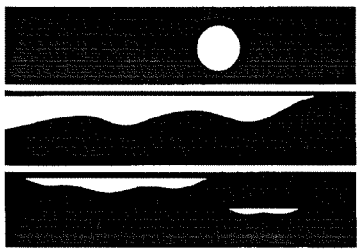

Aquatic Plants Technical Assistance Program

1996 Activity Report

May 1997
Publication No. 97-319

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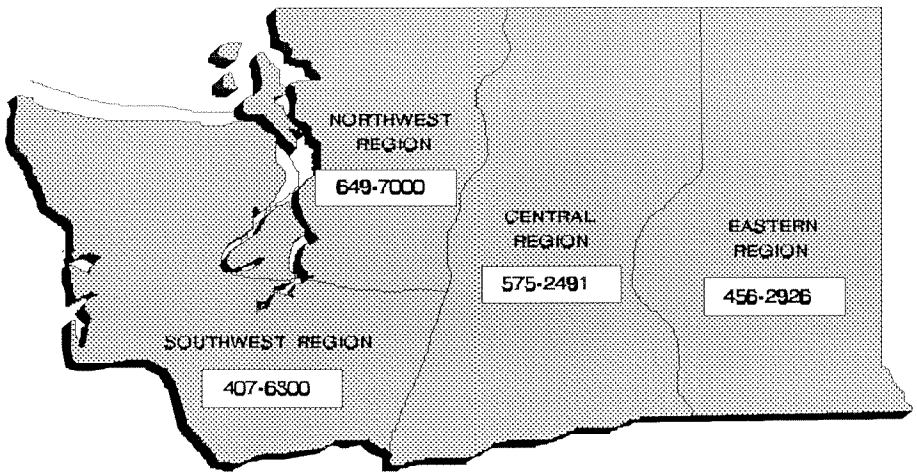

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Aquatic Plants Technical Assistance Program

1996 Activity Report

by
Jenifer Parsons

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Ambient Monitoring Section
Post Office Box 47600
Olympia, Washington 98504-7600

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Abstract

The objectives of the Aquatic Plant Technical Assistance Program are to provide advice on aquatic plant identification, biology, and management to government agencies and the public, to document aquatic plant distribution and habitat through site visits, and to assist with evaluating projects supported by Freshwater Aquatic Weed Program grant money.

During the 1996 field season aquatic plant data were gathered during 92 site visits to 88 waterbodies located throughout the state. Several previously unknown populations of non-native aquatic plants were recorded during the field season. These included 11 previously unknown populations of *Myriophyllum spicatum*, one population of *Egeria densa*, and two populations of *Myriophyllum aquaticum*. Other accomplishments during 1996 included gathering additional plants for the herbarium collection, providing educational and technical outreach, reviewing 16 project applications for Freshwater Aquatic Weed Program grant money, and providing assistance and editorial comments for the "Aquatic Plant Field Identification Guide" project.

Introduction

Legislative action in 1991 (RCW 43-21A.660) established the Freshwater Aquatic Weed Account to provide additional expertise on aquatic plant issues and a source of grant money for local aquatic plant management projects. The need for this program was recognized when the spread of aquatic plant problems in the state's public waters outgrew the ability of agency officials to adequately address them. To provide the technical expertise for aquatic plants, one full-time position was created within the Environmental Investigations and Laboratory Services Program of the Department of Ecology. This position was filled in February 1994. The objectives for this position are as follows:

- to provide technical assistance on aquatic plant identification and management to government agencies and the public;
- to conduct site visits to identify aquatic plants, evaluate plant community structure and identify the existence or potential for problems, particularly as they relate to invasive non-native aquatic plants; and
- to assist with rating grant applications to the Freshwater Aquatic Weed Account.

The purpose of this report is to document the progress of the Aquatic Plant Technical Assistance Program with respect to these objectives during 1996. Reports on the program's results from 1994 and 1995 are also available (Parsons 1995a; Parsons 1996a).

To simplify reporting, all plants are referred to by their scientific names. Table 1 lists the common names for the plants most frequently mentioned in the text.

Table 1. Scientific and common plant names

Scientific Name	Common Names
Cabomba caroliniana	fanwort
Egeria densa	Brazilian elodea
Hydrilla verticillata	hydrilla
Ludwigia hexapetala	water primrose
Lythrum salicaria	purple loosestrife
Myriophyllum aquaticum	parrot feather milfoil
Myriophyllum spicatum	Eurasian milfoil
Nymphaea odorata	fragrant waterlily

Technical Assistance

After the Freshwater Aquatic Weed Account was established, an external advisory committee identified technical assistance for aquatic plant taxonomy, ecology, and management as a high priority for the new Freshwater Aquatic Weed Management Program. Technical assistance was later defined as "Provid(ing) technical expertise within Ecology and to other agencies, local governments, lakes groups, and the general public regarding aquatic plant ecology and taxonomy, aquatic plant management, development of integrated aquatic plant management plans, and other aquatic plant management issues. Assistance will be provided through on-site visits, development of technical reports, participation in public workshops, and presentations to private and public groups and societies."

Providing technical assistance involves working with public and private sectors to develop a broad understanding of the roles aquatic plants play in the ecosystem and how human behaviors influence aquatic plant communities. Toward this aim I participated in several workshops, meetings, and conferences and wrote articles for various publications between January 1 and December 31, 1996 (Table 2). I have also assisted the public and local governments on an informal basis through phone conversations, identification of mailed plant specimens, and informal meetings which are not listed. In addition, much of the information the Department of Ecology has produced on aquatic plants in Washington is available on Ecology's web pages (http://www.wa.gov/ecology).

Table 2. Aquatic plant technical outreach activities - 1996.

Function	Date	Location	Role
Met with Lake Leland Improvement Club	01/03/96	near Quilcene, Jefferson County	Presented information on the biology and control of *Egeria densa*
Met with Thurston County Extension personnel	01/96		Edited aquatic plant section of Thurston County Native Plant Guide
Washington Lakes Protection Association newsletter	01/96		Article on *Egeria densa* biology
Meeting with representatives of the aquarium industry	01/10/96	Noxious Weed Control Board, Kent, Washington	Presented information on non-native aquatic plant distribution
Information brochure for aquarium industry	01/96		Provided information and write-up on non-native plants
Public pesticide consultant training	03/06/96	Bellevue, Washington	Attended course for recertification, presented by Washington Dpt of Agriculture
Reed Canarygrass Workgroup meeting	03/13/96	Thurston County	Initial meeting and discussion of invasive nature of *Phalaris arundinacea* (reed canarygrass).
Washington Lakes Protection Association newsletter	03/96		Article on *Nuphar lutea* biology
Aquatic Plant Workshop	03/23/96	Mason Lake Club, Mason Co	Presentation on aquatic plant identification and values

Function	Date	Location	Role
Nonindigenous Species Symposium	03/27/96	Portland, Oregon	Attended sessions
Western Aquatic Plant Management Society Annual Meeting	03/28-03/29/96	Portland, Oregon	Presented paper on non-native plants found in Washington, attended sessions, chaired a session
Botanical Electronic News	04/96		Wrote article on status of non-native plants found in Washington
South Sound Native Plant Society Meeting	05/03/96	Olympia, Washington	Presented program on aquatic plants
Pacific Biosnet list server	05/30/96		Wrote summary article on non-native aquatic organisms in the west
Met with visiting research fellow from Australia	06/10/96	Olympia, Washington	Discussed plant control issues, sampled Clear Lake, Pierce County
Met with Jefferson County Extension agent, local citizen	06/11/96 & 10/02/96	Leland Lake, Jefferson County	Observed *Egeria densa* spread, discussed options for control
Western Aquatic Plant Management Society Meeting Proceedings	06/96		Article on troublesome exotic aquatic plants in Washington
Met with regional Ecology personnel	06/19/96	Lk Steilacoom, Pierce County	Observed and discussed aquatic plants found in the lake
Washington Lakes Protection Association newsletter	07/96		Wrote article on biology and control of *Myriophyllum spicatum*
Met with Olympic National Park botanists	07/09-10/96	Clallam County	Discussed identification and distribution of aquatic plants, sampled Ozette and Crescent Lakes
Met with citizen, volunteer lake monitor	07/16/96	Alkali Lake, Grant County	Discussed identification and distribution of aquatic plants in central Washington
Met with citizen	08/02/96	Curlew Lake, Ferry County	Discussed identification of aquatic plants and population density issues
Island Lake Association Meeting	08/07/96	Shelton, Mason County	Presented results from aquatic plant survey regarding new population of *Myriophyllum spicatum*
Western Washington University Herbarium	08/15/96	Bellingham, Washington	Met with University Botanist, looked for historic specimens of invasive aquatic plants.
Met with Chelan County Noxious Weed Board personnel	09/16/96	Chelan County	Hand control of *Myriophyllum spicatum* in Wapato Lake
Washington Lakes Protection Association Annual Meeting	09/26-28/96	Spokane, Washington	Presented talk on the benefits and uses of aquatic plants
Washington Lakes Protection Association newsletter	10/96		Wrote article on *Elodea canadensis*

Site Visits

Introduction

This section documents aquatic plant surveys conducted during the 1996 field season. The general purpose of site visits was to identify aquatic plants (targeting exotic invasive species), evaluate plant community structure, estimate the extent of, or potential for, aquatic plant problems, and suggest possible management options. Another important aspect of site visits was to expand the aquatic plant database and herbarium collection.

Site Visit Objectives

The objectives for the 1996 site visits were as follows:

- to revisit selected lakes with exotic invasive plants in order to assess plant population changes since they were surveyed in 1994 and/or 1995;
- to revisit other selected lakes considered at high risk for a non-native plant invasion;
- to conduct field surveys in selected lakes that had not been surveyed by this program during previous field seasons;
- to confirm rare plant sightings from the 1994 field season; and
- to continue plant monitoring projects on selected lakes.

The 1996 Aquatic Plant Technical Assistance Implementation Plan (Parsons, 1996b) contains a more complete discussion of these objectives.

During site visits, meetings with concerned citizens or local government representatives were arranged if appropriate. If new populations of exotic species were found, the local weed board representative or county extension agent was contacted.

General Field Methods

For a detailed discussion of field methods and data quality control, refer to the Aquatic Plant Technical Assistance Final Quality Assurance Project Plan in Parsons (1995b). The main goal of field site visits is to create the most comprehensive species list possible for each waterbody. This facilitates the discovery of potentially problematic aquatic plants and provides baseline aquatic plant information. For most lakes the method used is to circumnavigate the littoral zone in a small boat. When a different plant or type of habitat is observed, samples are collected for identification using a weighted rake, by hand-pulling or by visual observation. In addition, notes on species

distribution, abundance, and maximum growth depth are made. This method was recommended by other aquatic plant researchers (Sytsma, 1994; Warrington, 1994) and was used successfully during the past two years. However, because the surveys are conducted from the surface, small populations of any plant species may be overlooked.

Some water quality and sediment hardness (penetrability) data were collected on selected lakes (Table 3). This was ancillary to the plant data, so frequency of sample collection was limited by time and logistical constraints. These parameters were chosen because they have been shown to influence plant community type (Srivastava *et al.*, 1995; Barko *et al.*, 1991; Smart, 1990; Barko and Smart, 1986; Barko, 1985; McKenna, 1984; Kadono, 1982; Hellquist, 1980) and because of their ease in collection. The alkalinity samples were collected in open water to minimize the diel influence of macrophytes. Alkalinity was measured using a Hach field test kit model AL-DT with a digital titrator to determine phenolphthalein and total alkalinity as $CaCO_3$. Secchi depth was also measured in deep open water. Sediment penetrability data were collected in the littoral zone using an impact penetrometer designed for lake sediments (Coley *et al.* 1994). The penetrometer was tested on different substrate types for replicability of results during the 1995 field season.

Table 3. Summary of water quality and sediment analyses.

Parameter	Method	Method Precision
Alkalinity	Hach field test kit using Phenolphthalein and a digital titrator	± 10 mg/L
Secchi depth	visual observation	± 0.1 m
Sediment penetrability	impact penetrometer	± 1 cm

Field visits occurred between late spring and early fall to correspond with the time of maximal growth and flowering. Sampling locations were recorded with a written description, visual placement on a map, and with a Global Positioning System (GPS) unit.

Collections were made of any unusual plant species and of known or suspected exotic species. These were pressed, mounted, and retained in the herbarium collection (see Herbarium section in this report). All data were recorded on field forms and entered into a relational database (see Parsons 1995a for a database design description).

Aquatic Plant Survey Results

During the 1996 field season 92 site visits were made to 88 waterbodies. Highlights of results from these surveys are provided in the following section. In addition, several special projects will be discussed in subsequent sections. These include:

- the *Hydrilla verticillata* eradication project in Pipe and Lucerne Lakes;
- the status of selected weed eradication projects;
- the expansion of *Egeria densa* in Leland Lake;

- control efforts for *Myriophyllum spicatum* in Wapato Lake; and
- results from plant monitoring projects.

General Results

Table 4 lists the lakes where aquatic plant data were gathered during the 1996 field season, the extent of the survey conducted, and any plants of concern that were found. A similar table with data on the waterbodies sampled during the three years of this program is contained in Appendix A. Additional information on any of the listed waterbodies can be provided by the author upon request.

