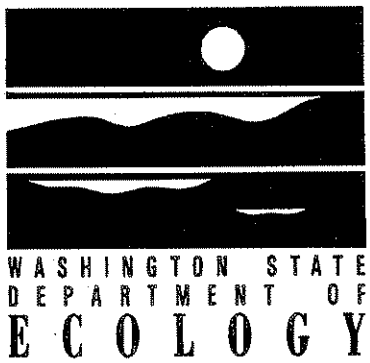

Aquatic Plant Technical Assistance

1994 Activity Report

June 1995
Publication No. 95-331

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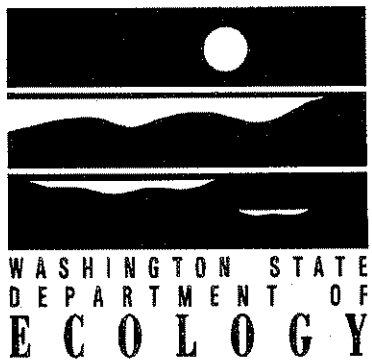

Aquatic Plant Technical Assistance

1994 Activity Report

Prepared by
Jenifer Parsons

Environmental Investigations
and Laboratory Services Program
Ambient Monitoring Section
Washington State Department of Ecology
Olympia, Washington 98504-7710

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Table of Contents

List of Tables iii

List of Figures iii

Acknowledgements iv

Abstract v

Introduction 1

Technical Assistance 1

Site Visits 3
- Introduction 3
- Site Visit Objectives 3
- Study Plan 4
- General Field Methods 4
- Aquatic Plant Survey Results 5

Database Structure 9

Herbarium 12
- Methods Used in Identification of Aquatic Plants 12
- Methods Used in Collection and Preservation 12

Observations on Biological Control 20

Aquatic Weed Management Fund Related Activities 21
- Grant Reviews 21
- Aquatic Plant Field Guide 22

Recommendations 22
- Aquatic Plant Technical Assistance 22

Literature Cited 23

APPENDIX A. Articles Published in Washington Lake Protection Association newsletter "Waterline"

APPENDIX B. Distribution of Known and Reported Populations of Invasive Aquatic Plants in Washington State

APPENDIX C. Field Form for Macrophyte Data

APPENDIX D. References Used in Aquatic Plant Identification

APPENDIX E. Information Sheet - How to Press and Mount Aquatic Plants

List of Tables

Table 1. Aquatic plant technical outreach activities 2

Table 2. Site visit and results summary table. 6

Table 3. Herbarium specimen list. 13

Table 4. AWMF grant applications - 1994 21

List of Figures

Figure 1. Database table structures. 10

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Abstract

The objectives of the Aquatic Plant Technical Assistance Program are to provide aquatic plant related technical assistance to government agencies and the public, conduct site visits to expand the base of knowledge on aquatic plants and their habitat, and to assist with evaluating applications for Freshwater Aquatic Weed Program grant money.

During 1994, the first year of this program, aquatic plant data were gathered and organized in a database for 76 waterbodies located throughout the state. Findings of particular significance were discovery of five previously unknown populations of *Myriophyllum spicatum* (Eurasian watermilfoil), two sites with *Egeria densa* (Brazilian elodea), and one site with *Lythrum salicaria* (purple loosestrife). Aquatic plants were assembled for an herbarium reference collection, which contains more than 150 pressed and mounted specimens. Observations on biological control agents (such as herbivorous insects) were also made during field visits. In addition, education and technical outreach efforts were well received, assistance was provided for an aquatic plant field identification guide contract, and 11 projects applying for Freshwater Aquatic Weed Program grant money were reviewed.

Introduction

The Freshwater Aquatic Weed Program was established to provide grant money to local governments for aquatic plant management projects and to respond to the demand for additional expertise regarding aquatic plants and related issues. 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 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 targeted objectives for this new technical outreach position were as follows:

1) to provide technical assistance on aquatic plant identification and management to government agencies and the public,
2) to conduct site visits to identify aquatic plants and evaluate plant community structure and the existence or potential for problems, and
3) to assist with rating grant applications for monies from the Freshwater Aquatic Weed Program.

The purpose of this report is to document the progress of the Aquatic Plant Technical Assistance Program with respect to these objectives.

Technical Assistance

An external advisory committee identified technical assistance for aquatic plant taxonomy, ecology, and management as an important need when the Freshwater Aquatic Weed Management Program was developed through legislative action (RCW 43-21A.660). 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."

Fulfilling this goal 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 the Washington Lake Protection Association (WALPA) newsletter (Appendix A) between February 1 and December 31, 1994 (Table 1). I have also assisted the public and local governments on an informal basis through phone conversations and informal meetings, which are not listed.

Table 1. Aquatic plant technical outreach activities

Function	Date	Location	Role
Vegetation management conference - Whatcom Co. Noxious Weed Control Board	02/15/94	Bellingham	Information gathering, networking.
Western Aquatic Plant Management Society Annual Meeting	03/17/94	Coeur d'Alene, ID	Oral presentation of paper on associations between macrophytes and macroinvertebrates in a freshwater pond, attended presentations, networking.
Volunteer Monitoring Conference field trip	04/14/94	Portland, OR	Attended Field trip - coastal lakes and macrophyte mapping.
Steel Lake Steering Committee Meeting	04/21/94	Federal Way	Offered assistance, they are creating an Aquatic Plant Management Plan.
WALPA (Washington Lakes Protection Association) newsletter	06/01/94		Wrote an article titled 'Aquatic Plants - Who Needs 'Em?' (Appendix A).
Met with representative from the Skagit Co. Noxious Weed Board	06/06/94	Skagit County	Provided assistance with plant identification, made recommendations regarding the extent of invasive plant problems.
WALPA aquatic plant workshop	06/18/94	Everett	Demonstration on how to press aquatic plants.
Ecology Public Grant Application Workshop	06/21/94	Lacey	Attended to answer questions, provide opinions.
Met with Thurston County Lakes Program Staff	07/08/94	Black Lake	Assisted with plant identification.
Met with Yakima River Purple Loosestrife Taskforce	08/08/94	Yakima	Provided assistance with plant identification - required by their Early Infestation Grant.
Met with citizens from Big Lake, Skagit County	08/23/94	Big Lake	Plant identification to aid development of the aquatic plant mapping portion of their Aquatic Plant Management Plan.

Table 1. Continued

Function	Date	Location	Role
Met with Kittitas Co Weed Control Board	08/30/94	Ellensburg	Assisted with plant identification, surveyed for exotic invasive plants.
WALPA Aquatic Plant Workshop	09/11/94	Spokane	Displayed pressed plants, answered questions.
Kitsap Water Festival	09/16/94	Bremerton	Hosted a 'Lake Game' for 4th and 5th grade students.
WALPA Annual Conference	09/22 - 24/94	Moses Lake	Gave presentations on aquatic plant identification and plant pressing, helped identify plants attenders brought.
US Army Corps of Engineers Annual Aquatic Plant Control Research Program Meeting	11/14 - 17/94	Vicksburg, Mississippi	Attended meetings, networking, information sharing.
WALPA newsletter	12/94		Article stating where new populations of invasive aquatic plants were found during 1994 (Appendix A).

Site Visits

Introduction

This section documents aquatic plant surveys conducted during the 1994 field season. The purpose of these site visits was to identify aquatic plants, evaluate plant community structure, estimate the extent of aquatic plant problems or potential for problems, and suggest possible management options. Another important aspect of this project was the creation and maintenance of an aquatic plant database and an herbarium collection, which will be discussed in separate sections. The information gathered during the field visits has significantly expanded the aquatic plant distribution knowledge base in Washington State.

Site Visit Objectives

- To develop a statewide base of aquatic plant data.

- To investigate the spread or decline of exotic invasive species in water bodies throughout the state.

