritized sites was not possible because of mechanical, weather or other general problems that arose.

Table 5. Summary of 2000 Willapa Bay *Spartina* Eradication Effort

Site	Solid Acreage Treated	Entity Conducting Treatment	Treatment Method Used
Maintenance Sites			
Niawiakum	7.78	DNR	Herbicide
Teal Slough	2.47	DNR	Herbicide
Smith Creek	24.42	WDFW	Mow/herbicide
Nemah Public Beach	3.5	WDFW	Dig, herbicide
Rhodesia Beach	1.5	DNR	Dig, herbicide
Primary Sites			
Bear to O'meara	44.06	DNR	Herbicide
Pot Shot	97.75	DNR, WDFW USFWS	Quality Mow/herbicide
North Bay	22.98	WDFW	Mow/herbicide
Bone River	6.11	DNR	Herbicide
Secondary Sites			
SE Long Island	16.00	DNR	Dig, herbicide
Porters Point	500	USFWS	Quality Mow
North Pot Shot	11.1		Herbicide
Tertiary Sites			
Leadbetter Point	16.89	DNR	Mow/herbicide
Non-Listed Sites			
Oysterville	19.56	DNR, WSDA	Mow/herbicide, sub-soil
Cost Share		WSDA, WDFW,	
Long Beach Peninsula	28.96	DNR	Mow/herbicide, sub-soil
Total	**803.08**		

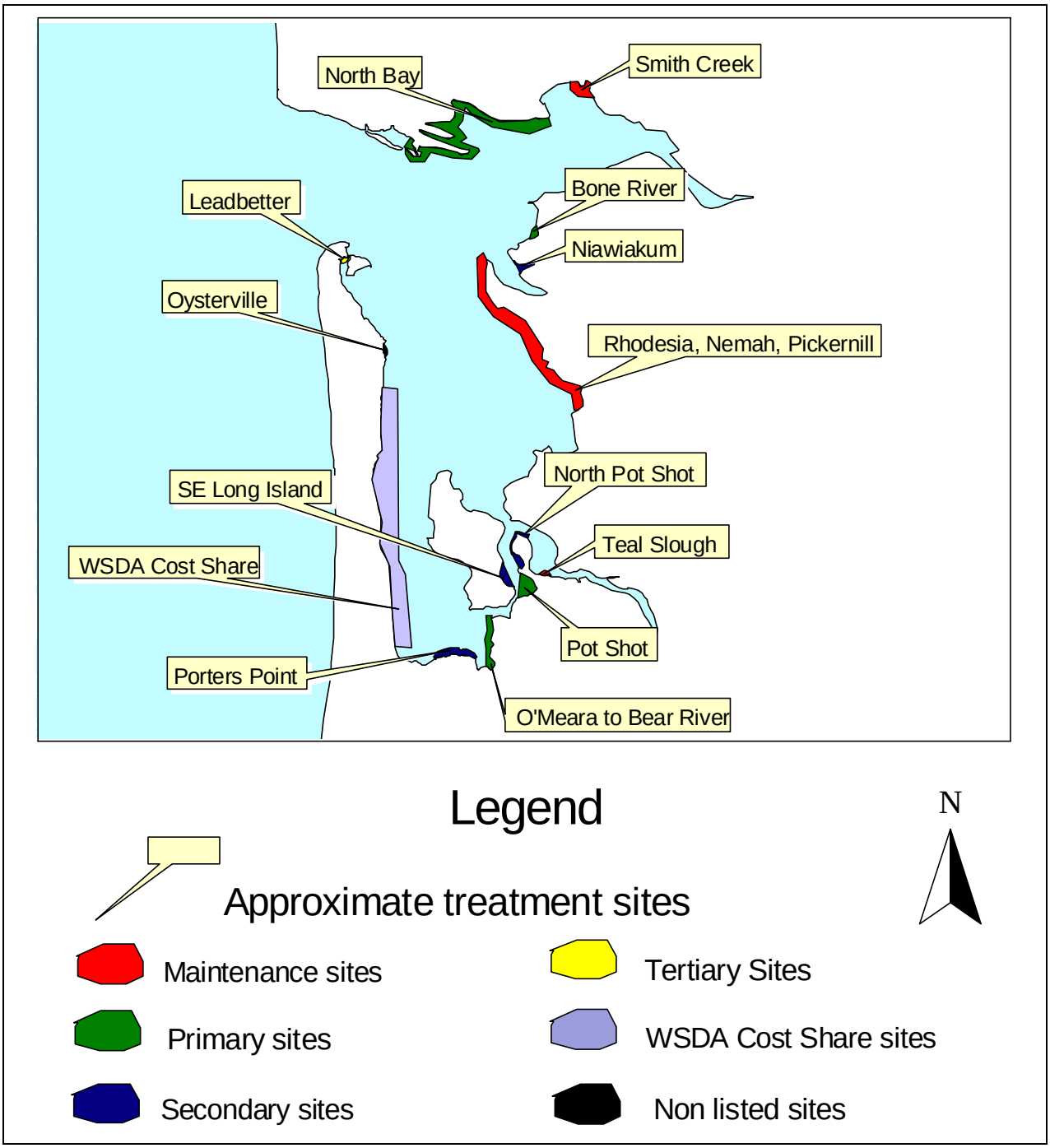
In 2000, the cooperative *Spartina* eradication effort in Willapa Bay resulted in treatment of approximately 800 solid acres of *Spartina*, or about 20% of the overall infestation. Table 5 shows what areas of the Bay were treated, who conducted treatment and what kind of treatment was done at all sites. Map 1 shows the approximate locations of all treatment sites.

Further growth projections calculated by DNR indicate that despite the cooperative treatment effort, the overall Willapa Bay *Spartina* infestation will still increase by approximately 12% by the beginning of the 2001 control season. The agencies are continuing to lose ground bay-wide with current amount of funding allocated for *Spartina* eradication in Willapa Bay.

Despite the increase in total *Spartina* within Willapa Bay, the agencies are making progress and killing *Spartina* on the areas they are treating. Figures 4, 5 and 6 *(see p. 32-34)* show comparison of infrared photos of three primary sites taken in 1997 (before *Spartina* eradication work) and in August 2000 (after/during *Spartina* eradication work).

If funding remains at the same level in 2001, the agencies will continue to focus on finite number of locations. Specifically, the agencies will continue working to prevent expansion on ecologically important sites and on sites that are currently *Spartina*-free. However, the overall size of the Willapa Bay infestation will continue to expand and displace native habitat exponentially.

Map 1. Approximate Location of 2000 Interagency Willapa Bay Treatment Sites



Grays Harbor

This waterbody includes the mouth of Grays Harbor, Grays Harbor, all the rivers, creeks and streams that run into Grays Harbor and the Copalis River drainage.

Extent of the Infestation in Grays Harbor
Property managers and landowners in Grays Harbor have been concerned about the potential invasion of *Spartina* due to the magnitude of the problem in neighboring Willapa Bay. This threat was originally validated when one large *Spartina* clone was discovered in Grays Harbor in 1992 by DNR staff. This was the only known infestation at the time in Grays Harbor and DNR mowed it repeatedly throughout the growing season.

In 1995, WDFW initiated surveys in response to concerns and reports of further *Spartina* invasion into Grays Harbor. WDFW performed a survey from both the ground and air and found no *Spartina*.

In 1996, WDFW staff surveyed the entire bay including the lower Chehalis River drainage either by boat or by fixed wing aircraft. They found and treated 10 clones with herbicide. WDFW observed no seedlings in Grays Harbor in 1996.

In 1997, WDFW revisited all sites treated the previous year and treated four of the 10 sites again with herbicide.

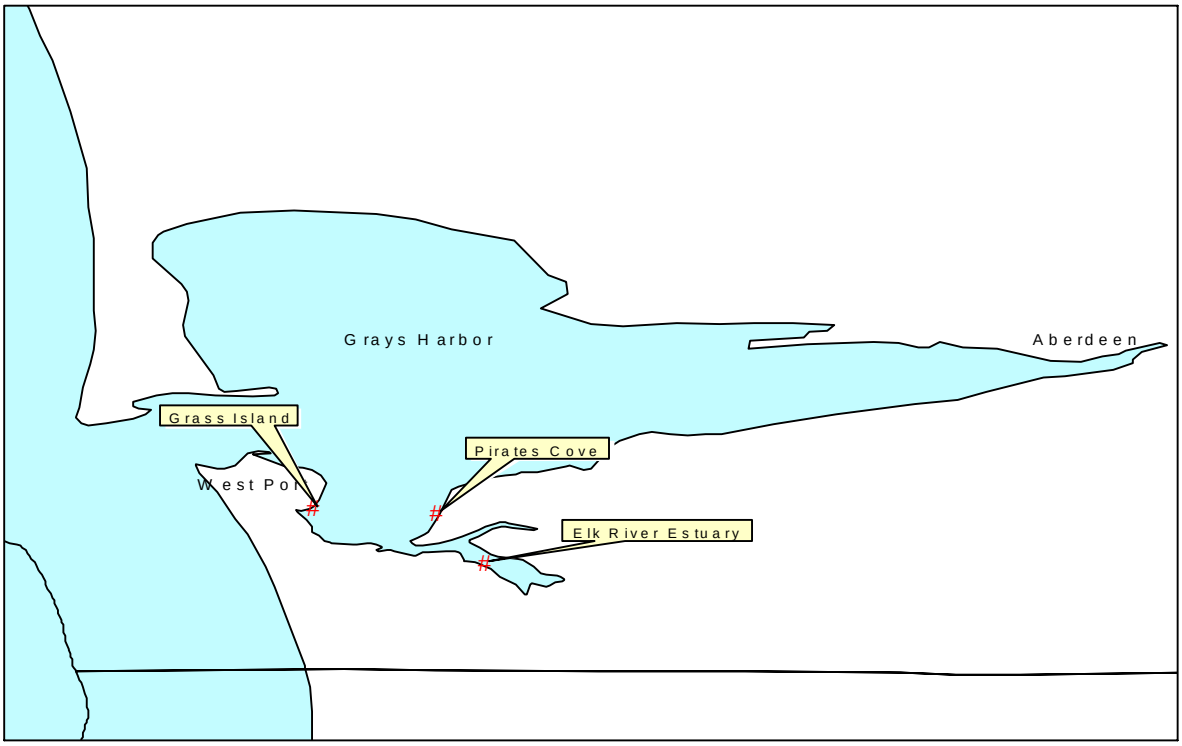
In June 1998, WDFW found five clones ranging in size from five feet to 20 feet in diameter. They treated these clones with herbicide. Late in the control season WDFW returned to evaluate treatment efficacy and found approximately 300 seedlings growing in the area where they had discovered the largest clone. They treated all seedlings with herbicide.