Table 4. Site visit and results summary table

County	Waterbody Name	WRIA	Date	Survey Extent	Plants of Concern
Chelan	Wapato Lake	47	06/24/96	whole littoral	*Myriophyllum spicatum*
			07/15/96	milfoil sites	
			09/16/96	milfoil sites	
Clallam	Beaver Lake	20	07/09/96	whole littoral	none
	Crescent Lake	19	07/10/96	4 sites	none
	Ozette Lake	20	07/09/96	3 sites	none
	Pleasant Lake	20	07/11/96	whole littoral	none
	Sutherland Lake	18	07/11/96	whole littoral	none
Cowlitz	Solo Slough	25	08/08/96	1 site from shore	*Egeria densa* *Ludwigia hexapetala* *Myriophyllum aquaticum*
Douglas	Jameson Lake	44	06/26/96	1 site from shore	none
Ferry	Curlew Lake	60	08/02/96	4 sites (launches)	none
Franklin	Snake River at Ice Harbor Dam	33	08/19/96	spot check, boat	*Myriophyllum spicatum*
	Snake River at Levey Park	33	08/19/96	spot check, boat	none
	Snake River, Lower Monumental Dam	33	08/20/96	spot check, boat	*Myriophyllum spicatum*
	Snake River at Windust Park	33	08/20/96	spot check, boat	none
Grant	Alkali Lake	42	07/16/96	whole littoral	none
	Banks Lake	42	06/25/96	spot check, shore	none
	Blue Lake	42	07/16/96	whole littoral	none
	Burke Lake	41	09/19/96	whole littoral	*Lythrum salicaria* *Myriophyllum spicatum*
	Deep Lake	42	06/25/96	whole littoral	none
	Dry Falls Lake	42	06/25/96	spot check, shore	none
	Evergreen Lake	41	09/18/96	whole littoral	*Lythrum salicaria* *Myriophyllum spicatum*
	Lenore Lake	42	07/17/96	whole littoral	none
	Park Lake	42	06/26/96	whole littoral	none
	Quincy Lake	41	09/17/96	whole littoral	*Lythrum salicaria*
Grays Harbor	Aberdeen Lake	22	07/22/96	whole littoral	none
	Quinault Lake	21	10/07/96	75% of littoral	none
	Sylvia Lake	22	07/22/96	whole littoral	none
Island	Cranberry Lake	6	09/05/96	spot check, shore	none
	Crockett Lake	6	09/04/96	spot check, shore	none
	Deer Lake	6	09/04/96	whole littoral	none
	Goss Lake	6	09/05/96	whole littoral	none
	Lone Lake	6	09/04/96	whole littoral	*Lythrum salicaria*

Jefferson	Anderson Lake	17	07/08/96	whole littoral	none
	Crocker Lake	17	06/11/96	whole littoral	none
	Leland Lake	17	06/11/96	whole littoral	*Egeria densa*
			07/02/96	whole littoral	
			10/02/96	whole littoral	
	Tarboo Lake	17	07/02/96	whole littoral	none
King	Pipe Lake	9	06/18/96	spot check, boat	*Hydrilla verticillata*
Kitsap	Horseshoe Lake	15	08/22/96	whole littoral	none
	Mission Lake	15	09/09/96	whole littoral	none
Kitsap/Mason	Tiger Lake	15	09/09/96	whole littoral	none
Lewis	Chehalis River	23	09/10/96	1 site from shore	*Myriophyllum aquaticum*
Mason	Benson Lake	14	07/23/96	whole littoral	none
	Island Lake	14	07/23/96	whole littoral	*Myriophyllum spicatum*
	Mason Lake	14	08/07/96	whole littoral	none
	Spencer Lake	14	08/22/96	south end, boat	none
Okanogan	Bonaparte Lake	49	08/27/96	whole littoral	none
	Crawfish Lake	52	08/28/96	whole littoral	none
	Duck (Bide-a-Wee) Lake	49	08/28/96	spot check, shore	none
	Leader Lake	49	08/29/96	whole littoral	none
	Omak Lake	49	08/28/96	north end, boat	none
	Sidley Lake	49	08/27/96	spot check, shore	none
	Spectacle Lake	49	08/27/96	whole littoral	none
	Whitestone Lake	49	08/26/96	whole littoral	*Lythrum salicaria* *Myriophyllum spicatum*
Pacific	Black Lake	24	08/08/96	spot check, shore	*Egeria densa*
Pend Oreille	Browns Lake	62	07/31/96	spot check, shore	none
	Davis Lake	62	07/30/96	north end, boat	*Myriophyllum spicatum*
	Diamond Lake	55	07/31/96	east end, boat	none
	Frater Lake	59	08/01/96	spot check, shore	none
	Half Moon Lake	62	07/31/96	north end	none
	Mill Lake	62	08/01/96	2 sites, shore	none
	Nile Lake	62	08/01/96	spot check, shore	*Myriophyllum spicatum*
	Pend Oreille River	62	08/01/96	spot check, shore	*Myriophyllum spicatum*
	Skookum Lake, North	62	07/31/96	spot check, shore	none
	Skookum Lake, South	62	07/31/96	whole littoral	none
	Sullivan Lake	62	08/01/96	north, south, boat	none
	Unnamed Wetland near Usk	62	08/01/96	shore	none
Pierce	Clear Lake	11	06/12/96	whole littoral	*Myriophyllum spicatum*
	Harts Lake	11	06/17/96	spot check, shore	*Myriophyllum spicatum*
			07/03/96	whole littoral	*Myriophyllum spicatum*
	Ohop Lake	11	07/25/96	whole littoral	*Egeria densa*
	Rapjohn Lake	11	07/25/96	whole littoral	none
	Silver Lake	11	06/17/96	spot check, shore	none
	Spanaway Lake	12	09/11/96	whole littoral	*Lythrum salicaria*
	Steilacoom Lake	12	06/19/96	spot check, boat	none
	Tanwax Lake	11	09/12/96	whole littoral	none
Skagit	Campbell Lake	3	08/13/96	whole littoral	*Myriophyllum spicatum*
	Erie Lake	3	08/13/96	spot check, shore	none
	Everett Lake	4	08/15/96	spot check, shore	none
	Heart Lake (35N-01E-36)	3	08/13/96	whole littoral	none
Snohomish	Shoecraft Lake	7	08/15/96	whole littoral	*Myriophyllum spicatum*
Stevens	Loon Lake	59	09/25/96	whole littoral	*Myriophyllum spicatum*
Wahkiakum	Columbia River at Skamokawa	25	08/08/96	spot check, boat	*Lythrum salicaria*
Walla Walla	Snake River at Charbonneau Park	33	08/19/96	spot check, boat	none
	Snake River at Fishhook Park	33	08/19/96	spot check, boat	none

	Snake River at Ice Harbor Dam	33	08/19/96	spot check, boat	*Myriophyllum spicatum*
	Snake River Lower Monumental Dam	33	08/20/96	spot check, boat	*Lythrum salicaria* *Myriophyllum spicatum*
Whatcom	Cain Lake	3	08/14/96	whole littoral	none
	Terrell Lake	1	08/14/96	whole littoral	*Lythrum salicaria*
	Wiser Lake	1	08/14/96	spot check, shore	none

The results of these surveys include discovery of seven previously unknown populations of *Myriophyllum spicatum* by aquatic plant technical assistance program personnel (Lake Sacajawea and Herbert G. West Lake on the Snake River; Lake Campbell, Skagit County; Harts Lake, Pierce County; Nile Lake, Pend Oreille County; Island Lake, Mason County; and Burke Lake, Grant County). In addition, four populations of *Myriophyllum spicatum* (Kress Lake, Cowlitz County; Loon Lake, Stevens County; Loomis Lake, Pacific County; and Hidden View Lake, Pierce County) one population of *Egeria densa* (Plummer Lake, Lewis County) and two populations of *Myriophyllum aquaticum* (private pond, King County; and a slough, Pierce County) were brought to my attention by the Weed Board and other state agency or local government personnel. Identification of these plants was confirmed through site visits or delivered plant material.

Figures 1, 2, and 3 illustrate where known populations of the noxious invasive aquatic plants *Myriophyllum spicatum*, *Egeria densa,* and *Myriophyllum aquaticum* occur in Washington. These include sites that have been visited by Aquatic Plant Management Program personnel and those reported by reliable sources. Also included are waterbodies where weed eradication efforts have been undertaken within the last five years. If no recurrence of the targeted weed occurs in five years, then the lake or pond will be removed from this list.

Figure 1. Known locations of *Myriophyllum spicatum* in Washington, 1996

County	No.	Waterbody Name	County	No.	Waterbody Name
Chelan	1	Chelan Lake	Klickitat	44	Columbia River, Bingen
	2	Cortez (Three) Lake		45	Columbia River, Maryhill
	3	Domke Lake		46	Horsethief Lake
	4	Wapato Lake	Lewis	47	Carlisle Lake
Clallam	5	unnamed pond		48	Riffe Lake
Clark	6	Caterpillar Slough		49	Swofford Pond
	7	Columbia River at Ridgefield	Mason	50	Island Lake
Cowlitz	8	Kress Lake	Okanogan	51	Okanogan River
	9	Willow Grove Slough		52	Osoyoos Lake
Franklin	10	Scooteney Reservoir		53	Whitestone Lake
	11	Snake River, Ice Harbor Dam	Pacific	54	Loomis Lake
	12	Snake River, Lower Monumental Dam	Pend Oreille	55	Davis Lake
Grant	13	Babcock Ridge Lake		56	Little Spokane River
	14	Banks Lake		57	Nile Lake
	15	Billy Clapp Lake		58	Pend Oreille River
	16	Burke Lake		59	Sacheen Lake
	17	Evergreen Lake		60	Trask Pond
	18	Moses Lake	Pierce	61	Clear Lake
	19	Potholes Reservoir		62	Harts Lake
	20	Stan Coffin Lake		63	Hidden Lake
	21	Winchester Wasteway	Skagit	64	Big Lake
	22	Winchester Wasteway Ext.		65	Campbell Lake
Island	23	Goss Lake		66	Clear Lake (34N-05E-07)
King	24	Angle Lake		67	McMurray
	25	Bass Lake		68	Sixteen Lake
	26	Desire Lake	Snohomish	69	Goodwin Lake
	27	Green Lake		70	Shoecraft Lake
	28	Lucerne Lake		71	Silver Lake (28N-05E-30)
	29	Meridian Lake		72	Stevens Lake
	30	Number Twelve Lake	Spokane	73	Eloika Lake
	31	Otter (Spring) Lake		74	Liberty Lake
	32	Phantom Lake	Stevens	75	Gillette Lake
	33	Pipe Lake		76	Heritage Lake
	34	Sammamish Lake		77	Loon Lake
	35	Sawyer Lake		78	Sherry Lake
	36	Shadow Lake		79	Thomas Lake
	37	Shady Lake	Thurston	80	Long Lake
	38	Ship Canal		81	Scott Lake
	39	Steel Lake	Wahkiakum	82	Columbia River, Cathlamet
	40	Union Lake	Walla Walla	83	Snake River, Ice Harbor Dam
	41	Washington Lake		84	Snake River, Lower Mon. Dam
	42	Wilderness Lake	Whatcom	85	Whatcom Lake
Kitsap	43	Long Lake	Yakima	86	Byron Lake

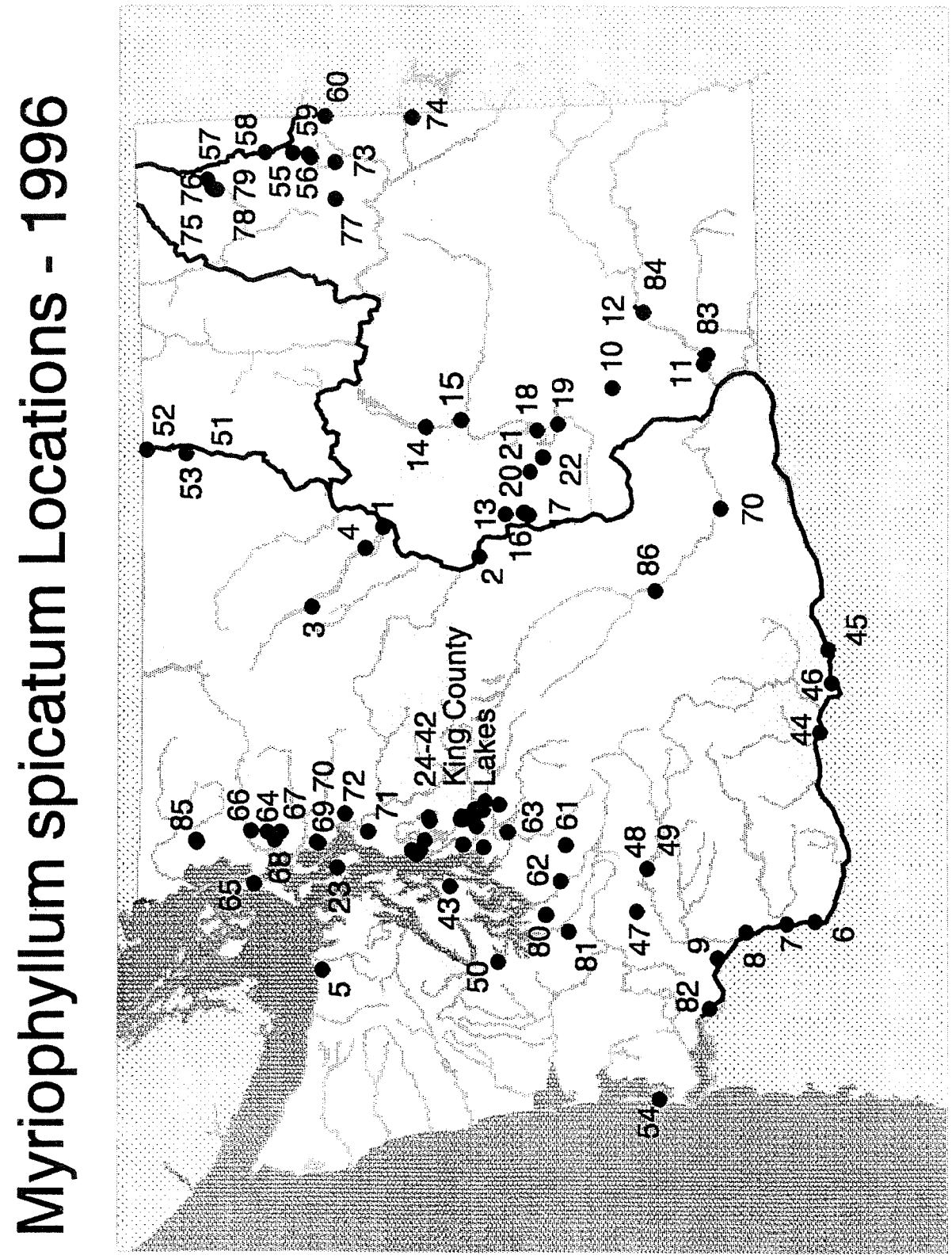

Figure 1. Known locations of *Myriophyllum spicatum* in Washington, 1996

Figure 2. Known locations of *Egeria Densa* in Washington, 1996.

