LOWER COLUMBIA RIVER AQUATIC NONINDIGENOUS SPECIES SURVEY 2001-2004

Final Technical Report: Appendices

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Technical Advisory Committee Participants

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<td>Andy Cohen</td>
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<td>Kathy Hamel</td>
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<td>Leslie Harris</td>
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<td>Paul Heimowitz</td>
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<tr>
<td>Henry Lee II</td>
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<td>Claudia Mills</td>
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<td>Blaine Parker</td>
<td>Columbia River Inter-Tribal Fish Commission</td>
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<td>Jennifer Parsons</td>
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<td>Greg Ruiz</td>
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<td>David Strayer</td>
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<td>Bruce Sutherland</td>
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<td>David Ward</td>
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<td>Erin Williams</td>
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APPENDIX B: SPECIES LIST

Guide to the format of this section

- Species arranged by Phylum/Division, then Class and/or other relevant taxonomic breakdown
- List of all species compiled from literature review and the field surveys

<table>
<thead>
<tr>
<th>Family</th>
<th>Species Name</th>
<th>LCRANS = present in survey, LIT= present in literature review</th>
<th>Origin</th>
</tr>
</thead>
</table>

- Species Descriptions
  - *Species Name*, Author
  - Synonyms (if applicable)
  - Source of Information (LCRANS, LIT)
  - Origin (i.e. Introduced, Cryptogenic or Native)
  - Descriptive paragraph
Kingdom: Monera
Division: Cyanophycota

Cyanobacteria

There are 124 freshwater genera of cyanobacteria or blue-green algae reported from North America, however this division is in a state of taxonomic flux (Sheath and Wehr 2003). Cyanobacteria can be important in surface blooms, often toxic, in nutrient rich waters. All three genera below are widely distributed (Komarek 2003).

<table>
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<tr>
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<table>
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<tr>
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<tr>
<td><em>Phormidium</em> sp.</td>
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<tr>
<td><em>Spirulina</em> sp.</td>
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Kingdom: Plantae
Division: Bacillariophyta

Phytoplankton species are the most common of all groups found in ballast water entering eastern Pacific ports (Carlton and Geller 1993, Levings et al. 2004, Cohen 1998).

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Kingdom: Plantae
Division: Bacillariophyta

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Division: Chlorophyta

Green Algae

The division Chlorophyta includes both planktonic forms and macroalgal species as well as marine, estuarine and freshwater species. Filamentous green algae can often form free-floating mats or may be intertwined with other algal masses attached to hard surfaces (Shubert 2003). Macroalgae were not actively collected and identified during the LCRANS survey.

<table>
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<th>Cryptogenic</th>
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<td><em>Pediastrum sp.</em></td>
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<td><em>Actinacrum hantshchi</em></td>
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<td><em>Scenedesmus longispina</em></td>
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<td><em>Scenedesmus sp.</em></td>
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<td><em>Eudorina sp.</em></td>
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</table>

CHLOROCOCCACEAE

*Scheroderia setigera* (Schroeder) Lemmermann
Synonyms: *Ankistrodesmus setigurus*, *Reinschiella setigera*
LCRANS
Origin Cryptogenic

Freshwater planktonic alga. Widely reported and common in the plankton of North America (Shubert 2003). Also found in Europe and Asia.

DICTYOSPHAERIACEAE

*Dictyosphaerium pulchellum*  Wood, 1872
LCRANS
Origin Cryptogenic

Appendices: page 9
Kingdom: Plantae
Division: Chlorophyta

Colonial form. This genus is common but not considered abundant in North America (Shubert 2003).

HYDRODICTYACEAE

*Pediastrum integrum* Naeg.
LCRANS
Origin Cryptogenic

The genus is found in all regions of North America (Shubert 2003).

SCENEDESMACEAE

*Actinastes hantzschii* Lagerheim, 1882
LCRANS
Origin Cryptogenic

Colonial alga. Genus is widely reported from North America, common in ditches, ponds, bogs and lakes (Shubert 2003).

*Scenedesmus longispina* Meyen
LCRANS
Origin Cryptogenic

The most commonly reported genus of coccoid green algae worldwide (Shubert 2003).

ULVACEAE

*Enteromorpha intestinalis* (L.) Link
Synonyms: *Ulva intestinalis*
LIT
Origin: Native

Found on rocks in the high to mid tidal zone in protected bays and estuaries from Alaska to Mexico (Abbott and Hollenberg 1976). The genus *Enteromorpha* is cosmopolitan.

VOLVOCACEAE

*Eudorina elegans*
LCRANS

According to Shubert (2003) *Eudorina elegans* is among the most frequently encountered species of green algae.
Division: Phaeophycophyta

The brown algae

Macroalgae were not actively collected and identified during the LCRANS survey but *Fucus distichus* was noted because of its abundance at Trestle Bay and Baker Bay sites.

<table>
<thead>
<tr>
<th>Fucaceae</th>
<th><em>Fucus distichus</em></th>
<th>LCRANS, LIT</th>
<th>Native</th>
</tr>
</thead>
</table>

**FUCACEAE**

*Fucus distichus*  Linnaeus 1767  
LCRANS, LIT  
Native  

Found attached to rocks in the upper to mid-intertidal zone from northern Washington State to Point Conception, California (Abbott and Hollenberg 1976). Dominant macrophyte in the intertidal zone in Trestle Bay and Baker Bay.

Division: Chrysophyta

Silicaflagellates

There are 72 genera of silicaflagellates known from inland habitats in North America, freshwater species are typically associated with standing bodies of water (Sheath and Wehr 2003). The skeletons of silicoflagellates usually comprise 1-2% of the siliceous component of marine sediments; making them much less abundant than diatoms. Marine species can contribute to blooms and are widely distributed throughout the world’s oceans (McCartney 1993).

<table>
<thead>
<tr>
<th>Dictyochaceae</th>
<th><em>Dictyocha fibula</em></th>
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<th>Cryptogenic</th>
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</table>

**DICTYOCHACEAE**

*Dictyocha fibula* Ehrenb.  
LCRANS  
Origin: Cryptogenic  

Marine species, also known from the eastern Atlantic.
Kingdom: Plantae
Division: Pyrrophycophyta

Division: Pyrrophycophyta

The dinoflagellates

Dinoflagellates are typically a minor component of the phytoplankton and at times form dense blooms – usually in the presence of high levels of nitrates and phosphates (Sheath and Wehr 2003).

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
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<th>Origin</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Protoperidinaceae</td>
<td><em>Protoperidinium depressum</em></td>
<td>LCRANS</td>
<td>Cryptogenic</td>
</tr>
</tbody>
</table>

CERATIACEAE
*Ceratium hirundella*
LCRANS
Cryptogenic

Freshwater dinoflagellate, found throughout North America, distributed worldwide.

PROTOPERIDINACEAE
*Protoperidinium depressum*
LCRANS
Cryptogenic

Marine dinoflagellate, distributed worldwide

Subkingdom: Tracheobionta
Division: Magnoliophyta

Aquatic vascular plants include a variety of lifeforms including submersed and emergent, free-floating and rooted species. Submersed species are restricted to shallow water, low current-velocity sites due to light and scouring effects. Emergent species occur are common on islands in the lower Columbia River. Emergent species are typically included in wetland deliniation work, however, submersed species are often overlooked. LCRANS sampling focused on cataloging introduced submersed species, although introduced emergent species were noted when observed. Submersed and emergent species were included in the literature review.
<table>
<thead>
<tr>
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Appendices: page 13
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Appendices: page 14
<table>
<thead>
<tr>
<th>Family</th>
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# = likely mis-identification   * = unsuccessful establishment

**ALISMATACEAE**

*Alisma triviale*  
American water plaintain  
Syn: *A. brevipes, A. plantago-americanum, A. plantago-aquatica, A. subcordatum*  
LIT  
Origin: Native
Kingdom: Plantae  
Division: Magnoliophyta

*Alisma triviale* is native to the California floristic province, i.e. from the dry regions of the Great Basin and the Mojave Desert to the Pacific coast to Canada (Hickman 1993). Also found in southeastern US, Eurasia, eastern Africa, and perhaps Australia.

*Sagittaria cuneata* Sheldon  
duck potato, arrowhead, wapato  
Syn: *Sagittaria arifolia*  
LIT  
Origin: Native – probably misidentified

Native to California, Pacific Northwest to Southern Canada (Hickman 1993). Only found east of Cascades in Oregon and Washington (Ecology 2003). May be confused with *S. latifolia* below. May also be confused with *Alisma* spp., *Valisneria* sp., or *Sparganium* spp. which all have ribbon-like underwater leaves but it is unlikely to be confused with other plants when the arrowhead shaped leaves are present (Ecology 2003).

*Sagittaria latifolia* Willd.  
duck potato, arrowhead, wapato  
Syn: *S. chinensis, S. esculenta, S. longirostra, S. obtuse, S. ornithorhyncha, S. planipes, S. pubescens, S. viscosa*  
LIT  
Origin: Native

Native to California, Pacific Northwest to Southern Canada (Hickman 1993). Unlike *S. cuneata*, *S. latifolia* is common on Pacific coast, and in central, and eastern United States. In Washington it is distributed primarily west of Cascades and the Columbia River Gorge. See above for notes on similar species.

**APIACEAE**

*Angelica lucida* L.  
seacoast angelica  
Syn: *Coelopleurum actaeifolium, Coelopleurum qmelinii, Coelopleurum lucidum, Coelopleurum lucidum ssp.*  
LIT  
Origin: Native

Native to the Pacific coasts of North America and Siberia. Used for medicinal purposes by some Eskimo communities. Also found in coastal areas of Northeastern North America.

*Heracleum maximum* Bartr.  
cowparsnip  
Syn: *H. lanatum, H. sphondylium var. lanatum, H. sphondylium ssp. montanum*  
LIT  
Origin: Native

Native to North America. Used as a wetland indicator species.
**Hydrocotyle ranunculoides** L.f.  floating marsh pennywort  
LCRANS, LIT  
Origin: Native

Native to Washington, Oregon and British Columbia. On the rare-palnt list for Washington and B.C. *Hydrocotyle ranunculoides* is considered an aggressive invader in Australia, the U.K., and parts of Africa.

**Lilaeopsis occidentalis** Coult. & Rose  western grasswort  
LIT  
Origin: Native

Distributed along the West coast of North America from California to British Columbia (Hickman 1993).

**Oenanthe sarmentosa** K. Presl ex DC.  water parsley  
LIT  
Origin: Native

Western N. America - British Columbia to California.

**Sium suave** Walter  hemlock water parsnip  
Syn:  *S. cicutifolium, S. floridanum, S. suave var. floridanum*  
LIT  
Origin: Native

Native to North America, distributed across the northern states and south to Texas. (Hickman 1993).

ARACEAE

**Lysichiton americanus** Hultén & St. John  western skunk cabbage  
Syn: *Lysichitum americanum, L.camtschaticensis*  
LIT

Native to Western North America (Hickman 1993).

ASTERACEAE

**Achillea millefolium** L.  western yarrow, milfoil  
Syn: *Achillea borealis, Achillea lanulosa*  
LIT  
Origin: Cryptogenic
There are both native and introduced phases of *Achillea millefolium* in North America. Introduced and native phases differ primarily in chromosome number and are difficult to distinguish morphologically. Native and introduced phases hybridize. The intricate pattern of morphologic, geographic, and ecologic variation within the species has frustrated all efforts to organize an intraspecific taxonomy on a circumboreal or even a strictly North American basis (Aleksoff, 1999).

*Aster subspicatus* Nees.  
**Douglas aster**
LIT
Origin: Native

*Bidens cernua* L.  
**nodding beggartick**
LIT
Origin: Native

*Boltonia asteroides*  
**boltonia aster, white doll’s daisy**
LIT
Origin: Cryptogenic

Patchy distribution east of the Rockies by this native North American daisy indicated that it may have been introduced to the western U.S. According to the USDA database this is *Boltonia asteroides var. recognita* (USDA - NRCS 2004).

*Canadanthus modestus*  
**Canada aster, giant mountain aster**
Syn: *Aster modestus*
LIT
Origin: Native

Native to the Pacific Northwest and Canada, this species is not widespread in the U.S. (USDA - NRCS 2004).

*Cotula coronopifolia* L.  
**brass buttons**
LCRANS, LIT
Origin: Introduced

Endemic to South Africa, *Cotula coronopifolia* is now also found in North America. On the Pacific Coast the species has become established from British Columbia to California. Its presence on the San Francisco Peninsula was reported in 1878. The introduction of *C. coronopifolia* to California is believed to have been via ship ballast (Cohen and Carlton 1995) and may have been spread by shipping up and down the West Coast.

*Helenium autumnale* L.  
**common sneezeweed**
Syn: *Helenium grandiflorum*
LIT
Origin: Native
Kingdom: Plantae
Division: Magnoliophyta

Distributed throughout the U.S. *Helenium autumnale var. grandiflorum* is most likely to be the species reported in previous literature.

**Senecio triangularis** Hook.  
arrowleaf ragwort  
LIT  
Origin: Native

Native to western North America (Hickman 1993).

AZOLLACEAE

**Azolla mexicana** Schlecht. & Cham. ex K. Presl  
Mexican water-fern  
LCRANS  
Origin: Native

Distribution: Western North America and northern South America. Other similar species of water-fern are found nearly worldwide (Ecology 2003).

BORAGINACEAE

**Myosotis laxa** Lehm.  
smallflowered forget-me-not  
LIT  
Origin: Native

May be confused with *Myosotis scorpiodes*, common European forget-me-not (Hickman 1993).

CABOMBACEAE

**Cabomba caroliniana** Gray  
fanwort, Carolina fanwort  
LCRANS, LIT  
Origin: Introduced

Native to North and South America’s eastern subtropical-temperate zones, *Cabomba caroliniana* is now found in Europe, Asia and Australia (Ecology 2001). Though the species is native to the southeastern United States it has been introduced to the northeastern US and Oregon. The attractive foliage of *C. caroliniana* has made it popular with the aquarium trade since the 1890’s. Still popular, the species has been commercially available for some time. The introduction of *C. caroliniana* has been attributed to discarded aquarium plants. Though the species can reproduce sexually, vegetative fragments are the primary mode of reproduction and dispersal. Once established, *C. caroliniana* can threaten recreational use, navigation and the habitat of native species. This species is considered invasive (Les and Mehrhoff 1999).
CALLITRICHACEAE

*Callitriche stagnalis* Scop.  European pond water-starwart
LCRANS, LIT
Origin: Introduced

Globally widespread, *Callitriche stagnalis* is found in Europe, northern Africa, Asia, Australia and North America. Once introduced to North America, many early collections of the species occurred in coastal areas of the United States. It has been hypothesized that the species initial establishment was in or near seaports, introduced by improper disposal of shipping ballast. The first documented specimens of *Callitriche stagnalis* found in Oregon were collected from an unspecified coastal location in 1871 and Clatsop County in 1902. By the turn of the century, *Callitriche stagnalis* had become a popular plant for aquariums, facilitating the establishment of inland populations via discarded plants. *Callitriche stagnalis* is a prolific seed producer and seeds are possibly the species primary mode of dispersal. The spread of *Callitriche stagnalis* has been comparatively slow, it is not a particularly aggressive colonizer but it will displace native species once it establishes itself. (Philbrick et al. 1998).

*Callitriche verna* L.  vernal water-starwart, spiny water-starwart
Syn: *Callitriche palustris*
LCRANS, LIT
Origin: Native

*C. verna* is found throughout the Northern hemisphere and is considered circumboreal.

CERATOPHYLLACEAE

*Ceratophyllum demersum* L.  coontail, hornwort
LCRANS, LIT
Origin: Native

*Ceratophyllum demersum* occurs across the entire U.S. and throughout most of Canada (IFAS 2004).

CHENOPODIACEAE

*Salicornia depressa* Standl.  low saltwort
Syn: *Salicornia europaea, Salicornia maritima, Salicornia virginica*
LIT
Origin: Native

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Division: Magnoliophyta

According to the Washington Flora Project *S. virginica* may be the best name for this plant. It is distributed along the Pacific, Gulf and Atlantic coasts of the U.S.

**CLUSIACEAE**

*Hypericum scouleri* Hook
*Scouleri's St. Johnswort*
Syn: *H. formosum* ssp. *Scouleri, H. formosum* var. *nortontiae*
LIT
Origin: Native

Native to western North America, *Hypericum scouleri* is a well-known medicinal plant.

**COMMELINACEAE**

*Murdannia keisak* (Hassk.) Hand.-Maz.
*Asian spiderwart*
Syn: Anelimia
LCRANS, LIT
Origin: Introduced – not established

Origin: Introduced throughout the Pacific Northwest and the Southeastern U.S., *Murdannia keisak* is associated with rice culture in East Asia where it is a native plant. According to the Virginia Native Plant Society (2004) it was probably first brought to South Carolina or Louisiana in rice imported for growth in this country. In the United States, it is now found in all eastern coastal states from Delaware to Louisiana, and in Kentucky and Tennessee. The aggressive nature of this plant has now been clearly displayed by its ability to establish itself in freshwater wetlands and crowd out native vegetation by forming a solid mat of vegetation. Even in its native region, this species is a troublesome weed. Not only does it produce thousands of very small seeds, it can reproduce vegetatively. It was found in a freshwater tidal marsh on Lois Island in the Columbia River estuary. The island was resurveyed by Portland State University and Washington Department of Ecology in November, 1997 and again during LCRANS but no *M. keisak* was found.

**CRASSULACEAE**

*Crassula aquatica* (L.) Schoenl
*Water pygmy weed*
Syn: *Tillaea aquatica* L. H&C
LIT
Origin: Native

*Crassula aquatica* is native to North America but is considered a rare or threatened species in many states (Rook 2002). It grows in a variety of location types including

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Division: Magnoliophyta

vernal pools, ponds and the edges of lakes, and may also be found in salt marshes (Hickman 1993).

CYPERACEAE

_Carex lyngbyei_ Hornem.  
Lyngby's sedge  
Syn: _Carex cryptocarpa, Carex cryptochlaena_  
LIT  
Origin: Native

A tidal wetland species, _Carex lyngbyei_ is common in Pacific Northwest marsh communities. It is native to the west coast and ranges from the central coast of California to Alaska (Hickman 1993).

_Carex obnupta_ Bailey  
Slough sedge  
Syn: _Carex magnifica_  
LIT  
Origin: Native

_Carex obnupta_ is native to the west coast of North America. It can be found along the Pacific Coast from California to British Columbia. It grows in bogs, marshes, wet meadows, ditches and the edges of rivers and lakes. It is very common in areas where fresh and salt water meet but is confined to lower elevations. Hickman 1993 considers it to be a horticultural variety.

_Eleocharis minima_  
Hairgrass, small spike rush  
Syn: _Eleocharis bicolor, Eleocharis uncialis_  
LIT  
Origin: Native

May be a misidentification as this species may be confused with other _Eleocharis_. The USDA distribution map does not show this species in Oregon or Washington but considers it to be native to North America (USDA - NRCS 2004). It is used as cool-water aquarium plant.

_Eleocharis palustris_ (L.) Roemer & J.A. Schultes  
Common spike rush  
Syn: _Eleocharis mamillata, Eleocharis perlonga, Eleocharis smallii, Eleocharis xyridiformis_  
LIT  
Origin: Native

A native species, _Eleocharis palustris_ is found widely throughout North America (USDA - NRCS 2004).
Kingdom: Plantae  
Division: Magnoliophyta  

*Schoenoplectus tabernaemontani* (K.C. Gmel.) Palla softstem bulrush  
LIT  
Origin: Native  

A native sedge *Schoenoplectus tabernaemontani* is distributed throughout North America (USDA - NRCS 2004).

*Schoenoplectus americanus* (Pers.) Volk. ex Schinz & R. Keller chairmaker's bulrush  
syn: *Scirpus americanus*  
LIT  
Origin: Native  

This native sedge is can be found throughout much of North America with the exception of the great lakes region (USDA - NRCS 2004).

*Schoenoplectus maritimus* (L.) Lye  
Syn: *Scirpus maritimus*  
LIT  
Origin: Native  

*Schoenoplectus maritimus*, a native bulrush, can be found throughout much of North America.

*Schoenoplectus robustus* (Pursh) M.T.  
Syn: *Scirpus robustus*  
LIT  

Although it is native to North America this record may represent a mis-identification as the USDA has no record of this species occurring in OR. There are, however, many other species of sedges that may be confused with this one.