In 1999, WDFW found and treated *Spartina* infestations at several new sites within Grays Harbor. WDFW, DNR and WSDA conducted a survey by helicopter on October 25, in an attempt to try to locate *Spartina* populations missed by ground survey. Weather was poor in the region but they discovered and treated approximately six new *Spartina* clones.

During the 2000 treatment season, WDFW surveyed and controlled small infestations located in the Elk River Estuary, Pirates Cove and Grass Island. Map 2 shows the approximate locations of these infestations. The total acreage treated in Grays Harbor for the 2000 treatment season was approximately 0.5 acres.

In 2001, WDFW, WSDA and DNR will put strong emphasis on preventing *Spartina* establishment in Grays Harbor. Specifically, the agencies plan to conduct extensive aerial surveys in this region next year so all known *Spartina* is treated before the end of the year.

Map 2. Approximate Locations of WDFW Grays Harbor Treatment Sites in 2000



Puget Sound and Hood Canal

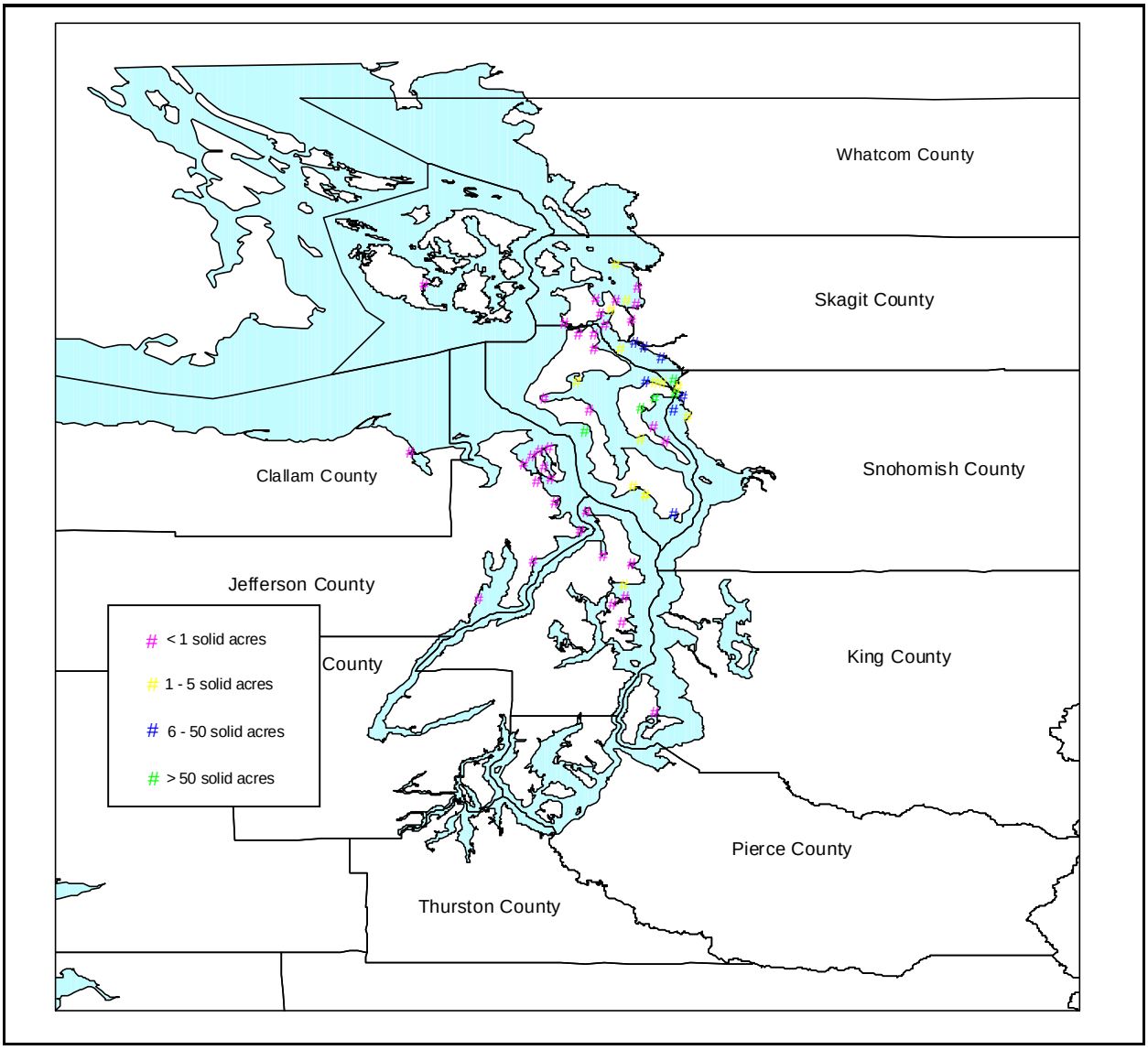
For purposes of the WSDA *Spartina* Program, Puget Sound and Hood Canal refers to San Juan, Skagit, Island, Snohomish, Clallam, Jefferson, Kitsap and King counties. Map 3 shows approximate locations and sizes of all known *Spartina* infestations in Puget Sound and Hood Canal.

Extent of the Infestation in Puget Sound and Hood Canal

In 1997 and 1999, WSDA and its partners completed two surveys to quantify the extent of *Spartina* colonization within Puget Sound. Two measurements were made to characterize the infestation. The first measurement estimated the total affected area or the area in which *Spartina* had invaded but not yet become one contiguous meadow. The second measurement was the solid area or actual abundance of *Spartina* if it were isolated in monoculture.

WDFW took infrared aerial photographs of known Puget Sound *Spartina* infestations at a 1:6,000 scale in August 1997. From these color photos, WDFW ocularly measured the *Spartina* with a hand lens and ruler. Patches smaller than three feet in diameter were not discernible in the photographs. WDFW calculated both the affected and solid area of *Spartina* at each site. WDFW then conducted field reconnaissance to ground verify the data. WSDA, WDFW, and Snohomish, Island, and Skagit County Noxious Weed Board crews manually measured infestations not photographed.

Map 3. Approximate Locations and Sizes of All Known Puget Sound and Hood Canal *Spartina* Infestations



In the summer of 1999, WSDA, WDFW and the Snohomish, Island and Skagit County Noxious Weed Board crews conducted field audits of all sites including some new sites discovered since 1997. Solid *Spartina* acres were estimated by comparing the infrared photos taken in 1997 with the amount of *Spartina* present at the site in 1999 and by measuring new infestations.

The estimated area of *Spartina* within Puget Sound and Hood Canal in 1997 was approximately 1,000 solid acres, spread over approximately 8,000 acres. At the beginning of the 1999 control season, there were an estimated 900 solid acres within Puget Sound and Hood Canal. This amounts to a 10% decrease in the overall *Spartina* population in Puget Sound and Hood Canal from 1997 to 1999.

WDFW took infrared aerial photographs of Puget Sound in September 2000. Acreage estimates from these photographs will be available next year.

Summary of the 2000 *Spartina* Eradication Effort in Puget Sound and Hood Canal

Snohomish County

WSDA provided $25,000 to the Snohomish County Noxious Weed Control Board (SC) for *Spartina* eradication activities in 2000. In addition, SC had $6,900 remaining from the 1999 Interagency Agreement with WSDA and $30,000 from the County. WDFW contributed approximately $2,500 worth of herbicide directly to SC crews and conducted substantial eradication work on property under its management. WSDA also contributed an additional $5,000 worth of herbicide for treatments in south Skagit Bay and the Groenveldt Estate contributed $1,500 for herbicide treatments on its property.

In total, 167 solid acres of *Spartina* were treated in Snohomish County in 2000. Table 6 shows the solid acres treated, who did the treatment and the treatment methods used on every site in Snohomish County. Map 4 shows the approximate location of the infestations.

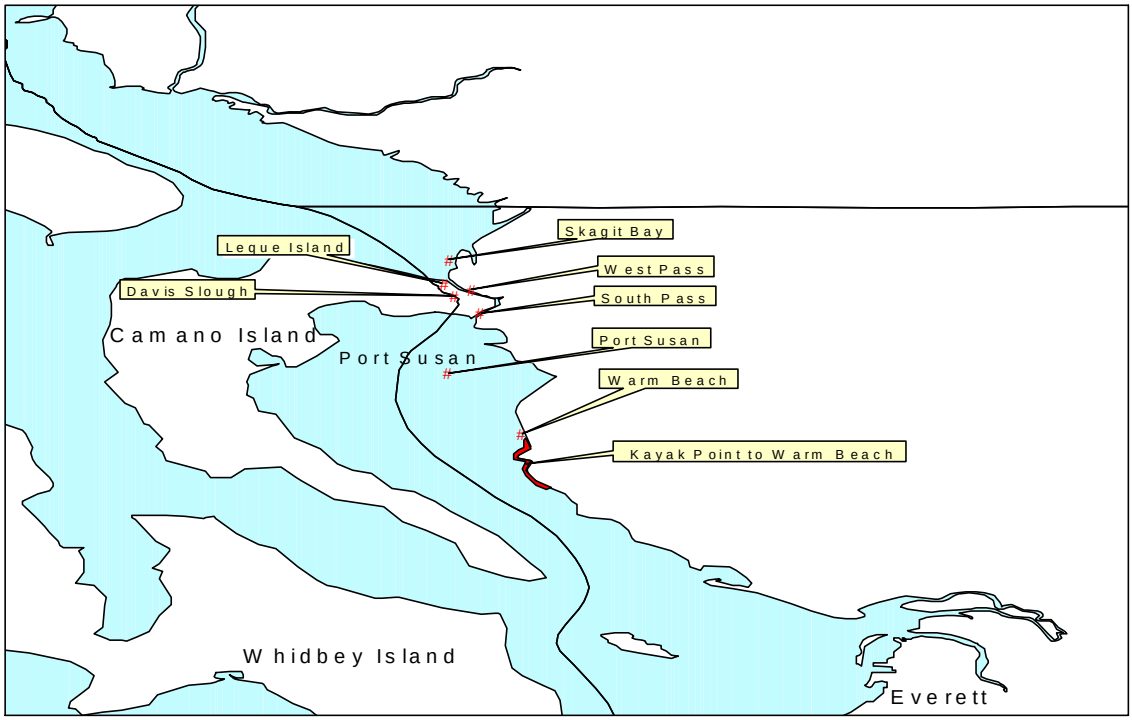
All known *Spartina* infestations within Port Susan were treated and the first substantial effort to treat the largest infestation in Puget Sound (south Skagit Bay) began. Isolated *Spartina* infestations on LeQue Island and along the Stillaguamish River were also substantially reduced and the Warm Beach region was maintained nearly *Spartina*-free.

