

10-2005

Alaska Aquatic Plant Survey Report 2005

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Alaska Aquatic Plant Survey Report 2005

Prepared for:

*US Fish and Wildlife Service
Contract Number: 7012050114*

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October 2005

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Introduction

Invasive, non-indigenous plants can degrade water quality and fish habitat when they invade lakes, ponds, and streams. Changes in plant community architecture in lakes due to invasion by canopy-forming invasive aquatic plants can result in loss of native plant biodiversity and reduction of the structural complexity of the underwater habitat (Engel 1987; Madsen et al 1994). Differences in photosynthetic biochemistry between non-indigenous and native plants can result in large diurnal pH and dissolved oxygen concentrations (Spencer et al 1994). In Alaska, because of the prevalence of floatplanes as a means of transport, invasive aquatic plants could also present a risk to human life and property.

Humans are the primary means of dispersal of non-indigenous aquatic plants. Unintentional transportation on trailered boats is a known vector of movement of invasive plants between lakes (Johnstone et al 1985; Pfauth & Sytsma 2004). Another vector is deliberate introduction by humans. The fragrant waterlily (*Nymphaea odorata*), for example, has been intentionally planted in lakes in western North America (Brayshaw 1989). The recent increase in popularity of water gardens has resulted in escape of ornamental, aquatic plants into natural systems (e.g., *Nymphoides peltata* in Oregon). The aquarium trade is another mechanism by which invasive, aquatic plant species are transported (Kay and Hoyle 2001, Padilla and Williams 2004).

In Alaska, transport of plant fragments on floatplanes flying between waterbodies in urban population centers and those in more remote locations within the state is a likely vector of aquatic plant introduction. Float plane and trailered boat traffic between the state of Alaska and regions to the south (Canada and contiguous US) are also likely sources of new infestations.

Aquatic plants in the native flora of Alaska range south into other lower latitude portions of North America as well as into the other circumboreal regions. For example, the 15 species of *Potamogeton* listed by Hulten (1969) have distributions that extend to the northeastern portion of the U.S. (Crowe and Hellquist, 2000). The state also supports two species of *Myriophyllum*, as well as *Lemna* spp., *Utricularia* spp., and others that are common throughout the contiguous states. It is therefore likely that introduced, invasive aquatic plants that have already established in Canada and the contiguous 48 states of the U.S., such as *M. spicatum* (Eurasian watermilfoil) and *P. crispus* (curlyleaf pondweed), would survive and thrive if introduced into waterbodies of Alaska.

The revised taxonomic status of *Myriophyllum spicatum* subspecies *exalbescens* is a source of confusion regarding the presence of *M. spicatum* in Alaska. Since the publication of Hulten's 1969 flora of the state, the taxon has been elevated to species status - *M. sibiricum* (Aiken and Cronquist 1988). Older plant lists and collections often did not include the subspecies appellation and were recorded only as *M. spicatum*, which is the currently accepted name for the invasive Eurasian watermilfoil. Thus, one could easily and mistakenly conclude from older records that the exotic, invasive Eurasian species is already present in the state.

Early detection of new infestations is key to control of invasive aquatic plants. Delays in detection and rapid response greatly increase the costs of control and greatly reduce the likelihood of successful mitigation or elimination of the harmful effects of the invasion. Since aquatic plant species vary in their response to management activities, the effective management of infested lakes and ponds is also predicated upon a good understanding of the species present. Regular surveys are critical to development of baseline information on aquatic plant communities and early detection of new invaders.