*Scirpus microcarpus* J.& K. Presl  
Syn: *Scirpus rubrotinctus* Fern.  
LIT  
Origin: Native  

Native to North America, this sedge is distributed throughout much of the U.S. except the Southeast.

EQUISETACEAE  

*Equisetum fluviatile* L.  

water horsetail  

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An ancient plant with a circumboreal distribution, *Equisetum fluviatile* commonly grows in dense colonies along shorelines or in shallow water. Most often confused with marsh horsetail (*E. palustre*).

**FABACEAE**

*Lathyrus palustris* L.  
marsh pea

Native to much of the U.S. *Lathyrus myrtifolius* is a state listed threatened and/or endangered species along much of the east coast (USDA - NRCS 2004).

*Vicia nigricans* ssp. *gigantea* (Hook.) Lassetter & Gunn.  
giant vetch

Native to Western N. America, *Vicia nigricans* ssp. *gigantea* is found from Alaska to California (Hickman 1993).

**HALORAGACEAE**

*Myriophyllum aquaticum* (Vell.) Verdc.  
parrot feather watermilfoil

*Myriophyllum aquaticum* is sold primarily for aquatic gardens, but sometimes also for aquarium use. Since 1996, sale of parrot feather has been banned in Washington because it is an aggressive invader that rapidly takes over lakes and ponds. Parrotfeather is a native of South America that grows well in Pacific Northwest waters. It is distributed throughout much of North America and Hawaii (USDA - NRCS 2004). According to the Washington Department of Ecology all of the parrot feather plants in the United States are female, so no seeds are produced. However, the plant spreads readily through fragmentation of the stems and rhizomes (Ecology 2001).

*Myriophyllum sibiricum* Komarov  
shortspike watermilfoil

Syn: *Myriophyllum exalbescens* Fern.
Though considered native to northern North America and Eurasia, *Myriophyllum sibiricum* may possibly be a circumboreal species that has increased in range (Ecology 2001, Aiken 1981). It is distributed throughout North America except in the southeastern U.S.

*Myriophyllum spicatum* L. spike watermilfoil
LCRANS, LIT
Origin: Introduced

Once commonly sold as an aquarium plant, *Myriophyllum spicatum*, is native to Europe and Asia. It was introduced to North America many years ago and is now found over much of the United States (Ecology 2001). *M. spicatum* can be found in lakes, ponds, shallow reservoirs and low energy areas of rivers and streams as well as in the brackish waters of protected tidal creeks and bays. This species is considered a serious pest in waterbodies that have experienced disturbances such as nutrient loading, intense plant management, or abundant motorboat use (Nichols 1994). Milfoil is rapidly spread from lake to lake on boat trailers. Milfoil forms very dense mats of vegetation on the surface of the water interfering with recreational activities such as swimming, fishing, water skiing, and boating and clogging water intakes used in power generation and irrigation (Ecology 2001). The vast, dense mats can rob oxygen from the water by preventing the wind from mixing the oxygenated surface waters to deeper water.

**HYDROCHARITACEAE**

*Egeria densa* Planch. Brazilian waterweed
LCRANS, LIT
Origin: Introduced

Native to South America, *Egaria densa* has also become established in Europe, Japan, Australia and North America (Ecology 2001). For decades *Egaria densa* has been commercially cultivated and sold for use in water gardens and aquariums. Due to its popularity it is now found throughout the United States, apparently dispersed by improper aquarium disposal and cultivated escapees. Populations of this species occurring in North America are staminate therefore no seeds are produced. The primary mode of reproduction is asexual via vegetative fragments. Recreational boating and other activities in infested water bodies contribute to the vegetative dispersal of *Egaria densa* (Les and Mehrhoff 1999). In 1944 *Egaria densa* was found in Oregon (Cohen and Carlton 1995). Officials now consider *Egaria densa* to be one of the greatest threats to Oregon’s water bodies. Silver Lake County, in Washington State spends over one million dollars a year to control *Egaria densa* (Ecology 2001). It is also illegal to sell *Egaria densa* in Washington State (Ecology 2001). Not only does *Egaria densa* displace native species, it clogs waterways and impedes navigation (Cohen and Carlton 1995). *Egaria densa* is currently considered a highly invasive species with increasing populations (Les and Mehrhoff 1999).

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Division: Magnoliophyta

**Elodea canadensis** Michx.  Canadian waterweed, common elodea
Syn: *Anacharis canadensis*, *Elodea brandegegae*, *Elodea ioensis*, *Elodea linearis*, *Elodea planchonii*, *Philotria canadensis*, *Philotria linearis*
LCRANS, LIT
Origin: Native

Origin: Native aquatic plant distributed throughout North America. Because it is a popular aquarium plant has been widely exported around the world, subsequently introduced and is now considered a noxious weed in parts of Europe, Australia, Africa, Asia, and New Zealand (Ecology 2001). Often confused with *Elodea nuttallii* and *Egeria densa*.

**Elodea nuttallii**  (Planch.) St. John  western waterweed
LCRANS, LIT
Origin: Native

Occurs in the Northwest and California, but is more common in the eastern U.S., *E. nuttallii* can be found in lakes, rivers, ponds and ditches. Unlike *E. canadensis*, *E. nuttallii* prefers fresh to slightly brackish water (Ecology 2001).

**Vallisneria Americana** Michx  tapegrass, water celery
LCRANS, LIT
Origin: Introduced

*Vallisneria americana* is an aquatic perennial indigenous to eastern North America. The species is now also found in Asia, Australia, Central America and the Caribbean. In the Pacific Northwest *Vallisneria americana* was introduced to provide habitat for wildlife and fish. The species is not an aggressive colonizer and does not cause many of problems associated with other introduced aquatic plants. Therefore *V. americana* is not considered a pest species (Ecology 2001).

**IRIDACEAE**

**Iris pseudacorus**  yellow flag iris, water flag
LCRANS, LIT
Origin: Introduced

Appendices: page 27
A perennial wetland plant with attractive yellow flowers, *Iris pseudacorus* was brought to and cultivated in eastern North America during the early to mid 19th century. By the 1860’s its escape from cultivation was reported. Native to Europe, it is now found throughout the United States and Canada (Cohen and Carlton 1995). Though it is invasive, *I. pseudacorus* is still offered commercially and is widely cultivated. Large, floating seeds are water dispersed. Rhizomes may also be broken off and can float downstream to establish new populations. Due to its competitiveness, *I. pseudacorus* populations are increasing. Once established, native species are displaced and the plant can become a nuisance. Little work has been done on effective removal of yellow flag; glyphosate application is somewhat effective, manual removal may more effective but may result in highly disturbed habitat.

**ISOETACEAE**

*Isoetes tenella* Léman spiny-spore quillwort
Syn: *Isoetes setacea, Isoetes muricata, Isoetes echinospora, Isoetes braunii*
LIT Origin: Native

Origin: Native
Distribution: from Newfoundland to British Columbia, south to Pennsylvania and California (Rook 2002).

**JUNCACEAE**

*Juncus balticus* Willd. Baltic rush, wire grass
LIT Origin: Native

Distributed throughout North America (USDA - NRCS 2004).

*Juncus effusus* L. common rush
LIT Origin: Native

Distributed throughout North America, may be one or more of four var. possibilities (USDA - NRCS 2004).

*Juncus filiformis* L. thread rush
LIT Origin: Native

Distributed throughout the western US and in the Great Lakes region (USDA - NRCS 2004).
Kingdom: Plantae
Division: Magnoliophyta

**Juncus nevadensis** S. Wats.  
Sierra rush  
LIT  
Origin: Native  

Native to the western U. S., there are four varieties found in Oregon and Washington (USDA - NRCS 2004).

**Juncus oxymeris** Engelm.  
pointed rush  
LIT  
Origin: Native  

Origin: Nativespecies with a distribution limited to the west coast of North America (USDA - NRCS 2004).

**JUNCAGINACEAE**

**Triglochin maritimum** L.  
seaside arrowgrass  
LIT  
Origin: Native  

Distributed throughout most of the U.S. except the gulf and mid Atlantic states (USDA - NRCS 2004), also found in Europe and Asia, *Triglochin maritimum* may be a circumpolar species complex.

**LAMIACEAE**

**Mentha aquatica** L.  
water mint  
LIT  
Origin: Introduced  

Found primarily along the eastern coast from Nova Scotia to South Carolina, but also occurring in most of the inland eastern states and throughout the central and western United States. Water mint is native to Europe and is often sold as a water garden plant. Was probably brought to North America with European immigrants who valued it for its medicinal and herbal uses.

**Mentha arvensis** L.  
wild mint  
LIT  
Origin: Native
Kingdom: Plantae
Division: Magnoliophyta

This is the only native species of Mentha found in the U.S., the rest are all introduced. This plant is very common and used for culinary purposes. Some states such as Nebraska consider this an invasive wetland plant. With a temperate distribution Hickman 1993 considers this to be naturalized from Europe but native tribal records indicated widespread use of this plant (http://www.wsdot.wa.gov/environment/culres/ethbot/m-p/Mentha.htm).

*Mentha x piperita* L. (pro sp.) *aquatica × spicata* peppermint

LIT
Origin: Introduced

Origin: Introduced hybrid of two nonnative Eurasian mint species *Mentha aquatica* x *M. spicata*, this plant is popular herb. Peppermint is found throughout much of North America. (USDA - NRCS 2004).

**Prunella vulgaris** L. common selfheal

LIT
Origin: Native

*Prunella vulgaris* is native to the continental U.S. but is considered an invasive native in the Northeast and in the Great Plains states (USDA - NRCS 2004).

**LEMNACEAE**

**Lemna minor** L. common duckweed

LCRANS, LIT
Origin: Native

*Lemna minor* is distributed throughout much of the temperate and subtropical regions of the world including North America, Eurasia, Australia, and New Zealand. It may be confused with other duckweeds as well as *Azolla mexicana*. Natural duckweed mats are likely to be a mixture of species.

**LILIACEAE**

**Veratrum californicum** Dur. California false hellebore, corn lily

LIT
Origin: Native

Native to North America west of the Rockies, there are two varieties of *Veratrum californicum* found in the Pacific Northwest. Traditional uses of *V. californicum* include its use as a contraceptive, the whole plant should be considered highly toxic (The Compleat Botanica).

Appendices: page 30
LYTHRACEAE

*Lythrum salicaria* L.  
**purple loosestrife, salicaire, spiked loosestrife**  
LCRANS, LIT  
Origin: Introduced

Origin: Introduced throughout much of North America, this species is considered a serious pest, is listed as a nuisance and/or noxious weed in many states, and is banned from sale in most U.S. states (USDA - NRCS 2004). Purple loosestrife disrupts wetland ecosystems by displacing native plants and animals. Economic impacts are high in agricultural communities when irrigation systems are clogged or when wetland pastures are lost to grazing.

MENYANTHACEAE

*Nephrophyllidium crista-galli* (Menzies ex Hook.) Gilg  
**deercabbage**  
Syn: *Fauria crista-galli*  
LIT  
Origin: Native

Native to Oregon and Washington (in the Olympic Mountains and North Cascades) north to British Columbia and Alaska (USDA - NRCS 2004).

NYMPHAEACEAE

*Nymphaea odorata* ssp. *odorata*  
**American white waterlily**  
LCRANS, LIT  
Origin: Introduced

*Nymphaea odorata* is native to eastern North America. It consists of two subspecies *N. odorata* ssp. *odorata* and ssp. *tuberosa* (Paine) Wiersema & Hellquist. The two subspecies are widespread in the eastern, central, and mid western United States. *N. a odorata* ssp *odorata* has been introduced into several western and northwestern states (Weirsema 1997). It is considered a class c nox weed in Washington.

ONAGRACEAE

*Epilobium ciliatum* Raf. ssp. *watsonii* (Barbey) Hoch & Raven  
**fringed willowherb**  
Syn: *Epilobium adenocaulon, Epilobium americanum, Epilobium brevistylum, Epilobium californicum, Epilobium delicatum, Epilobium ecomosum, Epilobium ursinum*  
LIT  
Origin: Native

Appendices: page 31
Native to the Pacific Northwest and California (USDA - NRCS 2004). *Epilobium ciliatum* has a nearctic distribution.

*Ludwigia uruguayensis* (Camb.) Hara  
Uruguayan primrose-willow, water primrose  
LIT  
Origin: Introduced

*Ludwigia uruguayensis* is a perennial herb with bright yellow, showy flowers and willow-like leaves that can be found creeping along the shoreline, floating on the water surface, or growing upright. It is a non-native species originally from South America and has been introduced into Europe and northern North America. Water primrose spreads by seeds and by plant fragments. It is easily dispersed by shipping, waterfowl, and human activity. It is also sold as an ornamental species. In Washington water primrose has established in the drainage canals in the Longview/Kelso area. It has been in the area for about 25 years. There is a herbarium specimen dated 1956, from the "Longview Toll Bridge" (Ecology 2001).

There has been some confusion in the past as to the origin of *L. uruguayensis*. Some authors consider this a species complex native to both South America and the Southern U.S. Jennifer Parsons of the Washington Department of Ecology and one of the taxonomic advisors to the LCRANS survey considers this whole complex to be weedy and non-native to the Pacific Northwest.

**ORCHIDACEAE**

*Platanthera dilatata* (Pursh) Lindl. ex Beck var. *dilatata*  
scentbottle  
LIT  
Origin: Native

Native to the northern U.S. and the western states, *Platanthera dilatata* var. *dilatata* is a rare orchid that inhabits soggy soil, bogs, marshes, meadows, fens and prefers full sun (USDA - NRCS 2004).

**PLANTAGINACEAE**

*Plantago lanceolata* L.  
narrowleaf plantain  
LIT  
Origin: Introduced

An introduced weed, *Plantago lanceolata*, is native to Europe, has been spread throughout the continental U.S., Alaska, Hawaii and Puerto Rico and thrives in many other temperate climates. *P. lanceolata* is commonly found along roadsides, railroads and other disturbed habitats. The leaves of many *Plantago* spp. have medicinal uses and it may have been intentionally transported to North America. The pollen of *P. lanceolata* is also a common allergen.
POACEAE

*Beckmannia syzigachne* (Steud.) Fern.  
American sloughgrass

Syn: *Beckmannia eruciformis auct. non; Beckmannia eruciformis ssp. baicalensis; Beckmannia eruciformis var. uniflora; Beckmannia syzigachne ssp. baicalensis; Beckmannia syzigachne var. uniflora*

LIT  
Origin: Cryptogenic  

Found in wet meadows, swamps, marshes and shallow water. Range Eastern Europe to central Asia and North America. Most sources consider this to be a native, new-world grass and it is considered threatened and endangered in two midwestern states (Hickman 1993, USDA - NRCS 2004) but the Global Compendium of Weeds (HEAR 2004) lists its origins as China and Asia.

*Deschampsia caespitosa* (L.) Beauv.  
tufted hairgrass

LIT  
Origin: Cryptogenic  

Distributed throughout the western and northern U.S. Most sources consider this to be a native, new-world grass (Hickman 1993, USDA - NRCS 2004) but the Global Compendium of Weeds (HEAR 2004) lists its origins as Eurasia, Africa, Australia (HEAR 2004).

*Distichlis spicata* (L.) Greene  
inland saltgrass

LIT  
Origin: Native  

Saltgrass is native to North America and is widely distributed (USDA - NRCS 2004). *Distichlis spicata* is the only saltgrass (*Distichlis*) native to the U.S.

*Elymus glaucus* Buckl.  
blue wildrye

LIT  
Origin: Native  

Origin: Nativegrass distributed throughout western North America (USDA - NRCS 2004). Hybridizes readily with other members of the genus *Elymus*.

*Glyceria striata* (Lam.) A.S. Hitchc.  
fowl mannagrass

LIT  
Origin: Native

**Hordeum brachyantherum** Nevski
LIT
Origin: Native

Native to the western U.S., spotty distribution in the east may indicate that it is introduced to eastern North America (USDA - NRCS 2004).

**Lolium arundinaceum** (Schreb.) S.J. Darbyshire
tall fescue
Syn: *Festuca arundinacea* Schreb. var. *arundinacea* Schreb.
LIT
Origin: Introduced

An agronomically important forage species native to Europe, *Lolium arundinaceum* is considered a pest species in the U.S. where it is widely distributed (USDA - NRCS 2004).

**Phalaris arundinacea** L.
reed canarygrass
LCRANS, LIT
Origin: Introduced

*Phalaris arundinacea* is a rhizomatous perennial grass (Ecology 2002). Reed canarygrass forms dense, highly productive stands that grow so vigorously they are able to inhibit and eliminate competing species (Apfelbaum and Sams 1987). In addition, areas that have existed as reed canarygrass monocultures for extended periods of time may also be characterized by seed banks that are lack any native species (Apfelbaum and Sams 1987, Ecology 2002).

Reed canarygrass is one of the most common species growing along the banks of the lower Columbia River system where it thrives in dense monocultures. Many recent habitat restoration projects along the system are investigating the efficacy of removing reed canarygrass stands.

Reed canarygrass is a circumboreal species (Larson 1993). While possibly native to North America, European cultivars have been widely introduced for use as hay and forage on the continent; there are no easy traits known for differentiating between the native plants and European cultivars (White et al. 1993, Ecology 2002) but it is thought that the invasive populations of reed canary grass are the result of these introduced cultivars. The species is common throughout most of southern Alaska and Canada, as well as all but the southeastern portion of the continental U.S. (Hitchcock et al. 1969).

**Spartina** spp.
cordgrasses
LIT

Appendices: page 34
Origin: Introduced*

Several species of cordgrass (*Spartina alterniflora*, *S. anglica*, *S. densiflora*, and *S. patens*) are nonnative, invasive plants in several estuaries along the west coast of North America. As ecological engineers, spreading rapidly by both seeds and rhizomes and forming dense monocultures, they can severely alter the natural hydrology and ecology of invaded habitats (Pfauth et al. 2003). Dense mats of *Spartina* are very effective at trapping sediments and, because of this effect, *Spartina* has, in the past, been intentionally introduced into coastal areas for erosion control. *Spartina* also impacts resident and migratory shorebirds by converting their foraging habitat, the unvegetated, intertidal mudflats, to densely vegetated salt marsh (Pfauth et al. 2003). The growth of *Spartina* is also detrimental to eelgrass beds and the pelagic species that depend on them for food (Pfauth et al. 2003).

While *Spartina* has not been discovered growing in the lower Columbia River system, potentially viable seeds have been found associated with rafts of vegetation stranded along the interior mouth of the estuary (David Jay pers. com).

POLYGONACEAE

*Polygonum hydropiperoides* Michx. swamp smartweed
LIT
Origin: Native

Origin: Native Range: Western California, from the dry regions of the Great Basin and the Mojave desert to the Pacific coast north to Canada, eastern North America and Mexico. (Hickman 1993).

PONTEDERIACEAE

*Eichhornia crassipes* (Mart.) Solms water hyacinth
LIT
Origin: Introduced*

Origin: Introduced throughout the southern United States and California, *Eichhornia crassipes* is native to South America (Hickman 1993). It is not established in the lower Columbia River basin and, due to colder winter temperatures, probably can’t overwinter in the Pacific Northwest. Nevertheless, this popular ornamental pond species has been found in a few Washington sloughs near Longview where it is now believed to have been successfully eradicated (Jennifer Parsons pers comm.). These were either escaped plants or unwanted plants from residential ponds.
Kingdom: Plantae  
Division: Magnoliophyta

*E. crassipes* is an unwanted aquatic plant because its dense mats clog waterways, making boating, fishing and almost all other water activities, impossible while greatly reducing water flow and oxygen levels within the mats. Furthermore water hyacinth greatly reduces biological diversity: mats eliminate native submersed plants by blocking sunlight, alter emersed plant communities by pushing away and crushing them, and also alter animal communities by blocking access to the water and/or eliminating plants the animals depend on for shelter and nesting (IFAS 2004).