Two problems still prevent large-scale *Spartina* acreage reductions in Snohomish County. The SC crews continue to lack adequate transportation and the participating agencies are not stopping seed production at the south Skagit Bay infestation, due to a lack of adequate funding. Until complete seed suppression is achieved, SC crews will continue to spend the majority of all future control seasons preventing re-infestation from south Skagit Bay.

Table 6. Summary of 2000 *Spartina* Eradication Effort in Snohomish County

Site	Solid Acreage treated	Entity Conducting Treatment	Treatment Method used
Port Susan	10.3	SC	Herbicide
Skagit Bay	40	SC	Mow/herbicide
Davis Slough	8.3	WDFW	Mow/herbicide
LeQue Island	81.3	WDFW	Mow/herbicide
Warm Beach	1.2	SC	Herbicide
West Pass	3.63	SC	Herbicide
Kayak Point to Warm Beach	0.0001	SC	Dig
South Pass	41.2	SC	Mow/herbicide
Total Solid Acres Treated	**167**		

Map 4. Approximate Locations of all 2000 Snohomish County *Spartina* Treatment Sites



Island County

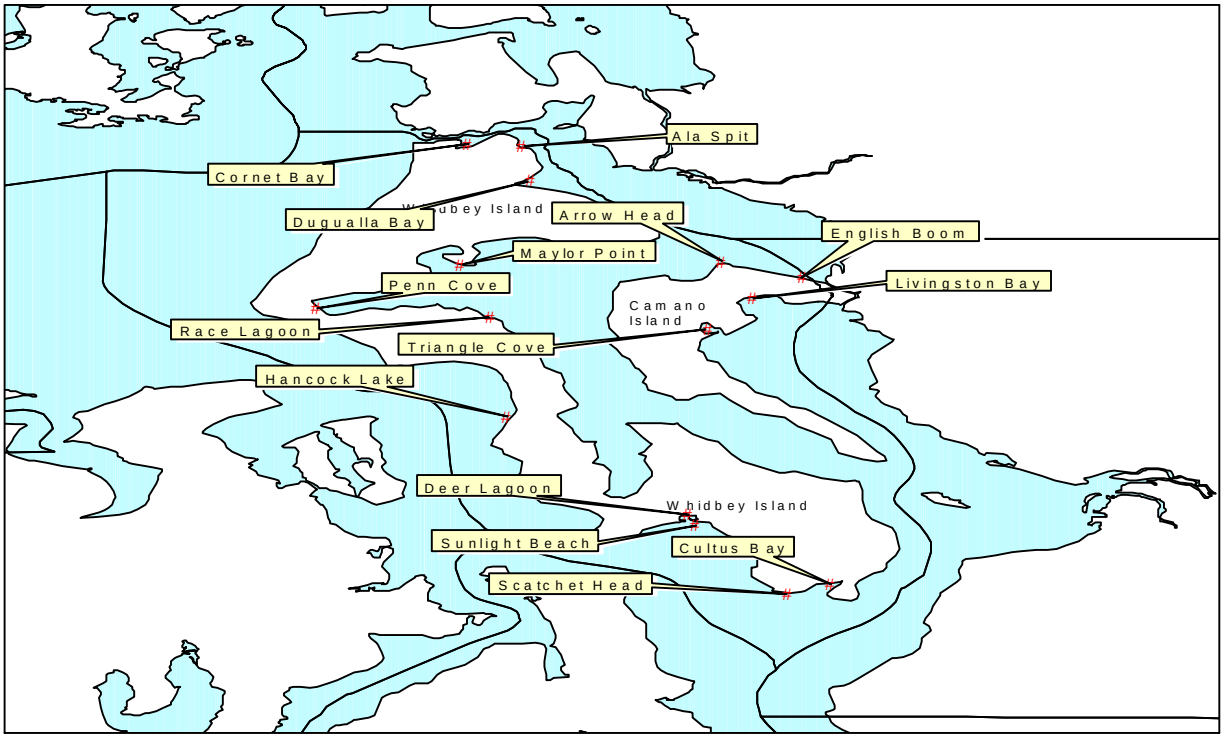
WSDA provided $25,000 to the Island County Noxious Weed Control Board (IC) for *Spartina* eradication activities in 2000. IC sub-contracted the majority of *Spartina* eradication work out to a private contractor, Wildlands Management (WM). In addition to the $25,000 contract with Island County, WM utilized herbicide provided by WSDA, Washington State Parks and Recreation Department, H & H Properties, Sundin Beach community and the Eagle Tree Estates. The United States Navy hired a contractor, Fircrest Pest Control (FPC), to treat *Spartina* on its Whidbey Island properties located around Lake Hancock and Maylor Marsh. Residents of the Skatchet Head community (SH), located on southern Whidbey Island, also contributed labor during community-organized cooperative *Spartina* digs within Cultus Bay.

In total, 180 solid acres of *Spartina* were treated in Island County in 2000. Table 7 shows the solid acres treated, who did the treatment and the treatment methods used on every site in Island County. Map 5 shows the approximate locations of the infestations.

Table 7. Summary of 2000 *Spartina* Eradication Effort in Island County

Site	Solid Acreage Treated	Entity Conducting Treatment	Treatment Method used
Ala Spit	0.35	WDFW, IC	Herbicide
Cornet Bay	0.5	WDFW	Herbicide, dig
Dugwalla Bay	0.25	WDFW	Herbicide, dig
Triangle Cove	4	WDFW	Mow/herbicide
Race Lagoon	0.08	IC	Herbicide, dig
Arrowhead Beach	10	WM	Herbicide
Maylor Marsh	54	FPC	Herbicide
Livingston Bay	85.75	WDFW, WM	Mow/herbicide
Deer Lagoon	3.5	WM	Herbicide
Cultus Bay	6	WM, WSDA, SH	Dig, herbicide
English Boom	8.5	WM	Herbicide
Nelsons lagoon	0.25	IC	Herbicide
Lake Hancock	5	FPC	Herbicide
Sunlight Beach	1.25	WM	Herbicide
Scatchet Head	0	WM, WSDA	Monitor
Penn Cove	0.25	WDFW, IC	Dig, herbicide
Total Solid Acres Treated	**179.68**		

Map 5. Approximate Locations of all 2000 Island County *Spartina* Treatment Sites



Nearly all of the smaller "outlier" infestations have been eradicated in Island County. On Whidbey Island, very few solid acres should remain next year out of more than 100 solid acres present in 1997. This is the result of a considerable investment by all participating entities the past three years. A few acres remain untreated at Mariners Cove and the Navy property will require some additional treatment.

WM has conducted work in Island County under contract the past several years and had considerable success in eradicating two large infestations on southern Whidbey Island, in Cultus Bay and Deer Lagoon. These two sites both contained in excess of 50 solid acres of *Spartina* in 1997. Both sites contained only scattered single plants in 2000. Figures 7 and 8 *(see p.35)* show Deer Lagoon in 1996 and 2000. These figures, provided by WM, demonstrate that eradication of *Spartina* on a large-scale is possible.

On Camano Island, small "outlier" infestations remain at Elger Bay on the west side and in a couple of lagoons on the east side. An infestation located at Arrowhead was treated for the first time in 2000 and will need considerable follow-up treatment. The mile or so stretch of beach known as English Boom will also require constant monitoring and treatment to prevent re-infestation from south Skagit Bay seed.

Livingston Bay, located on eastern Camano Island, continues to be a problem area. In addition to the large meadow on the west side of Livingston Bay that WDFW began treating in 2000, hundreds of small clones emerged on the north end and east side of the bay. WM and WDFW treated the majority of the clones in 2000 but they will require substantial work in future years to prevent them from coalescing into a solid *Spartina* meadow.

Triangle Cove, located south of Livingston Bay on Camano Island, contains approximately 180 to 200 solid acres of dense *Spartina*. This site has received minimal treatment the past several years and until more funding is available, will continue to remain untreated. This is an enormous problem because it is a potential seed source for all of Port Susan.