Study Plan

The following criteria were used to identify lakes to be surveyed for aquatic plants:

a. Lakes requested by citizens or government officials.
b. Confirm sightings where a population of an exotic invasive species was suspected, or where the extent of such populations needed to be documented. (*i.e.*, the southwest coastal area was surveyed to investigate reports of *Myriophyllum aquaticum* (parrotfeather), *Cabomba* (fanwort) and *Egeria densa* (Brazilian elodea), and to look for *M. spicatum* (Eurasian water-milfoil)).
c. Additional potential problem areas based on proximity to existing known populations of exotic invasive species, accessibility, and popularity with the public.

Before a waterbody was visited, background information was collected. This consisted of obtaining maps of the area (bathymetric and aerial photos, if available), talking to Ecology people with relevant information, and contacting the noxious weed board or other local, state, or federal government entities that may have had knowledge or information relating to aquatic plants in that region.

Meetings with lake groups or local government representatives were arranged if appropriate during the site visit. Educational outreach and networking were combined with field trips within the limits of time constraints. If a new population of an exotic species was found, the appropriate local government official was contacted and informed of the situation. In several cases, the local government is now interested in applying for Aquatic Weed Management Fund grant monies to use toward controlling the exotic plant problem.

General Field Methods

The objective for this, the first field season, was to create the most complete species list possible for each surveyed waterbody and include distribution notes on the plants found. Field methods from several related studies were reviewed and experts in aquatic plant ecology were consulted before the start of the field season (Sytsma, personal communication, 1994; Warrington, personal communication, 1994; Fortin *et al.*, 1993; Idaho Department of Health and Welfare, 1993; Madsen and Bloomfield, 1993; Newroth, 1993; Spencer and Whitehead, 1993; Titus, 1993; Simpson, 1991; Canfield *et al.*, 1990; Pine, *et al.* 1989, Downing and Anderson, 1985; Dubois *et al.*, 1984). The random and transect sampling designs used by many investigators work well when the objective is plant biomass measurements or aquatic macrophyte community maps. However, the nature of those designs can exclude habitat microsites, which often contain different plant communities. Therefore, for most lakes I used a method recommended by Dr. Patrick Warrington and Dr. Mark Sytsma. This method consisted of circumnavigating the littoral zone in a small boat. (In some cases either the waterbody size or access limits restricted the survey extent.)

When a different plant or type of habitat was observed, samples were collected using a weighted rake, by hand-pulling or by visual observation. This observation and intuition based system provided a relatively complete species list.

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 and visual placement on a map. Notes were made on the species name and density (a subjective value between 1 and 5, with 5 being the most dense).

Collections were made of any unusual species and of known or suspected exotic species. These were pressed, mounted, and retained in the herbarium collection (see Herbarium section in this report). Samples of milfoil species were sent fresh to Dr. Glen Furnier's lab at the University of Minnesota. This was to assist with the development of a protocol for differentiation between milfoil species using DNA analysis (a protocol we hope to employ locally next year). Other recorded information included the maximum depth of macrophyte growth, Secchi depth, and sediment type.

Aquatic Plant Survey Results

Maps of known or suspected populations of aquatic invasive plants have been included in Appendix B. These maps will be revised as the populations are verified, and as more populations are found. From these maps it can be seen that Eurasian watermilfoil (*Myriophyllum spicatum*) has been found throughout the Columbia River and many of its tributaries. From observations this year, it appears to be spreading out from these drainages, into lakes higher in the watersheds. This plant is also widespread in King County and all along the Interstate-5 corridor. This is not surprising since this is the part of the state with the highest population density, and the highway facilitates the plant's spread via boat trailers. Similar trends in colonization have been noted in other regions of the country as well (Madsen, 1994; Sheldon, 1994). The other invasive non-native plant with several occurrences in the state is Brazilian elodea (*Egeria densa*). So far it has only been found west of the Cascade mountains. It appears to be spreading in this region, most likely through aquarium or garden pond dumping. It has proven to be both tenacious and prolific in lakes where it occurs, causing problems at least as severe as Eurasian watermilfoil. Areas with populations of Brazilian elodea should be monitored closely to avoid a more widespread problem. (It is still sold in aquarium and garden supply stores, but its recent inclusion on the state noxious weed list, and information we plan to distribute to these establishments, will hopefully curtail this). The other two noxious invasive plants included on the maps are *Cabomba caroliniana* (fanwort) and *Myriophyllum aquaticum* (parrot feather). Until this year they were known only from sloughs along the lower Columbia River. However, a Thurston County official reported a new sighting of *M. aquaticum* in the Chehalis River near Chehalis, so this plant may also be becoming more widespread.

Table 2 lists the lakes where aquatic plant data were gathered during the 1994 field season, the extent of the survey conducted, and any plants of concern that were found. Previously unknown populations of weedy exotic species were identified at the following locations:

Table 2. Site visit and results summary table.

County	Waterbody Name	Date	WRIA*	Extent of Survey	Weedy Exotics Found
Chelan	Antilon Lake	8/31/94	47	from shore, N and S ends	none
	Chelan Lake	8/31/94	47	from shore, Chelan City Park	*M. spicatum* fragments
	Dry Lake	8/31/94	47	from shore, east end	none
	Roses Lake	8/31/94	40	south shore	none
	Wapato Lake	8/31/94	47	entire shoreline	*M. spicatum*
	Wenatchee Lake	9/1/94	45	west end, east boat launch	none
Clark	Battleground Lake	4/13/94	28	from dock only	*Egeria densa*
Cowlitz	Silver Lake	9/7/94	26	several locations thu' lake	*Myriophyllum spicatum*
	Solo Slough	4/13/94	25	spot check from shore	*M. aquaticum*
		7/14/94		spot check from shore	*Egeria densa*
					Ludwigia sp
					Cabomba caroliniana
	Willow Grove Slough	4/13/94	25	spot check from shore	*Cabomba caroliniana*
		7/14/94		spot check from shore	*Myriophyllum spicatum*
					Egeria densa
Grant	Burke Lake	6/28/94	41	entire shoreline	*Lythrum salicaria*
	Evergreen Lake	6/27/94	41	entire shoreline	*M. spicatum*
					Lythrum salicaria
	Potholes Reservoir	8/7/94	41	6 sites on N & W side	*M. spicatum*
	Quincy Lake	6/28/94	41	entire shoreline	*Lythrum salicaria*
	Stan Coffin Lake	6/29/94	41	entire shoreline	*M. spicatum*
					Lythrum salicaria
Island	Cranberry	8/24/94	6	4 sites around lake	none
Jefferson	Crocker Lake	5/24/94	17	northwest half - littoral	none
	Leland Lake	5/24/94	17	entire shoreline	*Egeria densa*
King	Steel Lake	5/11/94	9	entire shoreline, divers	*M. spicatum*
Kitsap	Long Lake	9/12/94	15	several locations	*Egeria densa*
					M. spicatum
					Lythrum salicaria
Kittitas	Easton Lake	8/30/94	39	spot check from shore	none
	Kiwanis Pond	8/30/94	39	spot check from shore	none
	unnamed fishing pond	8/30/94	39	most of shoreline	none
	unnamed ponds	8/30/94	39	spot checks	*Lythrum salicaria* at one
Lincoln	Sprague Lake	8/6/94	34	cove at NE end of lake	none
Mason	Devereaux Lake	8/16/94	15	spot check from shore	none
	Haven Lake	8/16/94	15	entire shoreline	none
	Isabella Lake	7/19/94	14	entire shoreline	none
	Limerick	8/15/94	14	entire shoreline	*Egeria densa*
	Lost Lake	8/11/94	14	entire shoreline	none
	Spencer Lake	8/15/94	14	most of shoreline	*Lythrum salicaria*
	Wooten Lake	8/16/94	15	most of shoreline	none
Okanogan	Aeneas Lake	7/25/94	49	entire shoreline	none

Table 2. Continued.

