

Aquatic Plants and Fish



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Introduction

Aquatic noxious weeds are introduced plants that now threaten our native vegetation, fish, wildlife and their habitat. In recognition of the importance of controlling aquatic noxious weeds, this pamphlet was created by Washington Department of Fish and Wildlife (WDFW) to:

- expedite the Hydraulic Project Approval (HPA) process for projects designed to control early infestations of **aquatic noxious weeds**,
- provide guidance in selecting control methods for early and more advanced infestations of **aquatic noxious weeds**, and
- expedite the HPA process for applicants who want to control **aquatic beneficial plants** using small scale projects only (e.g., around docks and in swimming areas).

Note: This pamphlet does not address aquatic plant control through the use of grass carp, herbicides or water column dye. See Appendix B (page 45) for information on these control methods.

Importance of Native Aquatic Vegetation...

Native aquatic plants play a significant role in lakes and streams by providing food and habitat for fish and wildlife, stabilizing shorelines, and contributing to nutrient cycling. Due to the importance of native aquatic plants to fish and wildlife, this pamphlet is primarily designed to address problems associated with aquatic noxious weeds (defined as those “aquatic” weeds that are on the state noxious weed list). Removal of native vegetation may be allowed in small amounts, but is generally discouraged. An over-abundance of native vegetation is usually an indication of excessive nutrients, such as nitrogen or phosphorus, or other problems in the lake or stream.

About This Pamphlet

This pamphlet may serve as the Hydraulic Project Approval (HPA) for some types of aquatic weed or plant control . If you use this pamphlet as your HPA for aquatic weed or plant control, please complete the following steps:

- Identify weed/plant and level of infestation (page 9)
- Select method of control (page 15)
- Determine appropriate timing for project if necessary (Appendix F, page 54)
- Acquire other permits if necessary (page 17)
- Conduct project following all provisions for selected control method(s) (page 18)
- Complete and return project tracking form (page 58)
- Check method effectiveness and periodically check for reinfestations (page 38)

Note: Depending on the method you select to control aquatic noxious weeds or beneficial plants, an individual HPA may be required (see Table 2 on page 17).

Endangered Species Act

Some salmon populations in Washington State have been listed under the Endangered Species Act (ESA) and more stock listings are expected. In addition to several Snake River stocks already listed as endangered or threatened, several anadromous steelhead trout populations in the Columbia River were recently listed as threatened or endangered. Bull trout in the Columbia River are also proposed for listing. For threatened populations, the National Marine Fisheries Service (NMFS) will soon issue protective regulations. These regulations may affect your aquatic plant control project. Further information regarding potential listings can be obtained from your local Washington Department of Fish and Wildlife Area Habitat Biologist.

Definitions

To familiarize you with the terms used in this pamphlet we have provided the following definitions.

Aquatic plants: noxious weeds **and** beneficial plants that occur within the ordinary high water line of state waters (see following definitions).

Aquatic noxious weed: an aquatic plant on the state noxious weed list as prescribed by RCW 17.10.010 (10). See page 10 for a list of these weeds.

Aquatic beneficial plant: all native and non-native aquatic plants, except those on the state noxious weed list as prescribed by RCW 17.10.010 (10), and that are of value to fish life.

Authorization: Verbal approval given by a WDFW Area Habitat Biologist **followed by written confirmation or** an on-site visit by the Area Habitat Biologist **and written confirmation**. Authorization may result in a timing restriction on the control project.

Bio-degradable: material, such as burlap, that is capable of being readily decomposed by biological means, such as by bacteria.

Bottom barrier/screen: synthetic or natural fiber sheets of material used to cover and kill plants growing on the bottom of a watercourse by depriving plants of sunlight.

Control: level of treatment of aquatic noxious weeds as prescribed by RCW 17.10.010(5).

Diver-operated dredging: the use of portable suction/hydraulic dredges held by SCUBA divers to remove aquatic plants.

Drawdown: decreasing the level of standing water in a watercourse to expose bottom sediments and rooted plants.

Early infestation: an aquatic noxious weed whose stage of development, life history, or area of coverage make 100 percent control and eradication, as prescribed by RCW 17.10.010 (5) likely to occur.

Eradication: kill or kill and remove all individuals from a plant population so that the plant species no longer occurs on the site. See “control.”

Entrained: the entrapment of fish into a watercourse diversion without the presence of a screen, into high velocity water along the face of an improperly designed screen, or into the vegetation cut by a mechanical harvester.

Hand cutting: removal or control of aquatic plants with hand-held tools or equipment, or equipment carried by a person when used.

Hydraulic Project Approval: a written approval for a hydraulic project signed by the director of the Department of Fish and Wildlife, or the director’s designates, or an “Aquatic Plants and Fish” pamphlet issued by the Department which identifies and authorizes specific aquatic noxious weed and aquatic beneficial plant removal and control activities.

Mechanical harvesting and cutting: the partial removal or control of aquatic plants with the use of mechanical harvesters which cut and collect aquatic plants, and mechanical cutters which only cut aquatic plants.

Purple loosestrife: *Lythrum salicaria* or *Lythrum virgatum* as prescribed in RCW 17.10.010 (10) and defined in RCW 17.26.020 (5b).

Rotovation: the use of aquatic rotovators which have underwater rototiller-like blades to uproot aquatic plants as a means of plant control.

Shoreline: the line marking the edge of a body of water within the permittee’s property boundaries.

Spartina: *Spartina alterniflora*, *Spartina anglica*, *Spartina x townsendii* and *Spartina patens* as prescribed in RCW 17.10.010(10) and defined in RCW 17.26.020 (5a).

Viable: any plant or plant part that is capable of taking root or living when introduced into a body of water.

Weed rolling: the use of a mechanical roller designed to control aquatic plant growth.

Before You Get Started

Projects conducted solely for the control of spartina (by any method) and purple loosestrife (with hand-held tools or equipment, or equipment which is carried by a person) may be conducted without obtaining an HPA (pamphlet or individual) from WDFW.

This pamphlet can help you in evaluating your aquatic weed or plant problem and contains useful information on the best way to proceed with your project. The following section provides you with the necessary steps to select the appropriate control method. Each control method is discussed in detail, including all requirements (provisions). Recommendations on practices that should be used during the control or removal project are also included to ensure protection of fish life and success of the control project. Timing guidelines that may be required are listed by county in Appendix F (page 54).

Note: This pamphlet does not address aquatic weed control through the use of grass carp, herbicides or water column dye. See Appendix B (page 45) for information on these control methods.

You may be required to contact and/or obtain additional permits from other agencies prior to conducting an aquatic plant removal or control project. **Step 4** (page 17) will help assist you in meeting potential permit requirements. A list of reference materials that provide more detailed information on various topics related to aquatic plant control, is located in References on page 56.

Aquatic plants often occur across property boundaries and your neighbor's property may also have a similar weed problem. We advise you to contact your neighbors to determine how widespread the weed problem may be. A comprehensive lake-wide approach to control aquatic noxious weeds will be more successful than independent attempts by minimizing the potential for re-infestation from adjacent properties. The development of a Vegetation Management Plan is a useful way to address these concerns.

Vegetation Management Plans (VMP) are based on the idea that decisions should be made with an understanding of the biology and

ecology of the target noxious weed and environmental characteristics of the site. All control strategies are considered and usually some combination of techniques are used in a planned approach. The VMP provides a means to make informed aquatic plant management decisions that protect human health and the environment. State and federal agencies with responsibilities for aquatic plant control strongly encourage development of long-term, integrated management strategies to deal with aquatic plants in lakes, ponds, or rivers. These plans should be flexible to address changes in water use priorities, land uses, or in the aquatic plant problem itself.

A useful manual to guide individuals or organizations in developing a Vegetative Management Plan is titled *A Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plans* and is available from the Department of Ecology (Ecology) publications office at **(360) 407-7472**.

Numerous species of fish and wildlife depend on nearshore areas for food and habitat and are susceptible to alterations of these areas. Some of these species of fish and wildlife are considered to be priority species by WDFW due to their sensitivity to habitat alterations, or other factors such as low numbers, tendency to form vulnerable aggregations, or commercial, recreational or tribal importance. Because these species may be present in your project area, please refer to Appendix A: Priority Species on page 39, before you begin your project.

Steps You Will Need To Follow and Complete

Step 1 - Plant or Weed Identification

The first step in addressing your aquatic plant problem is to identify the aquatic beneficial plants and noxious weed(s) in your lake or stream. This includes identification of the stage of noxious weed infestation. The control strategies/methods available will vary depending on the plant species targeted for control and the level of infestation. If, for example, you have noxious weeds growing among beneficial plants, you should choose a technique that thoroughly removes the noxious weeds and minimizes the loss of beneficial plants.

Plant Identification

First you must collect a sample of the plant you want to identify. If you plan to seek help in identifying the plant, put the aquatic plant in a ziploc bag with as much intact material as possible, including the flower if available. Double bag, refrigerate and take to the county weed board as soon as possible. If you are attempting to identify an emergent plant, put the plant in a paper towel and put in a ziploc bag and refrigerate. Again, take the sample to the county weed board as soon as possible.

The drawings in this section can help you identify aquatic noxious weeds. However, some species are very difficult to identify correctly. For example, the aquatic noxious weed Eurasian watermilfoil and the native milfoils are extremely difficult to distinguish. Experts sometimes rely on DNA testing. To ensure positive identification it is recommended you contact your county weed board or Ecology. This is especially important in determining whether the problem plants are noxious weeds or beneficial plants. Remember this pamphlet primarily addresses noxious weeds. Other pamphlets/brochures listed in the reference section can also assist with plant identification (e.g., *Aquatic Plants* by King County Surface Water Management and *A Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plans* by Ecology, and *Wetland Plants of the Pacific Northwest* by US Army Corps of Engineers).

Native plants provide important fish and wildlife habitat functions. If you have an **aquatic beneficial plant** over-abundance problem, this pamphlet may serve as the HPA for small-scale control projects and will provide guidance on other control options available to you.

If your problem plant is an **aquatic noxious weed** included in the following list, then this pamphlet may serve as your HPA for several methods of control. Aquatic noxious weeds are non-native, invasive plants that can become established and outcompete native species. These invasive plants can degrade fish and wildlife habitat as well as decrease usability of swimming, boating and fishing areas. Their control and/or elimination is necessary and important for Washington’s fish and wildlife. Many aquatic species reproduce from plant fragments that have the ability to root and form new plants. Purple loosestrife and others spread by seeds.