County	No.	Waterbody Name
Clark	1	Battleground Lake
	2	Lacamas Lake
Cowlitz	3	Solo Slough
	4	Willow Grove Slough
Grays Harbor	5	Duck Lake
Jefferson	6	Leland Lake
King	7	Fenwick Lake
Kitsap	8	Long Lake
Lewis	9	Plummer Lake
Mason	10	Limerick Lake
Pacific	11	Black Lake
Pierce	12	Ohop Lake
Skagit	13	Big Lake
Snohomish	14	Swartz Lake
Wahkiakum	15	Puget Island Sloughs

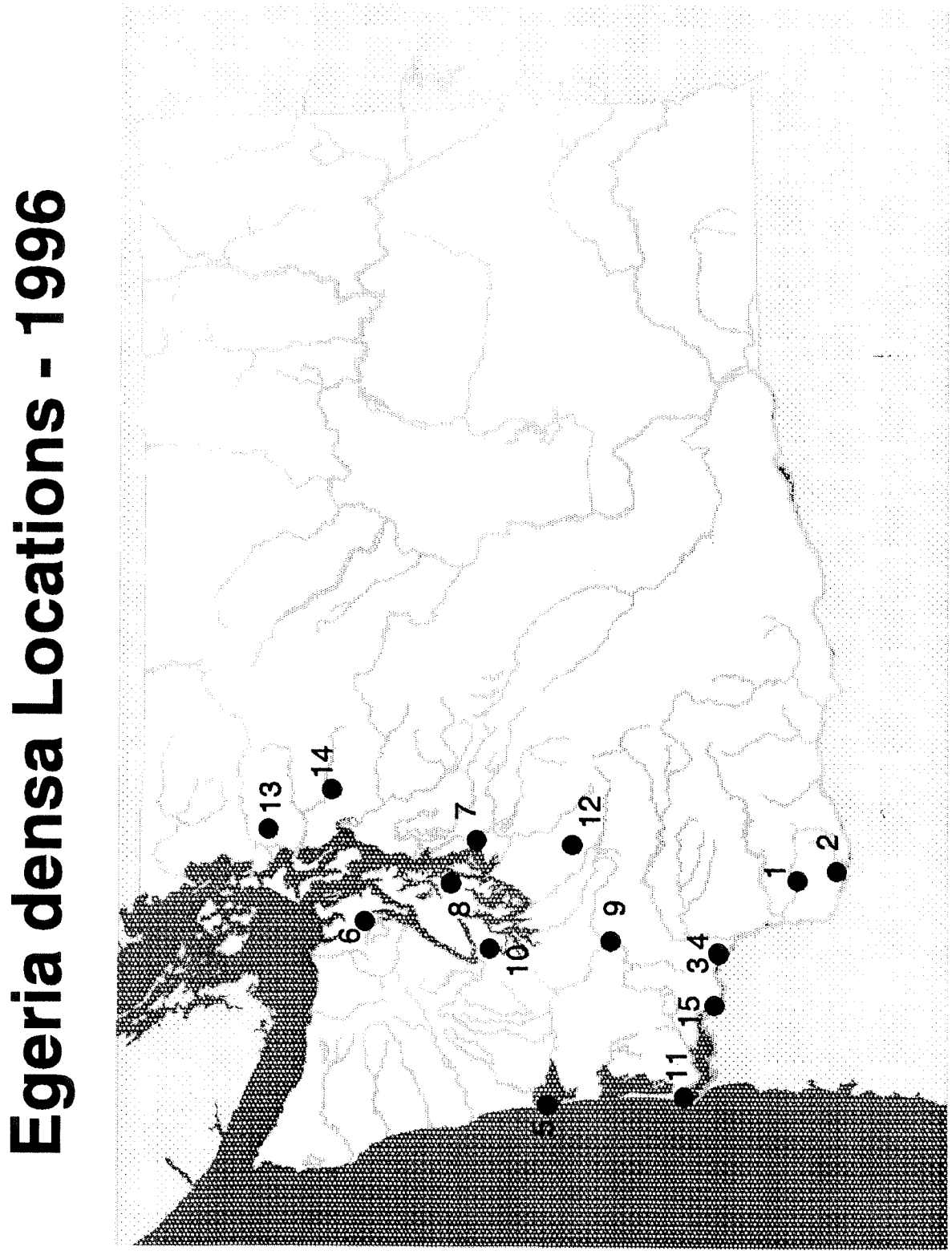

Figure 2. Known locations of *Egeria densa* in Washington, 1996

Figure 3. Known locations of *Myriophyllum aquaticum* in Washington.

County	No.	Waterbody Name
Cowlitz	1	Solo Slough
Island	2	Unnamed Pond (31N-02E-35)
King	3	Private Pond (24N-05E-11)
Lewis	4	Chehalis River
Pierce	5	Slough, Port of Tacoma
Snohomish	6	Nina Lake
Wahkiakum	7	Columbia River at Skamokowa
	8	Puget Island Sloughs

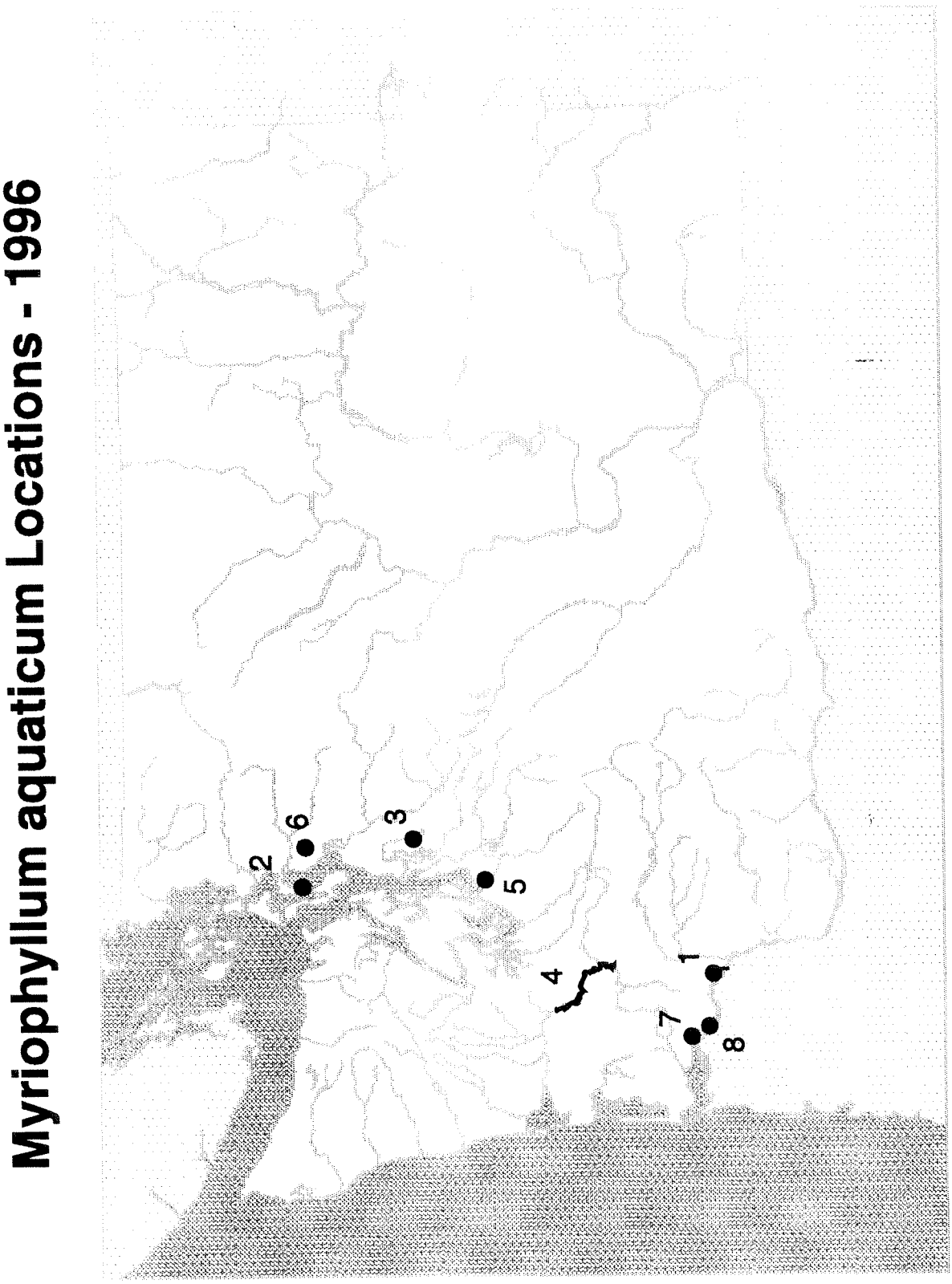

Figure 3. Known locations of *Myriophyllum aquaticum* in Washington

Hydrilla Verticillata - Summary of Activities

The presence of *Hydrilla verticillata* was confirmed in Pipe Lake (King County) on June 1, 1995. *Hydrilla* is an aggressive non-native aquatic plant which will out-compete the native vegetation if given the opportunity. Where it has become established (in the southern United States as far north as Connecticut and west to California) its rapid growth has radically changed aquatic environments. Millions of dollars are spent each year attempting to control its growth (Langeland, 1990; Anderson, 1987). Because this is the first known population of *Hydrilla* in the northwest, aggressive action has been taken to attempt its eradication.

The *Hydrilla* population is located in the 73 acre Pipe/Lucerne Lake system in southern King County (approximately 20 miles southeast of Seattle). Identification was confirmed in the early summer of 1995 by the presence of distinguishing tubers and through enzyme analysis conducted at the University of California, Davis. The enzyme analysis also indicated that this *Hydrilla* population is the monoecious variety (Ryan, 1995). At that time, the plants were well distributed throughout the lake, but were still in a pioneering stage. After the identification was confirmed, the Department of Ecology began working closely with personnel from King County Surface Water Management Division to decide on a plan of action. The sequence of events which ensued was led by King County personnel, and largely funded by the Department of Ecology's Aquatic Weed Management Fund. A summary of these events follows (for additional details on the events during 1995 see Parsons (1996a) or contact King County Surface Water Management personnel):

- June/July 1995. Soon after the discovery was made a public meeting was held for community members, the media were notified, and several television stations and newspapers reported on the problem.

- July 1995. A *Hydrilla* Task Force was formed from scientists experienced in dealing with *Hydrilla* in other parts of the country. The Task Force recommended treating the lake with aquatic herbicides and stocking sterile grass carp to eradicate the plant. Quarantining the lakes, screening the outlet, and posting signs about *Hydrilla* were also encouraged. (Note: the lakes are owned and managed by private community associations, so quarantining was not practical. Also, the outlet is seasonal and immaculately groomed by home owners, so any outgoing propagules would have little chance of survival. Therefore, screening was not undertaken.)

- July 1995. An experienced dive team mapped the *Hydrilla* population, finding up to 60% cover throughout the littoral zone. They also surveyed four lakes near Pipe/Lucerne Lakes to see if the plant had spread. No other populations of *Hydrilla* were found.

- July/August 1995. An emergency rule was developed to list *Hydrilla* as a Class A weed on the State Noxious Weed List. This action provided the State with more authority to control the plant.

- August/September 1995. The lakes were treated with the systemic aquatic herbicide Sonar®. The objective was to weaken the plants before they began setting tubers (which happens when day length shortens to less than 13 hours).

- August 1995. King County Surface Water Management personnel developed and posted informational signs at the boat launches.

- October 1995. Another public meeting was held. At that time, the *Hydrilla* looked weakened.

- May/June 1996. Divers surveyed the lakes to check for sprouting *Hydrilla* plants and to map their distribution. A much reduced population of 5 to 10 plants per square meter was observed (Sytsma, 1996; McNabb, 1996)

- June 1996. A public meeting was held to discuss the population status, and control options. Due to the wide distribution of the surviving plants, a second year of herbicide application was the chosen control method.

- July/August/September 1996. The lake was treated with the systemic aquatic herbicide Sonar®.

- September 1996. Divers surveyed the lakes and found only a few unhealthy *Hydrilla* plants.

- November 1996. A public meeting was scheduled, but canceled due to a power outage. An informational letter was sent to residents instead.

Hydrilla is an exceptionally tenacious plant, with many propagation strategies including tubers, turions, plant fragments, and seeds. The two years of herbicide treatment should have prevented development of new propagules or seeds. However, tubers which remain unsprouted in the sediment are not killed. Monoecious *Hydrilla* tubers will remain viable in the lab up to 4 years (Van and Steward, 1990). It is hoped that most of the tuber bank in Pipe/Lucerne Lakes sprouted during the spring of 1996, and that the second year of herbicide treatment killed the resulting plants. If this is the case, the population should be reduced to a level that can be controlled using non-chemical methods such as hand-pulling or bottom barrier installation. If the *Hydrilla* population is again too large for these methods, another chemical application or grass carp may be considered as control alternatives for 1997 (Walton, 1996).

Aquatic Weed Eradication Efforts

There are several Washington lakes that have undergone treatment efforts aimed at eradicating noxious aquatic weeds. Below is a discussion of those lakes where the targeted weed has not been observed for at least two years post treatment. Some of these lakes are still included on the aquatic weed distribution maps (Figures 1, 2, and 3) because it is generally felt by aquatic plant experts that the plant should not be observed for five years before the lake is declared weed free.

Goss Lake, Island County. Goss Lake is a deep 47 acre lake with high water clarity. It had a limited, though expanding population of *Myriophyllum spicatum*. In the summer of 1994 a whole lake treatment with an approved systemic herbicide was completed. Post treatment control included using bottom barrier on shoreline areas where the terrestrial form of *M. spicatum* was growing in response to draught induced low water levels. Surveys of the lake's littoral zone during 1995 and 1996 showed no evidence of *M. spicatum* regrowth. Monitoring should continue to ensure the early detection of any surviving milfoil.