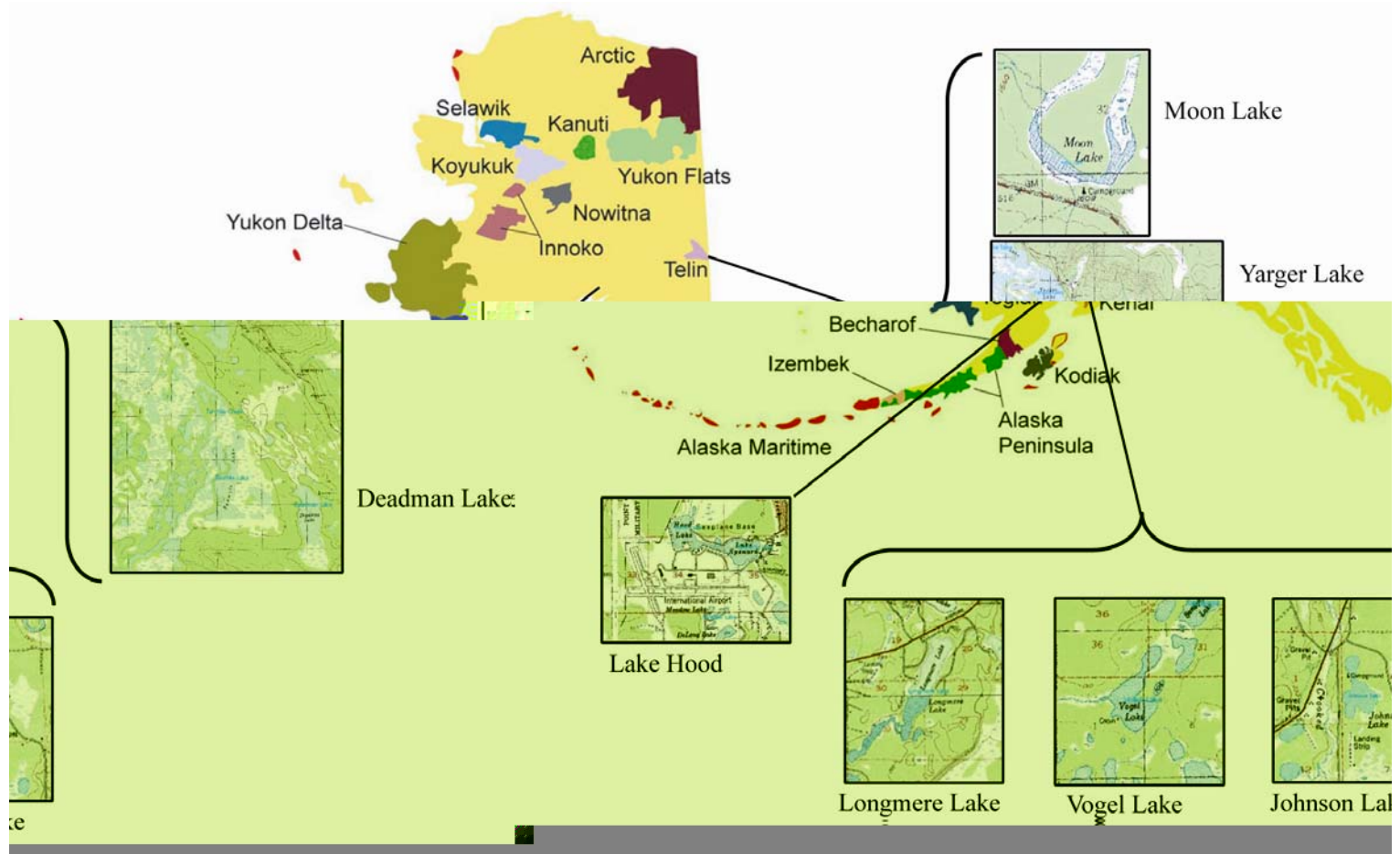
Submersed, aquatic plant communities in Alaska were systematically surveyed and documented by Hulten (1968) in the mid-twentieth century. Since then, local aquatic plant communities, such as those inhabiting waterbodies within the Kenai National Wildlife Refuge (NWR), have been occasionally surveyed (Friedersdorff 1983).

This report presents the results of field surveys of submersed and floating-leaved aquatic plants conducted in summer 2005 in six waterbodies located within, or near, two National Wildlife Refuges and one lake in a major urban center (Table 1, Figure 1). The waterbodies were chosen by US Fish and Wildlife Service personnel based on accessibility to and use by humans using trailered boats and/or floatplanes.

Table 1. Waterbodies surveyed for aquatic plants in 2005.

Waterbody name	Location	Date surveyed
Moon Lake	Near Tok	8/1/2005
Yarger Lake	Within Tetlin NWR	8/2/2005
Deadman Lake	Within Tetlin NWR	8/2/2005
Vogel Lake	Within Kenai NWR	8/4/2005
Johnson Lake	Near Kenai NWR	8/5/2005
Longmere Lake	Near Kenai NWR	8/5/2005
Lake Hood	Ted Stevens Anchorage International Airport	8/6/2005

Figure 1. Map of Alaska NWRs and survey locations.



Methods

The survey focused on submersed and floating-leaf aquatic plants in the littoral zones of the surveyed waterbodies. Fringing wetlands and emergent species were not sampled but notes of major species present were recorded. Surveys were conducted by tossing a plant sampling rake into the lake, retrieving the rake, and identifying the plant species in the sample. Some aquatic plant species, such as the submersed *Isoetes* species and tiny, floating-leaved species such as *Lemna*, are not well sampled with this method. Thus, visual observations were also made to supplement rake sampling. Surveys were conducted until no new species were found for a period of one hour. Lakes were accessed by boat, canoe, or floatplane except for Lake Hood which had limited foot access from floatplane docks. Surveys included GPS locations of each rake toss and a visual estimate of abundance of each species found. A voucher specimen for each species found in each lake was preserved and delivered to the Alaska Natural Heritage Program office in Anchorage for deposit into the University of Alaska Herbarium (ALA). Duplicate specimens of some species were similarly preserved and left at the Tetlin and Kenai NWRs for deposit into their herbaria. References used in plant identification were Hulten (1968), Brayshaw (1989), Crowe and Hellquist (2000), and Hamel et al (2001).