**POTAMOGETONACEAE**

*Potamogeton crispus* L.  
Curly-leaf pondweed, curly pondweed  
LCRANS, LIT  
Origin: Introduced

A native of Eurasia, *Potamogeton crispus* is now found worldwide. The earliest records of *Potamogeton crispus* in the United States that can be verified date its introduction as sometime in the 1860’s. However, there are reports that date the species presence in this country to as early as 1807 (Cohen, Carlton 1995). The first documented appearance of *Potamogeton crispus* in Oregon was in the Rogue River, Curry County, 1947 (Stuckey 1979). The establishment of *Potamogeton crispus* is due to a combination of intentional introductions, careless disposal of aquaria and escapes from cultivation (Les and Mehrhoff 1999). Though, if the species were present as early as the 1807 reports state, this would point to yet another means of introduction. During the early 20th century *Potamogeton crispus* was deliberately planted in marshes for waterfowl forage and aquatic wildlife habitat. Migrating waterfowl may also have a role in dispersing *Potamogeton crispus*. Additionally, activities associated with fish hatcheries and stocking may have transported the species between water bodies. *Potamogeton crispus* also became a popular aquarium and water garden plant during the early 20th century (Les and Mehrhoff 1999). A cold-water species, it can survive the winter in most areas of the United States, which is likely one reason it became popular with water gardeners. The primary form of propagation in *Potamogeton crispus* is by turions, a form of vegetative reproduction. Turions are formed in late spring. Being a cold-water species, *Potamogeton crispus* dies back and goes dormant when water temperatures are high during the summer months. When fall arrives the turions germinate and develop into plants that remain viable throughout the winter. The plants are the most robust during the spring; this is usually when they become a nuisance (Les and Mehrhoff 1999). *Potamogeton crispus* is a highly invasive species with increasing populations.  
Citations:

*Potamogeton epihydrus* Raf.  
LCRANS  
Origin: Native  
*Potamogeton foliosus* Raf.  
LIT  
ribbonleaf pondweed  
leafy pondweed

Appendices: page 36
Kingdom: Plantae  
Division: Magnoliophyta

Origin: Native  
*Potamogeton friesii* Rupr.  
LIT  
Fries' pondweed

Origin: Native  
*Potamogeton natans* L.  
LCRANS  
Floating pondweed

Origin: Native  
*Potamogeton pectinatus* (L.) Boerner  
LCRANS  
Sago pondweed

Origin: Native  
*Potamogeton pusillus* L.  
LCRANS  
Small pondweed

Origin: Native  
*Potamogeton richardsonii* (Benn.) Rydb.  
LCRANS, LIT  
Richardson's pondweed

Origin: Native  
*Potamogeton zosteriformis* Fern.  
LCRANS  
Flatstem pondweed

There are about 80-90 species of *Potamogeton* in the world (IFAS) and perhaps 20 of them occur in the Pacific Northwest (Ecology 2001). Most of them are native species and several of them, such as *P. pectinatus*, are considered invasive species in other parts of the world. They occur in a variety of aquatic habitats. Some pondweeds are totally submersed, others have floating leaves. Although some may vary greatly in size and leaf shape, many *Potamogeton* species are notoriously difficult to tell apart. Pondweeds are very important as wildlife food and some are sold commercially as aquarium or pond plants.

**RANUNCULACEAE**

*Caltha palustris* L. var. *palustris*  
LIT  
Yellow marsh marigold

This marsh marigold is circumboreal in distribution and can be found along the edges of ponds and sloughs in moist soil (Rook 2002). The roots of *Caltha palustris* were commonly used by Native Americans for medicinal purposes.

**ROSACEAE**

*Argentina anserina* (L.) Rydb.  
Syn: *Argentina argentina, Potentilla anserina*  
LIT  
Pacific silverweed

Appendices: page 37
Kingdom: Plantae
Division: Magnoliophyta

Origin: Native

Native to the coastal dunes, marsh edges and sandy bluffs of the western U.S. from Alaska to Southern California coastal areas, *Argentia anserine* also is sometimes found inland at low elevations.

RUBIACEAE

*Galium trifidum ssp. columbianum* (Rydb.) Hultén threepetal bedstraw
LIT
Origin: Native

*Galium trifidum ssp. columbianum* is distributed throughout the western U.S. and parts of the northern states and Canada (USGS-NRCS 2004).

RUPPIACEAE

*Ruppia maritima* L.- widgeon-grass
LCRANS, LIT
Origin: Cryptogenic

Opportunistic and tolerant to a wide range of environmental conditions, *Ruppia maritima* L. is found worldwide. Typically an inhabitant of marginal seagrass habitats, *Ruppia maritima* L can also be present as a subdominant species, becoming dominate when environmental conditions change. There are indications that *Ruppia maritima* L. becomes dominant in environmentally degraded areas and under unfavorable climatic conditions (Johnson et al. 2003).

SALICACEAE

*Salix hookeriana* Barratt ex Hook. dune willow, coastal willow
LIT
Origin: Native

Native to the western coast of North America the coastal willow if found from Northern California to Alaska (Hickman 1993).

SCROPHULARIACEAE

*Castilleja ambigua* Hook. & Arn. ssp. ambigua johnny-nip, Indian paintbrush, owl clover, purple owl’s clover
Syn: *Orthocarpus exsertus, Orthocarpus purpurascens*
LIT

Appendices: page 38
Kingdom: Plantae  
Division: Magnoliophyta

Origin: Native


Gratiola ebracteata  Benth. ex A. DC  bractless hedgehyssop  
LIT  
Origin: Native

Gratiola ebracteata can be found along the shorelines of lakes, ponds, and rivers, but never grows in deep water (Ecology 2001). Unlike G. neglecta, it is found only from southern British Columbia south to California and east to Montana (Ecology 2001, USDA-NRCS 2004).

Gratiola neglecta  Torr.  clammy hedgehyssop  
LIT  
Origin: Native

Gratiola neglecta  can be found along the shorelines of lakes, ponds, and rivers, but never grows in deep water (Ecology 2001). It is distributed throughout most of the U.S. and Canada.

Limosella aquatica L.  water mudwort, awl-leaf mudwort, northern mudwort  
LIT, LCRANS, LIT  
Origin: Native

May be a circumboreal species. In the U.S. it is distributed throughout the west and mid-west. Also found in Eurasia.

Mimulus guttatus  DC.  seep monkeyflower  
LIT  
Origin: Native

Distributed throughout the Western US, Canada and the great lakes region.

SPARGANIACEAE

Sparganium erectum  L.  simplestem bur-reed  
LIT  
Origin: Introduced*

Sparganium erectum, a federally listed noxious weed, was distributed to as many as 35 states, from Alaska to Georgia, after the Home Depot received it in a shipment of exotic reeds from Holland and sold them as pond plants (WAMPS 1999). This reed can choke Appendices: page 39
waterways and interfere with recreation in shallow waters. The 6-foot-long, green reed has a small yellow flower that contains a bur-like fruit. The plant was not known to exist in the United States before the Dutch shipment arrived. State and federal agriculture inspectors scrambled to recover as many plants as possible but it is not known if attempts to collect all species were successful. Washington and Oregon are two states where shipments of the contaminated plants are believed to have been shipped.

*Sparganium angustifolium* Michx. narrowleaf bur-reed

Narrow-leaf burr reed is native to the Western US, Alaska and can be found throughout the Great Lakes region. *Sparganium* is fodder for waterfowl, muskrats and deer. Stem base and tubers are edible (Ecology 2001).

**TYPHACEAE**

*Typha angustifolia* L.- Narrowleaf / Narrowed-leaved Cattail, Nail Rod

Endemic to Eurasia, *Typha angustifolia* is now found in South America and throughout North America. The presence of *Typha angustifolia* on the eastern coast of the United States was reported in the 1820s (Cohen, Carlton 1995). The species was possibly introduced to the Atlantic coast by dry ship ballast. *Typha angustifolia* was apparently used for matting and pillow stuffing. Parts of the plant were also eaten. These uses may have facilitated the dispersal of the species (Mills et al. 1993). *Typha angustifolia* is a perennial plant that is invasive and capable of spreading rapidly.

*Typha latifolia* L. broadleaf cattail

Origin: Native

Origin: Nativespecies, distributed widely throughout North America and in temperate parts of Central America, Eurasia, and Africa (Hickman 1993).

**ZANNICHELLIACEAE**

*Zannichellia palustris* L. horned pondweed

Appendices: page 40
A delicate underwater branching perennial this plant has a more or less worldwide distribution and is common throughout North America. In Washington, horned pondweed is common in hard water lakes of the Columbia Basin (Ecology 2001). It may be confused with *Ruppia maritima*.

**ZOSTERACEAE**

*Zostera japonica* Aschers. and Graebn  
Japanese eelgrass, dwarf eelgrass  
LCRANS, LIT  
Origin: Introduced

Native to Japan, *Zostera japonica* is now established on the coast of the Pacific Northwest. The first recorded collection of the species on the Pacific coast was from Washington State in 1957. *Zostera japonica* has been observed to be abundant in several areas of the Pacific Northwest coast that have been or are presently used for intensive oyster cultivation. It has been suggested that *Zostera japonica* was possibly used as packing material when oyster spat was shipped from Japan to oyster farms in the PNW. Being an annual plant, *Zostera japonica* is a prolific seed producer. Seeds may now be the primary mode of dispersal for this species (Harrison and Bigley 1982).

*Zostera marina*  
common eelgrass  
LIT  
Origin: Native

*Zostera marina* is widespread throughout the Atlantic and Pacific. In the eastern Atlantic it extends from the Arctic Circle to Gibraltar, including the Mediterranean. *Z. marina* forms large colonies on muddy substrates especially in estuaries, and also occurs on sandy substrates where there is weak wave action.
Kingdom: Animalia

Phylum: Porifera

The sponges

The identification of freshwater sponges depends on characteristics of spicules and on features of intact gemmules. Species identifications depend absolutely on obtaining all types of the spicules (megascleres, gemmoscleres and, if present, microscleres) (Penny and Racek 1968; Thorp and Covich 2001). Gemmoscleres are particularly important but they may occur only during certain times of the year (Thorp and Covich 2001:115). Spicule preparations require digestion of the tissue in nitric acid in a tube immersed in boiling water for 1 hour, followed by centrifugation. The acid is then poured off and the spicules are washed in ethanol (Penny and Racek 1968, Thorp and Covich 2001).

The procedures necessary for preliminary identification were beyond the scope of this investigation although one sponge, a forest-green specimen was collected from a freshwater site at Sauvies Island, Oregon.

Phylum: Ciliophora

Class: Ciliatea

Ciliates

Protozoans are often overlooked but play a major role in nutrient cycling (Taylor and Sanders 2001).

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<tr>
<th>Didiniidae</th>
<th>LCRANS</th>
<th>Native</th>
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<tr>
<td><em>Mesodinium rubrum</em></td>
<td>LCRANS</td>
<td>Native</td>
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DIDINIIDAE

*Mesodinium rubrum* (Lohmann, 1908)

Synonyms: *Cyclotrichium meunieri, Halteria rubra, Myrionecta rubra*

Origin: Native

LCRANS

Collected from Ilwaco Harbor and Young's Bay in October 2002 during a red tide, this is a solitary, bloom-forming, obligate autotroph (Lindholm 1985). This species contains a commensal photosynthetic alga (an endosymbiotic cryptophyte chloroplast) and is nontoxic. Identified by Dr. Rita Horner and Dr. Jin Wan Lee, it is probably a complex of
closely related species. Dr. Horner relates that it is common in the northeast Pacific and considers it a native species. The unexplained global distribution of *Mesodinium rubrum* could result from it being a complex of closely similar geographically isolated species or from widespread introductions of one or more of its populations.

**Phylum: Cnidaria**  
Class: Anthozoa

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<th>Class: Anthozoa</th>
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<td>Edwardsiidae</td>
<td>Nematostella vectensis</td>
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**EDWARDSIIDAE**

*Nematostella vectensis* Stephenson, 1935  
Syn: *Nematostella pellucida*  
LCRANS, LIT  
Origin: Introduced

Fifteen *Nematostella vectensis* were collected alive from muddy sand habitats and a shallow pool of a high *Carex* salt marsh in the lower Columbia River. J. T. Carlton (in correspondence) suggests that this species may have a trans-Arctic distribution i.e. ranging south from the Arctic on northern coastlines of the northern hemisphere to northern Japan, Puget Sound, Cape Cod, and the Bay of Biscay. Hand and Uhlinger (1991) demonstrated that the low latitude populations are a single species by interbreeding females from England, Maryland, Georgia, California, Oregon and Washington with males from Nova Scotia, Maryland, Georgia and Oregon in a total of 24 crosses which all produced healthy first and second generations. The global distribution of *N. vectensis* therefore appears unlikely to be of natural processes. The lack of large-scale genetic patterns among populations in different lagoons of Great Britain is consistent with occasional passive or anthropogenic dispersal of low number of individuals between lagoons (Pearson et al. 2002). Natural occurrences of the isolated British *Nematostella* populations therefore would be difficult to explain. More likely, the British populations are introduced.

Kozloff (1983) concludes that northeast Pacific *N. vectensis* are an Atlantic species for which “the exact date of introduction into our region is unknown” while Carlton (2000) lists N. vectensis as “cryptogenic” in Coos Bay. Confusion over the origins of the northeast Pacific *Nematostella* may partly result from poor information the likely expansion of its populations since the early 1900s and its occurrence only from San Francisco Bay north, a relatively narrow range if this were a native northeast Pacific species. Hand (1957) reported “This anemone probably is the ‘will-of-the-wisp’ species that I have hunted for more than 10 years in California. In 1946, the late Prof. S. F. Light described to me a very small anemone he had seen in small pools on the Salicornia marshes of Richardson’s Bay (a part of San Francisco Bay).” Since 1957, published reports of northeast Pacific, *Nematostella* are only from Puget Sound, Washington, Coos

Appendices: page 43
Bay, Oregon, Tomales Bay, California, and San Francisco Bay, California (Kozloff 1983, 
Hand & Uhlinger 1994). However, Jeff Cordell has found *N. vectensis* in almost every 
salt marsh of Oregon and Washington he has sampled in the last 20 years. In a 1994 
survey of Trestle Bay in the lower Columbia River, prior to the breaching of the jetty, 
densities of *N. vectensis* were reported as 2,715/m² but two years after the breach no 
cnidaria were found (Hinton and Emmett 2000).

The geographical and climatic range of *Nematostella vectensis* on the eastern North 
American coast, from Nova Scotia to Georgia and western Florida to Louisiana (Hand & 
Uhlinger 1994) is much broader than the European or eastern Pacific ranges. Nova 
Scotia is colder and the Gulf of Mexico is warmer than temperatures of southern and 
eastern Britain and the eastern Pacific coast between Puget Sound and San Francisco. *N. vectensis* would therefore require pre-adapted thermal tolerances of occur western 
Atlantic and Gulf of Mexico range if it is native to the eastern Pacific or Europe. 
Therefore *N. vectensis* is more likely to be the native to the western Atlantic and Gulf of 
Mexico.

Hand and Uhlinger (1994) considered ballast water transport to be the most likely 
mechanism for dispersing *Nematostella* since it does not occur on hard substratums and is 
unlikely to be introduced with transplanted oysters, on ship hulls or in the fouling faunas 
associated with other hard substratums. The asexual reproduction of this species Hand 
and Uhlinger (1992) allows it to colonize new habitats with very few original propagules. 
Moreover, well-fed individuals can grow to 16 cm in length and individuals can survive 6 
months of starvation (Hand and Uhlinger 1992). The extreme durability of this species 
and its close association with high intertidal sediments suggest that it could have been 
introduced to Britain and to the western United State in ballast sediments of early sailing 
ships. Many records of England indicate the regular use of ballast on board sailing 
vessels of the North Atlantic trade (Prowse 1895) and Dana (1840) reported sailing ship 
ballast dumped from the eastern United States directly into San Francisco Bay. Moreover 
Lindroth (1957) elegantly established the faunal connections between eastern and western 
North America and Great Britain via ballast sediments of sailing ships.

Class: Hydrozoa

<table>
<thead>
<tr>
<th>Clavidae</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><em>Cordylophora lacustris</em></td>
<td>LCRANS, LIT</td>
<td>Introduced</td>
</tr>
<tr>
<td>Hydridae</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Hydra spp.</em></td>
<td>LCRANS</td>
<td></td>
</tr>
</tbody>
</table>

CLAVIDAE

*Cordylophora lacustris* Agassiz, 1862
Syn: *Cordylophora caspia*
LCRANS, LIT
Origin: Introduced
Cordylophora lacustris is probably native to the Caspian Sea and the Black Sea. The first report of eastern Pacific C. lacustris is based on specimens collected in the lower Columbia River near Astoria, Oregon from pilings and posts in low salinity or fresh water in 1965 (Haertel and Osterberg 1967). However, Carlton (1979) found specimens collected from Lake Union, Washington in 1920 and (Cohen and Carlton 1995) found specimens from San Francisco Bay, California collected around 1930. Cordylophora lacustris was likely spread world wide prior to the 20th century in association with ship fouling and ballast water (Carlton 1979, Cohen and Carlton 1995).

Phylum: Ectoprocta
Class: Phylactolaemata

Ectoprocts were commonly lumped together with the entoprocts and referred to generally as “Bryozoa” (Thorp & Covich 2001). The class Phylactolaemata is an exclusively freshwater colonial group of ectoprocts. Adult stages attach to submerged surfaces such as branches, rocks and logs. The phylactolaemates form statoblasts dormant seed-like buds that are resistant to dessication and can remain dormant for long periods. The statoblasts are a likely life history stage for natural or anthropgenic transport between water bodies. The distributions of ectoprocts across North America are poorly known. Few large area surveys of bryozoa have been conducted in northwestern North America (see Wood 2001). Marsh and Wood (2002) were the first to survey freshwater bryozoans of the Pacific Northwest and records from outside of northeastern North America are few (Marsh and Wood 2002).

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Status</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fredericellidae</td>
<td>Fredericella browni</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td></td>
<td>Fredericella indica</td>
<td>LCRANS, LIT</td>
<td>Introduced</td>
</tr>
<tr>
<td>Pectinatellidae</td>
<td>Pectinatella magnifica</td>
<td>LCRANS, LIT</td>
<td>Introduced</td>
</tr>
<tr>
<td></td>
<td>Plumatella emarginata</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td></td>
<td>Plumatella vaihiriae</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
</tbody>
</table>

FREDERICELLIDAE

Fredericella browni Rogick, 1945
LIT
Origin: Cryptogenic

Collected from the Willamette River below the Oregon City Falls (Marsh and Woods 2002) and at three other Pacific Northwest sites. This is not a common species in Northeastern and Central United States where most bryozoan surveys have taken place (Marsh and Woods 2002). Specimen have also been reported in India (Pachut 1998).
**Fredericella indica** (Annandale, 1909)
LCRANS, LIT
Origin: Introduced

This species is common throughout North America especially in eastern states, at scattered sites in Europe, Africa, and Asia, and probably includes several species not yet distinguished (Thorp & Covich 2001). Distribution data for both U.S. states and Canadian provinces is likely incomplete. A month-long collection trip of bryozoans and sponges in the Pacific Northwest encountered this species at only four widely dispersed localities (Marsh and Wood 2002). While the origin of this species remains uncertain (likely eastern North America were it is very common) we consider *F. indica*, which is widespread in the lower bays of the basin (in brackish as well as freshwater), to be introduced into the lower Columbia River. Further surveys may reveal less disjunct distributions, however.

PECTINATELLIDAE

**Pectinatella magnifica** (Leidy, 1851)
Syn: *Fredericella magnifica*
LCRANS, LIT
Origin: Introduced

The gelatinous masses of *Pectinatella magnifica* form gelatinous colonies on submerged wood of any kind including docks Smith (2003). Massive colonies may exceed 60 cm in diameter, however colony sizes of less than 10 cm may go unnoticed for long periods until residents are "shocked" by its sudden appearance when ecological conditions favor massive “alien-like” colonies (Smith 2001). *P. magnifica*, is widely distributed east of the Mississippi River and is likely to be endemic to eastern and central North America (Smith 2001). Marsh and Wood (2002) found *P. magnifica* throughout Oregon including the Columbia River. The first records of *P. magnifica* in the lower Columbia River are from the late 1990s (see EMAP 2001 and Marsh and Wood 2002). Previously, *P. magnifica* had only been recorded from as far west as eastern Texas. *Pectinatella magnifica* has been introduced to Japan, Korea, India, and Europe (Smith 2001). The first records of *P. magnifica* in the lower Columbia River are from the late 1990s (see EMAP 2001 and Marsh and Wood 2002). The anchor-spiked statoblasts of *P. magnifica* are highly adapted for hooking onto fur and feathers for dispersal on birds and mammals between isolated water bodies in regions where it occurs.