It is critical to begin control projects for aquatic noxious weeds as soon as possible after discovering an initial infestation. Control is more effective and less expensive at low infestation levels.

Aquatic Noxious Weeds

<u>Common Name</u>	<u>Scientific Name</u>	<u>Growth Habitat</u>
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>	submergent
Brazilian elodea	<i>Egeria densa</i>	submergent
Parrot-feather	<i>Myriophyllum aquaticum</i>	submergent
Hydrilla	<i>Hydrilla verticillata</i>	submergent
Fanwort	<i>Cabomba caroliniana</i>	submergent
Reed canarygrass	<i>Phalaris arundinacea</i>	emergent/riparian/wetland
Giant hogweed	<i>Heracleum mantegazzianum</i>	riparian/wetland
Japanese knotweed	<i>Polygonum cuspidatum</i>	riparian/wetland
Indigo bush	<i>Amorpha fruticosa</i>	riparian/wetland
Yellow nutsedge	<i>Cyperus esculentus</i>	riparian/wetland
Salt cedar	<i>Tamarix</i> species	riparian/wetland
Garden loosestrife*	<i>Lysimachia vulgaris</i>	riparian/wetland
Purple loosestrife*	<i>Lythrum salicaria</i> and <i>virgatum</i>	emergent/riparian/wetland
Spartina*	<i>Spartina anglica</i> , <i>alterniflora</i> , and <i>patens</i>	emergent

*control of spartina using any method, or purple loosestrife using hand-held tools or equipment, or equipment carried by a person, does not require an HPA (individual or pamphlet).

Eurasian watermilfoil

Myriophyllum spicatum

Eurasian watermilfoil grows submersed, tolerates a wide range of water conditions, and often forms large infestations. Stems are reddish-brown to whitish-pink, branched and commonly grow to lengths of six to nine feet. Leaves are deeply divided, soft and feather-like, and are about two inches long. They are arranged in whorls of three to six leaves about the stem. Flowers of Eurasian watermilfoil are reddish and very small. They are held above the water on an emersed flower spike that is several inches long. The plants are spread primarily by stem fragments.



Brazilian elodea

Egeria densa

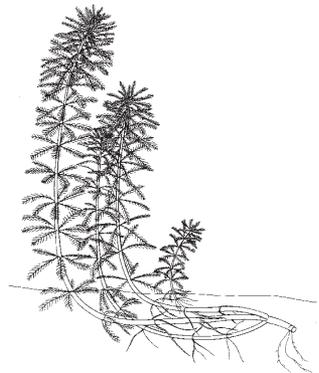
Brazilian elodea grows submersed, is rooted in the sediment, and sometimes has floating white flowers. Leaves grow in whorls of four (or eight), are greater than one-half inch long and less than one-quarter inch wide. The plants are spread by stem fragments.



Parrot-feather

Myriophyllum aquaticum

Parrot feather is an emersed plant that trails along the ground or water surface. Leaves are oblong, deeply cut and feathery like and bright blue-green in color. Like most water milfoils, parrot feather leaves are arranged in whorls about the stem. Leaves are in whorls of four to six and the stems can be five feet long. Stems trail along the ground or water surface, becoming erect and leafy at the ends. The plants are spread by stem fragments.



Hydrilla

Hydrilla verticillata

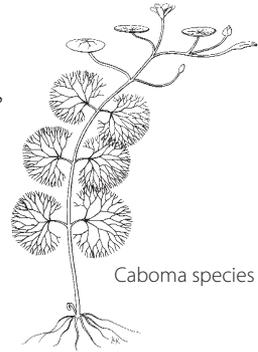
Hydrilla closely resembles Brazilian elodea and our native common elodea (*Elodea canadensis*). The primary distinguishing feature of Hydrilla is the presence of tubers that form on the roots. Hydrilla has small prickles on its leaves that give the plant a rough feel. Hydrilla typically has 3 to 8 leaves in a whorl around the stem. Hydrilla has three means of spreading: stem fragments, tubers and turions.



Fanwort

Cabomba caroliniana

Fanwort has distinctive fan-shaped submersed leaves arranged in pairs on the stem. Distinctive, but small, floating leaves may be present. Floating leaves are long (less than one-half inch) and narrow (less than one-quarter inch). White flowers float on the water surface. Fanwort can regenerate and spread by stem fragments.



Cabomba species

Reed canarygrass

Phalaris arundinacea

Reed canarygrass is a tall, perennial grass, sometimes exceeding 3 feet in height. The hollow stems have a reddish tinge at the top during the growing season. Flowers and seeds are borne on culms which stand high above the leaves. It usually grows where soils remain saturated or nearly saturated during most of the growing season and is commonly found in roadside ditches. (Reprinted with permission of the University of Washington Press, *Vascular Plants of the Pacific Northwest* by Hitchcock, et al).



Giant hogweed

Heracleum mantegazzianum

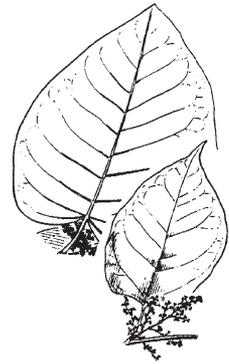
Giant hogweed grows 6 to 14 feet tall. Its height, thick hollow stems, hairy texture, and wide flower clusters make giant hogweed easy to recognize. The leaf stalks are blotched with deep purple and the flower stems are ribbed. The small white flowers of the hogweed are found in huge, flat-topped clusters at the end of long rays. The sap of giant hogweed is photoreactive, causes blistering, and requires careful handling.



Japanese knotweed

Polygonum cuspidatum

Japanese knotweed is a large, herbaceous, rhizomatous perennial. Its stems are erect, leafy, hollow and reed- or cane-like. Leaves are egg-shaped, abruptly pointed and more or less squared off at the base. This species of knotweed is frequently found in moist ravines or ditches. (Reprinted with permission of the University of Washington Press, *Flora of the Pacific Northwest* by Hitchcock and Cronquist).



Indigo bush

Amorpha fruticosa

Indigo bush is a rapidly growing shrub, generally 4 to 12 feet in height. Its firm woody branches end in hairy green twigs. Alternate compound leaves have 9 to 31 leaflets. Small blue-violet to dark purple flowers grow in densely flowered, erect racemes at the tops of the bushes. The fruit is a straight to curved pod about one-fourth inch long, containing one or two small, smooth, reddish brown seeds. The green pods turn light brown when the fruits ripen.



Cyperus esculentus

Yellow nutsedge is associated with intensively cultivated row crops, turf, and other disturbed sites. It resembles a grass, but is distinguished by its triangular stems and three-ranked glossy leaves. It grows 12 to 32 inches tall. The flower cluster has numerous straw-colored flowers originating from a single point. Yellow nutsedge reproduces primarily by rhizomes, cormlike basal bulbs, and tubers. (Reprinted with permission of the University of Washington Press, *Vascular Plants of the Pacific Northwest* by Hitchcock, et al).



Salt cedar

Tamarix species

Salt cedar is a shrub or small tree that grows up to 20 feet tall with reddish brown bark. It is commonly found in moist areas in the desert but is sometimes grown as an ornamental. Leaves are scale-like, blue-green and up to one-sixth inch long. The flowers are borne in racemes with each raceme being up to two inches long, and each flower on a very short stalk. (Reprinted with permission of the University of Washington Press, *Vascular Plants of the Pacific Northwest* by Hitchcock, et al).



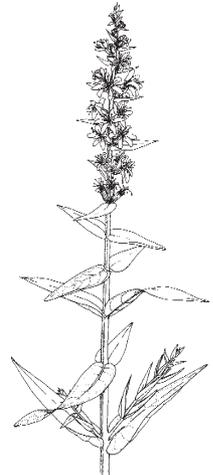
Garden loosestrife

Lysimachia vulgaris and

Purple loosestrife

Lythrum salicaria and ***virgatum***

Loosestrifes are easiest to identify when they are in full bloom - July through September. Its brilliant purple or majenta flowers on an upright stalk make it conspicuous even from a distance. The mature, bushy plants can grow as tall as 10 feet. The stems have long flower spikes with five or six petals per flower. The leaves vary, but are usually opposite each other with a tongue-like shape and smooth edges.



Spartina

Spartina anglica, alterniflora, and patens

Also known as smooth cordgrass, this perennial grass typically occurs in low salt and brackish marshes in sandy to muddy substrates where it may be inundated twice a day. This grass commonly grows 3 to 5 feet tall. Long flat leaves are 1 foot in length. The plant is lush green in summer and fades to gold in the fall. (Reprinted with permission of the University of Washington Press, *Vascular Plants of the Pacific Northwest* by Hitchcock, et al).



Step 2 - Determine Level Of Infestation

If you have determined that an aquatic noxious weed problem exists and have identified the plant, it is important to define the extent of the infestation. Are there only a few scattered noxious weeds present, a few localized dense patches, or are they widespread? If there are a few plants or they are highly localized, then you most likely have an **early infestation** and immediate control is needed to prevent further spread.

If you have an early infestation of aquatic noxious weeds, contact Ecology and your county weed board immediately.

If the plant you are concerned about is already well established, you may need a different control strategy. For all levels of infestation please consider the value and importance of developing Vegetation Management Plan (VMP)- see page 7.

Step 3 - Select Method of Control

Now that you have an idea of the plant species and level of infestation, here is a guide to recommended control methods and options. After determining if your intent is to control an aquatic noxious weed or an aquatic beneficial plant, select one of the classifications below. Then go to Table 1 to select the method(s) recommended for that classification. Table 2 will help you decide the HPA permit requirements of the control method(s) you select.

Class 1 - Early infestation of an aquatic noxious weed: contact Ecology and the county noxious weed board, and select an appropriate small scale manual control method. A long term control strategy through development of a VMP is highly recommended (page 7).

Class 2 - Well-established infestation of an aquatic noxious weed: contact the local noxious weed board and select an appropriate small scale manual control method. A long term control strategy through development of a VMP is highly recommended (page 7).

Class 3 - Isolated, aquatic beneficial plants at nuisance levels: select a small scale manual control method, and develop a VMP to keep the plants at an acceptable level while maintaining fish and wildlife habitat.