Silver Lake, Cowlitz County. Silver Lake is a large (approximately 2,300 acre) shallow eutrophic lake. It had a widely distributed and dense population of *Egeria densa*, as well as a more limited distribution of *Myriophyllum spicatum*. In 1992, 83,000 grass carp were planted in the lake (Scherer *et al.*, 1995). By the summer of 1994 almost no submersed vegetation could be found in the lake. In the summer of 1996 this condition continued, with a marked decrease in water clarity as well. The only vegetation surviving in the lake is the large floating leaved plant *Nuphar lutea* (yellow waterlily) and the emergent *Menyanthes trifoliata* (bog buckbean). Even these robust species have been impacted and currently form less vigorous stands than in the past. Because grass carp are still present in the lake, it is assumed that the targeted weeds will not be able to reestablish.

Killarney Lake, King County. Lake Killarney is a 31 acre shallow productive lake which had a well established *Myriophyllum spicatum* population. However, for many years the lake was chemically treated to control both aquatic plant and algal growth. During the summers of 1995 and 1996 no *M. spicatum* was observed in the lake, so most likely it succumbed to the successive herbicide treatments. The lake should continue to be monitored for any recurring patches of this plant, or for a reintroduction from nearby lakes.

Steel Lake, King County. Steel Lake is 40 acres and of moderate depth. Until 1994 it had a well established population of *Myriophyllum spicatum*. During the spring of that year the *M. spicatum* population apparently crashed. The reason for the population crash is unclear and an illegal herbicide application was postulated. However, an unusually large number of the caddisfly larvae *Triaenodes injecta* were also noted. These insects have been attributed to *M. spicatum* declines in British Columbia (Winchester, 1994) and may have contributed to the apparent decline of this plant in Steel Lake. The lake home owners association decided to continue with their plans to treat the lake with a systemic herbicide that summer. In the summer of 1996 divers surveyed the lake, and no *M. spicatum* was observed (Renstrom, 1997).

Carlisle Lake, Lewis County. Carlisle Lake is a small (29 acres) shallow abandoned mill pond. It had a dense population of *Myriophyllum spicatum* which was treated with a systemic herbicide in early summer, 1994. Divers surveyed the lake during 1995, and by June of 1996 no *M. spicatum* was observed, yet several native aquatic plants were recolonizing the area (Wamsley, 1997).

Note on Long Lake, Thurston County. Long Lake had a dense population *of Myriophyllum spicatum*, and was treated with a systemic herbicide during 1991. Each subsequent year it was surveyed by a team of divers to look for surviving plants. In the two years after herbicide

treatment, hand pulling and bottom barriers were used to control the surviving *M. spicatum*. In 1994 no *M. spicatum* was found in the lake. However, in 1995 a patch of milfoil with characteristics resembling both *M. spicatum* and *M. sibiricum* was found (Thurston County, 1995). Since that time its identity as *M. spicatum* was confirmed. Though these plants may represent a reintroduction, their presence makes the success of the eradication effort questionable.

Egeria densa in Lake Leland

Lake Leland is a 110 acre shallow lake in rural eastern Jefferson County. It supports a diverse community of native vegetation which appears to host much wildlife. Casual observation disclosed newts laying eggs on native pondweeds, large duck flocks, and many wintering trumpeter swans. The fish biologist for this area stated that Lake Leland supports the best warm water fishery in the region (Collins, 1995). During the 1994 field season an isolated though well developed population of *Egeria densa* was discovered in the western end of the lake (Figure 4). Additional site visits were made in 1995 and 1996, and the *Egeria* population boundaries were recorded with a GPS unit and by visual placement on a map. During 1995 the population expanded throughout most of the isolated western end of the lake (Figure 5). By the fall of 1996 small pioneering clumps of *Egeria* were present in much of the lake's main body, and the western end contained a dense ring of this species between depths of 1 to 3 meters (Figure 6). The people living in the community are concerned about the impacts this plant will have on their lake, and are in the process of creating an Aquatic Vegetation Management Plan.

Myriophyllum spicatum Control in Wapato Lake, Chelan County

During the 1994 field season, a small patch of *Myriophyllum spicatum* was discovered growing near the boat launch in Wapato Lake (near Lake Chelan, Chelan County). In 1995 this patch was hand pulled on two occasions, and another larger patch was discovered near the dock at the private campground. In the late summer of 1996 Ecology staff and the Chelan County Noxious Weed Control Board personnel worked together to continue hand pulling efforts, and to place bottom barrier over the larger patch. It was discovered at that time that the larger patch of milfoil was spreading to areas around and under the dock. Those areas were also pulled. Because *M. spicatum* will regrow from root crowns (Aiken *et al.*, 1979), and because newly established fragments are very difficult to detect among the dense native plant growth, control efforts will need to be continued in future years if this population is to be contained.