**Plumatella emarginata** Allman 1844
LIT
Origin: Cryptogenic

Occurring in North America, Great Britain, India, Australia and Japan; it is cosmopolitan in northern hemisphere and may be endemic to Europe (Wood 2001).
Kingdom: Animalia
Phylum: Ectoprocta

**Plumatella vaihiriae** (Hastings 1929)
Syn: *Hyalinella vaihiriae*
LIT
Origin: Cryptogenic – probably introduced

Previously known only from four sites in North America three of which are wastewater treatment plants, Marsh and Wood (2002) collected *Plumatella vaihiriae* from Oaks Bottom Slough (off of the Willamette River) in 1998. *Plumatella vaihiriae* is a nuisance fouling organism (Wood and Marsh 1999). The type locality of *P. vaihiriae* is a high mountain pond in Tahiti and it is known also from Hawaii and Argentina (Wood and Marsh 1999). An unconfirmed report of *P. vaihiriae* is from Australia (Wood and Marsh 1999). Unlike *Pectinatella magnifica* *P. vaihiriae* is characterized by rapid growth and massive colonies (Wood and Marsh 1999, Marsh and Wood 2002). Given its wide geographic range and limited literature citations this species is likely an invader but not enough information exists to confirm this.

Phylum: Entoprocta

The Entoprocts are a small group of species (~ 60 in all) that are distinct from the Ectoprocts but often lumped with them and referred to together as “Bryozoa.” *Urnatella* is the only freshwater genus in the phylum. Little is known about the distribution of entoprocts in North America as only a few large area surveys of bryozoa have been conducted (see Wood 2001) and most records from outside of northeastern North America only report relatively few species from a limited number of localities (Marsh and Wood 2002).

<table>
<thead>
<tr>
<th>Urnatellidae</th>
<th>LIT</th>
<th>Cryptogenic</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Urnatella gracilis</em></td>
<td></td>
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</tbody>
</table>

**URNATELLIDAE**

*Urnatella gracilis* Leidy 1851
LIT
Origin: Cryptogenic

Considered by Thorp and Covich (1991) to be the most common and widely distributed of the *Urnatella*, *Urnatella gracilis* is the only species of the genus reported from North America where its distribution ranges from the east to west coast and from Texas to Michigan. *U. gracilis* has a true cosmopolitan distribution as it is found on every continent but Antarctica and Australia (Thorp and Covich 1991).
Kingdom: Animalia
Phylum: Nemertea

Phylum: Nemertea
Class: Enopla

Nemertean identifications were not conducted by LCRANS.

<table>
<thead>
<tr>
<th>Emplectonematidae</th>
<th>Paranemertes californica</th>
<th>LIT</th>
<th>Native</th>
</tr>
</thead>
</table>

EMPLECTONEMATIDAE

*Paranemertes californica* Coe 1904
LIT
Origin: Native

Native to littoral and benthic sites in the Pacific. Reported by EMAP 1999 and EMAP 2000 collections.

Phylum: Annelida
SubClass: Oligochaeta

Very few macroinvertebrates are more poorly studied in the lower Columbia River than the oligochaetes. Few prior studies on the lower Columbia conducted oligochaete identifications, only noting the presence of oligochaetes when encountered. There are several reasons for this. Oligochaete taxonomy is widely regarded as a difficult field and expert identifications may be beyond the scope of many projects. In addition, traditional sorting and preserving techniques used for benthic samples often damage worms beyond identification. Very little is known about native origins and transport of many species, the majority of species are simply labeled as having cosmopolitan or near cosmopolitan distributions.

In the lower Columbia River special interest was paid to proper oligochaetes collection and preservation. In 2003 oligochaete samples were identified by Dr. Steve Fend. *Teneridrilus columbiensis* (a species named after its collection location – the Columbia River) was not found in the course of our sampling. Furthermore, some species limited to specific habitats (like banks or sandy weed beds) may not have been found at multiple stations because few such habitats were sampled overall. Of the seven native species collected, only three were found at nine or more stations (out of 45 possible stations) further indicating that collection efficiency was low and more comprehensive collection efforts should be undertaken.

Introduction mechanisms for oligochaetes are varied. Ballast water is a likely vector for many species, others may arrive in new habitats associated with sediments of nonnative ornamental aquatic plants or semi-aquatic plants.

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While oligochaetes are considered freshwater organisms but species such as *Tubifex tubifex* and *Limnodrilus hoffmeisteri* can withstand exposures of up to 10 ppt (Brinkhurst and Gelder 2001). Most others can only survive exposures of 5 ppt or less. However, recent studies have shown that low salinity water may improve the ability of oligochaetes to withstand stress (Brinkhurst and Gelder 2001).

<table>
<thead>
<tr>
<th>Enchytraeidae</th>
<th></th>
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<tbody>
<tr>
<td><em>Enchytraeus spp.</em></td>
<td>LIT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lumbriculidae</th>
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</thead>
<tbody>
<tr>
<td><em>Eclipidrilus n. sp.</em></td>
<td>LCRANS, LIT Native</td>
</tr>
<tr>
<td><em>Kincaidiana hexathea</em></td>
<td>LCRANS Native</td>
</tr>
<tr>
<td><em>Rhyenchelmis sp.</em></td>
<td>LCRANS</td>
</tr>
<tr>
<td><em>Stylodrilus heringianus</em></td>
<td>LCRANS Introduced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Naididae</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Amphichaeta sannio</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Arcteonais lomondi</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Chaetogaster diaphanous</em></td>
<td>LCRANS Introduced</td>
</tr>
<tr>
<td><em>Chaetogaster nr. diastrophus</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Dero digitata</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Nais cf. elinguis</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Nais cf. simplex</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Nais communis</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Nais pardalis</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Nais variabilis</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Ophidonais serpentina</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Paranais frici</em></td>
<td>LCRANS Introduced</td>
</tr>
<tr>
<td><em>Paranais litoralis</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Pristina aequiseta</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Pristina osborni</em></td>
<td>LCRANS, LIT Cryptogenic</td>
</tr>
<tr>
<td><em>Slavina appendiculata</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Stylaria lacustris</em></td>
<td>LCRANS Cryptogenic</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Ocnerodrilidae</th>
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</tr>
</thead>
<tbody>
<tr>
<td><em>Eukerria saltensis</em></td>
<td>LCRANS Introduced</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Tubificidae</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aulodrilus pluriseta</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Bothrioneurum vejdovskyanum</em></td>
<td>LCRANS, LIT Cryptogenic</td>
</tr>
<tr>
<td><em>Branchiura sowerbyi</em></td>
<td>LCRANS, LIT Introduced</td>
</tr>
<tr>
<td><em>Ilyodrilus frantzi</em></td>
<td>LCRANS, LIT Native</td>
</tr>
<tr>
<td><em>Ilyodrilus templetoni</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Limnodrilus hoffmeisteri</em></td>
<td>LCRANS Cryptogenic</td>
</tr>
<tr>
<td><em>Limnodrilus silvani</em></td>
<td>LIT Cryptogenic</td>
</tr>
<tr>
<td><em>?Limnodrilus udekemianus</em></td>
<td>LCRANS, LIT Cryptogenic</td>
</tr>
<tr>
<td><em>Rhyacodrilus coccineus</em></td>
<td>LCRANS, LIT Cryptogenic</td>
</tr>
<tr>
<td><em>Rhyacodrilus spp.</em></td>
<td>LIT</td>
</tr>
</tbody>
</table>
Kingdom: Animalia  
Phylum: Annelida

<table>
<thead>
<tr>
<th>Species</th>
<th>Source</th>
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<tbody>
<tr>
<td>Spirosperma nikolskyi</td>
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</tr>
<tr>
<td>Spirosperma spp.</td>
<td>LIT</td>
<td></td>
</tr>
<tr>
<td>Tasserkidrilus harmani</td>
<td>LCRANS, LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Telmatodrilus vejovsky</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Teneridrilus columbiensis</td>
<td>LIT</td>
<td>Native</td>
</tr>
<tr>
<td>Teneridrilus mastix</td>
<td>LCRANS, LIT</td>
<td>Native</td>
</tr>
<tr>
<td>Teneridrilus cf. calvus</td>
<td>LCRANS, LIT</td>
<td>Native</td>
</tr>
<tr>
<td>Tubifex tubifex</td>
<td>LCRANS, LIT</td>
<td>Native</td>
</tr>
<tr>
<td>Tubificidae sp 1</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Tubificidae sp 2</td>
<td>LIT</td>
<td></td>
</tr>
<tr>
<td>Varichaetadrilus pacificus</td>
<td>LCRANS, LIT</td>
<td>Native</td>
</tr>
</tbody>
</table>

LUMBRICULIDAE

Eclipidrilus n. sp.  
LCRANS, LIT  
Origin: Native

First collected from the lower Columbia River during Miller Sands examination (Date) not enough specimens were collected to make ID. LCRANS collected this species from Miller Sands as well as other sites in Cathlamet Bay. Further collections need to be conducted to gather more type specimens.

Kincaidiana hexatheca Altman, 1936  
LCRANS  
Origin: Native

Identified and labeled as native to northwestern North America by Steve Fend.

Stylophlorus heringianus Claparede, 1862  
LCRANS  
Origin: Introduced

This is a holarctic freshwater species whose status as an invasive species has been debated for many years (See Brinkhurst 1968, 1976). Likely native to Europe, this species has also been collected from places as diverse as Japan, Malaysia, and Egypt indicating that transport and introduction of *Stylophlorus heringianus* is certainly possible.

NAIDIDAE

Amphichaeta sannio Kallstenius, 1892  
LCRANS  
Origin: Cryptogenic – probably introduced

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Kingdom: Animalia  
Phylum: Annelida

Considered a European estuarine species by some (not reported from North America prior to the publication of Kathman and Brinkhurst 1998). Possibly synonymous with *A. raptisae*. Steve Fend considers this of unknown origin with a holarctic distribution.

*Arcteonais lomondi* (Martin 1907)  
LCRANS  
Origin: Cryptogenic

Widespread (Kathman and Brinkhurst 1998), unknown origin, holarctic distribution.

*Chaetogaster diaphanus* (Gruithuisen, 1828)  
Syn: *Nais diaphana*, *Chaetogaster diphanus cyclops*  
LCRANS  
Origin: Introduced

A freshwater species with a holarctic distribution (S. Fend personal communication), *Chaetogaster diphanous* is considered by the California Department of Fish and Game to be an introduced species (CDFG 2002). During their survey of the California coastal and estuarine waters this species was found only in the Sacramento San Joaquin Delta region of the San Francisco Bay (CDFG 2002). In the lower Columbia River a single specimen of *C. diaphanous* was found at a station located at the mouth of the Columbia Slough in Portland. Although its native range is unknown, the scattered and rare distribution of this species along the West Coast likely indicates that it is indeed nonnative to this region.

*Chaetogaster nr. diastrophus* (Gruithuisen 1828)  
syn: *Pseudochaetogaster longmeri*, *C. langi*  
LCRANS  
Origin: Cryptogenic

Widespread (Kathman and Brinkhurst 1998), near cosmopolitan, possibly holarctic in origin.

*Dero digitata* (Muller 1773)  
Syn: *Nais digitata*  
LCRANS  
Origin: Cryptogenic – probably introduced

Widespread (Kathman and Brinkhurst 1998), near cosmopolitan, probably tropical in origin.

*Nais cf. elinguis* Muller 1773  
LCRANS  
Origin: Cryptogenic

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Kingdom: Animalia
Phylum: Annelida

Widespread (Kathman and Brinkhurst 1998), near cosmopolitan, possibly holartic in origin.

*Nais cf. simplex* Piguet 1906
LCRANS
Origin: Cryptogenic

Widespread east of the Mississippi, also known from British Columbia (Kathman and Brinkhurst 1998), near cosmopolitan, possibly holartic in origin.

*Nais communis* Piguet 1906
LCRANS
Origin: Cryptogenic

Widespread (Kathman and Brinkhurst 1998). *Nais communis* and *N. variabilis* features often overlap, complex needs revision overall.

*Nais pardalis* Piguet 1906
LCRANS
Origin: Cryptogenic

Widespread, previously known as a variant of *N. bretscheri*, often confused with *N. variabilis* (Kathman and Brinkhurst 1998). Near cosmopolitan distribution, possibly holartic in origin.

*Nais variabilis* Piguet 1906
LCRANS
Origin: Cryptogenic

Widespread (Kathman and Brinkhurst 1998). *Nais communis* and *N. variabilis* features often overlap, complex needs revision overall.

*Ophidonais serpentina* (Muller 1773)
Syn: *Nais serpentina*
LCRANS
Origin: Cryptogenic

Widespread (Kathman and Brinkhurst 1998), unknown origin, near cosmopolitan distribution.

*Paranais frici* Hrabe, 1941
Syn: *Wapsa mobilis?*
LCRANS
Origin: Introduced
Near cosmopolitan distribution. It is most often found in coastal waters, but usually in freshwater. This is a brackish water genus (likely originated in the Tethys) (Timm 1980). Considered introduced in San Francisco Bay and parts of Southern California by Brinkhurst and Cook (1980) and Cohen and Carlton (1995). Two specimen were collected in the lower Columbia River in a grab sample taken at the Sportsmen’s Club boat launch in Kalama, WA. Species is present in Kozloff (1987) and probably established in the Pacific Northwest, but requires further confirmation. Considered introduced in the Baltic and in the Great Lakes. Timm (1980) considers it recently introduced to North America.

*Paranais litoralis* (Muller 1784)
Syn: *Nais litoralis*
LCRANS
Origin: Cryptogenic

Widespread, mostly coastal in tidal fresh or brackish water (Kathman and Brinkhurst 1998) but of unknown origin.

*Pristina aequiseta* Bourne 1891
Syn: *P. foreli* and *P evelinae*
LCRANS
Origin: Cryptogenic

Widespread (Kathman and Brinkhurst 1998).

*Pristina osborni* (Walton 1906)
Syn: *Naidium minutum, Naidium osborni Pristina minutum*
LCRANS, LIT
Origin: Cryptogenic

Member of a “group of taxonomically problematic species” (Collado and Schmelz 2002). Kathman and Brinkhurst (1998) report it from Illinois, the east coast of North America and Argentina.

*Slavina appendiculata* (d’Udekem 1855)
Syn: *Nais appendiculata, Nais gracilis*
LCRANS
Origin: Cryptogenic

Widespread (Kathman and Brinkhurst 1998), near cosmopolitan, unknown origin.

*Stylaria lacustris* (Linnaeus 1767)
Syn: *Nereis lacustris, Nereis proboscidea*
LCRANS
Origin: Cryptogenic
Widespread (Kathman and Brinkhurst 1998), holarctic and African distribution, possibly holarctic in origin.

OCNERODRILIDAE

Eukerria saltensis (Beddard, 1895)
LCRANS
Origin: Introduced

Native to South America, this worm is considered an invasive pest species in Australia where severe infestations can damage rice crops (see http://www.ricecrc.org/reader/Oligochaeta_aquatic_earthworms.htm). It is not an obligate aquatic species, and can survive in irrigated pastures. It is considered a tropical species with a near cosmopolitan distribution.

TUBIFICIDAE

Aulodrilus pluriseta (Piguet 1906)
Syn: Naidium pluriseta
LCRANS
Origin: Cryptogenic

The genus Aulodrilus is currently being rewritten to clear up misidentifications especially A. pluriseta and A. japonica (Kathman and Brinkhurst 1998). A widespread species, most North American A. pluriseta may actually be A. japonica.

Bothrioneurum vejdovskyanum Stolc 1886
LCRANS, LIT
Origin: Cryptogenic

Widespread in North America, especially in sandy situations, may be synonymous with B. americanum.

Branchiura sowerbyi Beddard, 1892
LCRANS, LIT
Origin: Introduced

Native to tropical and sub-tropical Asia, Branchiura sowerbyi, is a widely introduced oligochaete. This tubificid worm may have originally been spread around the world in the water and sediments associated with ornamental aquatic plants such as water-lilies (Cohen and Carlton 1995). Often only conspicuous in artificially warm water (where it grows to a large size) B. sowerbyi can be found at locations scattered throughout North America (Brinkhurst 1986). The first record of this species in North America came from the Ohio River in 1930 (Spencer 1932). B. sowerbyi was discovered in San Francisco
Bay in 1950 and the Bay had the only recorded west coast population until now (Cohen and Carlton 1995, NAS 2003). However, as only three specimen were found as a single sampling station on the lower Columbia River (in Crane Lake on Sauvie Island – note a shallow warm lake), we are uncertain as to how widespread or established this population is. In addition, fragments of *B. sowerbyi* may be erroneously identified as *Aulodrilus pluriseta* (Brinkhurst 1986)

*Ilyodrilus frantzi* Brinkhurst 1965  
LCRANS, LIT  
Origin: Native

Distributed throughout western North America.

*Ilyodrilus templetoni* (Southern 1904)  
Syn: *Tubifex templetoni*  
LCRANS, LIT  
Origin: Cryptogenic

Widespread and common. Similar to *Tubifex tubifex* (Kathman and Brinkhurst 1998).

*Limnodrilus hoffmeisteri* Claparede 1862  
LCRANS, LIT  
Origin: Cryptogenic

Native to North America *Limnodrilus hoffmeisteri* is considered a pollution indicator species. *L. hoffmeisteri* can also inhabit brackish waters to 10 ppt (Brinkhurst and Gelder 2001).

*Limnodrilus silvani* Eisen, 1879  
LIT  
Origin: Cryptogenic

*Limnodrilus udekemianus* Claparede 1862  
LCRANS, LIT  
Origin: Cryptogenic – possibly native

May be native to North America but has a cosmopolitan distribution

*Rhyacodrilus coccineus* (Vejdovsky 1875)  
Syn: *Tubifex coccineus*  
LCRANS, LIT  
Origin: Cryptogenic

Widespread North American distribution (Kathman and Brinkhurst 1998), the origin of this species is unclear and complicated by its cosmopolitan distribution.
Kingdom: Animalia
Phylum: Annelida

**Spiroserma nikolskyi** (Lastochkin and Sokolskaya 1935)
syn: *S. variegatus, S. oregonensis, Pelsoscolex oregonensi*,
LCRANS, LIT
Origin: Cryptogenic

Widespread, this genus may need more taxonomic work (Kathman and Brinkhurst 1998). Of unknown origin this species is distributed throughout Asia and North America.

**Tasserkidrilus harmani** (Loden 1979)
Syn: *Tubifex harmani*
LCRANS, LIT
Origin: Cryptogenic

This species is reported as widely distributed species throughout the North America but this is based on prior observations that were not made using all the accepted characteristics (Kathman and Brinkhurst 1998). It is a nearctic species with widely scattered records. It is probably native to North America.

**Telmatodrilus vejdovsky** Eisen 1879
LCRANS, LIT
Origin: Cryptogenic

**Teneridrilus columbiensis** (Brinkhurst and Diaz 1985)
Syn: *Isochaetides columbiensis*
LCRANS, LIT
Origin: Native

Type specimen collected in the lower Columbia River at Miller Sands. Not known from any other locations (Brinkhurst and Diaz 1985, Erseus et al. 1990).

**Teneridrilus mastix** (Brinkhurst 1978)
Syn: *Ilyodrilus mastix*
LCRANS, LIT
Origin: Native

Collected from the Fraser River, British Columbia; Columbia River, Oregon; San Francisco Bay, California; and Pearl River, China (Brinkhurst 1986, Erseus et al 1990). Carlton and Geller (1993) list *T. mastix* as a nonnative species introduced via ballast water from China. The California Department of Fish and Game (2002) lists the same species as cryptogenic but identify its origin as Asia. Although some controversy exists as to the origin of this species we do not believe that enough information exists to contradict the original description of the species as native to western North America.

**Teneridrilus cf. calvus** Erseus and Brinkhurst 1990
LCRANS, LIT
Origin: Native

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Kingdom: Animalia
Phylum: Annelida

Type specimen from Sacramento-San Joaquin Delta, California collected in freshwater muddy sediments (Erseus et al. 1990).

*Tubifex tubifex* (Muller 1774)
Syn: *Lumbricus tubifex*
LCRANS, LIT
Origin: Cryptogenic

Widespread but not as common as general texts suggest, this species occurs in marginal habitats (oligotrophic or hyereutrophic) and cold climates perhaps because it can avoid competition at such extremes (Kathman and Brinkhurst 1998). This is likely a complex with multiple variants. Susceptible to parasite infections such as whirling disease (*Myxobolus cerebralis*). *Tubifex tubifex*, like *Limnodrilus hoffmeisteri*, can withstand prolonged exposure to salinities up to 10ppt (Brinkhurst and Gelder 2001).