Class 4 - Well established and widespread beneficial aquatic plants at nuisance levels: select an appropriate manual control method, and develop a long term control strategy through development of a VMP (page 7).

Table 1. Recommended Methods of Weed/Plant Control

Detailed descriptions of these methods begins on page 22.

Class	Hand Pulling or Hand Tools	Bottom Barrier	Weed Roller	Diver Suction Dredge	Mech. Cutter	Mech. Harvester	Rotovator	Dragline and Clamshell Dredging
1	+	+	-	+	-	-	-	-
2	0	0	0	0	0	0	0	0*
3	+	+	+	0	+	0	-	-
4	+	+	+	0	0	0	-	0**

KEY . . .

- Not recommended for this type of weed/plant problem
- 0 Of some use for this type of weed/plant problem
- + Recommended for this type of weed/plant problem

* for reed canarygrass control only

** sometimes used for removal of water lilies

Caution: this table only gives a general summary of HPA requirements, please read specific requirements in the provisions of each control method selected (beginning on page 18).

**Table 2.
“General” HPA Requirements For Aquatic
Noxious Weed and Beneficial Plant Control**

Control Method	Aquatic Noxious Weeds			Aquatic Beneficial Plants		
	Pamphlet HPA	Pamphlet HPA and WDFW Authorization	Individual HPA ¹	Pamphlet HPA	Pamphlet HPA and WDFW Authorization	Individual HPA ¹
Hand Pulling or Hand Tools	✓			✓	✓ ²	
Bottom Barriers	✓	✓ ²		✓	✓ ²	
Weed Rollers	✓	✓ ²			✓	
Mechanical Cutting and Harvesters	✓				✓	
Diver Dredges	✓	✓ ²			✓	
Dragline and Clamshell Dredges			✓			✓
Rotovators			✓			✓

¹ Applicants may apply for individual HPAs for projects that exceed pamphlet limitations/thresholds

² Prior authorization from WDFW is required for projects that exceed specified thresholds

Step 4 - Acquire Other Permits If Necessary

This Hydraulic Project Approval pertains only to the provisions of the Washington State Fish and Wildlife Codes. It is the permittee’s responsibility to apply for and obtain any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

Use of this pamphlet as the HPA for removal or control of aquatic plants does not preclude the need to obtain and follow other applicable rules and regulations.

With one phone call to the Washington State **Permit Assistance Center** you can get information on environmental permits issued by federal, state or local government. (360) 407-7037

For example, some projects may require review under the State Environmental Policy Act (SEPA)- this is coordinated through your local jurisdiction and may require completing a checklist. Smaller projects are generally exempt from SEPA requirements. Before you start an aquatic plant removal or control project contact the **Permit Assistance Center (PAC) at (360) 407-7037**.

Phone numbers of agencies and departments that may require permits or have other involvement are listed in Appendix E: Agency Contacts (page 53).

Step 5 - Control Methods - Provisions (Requirements) and Recommendations

This section contains specific information on each type of control method including:

- general description
- advantages and disadvantages
- HPA requirements (individual, pamphlet or pamphlet with authorization)
- provisions (requirements that must be followed for each control method)
- recommendations (additional actions that should be taken to protect fish, wildlife and their habitats and increase project effectiveness).

If you use the pamphlet as the HPA for your project: you must follow the appropriate common provisions, and all provisions listed for the control technique selected when conducting your project (common provisions are listed in this section on page 20).

Depending on the control method you select, you may be required to conduct your project within the timing guidelines for the county or body of water in which you conduct your project (see Appendix F: Timing Table on page 54).

Careful adherence to the provisions, timing guidelines, and recommendations provided in this section will help ensure that project impacts to fish and wildlife are minimized. Also note that some projects will require prior authorization from WDFW. This additional step will ensure protection of resources in special habitats and minimize cumulative impacts. If you have any questions about the provisions, timing guidelines, or recommendations please call the WDFW regional office nearest to your home (Appendix E: Agency Contacts on page 53) and discuss the details with your local Area Habitat Biologist.

Early action, choosing the most effective technique(s), and properly implementing the technique are important factors that will increase your chances of success.

Early action is essential. Letting an aquatic noxious weed problem expand can drastically increase costs, difficulty of control, and reduce chances for potential success. Likewise, choosing an effective technique and implementing it correctly will decrease the risk of further weed invasion and the need for more costly, larger scale control measures that may in themselves be destructive. Therefore, it is recommended that you choose the most effective control method first, and apply it early while the problem is small, to avoid the potential need for more extensive/expensive control measures later.

Regardless of how successful the chosen control method may be, it is extremely important to follow-up your project with regular monitoring to determine control effectiveness, to detect re-invasion, and use follow-up control where necessary.

Long-term maintenance and monitoring, follow-up control, and searching for new infestations are essential activities for weed control projects to be successful over the long term. Even when competing native vegetation has been established, weed species that were once present may re-occur or new species may appear. Periodic monitoring should be conducted to detect potential new infestations, and follow-up control employed where necessary.

Common Technical Provisions

Note: Not all of these provisions are required for each control method. The following common technical provisions are applicable to numerous control techniques and are listed here to avoid repetition. **If applicable**, the provision number below is listed with the individual control techniques on the following pages.

1. Removal of detached plants and plant fragments from the watercourse shall be as complete as possible. This is especially important when removing or controlling aquatic noxious weeds. Detached plants and plant fragments shall be disposed of at an upland site so as not to reenter state waters.
2. Work shall be conducted to minimize the release of sediment and sediment-laden water from the project site.
3. Extreme care shall be taken to ensure that no petroleum products, hydraulic fluid or other deleterious material from equipment used are allowed to enter or leach into the watercourse.
4. If at any time as a result of project activities or water quality problems, fish life are observed in distress or a fish kill occurs, operations shall cease and both the Department and the Department of Ecology shall be notified of the problem immediately. The project shall not resume until further approval is given by the Department. Additional measures to mitigate impacts may be required.
5. Every effort shall be made to avoid the spread of plant fragments through equipment contamination. Persons or firms using any equipment to remove or control aquatic plants shall thoroughly remove and properly dispose of all viable residual plants and viable plant parts from the equipment prior to the equipment's use in a body of water.
6. Existing fish habitat components such as logs, stumps, and large boulders may be relocated within the watercourse if necessary to properly install the bottom barrier or screen, or weedroller, or to operate the equipment. These habitat components shall not be removed from the watercourse.

7. Alteration or disturbance of the bank and bank vegetation shall be limited to that necessary to conduct the project. All disturbed areas shall be protected from erosion, within seven calendar days of completion of the project, using vegetation or other means. The banks shall be revegetated within one year with native or other approved woody species. Vegetative cuttings shall be planted at a maximum interval of three feet (on center), and maintained as necessary for three years to ensure 80 percent survival. Where proposed, planting densities and maintenance requirements for rooted stock will be determined on a site-specific basis. After prior authorization by the Department, the requirement to plant woody vegetation may be waived for areas where the potential for natural revegetation is adequate, or where other engineering or safety factors preclude them.

8. Due to potential impacts to sockeye spawning areas, prior authorization by the Department shall be required for activities in Baker Lake and Lakes Osoyoos, Ozette, Pleasant, Quinault, Sammamish, Washington, and Wenatchee. Authorization may or may not be given for the activity, and if given, may require mitigation through a written agreement between the applicant and the Department for impacts by the activity to the spawning area.

Hand Pulling, Raking and Cutting



Hand pulling is similar to pulling weeds out of a garden.

Rakes for aquatic plants usually have a rope attached to the handle to facilitate a longer swath of plant removal.

A nonmechanical weed cutter is two, single-sided stainless steel blades forming a “V” shape and connected to a handle which is tied to a rope. The cutter is then thrown out about 20 feet into the water. As the cutter is pulled through the water it cuts a 48-inch wide swath through the vegetation.

Raking shall not be conducted in Baker Lake and Lakes Osoyoos, Ozette, Pleasant, Quinault, Sammamish, Washington, or Wenatchee without prior authorization by WDFW, due to potential impact to sockeye spawning areas.

Advantages

- Site specific
- Species specific (hand pulling)
- Low impact to native plants (except raking)
- Immediate plant removal
- Low cost

Disadvantages

- Slow, labor intensive
- Generates fragments
- Not practical for large areas
- Short-term turbidity increase

Provisions

The following provisions apply for both aquatic noxious weed and beneficial plant control or removal projects except where otherwise noted. This pamphlet serves as an HPA if all provisions listed below (in addition to the listed common technical provisions) are followed. If the intent of the project is to control aquatic beneficial plants the project must be done within the timing guidelines in Appendix F.

(page 54). Aquatic noxious weed control projects may be completed year-round. The pamphlet shall be on the job site at all times.

- Common provisions 1, 2, 3, 4 and 5 (page 20).
- Due to potential impacts to sockeye spawning areas, prior authorization by the Department shall be required for raking in Baker Lake and Lakes Osoyoos, Ozette, Pleasant, Quinault, Sammamish, Washington, or Wenatchee. Authorization may or may not be given for raking, and if given may require mitigation through a written agreement between the applicant and the Department for impacts by raking to the spawning area.
- Work shall be restricted to the use of hand-pulling, hand-held tools or equipment, or equipment that is carried when used.
- Removal or control of aquatic beneficial plants to maintain an access for boating or swimming shall be allowed along a maximum length of 10 linear feet of the applicant's shoreline. Projects for boating and swimming which cover a larger area shall require prior authorization by the Department.
- Where possible, the entire plant shall be removed when using hand-pulling for aquatic noxious weeds.
- Existing fish habitat components such as logs, stumps, and large boulders shall not be removed or disturbed.

Recommendations

Hand pulling is suitable primarily for small initial infestations and long-term maintenance projects. For noxious weed control it is most successful if you remove the entire plant, including the roots. Native plants should be left undisturbed as they will help control the growth of noxious weeds, and they provide benefits to fish and wildlife. Plant fragments generated during noxious weed removal must be carefully contained (using a net or similar device) and removed from the water to avoid re-rooting or drifting onshore. This technique is best conducted on calm days to minimize the movement of fragments offsite.