County	Waterbody Name	Date	WRIA*	Extent of Survey	Weedy Exotics Found
Okanogan	Conconully Lake	7/26/94	49	7 sites thru' shoreline	*M. spicatum?*
	Conconully Reservoir	7/26/94	49	north end	none
	Fish Lake	7/26/94	49	entire shoreline	none
	Palmer Lake	7/27/94	49	boatlaunches, from shore	none
	Spectacle Lake	7/27/94	49	5 sites, various locations	none
	Wannacut Lake	7/28/94	49	3 sites	none
	Whitestone Lake	7/27/94	49	5 sites, various locations	*M. spicatum*
					Lythrum salicaria
Pacific	Black Lake	7/12/94	24	most of shoreline	*Egeria densa*
	Island Lake	7/14/94	24	entire shoreline	none
	Loomis Lake	7/13/94	24	most of shoreline	none
	O'Neil Lake	7/12/94	24	entire littoral	none
	Surfside Lake	7/13/94	24	5 sites from bridges	none
Pend Oreille	Davis Lake	8/2/94	62	most of littoral	none
	Diamond Lake	8/2/94	55	at boatlaunch, from shore	none
	Fan Lake	8/3/94	55	entire shoreline	*Lythrum salicaria*
	Little Spokane River	8/2/94	55	at Fertile Valley Rd crossing	*M. spicatum*
				at Haworth Rd crossing	none
	Marshall Lake	8/1/94	62	3 sites, mostly at inlets	none
	Sacheen Lake	8/2/94	55	3 sites, covered entire shore	*M. spicatum*
					Lythrum salicaria
Pierce	American Lake	10/4/94	12	4 sites	none
	Clear Lake	7/21/94	11	entire shoreline	*M. spicatum*
	Tanwax Lake	7/21/94	11	entire shoreline	none
Skagit	Beaver Lake	8/25/94	3	entire shoreline	none
	Big Lake	8/23/94	3	3 sites, extreme ends	*E. densa*
				& launch	*M. spicatum*
	Campbell Lake	6/7/94	3	entire shoreline	none
	Clear Lake	8/25/94	3	boatramp only	*M. spicatum*
	Erie Lake	8/24/94	3	Entire shoreline	none
	Heart Lake (Fidalgo)	8/24/94	3	most of shoreline	none
	McMurray Lake	6/6/94	3	entire shoreline	*M. spicatum*
		8/23/94		entire shoreline	*M. spicatum*
	Sixteen Lake	6/6/94	3	entire shoreline	*M. spicatum*
Snohomish	Roesiger Lake	8/25/94	7	most of shoreline	none
Spokane	Amber Lake	8/5/94	34	at boatramp, from shore	none
	Badger Lake	8/5/94	34	2 sites at extreme ends	none
	Clear Lake	8/4/94	43	4 sites, most of shoreline	none
	Downs Lake	8/3/94	34	from shore - one location	none
	Eloika Lake	8/3/94	55	3 sites, missed some places	*M. spicatum*
	Fishtrap Lake	8/4/94	43	3 sites	none

Table 2. Continued.

County	Waterbody Name	Date	WRIA*	Extent of Survey	Weedy Exotics Found
Spokane	Long Lake (reservoir)	8/6/94	54	2 sites near boatlaunch	*Nymphoides peltata*
	Silver Lake	8/4/94	34	only at boatramp (closed)	none
	Williams Lake	8/5/94	34	boatlaunch and south end	none
Thurston	Black Lake	7/8/94	23	north end	none
Whitman	Rock Lake	8/5/94	34	south boatramp, from shore	none
Yakima	Yakima River	8/8/94	37	from Selah to Arboretum	*Lythrum salicaria*
		9/27/94		Arboretum to Union Gap	*Lythrum salicaria*
	pond nr hwy 12	8/8/94	37	one spot, from shore	none

* WRIA - Watershed Resource Inventory Area

Note: The following is a list of common names to aid table interpretation:

Cabomba caroliniana	fanwort
Egeria densa	Brazilian elodea
Ludwigia	water-primrose
Lythrum salicaria	purple loosestrife
Myriophyllum aquaticum	parrotfeather
Myriophyllum spicatum	Eurasian watermilfoil
Nymphoides peltata	water fringe
Sagittaria	arrowhead

- Wapato Lake in Chelan County - a few individual *Myriophyllum spicatum* plants were found near the boat launch.
- Leland Lake in Jefferson County - a large patch of *Egeria densa* is in the western end of the lake.
- Long Lake in Kitsap County - *Myriophyllum spicatum* joins a well established and previously verified population of *Egeria densa*.
- Spencer Lake in Mason County - A small patch of *Lythrum salicaria* (purple loosestrife) is along one segment of shoreline.
- Whitestone Lake in Okanogan County - has three small to medium-sized patches of *Myriophyllum spicatum*.
- Black Lake in Pacific County - *Egeria densa* is widely distributed and thick in some areas.
- Big Lake in Skagit County - *Myriophyllum spicatum* is new, joins an extensive population of *Egeria densa*.
- Clear Lake in Pierce County - *Myriophyllum spicatum*, reportedly eradicated with herbicide. These are apparently healthy remnant patches.

In all cases, local government officials have been notified of the existence of these plants.

In addition to the weedy plants, populations of three plants listed as rare by the Washington Natural Heritage Program (WNHP) were found during our surveys. These sightings were reported to WNHP. The first was; *Lobelia dortmanna* or water lobelia, which was documented in two Mason County lakes. This plant is also known from recent sightings in Clallam County, King County, San Juan County, and Skagit County. Another was *Limosella acaulis* (mudwort), which was found in a Grant County Lake. This sighting joins other recent sightings from Chelan County, Whatcom County, and sites along the Columbia River. The third plant, *Potamogeton obtusifolius* (bluntleaf pondweed), needs to be confirmed late in the growing season next year. It would be only the third record of this plant in the state.

Database Structure

The aquatic plant database consists of four related database tables in Microsoft Access®:

1) waterbody data table,
2) date data table,
3) station data table, and
4) macrophyte data table

The structure of the database tables is shown in Figure 1. The identifier used by the Lake Water Quality Assessment Program (LWQA) database (which is in dBASE IV) has also been included so the aquatic plant database can be related to the LWQA database when necessary.

Figure 1. Structure of Database Tables

WATERBODY DATABASE

Field Name	Key Field	Data Type	Description
Waterbody Name		Text	Name of the waterbody (50 char)
County		Text	County where the waterbody is located (25 char)
Name (county)	yes	Text	Waterbody name and county, (50 char)
State		Text	State where the waterbody is located (2 char)
Legal location		Text	Township, Range and Section of the waterbody (at the outlet) (20 char)
Latitude		Number	Latitude in degrees, minutes, seconds
Longitude		Number	Longitude in degrees, minutes, seconds
WRIA		Number	Water Resource Inventory Area (as defined by Ecology)
WTBS		Text	Waterbody Tracking System Number (10 char)
Maximum depth		Number	Maximum depth of the waterbody (feet)
Surface area		Number	Surface area of the waterbody (acres)
Ecoregion		Number	Ecoregion where the waterbody is located (defined by Ecology)
Elevation		Number	Elevation of the waterbody (feet)
Access		Memo	Lists types of access to the water
Type of uses		Memo	Lists the allowed uses of the waterbody
Comments		Memo	Contains any comments relating to the waterbody

DATE DATABASE

Field Name	Key Field	Data Type	Description
Name (county)	yes	Text	Waterbody name and county, (50 char)
Date	yes	Date	Date of the site visit (day-month-year)
Examiner		Text	Name of the person conducting the site visit (50 char)
Examiner association		Text	Affiliation of the Examiner (ie who they work for) (50 char)
Secchi depth		Number	A measure of water clarity (meters)
Max depth plant growth		Number	Maximum depth at which plants were observed to grow (meters)
Number of sites		Number	Number of sites where data was collected on this day
Comments		Memo	Any comments relating to this date at this waterbody (weather)

STATION DATABASE

Field Name	Key Field	Data Type	Description
Name (county)	yes	Text	Waterbody name and county, (50 char)
Station ID	yes	Text	Unique identifier for the station, (50 char)
GPS location north		Number	Location given by Global Positioning System, degrees, minutes and hundredths
GPS location west		Number	Location given by Global Positioning System, degrees, minutes and hundredths
Location description		Memo	Written description of location
Substrate		Text	Description of the substrate composition (50 char)
Depth		Text	Depth where the station is located (may be a range) (meters) (50 char)
Current		Text	Description of water flow at the station (50 char)
Comments		Memo	Any comments relating to this station at this waterbody

Figure 1. Continued.