*Varichaetadrilus pacificus* (Brinkhurst 1981)
LCRANS, LIT
Origin: Native

Unlike many oligochaetes of the family Tubificidae, *Varichaetadrilus pacificus* is contaminant intolerant (Canfield et al., 1994). This species is native to North America.

Phylum: Annelida
Subclass: Polychaeta

Older polychaete keys specific to the Pacific Northwest are considered to be full of errors and thus the taxonomic certainty of polychaetes found during the literature review is uncertain. Polychaete taxonomy on a world-wide basis is in a state of flux and disagreements between experts on identifications, origins and distribution complicate the process of identifying introduced polychaetes in the lower Columbia River.

Errant Polychaetes

<table>
<thead>
<tr>
<th>Glyceridae</th>
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</thead>
<tbody>
<tr>
<td><em>Glycera americana</em></td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td><em>Glycera macrobranchia</em></td>
<td>LIT</td>
<td>Native</td>
</tr>
<tr>
<td><em>Glycera nana</em></td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td><em>Glycera tenuis</em></td>
<td>LIT</td>
<td>Native</td>
</tr>
<tr>
<td><em>Hemipodus borealis</em></td>
<td>LIT</td>
<td>Native</td>
</tr>
<tr>
<td>Goniadidae</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Glycinde armigera</em></td>
<td>LIT</td>
<td>Native</td>
</tr>
<tr>
<td><em>Glycinde picta</em></td>
<td>LIT</td>
<td>Native</td>
</tr>
<tr>
<td><em>Glycinde polygnatha</em></td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Hesionidae</td>
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</tbody>
</table>

Appendices: page 57
GLYCERIDAE

The family family Glyceridae has been reevaluated by Markus Böggemann (2002). He concluded that of the 172 published species only 42 taxa remain valid. However the polychaete experts and members of the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT 2002) disagreed with many of Böggemann’s conclusions regarding Pacific taxa. In light of this lack of agreement on Glyceridae taxonomy the introduction status of many of these species remains unclear.

 Glycera americana Leidy 1855
 tufted gilled bloodworm
 LIT
 Origin: Cryptogenic

 Glycera macrobranchia Moore 1911
 Synonyms Glycera convoluta
 LIT
 Origin: Native

 Glycera nana Johnson, 1901
 LIT
 Origin: Cryptogenic
Kingdom: Animalia  
Phylum: Annelida

**Glycera tenuis** Hartmann 1944  
LIT  
Origin: Native

Many Glycera spp are reported from areas around the world. The actual origin of most of these species and their pattern of introduction is unknown. The genus Glycera, commonly known as blood worms, contains species typically found on the bottom of shallow marine waters, living on the sandy or silty bottoms of the intertidal or subtidal regions. Species such as *Glycera dibranchiata*, are extensively harvested for use as bait in fishing. While planktonic larval forms exist they may be demersal.

**Hemipodus borealis** Johnson, 1901  
Syn: *Hemipodus roseus*  
LIT  
Origin: Native

Found in mudflats and gravelly or sandy beaches, *Hemipodus borealis*, is common along the shore from British Columbia to Southern California.

**GONIADIDAE**

**Glycine armigera** Moore 1911  
LIT  
Origin: Native

Common along the Southern California coastal shelf, also recorded in the Fraser River this is a species with a marine to brackish salinity tolerance.

**Glycine picta** (Berkeley, 1927)  
LIT  
Origin: Native

There is some debate over the validity of both *G. picta* and *G. polygnatha* as they are very similar morphologically. Genetic or developmental studies might be needed to resolve this question. *G. picta* was described from British Columbia.

**Glycine polygnatha** Hartman, 1950  
LIT  
Origin: Cryptogenic

See *G. picta*

**HESIONIDAE**

**Hesionella mccullochae** Hartman, 1939  
LIT

Appendices: page 59
Kingdom: Animalia  
Phylum: Annelida

Origin: Native

Specimens need to be examined to check the identification. The genera Hesionella and Microphthalmus are very close morphologically. Species belonging to Microphthalmus have been reported from many more localities in the Northeast Pacific than *Hesionella mccullochae*.

**Podarkeopsis brevipalpa** (Hartmann-Schroeder, 1959)  
Synonyms: *Gyptis brevipalpa*  
LIT  
Origin: Cryptogenic

Probably also includes species mis-identified in the literature as *Podarkeopsis glabrus*.

**Podarkeopsis glabrus** Hartman 1961  
LIT

See *Podarkeopsis brevipalpa*.

**NEPHTYIDAE**

**Nephtys caecoides** Hartman 1938  
LIT  
Origin: Native

**Nephtys californiensis** Hartman 1938  
LIT  
Origin: Native

**Nephtys cornuta** Berkeley and Berkeley, 1945  
LIT  
Origin: Native

**Nephtys ferruginea** Hartman 1940  
LIT  
Origin: Native

**Nephtys parva** Clark and Jones, 1955  
LIT

*Nephtys parva* is a junior synonym of *N. cornuta*, however the specimens keyed out to this using local references probably belong to an undescribed species.

**NEREIDIDAE**

Appendices: page 60
**Hediste limnicola** (Johnson 1903)
Synonyms: *Neanthes limnicola*
LCRANS, LIT
Origin: Native

**Eteone columbiensis** Kravitz & Jones, 1979
LIT
Origin: Cryptogenic

Recently described from the Columbia River mouth, this species could be either native or introduced.

**Eteone dilatae** Hartman 1936
LIT
Origin: Native

Specimens mentioned in the literature should be examined to check the identification as there are several undescribed species in the Northeast Pacific.

**Eteone lighti** Hartman 1936
LIT
Origin: Cryptogenic

Described from San Francisco Bay and possibly introduced.

**Eteone longa** (Fabricius, 1780)
LIT
Origin: Cryptogenic

Specimens mentioned in the literature should be examined to check the identifications as it is unlikely that these are true *E. longa*. There are several undescribed species in the Northeast Pacific.

**Eteone spilotus** Kravitz & Jones, 1979
LCRANS, LIT
Origin: Native

Probably native, having been found in shelf sediments from California to Washington.

**Sedentary Polychaetes**

<table>
<thead>
<tr>
<th>Ampharetidae</th>
<th>Hobsonia floridana</th>
<th>LCRANS, LIT</th>
<th>Introduced</th>
</tr>
</thead>
</table>

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### Kingdom: Animalia
### Phylum: Annelida

<table>
<thead>
<tr>
<th>Capitellidae</th>
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<tbody>
<tr>
<td>Barantolla nr americana</td>
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<tr>
<td>Capitella capitata</td>
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</tr>
<tr>
<td>Heteromastus filiformis</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Heteromastus filobranchus</td>
<td>LIT</td>
<td>Native</td>
</tr>
<tr>
<td>Mediomastus acutus</td>
<td>LIT</td>
<td>Native</td>
</tr>
<tr>
<td>Mediomastus californiensis</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Mediomastus sp.</td>
<td>LCRANS</td>
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<th>Cirratulidae</th>
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<td>Chaetozone spinosa</td>
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<tr>
<td>Cirratulus cirratus</td>
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<th>Magelonidae</th>
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<tr>
<td>Magelona hobsonae</td>
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<tr>
<td>Magelona pitelkai</td>
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<td>Native</td>
</tr>
<tr>
<td>Magelona sacculata</td>
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<tr>
<th>Opheliidae</th>
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<tr>
<td>Armandia brevis</td>
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</tr>
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<td>Euzonius mucronata</td>
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<td>Native</td>
</tr>
<tr>
<td>Euzonius williamsi</td>
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<td>Native</td>
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<td>Ophelia limacina</td>
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</tr>
<tr>
<td>Ophelina acuminata</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Ophelina breviata</td>
<td>LIT</td>
<td>Cryptogenic#</td>
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<tr>
<th>Orbiniiidae</th>
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<td>Leitoscoloplos pugettensis</td>
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<tbody>
<tr>
<td>Owenia fusiformis</td>
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<table>
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<tr>
<th>Paraonidae</th>
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<tbody>
<tr>
<td>Paraconella platybranchia</td>
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<tr>
<th>Phyllodocidae</th>
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<tbody>
<tr>
<td>Phyllodoce spp.</td>
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</table>

<table>
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<tr>
<th>Polygordiidae</th>
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<tbody>
<tr>
<td>Polygordius spp.</td>
<td>LIT</td>
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</tbody>
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<tr>
<th>Spionidae</th>
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<tbody>
<tr>
<td>Malacoceros fuliginosus</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Polydora brachycephala</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Polydora cornuta</td>
<td>LCRANS, LIT</td>
<td>Introduced</td>
</tr>
<tr>
<td>Polydora sp.</td>
<td>LCRANS</td>
<td></td>
</tr>
<tr>
<td>Prionospio lighti</td>
<td>LIT</td>
<td>Native</td>
</tr>
<tr>
<td>Pseudopolydora kempti</td>
<td>LIT</td>
<td>Introduced</td>
</tr>
<tr>
<td>Pseudopolydora sp.</td>
<td>LCRANS</td>
<td></td>
</tr>
<tr>
<td>Pygospio californica</td>
<td>LIT</td>
<td>Native</td>
</tr>
<tr>
<td>Pygospio elegans</td>
<td>LCRANS, LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Scolelepis foliosa</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Scolelepis squamata</td>
<td>LIT</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Scolelepis n. sp. ?</td>
<td>LCRANS</td>
<td>Native</td>
</tr>
<tr>
<td>Scoloplos armiger</td>
<td>LIT</td>
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</table>

Appendices: page 62
Kingdom: Animalia  
Phylum: Annelida  

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
<th>Notes</th>
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<tbody>
<tr>
<td><em>Spiophanes berkleyorum</em></td>
<td>Native</td>
<td></td>
</tr>
<tr>
<td><em>Spio butleri</em></td>
<td>Native</td>
<td></td>
</tr>
<tr>
<td><em>Spio filicornis</em></td>
<td>Native</td>
<td></td>
</tr>
<tr>
<td><em>Streblospio benedicti</em></td>
<td>Introduced</td>
<td></td>
</tr>
<tr>
<td><em>Manayunkia aestuarina</em></td>
<td>Introduced</td>
<td></td>
</tr>
<tr>
<td><em>Manayunkia speciosa</em></td>
<td>Introduced</td>
<td></td>
</tr>
<tr>
<td><em>Manayunkia sp.</em></td>
<td>LCRANS</td>
<td></td>
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</tbody>
</table>

**AMPHARETIDAE**

*Hobsonia floridana* (Hartman 1951)  
Syn: *Hobsonia florida, Amphicteis floridus*  
LCRANS, LIT  
Origin: Introduced

**CAPITELLIDAE**

*Barantolla nr americana* (Hartman 1963)  
LIT  
Origin: Native

Specimens need to be examined to check the identification. *Barantolla americana* is found in shelf & slope depths off California. A related form, known as *B. nr. americana*, has been found in shallower water in Puget Sound and Alaska.

*Capitella capitata* (Fabricius, 1780)  
Syn: *Lumbricus capitus*  
LIT  
Origin: Cryptogenic

Should be referred to as "Capitella capitata complex". Formerly considered a cosmopolitan species but now recognized as a complex of sibling species that vary morphologically, genetically, and developmentally. Extensive laboratory work would be required.

*Heteromastus filiformis* (Claparde, 1864)  
LIT  
Origin: Cryptogenic

Considered to be cosmopolitan but records from around the world are likely to contain several species (pers. com. Leslie Harris). Believed to be native to the
Kingdom: Animalia  
Phylum: Annelida

Atlantic Ocean from the Gulf of Mexico to the Arctic, it can also be found in South Africa, New Zealand and Australia. The first West Coast record of this worm is from San Francisco Bay in 1936, and it is now well established in California, Oregon, Washington and British Columbia. It is likely transported in sediment and ballast water.

**Heteromastus filobranchus** Berkeley and Berkeley, 1932  
LIT  
Origin: Native

**Mediomastus acutus** Hartman, 1969  
LIT  
Origin: Native

**Mediomastus californiensis** Hartman, 1944  
LIT  
Origin: Cryptogenic

Reported from several areas of the world but validity of all records is unknown, as is the origin and pattern of introduction.

**CIRRATULIDAE**

**Chaetone spinosa** Moore, 1903  
LIT  
Origin: Cryptogenic – likely mis-identified

Local records are unlikely to be correctly identified. This is a deep-water species and there are no verified shallow water records for the Northeast Pacific.

**Cirratulus cirratus** (Müller, 1776)  
Syn: *Lumbricus cirratus*  
LIT  
Origin: Cryptogenic – likely mis-identified

Unlikely to be correctly identified. Many previous Northeast Pacific records of this species have been assigned to local species.

**MAGELONIDAE**

**Magelona hobsonae** Jones 1978  
LIT  
Origin: Native

**Magelona pitelkai** Hartman, 1944  
LIT
Kingdom: Animalia
Phylum: Annelida

Origin: Native

**Magelona sacculata** Hartman, 1961
LIT
Origin: Native

OPHELIIDAE

**Armandia brevis** (Moore, 1906)
Syn:
LIT
Origin: Native

**Euzonus mucronata** (Treadwell, 1914)  
bloodworms
Syn:
LCRANS
Origin: Native

*Euzonus mucronata* is common in the upper intertidal of sandy/silty beaches along the West Coast. *Euzonus* have high hemoglobin content turning them a distinctive red color. These worms were found by LCRANS in the high salinity tidal pools along Clatsop spit.

**Euzonus williamsi**  (Hartman, 1938)
Syn:
LIT
Origin: Native

See above.

**Ophelia limacina**  (Rathke, 1843)
Syn:
LIT
Origin: Cryptogenic

A boreal species. Local specimens need comparison to type or topotype material in order to confirm the id.

**Ophelina acuminata**  Oersted, 1843
LIT
Origin: Cryptogenic

Considered cryptogenic here due to the paucity of characters used to distinguish species. Genetic and development studies may be required for speciation.

**Ophelina breviata** (Ehlers, 1913)
Kingdom: Animalia
Phylum: Annelida

Syn: *Ammotrypane breviata*
LIT
Origin: Cryptogenic#

Known from Arctic and Subantarctic waters. Local specimens are likely to belong to another species.

ORBINIIDAE

*Leitoscoloplos pugettensis* (Pettibone, 1957)
Syn: *Leitoscoloplos elongatus*
LIT
 Origin: Native

A marine species, probably only recorded from sampling at the mouth of the Columbia.

OWENIIDAE

*Owenia fusiformis* delle Chiaje, 1841 single-tube worm
LIT
 Origin: Native

A widely distributed marine species probably only recorded from sampling at the mouth or outside of the Columbia.

PARAOONIDAE

*Paraonella platybranchia* (Hartman, 1961)
Syn:
LIT
 Origin: Native

A marine species, probably only recorded from sampling at the mouth or outside of the Columbia.

SPIONIDAE

*Malacoceros fuliginosus* (Claparede, 1868)
LIT
 Origin: Cryptogenic

Specimens need to be compared to type or topotype material to confirm the identification. Found in the Eastern Atlantic in high salinity bays and lagoons.

*Dipolydora caulleryi* Hartman, 1936

Appendices: page 66
Kingdom: Animalia  
Phylum: Annelida

Syn: *Polydora brachycephala*  
LIT  
Origin: Cryptogenic

Reported from the Columbia River as *Polydora brachycephala* this species has been synonymized with *Dipolydora caulleryi*. *D. caulleryi* is reported from both sides of the US, Europe, and Surinam. Its origin & pattern of introduction is unknown. It is considered an introduced marine polychaete by the California Department of Fish and Game.

*Polydora cornuta* Bosc, 1802  
Syb: *Polydora ligni*  
LCRANS, LIT  
Origin: Introduced

Verified records are found worldwide. The origin of the species and its pattern of distribution is unknown. Considered by Cohen and Carlton (1995) to be native to the North Atlantic and introduced to San Francisco Bay by the 1930s via ballast water or in association with oyster planting.

*Prionospio lighti* Maciolek, 1985  
LIT  
Origin: Native

*Pseudopolydora kempi* (Southern, 1921)  
Syn: *Pseudopolydora kempi japonica, P. kempi kempi*  
LIT  
Origin: Introduced

Native to Japan, there remains some doubt as to whether the local specimens actually belong to this species. Specimens collected by LCRANS were only identified as *Pseudopolydora* sp. The subspecies *Pseudopolydora kempi japonica* has been considered both valid species and a junior synonym of *P. kemp*. We consider it a junior synonym as prior species identifications could nto be verified. Also reported as introduced on the West Coast but not from the Columbia River is the closely related species *Pseudopolydora paucibranchiata*. Both species have planktonic larvae and could be readily transpoted via ballast water.

*Pygospio californica* Hartman 1936  
LIT  
Origin: Native

Found in marine intertidal sandflats (Blake 1975)

*Pygospio elegans* (Claparede, 1863)  
Syn: *Spio rathbuni*
Kingdom: Animalia
Phylum: Annelida

LCRANS, LIT
Origin: Cryptogenic

Unknown if this is a species complex or a single widely distributed species; also its origin and pattern of introduction is unknown.

*Scolelepis foliosa* (Audouin and Milne Edwards, 1833)
Syn: *Nerine foliosa, Scolelepis foliosa occidentalis*
LIT
Origin: Cryptogenic

Local specimens need to be compared to type or topotype material to confirm the identification.

*Scolelepis squamata* (Mueller, 1806)
Syn: *Lumbricus squamatus*
LIT
Origin: Cryptogenic

Local specimens need to be compared to type or topotype material to confirm the identification.

*Scoloplos armiger* (Müller, 1776)
Syn: *Scoloplos elongata*
LIT
Origin: Cryptogenic

Local specimens may not be the same as the true *S. armiger* from Norway.

*Spio butleri* Berkeley & Berkeley, 1954
LIT
Origin: Native

*Spio filicornis* (Müller, 1776)
Syn: *Nereis filicornis*
LIT
Origin: Cryptogenic

*Spiophanes berkeleyorum* Pettibone, 1962
LIT
Origin: Native

*Spiophanes bombyx* (Claparede, 1870)
LIT
Origin: Cryptogenic
Another cosmopolitan species that may consist of sibling species.

*Streblospio benedicti* Webster, 1879
LCRANS, LIT
Origin: Introduced

Origin and pattern of introduction of *Streblospio benedicti* are unknown. This variable species may prove to be another species complex.

SABELLIDAE

*Manayunkia aestuarina* (Bourne, 1883)
LCRANS, LIT
Origin: Introduced

Local references only used one character to speciate *Manayunkia*. Local records in the literature review must be compared to type or topotype material of *M. speciosa* for confirmation of identification. *Manayunkia aestuarina* is native to eastern North America and may have been introduced via ballast water or in association with stocked fish from eastern North America. EMAP specimens were confirmed as *M. aestuarina*.

*Manayunkia speciosa* Leidy, 1859
LCRANS, LIT
Origin: Introduced

Local references only used one character to speciate *Manayunkia*. This is inadequate and Local records in the literature review must be compared to type or topotype material of *M. speciosa* for confirmation of identification. *Manayunkia speciosa* is native to eastern North America and may have been introduced via ballast water or in association with stocked fish from eastern North America.

Phylum: Mollusca

SOME FRESHWATER MOLLUSKS OF THE LOWER COLUMBIA RIVER, OREGON AND WASHINGTON
Terrence J. Frest and Edward Johannes

Relatively little is known currently of the freshwater mollusk fauna of the mainstem Columbia River, particularly of its lower reaches, despite frequent visits by malacologists dating to before 1838. Historic data is considerable but mostly unpublished museum records. Much of the more recent information is in the rather
voluminous gray literature and needs to be reviewed and reidentified. A short survey of 12 sites in late June, 2002 from Portland, Oregon to the estuary provides some useful data as to historic vs. modern freshwater mollusk faunas. One emphasis was to search for so-called exotic (non-indigenous, non-native species). At least one such, the bivalve *Corbicula fluminea*, has been known to be present since perhaps 1937 (Burch, 1944; Counts, 1985).

Though the site coverage is limited, our results indicate that more detailed study would be rewarding. Exotics are more widespread than expected from the literature and native taxa have declined considerably. Still, more than one undescribed taxon was encountered. All of these considerations suggest that detailed survey should be undertaken.

We briefly review below necessary background information on the Columbia River freshwater malacoauna. We then systematically review species found. Finally, we discuss their significance within a historic context and within the wider context of other molluscan introductions.