Results

A total of 29 aquatic, flowering plant species; one macro-alga; one liverwort; and two aquatic mosses were documented in this survey. No nonnative, aquatic plant species were discovered during the survey. Short descriptions of each lake along with a species list of submersed and floating leaved aquatic plants found in each lake follow. Notes on emergent plant species are included in the lake descriptions. Refer to Appendix A for GPS coordinates and species found at each sample point and Appendix B for a table summarizing waterbody characteristics.

Moon Lake lies within an Alaska State Park northwest of Tetlin NWR and has easy access from the Alaska Highway. The park has a public campground and the lake serves as a floatplane base for the USFWS. Access to the lake was by USFWS canoe. Lake water was very clear (Secchi disk depth was 1.8 meters with the disk resting on the lake

bottom) and large colonies of submersed aquatic plants inhabit both arms of the lake. Sediment in the lake varied from silt to peaty muck. Extensive mats of *Lemna trisulca* and large beds of *Potamogeton praelongus* were especially notable. A complete species list is found in Table 2.

Table 2. Moon Lake species list (near Tetlin National Wildlife Refuge, AK)

Botanical name	Common name
<i>Chara sp.</i>	Muskwort (alga)
<i>Hippuris vulgaris</i>	Mare's tail
<i>Lemna trisulca</i>	Star duckweed
<i>Myriophyllum sibiricum</i>	Northern watermilfoil
<i>Potamogeton filiformis</i>	Slender leaved pondweed
<i>Potamogeton gramineus</i>	Grass leaved pondweed
<i>Potamogeton obtusifolius</i>	Blunt leaved pondweed
<i>Potamogeton praelongus</i>	White stemmed pondweed
<i>Potamogeton richardsonii</i>	Richardson's pondweed
<i>Ranunculus trichophyllus</i>	Water buttercup
Secchi disk: 1.8 m	
Note: 2 aquatic mosses also found in samples	

Yarger Lake is situated on the flats southeast of Northway Junction. It is easily accessible from the Alaska Highway by trailered boat and from the air by floatplane. The waters of Yarger Lake were silty with a Secchi disk depth of .71 meter. The lake bottom is a firm layer of fine silt. A large emergent marsh comprised of *Carex sp.*, *Equisetum sp.*, and *Typha latifolia* lies on the west side of the lake. A complete species list is found in Table 3.

Table 3. Yarger Lake species list (Tetlin National Wildlife Refuge, AK)

Botanical name	Common name
<i>Chara sp.</i>	Muskwort (alga)
<i>Lemna minor</i>	Lesser duckweed
<i>Lemna trisulca</i>	Star duckweed
<i>Hippuris vulgaris</i>	Mare's tail
<i>Myriophyllum sibiricum</i>	Northern watermilfoil
<i>Polygonum amphibium</i>	Water smartweed
<i>Potamogeton filiformis</i>	Slender leaved pondweed

<i>Potamogeton friesii</i>	Flat stalked pondweed
<i>Potamogeton gramineus</i>	Grass leaved pondweed
<i>Potamogeton obtusifolius</i>	Blunt leaved pondweed
<i>Potamogeton praelongus</i>	White stemmed pondweed
<i>Potamogeton richardsonii</i>	Richardson's pondweed
<i>Potamogeton zosteriformis</i>	Flat stem pondweed
<i>Ricciocarpus sp.</i>	Riccia (liverwort)
<i>Utricularia intermedia</i>	Flat leaved bladderwort
<i>Utricularia macrorhiza</i>	Common bladderwort
Secchi disk: .71 m	

Deadman Lake is situated near Yarger Lake to the south of the Alaska Highway. There is a public campground at Deadman Lake accessible from the highway and the lake itself gets occasional floatplane traffic. The waters of this lake were very clear with a Secchi disk depth of 4.0 meters and an estimated maximum water depth of 6.4 meters. This lake had a firm substrate composed of fine silt. Much of the littoral areas of the lake are covered with the leaves of *Nuphar variegatum*, especially at the southern end. Common emergents include *Menyanthes trifoliata*, *Equisetum* sp., and *Calla palustris*. A complete species list is found in Table 4.