Skagit County

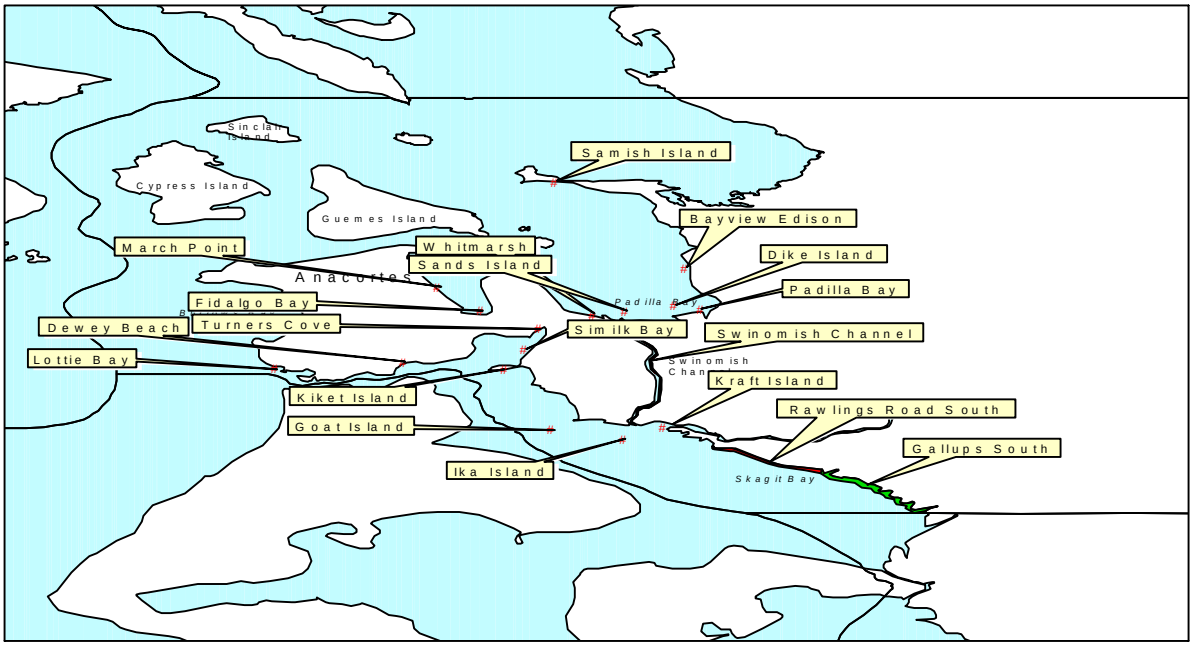
WSDA provided $20,000 to the Skagit County Noxious Weed Board (SK), $5,000 to the Swinomish Tribal Community (SW) and approximately $5,000 worth of WSDA crew time, supplies and equipment during the 2000 control season. In addition, SK procured and contributed $16,500 from a Skagit Fisheries Enhancement Grant and the SW, WDFW, Washington Department of Ecology (DOE) and WM allocated resources towards *Spartina* eradication activities.

In total, 62 solid acres of *Spartina* were treated in Skagit County in 2000. With the exception of a late season new discovery on Samish Island, all known *Spartina* infestations were treated. Table 8 shows the solid acres treated, who did the treatment and the treatment methods used on every site in Skagit County. Map 6 shows the approximate locations of all Skagit County 2000 treatment sites.

Table 8. Summary of 2000 *Spartina* Eradication Effort in Skagit County

Site	Solid Acreage treated	Entity Conducting Treatment	Treatment Method used
Gallups South	21	SK	Dig, herbicide
Rawlings Rd. South	14	SK	Dig, herbicide
Kiket Island	0.62	SK	Herbicide
Sands Island	3.73	SK	Herbicide
Kraft Island	9	SK	Herbicide
Ika Island	5.3	SK	Dig, herbicide
Dike Island	2.03	WM	Mow/herbicide
Padilla Bay	1.6	DOE	Mow/herbicide, Dig
Similk Bay	0.008	SK	Dig
Bayview Edison	0.001	SK	Dig
Samish Island	New*	New infestation*	No treatment
Turners Cove	2	SW, SK, WSDA	Mow/dig
Lottie Bay	0	SK	Monitor
Goat Island	0	SK	Monitor
Dewey Beach	0	SK	Monitor
Fidalgo Bay	0.003	SK	Dig
March Point	0	SK	Monitor
Whitmarsh	0	SK	Monitor
Swinomish Channel	2.75	SK, SW,WSDA	Mow, herbicide
Total Solid Acres Treated	**62.04**		

Map 6. Approximate Locations of all 2000 Skagit County *Spartina* Treatment Sites



San Juan, Clallam, Jefferson, Kitsap, King Counties

In 2000, the San Juan County Noxious Weed Board Coordinator (SJC) conducted surveys and dug *Spartina* at one site, Argyle Lagoon. Map 7 shows where these surveys and dig took place. WSDA hired a roving crew to work in Clallam, Jefferson, Kitsap and King counties. Map 8 shows the locations of all 2000 WSDA treatment sites. The U.S. Navy assisted WSDA with control on the Indian Island infestations. Table 9 shows the solid acres treated, who did the treatment and the treatment methods used on every site in San Juan, Clallam, Jefferson, Kitsap, and King counties.

Map 7. Approximate Locations of 2000 San Juan County *Spartina* Treatment/Survey Sites

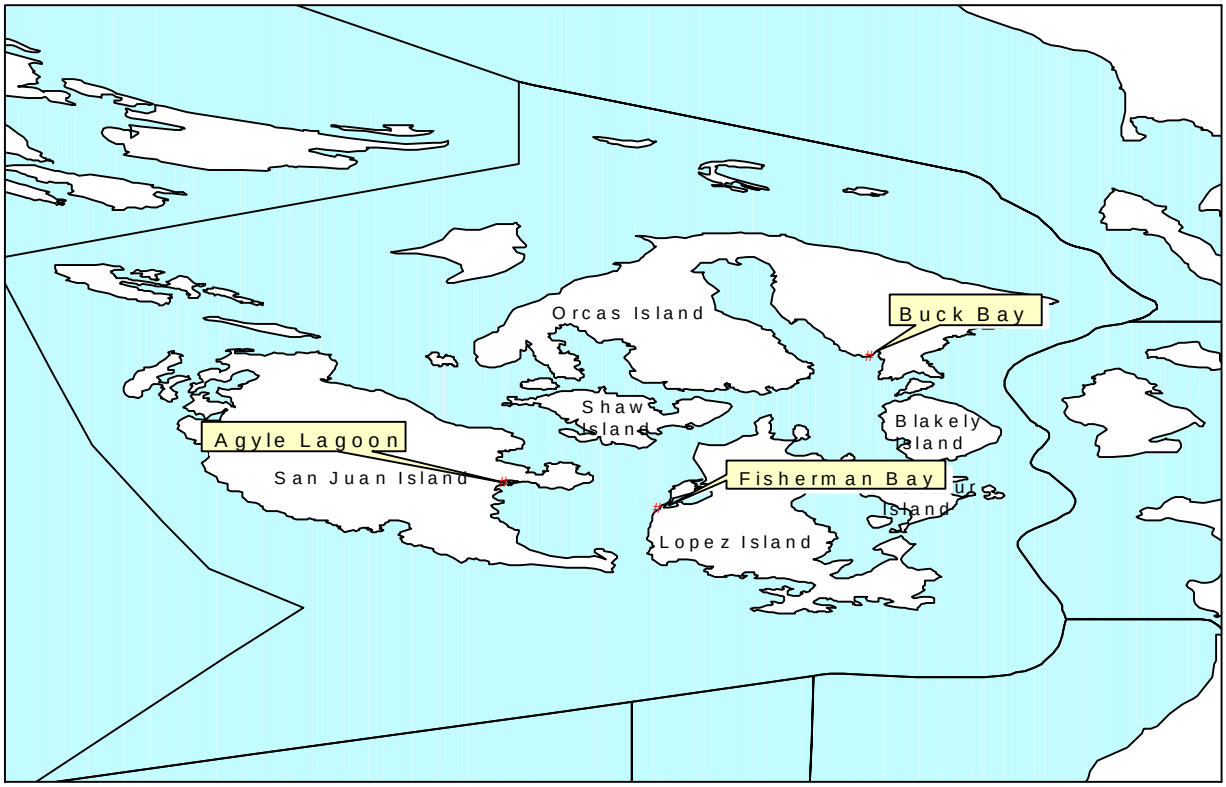
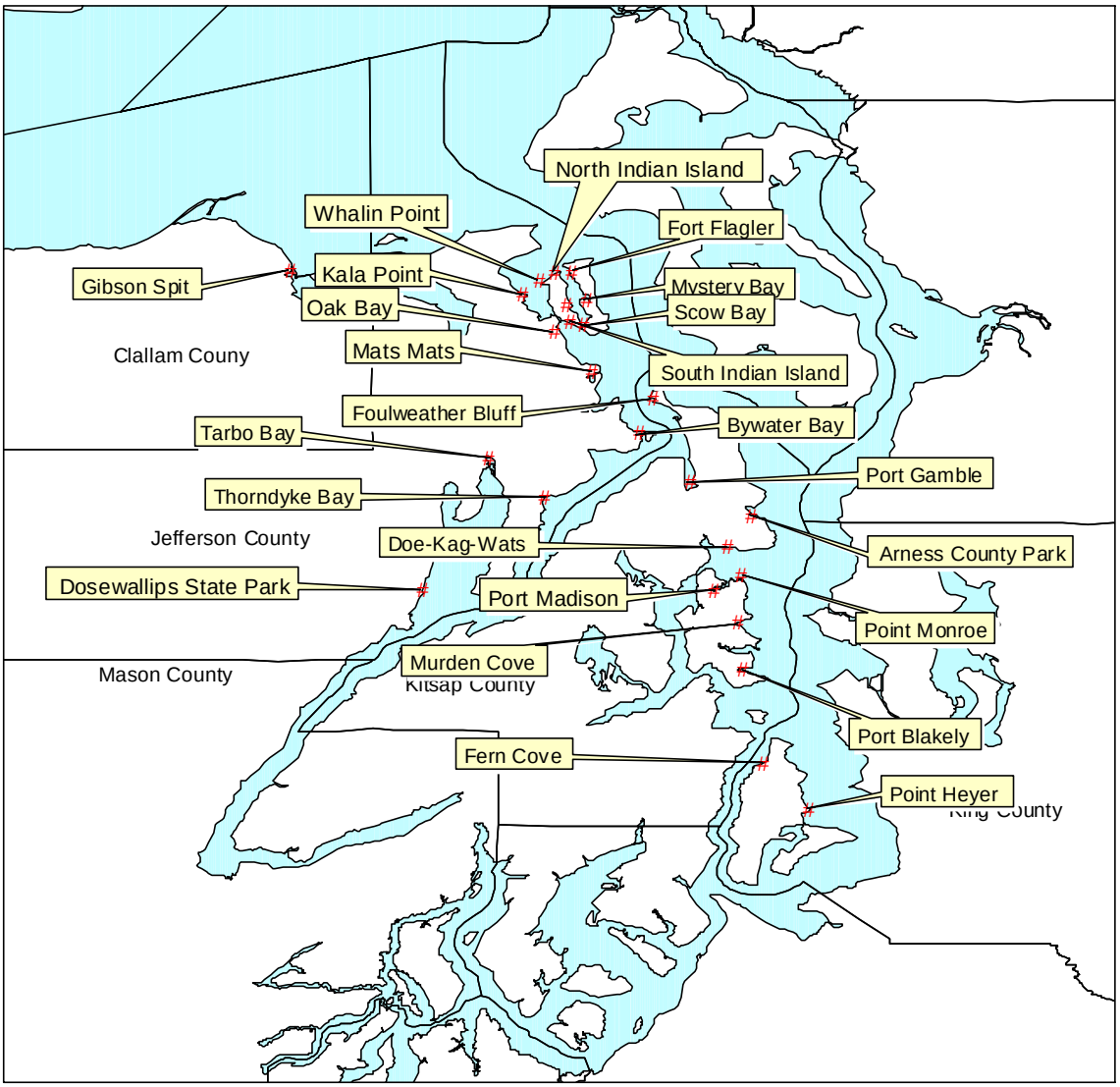