**MOLLUSK FAUNA OF THE COLUMBIA SYSTEM**

There has been relatively little published on the malacoauna of the mainstem Columbia River, despite the fact that some of the earliest western U. S. mollusk records are from this stream. There are no particular titles devoted solely to it, in fact. However, numerous references are scattered through the literature and there are large numbers of largely untapped museum records. We have collected the system extensively since 1988. A fair number of recent records are contained in Neitzel & Frest (1989, 1993). Quite a few collections were made from the lower Columbia by NMFS teams during the last 20 years. Unfortunately, the quality of identifications in these latter publications is quite low (note numerous allusions to amnicolids, for example, which are not present). Also, recent revisions have made many of the older literature identifications clearly mistaken. For example, Hershler & Frest (1996) revised the described species of the lithoglyphid *Fluminicola*, one of the two most common Oregon-Washington freshwater snail genera. On their evidence, probably 90-95% of literature records and most museum records are wrong. Recent work by Frest & Johannes (unpublished) indicates a similar error ratio in identifications of the other very common genus, *Juga*. Another very widespread western U. S. genus, *Pyrgulopsis*, has been expanded from about 20 species to about 170 in the last fifteen years (Frest, 1995; Hershler & Sada, 2002). The majority of these new taxa are Western. Taylor (1975) opined that at least half of museum lots of Western freshwater mollusks were wrongly identified; Frest et al. (2002) reiterate this figure for Idaho lots and note that gray literature reports are proportionately even less likely to be correct. Hence, caution should be used in making mollusk identifications from Washington and Oregon freshwater sites, as elsewhere in the West, and dependence on older records is unwise.

Western freshwater habitats differ considerably in taxonomic composition from those elsewhere in the U. S. Large freshwater mussels (unionoids) are relatively non-diverse (about 10 vs. about 300 taxa) and hydrobiids are much more diverse. Only sphaeriids (fingernail clams) are about equal in diversity in both areas. Per site (a) diversity seems lower in the West; but overall (g) diversity is more or less comparable,
Kingdom: Animalia
Phylum: Mollusca

with hydrobiids and lithoglyphids making up for the low unionoid diversity. This faunal makeup may be universal for Western stream mollusks (Frest & Johannes, 2002). Western and Eastern malacofaunas differ considerably at the generic level, with the usual pattern being different genera or at least subgenera in those families held in common. Hence, *Fluminicola* (West) vs. *Somatogyrus* (East); *Juga* (West) vs. *Elimia* and 6 other pleurocerid genera (East), etc. It now appears likely that the western hydrobiid swarm differs at the generic level from the eastern also (Hershler, 1994; pers. comm., 2003), instead of *Pyrgulopsis* being common to both.

Leaving aside taxonomic composition, there are significant differences in Western and Eastern-Central U. S. preferred freshwater mollusk habitats as well. Spring and cold, clear, low nutrient, flowing habitats with few macrophytes are more typically Western stream habitats (Frest, 2002a,b), often relatively warm, turbid, with abundant macrophytes and comparatively high dissolved nutrient and lower dissolved oxygen levels, are more significant in the East. Large permanent streams are relatively uncommon in the West. Western drainages are relatively young for the most part but have been considerably modified by geologic factors. Endemism and short-range species are the norm; and perhaps only 40-50% of total diversity has been formally described to date (Frest & Roth, 1995). It is thus not surprising that several new taxa were noted in this brief survey (Table 2). Over the last 15 years, some 100+ newly described species have been added to the Western freshwater mollusk fauna (Frest, 1995). Moreover, Western mollusk biogeographic provinces are small (Frest & Johannes, 2001). There is nothing at all comparable in size in the western U. S. to the Mississippi freshwater Province. In effect, all western freshwater mussels occur in one Province, the Pacific, equal to the Eastern Division; while several very areally limited terrestrial provinces are needed for land forms. Based upon snail genera, terrestrial and freshwater provinces are surprisingly congruent (Frest & Johannes, 2001; in press). Hence, even large streams like the Columbia, Klamath, or Sacramento may range across provinces and not have a uniform fauna in the mainstem, let alone the tributaries. This situation is not limited to mollusks but characterizes the fish fauna as well (McPhail & Lindsey, 1986; Minkley et al., 1986).

In dealing with Western freshwater mollusks, it is important to keep in mind such biogeographic considerations. Despite their relative youthfulness, most Western streams are composite systems geologically, recently assembled and with segmented and composite biotas. This much complicates distributional scenarios both for fish and for mollusks (Minkley et al., 1986; Smith et al., 2000, 2002; Taylor, 1985, 1988a,b; Taylor & Bright, 1987; Hershler & Sada, 2002).

The lower Columbia, not surprisingly after the foregoing, thus had several taxa endemic to it historically and before damming was a cold-water, rocky bottom stream with little in the way of stable soft substrate habitats and macrophyte beds. Dams and dredging have much modified most of the original exposed bedrock (e.g., The Dalles) and hard substrate habitat (Magnuson, 1996). Lower Columbia endemics are believed to have included such taxa as *Fluminicola nuttalliana* and perhaps one other extinct species (see Hershler & Frest, 1996 for discussion); *Vorticifex neritoides; Physella columbiana sensu* Taylor (1985) and probably several other taxa. Most of these are either much reduced or perhaps even extinct currently (see Table 2 for most historic species and their habitats). Similarly, reduction in salmon (the glochidial host) runs and in suitable habitat

Appendices: page 71
Kingdom: Animalia
Phylum: Mollusca

seems to have nearly extirpated the formerly very widespread freshwater mussel *Margaritinopsis falcata* from the lower Columbia and habitat changes alone much reduced others, such as *Gonidea angulata*. Native pleurocerids, hydrobiids, and lithoglyphids have likely also declined considerably. The native lancid *Fisherola nuttalli*, a member of a subfamily or family restricted to the West, is also now quite rare (not found in this survey but living at a few of our lower Columbia sites). We believe that the aberrant planorbid genus *Vorticifex*, another Western endemic, was historically one of the more common lower Columbia snails; it is now one of the more rare.

Perhaps because of habitat changes, introduced taxa such as *Corbicula* are among the most commonly encountered forms. However, as yet relatively few taxa have been introduced. Recent finds of the New Zealand mudsnail are very disturbing, however, and the non-native *Radix auricularia* is a snail community dominant higher in the system (Frest & Johannes, pers. obs.). We expect that, in its current condition, the lower Columbia would provide excellent habitat for the zebra mussel and predict that it could readily become a major pest species, as well as further degrading the native mollusk fauna. The New Zealand mudsnail, *Potamopyrgus antipodarum*, is a serious pest snail in parts of the middle Snake River in Idaho and is rapidly spreading both up and down stream. We have considerably expanded its known range in the lower Columbia River from Astoria and areas ca. 20 miles upstream (Tongue Point) some 60 miles closer to Portland.

Taxonomy herein is based upon the names utilized in Burch (1972-1989), modified where necessary by Taylor (1981) and Turgeon et al. (1998). The latter is the source for common names. We have also used the periodical literature extensively to update all sources and to reflect more recent nomenclatorial changes.

**Phylum: Mollusca**

**Class: Gastropoda**

** - considered probably extinct in the lower Columbia River

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Appendices: page 72
Kingdom: Animalia  
Phylum: Mollusca

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ANCYLIDAЕ

**Ferrissia californica** (Rowell, 1863)  
fragile ancylid  
LCRANS, LIT

Appendices: page 73
Kingdom: Animalia
Phylum: Mollusca

Origin: Native

Taylor (1981) believes that this name precedes *Ferrissia fragilis* for the common North American river limpet. This taxon is uncommon in the West and seems to prefer low-elevation, rather warm and eutrophic habitats, often with low flow (lotic) or is found in similar lentic habitats, such as ponds and lakes.

*Ferrissia parallelus*
LIT
Origin: Native

*Ferrissia rivularis*
LCRANS, LIT
Origin: Native

*Ferrissia rowelli*
LIT
Origin: Native

HYDROBIIDAE

*Fluminicola* n. sp. 1
LCRANS
Origin: Native

There appear to be at lest three *Fluminicola* in the lower Columbia and two in the lower Willamette. Aside from *virens*, or virens-like forms, at least one undescribed taxon occurs in both rivers. Formerly, both likely had the probably extinct *Fluminicola nuttalliana*; and there are historic records for *F. fuscus* (under the name *columbiana*) for the lower Columbia, and possibly the lower Willamette, as well (Neitzel & Frest, 1989, 1993). Hershler & Frest (1996) report another likely extinct taxon from the lower Willamette and possibly form the Columbia below Portland. There are only two remaining lower Columbia taxa found in some numbers; *virens* and this form. Both are probable cold-water stenotopes and often co-occur with *Juga (J.)plicifera plicifera*. Like most larger pebblesnails, this taxon seems to prefer cold and relatively pristine hard-substrate habitats, with little disturbance. Note that this taxon and the foregoing occurred historically in the Columbia upstream only as far as the Hanford Reach, while *fuscus* ranged into the Snake River (Frest, unpub.) and several other interior Washington tributaries (Neitzel & Frest, 1989, 1993; Hershler & Frest, 1996). This taxon has been cited as *Fluminicola* n. sp. 1 in Frest & Johannes (1993, 1995, 1996)

*Fluminicola* n. sp. 2
LCRANS
Kingdom: Animalia
Phylum: Mollusca

Origin: Native

This *virens*-group taxon seems to be restricted to relatively small and more or less pristine oligotrophic stream habitats. So far, it appears that this undescribed taxon may be restricted to small tributaries in Oregon and Washington below Portland.

**Fluminicola fuscus** (Haldeman, 1841) Columbia pebblesnail
LIT Origin: Native

Possibly locally extinct. This species until very recently was confused with several other taxa, and most commonly is cited as *Fluminicola columbiana* Hemphill. Original distribution: Lower Columbia River and a few of its major tributaries in WA, OR, ID, and BC (and probably MT as well). Possibly extinct in the lower Columbia River, WA-OR, and definitely extinct in most of the middle and upper Columbia River, WA, MT, and British Columbia.

**Fluminicola nuttallianus**
*Fluminicola nuttalliana*
LIT Origin: Native

Probably extinct (See Frest on *Fluminicola* n. sp. 1)

**Fluminicola virens** (Lea, 1838) Olympia pebblesnail
LCRANS, LIT Origin: Native

This pebblesnail taxon seems characteristic of the lower Columbia and middle to lower Willamette, although similar undescribed taxa occur widely in western Washington and Oregon. There is some possibility that the Columbia form is a distinct species: we are currently exploring that possibility using molecular genetic methods. The group including virens, recently redescribed by Hershler & Frest (1996), likely represents a monophyletic clade at a higher taxonomic level than species, as yet unnamed. Note that the common name is completely inappropriate. Pebblesnails are for the most part cold-water stenotopes and historically had very wide distribution in Oregon and Washington clear oligotrophic streams and springs. The common name is mysterious in origin, as the type locality is in Oregon and there is no reason to think Olympia, Washington *Fluminicola* are conspecific.

**Potamopyrgus antipodarum** (Grey 1853) New Zealand mudsnail
LCRANS, LIT Origin: Introduced

The New Zealand mudsnail was first noticed in the Columbia River in 1995, at Youngs Bay near Astoria, Oregon (Wonham and Carlton in press). Since then, it
Kingdom: Animalia  
Phylum: Mollusca

has been reported as far east as Cathlamet Bay, Oregon. We herein extend the species considerably eastward, to St. Helens, Oregon. Specimens at our two non-estuary sites are as yet quite rare; but massive increases are likely, to judge by the species’ history in the middle Snake River. We expect that the Columbia will provide sufficient degraded habitat as to allow this taxon to become a true nuisance species. While Mackie (1999b) does not seem to regard this taxon as a nuisance, except possibly to native mollusks, experiences in the middle Snake River (Bowler & Frest, 1992; Frest & Johannes, 1992) suggest that it not only negatively impacts native mollusks but also can be both an aesthetic irritant and impediment to hydroelectric, trout rearing, and irrigation facilities. Aside from impacts on native species (USFWS, 1995; Richards et al., 2001: see also earlier references in Frest et al., 2002), the species is a biofouler. At one Idaho Power hydroelectric facility, for example, it has proved necessary to operations to remove some 30 tons of organic detritus per day. Half of that by weight is *P. antipodarum*. Impact is further discussed below.

This taxon may have been introduced independently several times into the U. S. Gangloff (1998) regards the Lake Ontario (1991-1994), Idaho (1987), Lower Columbia (1997 sic) and Yellowstone National Park (1995) occurrences as separate. We regard at least the Montana (Yellowstone)) as derived from Idaho sources. There is also another introduction, possibly independent, in the Colorado River system in Arizona (pre-1998). Since 1998, other introductions have turned up in Owens Valley, CA, Polecat Creek, Wyoming likely derived from Yellowstone populations, and in two other areas in coastal and interior Oregon (Frest & Johannes, unpub.). Ballast water is suggested as the venue in Lake Ontario (Zaranko et al., 1997) and generalized in Mackie (1999b) but this hypothesis is untenable for most introductions, the lower Columbia being a possible exception. Several reported introductions have proven incorrect and due to confusion with native hydrobiids. This is a problem in the lower Columbia as well, as native *Pyrgulopsis* occurs here also (see below). Supposed *P. antipodarum* finds should always be confirmed by a specialist.

**LYMNAEIDAE**

*Fisherola nuttalli* (Haldeman, 1841) shortfaced lanx  
LIT  
Origin: Native

The native lancid *Fisherola nuttalli*, a member of a subfamily or family restricted to the West, is also now quite rare (not found in this survey but living at a few sites along the lower Columbia). Type locality: “Lower Columbia River” near the old mouth of the Willamette River near Portland, Multnomah Co., OR (could have been from the Willamette River itself). Formerly widespread in the lower Columbia River, Snake River, and a few major tributaries, WA-OR-ID-MT-BC. The lower Columbia River populations are largely extinct due to habitat
Kingdom: Animalia  
Phylum: Mollusca

modification caused by Bonneville Power Administration dams and impoundments (Frest and Johannes 1995).

**Fossaria (B.) bulimoides cockerelli**  
LCRANS  
Origin: Native

**Radix auricularia** (Linnaeus, 1758) Big-ear Radix  
Syn: *Lymnaea auricularia*  
LIT  
Origin: Introduced

The non-native *Radix auricularia* is a snail community dominant higher in the Columbia River system (Frest & Johannes, pers. obs.), also introduced in the Great Lakes ([http://nas.er.usgs.gov](http://nas.er.usgs.gov)) prefers still or standing water, Euarasian aquarium species, first collected from Great Lakes in 1901 (Mills et al. 1993)

**Stagnicola (Stagnicola) apicina**  
LCRANS, LIT  
Origin: Native

**Stagnicola caperata**  
LCRANS  
Origin: Native

**Stagnicola (Stagnicola) elodes** (Say, 1821)  
marsh pondsnail  
LCRANS, LIT  
Origin: Native

We are more familiar with this taxon as a swamp and wetland taxon in the Midwest. It is relatively rare in the Western U.S. Large stream sites are more common in the West, while the typical eastern site is more likely to be a warm pond or ditch or very small stream. In much of the lower Columbia, including more or less undisturbed habitats, this taxon seems to be replaced by *Stagnicola apicina*, not noted at our sites during this survey.

**Margaritiferidae**

**Margaritopsis falcata** (Gould 1850)  
western pearlshell  
Syn: *Margaritifera falcata*  
LIT  
possibly locally extinct

Reduction in salmon (the glochidial host) runs and in suitable habitat seems to have nearly extirpated the formerly very widespread freshwater mussel
Kingdom: Animalia
Phylum: Mollusca

*Margaritopsis falcata* from the lower Columbia. Original distribution: Southern Alaska to central California, eastward to western Montana, western Wyoming, and northern Utah (Frest and Johannes 1995). Threats such as extensive diversion of rivers for irrigation, hydroelectric, and water supply projects has much reduced the WA, OR, ID, and CA range of this species. In the lower Columbia River region threats include impoundments: continued siltation and other impacts on the few remaining sites with habitat characteristics approximating pre-impoundment conditions on the lower Columbia. Harbor and channel “improvements” in the vicinity of The Dalles and John Day Dam; nutrient enrichment of the lower Columbia due to agricultural run-off. This taxon is declining, in terms of area occupied and number of sites and individuals.

OLIVIDAE

*Olivella biplicata*
LIT
Origin: Native

PHYSIDAE

*Physella (Physella) gyrina* (Say, 1821) tadpole physa
LCRANS, LIT
Origin: Native

Physids are among the common river snails in the Western U. S., as they are in the East as well. Taxonomy is badly in need of revision; and we follow Taylor (1981) and Burch (1982) here, recognizing a small number of taxa in the West. Forms of *gyrina* are widespread in a variety of habitats in Western North America. Many literature reports are more likely ascribable to *Physella (Physella) propinqua*. This taxon seems to prefer small stream, pond, and lake habitats locally.

*Physella (Physella) columbiana*
LIT
Origin: Native

*Physella (Physella) hordacea*
LIT
Origin: Native

*Physella (Physella) lordi*
LIT
Origin: Native

*Physella (Physella) propinqua* (Tryon, 1865) Rocky Mountain physa

Appendices: page 78
Kingdom: Animalia
Phylum: Mollusca

LCRANS, LIT
Origin: Native

In contrast to *Physella (Physella) gyrina*, some forms of this taxon appear to prefer large river habitats, while others are more restricted (Frest & Johannes, 2001). Precise relationships of lower Columbia specimens remain to be determined. In relatively natural Columbia habitats, this taxon is rather rare. It seems to have benefited from siltation and eutrophication.

*Physella (Physella) traski*
LIT
Origin: Native

*Physella (Physella) virginea*
LIT
Origin: Native

PLANORBIDAE

*Gyraulus parvus*
LIT
Origin: Native

*Menetus (menetus) callioglyptus* (Vanatta, 1895)  button sprite
LCRANS
Origin: Native

Note that most sources regard this taxon as *Menetus opercularis* (Gould, 1847); but Taylor (1981) argues that that name applies to snails from Mountain Lake, California and now extinct. This is a widespread taxon in western Washington, northern Oregon, and northwestern California in a variety of habitats. It is usually uncommon in larger streams.

*Menetus dilatatus*
LCRANS
Origin: Native

*Menetus opercularis*
LIT

INVALID NAME – See above section on *Menetes callioglyptus*

*Planorbella subcrenatum*
LIT
Kingdom: Animalia
Phylum: Mollusca

Origin: Native

**Planorbella columbiense**
LIT
Origin: Native

**Promenetus umbilicatellus**
LIT
Origin: Native

**Pyrgulopsis n. sp. 1 cf. robusta**
LCRANS
Origin: Native

This taxon was first noticed in the lower Columbia in the John Day and Bonneville pools by FWS personnel in 1988. Immature specimens possibly belonging to this taxon were noted far downstream during this survey. The taxonomic status of this taxon is currently under investigation using molecular genetic methods. We will need adults to obtain a full suite of morphological characters. The lower Columbia juveniles as live photographed differ in coloration from equivalent life stages of Pyrgulopsis n. sp. 6 collected upstream. Relationships seem to be with other native U. S. Pyrgulopsis, notably P. idahoensis, P. hendersoni, and P. robusta (R. Hershler, pes comm., 2003; pers. obs.).

**Pyrgulopsis n. sp. 6**
LIT
Origin: Native

**Vorticifex effusus effuses**
LCRANS
Origin: Native

**Vorticifex effusus costata** (Hemphill, 1890)armeriisan ranshorn
LCRANS, LIT
Origin: Native

This appears to be the sole surviving species in the genus in the Columbia. We have not seen live *V. neritoides*, limited to the River historically below Portland, in the last few years. For distribution maps of these taxa, see Taylor (1985). *V. effusa costata* seems not to have occurred historically in the River above Grand Coulee. It is also absent from most tributaries, especially on the east side of the Washington and Oregon Cascade Mountains.

**Vorticifex neritoides**
LIT
Origin: Native
Possibly extinct (see above description)
Kingdom: Animalia
Phylum: Mollusca

PLEUROCERIDAE

*Juga (J.) n. sp.*
LCRANS
Origin: Native

This undescribed *Juga* taxon may be characteristic of immediate lower Columbia tributaries. It has been noted at several other sites in the first 100 river miles of the Columbia system (Frest & Johanes, unpub.). Sites are typically cold and oligotrophic, with clear water, moderate to high velocity currents, and rocky substrate.