Table 4. Deadman Lake species list (Tetlin National Wildlife Refuge, AK)

Botanical name	Common name
<i>Myriophyllum verticillatum</i>	Whorled watermilfoil
<i>Nuphar variegatum</i>	Small yellow pondlily
<i>Polygonum amphibium</i>	Water smartweed
<i>Potamogeton filiformis</i>	Slender leaved pondweed
<i>Potamogeton friesii</i>	Flat stalked pondweed
<i>Potamogeton gramineus</i>	Grass leaved pondweed
<i>Potamogeton praelongus</i>	White stemmed pondweed
<i>Potamogeton richardsonii</i>	Richardson's pondweed
<i>Potamogeton zosteriformis</i>	Flat stem pondweed
<i>Ranunculus trichophyllus</i>	Water buttercup
<i>Sagittaria cuneata</i>	Arum leaved arrowhead
<i>Sparganium minimum</i>	Slender bur-reed
<i>Utricularia intermedia</i>	Flat leaved bladderwort
<i>Utricularia macrorhiza</i>	Common bladderwort

Secchi disk: 4.0 m

Vogel Lake is located in the northern portion of the Kenai NWR and was accessible by air. The plants in the lake were sampled off the float of a USFWS floatplane. One sample point was from the shore of the USFWS cabin at the south end of the lake. Lake waters were clear with a Secchi disk depth of 4.1 meters. The substrate in the north end is mushy and the lake appears to be filling in while that in the south end is primarily gravel. Emergents present included *Carex* sp., *Juncus* sp., *Menyanthes trifoliata*, *Scirpus* sp., and *Sparganium angustifolium*. A complete species list is found in Table 5.

Table 5. Vogel Lake species list (Kenai National Wildlife Refuge, AK)

Botanical name	Common name
<i>Chara</i> sp.	Muskwort (alga)
<i>Isoetes echinospora</i>	Quillwort
<i>Lemna trisulca</i>	Star duckweed
<i>Myriophyllum verticillatum</i>	Whorled watermilfoil
<i>Nuphar polysepalum</i>	Yellow pondlily
<i>Nymphaea tetragona</i>	White waterlily
<i>Potamogeton gramineus</i>	Grass leaved pondweed
<i>Potamogeton natans</i>	Floating leaved pondweed
<i>Potamogeton obtusifolius</i>	Blunt leaved pondweed
<i>Potamogeton pusillus</i>	Small pondweed
<i>Potamogeton richardsonii</i>	Richardson's pondweed
<i>Potamogeton robbinsii</i>	Fern leaf pondweed
<i>Potamogeton zosteriformis</i>	Flat stem pondweed
<i>Utricularia intermedia</i>	Flat leaved bladderwort
<i>Utricularia macrorhiza</i>	Common bladderwort

Secchi disk: 4.1 m

Johnson Lake is located within a state park and is equipped with a public boat ramp. The lake is in a semi-urban setting and is heavily used by the general public. Common emergents include *Menyanthes trifoliata* and *Sparganium angustifolium*. A complete species list is found in Table 6.

Table 6. Johnson Lake species list (Kasilof, AK)

Botanical name	Common name
<i>Hippuris vulgaris</i>	Mare's tail

<i>Myriophyllum sibiricum</i>	Northern watermilfoil
<i>Nuphar polysepalum</i>	Yellow pondlily
<i>Potamogeton gramineus</i>	Grass leaved pondweed
<i>Potamogeton friesii</i>	Flat stalked pondweed
<i>Potamogeton pectinatus</i>	Sago pondweed
<i>Potamogeton richardsonii</i>	Richardson's pondweed
<i>Potamogeton zosteriformis</i>	Flat stem pondweed
<i>Utricularia macrorhiza</i>	Common bladderwort
Secchi disk: 3.2 m	

Longmere Lake is an elongated, rectangular-shaped lake which is used as floatplane base by residents who live on the lakeshore. The south end is less developed and contains more emergent species while the remainder of the lake has been developed with docks for floatplanes, jet skis, and boats; private residences onshore; and small beaches. Almost no emergents inhabit this portion of the lake. There is a public boat ramp but most of the surrounding property is privately owned. There are no inlet or outlet streams. The lake substrate is a firm layer of fine silt and much of the lake bottom is covered with a layer of aquatic moss. Common emergents include *Menyanthes trifoliata* and *Sparganium angustifolium*. A complete species list is found in Table 7.

Table 7. Longmere Lake species list (Soldotna, AK)

Botanical name	Common name
<i>Callitriche</i> sp	Water starwort
<i>Nuphar polysepalum</i>	Yellow pondlily
<i>Polygonum amphibium</i>	Water smartweed
<i>Potamogeton gramineus</i>	Grass leaved pondweed
<i>Subularia aquatica</i>	Awlwort
Secchi disk: 1.7 m	

Lake Hood is a shallow basin which was joined to neighboring Lake Spenard by a channel in 1940. The conjoined waterbodies, known as the Lake Hood Seaplane Basin and managed by the Ted Stevens Anchorage International Airport, comprise the largest and most active seaplane basin in the world. Private individuals and commercial air taxi operators use the approximately 404 slips situated on the lake complex. Lake waters support abundant aquatic macrophyte growth which gets entangled on aircraft floats and

rudders. Plans are underway for macrophyte control using a mechanical harvester (CH2M Hill 2005). All samples were collected from shore with the plant rake thus no Secchi disk reading was obtained. Few emergents were seen except for *Calla palustris* and *Sparganium angustifolium*. A complete species list is found in Table 8.