Table 9. Summary of 2000 *Spartina* Eradication Effort in San Juan, Clallam, Jefferson, Kitsap and King Counties

Site	Solid Acreage Treated	Entity Conducting Treatment	Treatment Method used
San Juan County			
Argyle Lagoon	0.001	SJC	Dig
Fisherman Bay	0	SJC	Monitor
Buck Bay	0	SJC	Monitor
Clallam County			
Gibson Spit	0.001	WSDA	Mow/herbicide, dig
Jefferson County			
Dosewallips State Park	0.001	WSDA	Herbicide, dig
Thorndyke Bay	0.001	WSDA	Dig
Tarboo Bay	0	WSDA	Monitor
Oak Bay	0.001	WSDA	Dig
Mats Mats	0	WSDA	Monitor
Scow Bay	0.001	WSDA	Dig
Whalin Point	0.01	WSDA/Navy	Dig
Kala Point	0.2	WSDA	Mow, dig
Bywater Bay	0.001	WSDA	Dig
South Indian Island	0.001	WSDA	Dig
North Indian Island	0.25	WSDA/Navy	Herbicide, dig
East Indian Island	0	Navy	Monitor
Fort Flagler	0.001	WSDA	Dig
Mystery Bay	0.001	WSDA	Dig
Kitsap County			
Murden Cove	0.001	WSDA	Dig
Blakely Harbor	0	WSDA	Monitor
Point Monroe	0.001	WSDA	Dig
Foulweather Bluff	0.1	WSDA	Mow/herbicide, dig
Port Gamble	0.001	WSDA	Dig
Doe-Kag-Wats	1.5	WSDA	Mow
Arness Park	0.001	WSDA	Dig
Port Madison	0.25	WSDA	Dig
King County			
Fern Cove	0	WSDA	Monitor
Point Heyer	0.001	WSDA	Dig
Total Solid Acres Treated	**2.3**		

Map 8. Approximate Locations of all 2000 Clallam, Jefferson, Kitsap and King county *Spartina* Treatment and Monitoring Sites



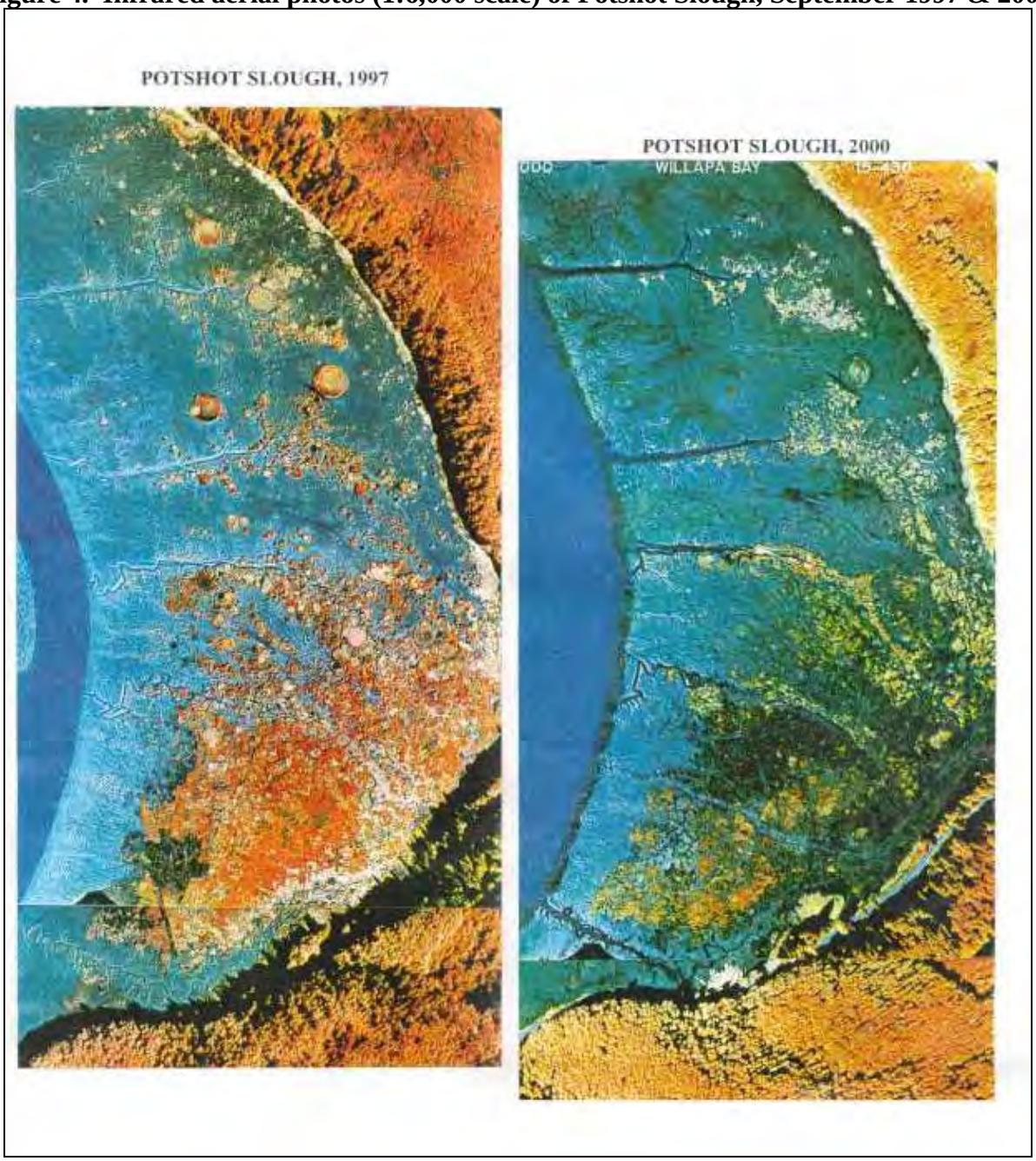
WSDA crews substantially reduced all known infestations in Clallam, Jefferson, Kitsap and King counties the past three years. With the exception of the Doe-Kag-Wats infestation located on the Suquamish Reservation in Kitsap County, all sites can be maintained relatively *Spartina*-free by surveying and digging new starts every year. The Doe-Kag-Wats infestation will require substantial labor to dig and mow since herbicide treatment is not an option on the reservation at this time.

Figure 1. *Spartina alterniflora* in Willapa Bay, Pacific County, Washington State

Figure 2. *Spartina patens* at Dosewalips State Park, Jefferson County, Washington State

Figure 3. *Spartina anglica* on Suquamish Reservation, Kitsap County, Washington State

Figure 4. Infrared aerial photos (1:6,000 scale) of Potshot Slough, September 1997 & 2000



Note for Figure 4

In infra-red photography, plant foliage is visible in various shades of orange. The healthier the plant material, the darker orange it appears. In the photos of Potshot Slough, the vegetation located within the Bay (shown in blue) is *Spartina*; the orange vegetation along the shoreline is trees and shrubs. The white and yellowish areas in the 2000 photo are treated areas in the process of decomposing. All remaining live *Spartina* was treated after the photograph was taken and the agencies anticipate reprioritizing this site to maintenance level next year.