*Juga hemphilli*
LIT
Origin: Native

*Juga (J.) plicifera plicifera* (Lea, 1838) pleated juga
LCRANS, LIT
Origin: Native

This is basically a big-river *Juga* species, characteristic of the Lower Columbia and middle-lower Willamette. While formerly much more widespread, it still appears frequently in lower Columbia habitats. Most reports from other streams appear to refer to other subspecies or other *Juga* taxa. Note that historically *Juga* may have reached no farther upstream than just below the Hanford Reach or the mouth of the Yakima River (Frest, unpub.).

*Juga silicula*
LIT
Origin: Native

POLYGYRIDAE

*Vespericola sp.*
LCRANS

The common Columbia River taxon is *Vespericola columbianus*; another taxon found in the lower Columbia region is *V. columbianus latilabris*. Other taxa are found by the mouth of the Columbia Gorge. These specimens appear to differ in morphology from any yet described.

VIVIPARIDAE

*Cipangopaludina chinesis malleatus* (Reeve, 1863) Chinese mystery snail
LCRANS
Origin: Introduced

This non-indigenous taxon has been reported widely in North America (Burch, 1989) but this is the first finding in the Columbia River system. It does not appear likely to become
a pest species or to have major negative impact (Mackie, 1999c). However, its occurrence is symptomatic of many others likely to have been so far unnoticed. Hanna (1966) and Mackie (1999c) emphasizes food usage as the rationale for introductions. However, the aquarium trade route is much more likely for most (this species is not mentioned in Mackie, 1999a, nor are apple snails Pomacea). The species is raised specifically for this purpose in the middle Snake River region (Bowler & Frest, 1992) and has commonly seen in pet stores throughout the U. S., as are apple snails, for at least 30 years. Note that all of the non-native taxa mentioned in Bowler & Frest (1992) could quite easily be introduced into the Columbia: many may have already been.

Phylum: Mollusca
Class: Bivalvia

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<tr>
<th>Class</th>
<th>Genus and Species</th>
<th>Status</th>
<th>Notes</th>
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<td>Cardiidae</td>
<td><em>Clinocardium nuttallii</em></td>
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<tr>
<td>Corbiculidae</td>
<td><em>Corbicula fluminea</em></td>
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<td><em>Tresus capax</em></td>
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<td><em>Margaritifera (Margaritifera) falcate</em></td>
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<td><em>Cryptomya californica</em></td>
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<td><em>Mya arenaria</em></td>
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<td><em>Mytilus edulis</em></td>
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<td>Cryptogenic</td>
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<td><em>Mytilus ?trossulus?</em></td>
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<td><em>Musculium raymondi</em></td>
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<td><em>Musculium securis</em></td>
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<td><em>Pisidium casertanum</em></td>
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<td><em>Nuttallia obscurata</em></td>
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<td>Tellinidae</td>
<td><em>Macoma baltica</em></td>
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<td>Thyasiridae</td>
<td><em>Axinopsida serricata</em></td>
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Kingdom: Animalia
Phylum: Mollusca

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<td><em>Anodonta kennerlyi</em></td>
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<td><em>Anodonta nuttalliana</em></td>
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<td><em>Anodonta oregonensis</em></td>
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<td><em>Anodonta wahlametensis</em></td>
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<tr>
<td><em>Gonidea angulata</em></td>
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<td>Native</td>
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</tbody>
</table>

**CARDIIDAE**

*Clinocardium nuttallii* (Conrad, 1837) Nuttall cockle

Synonyms: *Clinocardium corbis*

LIT

Origin: Native

**CORBICULIDAE**

*Corbicula fluminea* (Müller, 1774) Asian clam

LCRANS, LIT

Origin: Introduced

Corbiculids were native residents of North America for a considerable time before becoming extinct on the continent relatively recently (Taylor, 1988a,b). The recent introductions from the Western Pacific seem to have begun in the Columbia in the last 75 years; and this corbiculid is now widely distributed across the continent. Taxonomic status of *Corbicula* in North America is still somewhat cloudy, with claims for at least two taxa. More recently, morphological differences within the introduced populations have been ascribed to origin as separate clones of uncertain number, distribution, and status. If more than one taxon is present, the morphological range seen in the Columbia is great enough to suggest that two taxa may be present, although most populations may be mixes of two clones belonging to one only. Despite the early introduction, *Corbicula* is only moderately successful as an invader in Washington and Oregon, especially as compared with, say, the Tennessee Valley. It is a pest species with considerable economic impact in the central and eastern states.

McMahon (1999, fig. 22.2; 2001, fig. 11) seems to restrict *Corbicula* to the lower Columbia in Washington; but the species also occurs commonly to the Idaho border and in the Snake River in Idaho, as well as in Utah (Counts, 1985, 1986). The Idaho records date to at least 1966 (Hanna, 1966; Frest & Bowler, 1993; Frest & Johannes, 2001). McMahon (1999, p. 317) states that *Corbicula* in North America likely derives from a single introduction in northeastern Washington. Presumably, he means south-western Washington, i.e., the lower Columbia River, as Counts (1986) says.

**MACTRIDAE**

*Tresus capax* (Gould, 1850) fat gaper
Kingdom: Animalia
Phylum: Mollusca

LIT
Origin: Native

MARGARITIFERIDAE

*Margaritifera (Margaritifera) falcata* (Gould, 1850) western pearlshell
LIT
Origin: Native

Populations in the Columbia River greatly reduced due to human mediated erosion, reservoir construction etc. Once an important food item for tribal peoples.

MYIDAE

*Cryptomya californica* (Conrad, 1837) false mya, California softshell clam
LCRANS, LIT
Origin: Native

*Mya arenaria* Linnaeus 1758 softshell clam
LCRANS, LIT
Origin: Introduced

Established from Monterey Bay, CA to Prince William Sound, AK *Mya arenaria* is most abundantly in intertidal and shallow subtidal areas. Probably introduced unintentionally to the West Coast of North America with oyster shipments from the Atlantic coast, *Mya* was later intentionally planted to establish a commercially harvestable population in many West Coast bays.

MYTILIDAE

*Mytilus edulis* Linnaeus, 1758 blue mussel
LIT
Origin: Cryptogenic

*Mytilus edulis* is native to the Atlantic Coast. Introduced *M. edulis* have been reported in Puget Sound. Readily confused with *M. trossulus*, it can also hybridize with other *Mytilus* species.

*Mytilus trossulus* Gould, 1850 bay mussel, foolish mussel
LCRANS
Origin: Native

The native mussel, *Mytilus trossulus*, is often difficult to distinguish from *M. edulis* and *M. galloprovincialis*, two introduced mussels with which it can readily hybridize. No records of the Mediterranean *M. galloprovincialis* exist for the Columbia River Estuary.
but it can be found in other bays along the West Coast and was probably introduced via ballast water.

**PHARIDAE**

*Siliqua patula*
LIT
Origin: Native

**PISIDIIDAE**

*Musculium raymondi* (Cooper, 1890) lake fingernail clam
LCRANS
Origin: Native

As the common name would suggest, this taxon is most often found in lentic habitats, or at least in low flow situations. It has been found elsewhere in the lower Columbia proper; but not yet here. The most frequent name seen in the literature for this taxon or others resembling it is *Musculium lacustre*; but Taylor (1981) feels that western U.S. populations are best ascribed to a separate taxon. *Lacustre* is a frequently seen taxon in eastern and central North America in warm-water, soft-sediment situations but is rather uncommon in the West (Frest & Johannes, 2001).

*Musculium securis* (Prime, 1852) pond fingernail clam
LCRANS
Origin: Cryptogenic

Despite the common name, this taxon in the Northwest is most frequently (not often, but increasingly!) seen in larger, warmer rivers with slow flow and definite nutrient enhancement. It is quite uncommon here in pristine habitats but very frequently encountered in eastern North America.

*Pisidium casertanum* (Poli, 1791) ubiquitous peaclam
LCRANS, LIT
Origin: Native

As the common name implies, this is a very frequently encountered sphaeriid species, perhaps the most widespread native mollusk in the northern hemisphere. It is rapidly spreading currently south of the Equator a well. Very frequent in a wide variety of habitats in the West. For examples, see Frest & Johannes (2001).

*Pisidium compressum* Prime, 1852 ridgebeak peaclam
LCRANS, LIT
Origin: Native

Appendices: page 85
Kingdom: Animalia  
Phylum: Mollusca

This small taxon is found widely in both the western and eastern portions of the U. S. It is perhaps less common in the West, particularly in the formerly ubiquitous cold oligotrophic habitats once prevalent but now much reduced in areal extent.

**Pisidium pauperculum** Sterki, 1896  
fat peaclam  
Syn: *P. nitidum*  
LCRANS  
Origin: Native

Specimens from the lower Columbia are among the largest seen of this small taxon. It is most often a lentic taxon but can occur in soft substrate lotic habitats as well. In the West, these are most often impounded rivers that have slow flow and are somewhat eutrophic. Rather uncommon in the Northwest in a variety of low-elevation habitats. We follow Taylor (1981) in recognizing this species, sometimes (e.g., Clarke, 1981) synonymized with *P. nitidum*.

**Pisidium variabile**  
LCRANS, LIT  
Origin: Native

**Sphaerium patella**  
LIT  
Origin: Native

**Sphaerium simile**  
LCRANS  
Origin: Native

**Sphaerium striatinum**  
LCRANS  
Origin: Native

PSAMMOBIIDAE

**Nuttallia obscurata** (Reeve, 1857)  
purple mahogany-clam, purple varnish clam, dark mahogany-clam  
LCRANS  
Origin: Introduced

*Nuttallia obscurata* is a brackish bivalve native to Asia, primarily Japan and Korea. It is believed that *N. obscurata* was introduced to the west coast of North America via ballast water to Strait of Georgia region in the late 1980s (Mills 1999). Now established from Coos Bay to Vancouver Island, *N. obscurata* may have arrived at the mouth of the Columbia River through natural spread, as a discarded live seafood species or via coastal ballast water.
TELLINIDAE

*Macoma baltica* (Linnaeus, 1758) altic macoma
Syn: *M. inconspicua*
LIT, LCRANS
Origin: Native

Common in mid to low intertidal and distributed from San Francisco Bay to the Bering Straight (Ricketts et al. 1985). May have been introduced by man southern most limit in San Francisco Bay (Cohen and Carlton 1995).

THYASIRIDAE

*Axinopsida serricata*
LIT
Origin: Native

UNIONIDAE

*Anodonta californiensis* Lea, 1852 California floater
LCRANS, LIT

This mussel is widely but sporadically distributed in eastern Washington but is much less common west of the Cascades in Washington. The species may well be composite (Taylor, 1981; pers. obs.). It is currently rare in the southwestern states and southern California, which area includes the type locality, and is understudy for possible listing there. The species appears to be declining seriously in Washington, including in the Columbia proper.

*Anodonta kennerlyi*
LIT
Origin: Native

*Anodonta nuttalliana* Nuttal’s floater
LIT
Origin: Native

This native floater has been found, along with *A. oregonensis* and *A. wahlametenis* in the Columbia River Slough by Al Smith (pers com 2004).

*Anodonta oregonensis* Lea, 1838 Oregon floater
LCRANS, LIT
Origin: Native

Appendices: page 87
Kingdom: Animalia  
Phylum: Mollusca

The Oregon floater was first described from the lower Columbia River but appears currently uncommon to rare in it. It is found over much of Washington and Oregon, although seldom in large numbers. Along the Cascade axis, it seems to be replaced by *Anodonta kennerlyi*, and is more often found in streams than that largely lentic taxon.

*Anodonta wahlametensis* Lea, 1838  
Willamette floater  
LCRANS, LIT  
Origin: Native

Also first described from the lower Columbia and Multnomah Channel, this species has a disjunct range, with only a small portion in the lower Columbia River. Most of the range is in extreme southern Oregon and northern and central interior California. Much of the original range is no longer inhabited by the taxon (Taylor, 1981; 1985; pers obs.)

*Gonidea angulata* (I. Lea, 1838)  
Western ridged mussel  
LCRANS, LIT  
Origin: Native

Should be a common species in the Columbia River but habitat changes may have significantly reduced its numbers.

Phylum: Arthropoda  
Subphylum: Crustacea  
Infraclass: Cirripedia

Acorn barnacles, Cirripedia, are conspicuous sessile crustaceans that form volcano like shells of their plates in massive numbers on solid substratums such as rocks, pilings boats and floats. Barnacles are very special crustaceans because they undergo two metamorphic changes (rather than one or none) during development. The acorn barnacles use their feet (cirripedia) to feed on plankton and are economically significant due to the problems the cause when attached to marine structures.

<table>
<thead>
<tr>
<th>Balanidae</th>
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<tbody>
<tr>
<td><em>Balanus crenatus</em></td>
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<tr>
<td><em>Balanus improvisus</em></td>
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</tr>
<tr>
<td><em>Balanus glandula</em></td>
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</tr>
<tr>
<td><em>Balanus</em> sp. unk</td>
<td>LCRANS</td>
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</tbody>
</table>

**BALANIDAE**

*Balanus crenatus* Bruguière, 1789  
LIT  
Origin: Native
Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea

Bering Sea to Santa Barbara, California. Pleistocene: Alaska, British Columbia, Washington, Oregon, California (Pitumbo & Ross 2002:100). Not expected in the low salinity areas of the Lower Columbia River where reports of it are probably misidentifications of *Balanus improvisus* or *B. glandula*.

**Balanus improvisus** Darwin, 1854  
LCRANS, LIT  
Origin: Introduced

*Balanus improvisus* is tolerant of long exposures to freshwater and full seawater and can reproduce in salinities as low as 10 PSU. *Balanus improvisus* is native to the north Atlantic and has been introduced all over the world on the hulls of sailing ships and with transplanted oysters. The east Pacific distribution of *B. improvisus* is from Vancouver Island, Canada to Monterey, California, and Equador (Pitombo & Ross 2002:101, Carlton 1979:592-597, Zullo 1979, Cohen & Carlton 1995:79-80). The first record of *B. improvisus* in the lowerbria River specimens occurring on the shells of the native crayfish, *Pacifasticus trowbridgii* collected in brackish waters of Young’s Bay in 1957 (Miller 1965, Carlton 1979, Zullo 1979). *Balanus improvisus* is readily distinguished from all other northeast Pacific barnacles by the combination of its calcareous base, extended spur of the tergum, large adductor ridge of the scutum, wall plates with internal tubes and its occurrence in very low salinities.

**Balanus glandula** Darwin, 1854  
LCRANS, LIT  
Origin: Native

The most common balanoid of the northeastern Pacific, *B. glandula* occurs in bays and polyhaline waters and on the open rocky coast in the intertidal from the Unilaska Island, Aleutian Islands, Alaska to Bahia de San Quintin, Baja California, Mexico (Henry 1942) and in Pleistocene deposits (Ross 1976). This species was probably introduced to Puerto del Mar del Plata, Argentina (Newman & Abbott, 1980) from the Northeast Pacific. This is the most common barnacle in the lower Columbia River.

**Balanus sp. unk** (Chapman)  
LCRANS  
Indeterminate

With carina, rostrum, lateral plates and deep spur of tergum similar to *B. improvisus*. The spur is up to 1/3 width of tergum and is far wider than expected for *B. improvisus*. The sharply quadrate articular ridge of the scutum is aligned with the angular adductor ridge but separated by a deep incision that is partially formed by a hatchet like extension of the articular ridge. The depressor muscle crests of the tergum are wide relative to illustrations of *B. improvisus*. (Specimens from 6.1332x, Port of Ilwaco, Washington, Baker Bay, Columbia River, April 17, 2002.)
Kingdom: Animalia
Phylum: Chordata
Class: Amphibia

Phylum: Arthropoda
Subphylum: Crustacea
Class: Ostracoda

Ostracods were neither targeted nor sent to experts for taxonomic identification by this survey. Further work is needed to determine both eth-native and introduced species present in the lower Columbia River.

<table>
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<tr>
<th>Family</th>
<th>Genus</th>
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<td>Eucypris spp.</td>
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<td>Candonidae</td>
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<tr>
<td>Limnocytheridae</td>
<td>Limnocythere spp.</td>
<td>LIT</td>
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**DARWINULIDAE**

*Darwinula stevensoni* (Brady and Robertson, 1870)
Syn: *Polycheles improvisa, Polycheles stevensoni*

May be a cosmopolitan ostracod, asexual reproduction, common in European waters.

---

Phylum: Arthropoda
Subphylum: Crustacea
Subclass: Copepoda

Species descriptions by Jeff Cordell

The following copepods collected in the lower Columbia River consist of those taxa for which a strong case can be made for their status as introduced species. Several of these taxa (*Leimia vaga, Tachidius triangularis*) are regarded as cryptogenic because they are small and easily overlooked in typical sampling programs, and their distributions are poorly known. However, they are included in the list because they occur in widely disjunct populations, and/or previous authors have regarded them as introduced to the northeastern Pacific. A number of other harpacticoid copepods were collected in this survey that were described from elsewhere and may have been introduced to the northeastern Pacific. These were not included in this list because they are very widely distributed, (e.g., on both coasts of the United States and in Europe) and/or their taxonomy is poorly known, and therefore their status as introduced or cryptogenic is less...
clear. These species include *Coullana canadensis, Huntemmania jadensis, Limnocletodes behningi, Microarthridion littorale, Nannopus palustris, Onychocamptus mohammed, Paronychocamptus cf huntsmanni,* and *Tachidius (Tachidius) discipes.*

Also, several specimens of an unidentified species of Thermocyclops were found in this survey. Thermocyclops has not been previously recorded from western North America, but is widespread, occurring in southeastern North America, Central and South America, Europe, Asia, the Indian subcontinent, and Africa (Ueda and Reid 2003). The disposition of this species as introduced is unknown, and will become clearer if enough specimens can be examined to make a specific identification.

### CALANOID COPEPODS

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Phylum: Arthropoda  
Subphylum: Crustacea

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**Pseudodiaptomus inopinus** (Burkardt, 1913)

*Pseudodiaptomus inopinus* is native to the Indo-Pacific, and occurs in a variety of fresh and brackish water habitats from Siberia to the South China Sea, and on both coasts of Japan. The first record of this species on the west coast of the North America was in 1990, from the Columbia River estuary (Cordell et al. 1992). It was subsequently found to be established in many smaller estuaries in the Pacific Northwest, probably via introduction by ballast water (Cordell and Morrison 1996). *P. inopinus* appeared to be a stable and dominant component of the zooplankton in the tidal tributaries of the Columbia River estuary until 2002, when it was found to have been replaced by two other Asian calanoid copepods, *Pseudodiaptomus forbesi* and *Sinocalanus doerri*. Studies on the Chehalis River, which is north of the Columbia River, have found that when *P. inopinus* dominates the plankton in tidal brackish areas it can be important prey of the native shrimps *Neomysis mercedis* and *Crangon franciscorum* (J. Cordell, unpublished data). However, in this survey its abundance peak in the late summer-early fall did not correspond to times when juvenile salmon and other planktivorous fish are present, and it did not occur in their diets. In addition, *P. inopinus* may have ecological effects on other zooplankton. For example, another estuarine copepod, *Eurytemora affinis*, appears to be restricted temporally and spatially with regard to its expected distribution when *P. inopinus* is present (J. Cordell, unpublished data).

**Pseudodiaptomus forbesi** (Poppe & Richard, 1890)

In its native range, *P. forbesi* has been reported from the Yangtze River in China and from Japan (http://www.obs-banyuls.fr/Razouls/Webcd/Pseudodiaptomidae.htm). It was first collected in the northeastern Pacific from the upper San Francisco Bay estuary in 1987 (Orsi and Walter 1991), where it now appears to be a permanent part of the brackish-oligohaline plankton assemblage. This species was first found in the Columbia River estuary in benthic samples taken by the WEMAP survey. Along with *Sinocalanus doerri*, it appears to have replaced *P. inopinus* in this estuary. In 2003 samples from this survey, *P. forbesi* was one of the most abundant mesozooplankton species in tidal tributaries of the main estuary, comprising up to 52% of the plankton numbers in the Grays River. It occurred in the furthest upstream samples taken in this survey, and in

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summarized 2003 comprised 31% of the plankton numbers in Crane Lake, which is located near the city of Portland, Oregon.