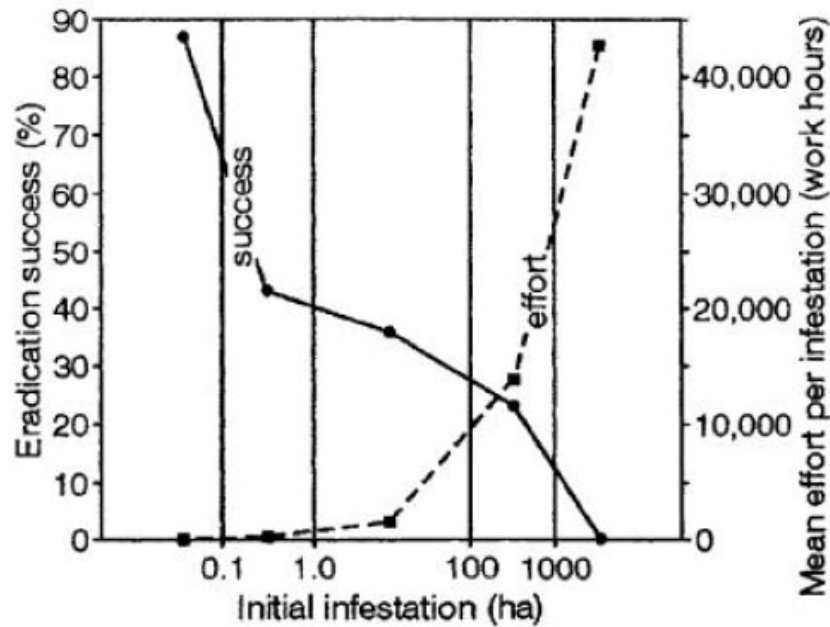
Table 8. Lake Hood species list (Anchorage, AK)

Botanical name	Common name
<i>Eleocharis acicularis</i>	Needle spike-rush
<i>Myriophyllum sibiricum</i>	Northern watermilfoil
<i>Myriophyllum verticillatum</i>	Whorled watermilfoil
<i>Potamogeton gramineus</i>	Grass leaved pondweed
<i>Potamogeton friesii</i>	Flat stalked pondweed
<i>Potamogeton pectinatus</i>	Sago pondweed
<i>Potamogeton praelongus</i>	White stemmed pondweed
<i>Potamogeton richardsonii</i>	Richardson's pondweed
<i>Potamogeton zosteriformis</i>	Flat stem pondweed
<i>Zannichellia palustris</i>	Horned pondweed
Secchi disk: n/a	

Conclusions and recommendations

No non-native aquatic plants were found in the surveyed lakes, which suggests that prevention and early detection should be the focus of aquatic plant management in these lakes. Rejmanek and Pitcairn's (2002) analysis of data from California shows that the earlier infestations were detected (i.e., the smaller the population size), the less the cost for treatment (Figure 2). The California data make clear that a strategy aimed at early detection and prevention can result in significant cost savings relative to detection and treatment at later stages of infestation.

Figure 2. Eradication success vs. effort (from Rejmanek and Pitcairn 2002)



It is our recommendation that federal and state agencies in Alaska should focus their efforts on public education and regular surveys of high risk waterbodies. A statewide organization focused on invasive and noxious plant management in Alaska has produced a strategic plan (Hebert 2001) which makes similar recommendations. We also recommend that educational signs be posted at waterbodies having easy public access. An example of a sign aimed at both plants and animal invaders is contained in Appendix C. Lake Hood, in particular, should be surveyed annually for aquatic invasive plants. Surveys should be done in July and August when most aquatic plant species have achieved maximum biomass (making detection and identification easier) but have not yet senesced. This survey has made a start at inventorying waterbodies which are at risk for invasion by non-native, aquatic, nuisance plants, but much more extensive surveys, pathway analyses, and monitoring are needed to get a clear picture of the risks which aquatic, invasive plants present to Alaska fish, wildlife and human populations.

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Acknowledgements

The authors wish to thank Dr. Denny Lassuy (USFWS) for coordinating housing and transportation as well as for field assistance, personnel of the Kenai and Tetlin NWRs for their hospitality and assistance, and Selene O'Dell for her able assistance in collecting, pressing and identifying aquatic plants.