MACROPHYTE DATABASE

Field Name	Key Field	Data Type	Description
Name (county)	yes	Text	Waterbody name and county, (50 char)
Station ID	yes	Text	Unique identifier for the station, (50 char)
Date	yes	Date	Date of the site visit, (50 char)
Species code	yes	Text	Six letter abbreviation (first 3 letters of the genus and species), (50 char)
Distribution Value		Number	Value between 1 and 5 with 5 being the most dense growth
Comments		Memo	Any comments relating to this plant
In herbarium		Yes/No	Yes if the plant was collected and preserved in the herbarium

The database structure has been designed to allow the incorporation of other databases as the need arises (such as a polygon database when a vegetation mapping project is undertaken). It has also been designed to be used with a Geographic Information System (GIS) for creating both large and small scale maps.

A field form designed to correspond with the database (Appendix C) was filled out during the field visits. This form facilitates data entry. All completed field forms and maps are filed by county and lake name.

Herbarium

Methods Used in Identification of Aquatic Plants

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). A number of books and other sources have been gathered to use as cross references (Appendix D). In addition to the books, several people from within and outside the agency were consulted in cases where identification was difficult. In the case of the *Myriophyllum* group (milfoil), samples were sent to the University of Minnesota to assist with protocol development for using DNA analysis in species identification.

Methods Used in Collection and Preservation

The methods we followed were taken from Haynes (1984), and are summarized in an information sheet prepared for the public on how to press and mount aquatic plants (Appendix E). First, we collected all available parts of the plant (roots, stem, flowering parts) and sealed them 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 specimens are stored as a reference collection in a sealed herbarium cabinet located in the Ecology headquarters building benthic lab.

Specimens that have been collected, pressed, and labeled to date are listed in Table 3. Some additional specimens are awaiting confirmation of identification from DNA analysis or from experts in the taxon before they will be included. New specimens will be added to the herbarium as they are collected in future years. When organization is complete for this year, the collection will be made available to interested Ecology staff and the public as both a reference and permanent record.

Table 3: Herbarium Specimen List

Scientific name	Common name	Waterbody Name	Date
Alisma gramineum	narrowleaf water-plantain		
		Aeneas, Okanogan County	25-Jul-94
Brasenia schreberi	watershield		
		Tanwax Lake, Pierce County	21-Jul-94
Cabomba caroliniana	fanwort		
		Cullaby Lake, Clatsop County	13-Apr-94
		Solo Slough, Cowlitz County	13-Apr-94
		Willow Grove Slough, Cowlitz County	14-Jul-94
Callitriche hermaphroditica	northern water-starwort		
		Evergreen Lake, Grant County	27-Jun-94
Callitriche stagnalis	pond water-starwort		
		Isabella Lake, Mason County	19-Jul-94
		Yakima River (13N-19E-07), Yakima County	08-Aug-94
Ceratophyllum demersum	Coontail; hornwort		
		Campbell Lake, Skagit County	07-Jun-94
		Yakima River (13N-19E-07), Yakima County	08-Aug-94
Cinna latifolia	wood reed-grass		
		Crocker Lake, Jefferson County	24-May-94
Dulichium arundinaceum	Dulichium		
		Island Lake, Pacific County	14-Jul-94
		Lost Lake, Mason County	11-Aug-94
Egeria densa	Brazilian elodea		
		Battleground Lake, Clark County	13-Apr-94
		Big Lake, Skagit County	23-Aug-94
		Black Lake, Pacific County	12-Jul-94
		Leland Lake, Jefferson County	24-May-94
		Limerick Lake, Mason County	15-Aug-94
		Long Lake, Kitsap County	12-Sep-94
		Solo Slough, Cowlitz County	13-Apr-94
		Willow Grove Slough, Cowlitz County	14-Jul-94

Scientific name	Common name	Waterbody Name	Date
Elatine triandra	three-stamen waterwort		
		Unnamed Pond, Kittitas County	30-Aug-94
Eleocharis acicularis	needle spike-rush		
		Limerick Lake, Mason County	15-Aug-94
Elodea canadensis	common elodea		
		Burke Lake, Grant County	28-Jun-94
		Campbell Lake, Skagit County	07-Jun-94
		Conconully (Salmon) Lake, Okanogan County	26-Jul-94
		Leland Lake, Jefferson County	24-May-94
		Limerick Lake, Mason County	15-Aug-94
		McMurray, Skagit County	06-Jun-94
		Sixteen Lake, Skagit County	06-Jun-94
		Yakima River (13N-19E-07), Yakima County	08-Aug-94
Elodea nuttallii	Nuttall's waterweed		
		Conconully Reservoir (35N-25E-18), Okanogan County	26-Jul-94
		Roesiger (south arm) Lake, Snohomish County	25-Aug-94
		Tanwax Lake, Pierce County	21-Jul-94
Glyceria borealis	northern mannagrass		
		Loomis Lake, Pacific County	13-Jul-94
Hippuris vulgaris	common marestail		
		Conconully Reservoir (35N-25E-18), Okanogan County	26-Jul-94
		Downs Lake, Lincoln County	03-Aug-94
Hydrocotyle ranunculoides	water-pennywort		
		Long Lake, Kitsap County	12-Sep-94
		Loomis Lake, Pacific County	13-Jul-94
Isoetes lacustris	lake quillwort		
		Clear Lake, Pierce County	21-Jul-94
		Isabella Lake, Mason County	19-Jul-94
Juncus acuminatus	tapered rush		
		Lost Lake, Mason County	11-Aug-94
Juncus supinus	bulbous rush		

Scientific name	Common name	Waterbody Name	Date
		O'Neil Lake, Pacific County	12-Jul-94
Limosella acaulis	mudwort		
		Evergreen Lake, Grant County	27-Jun-94
Lobelia dortmanna	water gladiole; water lobelia		
		Nahwatzel Lake, Mason County	25-Aug-94
		Spencer Lake, Mason County	15-Aug-94
Ludwigia palustris	water-purslane		
		Limerick Lake, Mason County	15-Aug-94
		O'Neil Lake, Pacific County	12-Jul-94
Megalodonta beckii	water marigold		
		Davis Lake, Pend Oreille County	02-Aug-94
Myriophyllum aquaticum	parrotfeather		
		Solo Slough, Cowlitz County	14-Jul-94
Myriophyllum hippuroides	western watermilfoil		
		Black Lake, Pacific County	12-Jul-94
		Loma Lake, Snohomish County	30-May-94
Myriophyllum sibiricum	northern watermilfoil		
		Aeneas, Okanogan County	25-Jul-94
		Beaver Lake, Skagit County	25-Aug-94
		Burke Lake, Grant County	28-Jun-94
		Campbell Lake, Skagit County	07-Jun-94
		Clear Lake, Spokane County	04-Aug-94
		Cranberry Lake, Island County	24-Aug-94
		Eloika Lake, Spokane County	03-Aug-94
		Erie Lake, Skagit County	24-Aug-94
		Fan Lake, Pend Oreille County	03-Aug-94
		Fish Lake, Okanogan County	26-Jul-94
		Fishtrap Lake, Lincoln County	04-Aug-94
		Heart Lake (35N-01E-36), Skagit County	24-Aug-94
		Kiwanis Pond, Kittitas County	30-Aug-94
		Quincy Lake, Grant County	28-Jun-94
		Sprague Lake, Adams County	06-Aug-94
		Wapato Lake, Chelan County	31-Aug-94