Use of hand cutters or rakes is also effective for small areas and for confined locations around docks and floats. Plant stems and fragments will float to the surface following cutting or raking and must be promptly removed from the water to avoid re-rooting at other locations. Use of these techniques should also be reserved for calm days to avoid plant

stems and fragments from floating offsite during removal. Purple loosestrife plant parts and roots must be removed from the site, however, permission is required to transport purple loosestrife. This is obtained by calling:

Department of Agriculture

Greg Haubrich
Weed Specialist
2015 South 1st St.
Yakima, WA 98903
(509) 576-3039, fax (509) 575-7858

For final disposal of purple loosestrife:

1. bag plant and roots,
2. allow plant material to dry and burn completely or,
3. deposit bagged material in landfill or other approved site.

To address long term plant management issues, the development of a VMP is recommended (page 7).

Hand pulling, raking and cutting is only allowed in small areas for beneficial plant control in recognition of the spawning and rearing habitat they may provide for fish.

Because priority species of fish and/or wildlife may be present in the area of your proposed project, please refer to Appendix A: Priority Species on page 39, before you begin your project. You may also want to contact the WDFW Area Habitat Biologist for more information on priority species in your area.

Bottom Barriers



A bottom barrier covers the sediment like a blanket. By blocking light, it reduces the growth of aquatic plants.

Note: Bottom barriers shall not be installed in Baker Lake, Lakes Osoyoos, Ozette, Pleasant, Quinault, Sammamish, Washington, or Wenatchee without prior authorization by WDFW, due to potential impact to sockeye spawning areas.

Advantages

- Immediate open water area
- Site specific
- Useful around obstructions

Disadvantages

- Not practical for large areas
- Not species specific
- May be damaged by boat anchors, fishing gear or harvesters
- Fish spawning and benthic organism impacts
- Maintenance required
- Potentially hazardous to swimmers and boaters

Provisions

The following provisions apply for both aquatic noxious weed and beneficial plant control or removal projects except where otherwise noted. This pamphlet serves as an HPA if all provisions listed below (in addition to the listed common technical provisions) are followed. If the intent of the project is to control aquatic beneficial plants the project must be done within the timing guidelines in Appendix F (page 54). Aquatic noxious weed control projects may be completed year-round. The pamphlet shall be on the job site at all times.

- Common provisions 4, 5, 6 and 8 (page 20).
- For removal and control of aquatic noxious weeds, bottom barrier or screen material shall not cover more than 50 percent of the length of the applicant's shoreline. Bottom barrier or screen projects covering a larger area shall require prior authorization by the Department. Bottom barrier or screen and anchor material consisting of biodegradable material may be left in place. Bottom barrier or screen and anchor material that is not biodegradable shall be completely removed within two years of placement to encourage recolonization of aquatic beneficial plants unless otherwise approved by the Department.
- To remove or control aquatic beneficial plants such that an access is maintained for boating or swimming, bottom barrier or screen and anchor material that is either biodegradable or non-biodegradable may be installed along a maximum length of 10 linear feet of the applicant's shoreline. Bottom barrier or screen projects for boating and swimming access which cover a larger area shall require prior authorization by the Department.
- Bottom barrier or screen material shall be securely anchored with pea-gravel filled bags, rock or similar mechanism to prevent billowing and movement offsite.
- Bottom barrier or screen and anchors shall be regularly maintained while in place to ensure the barrier or screen and anchors are functioning properly. Barriers or screens that have moved or are billowing shall immediately be securely reinstalled or removed from the watercourse.

Recommendations

Use of bottom barriers is most appropriate for localized, small-scale or initial noxious aquatic weed infestations where control of all plants is desirable. Bottom barriers are recommended as a component of a weed control plan for early infestations of noxious weeds. This technique can be used in small, confined areas adjacent to docks or floats where mechanical control technologies may not be as effective.

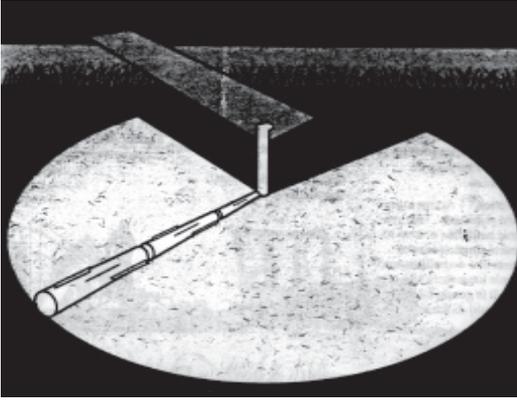
Barriers must be securely anchored to the bottom, using pea-gravel filled bags or rocks (not metal debris), and regularly maintained to prevent the creation of navigational hazards or danger to swimmers resulting from

billowing due to gas buildup. To address long term plant management issues, the development of a VMP is recommended (page 7).

Control of beneficial plants using bottom barriers is only allowed for small areas due to the use of aquatic vegetation for spawning and rearing by fish.

Because priority species of fish and/or wildlife may be present in the area of your proposed project, please refer to Appendix A: Priority Species on page 39 before you begin your project. You may also want to contact the WDFW Area Habitat Biologist for more information on priority species in your area.

Weed Rollers



Weedrollers are useful for controlling beneficial plants only in a small defined area. This technique “wears down” weeds by frequent agitation. Weed rollers consist of a mechanically driven roller that sets on the lake bed and is moved across an arc up to 270 degrees by means of a small electrical power unit. Plants are detached from the soil or flattened (inhibiting growth) by the roller and attached fins.

Note: Weed rollers shall not be installed in Baker Lake, Lakes Osoyoos, Ozette, Pleasant, Quinault, Sammamish, Washington, or Wenatchee without prior authorization by WDFW, due to potential impact to sockeye spawning areas.

Advantages

- Site specific
- Creates open area near dock
- Low-cost operation (after initial purchase)

Disadvantages

- May interfere with fish spawning
- Not species specific
- Generates fragments
- Short-term turbidity increase
- Expensive to purchase
- Requires maintenance

Provisions

The following provisions apply for both aquatic noxious weed and beneficial plant control or removal projects except where otherwise

noted. This pamphlet serves as an HPA if all provisions listed below (in addition to the listed common technical provisions) are followed and the project is conducted within the timing guidelines in Appendix F (page 54). The pamphlet shall be on the job site at all times.

- Common provisions 1, 2, 3, 4, 5, 6 and 8 (page 20).
- Weed rollers shall not be used to remove an aquatic noxious weed early infestation. To remove or control all other infestation levels of aquatic noxious weeds, weed rollers shall not cover an area of more than 2,500 square feet. Weed roller projects covering a greater area shall require prior authorization by the Department.
- Where the intent is to remove or control aquatic beneficial plants, prior authorization by the Department shall be required.

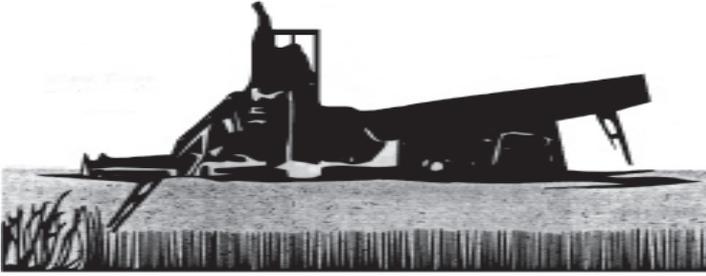
Recommendations

Weed rollers are best used when control of all aquatic plants is desired. The area should be hand pulled before installing the weed roller. Following this, they may be used when necessary to maintain an area clear of plants. This pattern of use will minimize the production of plant fragments. Food grade oil is recommended to be used in the weed roller motor where possible.

To address long term plant management issues, the development of a VMP (page 7) is recommended. Prior authorization to use weed rollers for beneficial plant control is required due to the spawning and/or rearing habitat provided by this vegetation for fish.

Because priority species of fish and/or wildlife may be present in the area of your proposed project, please refer to Appendix A: Priority Species on page 39, before you begin your project. You may also want to contact the WDFW Area Habitat Biologist for more information on priority species in your area.

Mechanical Harvesting and Cutting



Mechanical harvesters are large floating machines that cut and collect aquatic plants. **Mechanical weed cutters** cut aquatic plants several feet below the water’s surface but do not collect the plants while the machinery operates. Mechanical harvesters and/or cutters are not appropriate techniques to address early infestations of aquatic noxious weeds.

Advantages

- Minimum bottom disturbance
- Immediate plant removal to cutting depth
- Materials may be composted
- Reduces nutrient loading (if cut material is immediately removed from water)

Disadvantages

- Plant disposal problems
- Generates plant fragments
- Fish and invertebrate mortalities
- Repeated treatments necessary (like lawn mowing)
- Does not reduce plant density
- Not species specific

Provisions

The following provisions apply for both aquatic noxious weed and beneficial plant control or removal projects except where otherwise noted. This pamphlet serves as an HPA if all provisions listed below (in addition to the listed common technical provisions) are followed and the project is conducted within the timing guidelines in Appendix F (page 54). The pamphlet shall be on the job site at all times.

- Common provisions 1, 3, 4, 5, 6 and 7 (page 20).
- Mechanical harvesters and cutters shall not be used to remove an aquatic noxious weed early infestation.
- If the intent of the project is to remove aquatic beneficial plants, prior authorization by the Department shall be required.
- Mechanical harvester and cutter operations shall only be conducted in waters of sufficient depth to avoid bottom contact with the cutter blades.
- Mechanical harvesters and cutters shall be operated at all times to cause the least adverse impact to fish life.
- Mechanical harvesters and cutters shall be well-maintained and where practicable, food-grade oil in the hydraulic systems should be used.
- Fish life that may be entrained in the cut vegetation during mechanical harvester operations shall be immediately and safely returned to the watercourse.

Recommendations

Mechanical cutters and harvesters are not recommended for control of early infestations of aquatic noxious weeds due to the high potential for rapid spreading of fragments to other areas of the water body.

Harvest operators should be properly trained to operate the equipment to be used. Operators should also carry and be trained in the use of containment equipment. Individuals hiring harvesters should request to see maintenance logs for decontamination of equipment. To address long term plant management issues, the development of a VMP is recommended (page 7).

Because priority species of fish and/or wildlife may be present in the area of your proposed project, please refer to Appendix A: Priority Species on page 39, before you begin your project. You may also want to contact the WDFW Area Habitat Biologist for more information on priority species in your area.