Appendix A. Survey data

Estimates of species abundance are indicated by numbers in parentheses after species names. 1= sparse, 2= moderately abundant, 3 = abundant

Table 9. Moon Lake, near Tok, Alaska

Latitude	Longitude	Species		
63.37603	143.54447	<i>Lemna trisulca</i> (3) <i>Hippuris vulgaris</i> (1)	<i>Potamogeton richardsonii</i> (2) <i>Potamogeton filiformis</i> (2)	<i>Myriophyllum sibiricum</i> (2) * <i>Chara</i> sp.(2)
63.38141	143.53662	<i>Potamogeton gramineus</i> (1) <i>Ranunculus trichophyllus</i> (1)	<i>Potamogeton obtusifolius</i> (1)	<i>Potamogeton praelongus</i> (3)

* *Chara* is a freshwater macro alga
Secchi disk: 1.8 meters (disk on lake bottom, water very clear)

Table 10. Deadman Lake, Tetlin NWR, Alaska

Latitude	Longitude	Species		
62.88796	141.54355	<i>Nuphar variegatum</i> (3) <i>Potamogeton richardsonii</i> (2) <i>Myriophyllum verticillatum</i> (2) <i>Sparganium minimum</i> (1)	<i>Potamogeton filiformis</i> (1) <i>Potamogeton zosteriformis</i> (3) <i>Lemna trisulca</i> (2) aquatic moss	<i>Potamogeton friesii</i> (1) <i>Potamogeton praelongus</i> (3) <i>Utricularia macrorhiza</i> (1)
62.88437	141.54467	<i>Potamogeton praelongus</i> (3)	<i>Myriophyllum verticillatum</i> (2)	<i>Polygonum amphibium</i> (2)
62.87748	141.54607	<i>Potamogeton praelongus</i> (3) <i>Nuphar variegatum</i> (3)	<i>Myriophyllum verticillatum</i> (2) aquatic moss	<i>Lemna trisulca</i> (2)
62.87310	141.54597	<i>Utricularia macrorhiza</i> (1) <i>Lemna trisulca</i> (2) <i>Menyanthes trifoliata</i> †	<i>Utricularia intermedia</i> (1) <i>Nuphar variegatum</i> (3)	<i>Sparganium minimum</i> (2) <i>Potamogeton zosteriformis</i> (3)
62.878393	141.55170	<i>Sagittaria cuneata</i> (1) <i>Nuphar variegatum</i> (3) <i>Potamogeton gramineus</i> (1)	<i>Potamogeton richardsonii</i> (2) <i>Utricularia macrorhiza</i> (1) <i>Calla palustris</i> †	<i>Potamogeton friesii</i> (1) <i>Potamogeton filiformis</i> (1) <i>Menyanthes trifoliata</i> .
62.88009	141.55597	<i>Ranunculus trichophyllus</i> (1) <i>Potamogeton richardsonii</i> (2) <i>Potamogeton praelongus</i> (2)	(3) <i>Potamogeton zosteriformis</i> <i>Nuphar variegatum</i> (3)	<i>Lemna trisulca</i> (1) <i>Myriophyllum verticillatum</i> (2) <i>Sagittaria cuneata</i> (1)

62.89184	141.55572	<i>Calla palustris</i> † <i>Potamogeton praelongus</i> (2) <i>Myriophyllum verticillatum</i> (2) <i>Sparganium minimum</i> (2) <i>Menyanthes trifoliata</i> †	<i>Potamogeton richardsonii</i> (2) <i>Lemna trisulca</i> (2) <i>Nuphar variegatum</i> (3)	<i>Sagittaria cuneata</i> (1) <i>Potamogeton zosteriformis</i> (2) <i>Utricularia macrorhiza</i> (1)
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† plant is an emergent

Secchi disk: 4.0 meters, max. depth ~6.4 meters

Table 11. Yarger Lake, Tetlin NWR, Alaska

Latitude	Longitude	Species		
62.96473	141.64255	<i>Potamogeton obtusifolius</i> (1) <i>Potamogeton friesii</i> (1)	<i>Myriophyllum sibiricum</i> (2) <i>Potamogeton zosteriformis</i> (3)	<i>Potamogeton richardsonii</i> (2)
62.96303	141.65268	<i>Myriophyllum sibiricum</i> (2) <i>Utricularia macrorhiza</i> (1) <i>Ricciocarpus natans</i> *	<i>Lemna trisulca</i> (2) <i>Potamogeton filiformis</i> (1)	<i>Lemna minor</i> (1) <i>Potamogeton obtusifolius</i> (1)
62.96259	141.65365	<i>Lemna trisulca</i> (1) <i>Potamogeton richardsonii</i> (3)	<i>Myriophyllum sibiricum</i> (2) <i>Chara</i> sp.(1)*	<i>Utricularia macrorhiza</i> (1)
62.96186	141.66168	<i>Hippuris vulgaris</i> (2) <i>Potamogeton</i> sp.	<i>Utricularia macrorhiza</i> (1) <i>Myriophyllum sibiricum</i> (1)	<i>Potamogeton gramineus</i> (1)
62.95765	141.65600	<i>Polygonum amphibium</i> (3) <i>Potamogeton richardsonii</i> (2) <i>Potamogeton filiformis</i> (1) <i>Potamogeton obtusifolius</i> (1)s <i>Hippuris vulgaris</i> (1)	<i>Lemna trisulca</i> (2) <i>Utricularia macrorhiza</i> (1) <i>Potamogeton praelongus</i> (2)	<i>Potamogeton zosteriformis</i> (2) <i>Myriophyllum sibiricum</i> (2) <i>Potamogeton gramineus</i> (2)