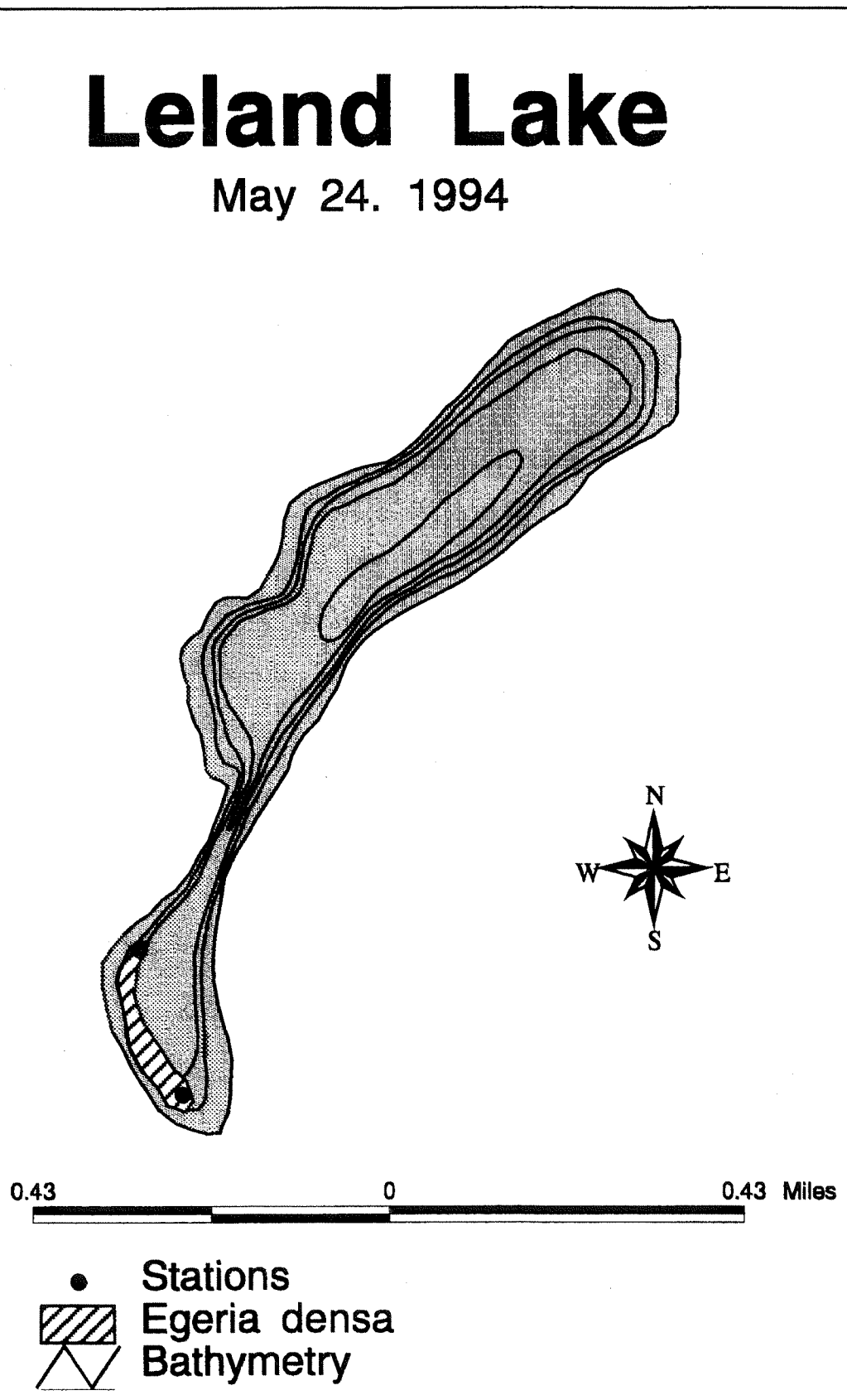

Figure 4. Leland Lake *Egeria densa* in 1994

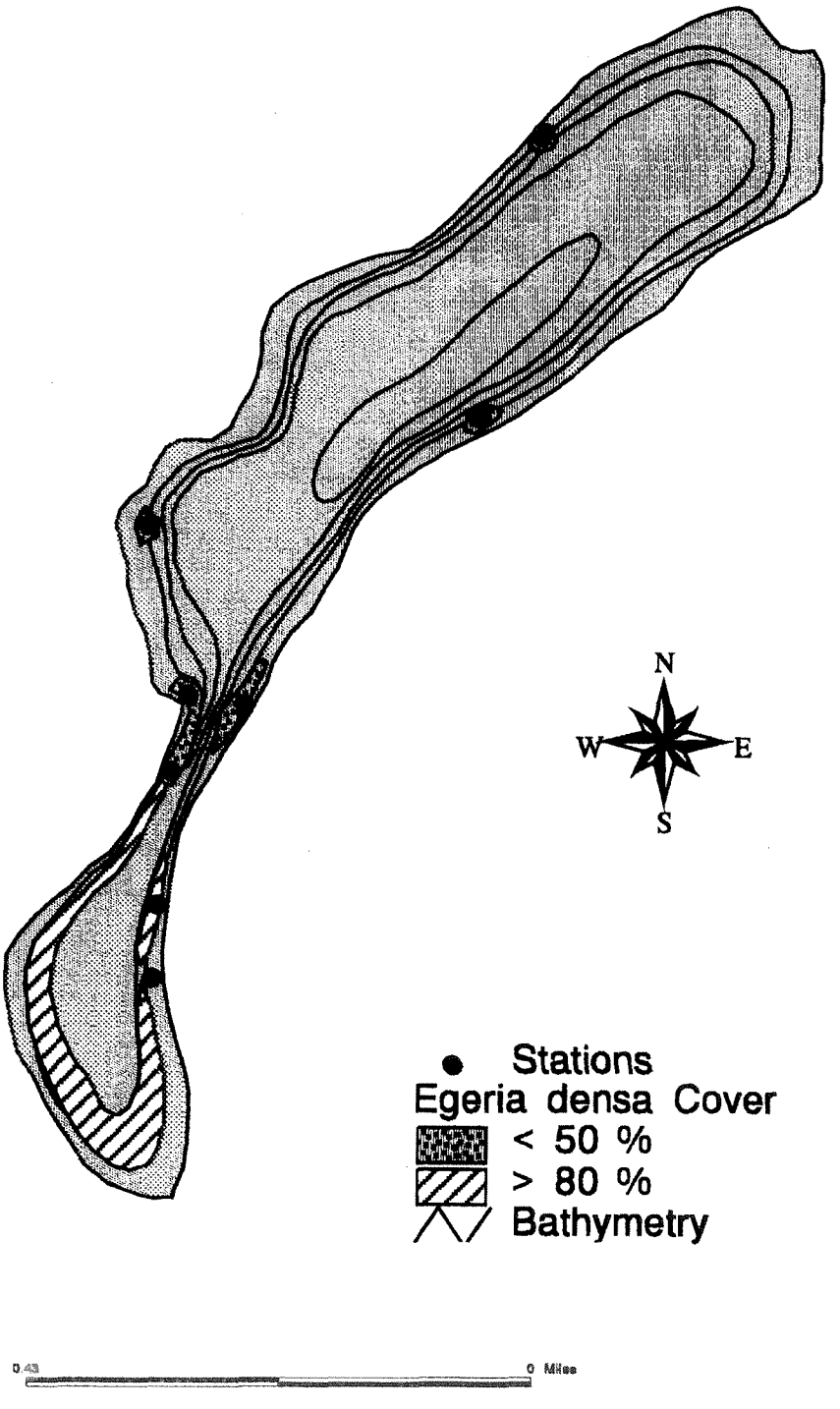

Figure 5. Leland Lake *Egeria densa* in 1995

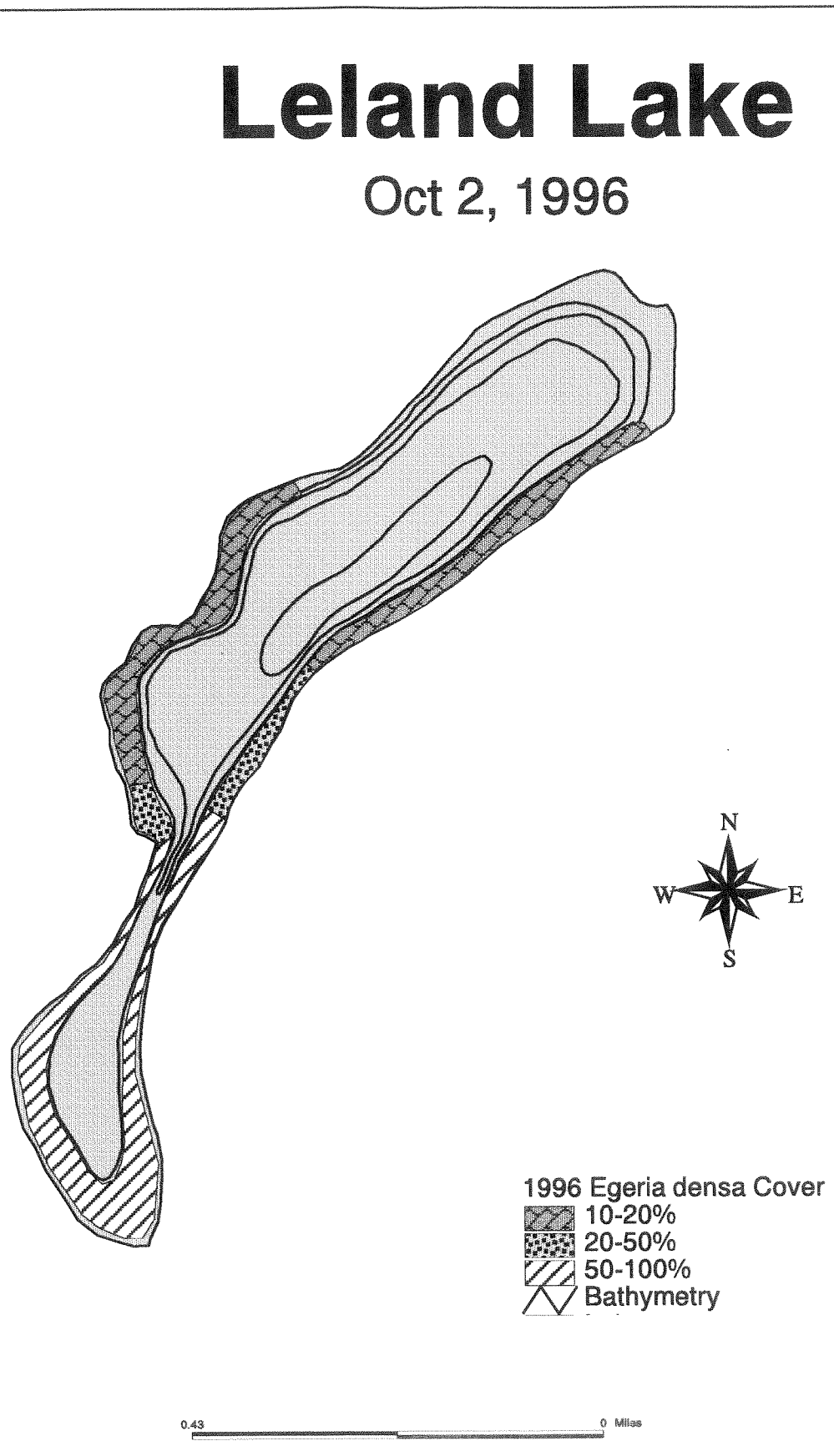

Figure 6. Leland Lake *Egeria densa* in 1996

Plant Monitoring Project

More in-depth macrophyte data were gathered during September 1995 and 1996 on two isolated Grant County lakes: Evergreen Lake and Quincy Lake. These lakes were chosen because of their close proximity to each other and because Evergreen Lake has a widely distributed population of *Myriophyllum spicatum,* while Quincy Lake does not appear to support a *M. spicatum* population. On each lake, several transects were established running perpendicular to shore. Transect locations were recorded with a GPS unit and a written description. Plant species and cover data were collected at 1 m depth intervals until the maximum depth of plant growth was reached (or the other side of the lake). The data were used to update bathymetric plant community maps. These transects will be revisited in future years to continue monitoring plant community changes.

Evergreen Lake is the larger and deeper of the two lakes (250 acres, 55 feet deep) (Figure 7). It receives direct irrigation runoff as its main water supply (Haltrap, 1995), and could have originally been colonized by *Myriophyllum spicatum* through fragments floating in from infested waterbodies upstream. Much of the shoreline is steep and rocky, providing inhospitable aquatic plant habitat. However, in the coves and in deeper water a dense aquatic plant community thrives. In 1995 *M. spicatum* dominated the plant community between depths of 3 to 5 meters throughout much of the lake that was surveyed (the exception being the far east end). There was, however, a diverse group of other species found as well. In the 1996 survey the *M. spicatum* population level had decreased throughout this band. In most areas it was not the dominant plant, but shared that distinction with a mix of several native or naturalized plants (*Chara, Potamogeton crispus, Elodea canadensis, Ceratophyllum demersum*). The area where its level had increased was the far east end. During both years the maximum depth of macrophyte growth was approximately 7 meters. In general the plant community appeared less vibrant in 1996 than it had in 1995. This was fairly typical for all lakes visited in 1996, probably due to the cool rainy growing season.

Quincy Lake is a long narrow 51 acre lake with a maximum depth of 23 ft (Figure 8). This lake has no direct water supply, instead being fed by ground water (the water table is elevated due to irrigation in the Columbia Basin). It is much more alkaline than Evergreen Lake (Quincy total alkalinity = 386 mg/L $CaCO_3$, Evergreen = 70 mg/L $CaCO_3$). Therefore, Quincy Lake has a more limited plant community, consisting of those tolerant of alkaline conditions. This could be the reason *Myriophyllum spicatum* is not found in this lake (see discussion under Alkalinity results). The population of *Lythrum salicaria* had increased over the study period in spite of control efforts, and in 1996 many small seedlings were observed. In deeper water throughout the lake (to 6 meters deep), *Chara* was the dominant macrophyte. The more shallow zones were populated by a mixture of species including *Myriophyllum sibiricum, Potamogeton pectinatus* and *Ceratophyllum demersum*. *Ruppia* (wigeongrass), a plant tolerant of extremely alkaline or brackish conditions was also present in small patches.

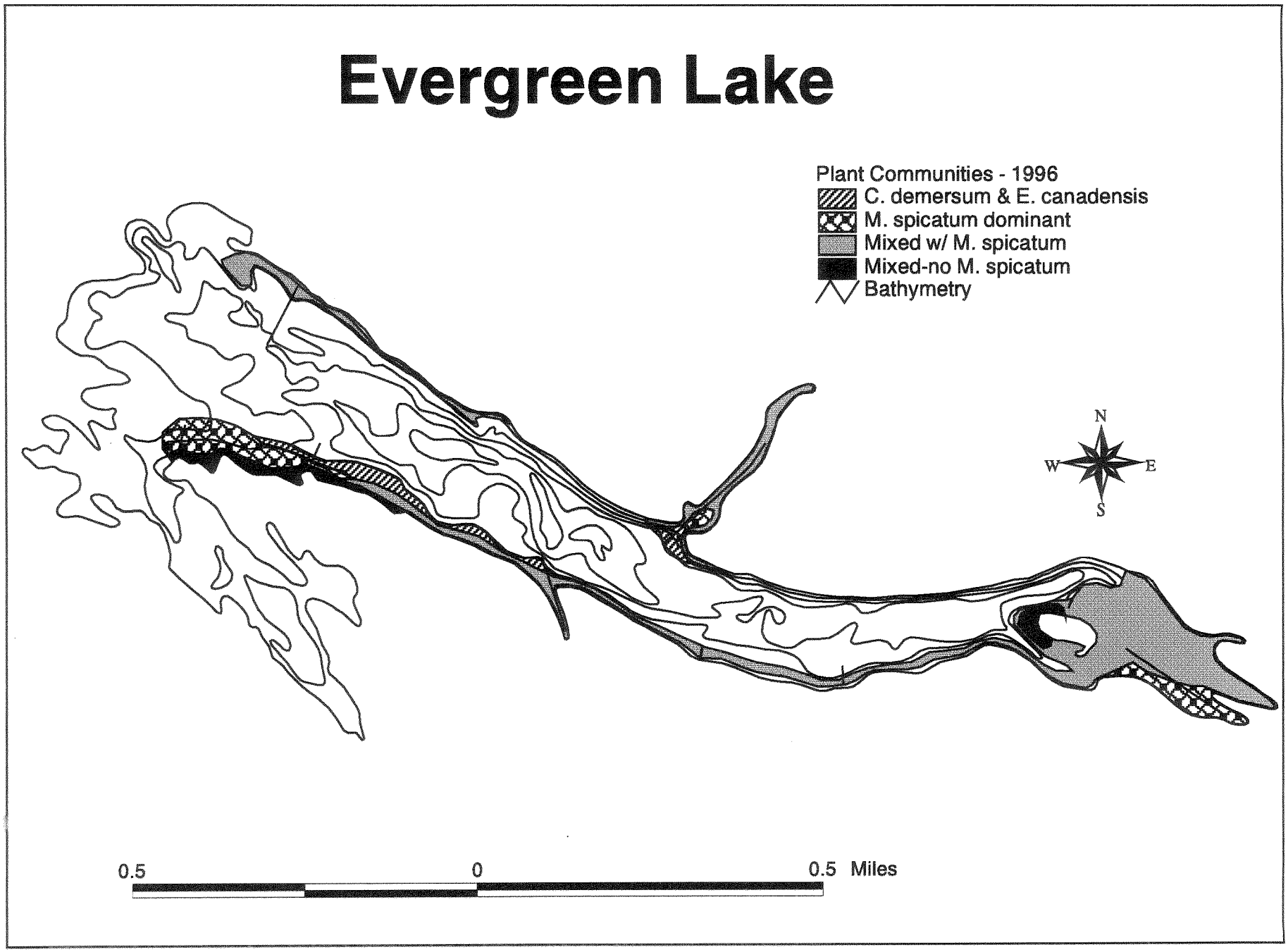

Figure 7. Evergreen Lake aquatic plant communities

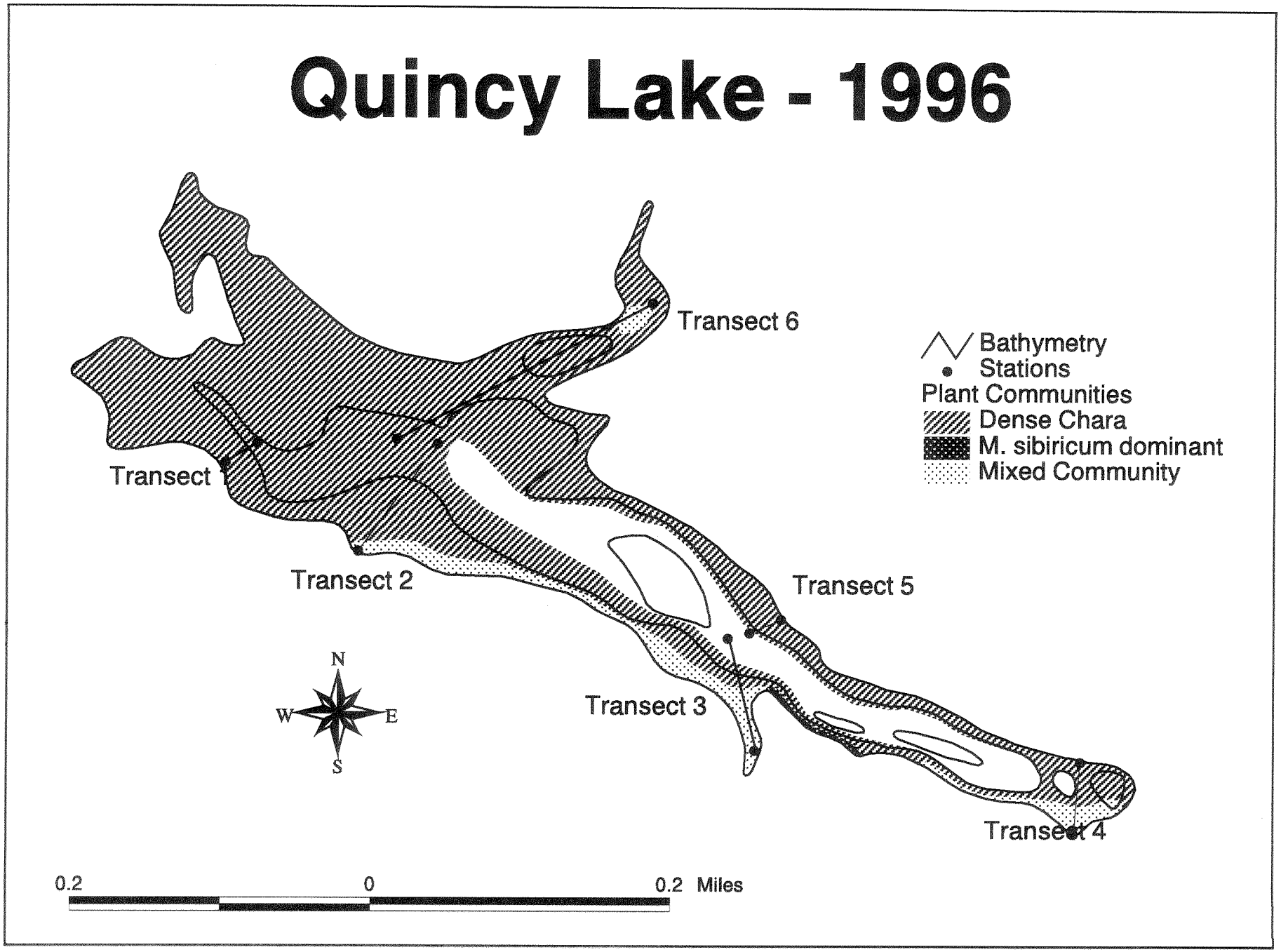

Figure 8. Quincy Lake aquatic plant communities

Rare Plants

In addition to the weedy plants, populations of plants listed as rare by the Washington Natural Heritage Program (WNHP) (Washington Natural Heritage Program, 1994) were observed during the field surveys. *Limosella acaulis* (mudwort), was again observed in Grant County; in addition, *Crassula aquatica* was observed in this area during 1996. Several lakes with populations of *Lobelia dortmanna* in Clallam and Mason Counties were also visited. These populations were reported to the WNHP database manager. It was hoped that the suspected population of *Potamogeton obtusifolius* in a Mason County lake could be confirmed, however that lake was not visited this year.

Alkalinity Results

There is a wide range of alkalinity values reported for Washington lakes, with the general trend of lower values west of the Cascade Mountains and in the mountainous northeast corner. Table 5 lists results from the alkalinity data collected this year using a field test kit. Four times through the field season a known standard addition was used to test the accuracy of the field test kit. An average correction value was calculated from the results and applied to all test results. The results presented in Table 5 are the corrected values. As part of another project alkalinity samples were also collected from the Sun Lakes region during the same time period and analyzed by Manchester Environmental Laboratory using EPA Method 310.2. Comparison of the results (Table 6) shows that, except for the sample from Alkali Lake, the corrected results from the field test kit were within the ±10 mg/L accuracy purported by the manufacturer. The difference in Alkali Lake could be due to the dense aquatic macrophyte community found throughout this shallow lake. Because alkalinity is tied to carbon acquisition by aquatic plants, dense macrophyte beds will influence the alkalinity in a diurnal pattern (Smart, 1990; Wetzel, 1983).

Table 5. Alkalinity data results.