Diver Dredging

Diver dredging utilizes a small barge or boat carrying portable dredges with suction heads that are operated by SCUBA divers to remove individual rooted plants (including roots) from the sediment. Divers physically dislodge plants with sharp tools. The plant/sediment slurry is then suctioned up and carried back to the barge through hoses operated by the diver. On the barge or boat, the plant parts are sieved out and disposed of off-site. The water sediment slurry is filtered and discharged back to the water or piped off-site for upland disposal.

Note: Diver dredging shall not be conducted in Baker Lake, Lakes Osoyoos, Ozette, Pleasant, Quinault, Sammamish, Washington, or Wenatchee without prior authorization by WDFW, due to potential impact to sockeye spawning areas.

Advantages

Site specific
Species specific
No depth constraints
Used near obstacles

Disadvantages

Labor intensive
Slow
Potential fragment production
Temporary bottom disturbance and increased turbidity
Expensive

Provisions

The following provisions apply for both aquatic noxious weed and beneficial plant control or removal projects except where otherwise noted. This pamphlet serves as an HPA if all provisions listed below (in addition to the listed common technical provisions) are followed. Aquatic noxious weed control projects may be completed year-round. Aquatic beneficial plant removal or control projects shall be completed within the timing guidelines in Appendix F (page 54). The pamphlet shall be on the job site at all times.

- Common provisions 2, 3, 4, 5, 6, 7 and 8 (page 20).
- If the intent of the project is to remove or control aquatic beneficial plants, prior authorization from the Department shall be required.

- Dredging shall be conducted at all times with dredge types and methods that cause the least adverse impact to fish life.
- Dredges shall be well-maintained and where practicable, food-grade oil in the hydraulic system should be used.
- Upon completion of the dredging, the bed shall not contain pits, potholes, or large depressions to avoid stranding of fish.
- Removal of plants and plant fragments from the watercourse shall be as complete as possible. This is especially important when removing or controlling aquatic noxious weeds. Plants and plant fragments shall be removed from the dredge slurry prior to its return to the watercourse. Dredged bed materials, including detached plants and plant fragments, shall be disposed of at an upland disposal site so as not to reenter state waters.
- A hydraulic dredge shall only be operated with the intake at or below the surface of the material being removed. The intake shall only be raised a maximum of three feet above the bed for brief periods of purging or flushing the intake system.

Recommendations

Considered a selective technique, diver dredging is particularly well suited for low-level, early infestations of aquatic noxious weeds. It can also be used to assist in long term maintenance following herbicide treatments. Diver dredging is not recommended for use to control aquatic beneficial plants.

A temporary water quality modification permit from Ecology and a shoreline permit from your local jurisdiction (city or county) may be needed (page 17). A permit from the Corps of Engineers may also be required. To address long term plant management issues, the development of a VMP is recommended (page 7).

Because priority species of fish and/or wildlife may be present in the area of your proposed project, please refer to Appendix A: Priority Species on page 39, before you begin your project. You may also want to contact the WDFW Area Habitat Biologist for more information on priority species in your area.

Dragline and Clamshell Dredging

Use of backhoes, tracked excavators and similar equipment is often employed to remove aquatic noxious weeds along ditches and streambanks. Most commonly, these techniques are used to control or remove reed canarygrass. Operations are generally conducted from the streambank with the equipment reaching out over the water to remove the vegetation. Vegetation and associated sediment is retrieved to the shore and removed from the site.

Advantages

- Site specific
- Used near obstacles

Disadvantages

- Labor intensive
- Increased turbidity
- Streambank and bed disturbance
- Disposal of plant material
- Revegetation of streambank may be necessary
- Not species specific

Provision

An individual HPA is required for all dragline and clamshell dredging projects or other dredging projects for aquatic plant removal or control not including diver-operated dredging.

Technical provisions for dredging projects, other than diver operated dredging, can be found in WAC 220-110-337.

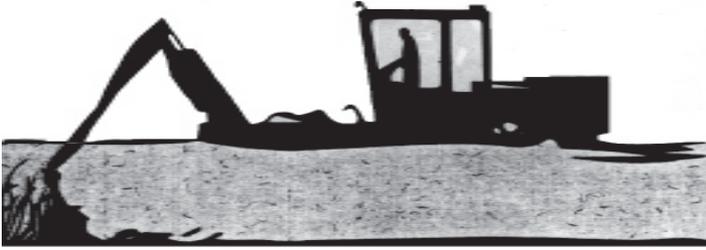
Recommendations

All dredge equipment should be well maintained and thoroughly cleaned before it is to be used for an aquatic weed removal project. To prevent the spread of plant fragments, cleaning should include a thorough examination of the machinery for plant parts. To minimize potential impacts from leaks, food grade oil should be utilized in the hydraulic

systems where feasible. To avoid adverse impacts to fish habitat, every effort should be made to avoid channelizing the stream course during dredging operations. Dragline and clamshell dredges should not be used for early infestations of aquatic noxious weeds. To address long term plant management issues, the development of a VMP is recommended (page 7).

Because priority species of fish and/or wildlife may be present in the area of your proposed project, please refer to Appendix A: Priority Species on page 39, before you begin your project. You may also want to contact the WDFW Area Habitat Biologist for more information on priority species in your area.

Rotovation



Rotovators are floating machines that use underwater rototiller-like blades to uproot aquatic plants. Rotovation is not an appropriate technique for addressing early infestations of aquatic noxious weeds.

Advantages

- Potentially removes entire plant
- Generally reduces plant density
- May increase growth of native species

Disadvantages

- Generates plant fragments
- Not species specific
- Fish and invertebrate mortalities
- Bottom disturbance with increased turbidity
- Bottom obstructions limit use
- Potential release of toxic substances and nutrients from sediments

Provisions

An individual HPA is required for all rotovation projects.

Technical provisions for rotovation projects can be found in WAC 220-110-336.

Recommendations

Rotovation is most suitable for use in larger lakes or in rivers due to the size of the equipment and the high cost. It may be conducted year-round depending upon location and fish species present, however, it is generally most effective when conducted in the winter and spring during reduced plant growth. Because rotovators “dig” into the sediments and may cause disruption to buried utility lines or water intake pipes,

it is recommended that all such utilities be located prior to beginning work. Rotovation should not be used in areas with early infestations of aquatic weeds due to the high potential for spreading of plant fragments. Individuals hiring rotovators should request to see maintenance logs for verification of decontamination of equipment.

To address long term plant management issues, the development of a VMP is recommended (page 7).

Because priority species of fish and/or wildlife may be present in the area of your proposed project, please refer to Appendix A: Priority Species on page 39, before you begin your project. You may also want to contact the WDFW Area Habitat Biologist for more information on priority species in your area.

Step 6 - Complete and Return Tracking Form

Completion and return of the tracking form will help WDFW better understand the nature and extent of aquatic weed control projects. The form is located inside the backcover of the pamphlet (see page 58). Your participation in completing this form will also ensure that you will receive any future updates or changes to the pamphlet (techniques, provisions, timing tables, etc.). We are also interested in your comments on the pamphlet to ensure that future editions meet the needs of both the user and the resource.

Step 7 - Monitor for Reinfestation

Monitoring is one of the most important steps of noxious weed control. Early detection of reinfestations of noxious weeds and prompt follow-up can greatly increase the effectiveness of control efforts, reduce control costs, and decrease environmental impacts. Without monitoring and follow-up, a potentially effective control effort can be wasted. Monitoring should include:

- method effectiveness (the best basis for planning future control)
- checking for re-invasion of the noxious weed(s)
- checking for new infestations of different noxious weeds, particularly after disturbing the site and providing an open niche for weed establishment

The establishment of desirable native species will compete with future weed invasions. However, even when competing native vegetation has been established, weed species that were once present may re-occur or new species may appear.

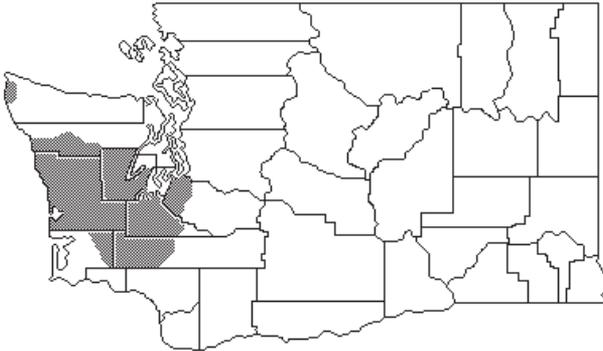
Appendices

Appendix A: Priority Species

The Priority Species List is a catalog of those species identified by the Washington Department of Fish and Wildlife (WDFW) as priorities for management and preservation. These species require protective measures to ensure their perpetuation due to their population status, sensitivity to habitat alterations, and /or recreational, commercial, or tribal importance. Priority species include all State Endangered, Threatened, Sensitive, and Candidate species; animal aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are also vulnerable.

Before you begin your aquatic plant control project, please read the following information and review the maps to determine if your project may impact the indicated species. If you are unsure of the impacts please contact your WDFW Area Habitat Biologist for localized information. For a complete listing of priority habitats and species please request a copy of the publication *Priority Habitats and Species List* from the nearest WDFW Regional office.

Olympic Mudminnow (*Novumbra hubbsi*)

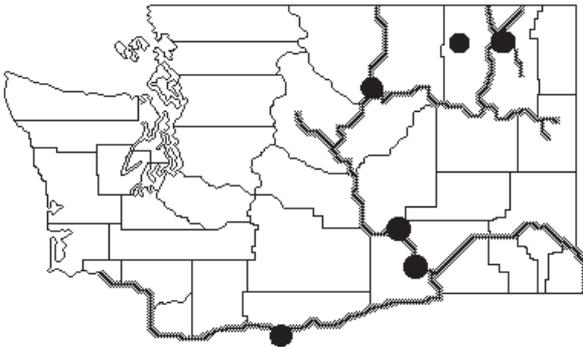


The entire population of Olympic mudminnows are found within portions of the Olympic Peninsula and central western Washington. The mudminnows inhabit pond and marsh habitat and areas with gently flowing water in the coastal lowlands. They are often found in dense aquatic vegetation, with a deep, soft mud bottom.

Mudminnows breed from early March to mid-June. Male fish defend territories in clumps of vegetation, including seasonally flooded reed canarygrass, or over carpets of moss; females lay their eggs on the bottom substrate. They feed on a variety of aquatic invertebrates and molluscs.

Olympic mudminnows are most threatened by reduction or deleterious changes to the habitat within their limited range. Such changes include clearing vegetation from the water they inhabit.