Scientific name	Common name	Waterbody Name	Date
		Whitestone Lake, Okanogan County	27-Jul-94
		Williams Lake, Spokane County	05-Aug-94
Myriophyllum spicatum	Eurasian water-milfoil		
		Big Lake, Skagit County	23-Aug-94
		Byron Lake, Yakima County	30-Aug-94
		Carlisle Lake, Lewis County	31-Aug-94
		Chelan Lake, Chelan County	31-Aug-94
		Clear Lake (34N-05E-07), Skagit County	25-Aug-94
		Clear Lake, Pierce County	21-Jul-94
		Cortez (Three) Lake, Chelan County	23-Aug-94
		Eloika Lake, Spokane County	03-Aug-94
		Evergreen Lake, Grant County	27-Jun-94
		Long Lake, Kitsap County	12-Sep-94
		Long Lake, Kitsap County	17-Mar-95
		McMurray, Skagit County	23-Aug-94
		McMurray, Skagit County	06-Jun-94
		Potholes Reservoir, Grant County	07-Aug-94
		Sacheen Lake, Pend Oreille County	02-Aug-94
		Sixteen Lake, Skagit County	06-Jun-94
		Stan Coffin Lake, Grant County	29-Jun-94
		Steel Lake, King County	17-May-94
		Wapato Lake, Chelan County	31-Aug-94
		Whitestone Lake, Okanogan County	27-Jul-94
		Willow Grove Slough, Cowlitz County	14-Jul-94
Myriophyllum verticillatum	whorled watermilfoil		
		Little Spokane River, Pend Oreille County	02-Aug-94
Najas flexilis	common naiad		
		Burke Lake, Grant County	28-Jun-94
		Loomis Lake, Pacific County	13-Jul-94
		Spencer Lake, Mason County	15-Aug-94

Scientific name	Common name	Waterbody Name	Date
Najas gradalupensis	Guadalupe water-nymph		
		Erie Lake, Skagit County	24-Aug-94
Nuphar polysepalum	spatter-dock, yellow water-lily		
		Leland Lake, Jefferson County	24-May-94
Nymphoides peltata	water fringe		
		Long Lake (Reservoir), Spokane County	06-Aug-94
Polygonum amphibium	water smartweed		
		Aeneas, Okanogan County	25-Jul-94
		Wapato Lake, Chelan County	31-Aug-94
Polygonum hydropiperoides	common smartweed		
		Limerick Lake, Mason County	15-Aug-94
Potamogeton amplifolius	large-leaf pondweed		
		Sixteen Lake, Skagit County	06-Jun-94
Potamogeton crispus	curly leaf pondweed		
		Evergreen Lake, Grant County	27-Jun-94
		Long Lake, Kitsap County	12-Sep-94
		Yakima River (13N-19E-07), Yakima County	08-Aug-94
Potamogeton epihydrus	ribbonleaf pondweed		
		Black Lake, Pacific County	12-Jul-94
		Black Lake, Thurston County	08-Jul-94
		Island Lake, Pacific County	14-Jul-94
		Lost Lake, Mason County	11-Aug-94
		McMurray, Skagit County	06-Jun-94
Potamogeton foliosus	leafy pondweed		
		Conconully (Salmon) Lake, Okanogan County	26-Jul-94
		Haven Lake, Mason County	16-Aug-94
		Unnamed Pond, Kittitas County	30-Aug-94
		Williams Lake, Spokane County	05-Aug-94
		Yakima River (13N-19E-07), Yakima County	08-Aug-94
Potamogeton gramineus	grass-leaved pondweed		
		American Lake, Pierce County	04-Oct-94

Scientific name	Common name	Waterbody Name	Date
Potamogeton illinoensis	Illinois pondweed		
		Aeneas, Okanogan County	25-Jul-94
Potamogeton natans	floating leaf pondweed		
		O'Neil Lake, Pacific County	12-Jul-94
		Unnamed Pond (19N-02W-31), Thurston County	17-Jun-94
		Williams Lake, Spokane County	05-Aug-94
Potamogeton nodosus	longleaf pondweed		
		Evergreen Lake, Grant County	27-Jun-94
Potamogeton pectinatus	sago pondweed		
		Aeneas, Okanogan County	25-Jul-94
		Evergreen Lake, Grant County	27-Jun-94
		Quincy Lake, Grant County	28-Jun-94
		Spectacle Lake, Okanogan County	27-Jul-94
Potamogeton praelongus	whitestem pondweed		
		Leland Lake, Jefferson County	24-May-94
		Tanwax Lake, Pierce County	21-Jul-94
Potamogeton richardsonii	Richardson's pondweed		
		Campbell Lake, Skagit County	07-Jun-94
		Evergreen Lake, Grant County	27-Jun-94
Potamogeton robbinsii	fern leaf pondweed		
		Isabella Lake, Mason County	19-Jul-94
		Leland Lake, Jefferson County	24-May-94
Potamogeton zosteriformis	eel-grass pondweed		
		Isabella Lake, Mason County	19-Jul-94
		Loomis Lake, Pacific County	13-Jul-94
		Williams Lake, Spokane County	05-Aug-94
Ranunculus aquatilis	water-buttercup		
		Evergreen Lake, Grant County	27-Jun-94
		Quincy Lake, Grant County	28-Jun-94
Ranunculus flammula	creeping buttercup		
		Devereaux Lake, Mason County	16-Aug-94
		O'Neil Lake, Pacific County	12-Jul-94
		Surfside Lake, Pacific County	13-Jul-94

Scientific name	Common name	Waterbody Name	Date
Rorippa nasturtium-aquaticum	water-cress		
		Unnamed slough (34N-04E), Skagit County	07-Jun-94
Ruppia maritima	ditch-grass		
		Wannacut Lake, Okanogan County	28-Jul-94
Sagittaria cuneata	Arumleaf arrowhead, wapato		
		Badger Lake, Spokane County	05-Aug-94
Scirpus cyperinus	wool-grass		
		Spencer Lake, Mason County	15-Aug-94
Scirpus maritimus	seacoast bulrush		
		Aeneas, Okanogan County	25-Jul-94
Scirpus subterminalis	fescue scolochloa		
		Island Lake, Pacific County	14-Jul-94
		Spencer Lake, Mason County	15-Aug-94
Sparganium angustifolium	narrowleaf bur-reed		
		Fan Lake, Pend Oreille County	03-Aug-94
		O'Neil Lake, Pacific County	12-Jul-94
Sparganium eurycarpum	broadfruited bur-reed		
		Loomis Lake, Pacific County	13-Jul-94
Sparganium sp.	bur-reed		
		O'Neil Lake, Pacific County	12-Jul-94
Utricularia vulgaris	common bladderwort		
		Downs Lake, Lincoln County	03-Aug-94
		Leland Lake, Jefferson County	24-May-94
Vallisneria spiralis	water celery, tapegrass		
		Clear Lake, Pierce County	21-Jul-94
		Tanwax Lake, Pierce County	21-Jul-94
Zannichellia palustris	horned pondweed		
		Stan Coffin Lake, Grant County	29-Jun-94
Zizania aquatica	wild rice		
		Loomis Lake, Pacific County	13-Jul-94

Observations on Biological Control

There is considerable interest throughout the country in development of exotic invasive aquatic plant biological control tools. A classical biological control agent will only cause damage to the targeted plant, will not proliferate or become a nuisance, and will not cause environmental degradation. Biological control is attractive because it is seen as more natural, requires little maintenance, and is usually a long term solution to specific aquatic plant problems.