County	Waterbody Name	Date	Alkalinity mg/l CaCO3
Chelan	Wapato Lake	06/24/96	200
Clallam	Beaver Lake	07/09/96	30
	Crescent Lake	07/10/96	49
	Ozette Lake	07/09/96	8
	Pleasant Lake	07/11/96	14
	Sutherland Lake	07/11/96	65
Grant	Alkali Lake	07/16/96	229
	Blue Lake	07/16/96	207
	Burke Lake	09/19/96	172
	Deep Lake	06/25/96	147
	Evergreen Lake	09/18/96	70
	Lenore Lake	07/17/96	931
	Park Lake	06/26/96	190
	Quincy Lake	09/17/96	386

Grays Harbor	Aberdeen Lake	07/22/96	28
	Quinault Lake	10/07/96	24
	Sylvia Lake	07/22/96	16
Island	Deer Lake	09/04/96	20
	Goss Lake	09/05/96	26
	Lone Lake	09/04/96	74
Jefferson	Anderson Lake	07/08/96	58
	Leland Lake	06/11/96	26
	Tarboo Lake	07/02/96	9
King	Pipe Lake	06/18/96	31
Kitsap	Horseshoe Lake	08/22/96	5
	Mission Lake	09/09/96	35
Kitsap/Mason	Tiger Lake	09/09/96	5
Mason	Benson Lake	07/23/96	6
Okanogan	Crawfish Lake	08/28/96	21
	Leader Lake	08/29/96	102
	Omak Lake	08/28/96	2986
	Spectacle Lake	08/27/96	77
Pend Oreille	Davis Lake	07/30/96	46
	Diamond Lake	07/31/96	35
	Skookum Lake, South	07/31/96	9
	Sullivan Lake	08/01/96	52
Pierce	Clear Lake	06/12/96	20
	Harts Lake	07/03/96	67
	Ohop Lake	07/25/96	28
	Rapjohn Lake	07/25/96	28
	Spanaway Lake	09/11/96	48
	Tanwax Lake	09/12/96	29
Skagit	Campbell Lake	08/13/96	85
	Heart Lake (35N-01E-36)	08/13/96	82
Stevens	Loon Lake	09/25/96	85
Whatcom	Cain Lake	08/14/96	18
	Terrell Lake	08/14/96	38

Table 6: Comparison of Sun Lakes Alkalinity Data

Waterbody Name	Date	Alkalinity - mg/l CaCO3 Field Test Kit	Alkalinity - mg/l CaCO3 Laboratory analysis
Alkali Lake	7/16/96	229	
	7/23/96		245
Blue Lake	7/16/96	207	
	7/23/96		206
Deep Lake	6/25/96	147	
	6/21/96		144
Lenore Lake	7/17/96	931	
	7/23/96		922
Park Lake	6/26/96	190	
	6/21/96		189

The alkalinity data for plant species which were observed in at least five different lakes are presented in Figure 9. Two lakes with extremely high alkalinity were omitted from the analysis to maintain a readable scale (Lenore Lake and Omak Lake). Many species observed appear to have a broad range of tolerance. However, several have only been observed in lakes within a limited alkalinity range. Both *Potamogeton epihydrus* and *Sparganium angustifolium* were only found in lakes with less than 40 mg/L $CaCO_3$. On the other end of the scale, *Ruppia maritima* was not found in any lake with less than 154 mg/L $CaCO_3$. There have been few other studies with alkalinity ranges given for aquatic plants. In one such study of lakes in Japan, Kadono (1982) found *Myriophyllum spicatum* and *Ceratophyllum demersum* more often in lakes with higher alkalinity (range of *M. spicatum* was 13 to 145 mg/L and *C. demersum* was 9 to 451 mg/L $CaCO_3$). In Washington lakes, *C. demersum* and *M. spicatum* were found within a very similar range. Kadono also observed *Brasenia schreberi* in lakes with relatively low alkalinity, a pattern which the Washington data also follow. In another study, Hellquist (1980) studied the correlation between *Potamogeton* species distribution and alkalinity in New England lakes. There are several differences between those results and what has been observed in Washington (Table 7). Hellquist found *P. pectinatus* between 30 to 280 mg/L $CaCO_3$, but in Washington this plant was found in a higher range (to 931 mg/L $CaCO_3$) though it had a similar median value (113 to 114 mg/L $CaCO_3$). This could be an artifact from a lack of extremely alkaline lakes in New England. He found *P. epihydrus* in lakes with up to 161 mg/L $CaCO_3$, whereas in the Washington lakes studied this plant appears restricted to less alkaline waters. Other plants with quite different alkalinity ranges between the two studies include *P. illinoensis, P. natans, P. praelongus* and *P. richardsonii*. The other plants in common between the two studies had fairly similar ranges and medians. The differences in observed values could be due to different physiological characteristics of the plants (different ecotypes), to differences in plant community composition between the two regions, or to other factors influencing the plants such as other water quality or sediment variables. Also, the data from Washington lakes are from a more limited set, so additional observations may affect the results.

Figure 9. Box plot of alkalinity ranges for selected macrophytes.

Legend:

bar within the box - median
hinges (box edges) - within which 25% to 75% of the values lie
whiskers - include values within 1.5 Hspreads of the hinges (Hspread is the absolute value of the difference between the values of the two hinges).
asterisk - values within 3 Hspreads of the hinges
open circle - values outside 3 Hspreads of the hinges

Plant Name Codes (from bottom to top of plot):

Brasenia schreberi	*Polygonum amphibium*	*Potamogeton praelongus*
Ceratophyllum demersum	*Potamogeton amplifolius*	*Potamogeton pusillus*
Chara sp.	*Potamogeton crispus*	*Potamogeton richardsonii*
Elodea canadensis	*Potamogeton epihydrus*	*Potamogeton robinsii*
Isoetes lacustris	*Potamogeton foliosus*	*Potamogeton zosteriformis*
Myriophyllum sibiricum	*Potamogeton gramineus*	*Ranunculus aquatilus*
Myriophyllum spicatum	*Potamogeton illinoensis*	*Ruppia maritima*
Najas flexilis	*Potamogeton natans*	*Sparganium angustifolium*
Nuphar lutea	*Potentilla palustris*	*Vallisneria americana*
Nymphaea odorata	*Potamogeton pectinatus*	*Zannichellia palustris*

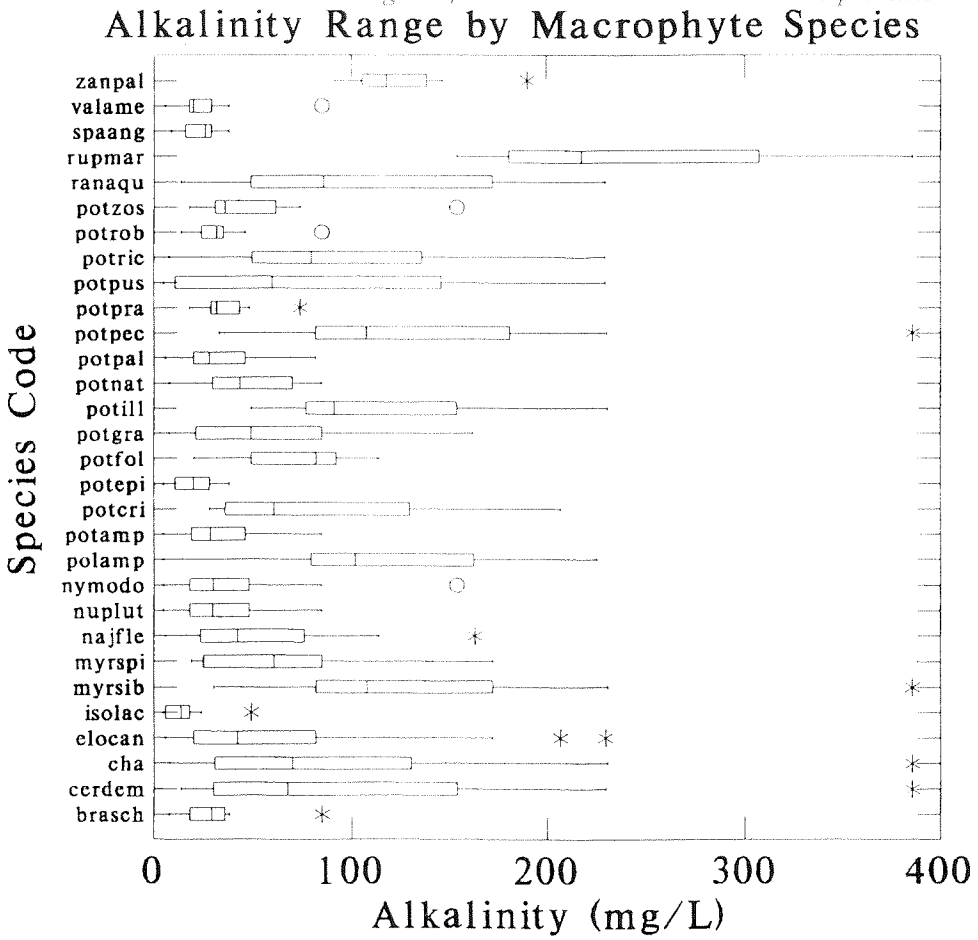

Table 7: Comparison of Alkalinity Ranges

Species	New England Lakes Alkalinity Range mg/l CaCO3	median mg/l CaCO3	n	Washington Lakes Alkalinity Range mg/l CaCO3	median mg/l CaCO3	n
Potamogeton amplifolius	4 to 151	28	78	5 to 85	28	22
P. crispus	15 to 208	93	31	28 to 207	61	10
P. epihydrus	2 to 161	*	169	5 to 38	20	11
P. foliosus	17 to 168	73	62	20 to 114	82	7
P. gramineus	3 to 151	*	117	8 to 162	49	10
P. illinoensis	24 to 151	80	24	49 to 230	91	6
P. natans	3 to 162	21	152	8 to 85	43	8
P. pectinatus	37 to 283	113	26	33 to 931	114	25
P. praelongus	10 to 151	44	39	18 to 74	32	8
P. pusillus	3 to 206	*	172	5 to 229	59	8
P. richardsonii	17 to 131	44	27	8 to 229	79	16
P. robbinsii	4 to 122	26	49	14 to 85	32	10
P. zosteriformis	6 to 151	49	74	18 to 154	36	11

* values for more than one variety combined, original values not available to calculate a median

Sediment Characteristics Results

Table 8 lists results from the penetrometer data collected, along with the sediment type and plants present at the site. The impact penetrometer was developed to measure sediment hardness (Coley *et al.*, 1994). There is a general pattern of rocky, or rocky and sandy sediment having the lowest penetrometer readings, sandy sediments in the middle readings and organic muck at the highest readings. No corresponding pattern is evident from looking at the data on plants associated with the penetrometer readings (no statistical analyses were conducted). Rooted vascular plants were found on rocky firm substrate, and also on very soft organic substrate. The attached (but not rooted) macroalgae *Chara* was also found throughout the spectrum. Casual observations demonstrate patterns in the extremes. For instance, on extremely rocky sediment, where no penetrometer readings are possible, often there are also no aquatic plants. Similarly, on extremely floculant sediments where the penetrometer simply sinks into the mire, there are often no rooted aquatic plants. Patterns of influence between sediment characteristics and aquatic plants demonstrated by other studies indicate that sediment organic matter, sediment density, and sediment fertility all affect macrophyte community composition (Barko *et al.*, 1991; Barko and Smart, 1986). However, no data on these parameters were gathered this year.

Table 8: Sediment Hardness and Macrophyte Data

Lake Name (County)	Penetro-meter cm/slam	Macrophytes Present	Substrate
Horseshoe (Kitsap)	0.80	*Juncus supiniformis*	hard, rocky
Evergreen (Grant)	1.00	Sparse *Chara*	clay-like, rock
Tiger (Kitsap/Mason)	2.80	Patch of *Nymphaea odorata*	gravel
Evergreen (Grant)	3.00	Sparse *Chara*	rocky
Tanwax (Pierce)	3.20	*Vallisneria americana* bed, sandy	sandy
Davis (Pend Oreille)	3.80	dense *Potamogeton amplifolius*, patchy *Myriophyllum spicatum*	sand, rock
Lone (Island)	4.40	sparse *Elodea canadensis*, sandy soil	sandy/organic
Terrell (Whatcom)	4.60	dense *Sparganium angustifolium, Vallisneria americana*	
Evergreen (Grant)	4.60	*Ranunculus aquatilus* dense, *Elodea canadensis* present	
Evergreen (Grant)	4.80	*Myriophyllum spicatum*	
Burke (Grant)	5.60	Thick *Myriophyllum sibiricum*	black sandy mud
Quincy (Grant)	6.40	*Chara*	
Bonaparte (Okanogan)	6.80	*Potamogeton richardsonii*	sandy, organic
Park (Grant)	8.60	Dense bed of *Potamogeton pectinatus* and *Potamogeton richardsonii*	
Campbell (Skagit)	8.60	Patch of *Myriophyllum spicatum*, *Myriophyllum sibiricum*	organic mud, sand/silt gravel
Quincy (Grant)	9.40	Dense *Chara* - pushed through 20 cm	organic
Burke (Grant)	10.00	thick *Myriophyllum sibiricum*	black sandy mud
Quincy (Grant)	12.50	Thick *Chara*	
Quincy (Grant)	12.50	*Chara* 20 cm thick	sand/organic
Quincy (Grant)	12.50	Thick *Chara* - pushed through 25 cm	black organic/sand
Park (Grant)	25.00	*Chara*	sandy, whitish
Skookum, South (Pend Oreille)	45.00	sparse *Nuphar lutea*, mucky sediment	soft muck
Mission (Kitsap)	50.00	*Elodea canadensis, Potamogeton robbinsii, P. amplifolius*	organic layer
Park (Grant)	50.00	*Chara*	muck, sand
Harts (Pierce)	50.00	*Myriophyllum spicatum*	seems organic, muck
Diamond (Pend Oreille)	50.00	dense *Elodea canadensis*	soft muck
Mason (Mason)	50.00	sparse *Vallisneria* (3-5 plants / sq m)	light colored sand / silt
Campbell (Skagit)	50.00	edge of *Myriophyllum sibiricum* bed	organic mud
Quincy (Grant)	50.00	Thick *Myriophyllum sibiricum*	black silt

Herbarium

Methods Used in Aquatic Plant Identification

All plants were identified to the lowest taxonomic group possible, usually to species unless critical features of the plant were missing (such as flowers or fruits). To assure proper identification, a number of books and other sources have been gathered to use as cross references (Appendix B). In addition, several people from within and outside the agency are consulted in cases where identification is difficult. If this is not satisfactory, the plant is sent to taxonomic experts for an opinion. Kartesz (1994), The Jepson Manual (Hickman, 1993), and personal consultation with authors of the Flora of North America (Flora of North America Editorial Committee, 1993) are used to ensure the nomenclature is current. In the case of questionable *Myriophyllum* species, samples were sent to the University of California, Davis for DNA analysis.