* *Ricciocarpus* is a liverwort, *Chara* is a macro-alga

Secchi disk: .71 meter

Table 12. Vogel Lake, Kenai NWR, Alaska

Latitude	Longitude	Species		
60.99648	150.42001	<i>Nuphar polysepalum</i> (3) <i>Potamogeton robbinsii</i> (3) <i>Potamogeton gramineus</i> (1) Aquatic moss	<i>Sparganium minimum</i> (2) <i>Utricularia macrorhiza</i> (1) <i>Menyanthes trifoliata</i> †	<i>Utricularia intermedia</i> (1) <i>Potamogeton natans</i> (2) <i>Sparganium angustifolium</i> †
60.99565	150.42593	<i>Nuphar polysepalum</i> (3) <i>Myriophyllum verticillatum</i> (2) <i>Potamogeton zosteriformis</i> (2)	<i>Potamogeton obtusifolius</i> (1) <i>Potamogeton robbinsii</i> (3) <i>Sparganium angustifolium</i> †	<i>Potamogeton pusillus</i> (1) <i>Nymphaea tetragona</i> (2) <i>Scirpus</i> sp. †

60.99319	150.42628	<i>Nuphar polysepalum</i> (2) <i>Nymphaea tetragona</i> (2) <i>Lemna trisulca</i> (2) <i>Sparganium angustifolium</i> †	<i>Potamogeton natans</i> (2) <i>Sparganium minimum</i> (2) <i>Myriophyllum verticillatum</i> (2)	<i>Potamogeton pusillus</i> (1) <i>Potamogeton zosteriformis</i> (3) <i>Hippuris</i> sp.
60.988870	150.43444	<i>Chara</i> sp.* Aquatic moss <i>Carex</i> sp. †	<i>Isoetes echinospora</i> (2) <i>Nuphar polysepalum</i> (3) <i>Juncus</i> sp. †	<i>Potamogeton natans</i> (2) <i>Sparganium minimum</i> (2)
60.98546	150.42774	<i>Potamogeton robbinsii</i> (3) <i>Potamogeton gramineus</i> (1) <i>Potamogeton richardsonii</i> (2)	<i>Nymphaea tetragona</i> (2) <i>Myriophyllum verticillatum</i> (2) <i>Potamogeton zosteriformis</i> (2)	<i>Potamogeton natans</i> (1) <i>Nuphar polysepalum</i> (2) <i>Isoetes echinospora</i> (2)

† plant is an emergent
Secchi disk: 4.1 meters

Table 13. Longmere Lake, Soldotna, Alaska

Latitude	Longitude	Species		
60.50964	150.90749	<i>Potamogeton gramineus</i> (1) <i>Isoetes occidentalis</i> (2)	<i>Subularia aquatica</i> (2) <i>Sparganium angustifolium</i> †	<i>Callitriche</i> sp. Aquatic moss
60.50933	150.90546	<i>Polygonum amphibium</i> (2) <i>Eleocharis</i> sp. †	<i>Nuphar polysepalum</i> (2) <i>Sparganium angustifolium</i> †	<i>Callitriche</i> sp. <i>Subularia aquatica</i> (3) <i>Sparganium angustifolium</i> †
60.50669	150.90328	<i>Potamogeton gramineus</i> (1) <i>Subularia aquatica</i> (3)	<i>Nuphar polysepalum</i> (2)	<i>Sparganium angustifolium</i> †
60.49347	150.91872	<i>Potamogeton gramineus</i> (2) <i>Isoetes occidentalis</i> (2) <i>Eleocharis</i> sp. †	<i>Subularia aquatica</i> (2) <i>Callitriche</i> sp.	<i>Nuphar polysepalum</i> (2) Aquatic moss
60.50043	150.91649	<i>Nuphar polysepalum</i> (2)	<i>Potamogeton gramineus</i> (2)	

† plant is an emergent
Secchi disk: 1.71 meter

Table 14. Johnson Lake, Kasilof, Alaska

Latitude	Longitude	Species		
60.29557	151.26778	<i>Potamogeton gramineus</i> (2) <i>Potamogeton richardsonii</i> (3)	<i>Myriophyllum sibiricum</i> (2) <i>Potamogeton pectinatus</i> (3)	<i>Menyanthes trifoliata</i> . † <i>Potamogeton zosteriformis</i> (3)
60.29572	151.26614	<i>Potamogeton richardsonii</i> (2) <i>Nuphar polysepalum</i> (3) Aquatic moss	<i>Myriophyllum sibiricum</i> (2) <i>Potamogeton pectinatus</i> (2)	<i>Potamogeton zosteriformis</i> (2) <i>Menyanthes trifoliata</i> †
60.29408	151.26554	<i>Sparganium angustifolium</i> †	<i>Potamogeton richardsonii</i> (2)	<i>Nuphar polysepalum</i> (2)