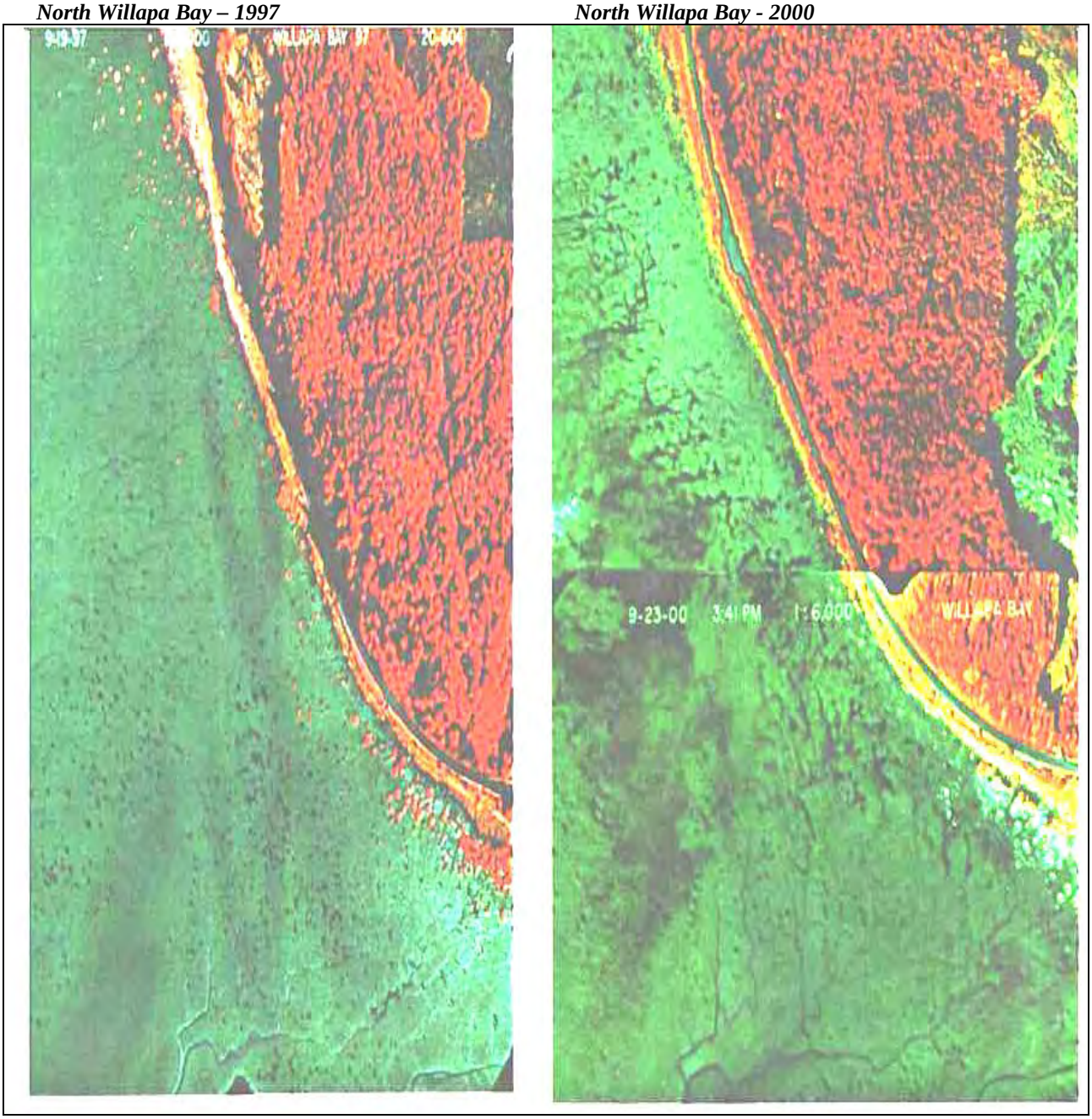
Figure 5. Infrared aerial photos (1:6,000 scale) of O'meara Point to the Bear River, September 1997 & 2000

Note for Figure 5

In the O'Meara Point to Bear River photograph set there were visible clones along the entire shorelines in 1997. After eradication work by DNR in 1998, 1999 and 2000, there were no visible clones in the 2000 photographs.

Figure 6. Infrared aerial photos (1:6,000 scale) of North Willapa Bay (section of shoreline adjacent to Hwy 505), September 1997 & 2000

North Willapa Bay – 1997 *North Willapa Bay - 2000*



Note for Figure 6

In the North Bay photograph set there were visible clones along the entire shorelines in 1997. After eradication work by WDFW in 1998, 1999 and 2000, there were no visible clones in the 2000 photographs.

Figure 7. Deer Lagoon, Whidbey Island, Before *Spartina* Eradication Effort in 1996

Figure 8. Deer Lagoon, Whidbey Island, After *Spartina* Eradication Effort in 2000

Figure 9. WSDA Otter Treating *Spartina* in Willapa Bay October 2000

Figure 10. Willapa Bay *Spartina* Clone before WSDA Otter Treatment

Figure 11. Willapa Bay *Spartina* Clone in Figure 10 immediately after Treatment

Figure 12. WSDA Otter Treating *Spartina* Infestation in Willapa Bay October 4, 2000

Figure 13. One-Acre Site Shown in Figure 13, November 16, 2000 (more than a month after Otter treatment)

New Developments and Challenges

Shellfish Glyphosate Residue Study

In October 1998, the Environmental Protection Agency (EPA) informed WSDA that further evidence was needed to demonstrate the rates specified in the Washington State Special Local Needs registration of the herbicide Rodeo® for *Spartina* eradication would not result in residues in excess of the established tolerance for glyphosate in shellfish.

With WSDA serving as project sponsor, the University of Washington (UW) School of Aquatic and Fisheries Sciences conducted a study titled *Tissue Residues of Glyphosate and Aminomethyl Phosphonic Acid (AMPA) in Shellfish Associated with Application of Rodeo® to Control Spartina alterniflora*. The study was done in compliance with Good Laboratory Practices (GLP) standards. The Washington Pesticide Registration Commission, USFWS, Monsanto Chemical Co., WDFW, WSDA and UW all contributed funding and other support to the study.

The study was conducted in spring and summer 2000 at the Batelle Pacific Northwest Laboratories in Sequim, Washington. Based on this research, UW researchers reported that higher application rates specified on the 1998 Washington label for *Spartina* control would "…not likely result in tissue concentrations of glyphosate that exceed the current tolerance for edible tissue (3.0 ppm wet weight)." The UW researchers also reported their results were consistent with several other recent studies which found "primary concerns associated with the control of *Spartina* in Willapa Bay and other West Coast estuaries are not related to chemical or other control strategies and their non-target effects, but to the continued spread of the exotic grass and the subsequent loss of mud flats, eel grass (Zostera japonica), and high elevation salt marsh."

Mechanical Control of *Spartina*

Spartina infestations throughout Willapa Bay have been expanding exponentially in past years primarily due to the difficulty in controlling large meadows. Past work by WSDA and USFWS has demonstrated that the technology was available to mow these large infestations. However, mowing, alone, does not eradicate *Spartina*. In order to achieve eradication, the mowed out areas must be treated with a combination of other methods including herbicide applications and digging, at a cost of approximately $1,500 to eradicate one solid acre of *Spartina*.

WSDA and its partners learned a key lesson from the amphibious mowing machine projects – disrupting the root mass of *Spartina* effectively kills it. A local Willapa Bay clam farmer and crab fisherman, Mr. Ernie Soule, demonstrated this concept on a small scale. Mr. Soule effectively used a home-built ripping implement mounted to a tractor to rip and cut the roots of *Spartina* and kill it. Mr. Soule's major limitation was lack of traction with his wheeled tractor.

August through October 2000, WSDA researched, purchased, re-fabricated and operated a small used vehicle called an Otter Remote Access Tracked Vehicle (Otter). WSDA leased Mr. Soule's invented implement and attached it to the Otter via a hydraulic three-point hitch. Figure 9 *(see p.*

36) shows the WSDA Otter ripping, cutting and burying *Spartina* root mass in Willapa Bay October 2000.

In 30 hours of machine time, WSDA treated approximately five solid acres of *Spartina* in Willapa Bay and two solid acres in Puget Sound. Figures 10 and 11 *(see p. 36)* show a treated clone before treatment and immediately after treatment. The *Spartina* above and below ground material is cut into pieces and buried in the mud slurry by the implement.

Efficacy one month after Otter treatment appeared to be near 100% at the majority of treated sites in Willapa Bay. Figures 12 and 13 *(see P. 37)* show a one-acre *Spartina* infestation before and a month after WSDA Otter treatment.

The machine did have some problem with extremely dense mounded clones in Willapa Bay and mounded dredge spoil sites in Puget Sound. These types of infestations will require substantially more power to rip apart than the Otter possesses in its current configuration.

For the remainder of this biennium WSDA will:

- Re-fabricate the Otter with hydrostatic drive system and diesel engine. This will eliminate the majority of the mechanical problems and better utilize engine power by way of hydraulics.

- Resume activity full time in March 2001. Tides, weather and funding are not conducive to running the machine December through February.

- Treat approximately two solid acres of *Spartina* per day during the 2001 control season at areas identified in 2001 Willapa Bay *Spartina* Management Plan and possibly work into the WSDA Private Cost Share Program.

Biological Control of *Spartina*

In May 2000, state and federal permits were issued to the University of Washington's Olympic Natural Resource Center (ONRC) to allow release of the planthopper *Prokelisia marginata* as a biological control agent to combat *Spartina alterniflora* in Willapa Bay. In anticipation of the permits, a University of California – Davis researcher, Dino Garcia Rossi, began carefully cultivating a starter population of 1,500 parasite-free and disease-free Prokelisia in late 1999. On June 20, 2000 Mr. Garcia-Rossi carried the insects on board a flight from California in small cages. He transported the starter population directly to a green-house specially designed for the project at the Pacific Coast Cranberry Research Foundation facility in Long Beach, Washington.

Once at the green house in Long Beach, ONRC Biological Control Specialist Dr. Fritizi Grevstad, Research Assistant Deanna McQuarrie, and Mr. Garcia-Rossi sorted the insects by gender and placed them in small vials. The vials were placed into cages containing *Spartina* within the green-house and opened. The planthoppers multiplied rapidly and by the last week in

July sufficient numbers had been reared to allow 9,000 to be transferred into field release cages. Approximately 2,000 were left in the greenhouse for continued rearing.

Dr. Grevstad placed an initial population of 1,500 insects in two cages at three sites in Willapa Bay August 1, 2 and 3, 2000. All three sites were secluded, relatively protected areas with large dense *Spartina* infestations. None were visible from the road or from common boat routes. Additional releases of approximately 750 insects per cage were made during the second week in September.

Between September 26 and 28, Dr. Grevstad opened the cages and released the insect into the environment in Willapa Bay. Almost all of the original nymphs had become adults and there were large numbers of egg scars on the *Spartina* leaves within the cages. As of November 15, the insects released from the cages had dispersed and/or died off. Most of the eggs hatched and the new nymphs were moving to protected wintering sites. They had also survived a couple of frosts and storms so the outlook for winter survival is good.

North Puget Sound Permit Appealed

On June 30, 1999, DOE issued a new, two-year water quality permit for use of Rodeo® for *Spartina* eradication in North Puget Sound. This permit was the first of the six regional permits to incorporate changes authorized by Senate Bill 5670 (Chapter 11, Laws of 1999 1st Special Session). Among other provisions, Senate Bill 5670 established conditions for *Spartina* water quality permits, including a maximum wind speed of ten miles per hour and a minimum drying time of four hours between application and tidal inundation. Where appropriate, herbicide applications under this permit commenced in July 1999.

The North Puget Sound permit was appealed on July 23, 1999 by several groups opposed to herbicide use. Grounds cited in the appeal include procedural matters and concerns over adherence to federal statutes, particularly the Clean Water Act. A stay was also requested. The Pollution Control Hearings Board denied the petition for stay on October 7, 1999 and eventually the entire appeal, granting Summary Judgment in favor of WSDA DOE January 26, 2000. However, the process consumed substantial WSDA staff time, directly affecting the *Spartina* eradication program statewide in 1999 and 2000.