Methods Used in Collection and Preservation

The methods used in preserving aquatic plants were those of Haynes (1984). First, all available plant parts (roots, stem, flowering parts) were collected and sealed in a wet plastic bag. Within three days, but usually sooner, the plants were washed, identified, and arranged on a sheet of 100% rag herbarium paper. If the plant was too limp to maintain its shape in air, it was arranged on the paper in a tray of water. The herbarium sheets with plants and a written site description were then sandwiched between newspaper, blotter paper and cardboard in a plant press. When the specimen dried, it was fixed to the paper with herbarium glue or binding tape (if it was not already sufficiently adhered from the wet pressing process). A label with identification and collection information was attached. These finished reference specimens are stored in a sealed herbarium cabinet located in the Ecology headquarters building benthic laboratory.

The herbarium collection contains 99 unique taxa from 37 families (Table 9). There is a total of 284 specimens, and in most cases each species is represented by more than one specimen. Each time a noxious weed is found, a collection is made to be kept as a record. Additional taxa will be added to the herbarium as they are collected in future years. Also, specimens from aquatic plant mapping projects funded under the Aquatic Weed Management grant program are housed in this herbarium. The collection is available to both Ecology staff and the public as a reference and permanent record.

Table 9: Herbarium Specimens - Grouped by Family

Family	Scientific name	Common name
Alismataceae		
	Alisma gramineum	narrowleaf water-plantain
	Sagittaria cuneata	Arumleaf arrowhead, wapato
	Sagittaria graminea	slender arrowhead
Apiaceae		
	Cicuta douglasii	western water-hemlock
	Hydrocotyle ranunculoides	water-pennywort
	Lilaeopsis occidentalis	lilaeopsis
Asteraceae		
	Megalodonta beckii	water marigold
Azollaceae		
	Azolla mexicana	mexican water-fern
Boraginaceae		
	Myosotis laxa	small flowered forget-me-not
Brassicaceae		
	Rorippa nasturtium-aquaticum	water-cress
	Rorippa palustris	marsh yellowcress
	Subularia aquatica	awlwort
Cabombaceae		
	Brasenia schreberi	watershield
	Cabomba caroliniana	fanwort
Callitrichaceae		
	Callitriche anceps	two-edged water-starwort
	Callitriche hermaphroditica	northern water-starwort
	Callitriche heterophylla	different-leaved water-starwort
	Callitriche stagnalis	pond water-starwort
	Callitriche verna	spring water-starwort
Campanulaceae		
	Lobelia dortmanna	water gladiole; water lobelia
Ceratophyllaceae		
	Ceratophyllum demersum	Coontail; hornwort
Characeae		
	Nitella sp.	stonewort
Crassulaceae		
	Crassula aquatica	pygmy-weed
Cyperaceae		
	Carex unilateralis	one-sided sedge
	Cyperus erythrorhizos	red rooted cyperus
	Dulichium arundinaceum	Dulichium
	Eleocharis acicularis	needle spike-rush

Table 9. Continued.

Family	Scientific name	Common name
	Eleocharis parvula	small spike-rush
	Scirpus acutus	hardstem bulrush
	Scirpus americanus	american bulrush
	Scirpus cyperinus	wool-grass
	Scirpus fluviatilis	river bulrush
	Scirpus maritimus	seacoast bulrush
	Scirpus nevadensis	Nevada bulrush
	Scirpus subterminalis	fescue scolochloa
Elatinaceae		
	Elatine triandra	three-stamen waterwort
Fontinalaceae		
	Fontinalis antipyretica	water moss
Haloragaceae		
	Myriophyllum aquaticum	parrotfeather
	Myriophyllum hippuroides	western watermilfoil
	Myriophyllum quitense	waterwort watermilfoil
	Myriophyllum sibiricum	northern watermilfoil
	Myriophyllum sp.	water-milfoil
	Myriophyllum spicatum	Eurasian water-milfoil
	Myriophyllum verticillatum	whorled watermilfoil
Hippuridaceae		
	Hippuris vulgaris	common marestail
Hydrocharitaceae		
	Egeria densa	Brazilian elodea
	Egeria najas	Asian anacharis
	Elodea canadensis	common elodea
	Elodea nuttallii	Nuttall's waterweed
	Hydrilla verticillata	hydrilla
	Vallisneria americana	water celery
Isoetaceae		
	Isoetes lacustris	lake quillwort
Juncaceae		
	Juncus acuminatus	tapered rush
	Juncus supinus	bulbous rush
Lamiaceae		
	Lycopus asper	rough bungleweed
Lemnaceae		
	Wolffia sp.	water-meal
Lentibulariaceae		
	Utricularia inflata	big floating bladderwort
	Utricularia macrorhiza	common bladderwort
	Utricularia minor	lesser bladderwort

Table 9. Continued.

Family	Scientific name	Common name
	Utricularia sp.	bladderwort
	Utricularia vulgaris	common bladderwort
Menyanthaceae		
	Nymphoides peltata	water fringe
Najadaceae		
	Najas flexilis	common naiad
	Najas gradalupensis	Guadalupe water-nymph
Nymphaeaceae		
	Nuphar lutea ssp. polysepala	spatter-dock, yellow water-lily
Onagraceae		
	Ludwigia hexapetala	water primrose
	Ludwigia palustris	water-purslane
Poaceae		
	Cinna latifolia	wood reed-grass
	Glyceria borealis	northern mannagrass
	Zizania aquatica	wild rice
Polygonaceae		
	Polygonum amphibium	water smartweed
	Polygonum hydropiperoides	common smartweed
Pontederiaceae		
	Heteranthera dubia	water star-grass
Potamogetonaceae		
	Potamogeton amplifolius	large-leaf pondweed
	Potamogeton crispus	curly leaf pondweed
	Potamogeton epihydrus	ribbonleaf pondweed
	Potamogeton foliosus	leafy pondweed
	Potamogeton friesii	flat-stalked pondweed
	Potamogeton gramineus	grass-leaved pondweed
	Potamogeton illinoensis	Illinois pondweed
	Potamogeton natans	floating leaf pondweed
	Potamogeton nodosus	longleaf pondweed
	Potamogeton pectinatus	sago pondweed
	Potamogeton praelongus	whitestem pondweed
	Potamogeton pusillus	slender pondweed
	Potamogeton richardsonii	Richardson's pondweed
	Potamogeton robbinsii	fern leaf pondweed
	Potamogeton zosteriformis	eel-grass pondweed
Primulaceae		
	Lysimachia nummularia	creeping loosestrife
	Lysimachia thyrsiflora	tufted loosestrife
Ranunculaceae		
	Ranunculus aquatilis	water-buttercup

Table 9. Continued.

Family	Scientific name	Common name
	Ranunculus flammula	creeping buttercup
Ruppiaceae		
	Ruppia maritima	ditch-grass
Scrophulariaceae		
	Gratiola neglecta	hedge-hyssop
	Limosella acaulis	mudwort
	Lindernia dubia	false-pimpernel
	Veronica anagallis-aquatica	water speedwell
Sparganiaceae		
	Sparganium angustifolium	narrowleaf bur-reed
	Sparganium eurycarpum	broadfruited bur-reed
	Sparganium nutans	small bur-reed
	Sparganium sp.	bur-reed
Zannichelliaceae		
	Zannichellia palustris	horned pondweed

Aquatic Weed Management Fund Related Activities

Sixteen grant applications submitted to the Water Quality Financial Assistance Section for Aquatic Weed Management Fund (AWMF) grant moneys were reviewed (Table 10). Recommendations on funding priorities were made in December, and awards are scheduled to be made during 1997. There were more qualified applicants than money available, so not all projects listed received funding. (For more information on project funding mechanisms contact the AWMF administrator at the Department of Ecology, Water Quality Program).

Table 10. Aquatic Weed Management Fund grant applications - 1996 (projects receiving at least partial funding are indicated by an asterisk).

Applicant	Project Title
Ferry Conservation District	Ferry Lakes Invader Project*
Jefferson County Conservation District	Lake Leland Brazilian Elodea Study*
Pacific Conservation District	Loomis Lake Milfoil Management Plan*
Stevens County Noxious Weed Board	Milfoil Eradication Project*
Mason County	Lake Limerick Aquatic Weed Management*
Okanogan County Noxious Weed Board	Purple Loosestrife Waterworks Phase II*
City of Everett	1997 Silver Lake Milfoil Control
City of Ocean Shores	Aquatic Weed Implementation Project #3
San Juan County Noxious Weed Board	Early Detection Survey and Education
King County Surface Water Management	Aquatic Weed Volunteer Monitoring Training*
City of Kent	Lake Meridian Aquatic Plant Management Plan
Snohomish County	Seven Lake Milfoil Eradication IAPMP*
Skagit County	Big Lake Weed Management Plan*
Skagit County	Lake Campbell/Erie Aquatic Weed Management
Washington State Department of Natural Resources	Chehalis River Purple Loosestrife Project*
Yakima County Noxious Weed Board	Yakima River Purple Loosestrife Project*

Aquatic Plant Field Guide

During 1994, money from the AWMF was targeted for development and production of an Aquatic Plant Field Guide. The guide will include approximately 120 aquatic plants with photographs, line drawings, written descriptions, and notes on the values and natural history of the plants. We selected a consultant team headed by Shapiro and Associates to develop the guide. During 1995 and 1996 this team compiled photographs and drawings of the plants, and composed written descriptions. Each page is extensively reviewed by aquatic plant technical assistance personnel for accuracy and readability. At the end of this initial review, the completed pages will be reviewed externally. The publication is expected in 1997.

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Appendix A

Site Visit Summary Table 1994-1996

Waterbodies Surveyed for aquatic plants 1994-1996

County	Waterbody Name	RI	Date	Survey Extent	Weedy Exotic Plants
Chelan	Antilon Lake	47	8/31/94	from shore, N and S ends	none
	Chelan Lake	47	8/31/94	from City Park shore	*Myriophyllum spicatum*
	Dry Lake	47	8/31/94	from shore, east end	none
	Roses Lake	47	8/31/94	south shore	none
	Wapato Lake	47	8/31/94	entire shoreline	*Myriophyllum spicatum*
			6/27/95	whole littoral	
			8/8/95	whole littoral	
			9/11/95	whole littoral	
			06/24/96	whole littoral	
			07/15/96	milfoil sites	
			09/16/96	milfoil sites	
	Wenatchee Lake	45	9/1/94	west end, east boat launch	none
Clallam	Beaver Lake	20	07/09/96	whole littoral	none
	Crescent Lake	19	07/10/96	4 sites	none
	Ozette Lake	20	07/09/96	3 sites	none
	Pleasant Lake	20	07/11/96	whole littoral	none
	Sutherland Lake	18	07/11/96	whole littoral	none
	Unnamed (30N-04W-17)	18	7/13/95	ID from plant sample	*Myriophyllum spicatum*
Clark	Battleground Lake	28	4/13/94	from dock only	*Egeria densa*
	Caterpillar Slough	28	8/15/95	spot check from boat	*Myriophyllum spicatum*
	Columbia River at Ridgefield	28	8/15/95	spot check from boat	*Myriophyllum spicatum* *Lythrum salicaria*
	Vancouver Lake	28	8/15/95	spot check from shore	none
Cowlitz	Silver Lake	26	9/7/94	several locations thu' lake	*Myriophyllum spicatum*
			9/19/95	several sites, from boat	none
	Solo Slough	25	4/13/94	spot check from shore	*Myriophyllum aquaticum*
			7/14/94	spot check from shore	*Cabomba caroliniana*
			8/16/95	from shore	*Egeria densa*
			08/08/96	from shore	*Ludwigia hexapetala* *Myriophyllum spicatum*
	Willow Grove Slough	25	4/13/94	spot check from shore	*Cabomba caroliniana*
			7/14/94	spot check from shore	*Myriophyllum spicatum*
			8/16/95	several sites, from boat	*Egeria densa* *Cabomba caroliniana* *Lythrum salicaria* *Myriophyllum spicatum*
Douglas	Jameson Lake	44	06/26/96	1 site from shore	none
Ferry	Curlew Lake	60	8/22/95	5 sites, whole littoral	none
			08/02/96	4 sites (luanches)	none
	Ellen Lake	58	8/23/95	whole littoral	none
	Trout Lake	58	8/22/95	whole littoral	none
	Twin Lakes	58	8/23/95	4 sites, both lakes	none
Franklin	Scooteney Res	36	7/26/95	spot check from shore	*Myriophyllum spicatum*
	Snake River - Lower	33	08/20/96	spot check, boat	*Myriophyllum spicatum*
	Snake River at Ice Harbor Dam	33	08/19/96	spot check, boat	*Myriophyllum spicatum*
	Snake River at Levey Park	33	08/19/96	spot check, boat	none
	Snake River at Windust Park	33	08/20/96	spot check, boat	none