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60.29278	151.26687	<i>Potamogeton zosteriformis</i> (2) <i>Nuphar polysepalum</i> (3) <i>Potamogeton richardsonii</i> (2) <i>Utricularia vulgaris</i> (1)	<i>Myriophyllum sibiricum</i> (2) <i>Myriophyllum sibiricum</i> (2) <i>Menyanthes trifoliata</i> †	<i>Potamogeton zosteriformis</i> (3) <i>Potamogeton gramineus</i> (1)
60.28907	151.26022	<i>Potamogeton richardsonii</i> (2)	<i>Nuphar polysepalum</i> (3)	
60.28711	151.26605	<i>Potamogeton zosteriformis</i> (3) <i>Nuphar polysepalum</i> (3)	<i>Potamogeton pectinatus</i> (2) <i>Sparganium angustifolium</i> †	<i>Myriophyllum sibiricum</i> (2) <i>Potamogeton richardsonii</i> (2)
60.29248	151.26689	<i>Hippuris vulgaris</i> (1)		

† plant is an emergent
Secchi disk:3.2 meters

Table 15. Lake Hood, Anchorage, Alaska

Latitude	Longitude	Species		
61.17863	149.97480	<i>Myriophyllum sibiricum</i> (3) <i>Potamogeton gramineus</i> (2) <i>Polygonum</i> sp.	<i>Potamogeton richardsonii</i> (3) <i>Potamogeton friesii</i> (2)	<i>Potamogeton pectinatus</i> (3) <i>Eleocharis acicularis</i> (3)
61.17933	149.97012	<i>Zannichellia palustris</i> (2) <i>Potamogeton gramineus</i> (2)	<i>Sparganium angustifolium</i> † <i>Potamogeton praelongus</i> (2)	<i>Eleocharis</i> sp. † <i>Potamogeton friesii</i> (1)
61.18594	149.96861	<i>Potamogeton pectinatus</i> (3) <i>Potamogeton richardsonii</i> (2)	<i>Potamogeton zosteriformis</i> (2) <i>Eleocharis</i> sp. †	<i>Myriophyllum sibiricum</i> (2)
61.18224	149.96859	<i>Calla palustris</i> † <i>Potamogeton zosteriformis</i> (2)	<i>Myriophyllum verticillatum</i> (1)	<i>Potamogeton pectinatus</i> (3)

† plant is an emergent

Shore access only – unable to access mid-lake for Secchi reading

Appendix B. Waterbody characteristics.

Table 16. Waterbody characteristics

Waterbody name	Date surveyed	Secchi depth	Est. max. lake depth	Sediment type	Setting
Moon Lake	8/1/2005	1.8 meters	1.8 meters	silt to peaty muck	Rural
Yarger Lake	8/2/2005	.71 meter	.71 meter	fine silt	Rural
Deadman Lake	8/2/2005	4.0 meters	6.4 meters	fine silt	Rural
Vogel Lake	8/4/2005	4.1 meters	n/a	peaty muck to silt	Remote rural
Johnson Lake	8/5/2005	3.2 meters	n/a	n/a	Semi-urban
Longmere Lake	8/5/2005	1.71 meter	n/a	fine silt	Semi-urban
Lake Hood	8/6/2005	n/a	n/a	n/a	Urban

Appendix C. Aquatic Nuisance Species sign.

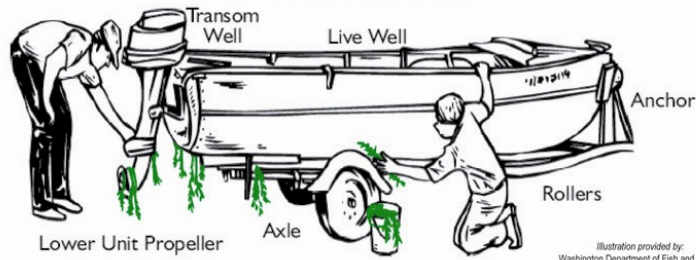
STOP Harmful Species

**Unwanted plants and animals can ruin
your favorite fishing and boating waters.**



**It is unlawful to transport zebra mussels, noxious aquatic weeds,
and other aquatic nuisance species.**

- OAR 635-056, OAR 603-52-1200



- **REMOVE** all plants and animals from boats, motors, trailers, anchors and gear before and after launching.
- **INSPECT** hard to reach spots, damp areas and other protected places where harmful species can survive for days.
- **DRAIN** all water from boats, trailers, tackle and gear before leaving the area.
- **DISPOSE** of livewell water, bait, plants and other material away from shore, or in trash cans.

**To report harmful species please call (toll free) 1-866-INVADER
or contact these agencies for more information:**