MONITORING OF *HOWELLIA AQUATILIS* (WATER HOWELLIA) AND ITS HABITAT AT THE HARVARD–PALOUSE RIVER FLOOD PLAIN SITE, IDAHO: THIRD-YEAR RESULTS

by

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ABSTRACT

Howellia aquatilis (water howellia) is an aquatic macrophyte that is federally listed as threatened by the U.S. Fish and Wildlife Service (USFWS). It occurs in internally drained ponds that dry out each year. The single known Idaho location of the species occurs on the flood plain of the Palouse River in northern Idaho, in ponds formed by fluvial processes. The ponds are the low points of abandoned channels or channel migration scars. Threats to the population include invasion by two aggressive exotics–*Phalaris arundinacea* (reed canarygrass) and *Acorus calamus* (sweet flag). Water howellia populations and pond water depths at the site have been monitored since 1999. Photopoints were established in 2000. This is the third annual report documenting monitoring results. In 2001, flowering took place in late June when the water was 1-3 dm deep. Water howellia was more abundant than in the previous two years. Established photopoints were taken in May and again in June, and an additional photopoint was added at each pond. Photos will be appended to copies of this report to the USFWS and will be archived at the Idaho Conservation Data Center. The ponds were mapped, showing their internal and edge vegetation, and water howellia locations. Suppression measures for reed canarygrass were researched; excavating, clipping, and covering with a weed block were tested on a limited basis. The monitoring program, along with results of weed suppression measures, will provide a basis for possible future management of the site.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

BACKGROUND

Howellia aquatilis (water howellia) is an annual aquatic plant representing a monotypic genus in the family Campanulaceae. It has very specific habitat requirements and has been rare throughout the period of botanical record. It is currently known from 14 sites in western Montana, northern Idaho, eastern and western Washington, and California (Shelly and Moseley 1988). It is rare throughout its range, occurring in ephemeral ponds and at the margins of permanent ponds, which in most cases are glacial potholes (Shapley and Lesica 1997). The ponds are shallow, the bottoms vegetated with aquatic, emergent, and wetland plants, and are surrounded by deciduous shrubs and trees. A detailed description of the plant, its biology, and habitat can be found in Shelly and Moseley (1988). *Howellia* is listed as threatened by the U.S. Fish and Wildlife Service.

The life cycle of water howellia is intimately tied to the hydrology of the ephemeral ponds that comprise its habitat. Ponds must dry out each year in order for germination to occur. As an annual plant, viability in the short term depends on hydrologic conditions necessary for seed production and germination. Habitat management for water howellia requires an understanding of pond hydrology and geometry (Shapley and Lesica 1997) and the effects of colonization by exotics (Lesica 1997).

In Idaho, the sole water howellia site is on the flood plain of the Palouse River, in ponds formed within scars created by migration of the river channel (Lichthardt and Moseley 2000). Three ponds, each less than 0.1 hectare in area occur on a parcel of private land occasionally used for pasture.

In 1999, the fluvial processes of the flood plain were examined by looking at historical photos, mapping vegetation at the site, and surveying a cross-section of the flood plain (Lichthardt and Moseley 2000). Water depth gages were installed in each pond.

A habitat and population monitoring program is one of the recovery actions specified in the draft Recovery Plan (Shelly and Gamon 1996). Populations and water depths have been monitored from 1999 to 2001. *Phalaris arundinacea* (reed canarygrass) and *Acorus calamus* (sweet flag), aggressive rhizomatous exotics found within the ponds, were identified as a major conservation concerns (Lichthardt and Moseley 2000).

In 2001 we continued monitoring water howellia populations and pond water levels at the Palouse River site, created accurate diagrams of the ponds, and evaluated various options for weed suppression. We also wrote to the land owner, Ruth Ownbey, to inform her of the status of the water howellia populations and our activities at the site.

MONITORING

Populations

Populations were surveyed on June 28, 2001. Water was 1-3 dm deep in the ponds at this time and water howellia was in flower and early fruit. One person moved carefully through each pond, flagging locations of water howellia with wire flags and estimating the areas occupied. Data were submitted to the Idaho Conservation Data Center (Appendix 1). Water howellia locations were later mapped on pond diagrams (Appendix 2). Population estimates from this year are compared with the two past years in Table 1.

Table 1. Approximate area occupied by water howellia over three years.

	Pond 1	Pond 2	Pond 3
	sq. meters		
1999	0.5	50	0.5
2000	No data	110-130	0.5
2001	3[1]	345	1[2]

[1] Four plants estimated.
[2] Eight to 12 plants estimated.