Grant	Alkali Lake	42	07/16/96	whole littoral	none
	Babcock Ridge Lake	41	7/24/95	2 sites, whole littoral	*Myriophyllum spicatum* *Lythrum salicaria*
	Banks Lake	42	06/25/96	spot check, shore	none
	Billy Clapp Lake	42	8/30/95	4 sites, whole littoral	*Myriophyllum spicatum*
	Blue Lake	42	07/16/96	whole littoral	none
	Burke Lake	41	6/28/94	entire shoreline	*Lythrum salicaria*
			09/19/96	whole littoral	*Myriophyllum spicatum*
	Canal Lake	41	8/30/95	4 sites, whole littoral	*Lythrum salicaria*
	Corral Lake	41	7/25/95	whole littoral	*Lythrum salicaria*
	Crater Lake	41	7/24/95	spot check from shore	none
	Deep Lake	42	06/25/96	whole littoral	none
	Dry Falls Lake	42	06/25/96	spot check, shore	none
	Evergreen Lake	41	6/27/94	entire shoreline	*Lythrum salicaria*
			9/12/95	8 transects, whole littoral	*Myriophyllum spicatum*
			09/18/96	8 transects, whole littoral	
	Lenore Lake	42	07/17/96	whole littoral	none
	Long Lake (17N-29E-32)	41	8/31/95	2 sites, whole littoral	none
	Park Lake	42	06/26/96	whole littoral	none
	Potholes Reservoir	41	8/7/94	6 sites on N & W side	*Myriophyllum spicatum*
	Quincy Lake	41	6/28/94	entire shoreline	*Lythrum salicaria*
			9/13/95	3 transects, whole littoral	
			09/17/96	3 transects, whole littoral	
	Soda Lake	41	7/25/95	whole littoral	none
	Stan Coffin Lake	41	6/29/94	entire shoreline	*Myriophyllum spicatum* *Lythrum salicaria*
	Warden Lake	41	7/25/95	2 sites, whole littoral	*Lythrum salicaria*
	Winchester Wasteway	41	7/26/95	spot check from shore	*Lythrum salicaria*
	Windmill Lake	41	8/30/95	south end	none
Grays	Aberdeen Lake	22	07/22/96	whole littoral	none
	Duck Lake	22	9/9/95	2 sites, from shore	*Egeria densa*
	Quinault Lake	21	10/07/96	75% of littoral	none
	Sylvia Lake	22	07/22/96	whole littoral	none
Island	Cranberry Lake	6	8/24/94	4 sites around lake	none
			09/05/96	spot check, shore	none
	Crockett Lake	6	09/04/96	spot check, shore	none
	Deer Lake	6	09/04/96	whole littoral	none
	Goss Lake	6	09/05/96	whole littoral	none
	Lone Lake	6	09/04/96	whole littoral	*Lythrum salicaria*
Jefferson	Anderson Lake	17	07/08/96	whole littoral	none
	Crocker Lake	17	5/24/94	northwest half - littoral	none
			6/14/95	whole littoral	
			06/11/96	whole littoral	
	Leland Lake	17	5/24/94	entire shoreline	*Egeria densa*
			6/14/95	whole littoral	
			10/3/95	whole littoral	
			11/8/95	Egeria site	
			06/11/96	whole littoral	
			07/02/96	whole littoral	

			10/02/96	whole littoral	
	Tarboo Lake	17	07/02/96	whole littoral	none
King	Lucerne Lake	9	6/9/95	outlet	*Hydrilla verticillata*
			7/15/95	spot check	*Myriophyllum spicatum*
	Pipe Lake	9	6/1/95	several sites, divers	*Hydrilla verticillata*
			6/9/95	near boatlaunch, outlet	*Myriophyllum spicatum*
			7/12/95	from shore	
			7/15/95	6 sites, biomass samples	
			8/1/95	6 sites, biomass samples	
			06/18/96	spot check, boat	
	Steel Lake	9	5/11/94	entire shoreline, divers	*Myriophyllum spicatum*
Kitsap	Horseshoe Lake	15	08/22/96	whole littoral	none
	Kitsap Lake	15	8/3/95	2 sites, whole littoral	none
	Long Lake	15	9/12/94	several locations	*Egeria densa*
			3/17/95	6 transects, whole littoral	*Myriophyllum spicatum*
					Lythrum salicaria
	Mission Lake	15	09/09/96	whole littoral	none
	Panther Lake	15	8/2/95	whole littoral	none
	Wildcat Lake	15	10/4/95	4 sites, whole littoral	none
Kitsap/Maso	Tiger Lake	15	09/09/96	whole littoral	none
Kittitas	Easton Lake	39	8/30/94	spot check from shore	none
	Kiwanis Pond	39	8/30/94	spot check from shore	none
	unnamed fishing pond	39	8/30/94	most of shoreline	none
	unnamed ponds	39	8/30/94	spot checks	Lythrum salicaria at one
Klickitat	Columbia River at Bingen	29	8/14/95	spot check from shore	*Myriophyllum spicatum*
	Columbia River at Maryhill	30	8/14/95	spot check from boat	*Myriophyllum spicatum*
	Horsethief Lake	30	8/14/95	spot check from shore	*Myriophyllum spicatum*
Lewis	Chehalis River	23	7/27/95	shoreline, from boat	*Myriophyllum aquaticum*
			09/10/96	1 site from shore	
Lincoln	Sprague Lake	34	8/6/94	cove at NE end of lake	none
Mason	Benson Lake	14	07/23/96	whole littoral	none
	Devereaux Lake	15	8/16/94	spot check from shore	none
	Haven Lake	15	8/16/94	entire shoreline	none
	Isabella Lake	14	7/19/94	entire shoreline	none
			8/2/95	checked for rare plant	
	Island Lake	14	07/23/96	whole littoral	*Myriophyllum spicatum*
	Limerick Lake	14	8/15/94	entire shoreline	*Egeria densa*
			7/13/95	spot check, boat	
	Lost Lake	14	8/11/94	entire shoreline	none
	Mason Lake	14	08/07/96	whole littoral	none
	Spencer Lake	14	8/15/94	most of shoreline	*Lythrum salicaria*
			7/13/95	spot check, boat	*Lythrum salicaria*
			08/22/96	south end, boat	none
	Wooten Lake	15	8/16/94	most of shoreline	none
Okanogan	Aeneas Lake		7/25/94	entire shoreline	none
	Alta Lake	48	6/29/95	whole littoral	none
	Big Twin Lake	48	8/9/95	most of littoral	none
	Bonaparte Lake	49	08/27/96	whole littoral	none
	Buffalo Lake	53	8/21/95	3 sites, boat	none

	Conconully Lake	49	7/26/94	7 sites thru' shoreline	*Myriophyllum spicatum?*
	Conconully Reservoir	49	7/26/94	north end	none
	Crawfish Lake	52	08/28/96	whole littoral	none
	Davis Lake	48	8/9/95	whole littoral	none
	Duck (Bide-a-Wee) Lake	49	08/28/96	spot check, shore	none
	Fish Lake	49	7/26/94	entire shoreline	none
	Green Lake	49	6/29/95	2 sites, whole littoral	none
	Leader Lake	49	08/29/96	whole littoral	none
	Little Twin Lake	48	8/9/95	whole littoral	none
	Omak Lake	49	08/28/96	north end, boat	none
	Palmer Lake	49	7/27/94	boatlaunches, from shore	none
			6/28/95	whole littoral	none
	Patterson Lake	48	8/10/95	2 sites, whole littoral	none
	Pearrygin Lake	48	8/10/95	3 sites, whole littoral	*Lythrum salicaria*
	Sidley Lake	49	08/27/96	spot check, shore	none
	Spectacle Lake	49	7/27/94	5 sites, various locations	none
			08/27/96	whole littoral	none
	Wannacut Lake	49	7/28/94	3 sites	none
	Whitestone Lake	49	7/27/94	5 sites, various locations	*Myriophyllum spicatum*
			6/28/95	6 sites, whole littoral	*Lythrum salicaria*
			08/26/96	whole littoral	
Pacific	Black Lake	24	7/12/94	spot check, shore	*Egeria densa*
			08/08/96	most of shoreline	
	Island Lake	24	7/14/94	entire shoreline	none
	Loomis Lake	24	7/13/94	most of shoreline	none
	O'Neil Lake	24	7/12/94	entire littoral	none
	Surfside Lake	24	7/13/94	5 sites from bridges	none
Pend Oreille	Browns Lake	62	07/31/96	spot check, shore	none
	Davis Lake	62	8/2/94	most of littoral	none
			07/30/96	north end, boat launch	*Myriophyllum spicatum*
	Diamond Lake	55	8/2/94	boatlaunch, from shore	none
			07/31/96	east end, boat launch	none
	Fan Lake	55	8/3/94	entire shoreline	*Lythrum salicaria*
	Frater Lake	59	08/01/96	spot check, shore	none
	Half Moon Lake	62	07/31/96	north end	none
	Little Spokane River	55	8/2/94	at Fertile Valley Rd crossing	M. spicatum
			8/2/94	at Haworth Rd crossing	none
	Marshall Lake	62	8/1/94	3 sites, mostly at inlets	none
	Mill Lake	62	08/01/96	2 sites, shore	none
	Nile Lake	62	08/01/96	spot check, shore	*Myriophyllum spicatum*
	Pend Oreille River	62	08/01/96	spot check, shore	*Myriophyllum spicatum*
	Sacheen Lake	55	8/2/94	3 sites, covered entire shore	*Myriophyllum spicatum*
					Lythrum salicaria
	Skookum Lake, North	62	07/31/96	spot check, shore	none
	Skookum Lake, South	62	07/31/96	whole littoral	none
	Sullivan Lake	62	08/01/96	north and south, boat	none
	Unnamed Wetland near Usk	62	08/01/96	shore	none
Pierce	American Lake	12	10/4/94	4 sites	none
	Bay Lake	15	9/28/95	whole littoral	*Lythrum salicaria*

	Clear Lake	11	7/21/94	entire shoreline	*Myriophyllum spicatum*
			06/12/96	whole littoral	
	Harts Lake	11	06/17/96	spot check, shore	*Myriophyllum spicatum*
			07/03/96	whole littoral	
	Ohop Lake	11	07/25/96	whole littoral	*Egeria densa*
	Rapjohn Lake	11	07/25/96	whole littoral	none
	Silver Lake	11	06/17/96	spot check, shore	none
	Spanaway Lake	12	09/11/96	whole littoral	*Lythrum salicaria*
	Steilacoom Lake	12	06/19/96	spot check, boat	none
	Tanwax Lake	11	7/21/94	entire shoreline	none
			09/12/96	whole littoral	none
Skagit	Beaver Lake	3	8/25/94	entire shoreline	none
	Big Lake	3	8/23/94	3 sites, extreme ends	*Egeria densa*
			8/23/94	& launch	*Myriophyllum spicatum*
	Campbell Lake	3	6/7/94	entire shoreline	none
			08/13/96	whole littoral	*Myriophyllum spicatum*
	Clear Lake	3	8/25/94	boatramp only	*Myriophyllum spicatum*
	Erie Lake	3	8/24/94	Entire shoreline	none
			08/13/96	spot check, shore	none
	Everett Lake	4	08/15/96	spot check, shore	none
	Heart Lake (35N-01E-36)	3	08/13/96	whole littoral	none
	Heart Lake (Fidalgo)	3	8/24/94	most of shoreline	none
	McMurray Lake	3	6/6/94	entire shoreline	*Myriophyllum spicatum*
			8/23/94	entire shoreline	
	Sixteen Lake	3	6/6/94	entire shoreline	*Myriophyllum spicatum*
Snohomish	Goodwin Lake	7	6/20/95	3 sites, littoral survey	*Myriophyllum spicatum*
	Nina Lake	7	6/20/95	2 sites, from shore	*Myriophyllum aquaticum*
	Roesiger (south arm) Lake	7	8/25/94	east side, littoral	none
			6/21/95	spot check, boat	none
			8/29/95	most of shoreline	none
	Shoecraft Lake	7	08/15/96	whole littoral	*Myriophyllum spicatum*
Spokane	Amber Lake	34	8/5/94	at boatramp, from shore	none
	Badger Lake	34	8/5/94	2 sites at extreme ends	none
	Chapman Lake	34	8/24/95	3 sites	none
	Clear Lake	43	8/4/94	4 sites, most of shoreline	none
	Downs Lake	34	8/3/94	from shore - one location	none
	Eloika Lake	55	8/3/94	3 sites, missed some places	M. spicatum
	Fishtrap Lake	43	8/4/94	3 sites	none
	Long Lake (reservoir)	54	8/6/94	2 sites near boatlaunch	*Lythrum salicaria*
			8/25/95	1 site	
	Silver Lake	34	8/4/94	only at boatramp (closed)	none
			8/24/95	2 sites	none
	Williams Lake	34	8/5/94	boatlaunch and south end	none
Stevens	Loon Lake	59	09/25/96	whole littoral	*Myriophyllum spicatum*
Thurston	Black Lake	23	7/8/94	north end	none
			4/18/95	1 site to test methods	none
	Hicks Lake	13	5/24/95	3 sample sites, shoreline	none
	Lawrence Lake	13	11/7/95	spot check from shore	none
	Long Lake	14	6/6/95	spot check	*Myriophyllum spicatum*

			9/20/95	milfoil site	
			10/18/95	spot check	
			11/2/95	milfoil site	
Wahkiakum	Columbia River at Cathlamet	25	8/16/95	spot check, boat	*Lythrum salicaria* *Myriophyllum spicatum*
	Columbia River at Skamokawa	25	08/08/96	spot check, boat	*Lythrum salicaria*
	Puget Island Sloughs	25	5/16/95	2 sloughs, from shore	*Egeria densa* *Myriophyllum aquaticum*
Walla Walla	Snake River - Lower	33	08/20/96	spot check, boat	*Lythrum salicaria* *Myriophyllum spicatum*
	Snake River at Charbonneau	33	08/19/96	spot check, boat	none
	Snake River at Fishhook Park	33	08/19/96	spot check, boat	none
	Snake River at Ice Harbor Dam	33	08/19/96	spot check, boat	*Myriophyllum spicatum*
Whatcom	Cain Lake	3	08/14/96	whole littoral	none
	Terrell Lake	1	08/14/96	whole littoral	*Lythrum salicaria*
	Whatcom Lake	1	6/21/95	3 sites, littoral, west basin	*Myriophyllum spicatum*
	Wiser Lake	1	08/14/96	spot check, shore	none
Whitman	Rock Lake	34	8/5/94	south boatramp, from shore	none
Yakima	Giffin Lake	37	7/19/95	from shore	none
	Morgan Lake	37	7/19/95	spot check, from shore	none
	pond nr hwy 12	37	8/8/94	one spot, from shore	none
	Unnamed pond (14N-19E-31)	39	7/18/95	spot check, from shore	none
	Unnamed Ponds (12N-19E-20)	37	7/18/95	spot check, from shore	*Myriophyllum spicatum*
	Yakima River	37	8/8/94	from Selah to Arboretum	*Lythrum salicaria*
			9/27/94	Arboretum to Union Gap	*Lythrum salicaria*
			7/19/95	Mabton Bridge	none

Appendix B

Plant Identification References

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