Recommendations for the Future

The Puget Sound Water Quality Action Team identified *Spartina* as a key indicator of Puget Sound health in its widely released publication *Puget Sound's Health 2000*. The Washington State Conservation Commission identified *Spartina* as a serious threat to salmonid survival in the Stillaguamish and Island County Water Resource Inventory Areas (WRIAs) at the beginning of 2000. A valuable shellfish industry is in danger of being wiped out in Willapa Bay because of habitat loss associated with *Spartina* colonization.

Research indicates that the number one factor contributing to the endangerment of any species is habitat destruction; the number two factor is introduction of non-native species. *Spartina* is a

non-native species that destroys habitat. *Spartina* has the potential to invade every mud flat, cobblestone beach and salt marsh in Washington State if allowed to grow uncontrolled. To date, *Spartina* has already impacted more than 8,000 acres in Puget Sound and approximately 16,000 acres in Willapa Bay.

Strategies for eradicating *Spartina* have evolved over time with treatment efforts each year being built on the results of the previous years' effort. Equipment to access and treat *Spartina* has also evolved. The agencies now use airboats to transport equipment and personnel, large scale amphibious mowing machines to stop seed production, small tracked vehicles to shred and rip apart isolated infestations, high pressure spray systems to treat large clones and fringes of meadows and volunteers, landowners and students to dig seedlings. Because of these new tools and our experiences the past few years, we feel more than ever that it is possible to eradicate *Spartina* from Washington State provided adequate resources are available. To achieve this goal, WSDA is requesting an additional $1,480,000 for *Spartina* eradication statewide during the 2001-2003 biennium.

WSDA's proposal expands on the current successful cooperative efforts in Puget Sound and Grays Harbor and brings new mechanized eradication tools to the efforts in Willapa Bay, including a tool with the ability to eradicate the larger meadows that are producing the majority of the seed in the Bay.

Specifically, the WSDA proposal provides additional funding to:

- Double the current Interagency Agreement dollar amounts and work plans in Skagit, Island and Snohomish counties.

- Double the current Interagency Agreement dollar amount and work plan with WDFW for eradication of the outlying *Spartina* clones in Willapa Bay and Grays Harbor.

- Hire, equip and support four *Spartina* crew members six months each year for *Spartina* eradication work in Clallam, Jefferson, Kitsap, Mason, Thurston, Pierce and King counties. This crew will also be responsible for survey of Whatcom and San Juan counties and for coordinating treatment of *Spartina* infestations on tribal property.

- Purchase, equip, staff and operate two additional remote access tracked vehicles equipped with sub-soil implements to use for ripping *Spartina* root mass.

- Contract for eradication of 1,000 acres of solid *Spartina* in meadows in Willapa Bay each year, with a contract performance guarantee of 80% eradication. WSDA is aware of at least one company, based out of Lawrence, Kansas, that is interested in building a large machine modeled after one they currently use to carry out submerged aquatic vegetation management projects for state and federal agencies in Texas, Florida and Vermont.

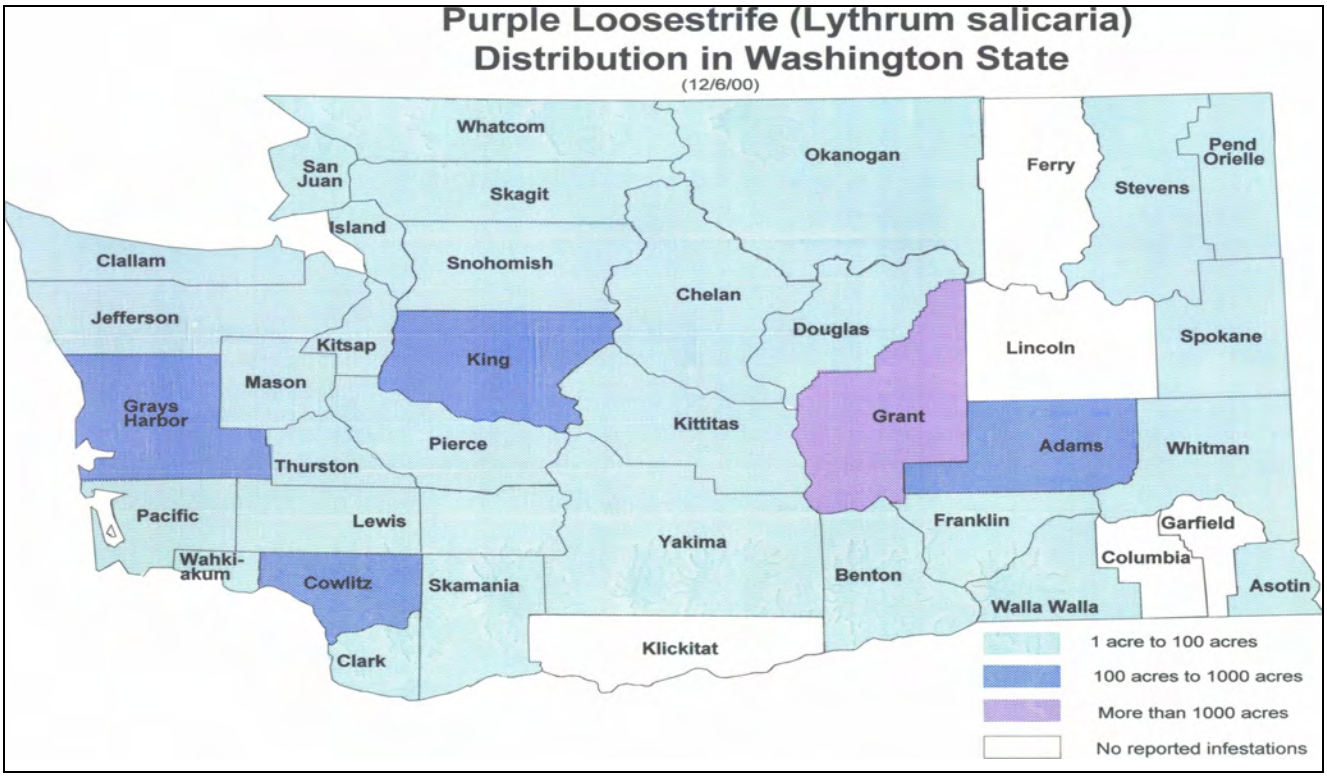
The WSDA proposal eradicates all known infestations of *Spartina* in Puget Sound, Hood Canal and Grays Harbor over a period of four years and begins the first real reduction in Willapa Bay, eradicating nearly a quarter of the 4,000 plus solid acres of *Spartina* in the first two years. With no additional funding, we project the *Spartina* in Willapa Bay will continue to spread substantially, increasing from an estimated 4,600 solid acres at the end of FY01 to more than 11,000 solid acres at the end of FY07. In Puget Sound and Grays Harbor, we will eradicate *Spartina* at a rate of 2.5% per year with a minimal reduction in solid acres from approximately 850 acres at the end of FY01 to 730 acres at the end of FY 07.

PURPLE LOOSESTRIFE CONTROL PROGRAM

Introduction

Purple loosestrife infests several thousand acres of vital riparian habitat in Washington State and is known to occur in 34 of 39 counties (Map 9). The largest infestations are found in Grant County. Actual infested acreage is difficult to estimate due to the large area involved and the remote locations of many sites. A statewide inventory of purple loosestrife would be beneficial but expensive to complete.

Map 9. Distribution of Purple Loosestrife in Washington State.



WSDA and other weed control agencies have explored many control options including hand pulling, mechanical control (cutting and mowing), burning, water level manipulation, covering small infestations with black plastic, herbicides and biological control agents. The size and location of the infestation often dictates the most effective method of control. The areas that purple loosestrife inhabits are very sensitive to disturbance. Removing large plants usually opens up the area for a flush of seedling plants the following season that must be dealt with.

In Washington, small infestations of purple loosestrife are often controlled by hand pulling the entire plant or by removing the flower heads before viable seed have been produced. The latter method has the disadvantage of leaving the adult plant in place but does serve to eliminate the spread by seed. A permit from WSDA is required to transport and dispose of removed plants and plant parts. This is required to ensure that new infestations are not created from the removed

plants. WSDA provides these permits to applicants at no cost. These sites are usually located in areas where large-scale colonization has not occurred or is not possible.

In areas where infestations are larger, hand pulling usually becomes too labor-intensive and costly to be feasible. Herbicides are used to treat areas that are too large to hand pull. Glyphosate is the herbicide most commonly used for the control of purple loosestrife. Glyphosate works well for controlling purple loosestrife plants but is a non-specific systemic and, when broadcast sprayed, can harm other vegetation in the area. 2,4-D is another approved herbicide in very limited areas. 2,4-D has the advantage of being selective for broadleaf plants, such as purple loosestrife, and does not harm monocot species that comprise many important aquatic perennial plants such as cattails. Very large infestations, where it is not financially or biologically feasible to treat with herbicides, are treated with biological control agents. In these areas there are simply too many plants to treat with other currently available control methods.

The overall purple loosestrife control program in Washington State is comprised of several parts including the following activities:

- Ongoing education of the public about the threat posed by purple loosestrife is the first step in reducing the spread in Washington State. Many federal, state and county agencies are involved in this continuing process.

- New introductions of purple loosestrife, which is sometimes sold as an ornamental, have been limited by the WSDA quarantine against the sale and transport of plants both into and within Washington State. WSDA Plant Services Specialists inspect nurseries to ensure that plants are not being sold.

- Small outlying infestations are being identified earlier and treated manually or with herbicides to eradicate and eliminate the spread of these populations.

- The large infestations, such as the Winchester Wasteway area in Grant County, are being treated with biological control agents to reduce the density and limit the spread of the infestations.

Basic Program Components

The WSDA Purple Loosestrife Control Program has several basic components including budget, water quality permits, cooperative projects, regulatory programs and biological control programs. These activities are detailed in this section of the report.

Budget

WSDA again allocated $100,000 of its appropriation from the ALEA account for purple loosestrife control activities this biennium. Table 10 shows projected expenditures for FY00 and FY01.