Water levels

Water levels in the three ponds were read at each visit, beginning in April (Table 2). Water level is read directly from a vertical section of PVC pipe located in the deepest part of the pond. The pipe is 1 m high aboveground and marked off in 1 cm increments.

Mapping ponds

In 2001 more accurate maps of the ponds were made (Appendix 2). Mapping was done after water howellia had gone to seed and there was no standing water. From the gage, a compass and meter tape were used to plot points around the edge of the pond and points delineating different plant communities. These points were then used to diagram the pond and its features, including the flagged water howellia locations. We mapped an area defined by rooted shrubs. This area includes both the pond and, at ponds 2 and 3, large areas of solid reed canarygrass (Appendix 2, Figures 2 and 3). These diagrams can be used to track changes in weed coverage within the ponds.

Plant communities of the pond bottoms, as well as edge vegetation, are shown on pond maps (Appendix 2). Reed canarygrass is usually present under the shrubs at the pond edge, but in the open it has developed dense swards raised well above the water. Most of the areas mapped as reed canarygrass in the figures are dense monocultures and are free of standing water by May.

Table 2. Depth of water howellia ponds with concurrent river discharge rate and stage[1], 1999-2001.

Date	Water depth (m)			Discharge[1]	Stage[1]
	Pond			(cfs)	(m)
1999:	1	2	3		
July 1[2]	.20	no data	no data	50	1.68
July 13[3]	0	.24	0	28	1.62
July 16	0	.21	0	25	1.58
Aug. 3	0	0	0	14	1.55
2000:					
March 27	.53	.54	.67	918	2.68
April 24	.50	.48	.55	500	2.32
May 23	.42	.46	.44	122	1.83
June 13	.37	.44	.42	338	2.13
June 23	.27	.42	.34	76	1.74
July 15	0	.22	.02	24	1.58
Aug. 3	0	0	0	12	1.52
Sept. 12	0	.10	0	44	1.65
Oct. 6	0	0	0	17	1.55
2001:					
April 9	.48	.48	.43	302	2.08
May 3	.48	.49	.48	550	2.30
June 1	.33	.44	.32	40[4]	1.66
June 28	.17	.34	.19	53[5]	1.68
July 24	0	0	0		

[1] Discharge rate and stage measured at the USGS gage, 24 km downstream.
[2] All three ponds contained water on July 1, prior to installation of gages. Pond 1 depth is an estimate.
[3] Gages installed.
[4] Steadily dropping since May 29.
[5] Had been 23 cfs before rain started on the 27th, still increasing through the 28th.

All three ponds are irregularly oval depressions set within elongate, arcing meander scars. The entire scar holds water in the winter months. Each pond also extends into a narrower, channel-like portion–the pond "tail"–which is partly to mostly shaded. The pond bottoms have an herbaceous emergent community dominated by *Carex vesicaria*, *Sium suave*, *Alopecurus aequalis*, *Alisma plantago-aquatica*, *Sparganium emersum*, and, at pond 3, *Eleocharis palustris* (common spikesedge). Ponds are surrounded by tall shrubs–*Physocarpus capitatus*, *Salix bebbiana*, *Salix drummondiana*, and *Crataegus douglasii*; small trees (*Alnus incana*); and a few large conifers including *Abies grandis*, *Picea engelmannii*, *Pseudotsuga menziesii*, and *Pinus contorta*. A complete species list can be found in Lichthardt and Moseley (2000).

Pond 1: The central area of the pond is occupied by large clumps of *Carex vesicaria* (inflated sedge), along with *Sium suave* (water parsnip) and scattered clumps of reed canarygrass (Appendix 2, Figure 1). For the past three years only a small amount of water howellia has occurred along the southeast edge (Appendix 4, Photo 1). North, east, and south edges of the pond are relatively abrupt and bordered by shrubs. On the west side the bottom tapers gradually, and supports sparse growth of reed canarygrass and willow. Areas of partially submerged reed canarygrass surround the pond. Reed canarygrass may become more dense after the pond dries out.

Pond 2: This is the largest pond, the main portion being approximately 650 sq. m in area, with a very long, gradually narrowing "tail" to the west (approx. 190 sq. m; Appendix 2, Figure 2). About 80 percent of the main pond is occupied by *Acorus calamus* and reed canarygrass (Appendix 4, Photo 2). Most of the area occupied by reed canarygrass is above the late-spring water level and therefore not part of the pond proper, although this area may have been at one time. *Acorus* is a clonal emergent up to 2 m tall, that forms a dense sward very similar to cattails (*Typha*). The *Acorus* almost entirely shades the pond bottom and in early spring residue covers the bottom. In spite of this, water howellia was found throughout the *Acorus* sward in 2001. In fact, water howellia occupied virtually all of the area not occupied reed canarygrass (about 345 sq. m) or nearly the entire pond. Both reed canarygrass and *Acorus* are forming small islands throughout the pond.