Currently, the only method of biological control employed in Washington State is the use of grass carp (*Ctenophyaryngodon idella*). These carp are not classical biological control agents. In most cases they have proven to be very effective in reducing plant biomass, however, they are problematic in that they consume native plants as well as the targeted exotic species. Also, it is difficult to obtain an optimal stocking rate that will maintain a desired level of macrophyte growth within the lake. (The carp are usually overstocked, resulting in a severe reduction in the submersed plant community.)

Another biological control tool which has been experimented with in other areas, but not in Washington, is the use of herbivorous aquatic insects. Control of *Myriophyllum spicatum* (Eurasian water-milfoil) with aquatic insects has shown promise. One insect in particular, *Euhrychiopsis lecontei* (a native aquatic weevil), shows potential because it is prolific, easy to propagate, and it demonstrates a high degree of host specificity for *M. spicatum* (Crosson, 1994; Creed and Sheldon, 1993). In 1993, Robert Creed visited Washington to search for populations of this weevil. He observed them and characteristic damage to *M. spicatum* plants in Lake Sacheen, the Columbia River at Entiat, Lake Pateros at Wells Dam, the Okanogan River below Osoyoos, and Curlew Lake (Creed, personal communication, 1994). A weevil larvae has also been observed to be causing damage to *M. spicatum* plants at Lake Gillette by a member of the Lake Water Quality Assessment Program. During the 1994 field season, we also observed the weevils in Lake Sacheen. However, they were only in areas that had not been mowed by the Lake Association's mechanical harvester, which is used to control the milfoil. Because the weevils live in the apical meristems of the plant (the top, growing portion), it is assumed the harvester is also harvesting the beetle population. It has been documented in Vermont that significantly more weevils are found in portions of lakes that have not been harvested (Sheldon, 1994). Management methods could be interfering with a potential natural control mechanism.

Three other insects have also been associated with declines in *M. spicatum* populations: *Acentria nivea* (a moth larvae), *Cricotopus myriophylli* (a midge larvae), and *Triaenodes tarda* (a caddisfly larvae) (Sheldon, 1994; Kangasniemi *et al.*, 1992; Macrae *et al.*, 1990). During the 1994 field season, we observed the caddisfly larvae *Triaenodes injecta* causing considerable damage to *M. spicatum* plants in Steel Lake and Lake Sixteen (Ross, 1944, was used in identification). This is a different species of the same genus which is known to occasionally cause massive declines in milfoil infestations in British Columbia (Newroth, 1994). A midge larvae, *Parachironomus* sp., was observed in great numbers on *M. spicatum*

plants in Lake McMurray during a plant survey in June 1994. This small fly has not been attributed to declines in milfoil populations elsewhere. However, its case-building activity in the plant's apical meristems appeared to be inhibiting growth, as has been reported with the midge *Cricotopus myriophylli*.

Aquatic Weed Management Fund Related Activities

Grant Reviews

Several grant applications submitted to the Water Quality Financial Assistance Program for Aquatic Weed Management Fund (AWMF) Grant monies were reviewed, and recommendations on funding priorities were made (Table 4).

Table 4. AWMF grant applications - 1994 (not in order of priority).

Applicant	Project Title
King County Dept Public Works	Crary Weed Roller Pilot Project
King County Surface Water	King County Aquatic Plant Survey
City of Everett	Silver Lake Milfoil Control
City of Ocean Shores	Duck Lake Implementation Project
Skagit County	Big Lake Weed Management Plan
Yakima River Purple Loosestrife Taskforce	Yakima River Purple Loosestrife Project
King County Surface Water	Lake Killarney Integrated Aquatic Plant Management Plan
Stevens County Noxious Weed Board	Integrated Aquatic Vegetation Management Planning Project
Thurston County	Purple Loosestrife Survey
Mason County Department of Health	Lake Limerick Plant Management Plan Implementation
Skagit County	Lake McMurray Milfoil Eradication Project (Early Infestation Project)

Aquatic Plant Field Guide

Despite the large number of botanical references available, there is no single, up-to-date, lay person's guide to the aquatic plants of Washington State. Therefore, money from the Aquatic Weed Management Fund has been targeted for the development and production of an Aquatic Plant Field Guide. This guide will include approximately 120 aquatic plants with photographs, line drawings, written descriptions, and notes on the values and natural history of the plants. This project has a core team of three reviewers from Ecology, and several outside reviewers. We developed a draft plan for the project, which went out for bid in September. Eight well-qualified teams responded. We selected a consultant team headed by Shapiro and Associates to conduct the project. The target time-line for development of the camera-ready copy is the end of 1995. The review team will continue to work closely with the consultant team through completion of the project.

Recommendations

I have included a brief list of recommendations for 1995. There are several recommendations for the Aquatic Plant Technical Assistance portion of the Freshwater Aquatic Weeds Program and one recommendation for the Early Infestation Grant portion.

Aquatic Plant Technical Assistance

1) Continue and expand educational and technical outreach projects. This includes the Aquatic Plant Field Guide, which will be a significant tool for education.

2) Continue field of high use lakes and/or lakes close to known infestations of exotic invasive plants.

3) Return to the lakes where populations of invasive plants were discovered last year. Compare population levels to those observed in 1994. Map the plant communities with a Global Positioning System Unit and assess the situation for containment or eradication measures under the proposed changes to the Early Infestation Policy (Hamel, in preparation).

4) Return to lakes where populations of listed rare plants have been reported but not confirmed to obtain sample material.

5) Choose a few lakes to do more in-depth plant community analysis which will be monitored on a year-to-year basis. Include lakes with exotic plants and known populations of herbivorous aquatic insects to document effects of these insects.

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Appendix A

Articles Published in WALPA "Waterline"

"Aquatic Plants - Who Needs 'Em?"

July/August 1994

AQUATIC PLANTS - WHO NEEDS 'EM?

At first glance aquatic plants often seem slimy and smelly, not something very useful, and certainly not something you want to go swimming with. Our first reaction is often to wish they were gone. However, as is true of many parts of nature we would rather do without, aquatic plants are an important part of the lake ecosystem. The following points contain a few of the important roles they play in a lake.

* Aquatic plants provide important food for many animals. Ducks and geese eat the seeds, leafy parts and tubers of plants such as pondweeds (Potamogeton spp.), watershield (Brasenia schreberi), arrowhead (Sagittaria latifolia), water pepper (Polygonum spp.) and duckweed (Lemna spp). Songbirds use fluff from cattails (Typha sp.) as nest material, and eat the seeds of many emergent plants. Otter, beaver, muskrats and moose will also graze on a variety of aquatic plants. Historically, humans have also utilized aquatic plants as a food source. Cattails have edible shoots and roots, and even the pollen has been used in making biscuits. Arrowheads form large edible tubers at the root ends, called duck potatoes, which were consumed by Native Americans. Watercress (Rorippa nasturtium-aquaticum) has many historic medicinal uses, and its spicy vegetation continues to be used in salads and garnishes. Water-lily roots are a common source of food in many parts of the world, and have historic medicinal value. Even the submerged plant Coontail (Ceratophyllum demersum) has been used for medicinal purposes.

* Aquatic plants provide important living space for small animals such as insects, snails and crustaceans, which in turn supply food for fish and waterfowl. Many studies have shown that vegetated areas support many times more of these tiny creatures than do non-vegetated areas.