Table 10. Purple Loosestrife Anticipated Budget Activity for the 2000-01 Biennium

Activity	$ Allocated by WSDA for the 2000-01 Biennium
WSDA Coordination and control activities	$46,000
Biological Control Contract with WSU	$50,000
Equipment purchases	$4,000
TOTAL	**$100,000**

Water Quality Permit for Herbicide Control

Activities for 2000 included preparing the necessary documents for one statewide water quality permit. In 2000, the purple loosestrife permit covered not only purple loosestrife but also seven other species of noxious weeds that can infest wetland sites. WSDA is the lead agency for herbicide applications to control these noxious weed species in a manner similar to the *Spartina* program. This permit allows herbicide treatment (Rodeo® and in some instances 2-4,D) for purple loosestrife, wand loosestrife, garden loosestrife, saltcedar, indigobush, Japanese knotweed, reed canarygrass and meadow knapweed in aquatic or semi-aquatic sites throughout the state.

WSDA issued coverage under the permit to 46 individuals and agencies in 2000. All geographic areas of the state were represented. This year more than 2000 affected acres were treated for purple loosestrife under the WSDA permit. In addition, more than 300 acres of the seven other species of noxious weeds listed on the permit were treated.

Cooperative Projects

WSDA continues to partner with WDFW to control purple loosestrife and *Spartina* on approximately 50 acres of Bureau of Land Management (BLM) lands in Skagit County. The BLM land is adjacent to WDFW land in a remote area near the mouth of the Skagit River. WDFW staff conducts the control work and BLM funds part of the effort through its contract with WSDA. This cooperative effort saves time and money for both land managing agencies. WSDA issued permits for manual control projects to allow movement of plants to disposal sites in 2000. These permits are required for compliance with the *Lythrum* (purple loosestrife) quarantine (WAC 16-752-400).

WSDA enhanced county noxious weed control board activities by purchasing equipment such as small boats and canoes. This equipment is used to survey and control purple loosestrife infestations as well as collect and re-distribute biological control organisms. The Washington State Noxious Weed Control Board suggested the purchase of this equipment. Small watercraft, including canoes and a 12-foot-boat with an outboard motor, were purchased in 1997 and are stored and maintained by the Skagit, Pend Oreille and Benton County Noxious Weed Control Boards.

In 1998, WSDA purchased an eighteen-foot boat capable of navigating on the Columbia River. The Thurston County Noxious Weed Control Board stored and maintained the boat in 2000. All of the boats purchased by WSDA are available to weed control agencies by request. WSDA has also purchased other equipment including backpack sprayers, weed wrenches and boat-mounted sprayers for use by weed control entities.

In cooperation with county noxious weed control boards and the Washington State Noxious Weed Control Board, WSDA continues to develop and maintain a database and mapping system to assist in tracking purple loosestrife infestations, control efforts and biological control distribution. WSDA obtained funds for the mapping software through a grant from the United States Department of Agriculture - Cooperative Agricultural Pest Survey (CAPS) program. WSDA is currently in the process of mapping known purple loosestrife locations. Biological control agent release sites have been mapped since 1996. WSDA is currently mapping the 1999 sites. In 1998, WSDA purchased ArcView® Geographic Information System (GIS) for its Noxious Weed Program. WSDA plans to enter purple loosestrife data into GIS in 2001. This will facilitate the sharing of information between local, state and federal agencies, most of which are already using similar GIS technology. WSDA will map some of the more extensive purple loosestrife infestations using Global Positioning System (GPS) technology in 2001. WSDA purchased a Trimble GeoExplorer GPS unit in 1996 that is used by weed staff and is also available for counties to use.

WSDA participates in the Chehalis River Task Force, which is attempting to control noxious weeds, including purple loosestrife, in the Chehalis River Drainage. Approximately 100 acres on 51 different sites have been identified to date. These are under varying control programs depending on jurisdiction. WSDA also participates in the Yakima River Purple Loosestrife Task Force and the Mid Columbia Purple Loosestrife Management Project, which is addressing the problem of purple loosestrife in the Yakima River Drainage and the Mid Columbia region. WSDA provided herbicide and equipment to the project in 2000, as well as use of WSDA boats.

WSDA continues to work with weed control entities and private groups to control purple loosestrife using non-chemical methods. Instructional manuals, hand clippers, plastic bags and "weed wrenches" are available for use by community groups who are manually controlling infestations in sensitive areas. WSDA has paid for the proper disposal of purple loosestrife plants in some instances where the costs were prohibitive to the volunteer groups.

In a cooperative effort with the Stevens County Noxious Weed Control Board, the Washington State Noxious Weed Control Board and WDFW, all purple and garden loosestrife sites at Loon Lake in Stevens County were controlled in 2000. The area was surveyed and mapped by staff from the Stevens County board and control was conducted by WDFW staff and a private contractor hired by WSDA and Washington State Noxious Weed Control Board. Cooperative efforts such as this allow for more efficient use of resources and more are planned for 2001.

Regulatory Program

WSDA has regulatory authority for noxious weed control in counties that do not have activated noxious weed control boards. In 2000, WSDA staff conducted control work in Kitsap, Mason and Douglas counties. Mason and Kitsap counties are currently in the process of activating boards, while Douglas County has opted not to activate a board at this time. In the absence of a board, WSDA staff worked closely with Washington State University Cooperative Extension personnel in Douglas County on weed issues in that county.

WSDA Plant Services Specialists routinely inspect nurseries and other retail outlets to help prevent the sale of purple loosestrife in Washington State. Nursery companies in other states are also notified that purple loosestrife plants cannot be sold into Washington State.

Biological Control Program

Given the extensive infestation of purple loosestrife in Washington State and the limited resources available to combat this invader, WSDA has chosen to place a strong emphasis on a biological control program. Two species of leaf beetles, *Galerucella calmariensis* and *G. pusilla*, and two species of beetles (weevils), *Hylobius transversovittatus* and *Nanophyes marmoratus*, have been released in Washington State. These biological control agents undergo extensive testing before they are allowed into the United States to ensure that they will only feed on the target species.

Galerucella were first introduced to Washington State in 1992. This native of Europe feeds on the buds and leaves of the plant causing skeletonizing and defoliation of host plants to the extent that plants are often killed. Heavily defoliated plants may die or produce fewer shoots the following year. *Galerucella* move fairly readily and quickly to neighboring infestations.

Hylobius transversovittatus is a native of Europe that was also introduced into Washington State in 1992. *Hylobius* larvae mine the roots of purple loosestrife while adults feed on the leaves. This species does not move far from its point of release necessitating manually transporting it from site to site.

Nanophyes marmoratus was introduced to Washington State in 1996. The initial weevils were obtained from the Oregon Department of Agriculture as part of a biological control agent exchange program. Larvae consume the stamens, petals and ovaries of unopened floral buds. Infested buds fail to open and drop from the plant. Adults feed on young leaves near the shoot tips and on flower buds when they begin to form. Flower buds, which are fed upon by either larvae or adults, usually abort and fail to produce seeds. Another species of *Nanophyes*, *N. brevis* has not yet been approved for introduction into the United States.

WSDA continued to contract with Dr. Gary Piper of Washington State University to raise, collect and release biological control agents for purple loosestrife in Washington State. In 1999 and 2000, Dr. Piper shifted the emphasis of his work from *Galerucella* to *Hylobius* and *Nanophyes*.

Galerucella is now well established and is spreading on its own as well as by field collections conducted by other agencies. Several thousand *Hylobius* and *Nanophyes* were released in Washington State in 2000. Since 1996 when WSDA became involved in this project, more than 25 county, state, federal and tribal agencies have been the recipients of purple loosestrife biological control agents propagated at Washington State University.

For 2001, WSDA plans to again contract with Dr. Piper for biological control work with the emphasis placed on *Hylobius* and *Nanophyes* research, production and distribution. These two species are not as widely distributed in Washington State as the emphasis to date has been placed on *Galerucella*. *Nanophyes* shows great potential to further reduce purple loosestrife populations by feeding in the seed heads, reducing the tremendous amount of seeds produced by individual plants. Since *Nanophyes* has only been released in the field in Washington State since 1998, much work remains to ensure its distribution throughout the state.

WSDA again participated in a project initiated by the Washington State Noxious Weed Control Board to collect and redistribute *Galerucella* from the Winchester Wasteway area in Grant County to other areas of the state. This is the largest collection and redistribution of its kind in the United States. The *Galerucella* are having a significant impact on the purple loosestrife in the Winchester Wasteway area (see Figures 14 and 15 on page 49). WSDA purchased equipment for the project and made releases of these insects in Douglas and Yakima counties. More than 40 federal, state and county agencies participated in the project in 2000.

In 2000, WSDA continued to fund a pilot project in cooperation with the WDFW, the Washington State Noxious Weed Control Board, the King County Noxious Weed Control Board and the University of Washington for the rearing of *Galerucella* beetles in a mesh enclosure at the Center for Urban Horticulture in Seattle. WSDA hopes that *Galerucella* raised in western Washington will be more suitably acclimated to the environment thereby increasing their tolerance and survivability in the moister climate. Additionally, it may be more cost-effective to raise certain biological control agents for release rather than to collect them in the field. The project was much more successful in 2000 than in 1999. WSDA anticipates continuing this project, with some slight modifications, in 2001.

Recommendations for the Future

For 2001 WSDA plans to continue to take an integrated pest management approach to addressing the problem of purple loosestrife in Washington State and to continue the ongoing cooperative projects that have been successful to date. In addition, new control projects are being planned with Clark and Snohomish counties and others are still in the formative stage. WSDA is working on forming a purple loosestrife working group that will include federal, state, tribal and local land managing agencies, county weed control entities, research personnel and other interested parties to better address the problem of purple loosestrife in Washington State. This group will be able to combine resources and expertise and take a more coordinated approach toward the statewide planning, education and control efforts. An initial meeting is being planned for January 2001.

Figure 14. Photo taken in 1995 at Winchester Wasteway in Grant County (Bureau of Reclamation)

Figure 15. Photo taken in 1998 at same site as Figure 15 two years after *Galerucella* beetle establishment (Bureau of Reclamation)