California Floater (*Adnodonta californiensis*)



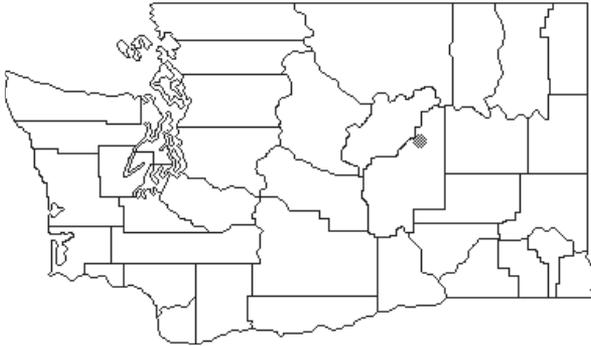
The California floater has been recorded in Washington, Idaho, western Wyoming, Oregon, California, Nevada, Utah, and Arizona. This species may be nearing extinction in some of the more southern states, including parts of California. In Washington, the California floater is known to occur in the Columbia River system and in a few other lakes and rivers in eastern Washington. The only sites from which there are recent records of live California floaters include portions of the Columbia and Okanogan Rivers, Curlew Lake and several ponds adjacent to the Columbia River downstream from the Hanford reactor sites. In western Washington, the California floater has been reported from Seattle (a doubtful record), and the Columbia River counties of Wahkiakum, Cowlitz, Clark, Skamania, and Klickitat.

The California floater is a State Candidate species. The species is declining or extinct over much of its range due to habitat alternation and pollution. The floater lives, feeds, respire, and reproduces in clean fresh water. The juvenile clams attach to gravel or rocks in clean flowing, well aerated waters. These riffle areas, with rocky or gravel substrate, are

essential for early development, especially when immediately upstream from the quiet, soft bottom habitat of mature clams. Adult clams, as well as young clams in the final stages of maturation, live partially buried in soft mud or sand bottoms. The floater requires a relatively stable substrate to avoid being buried and/or suffocated by shifting sediments.

A decreasing area of stable, unpolluted habitat appears to be the most limiting factor for this species. The use of insecticides and herbicides may also negatively affect this species. If pesticide use is planned for areas where this species occurs, review Appendix B: Other Methods/ Chemical Control Methods for contacts useful when assessing pesticides and their alternatives (see page 45). This species should be considered when projects are planned which might cause erosion, siltation, or bedload movement in streams, fish blockage, deleterious effects on native fish populations, or those projects which might introduce non-native aquatic organisms.

Yuma Skipper (*Ochlodes yuma*)

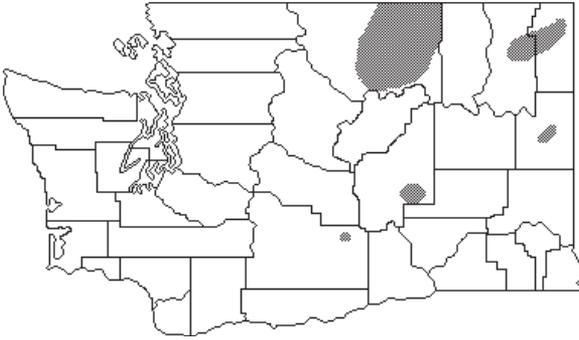


The Yuma skipper (*Ochlodes yuma*) is a butterfly species that should be one of the highest priorities for Washington butterfly conservation. It is found near dense hedges of the native, corn-like host plant, *Phragmites communis*, which grows along edges of seeps, springs, riverbanks, sloughs, canals, and lakes. This butterfly uses the host plant for egg deposition, larval nests, and as a larval food source. Adults take nectar from a variety of tall flowers.

If insecticide or herbicide use is planned where this species occurs, refer to Appendix B (page 45) for contacts helpful when evaluating pesticides and their alternatives.

Silver-bordered bog fritillary

(Boloria selene atrocotalis)

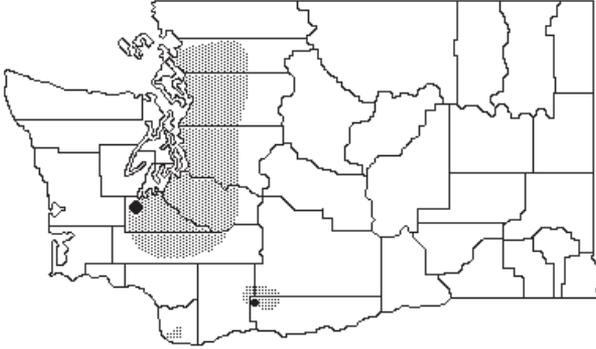


In Washington, this butterfly occurs east of the Cascade Mountains in the Columbia Basin, and in Okanogan and Pend Oreille counties. Though numerous where it occurs, the distribution of this species is disjunct, with fewer than 20 sites known. This butterfly is strongly associated with boggy meadows and true bogs, with the northern bog violet.

The silver-bordered bog fritillary is a State Candidate species. Many localized populations of butterflies have been lost and a great many more are in jeopardy. The most common causes of butterfly habitat loss and human-caused mortality are development, logging, grazing, impoundments, and the use of herbicides. If insecticide or herbicide use is planned for areas where this species occurs, review Appendix B: Other Methods/Chemical Control Methods (page 45), which lists contacts that may be helpful when assessing pesticides and their alternatives.

Oregon Spotted Frog (*Rana pretiosa*)

Columbia Spotted Frog (*Rana luteiventris*)



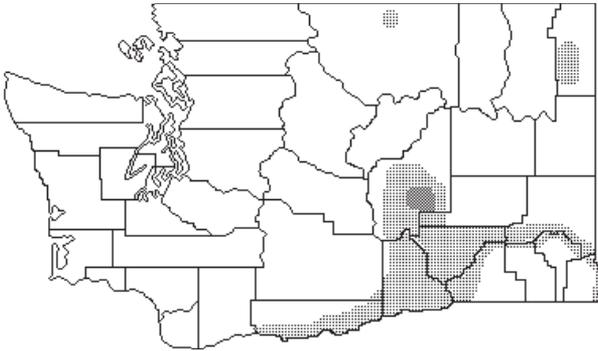
Until recently, Columbia and Oregon spotted frogs were considered one species, the spotted frog, *Rana pretiosa*. However, recent evidence supports separate species designations. In Washington, there is only one known population of Oregon spotted frog west of the Cascades. Other lowland western Washington populations are believed to be extinct. In 1990, one specimen was found in Thurston County, Washington. This is the only confirmed sighting in western Washington lowlands in over 20 years. The Columbia spotted frog is found in parts of the Cascade mountains, and in areas of eastern Washington.

The Columbia spotted frog and the Oregon spotted frog are State Candidate species. The Oregon spotted frog is also a Federal Candidate species.

Both species of spotted frogs are highly aquatic, inhabiting marshes, and marshy edges of ponds, streams and lakes. Spotted frogs usually occur in slow moving waters, with abundant emergent vegetation, and a thick layer of dead and decaying vegetation on the bottom. The frogs take refuge in this layer when disturbed. Female spotted frogs tend to deposit their eggs near other spotted frog egg masses sometime in March to early April. The egg masses are not attached to vegetation, but rest on the bottom in shallow water (less than 12 inches deep).

If pesticide or herbicide use is being considered for areas where Columbia or Oregon spotted frogs exist, refer to Appendix B: Other Methods/Chemical Control Methods, which contains contacts useful when assessing pesticides and herbicides (see page 45).

Northern Leopard Frog (*Rana pipiens*)



In Washington, this frog is found east of the Cascade Mountains, throughout the northeast and north-central portions of the state. It has been documented in the Potholes Reservoir in Grant County, and along the Columbia and Snake Rivers in Walla Walla, Benton, Klickitat, and Whitman counties. These frogs have also been known to occur in Pend Oreille, Stevens, and Okanagan counties.

The northern leopard frog is a State Candidate species.

The northern leopard frog inhabits marshes, wet meadows, riparian areas, and moist open woods. This frog breeds in marshes, ponds and along vegetated lake margins. It avoids bodies of water with no vegetation.

To maintain adequate cover for the frogs, wetland vegetation should not be removed from stream banks or pond edges. Removing vegetative cover may raise water temperatures and increase sedimentation, enhancing conditions for competing bullfrogs.

Pesticides and herbicides should not be applied to waters used by northern leopard frogs. If pesticide or herbicide use is being considered for areas where the northern leopard frog exists, refer to Appendix B: Other Methods/Chemical Control Methods (page 45), which contains contacts useful when assessing pesticides, herbicides, and their alternatives.

Appendix B: Other Methods

The following aquatic plant control techniques are less frequently used than those previously discussed, or do not require approval through the Hydraulic Code administered by WDFW. These techniques are therefore not addressed relative to HPA requirements (except in those few instances where it is appropriate) and are primarily included here for discussion and information purposes.

Biological Control Methods - Grass Carp

Sterile grass carp used to control aquatic vegetation have produced extremely variable results in Washington. In most cases their use has resulted in either complete eradication or no noticeable control of aquatic plants. Successfully using them to reduce aquatic plants to an intermediate level of abundance has seldom occurred. Therefore, grass carp should not be used in lakes unless complete eradication of aquatic vegetation is acceptable. Their use should be restricted to circumstances where potential adverse impacts are minimal, such as small ponds, closed ditch systems, and lakes with no outlet. Use of grass carp in large lakes should only occur in rare instances, under carefully defined conditions, and they should never be planted in rivers. In addition, grass carp should not be planted in lakes where submersed plant communities provide important habitat for fish and/or wildlife.

A fish stocking permit from WDFW must be obtained prior to planting grass carp in Washington waters. An individual HPA will also be required if installation of barriers, including screens, is proposed or required.

Chemical Control Methods - Herbicides

Traditionally, herbicides have been relied on to address many aquatic weed problems. In recent years, however, greater concern with environmental and human health impacts from herbicides has led to increased restrictions on their use. As a result, aquatic herbicide use has become more selective and is often part of a VMP (page 7).

Application of aquatic herbicides is regulated primarily by Ecology and the Department of Agriculture. Each agency should be contacted for information on herbicide label restrictions, required applicator licensing, and other limits on use in aquatic environments (see Appendix E:

Agency Contacts, page 53). Also, local jurisdictions can further restrict or prohibit aquatic herbicide use and should be consulted early. Lastly, aquatic herbicide use may be of direct concern to your neighbors. It is recommended that you contact them prior to planning any use of herbicides in the water.