* Young fish and amphibians will use aquatic plants as a source of cover from predatory fish and birds. This, coupled with the abundant food supply, makes aquatic plants important nurseries for baby fish, frogs and salamanders.

* The sturdy emergent plants provide nest and den building materials for many birds and mammals. Humans also construct baskets, mats, boats and entire dwellings from Cattail, rush and bulrush stems.

* Aquatic plants form a vital part of the complex system of chemical cycling in a lake. They can also influence the supply of oxygen in the water. Recently, aquatic plants have received a lot of attention for their ability to soak up pollutants from contaminated water.

If aquatic plants are so wonderful, why are they perceived as a problem? Most of the time, problems arise when plants are so numerous they impede recreational activities such as boating and swimming. When growth becomes very thick, they also harm some fisheries, particularly juvenile salmon and trout habitat. The causes of unnaturally high levels of plant growth are complex. Often it is attributed to increased nutrients, which come from around the lake or in the watershed. Contributing problems can include failing septic systems, fertilizer run-off or agricultural waste. These increased nutrients cause the natural process of lake aging (eutrophication) to proceed at an accelerated rate, and increased plant and algae growth is part of this process. Another problem can arise if a non-native species is inadvertently introduced to the lake. This often happens when recreational users unknowingly carry plants from one waterbody to another, or when someone dumps aquarium plants in a lake. Several exotic species such as Eurasian Watermilfoil (Myriophyllum spicatum) or Brazillian Elodea (Egeria densa) are aggressive, and can crowd out more desirable native vegetation.

Changes in the vegetation such as this may take place slowly, or quite rapidly. What can individuals concerned about a certain lake do? Along with preventing or eliminating pollution, you can monitor plant community changes by collecting and identifying aquatic plants on a year to year basis. This is also a good way to detect detrimental changes at an early stage, when control or elimination of the problem is both less complicated and less costly. Collecting and preserving plants is not difficult, and the result is an increased awareness of aquatic plants, as well as a valuable historic record of what grows in the lake. However, proper identification of the plant can be tricky and is essential, particularly if you believe any may be exotic invasive species. If you are unsure what plant you have, you may send plants to us for identification. If you wish detailed instructions on how to preserve plants, or on how to send plants to us for identification, please contact me, Jenifer Parsons, at (206) 407-6679. I will be happy to give you additional information.

"New Locations of Aquatic Weeds Found"

December 1994

New Locations of Aquatic Weeds Found

During the summer of 1994, my assistant, Sarah Levy, and I visited 75 lakes throughout Washington. During these visits we compiled lists of the plant species we observed, and made some approximations as to the growth density of these plants. As a result of this effort, we found several locations of exotic invasive plants we did not previously know about. The following is a list of these lakes:

Wapato Lake in Chelan County, a small patch of Eurasian watermilfoil (*Myriophyllum spicatum*) was observed.
Lake Leland, Jefferson County, Brazilian elodea (*Egeria densa*) is growing in the west end of the lake.
Long Lake, Kitsap County, a limited quantity of Eurasian watermilfoil was observed in the south end, it joins a well established population of Brazilian elodea.
Spencer Lake, Mason County, a small patch of purple loosestrife (*Lythrum salicaria*) is on the southwest shore.
Whitestone Lake, Okanogan County, two small patches of Eurasian watermilfoil.
Black Lake, Pacific County, a well established population of Brazilian elodea.
Big Lake, Skagit County, Eurasian watermilfoil is new, Brazilian elodea is already well established.
Clear Lake, Pierce County, Eurasian watermilfoil is becoming reestablished.

In addition to these discoveries of weedy plants, three aquatic plants listed on the Washington Natural Heritage Program's rare plant list were also made at four different lakes. These plants are mudwort (*Limosella acaulis*), water lobelia (*Lobelia dortmanna*) and bluntleaf pondweed (*Potamogeton obtusifolius*).

If you have any questions about any of these findings, please give me, Jenifer Parsons, a call at the Department of Ecology (206) 407-6679.

Appendix B

Distribution of Known and Reported Populations of Invasive Aquatic Plants in Washington State

Invasive Aquatic Plants in Washington State

Legend

- Myriophyllum spicatum
- Myriophyllum aquaticum
- Egeria densa
- Cabamba caroliniana

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WASHINGTON STATE DEPARTMENT OF ECOLOGY

Prepared by EILS Program, 4/95

Legend - Invasive Aquatic Plant Map

County	Site Number	Waterbody Name	Comments
Benton	1	Columbia River at Tricities	
	2	Umatilla Lake	
	3	Wallula Lake	
Chelan	4	Chelan Lake	
	5	Cortez Lake	
	6	Domke Lake	milfoil species not verified
	7	Wapato Lake	
Clark	8	Bachelor Slough	
	9	Battleground Lake	
	10	Caterpillar Slough	
	11	Lacamas Lake	
Cowlitz	12	Silver Lake	grass carp stocked, plants eradicated
	13	Solo Slough	
	14	Willow Grove Slough	
Douglas	15	Pateros Lake	
	16	Rock Island Dam	
	17	Rocky Reach Dam	
	18	Rufus Woods Lake	
Ferry	19	Curlew Lake	milfoil species not verified
Franklin	20	Scooteney Reservoir	milfoil species not verified
Grant	21	Banks Lake	milfoil species not verified
	22	Billy Clapp Lake	milfoil species not verified
	23	Crater Lake	milfoil species not verified
	24	Evergreen Lake	
	25	Moses Lake	
	26	Potholes Lake	
	27	Priest Rapids Reservoir	
	28	Stan Coffin Lake	
	29	Wanapum Dam	
	30	Winchester Wasteway	milfoil species not verified
	31	Winchester Wasteway Ext.	milfoil species not verified
Grays Harbor	32	Duck Lake	
Island	33	Goss Lake	
Jefferson	34	Leland Lake	
King	35	Angle Lake	
	36	Bass Lake	
	37	Desire Lake	
	38	Green Lake	
	39	Meridian Lake	
	40	Number Twelve Lake	
	41	Otter (Spring) Lake	
	42	Phantom Lake	
	43	Sammamish Lake	
	44	Sawyer Lake	
	45	Shadow Lake	
	46	Shady Lake	

County	Site Number	Waterbody Name	Comments
King	47	Ship Canal	
	48	Star Lake	
	49	Steel Lake	milfoil eradication underway
	50	Union Lake	
	51	Union Bay	
	52	Washington Lake	
Kitsap	53	Long Lake	
Klickitat	54	Celilo Lake	
Lewis	55	Carlile Lake	milfoil eradication underway
	56	Chehalis River	
	57	Riffe Lake	
	58	Swofford Pond	milfoil eradication underway
Mason	59	Limerick Lake	
Okanogan	60	Buffalo (Annum) Lake	milfoil species not verified
	61	Conconully Lake	milfoil ID being researched
	62	Okanogan River - Oroville	
	63	Osoyoos Lake	
	64	Whitestone Lake	
Pacific	65	Black Lake	
Pend Oreille	66	Little Spokane River	
	67	Pend Oreille River - Box Canyon	
	68	Sacheen Lake	
	69	Trask Pond	
Pierce	70	Clear Lake	
Skagit	71	Big Lake	
	72	Clear Lake	
	73	McMurray Lake	
	74	Sixteen Lake	
Skamania	75	Spirit Lake	milfoil species not verified
Snohomish	76	Goodwin Lake	milfoil species not verified
	77	Shoecraft Lake	milfoil species not verified
	78	Silver Lake	
	79	Stevens Lake	milfoil species not verified
	80	Swartz Lake	
	81	Wallace Lake	
Spokane	82	Eloika Lake	
	83	Silver Lake	
Stevens	84	Columbia River - Northport	
	85	Heritage Lake	
	86	Gillette Lake	
	87	Sherry Lake	
	88	Thomas Lake	
Thurston	89	Long Lake	milfoil apparently eradicated
Wahkiakum	90	Skamokawa Slough	
	91	Cathlamet Sloughs	
Whatcom	92	Whatcom Lake	milfoil species not verified
	93	Wiser Lake	milfoil species not verified
Yakima	94	Byron Lake	