Pond 3: The main pond is about 100 sq. m in size with a short, narrow tail approximately 6 m long (Appendix 2, Figure 3) that is partly shaded. The main pond is occupied by a dense sward of *Eleocharis palustris* which is not found in the other two ponds. In 2001 water howellia was again present on the northeast edge of the pond, but occupied a larger area than the previous two years. It also occurred in the pond tail, where it had not previously been observed. Solid swards of reed canarygrass adjoin the pond in two separate places that may once have been part of the pond (Appendix 4, Photo 3).

Photopoints

Starting in 2000, photopoints have been taken on the following schedule:

May 28, 2000
September 10, 2000
May 30, 2001
June 28, 2001

Sets of slides were sent to the USFWS and the Idaho CDC as part of yearly monitoring reports. This year photos are being submitted to USFWS in digital format and to Idaho CDC as slides.

Ideally, photopoints should be taken in late June, when water howellia is blooming. They were taken in late May of 2001 to replicate what had been done the year before.

It is difficult to capture much of a pond in a photo because of the dense vegetation surrounding them. In 2001 a new photopoint from within the pond itself was added at each pond: photopoint 4 (ponds 1 and 3) and photopoint 3 (pond 2; Appendix 3). Two or three photos can be taken from a single point to show most of the pond. Photopoint locations are described in Appendix 3 and photo captions appear in Appendix 4.

WEED CONTROL

Reed canarygrass is invading all three water howellia ponds and may already have filled in portions of ponds 2 and 3. *Acorus calamus* occupies 100 sq. m of pond 2.

Due to the dynamic nature of flood plains, the ponds are ephemeral on a scale possibly as short as decades. However reed canarygrass and *Acorus* could accelerate the filling of the ponds. Reed canarygrass in particular builds up large quantities of residue rapidly, raising it above the level of summer submergence through the rapid accumulation of rhizome mass and leaf residue. It can grow as an emergent when its rhizomes are linked to an above-water colony and this way colonizes and raises up shallow water areas. Water howellia appears to coexist with *Acorus,* but the *Acorus* is displacing the other vegetation in pond 2.

We approached the problem of weed incursion in three ways: 1) research on reed canarygrass and its control, 2) experimental use of excavation, mowing, and covering on reed canarygrass, and 3) evaluation of potential suppression methods.

Literature search

A search of library resources revealed little related to control of reed canarygrass. However the topic is thoroughly covered in a Natural Resources Conservation Service (NRCS) publication by Stannard and Crowder (2001). They say that reed canarygrass can be suppressed through tillage, flooding, chemicals, or shading depending on the site and the available funds.

The aggressiveness of reed canarygrass stems from its ability to spread by both seed and rhizomes. Infestations establish quickly because dense rhizome growth occurs during the first growing season. Although not tolerant of prolonged flooding, reed canarygrass can invade shallow water by sending out rhizomes from higher ground.

Most control plans include spraying with a glyphosate-based herbicide that goes by the trade name Rodeo (Pizzo and Schroeder 2001, Kilbride and Paveglio 1999). Rodeo is labeled for use in wetlands. Pizzo and Schroeder found that a low concentration of Rodeo (1 to 2 percent) will kill reed canarygrass while still maintaining a viable "native population" (they cite *Iris virginica* as an example). Others say that herbicide alone does not kill reed canarygrass. Spraying is usually used in combination with other suppression methods such as cultivation or burning. Herbicide application must be made in the spring when leaves are still short. In southwestern Washington, Kilbride and Paveglio (1999)

found the most effective treatment was disking, with follow-up application of Rodeo during the next growing season. The follow-up herbicide treatment was imperative for effective control.

Growth of reed canarygrass can be suppressed using partial or complete shade. In one case it was eliminated by covering it with black plastic, and later excavating the rhizomes (Robin Jenkinson pers. comm.).

Experimental excavation, clipping, and covering of reed canarygrass

There are many limitations on what control measures that can reasonably be used at the howellia ponds. We are probably limited to small equipment or hand tools. Burning would require landowner's approval and is likely too large a liability risk. To do any significant excavating of either or both of the target weeds would require a small crew of volunteers or other labor. In 2002 we began experimenting with several measures on a very limited scale to assess their feasibility and determine a time-frame. This work was done in late July, when water howellia had gone to seed and there was no standing water in the ponds.