Herbicides can adversely impact fish, wildlife and non-target plants. WDFW recommends that herbicide application be restricted to those circumstances where other weed removal or control techniques are not sufficient. Herbicides should only be used as part of an integrated plan for noxious weed control. Relying solely on aquatic herbicides year after year is generally not appropriate, advisable, or cost effective.

It is beyond the scope of this pamphlet to discuss each type of herbicide and its potential impacts. However, because of toxicity to fish and other organisms at relatively low levels, accumulation in aquatic sediments, and long term effects on aquatic system health, WDFW strongly discourages the use of copper compounds to control algae and aquatic plants in waters of the state.

For additional information for evaluating herbicides, pesticides and their alternatives, the following list is provided.

United States Environmental Protection Agency

Provides information, brochures and technical help on pesticide application.

Region 10 Public Affairs Office, Seattle 1-800-424-4372

Washington State Department of Agriculture

**Pesticide Management - General Information (360) 902-2010
Compliance**

Enforces state and federal laws; investigates complaints of pesticide misuse

Manager	(360) 902-2036
Olympia Compliance	(360) 902-2040
Mount Vernon Compliance	(360) 428-1091
Spokane Compliance	(509) 625-5229
Walla Walla Compliance	(509) 527-4130
Wenatchee Compliance	(509) 664-3171
Yakima Compliance	(509) 575-2746

Washington Department of Ecology

Regional Contacts

Ecology provides information and permits on applying pesticides directly or indirectly to open bodies of water

Eastern Region, Spokane	(509) 456-2873
Central Region, Yakima	(509) 457-7207
Northwest Region, Bellevue	(425) 649-7070
Southwest Region, Olympia	(360) 407-6292

Watershed Controls

The reduction of external nutrient and sediment inputs to lakes and streams can be accomplished through implementation of Best Management Practices (BMPs) in the watershed. Decreasing or eliminating the input of growth-stimulating nutrients like phosphorus and nitrogen to lakes and streams can help in the overall process of controlling aquatic weeds and plants. Use of BMPs in watersheds complements other in-lake weed control techniques and is a useful part of a whole lake plan (i.e., an integrated approach). Examples of homeowner BMPs include: regular septic tank maintenance, careful use of lawn and garden fertilizers, cleaning up pet wastes, and disposal of lawn clippings well away from the water's edge. Additional inputs of nutrients and sediment can be reduced by implementing prudent agricultural, forestry, construction and road maintenance practices in the watershed. Contact your local jurisdiction, Conservation District, WSU Extension Service, or Ecology regarding nutrient reduction programs for your area.

Physical Control Methods

Drawdown

Lowering the water level exposes plants and root systems to extreme temperature and moisture conditions (freezing and dry or hot and dry) and can effectively control some plants. Control of aquatic weeds using drawdown is more common in reservoirs and ponds than in natural lakes. It is important to accurately identify the plant species to be controlled by this technique due to the variability of responses among different plants. In western Washington where mild, wet winters are common, drawdown has not been effective for control of many aquatic weeds. This technique can also adversely affect native plants, associated animal communities and recreational use of the water body. An individual HPA is required for water level manipulations to remove or control aquatic vegetation.

Technical provisions for water level manipulation projects can be found in WAC 220-110-338.

Water Column Dye

This technique utilizes dark-colored dyes to reduce sunlight penetration into the water column thereby shading aquatic plants. Applications are restricted to closed systems (ponds or lakes with no outflow), and effectiveness is generally best when used in shallow water bodies during the early part of the growing season. All label recommendations should be closely followed during use. Contact Ecology and your local jurisdiction for further permit information and requirements.

Appendix C: Sockeye Salmon and Kokanee Spawning Habitat

Most sockeye spawning occurs in rivers and streams that are tributary to lakes, but often substantial numbers of sockeye salmon spawn along lake shores in areas where ground water percolates through the gravel (upwelling). Generally, sockeye utilize areas along lake shores where the gravel is small enough to be readily dislodged by digging. Sockeye, however, may also utilize lake shore areas with other substrate types and sizes, depending largely on the presence or absence of upwelling. Populations of lake spawning sockeye are found in Baker Lake and Lakes Osoyoos, Ozette, Pleasant, Quinault, Sammamish, Washington and Wenatchee.

Kokanee prefer smaller streams that are tributary to lakes for spawning areas, but like sockeye will utilize lake shore areas as well. Along lake shores they generally spawn in areas with pea-sized gravel and prefer locations that have upwelling. Native stocks of kokanee in Washington occur in Lakes Chelan, Sammamish, Washington, Wenatchee and Whatcom. In addition, WDFW stocks several Washington lakes with kokanee. Contact your local WDFW Area Habitat Biologist for further information on sockeye or kokanee in your area.

Appendix D:

Long Term Management Issues

Importance of Native Vegetation

Aquatic noxious weeds (non-native species) can adversely affect ecological functions and aesthetics in lakes and streams by crowding out native vegetation and creating single species stands. While it is recognized that native aquatic plants can become a nuisance to swimmers and boaters due to excessive growth, it is important to recognize the value of native plant species for fish and wildlife. These native plants provide habitat for fish and wildlife, help stabilize shorelines and streambanks, produce oxygen, trap beneficial nutrients, and keep sediment in place. Aquatic beneficial plants are defined as native plants (such as pondweeds, bladderwort, or coontail) or non-native plants not included on the state noxious weed list (such as fragrant water pondlily).

Habitat Value to Fish and Wildlife

Native aquatic plants provide habitat (e.g., food and cover) for fish and wildlife. For example, pondweed is a critical food source for waterfowl and marsh birds. These plants are of particular importance to canvasbacks, trumpeter swan, mallard, redhead, canada goose, ring-necked duck and coot, in addition to 17 other waterfowl species. Pondweed also provides cover from predators for warmwater fish such as perch and bass.

Coontail seeds and leaves, although not as preferred as pondweed, are eaten by waterfowl, especially gadwall, ring-necked duck, scaup, mallard, and redhead duck. Chara or muskgrass is one of the most preferred foods of ducks especially coot, mallard, wigeon, redhead, ring-necked, ruddy, two species of scaup and teal, and pintail. Cattail is a major food and cover source for muskrat and geese and provides nesting habitat for marsh wren and red-winged black-bird. Bullrush is also an important marsh plant for food and cover. Its seeds provide food for many species of waterfowl, marsh and shorebirds, upland birds, songbirds, and small mammals and its rootstock and stems provide food for muskrat and nesting habitat for marsh wren.

Warmwater gamefish often utilize vegetation in the shallow waters of lakes for spawning, early rearing, and feeding. Largemouth and smallmouth bass generally prefer ponds and reservoirs with abundant aquatic vegetation. Bluegill, sunfish and crappie also inhabit vegetated quiet or slow-moving waters for protection from predators. Too much vegetation can result in overpopulation if predators are unable to access prey species, while too little vegetation can also adversely affect the predator-prey balance and result in a decline in the fishery.

Aquatic plants provide important living space for insects, snails and crustaceans, which in turn become food for fish and waterfowl. Vegetated areas support many times more of these tiny creatures than do non-vegetated areas. The plants make important nurseries for young fish (including salmon and trout), frogs, salamanders and other amphibians. Several species of reptiles, including turtles, garter snakes and water snakes use these areas for cover and forage. Otter, beaver, muskrat, turtles, and moose will graze on a variety of aquatic plants.

Effect of Noxious Weeds on Native Plants

Native species, which evolved along with other plants and animals in the Pacific Northwest, have natural checks and balances that usually keep native plant populations under control. However, some non-native aquatic plants can out-compete native aquatic plants, forming single species stands which provide poor habitat for native fish and wildlife. Non-native plants frequently gain a foothold because of recent soil disturbance.

Introduced accidentally or as landscape plants, many noxious weed species now threaten native vegetation, fish and wildlife. The long-term effects of expanding noxious plant populations will have devastating impacts on fish and wildlife habitat, unless measures are taken to control such infestations. The establishment and maintenance of desirable native vegetation is one of the most effective prevention strategies available to control non-native species. This practice can provide long-term benefits, but will not eliminate the need to monitor for noxious weed re-invasions and provide spot control where necessary.

Erosion Control

The roots of many aquatic plants, particularly those growing near the shoreline, reinforce and stabilize shorelines and protect soil against erosion from wind, wave action, currents, and other forces. By helping to secure the sediments they grow in, plants can also contribute to increased water clarity.

Nutrient Recycling

Aquatic plants form a vital part of the complex system of chemical cycling in a lake. They influence the supply of oxygen in the water and can assist in absorbing pollutants from contaminated water.

Algal blooms are generally caused by excess nutrients such as phosphorus or nitrogen in lakes. Rooted aquatic plants remove nutrients from sediments as they grow while free-floating plants like coontail and bladderwort remove nutrients directly from the water. Emergent aquatic vegetation also slows water movement along shorelines and allows nutrient rich sediment to settle to the bottom, where it is less available to algae.

Maintaining Lake Health

Native plants can become a “problem” if they are so numerous they impede recreational activities such as boating and swimming. Dense surface canopies of aquatic plants (both native and non-native) can significantly impair water quality, reducing fish habitat and altering water pH and oxygen levels. The causes of unnaturally high levels of plant growth are complex. Often excess nutrients, which come from around the lake or in the watershed are responsible. Failing septic systems, fertilizer run-off or animal waste can all contribute to the nutrient overload and cause the natural process of lake aging to proceed at an accelerated rate. Increased plant and algal growth are indications of this process. Reducing and eliminating pollutant and excess nutrient sources are therefore vital to maintaining lake health. Controlling these sources through the use of best management practices in the watershed is the most effective way to achieve this end. Forming a citizen-based organization is an important first step in addressing these issues.

A VMP (page 7) should then be developed to ensure the problems are addressed using an integrated approach that balances resource protection, water quality, and recreational uses.

Avoidance of Non-native Plant Introduction

Many of the aquatic noxious weeds present in our lakes and streams have been introduced when someone discarded aquarium plants into a lake. These plants are frequently spread to other lakes by boats, trailers and jetskis that have not been thoroughly cleaned after use in lakes or rivers with weed problems. Other noxious weeds have been introduced as landscape plants, “escaping” into the environment. It is therefore important to avoid use of noxious plants in landscaping to avoid unwanted spreading to areas outside your yard or garden. Contact your local county weed board for more information on landscaping plants to avoid.