Appendix C

Field Form for Macrophyte Data

MACROPHYTE DATA SHEET

LAKE DATA

Name of Lake or River: _____

County: _____ State: _____ Legal: T____N R_____ Sec____

Maximum Depth (m): _____ Current: _____

Lake Surface Area (acres): _____ Elevation: _____ ft or m

User Access: _____

Type of Uses: _____

DATE DATA

Date: _____ Examiner: _____

Examiner Affiliation: _____ Number of Samples Collected: _____

Secchi Depth (m): _____ Maximum depth of macrophyte growth: _____

Trophic State Classification: _____

Vegetative community composition:

Emergent:	_____% cover
Floating leaved plants (rooted):	_____% cover
Submerged:	_____% cover
Floating (not rooted)	_____% cover
Open Water:	_____% cover

Comments: _____

SUMMARY SPECIES LIST

Species:	Distribution in Lake:
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Appendix D

References Used in Aquatic Plant Identification

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Appendix E

Information Sheet -
How to Press and Mount Aquatic Plants

WASHINGTON STATE DEPARTMENT OF ECOLOGY

HOW TO PRESS AND MOUNT AQUATIC PLANTS

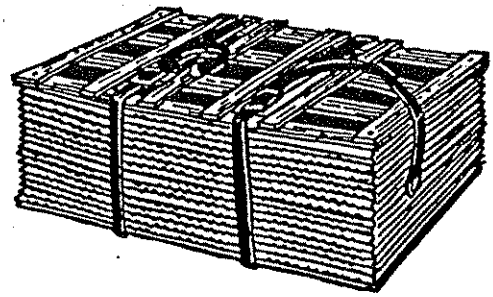

fig. 1 - Plant Press

Materials needed:

Plant press* - may be purchased or built. It consists of alternate layers of corrugated cardboard, absorbent (blotting) paper or newspaper, and equal sized pieces of plywood with straps or some method of applying even pressure. See fig. 1 for an example.

Pencil and tablet - for making notes on site.

Herbarium paper* - acid-free 100% rag paper is best. If you would rather buy paper locally, try to use heavy stock, relatively acid free paper with a high rag content. High grade thick typing paper will work and is usually found at quality stationary stores, or university bookstores generally sell 'biology paper' which is good quality 8½" x 11" white paper.

Packets* - for extra plant structures, use small envelopes or a piece of folded paper (2" x 3").

Herbarium paste* - available from the listed companies. White glue can also be used (should have a polyvinyl acetate base).

Linen tape - book binders tape is best. Cellophane tapes should be avoided.

Labels* - see fig. 2 for an example of a completed label. They should be sized to fit in the lower right corner of the herbarium paper.

* These items are available from biological supply companies such as: Carolina Biological Supply Co. (800) 547-1733, Wards Biological Supply (800) 962-2660, or Herbarium Supply Co. (800) 348-2338. (This list is not intended to endorse or promote specific vendors, and it is not comprehensive.)

Washington State
Department of Ecology Herbarium
Olympia, WA

plant name → Sparganium eurycarpum Engelm.

site description → PACIFIC COUNTY: T14N R11W S04. Tidal area 5.5 miles south of the Pacific and Grays Harbor County line on Highway 105. Growing in wet soil between drift logs above the beach with Carex obnupta and Oenanthe sarmentosa.

collector → E. Burnett

3 July 1991 ← date

fig. 2 - Example of Completed Label

Collect the Plant:

1. Collect as much of the plant as possible; include roots, stems, leaves, flowers and fruits. Plants may be collected by hand pulling, or using a weighted rake to gather plants in deeper water.

2. Write as much information about the plant as possible on the tablet (information will be used later for aid in plant identification and for labeling the plant). Include the date; collector's name and address; location (name of water body as well as location on the water body); depth of water; flow rate of water; substrate description, whether leaves and/or flowers are submersed (below the water surface), floating, or emergent (above the water surface); color and odor of flowers; names of plant species associated with the collected plant.

3. Wash the plant in clean water to remove algae, debris and sediment. Keep the plants moist until they can be pressed.

Press the Plant:

Note: It is easiest to identify aquatic plants before pressing. If this is not possible, press the plant while it is fresh, then send it to an aquatic plant expert as instructed below.

1. Prepare the plants for pressing:
   - For delicate submersed plants the best method is to float the plant onto a sheet of paper (newspaper or a heavy stock paper will work, or you can float the plant directly onto the herbarium paper). This is accomplished by placing the plant in water with the paper below it. Position the plant on the paper and hold it in place with a finger. Slowly lift the paper plus plant from the water. The water flowing from the paper should separate the leaves while the plant adheres to the wet paper. Cover the plant with newspaper or absorbent paper. (If the plants tend to stick to the paper, they can be covered on one side with wax paper).
   - When pressing plants with whorled or finely divided leaves, it is useful to separate one node (the stem section where leaves are attached) and float that onto a small portion of the paper. This yields a cross section showing the leaf pattern, see fig. 3.
   - For plants with large bulky stems, roots or leaves, the bulky portion can be split before pressing to facilitate drying, and to prevent uneven pressure in the press
   - If extra flowers, fruits or vegetative parts are collected, these should be pressed, dried, and later placed in the packets and glued to the herbarium paper.

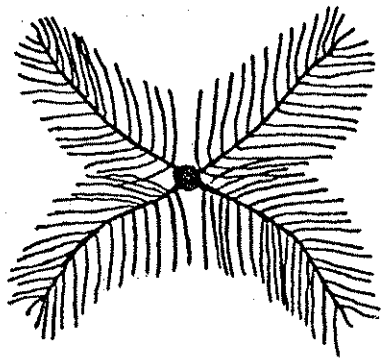

fig. 3. *Eurasian Watermilfoil*

2. Press the plant material by placing the plant between two sheets of newspaper or absorbent paper then sandwiching this between two sheets of corrugated cardboard. Several prepared specimens can be stacked in this manner (label or number the plants so you know which plant matches which field note). Then, put the stack between two firm pieces of wood and apply an even pressure using straps, bolts or a heavy weight. Place this bundle in a warm dry area. To avoid mildew, change the newspaper periodically until the plants are dry. The plants will dry faster if placed over a heat register, fan or incandescent light bulbs.

Mount the Plant:

Note: If identification of the specimen needs to be verified, send a duplicate pressed, but unmounted specimen with a complete label to an authority on aquatic plants. They will keep this specimen for their collection and notify you of the plant's name. Be sure the two specimens are from the same plant!

1. Once the plant has dried and is identified, it is mounted and kept for future reference:
   - Arrange the plants on a piece of herbarium paper. If the plant is too long it may be cut into several sections and placed lengthwise on the paper.
   - Either glue or tape the specimen to the paper (use of glue or paste will sometimes tend to cause delicate submersed plants to curl, tape may be preferable in such cases).
   - Complete a label with the plant's latin (scientific) name, location and site description, name of collector and date collected (see fig. 2). Adhere the label to the lower right corner of the paper.
   - If additional reproductive (seeds, fruits, flowers) or vegetative parts have been collected, these are placed in the packet. This is glued to the top of the herbarium paper so the contents may still be accessed.

2. Care should be taken to ensure the specimens are not damaged by insects. Mounted plants should be stored with an insecticide or repellent (ie. moth balls) to prevent colonization by insects.

Questions? contact Jenifer Parsons at the Department of Ecology (206) 407-6679