At pond 3, small "islands" of reed canarygrass were removed from the pond. These are spots where reed canarygrass was getting a foothold by establishing on rotted wood and old stumps. The major work done at pond 3 was in the southwest corner, where there is an advancing front of reed canarygrass along an 8-m portion of the pond margin. We pushed this edge back approximately 3/4 m by excavating the reed canarygrass to a depth of 8 inches. This produced an abrupt edge which was then covered with overlapping panels of flexible, corrugated vinyl, secured with L-shaped lengths of rebar (Appendix 4, photo 4). One edge of each panel was secured into the pond bottom by tamping it into the soil. Reed canarygrass was clipped for about 1.5 m out from the edge. The portion of this clipped area not covered by vinyl was covered with painting tarp, also anchored with rebar.

At pond 2, islands of *Acorus* and reed canarygrass separate from the main colonies were dug up and their locations marked with wire flags. In addition, a patch of reed canarygrass at the edge of the shrub canopy, approximately 2 x 2 m in size, was clipped close to the ground. This gave us the potential to hit it with a chemical treatment upon regrowth, or at least to observe the timing of regrowth.

Evaluation of weed suppression measures

The weed problem in the water howellia ponds can be dealt with in three stages: 1) stop the advance of reed canarygrass within the ponds 2) reduce the area occupied by reed canarygrass and 3) restore portions of the ponds that have been colonized by weeds. Stopping the advance of weeds should be the top priority. Regardless of the steps undertaken, maintenance of the site must be ongoing.

To slow encroachment of the two weeds, satellite islands should be excavated annually and the pond edge steepened where it joins reed canarygrass on higher ground.

To reduce the amount of reed canarygrass in the pond areas (i.e., the areas shown in the figures in Appendix 1) we suggest using a light-blocking material to kill reed canarygrass, and then replanting woody species. The light-blocking material should be a sturdy, non-reactive material that can be secured in place and which completely blocks light. We propose experimenting with hay tarp material as a weed block. Hay tarp is 7.3 oz woven poly that is UV-treated and completely blocks light. Used hay tarp is available for .03/sq. ft from Inland Tarp and Cover in Moses Lake, WA. It will not degrade the way black plastic does, and comes in very large sizes.

Before laying the weed block, accumulated plant residue should be removed. The blocking material will need to be weighted down to keep it from floating off. Possibly lengths of pipe could be tied to the edges for this purpose.

Appropriate shrubs should be planted into the blocking material at the beginning of the third year. We fear that opening holes in the tarp too soon will allow surviving reed canarygrass to grow up through and compete with the shrubs. Planting tubes will probably be needed to protect the seedlings from deer.

To restore portions of the pond now occupied by solid stands of reed canarygrass or *Acorus* will require weed suppression followed by excavation of the rhizome mass, and planting of shrubs and sedges. This would likely occur in stages to insure that the howellia populations are not affected. Most or all of the excavation work would have to be done by hand.

RECOMMENDATIONS

We recommend that the first stage of weed suppression tactics described above be started in 2002. At pond 3, effects of our weed-blocking experiment should be noted and the painting tarp should be replaced with a material that blocks more light. A weed block should also be installed over an experimental area at pond 2.

Seed should be collected from *Physocarpus capitatus* and other shrubs of the pond margins at the site in anticipation of future planting efforts. No local commercial source is known for this species. *Alnus incana* (thinleaf alder) and *Salix drummondiana* (Drummond's willow) can be obtained from the nearby Wildlife Habitat Institute.

There are two small areas at pond 3 where shrub establishment could be tried this year if seedlings are available. Black plastic might be used around the seedlings to reduce weed competition.

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-- MOST APPENIDICES NOT AVAILABLE ON THE WEB --

Appendix 1

Element Occurrence Record for Howellia aquatilis

Record No. 001
Scientific Name: HOWELLIA AQUATILIS
Common Name: WATER HOWELLIA
Federal Status: LT State Status: GP2
Global Rank (G1 rare - G5 common): G2 State Rank (S1 rare - S5 common): S1
First Observed (date): 1967
Last Observed (date): 2001-06-28

Township Range Section(s) Comments on section(s)

041N.....003W...08.....NE4 center, NE4SW4SW4

Latitude: 465503N Longitude: 1164422W
County: Latah
Quad Name: HARVARD
Place Name: HARVARD PONDS
Elevation (ft)
minimum: 2560 maximum:
Location:
Near junction of State Routes 6 and 9; on W side of State Route 9, 50 yds S of intersection; pond just inside property fenceline. Also in two ponds at the southern edge of a large meadow on the margin of the floodplain (south of the river).