Importance of Monitoring Plant Community Changes

Plant community changes can be monitored by collecting and identifying aquatic plants on a year to year basis. This is also a good way to detect detrimental changes and/or introduction of noxious weeds at an early stage, when control or elimination of the problem will be cheaper and less complicated.

Appendix E: Agency Contacts

The agencies and individuals listed below can provide you with additional information on aquatic weeds and the permit requirements that may apply to your project.

WA Dept. of Ecology	Kathy Hamel	(360) 407-6562
	Jenifer Parsons	(360) 407-6679
	Allen Moore	(360) 407-6563
	Permit Assistance Center	(360) 407-7037
WA Dept. of Agriculture	Diane Dolstad	(360) 902-2071
	Greg Haubrich (for purple loosestrife transport permit)	(509) 576-3039
WA Noxious Weed Control Board	Bridget Simon	(253) 872-2318
	Lisa Lantz	(253) 872-2972
WA Dept. of Natural Resources	Janie Civile	(360) 902-1095
	Regional Information	1-800-497-8283
WA Dept. of Fish and Wildlife - Area Habitat Biologists	Region 1 (Spokane)	(509) 456-4082
	Region 2 (Ephrata)	(509) 754-4624
	Region 3 (Yakima)	(509) 575-2740
	Region 4 (Mill Creek)	(425) 775-1311
	Region 5 (Vancouver)	(360) 906-6720
	Region 6 (Montesano)	(360) 249-6523
U.S. Army Corps of Engineers	Seattle	(206) 764-3495
	Walla Walla	(509) 527-7153
	Portland	(503) 326-6998
County weed boards*	contact your local weed board (see phone book for local listing)	
Local jurisdictions	contact your city or county planning department	
Washington State Lake Protection Association	P.O. Box 1206 Seattle, WA 98111-1206	1-800-607-5498

* If your county does not have a local weed board, contact the Department of Agriculture.

Appendix F: Timing Table

The following table lists the timing guidelines for each county and, where necessary, the specific stream or river. The listed timing indicates those **periods when you may conduct your project** if you are using the pamphlet as the HPA. Project activities conducted outside of the timing guidelines will require prior authorization by WDFW. If you have any questions concerning the timing guidelines, contact the WDFW Area Habitat Biologist at the regional office nearest your home (Appendix E: Agency Contact, page 53).

TIMING FOR HYDRAULIC PROJECTS			
COUNTY	GENERAL TIMING ¹	TIMING FOR SPECIFIC STREAMS	
		STREAM (WRIA)	TIMING
Adams	July 1-September 30	None	
Asotin	July 15-October 15	Asotin Creek (35.1716) below N/S Forks	July 15-September 30
		NF (35.1944) and SF (35.2035)	July 15-August 31
		Asotin Creeks	July 15-August 31
		Tucannon River (35.0009)	July 15-August 31
Benton	June 1-October 31	None	
Chelan	July 1-August 31	None	
Clallam	July 1-September 30	Clallam River (19.0129)	July 1-August 31
		Dungeness River (18.0018)	July 1-August 15
		Elwha River (18.0272)	July 1-August 31
		Gray Wolf River (18.0048)	July 1-August 15
		Jimmycomelately Creek (17.0285)	July 1-August 31
Clark	July 1-September 30	Speelyai Creek (27.0430)	June 1-August 31
		Washougal River (28.0159)	July 1-August 31
Columbia	July 15-October 31	Tucannon River (32.0009) below Marengo	July 15-September 30
		Tucannon River (32.0009) above Marengo	July 15-August 31
		NF Touchet River (32.0097) above Wolf Creek	July 15-August 31
		Wolf Creek	July 15-August 31
Cowlitz	July 1-September 30	Cowlitz River (26.0002)	July 1-August 31
		Kalama River (27.0002)	July 1-August 31
		Toutle River (26.0227) and its tribs	July 1-August 31
Douglas	July 1-September 30	None	
Ferry	July 1-September 30	San Poil River (52.MISC)	July 1-August 31
Franklin	July 1-September 30	None	
Garfield	July 15-October 15	Tucannon River (35.0009)	July 15-August 31
Grant	July 1-September 30	None	
Grays Harbor	July 1-September 30	None	
Island	June 15-September 15	None	
Jefferson	July 1-September 30	Dosewallips River (16.0442)	July 1-August 31
		Duckabush River (16.0351)	July 1-August 31
		Quilcene River (17.0012)	July 1-August 15
King	July 15-September 15	Greenwater River (10.0122)	July 1-September 1
		Sammamish River (08.0057) and its tribs	July 1-September 1
		Snoqualmie River (07.0219) and its tribs	July 1-September 30
		Skykomish River (07.0012)	July 1-September 1
		Wallace River (07.0940)	July 1 - September 1
Kittitas	June 15-September 15	None	
Kitsap	July 1-September 30	None	
Klickitat	June 15-September 30	Klickitat River (30.0002) and its tribs	June 15-August 15
Lewis	June 15-September 30	Cowlitz River (26.0002)	July 1-August 31
		Newaukum River (23.0882) & its forks	July 1-August 31
Lincoln	June 15-October 15	None	

COUNTY	GENERAL TIMING ¹	TIMING FOR SPECIFIC STREAMS	
		STREAM (WRIA)	TIMING
Mason	July 1-September 30	Hamma Hamma River (16.0251)	July 1-August
		31Skokomish River (16.0001)	July 1-August 31
		Union River (15.0503)	July 1-August 15
Okanogan	July 1 - August 31	None	
Pacific	July 1 - September 30	None	
Pend Oreille	July 1-September 30	None	
Pierce	July 1-September 15	Clearwater River (10.0080)	July 1-September 1
		Greenwater River (10.0122)	
		South Praire Creek (10.0429)	July 1-September 1
San Juan	June 15-October 15	None	July 1-September 1
Skagit	June 15-September 30	Sauk River (04.0673)	July 15-August 15
		Suialtle River (04.0710)	July 15-August 15
Skamania	July 1-September 30	Wind River (29.0023)	July 15-August 31
		White Salmon River (29.0160)	June 1-August 15
Snohomish	June 15-September 30	Sultan River (07.0881)	July 1-September 15
		NF Skykomish River (07.0982)	July 1-September 15
		SF Skykomish River (07.0012)	July 1-September 15
		Pilchuck River (07.0125)	July 1-September 30
		Stillaguamish River (05.0001)	July 1-September 15
		SF Stillaguamish River (05.0135)	
		- above Granite Falls	July 1-August 31
		- below Granite Falls	July 1-September 15
NF Stillaguamish River (05.0001)	July 1-August 15		
Spokane	June 15-September 30	None	
Stevens	July 1-September 30	Big Sheep Creek (61.0150)	July 1-August 31
Thurston	July 1-September 30	None	
Wahkiakum	July 1-September 15	None	
Walla Walla	July 15-October 15	Mill Creek (32.1436) above Walla Walla	July 15-August 31
		Blue Creek (32.1497)	July 15-August 31
Whatcom	June 15-September 30	Nooksack River (01.0120)	June 15-August 31
		NF Nooksack River (01.0120) & tribs	July 1-August 15
		SF Nooksack River (01.0246)	July 1-August 15
Whitman	June 15-October 15	None	
Yakima	June 15-September 15	American River (38.1000)	June 1-June 30

**GENERAL AND SPECIFIC TIMING FOR MAINSTEM COLUMBIA AND SNAKE RIVERS;
ISOLATED FRESHWATER LAKES; AND MARINE WATERS**

Columbia River

Mouth-McNary Dam	December 1-February 28	None	
McNary-Priest Rapids Dams	January 1-February 28	Hanford Reach (36.0001)	August 1-August 31
Priest Rapids Dam-Wenatchee	October 16-March 31	None	
Above Wenatchee	September 1-March 31	None	
Snake River	January 1-February 28	None	
	August 1-August 31	None	
Isolated Lakes ²	July 1-September 30	None	

Marine Waters

Pacific Ocean	June 15-February 28		
Puget Sound & Straits	June 15-March 14	Contact local WDFW Area Habitat Biologist regarding additional, specific restrictions for surf smelt and sand lance spawning	Area and species dependent

1 The general timing by county applies to all fresh and brackish streams within that county, unless specific timing is listed for a specific stream or streams in that county. If a specific stream is listed, the timing for that stream supersedes the general timing listed for the county. The Columbia and Snake Rivers are listed separately from the counties through which they run.

2 Isolated lakes. For lakes that are part of a stream (reservoirs and wide spots in the river), e.g. Lake Roosevelt which is actually the Columbia River, the stream timing applies.

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WDFW Aquatic Plant Control Tracking Form

Please complete this form and mail to WDFW in the envelope provided after your project is completed.

Completion and return of this form will help WDFW better understand the nature and extent of aquatic weed control projects. Your participation in completing this form will also ensure that you will receive any future updates or changes to the pamphlet (techniques, provisions, etc.) that may be of interest. We are also interested in your comments on the pamphlet.

What weed(s) or plant (s) did you attempt to control?

What control method did you use? (Check all that apply)

- | | |
|---|---|
| <input type="checkbox"/> bottom barrier | <input type="checkbox"/> herbicide |
| <input type="checkbox"/> hand pulling, cutting or raking | <input type="checkbox"/> draw down |
| <input type="checkbox"/> weed roller | <input type="checkbox"/> watershed controls |
| <input type="checkbox"/> mechanical harvesting or cutting
dredging | <input type="checkbox"/> dragline and clamshell |
| <input type="checkbox"/> rotoavation | <input type="checkbox"/> grass carp |
| <input type="checkbox"/> diver dredging | <input type="checkbox"/> water column dye |

What waterbody (lake, stream or river) did you complete your control project on?

Lake name _____

Stream name _____

County _____

Nearest city/town _____

Did you begin the process of developing a Vegetation Management Plan (VMP)?

Yes _____ No _____ Thinking about it _____

Comments? _____

Notification Clause

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Phil Anderson, Director, Washington Department of Fish and Wildlife. Miranda Wecker, Chair, Washington Fish and Wildlife Commission.

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**FISH and
WILDLIFE**