Managed Area(s):

Land Ownership:
Private land (in will to National Audubon Society).
Habitat:
Vernal pools, formed in channel scars, along the edge of the floodplain of the Palouse River. Substrate is acidic. Associated species are Cornus stolonifera, Alnus incana, Crataegus douglasii, Amelanchier alnifolia, Glyceria occidentalis, Alisma plantago-aquatica var americanum, Phalaris arundinacea, Cicuta douglasii, Carex vesicaria, Alopecurus aequalis, Lemna sp., Physocarpus capitatus, Sium suave, Dactylis glomerata, Pseudotsuga menziesii, Ranunculus flabellaris, Myosotis scorpioides, Salix bebbiana (pond 3), Salix drummondiana (ponds 1 and 2), Eleocharis palustris (pond 3), and Acorus calamus (pond 2). In late summer, both pools were without water; bottoms were moist, solid, and vegetated with primarily Sium suave, Carex vesicaria, and Acorus calamus. 2001: Pond 1: ca. 4 plants in a 3 sq. m area at SE edge of pond with Sium suave and Phalaris arundinacea; approximately 1999 location. Pond 2: plants occur throughout the free water area of the pond, or about 400 sq. m. Plants are dense over much of the pond and are scattered throughout the Acorus calamus colony. Pond 3: 20-30 plants as scattered individuals or groups up to 0.75 sq. m in size. Plants are in 5-6" of water,

usually within a meter of the water's edge, with sparse Eleocharis palustrus; open-partial shade.

Population Data:
1988: 30 plants estimated in northern pond (#3). Observation of previous years confirmed in survey by Bob Moseley, Idaho CDC. 1995: Ca 50 plants, perhaps more, in flower in about 15 inches of water in ponds 1 and 2 south of the river. Observation on a cursory visit by Loring Jones, INPS, and Bertie Weddell, Pullman, WA. 1996 (July; ponds 1 and 2): More plants were evident than in previous years; population is 75-90% flowering. No plants were flowering in the east pool (pond 1); the west pool had ca 100 flowering in 0-3" of water. (September): Both pools were without water. 1999: An estimated 100 to 500 plants observed, occupying approximately 0.5 sq m in pond 1, 50 sq m in pond 2, and 0.5 sq m in pond 3. Thorough survey by B. Moseley, and J. Lichthardt, Idaho CDC. 2000: Pond 1 was dry; in ponds 2 and 3, Howellia occupied approximately the same area and locations as in 1999. Thorough survey by Karen Gray (IDCDC) and Bertie Weddell. 2001: 1000 - 5000 estimated genets (most at pond 2); less than 1% were in flower, the rest in fruit or vegetative; high population vigor, with many more plants in ponds 2 and 3 compared to previous visits. Thorough survey by Juanita Lichthardt and Karen Gray, IDCDC.

Population Size (acres unless otherwise stated): 50+ SQ M
Comments:
Overall site quality assessed as good in 2001.
Specimens:
R. K. Moseley 1264 (ID).
Best Source or Contact:
Idaho Conservation Data Center.

Appendix 3

Locations of photopoints for water howellia

Photo-point	
POND 1	
1	From base of large spruce at east edge of pond, 125˚ from gage, standing next to tree on its south side.
2	From blaze on trunk of large downed Douglas-fir, 330˚ from gage and 315˚ from large spruce on opposite side of pond.
3	From slope end (south end) of downed Douglas-fir (flat spot), 280˚ from gage.
4	Standing in water, approximately 10 m at 250˚ from gage; focal length (f.l.)=50 mm.
POND 2 (points 1 and 2 are on the slope above the pond)	
1 (east)	From under the drip-line of a grand fir located at the forest edge, which is the largest tree in the vicinity. Tree is next to a large cut-stump. Stand 4-5 m at 40˚ from trunk, approximately south of gage.
2 (west)	Just under the drip-line of a pole grand fir and east of a pole Douglas-fir, upslope from a tall alder at the pond edge, 235˚ from the gage. Saplings are the only trees downslope. Point is approx. 4 m downslope of the trunk of a pole grand fir growing next to a maple. Photo taken at azimuth 40˚, with tallest alder at left of frame.
3	Standing at the mouth of the tail portion of the pond, at the deepest point. One photo is taken toward the gage and the other looking into the pond tail.
POND 3	
1	Standing on 3-ft high platform, in opening among hawthorn on highway side of pond; gage at left (f.l.=30 mm).
2	From below and slightly north of platform, at pond edge (where shrubs rooted); 80˚ from gage (f.l.=50 mm).
3	From pond edge, 10˚ from gage.
4	Standing at edge of reed canarygrass, 326˚ from gage.

(19˚ east declination used for bearings)