**Sinocalanus doerri** (Brehm, 1909)

This species was introduced to San Francisco Bay from its native range in mainland China (Orsi et al. 1983). In the early 1980s it was the most abundant copepod in the oligohaline-tidal fresh region of the Sacramento-San Joaquin delta, but by the mid 1990s it had declined greatly (Orsi 1999). It first was first reported from the Columbia River estuary in 2002, by this survey. It occurred upstream to Crane Lake near Portland, Oregon, and was very abundant in tidal tributaries of the estuary, where it comprised up to 47% of the plankton numbers in summer 2003 samples.

**Limnoithona sinensis** (Burkhardt, 1912)

This cyclopoid copepod was first collected in San Francisco Bay estuary in 1979, from the San Joaquin River. It is a fresh water species native to the Yangtze River. It was also collected from the Columbia River from 1979 to 1980 during the CREDDP surveys. This species was not found in the present survey. It has been reported to have disappeared from the San Francisco Bay estuary, having been replaced by its congener *L. tetraspina*, another introduced species (Orsi and Ohtsuka 1999). However, recent analyses of ballast water taken from upper San Francisco Bay in 1999 show that *L. sinensis* was still present at that time (J. Cordell and G. Ruiz, unpublished data). Therefore, this species may still exist in a restricted range in upper San Francisco Bay.

**Limnoithona tetraspina** (Zhang & Li, 1976)

*Limnoithona tetraspina*, which is native to the Yangtze River, first occurred on the North American west coast in 1993, in the upper part of San Francisco Bay. Since its introduction there, it has been the most abundant copepod in the bay, with mean abundances of >10,000 m$^{-3}$. Three specimens of this species were found in 2003 samples from this survey, from both lower (Grays River) and upper (Trojan Power Plant) sites.

**Leimia vaga** (Willey, 1923)

This harpacticoid copepod can be regarded as a cryptogenic species. Described from Nova Scotia, it is also abundant in many estuaries in Oregon and Washington, where it is restricted to brackish water (J. Cordell, unpublished data), and has also been reported from Prince William Sound, Alaska (Hines and Ruiz, 2000). It was not reported from brackish water habitats in the Nanaimo River estuary, British Columbia in Kask’s (1982) checklist of harpacticoids from there. The fact that *L. vaga* has restricted habitat requirements and apparently disjunct populations on the Pacific coast may indicate that it has been introduced.

**Tachidius (Neotachidius) triangularis** Shen and Tai, 1963

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This species is one of the most abundant harpacticoids in marine-influenced tidal channels of coastal Pacific Northwest estuaries; and also occurs in eelgrass beds. Described from the Pearl River delta, South China, Kask et al. (1982) regarded it as a probable introduction to the Nanaimo River estuary, British Columbia. In this survey *T. (N.) triangularis* occurred in Baker Bay and in the early 1990s it was recorded in Trestle Bay in an unpublished USFWS study.

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### Phylum: Arthropoda

**Subphylum: Crustacea**

**Suborder: Cladocera**

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<td><em>Alona quadrangularis</em></td>
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<td><em>Alona affinis</em></td>
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<td><em>Alona guttata</em></td>
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<tr>
<td><em>Alonella</em> sp.</td>
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<tr>
<td><em>Camptocercus reticrostris</em></td>
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<tr>
<td><em>Chydorus sphaericus</em></td>
<td>LIT</td>
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<tr>
<td><em>Chydorus</em> spp.</td>
<td>LCRANS, LIT</td>
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<tr>
<td><em>Eurycercus lamellatus</em></td>
<td>LIT</td>
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<tr>
<td><em>Eurycercus</em> sp.</td>
<td>LCRANS, LIT</td>
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<tr>
<td><em>Leydigia quadrangularis</em></td>
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<tr>
<td><em>Leydigia acanthocercoides</em></td>
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<td><em>Leydigia</em> sp.</td>
<td>LCRANS, LIT</td>
</tr>
<tr>
<td>Other <em>Chydoridae</em></td>
<td>LCRANS</td>
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<tr>
<td><em>Monospilus dispers</em></td>
<td>LIT</td>
</tr>
<tr>
<td><em>Pleuroxus striatus</em></td>
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<tr>
<td><em>Pleuroxus denticulatus</em></td>
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<td><em>Pseudochydorus globosus</em></td>
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<tr>
<td><strong>Daphnidae</strong></td>
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<tr>
<td><em>Ceriodaphnia pulchella</em></td>
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<tr>
<td><em>Ceriodaphnia quadrangula</em></td>
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<tr>
<td><em>Ceriodaphnia reticulata</em></td>
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<tr>
<td><em>Ceriodaphnia</em> spp.</td>
<td>LCRANS, LIT</td>
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<tr>
<td><em>Daphnia parvula</em></td>
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</tbody>
</table>
Phylum: Arthropoda  
Subphylum: Crustacea  
Class: Malacostraca  
Peracarida – Cumacea  

Section write ups by John Chapman  

Cumaceans small motile animals that brood their young in a pouch. Few species produce more than one or two brood in their life but they can reach great abundances in some areas nevertheless. Only Cumella vulgaris and Nippoleucon hinumensis were collected in the lower Columbia Riversurvey. Both species are tolerant of reduced salinities and are likely to be the only species that permanently reside in the estuary. All other
Cumaean species reported in the lower Columbia River are either obligate marine species that are perhaps were incidental or are likely misidentifications.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Origin</th>
<th>Notes</th>
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<tr>
<td>Diastylidae</td>
<td><em>Colurostylis occidentalis</em></td>
<td>LIT</td>
<td>Native^</td>
</tr>
<tr>
<td></td>
<td><em>Colurostylis spp.</em></td>
<td>LIT</td>
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<tr>
<td></td>
<td><em>Diastylopsis dawsoni</em></td>
<td>LIT</td>
<td>Native^</td>
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<tr>
<td></td>
<td><em>Diastylopsis spp.</em></td>
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<tr>
<td>Lampropidae</td>
<td><em>Lamprops sp. A</em></td>
<td>LIT</td>
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<tr>
<td>Leuconidae</td>
<td><em>Eudorellopsis</em> sp.*</td>
<td>LIT</td>
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<td></td>
<td><em>Hemileucon comes</em></td>
<td>LIT</td>
<td>Introduced#</td>
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<tr>
<td></td>
<td><em>Hemileucon spp.</em></td>
<td>LIT</td>
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<tr>
<td></td>
<td><em>Leucon sp.</em></td>
<td>LIT</td>
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<tr>
<td></td>
<td><em>Nippoleucon hinumensis</em></td>
<td>LCRANS, LIT</td>
<td>Introduced</td>
</tr>
<tr>
<td>Nannastacidae</td>
<td><em>Cumella vulgaris</em></td>
<td>LCRANS, LIT</td>
<td>Native</td>
</tr>
</tbody>
</table>

^ = marine species
# = probable misidentification

### DIASTYLIDAE

**Anchicolurus occidentalis** (Calman, 1912)

LIT

Origin: Native

(Calman, 1912); *Colurostylis (?) occidentalis* - Calman, 1912:605,670, figs.100-112; *Colurostylis occidentalis* - Zimmer, 1936:439; Zimmer, 1940:61; Zimmer, 1941:35, fig.44; Lie, 1969:23; *Anchicolurus occidentalis* - Stebbing, 1912:176; Stebbing, 1913:130-131, figs.85-86; Gladfelter, 1975:242, tab.2; Gladfelter, 1975b:275; Bacescu, M., 1992:267,

An offshore marine species not encountered in the present survey and of doubtful occurrence in the non-marine LCR.

**Diastylopsis dawsoni** (Smith, 1880)

LIT

Origin: Native


A probable native species not encountered in the present survey and of doubtful occurrence in the non-marine LCR. A complication with *Diastylopsis dawsoni*, however, is that it has been reported from the North Atlantic, and the western Pacific in addition to
the eastern Pacific. Possibly eastern Pacific records of *D. dawsoni* are in fact the extremely similar native *Diastylopsis tenuis* and the western populations are a separate species. On the other hand fully marine species have been introduced to the eastern Pacific (Gosliner, T. 1995. The introduction and spread of *Philine auriformis* (Gastropoda: Opisthobranchia) from New Zealand to San Francisco Bay and Bodega Harbor. *Marine Biology*, 122: 249-255).

**LEUCONIDAE**

**Hemileucon comes** Calman, 1907  
LIT  
Origin: Introduced – probable misidentification

Calman 1907:38-39, pl. 9, figs. 26-32; Bacescu 1988:149.  
*Hemileucon comes* is native to New Zealand and its occurrence in the northeastern Pacific is unconfirmed. However it resembles and thus is a probable misidentified record of *Nippoleucon hinumensis* in the LCR.

**Nippoleucon hinumensis** Gamo, 1967  
LCRANS, LIT  
Origin: Introduced


The type locality of *N. hinumensis* is the brackish water Lake Hinuma, Honshu Japan. In the northeast Pacific, *Nippoleucon hinumensis* has been variously misidentified in collections from the northeast Pacific as *Leucon* or *Hemileucon*. Carlton (1979) did not find it in his comprehensive survey of San Francisco Bay NAS but then it became abundant and widespread in San Francisco Bay since at least 1986 (Cohen & Carlton 1995). *Nippoleucon hinumensis* could be a ballast water introduction (Cohen and Carlton 1995) but it occurs even in estuaries of the NEP that do not receive ballast water traffic, and its spread along the northeastern Pacific coast prior to 1986 is unknown. Other mechanisms of introduction, including transplanted oysters from Japan have not been examined closely. *Nippoleucon hinumensis* is one of the many likely introductions of the NE Pacific that have not yet been published in the peer-reviewed sources. *N. hinumensis* ranges between Elliot Bay, Puget Sound Washington to San Francisco Bay in the NE Pacific (Cohen et al. 2001). Surprisingly Wasson et al. (2001) do not report *N. hinumensis* from Elkhorn Slough, California, which is only 150 km south of San Francisco Bay. *Nippoleucon hinumensis* can readily be confused with *Leucon* or *Hemileucon*.

**NANNASTACIDAE**

**Cumella vulgaris** Hart, 1930  
LCRANS, LIT  
Origin: Native

Appendices: page 99
Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea  


_Cumella vulgaris_ is tiny and common to abundant on shallow subtidal muddy/sand bottoms, of marine intertidal and rocky intertidal pools. It ranges from Alaska to central California (Gladfelter 1975, Bacecu 1992:227) and tolerates extremely broad temperature and salinity ranges. Few species have such broad geographical and physiological ranges. _Cumella vulgaris_ may consists of more than one species.

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Phylum: Arthropoda  
Subphylum: Crustacea  
Class: Malacostraca  
_Peracarida – Tanaidacea_

Section write ups by John Chapman  
Tanaidaceae are distant relatives of Isopoda with long bodies and chelate first walking legs. Tanaidaceans undergo complex sequential sex and morphology changes in response to local population and environmental conditions. The enormous morphological changes greatly complicate taxonomic analyses. The taxonomy of northeastern Pacific tananaidaceans is poorly resolved. As in all peracaridans, juvenile development is direct, requires significant parental care and occurs without a pelagic larval dispersal stage.

<table>
<thead>
<tr>
<th>FAMILY</th>
<th>SPECIES</th>
<th>LCRANS</th>
<th>ORIGIN</th>
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<tr>
<td>Leptocheiliidae</td>
<td><em>Leptocheilia dubia</em></td>
<td>LCRANS</td>
<td>Cryptogenic</td>
</tr>
<tr>
<td>Tanaidae</td>
<td><em>Sinobus stanfordi</em></td>
<td>LCRANS</td>
<td>Introduced</td>
</tr>
</tbody>
</table>

**LEPTOCHELIIDAE**

*Leptocheilia savignyi* (Kroyer, 1842)  
LCRANS  
Origin: Cryptogenic  

(Kroyer, 1842); Ishimaru 1985(with citations); Dojiri & Sieg, 1997:213-214,217, figs.3.9, 3.10; Carlton, J.T., 2001:20.

*Leptocheilia savignyi* has also been referred to as _Leptocheilia dubia_ in the northeast Pacific. However _L. dubia_ is one of many synonyms of _L savignyi_. The _Leptocheilia savignyi_ complex occurs on all temperate and boreal marine coasts of the northern hemisphere but not in the Arctic Ocean (Ishimaru 1985). The biogeography and taxonomy of the species are too poorly resolved to decipher the native or introduced origins of this species. _Leptocheilia savignyi_ is a dominant benthic organism in many high salinity areas and its tube building can effect significant alterations of sediment.
stability in northeast Pacific estuaries. Few *L. dubia* were encountered in the Columbia River.

TANAIDAE

*Sinelobus stanfordi* (Richardson, 1901)
Syn: *Leptochelia philetaerus, Tanais estuaries, Tanais herminiae, Tanais philetaerus, Tanais stanfordi, Tanais sylviae*

LCRANS
Origin: Introduced


*Sinelobus stanfordi* is a cosmopolitan, tropical and temperate latitude freshwater and marine, shallow water species with a complex taxonomy and massive list of synonymies (Sieg 1980:60-68, Sieg & Winn 1981:329, fig. 6). Very likely transported around the world since 1500 in association with solid ballast, in fouling communities associated the hulls of sailing ships and then again with ballast water and aquaculture transplants. Its origins in the LOWER COLUMBIA RIVER could be due to many mechanisms. The specific name is by consensus among local taxonomists and the species epithet is very unlikely to remain after its taxonomy is more clearly resolved.

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Phylum: Arthropoda
Subphylum: Crustacea
Class: Malacostraca
Peracarida – Isopoda

Section write ups by John Chapman

Isopoda occur in fresh and marine waters and in most terrestrial environments. Most isopods are dorsoventrally flattened and have 7 pairs of walking legs of similar form. *Argaia* and *Liriopsis* are parasites of marine fish, encountered only incidentally within the Columbia River. The all native Idoteidae species are marine and also are encountered only incidentally within the lower Columbia River.

A notable missing species in the lower Columbia River is the Asian idoteid *Synidotea laevidorsalis* Miers, 1881 introduced to San Francisco Bay over 100 years ago. *Synidotea laevidorsalis* can reproduce in salinities as low as 10 PSU and occurs in Willapa Bay, Washington, immediately north of the lower Columbia River but has not been reported from the lower Columbia River. Possibly, the record of *Synidotea angulata* (below) was actually *S. laevidorsalis*.

**Epicaridea**

LIT
ASELLIDAE

The epigean *Asellus* of the northeast Pacific consist of the native *A. alaskensis* Bowman & Holmquist, 1975, *A. occidentalis* Williams, 1972 and *A. tomalensis* Bowman 1974 and the introduced nonindigenous *A. hilgendorfii* Bovallis, 1886 and *A. racovitzai racovitzai* Williams, 1970. The incomplete taxonomy and geographical information on these species greatly complicates efforts to resolve their origins.

**Caecidotea occidentalis** (Williams 1970)
LCRANS, LIT
Origin: Native

Appendices: page 102
See discussions of *A. tomalensis* and *A. racovitzai racovitzai* below.

**Caecidotea racovitzai racovitzai** (Williams, 1970)
LCRANS, LIT
Origin: Introduced


The palm of the propodus of the first pereopod bears a triangular process near the midpoint and the first pleopod of the male is subequal to the second pleopod. The mesial process of the endopod of the second male pleopod is present and the cannula is relatively long and narrow with the caudal process acutely pointed. *Asellus communis* was the first specie of North American *Asellus* to be described. Say’s (1818) brief description provided no details or figures of the male sexual pleopods. It is uncertain whether any of the several subsequent redescriptions of this species (none of which referred to the type material) in fact apply to *A. communis* Say, 1818. Williams (1970) reports *Asellus racovitzai racovitzai* and *A. communis* from broad regions of the eastern Great Lakes and the northeastern U.S. William’s (1970) western North American records of both species are from Echo Lake, Kings County, Washington.

The male triangular extension of the mid propodus of pereopod 1 and three tipped endopodite of the second pleopod clearly distinguish *Asellus racovitzai* from *A. communis, A. occidentalis* and *A. tomalensis*. Hatch (1947) reports *A. communis* from Ontario, Quebec and Nova Scotia, from the Arboretum, and the Plantation Pond, Lake Washington, Univ. Washington Campus. This species has been referred under *Caecidotea sp.* (Smith 2001, Thorp & Covich 2001). However, Birstein (1951:48-59) argues for the synonymy of Caecidotea under *Asellus*, which appears to have been accepted by Williams (1970) and Bowman (1974) and Miller (1975). Hatch’s (1947) records and others assumed by Bowman (1975) to be *A. occidentalis* are not confirmed and could be in fact be *A. racovitzai* or *A. communis* "occurring in the side channels and on vegetated shores in areas of dense aquatic vegetation of the Columbia River".

Toft et al. (2002) review the criteria for nonindigenous species that apply to the possible introduction of C. racovitzai to the San Francisco Bay delta

Origins: Very likely, an introduction from the eastern U.S. but requiring more detailed taxonomic analyses.

**Caecidotea sp cf racovitzai** (Chapman)
LCRANS

These female specimens are possibly *Caecidotea racovitzai racovitzai* but cannot be identified with confidence. They should be counted as a record for the genus but not as additions to species lists.

**Caecidotea tomalensis** Harford, 1877
LIT
Origin: Native – possibly misidentified

Appendices: page 103
Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea


The dactyl and propodus palm of pereopod 1, postmandibular lobes of head and the distal endopod of male pereopod 2 closely match *A. occidentalis* of Williams (1970) and Bowman (1974). However, the male pleotelson is more similar to Williams (1970, fig. 53G) than to Bowman (1974, fig. 18). The pleotelson shape is constant among males ranging from 3-8 mm in length in sample 8.501x.

*Asellus occidentalis* is distinguished from *A. communis* and *A. racovitzae* (the only other species known from Washington and Oregon) by the absence of an anterior tooth and mid triangular process on the palm of the propodus of male pereopod 1 and by the absence of a process on the lateral edge of the base of the endopod of the male second pleopod. Characters that distinguish these *Asellus occidentalis* from the *A. tomalensis* are the long, triangular apex of the endopod of male pleopod 2, which is rounded in *A. tomalensis*, and the acute postmandibular lobes of the head, which are evenly rounded in *A. tomalensis*. The steeply inclined posterior edges of the telson of these specimens more closely match *A. tomalensis* of Bowman (1974). Ellis (1971) found *A. occidentalis* (as *A. tomalensis*) an intermittent pond adjacent to the south fork of the Klassanin River in Clatsop County, Oregon, but not in apparently suitable habitats of the south fork above and below the pond. Williams (1970) in his revision of 14 epigean species of North American *Asellus*, lists only *A. occidentalis* as restricted to the Pacific coast (Oregon, Washington, British Columbia). The only other Pacific coast epigean species that Williams listed, (*A. communis* and *A. racovitzae*) were known then only from Echo Lake, Washington. Both, *A. communis* and *A. racovitzae* were collected by E. L Bousfield 20 August 1955. Both of these species appear to be introduced to the Pacific coast from the eastern United States (Bowman 1974, Toft et al. 2002).

Williams (1970:13) considered Bousfield’s material from Echo Lake and personal notes to be “of considerable interest” and included them in his publication: Bousfield personal commuication to Williams, (1 Sept. 1967) “Echo Lake is the type locality of *Crangonyx richmondensis occidentalis* H. & H., one of a species complex that is usually found together with *A. communis* in the east. . . . *Crangonyx psuedogracidilis* Bousf., formerly thought to be endemic to eastern North America, has also turned up in material from Oregon and Washington cf. Bousfield, 1961, and indicates that freshwater peracaridans may have much wider distributions than formerly believed.” Indeed, since Bousfield’s 1967 note, the introductions of *C. pseudogracidilis* (Costello 1993, Chapman 2000) and *A. communis* (Williams 1972, Chapman 2000) were discovered in Europe, and *A. racovitzae* has since appeared in San Francisco Bay (Toft et al. 1999, 2002).

Williams (1972) described his Pacific coast *Asellus* material as a new species (*Asellus occidentalis*) rather than *Asellus tomalensis* Harford, 1877 (as others had done e.g., Fee
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

1926, Carl 1937, Hatch 1947, Ellis 1971). William’s justification of this designation was that the published descriptions of *A. tomalensis* were inadequate (Bowman 1974). The single type specimen of *A. tomalensis*, collected by Lockington in “Tomales Bay, and vicinity”, California, was in the California Academy of Sciences, collections that were destroyed in the 1906 San Francisco earthquake. Attempts by William’s colleagues to collect more specimens from Tomales Bay were unsuccessful. Williams was therefore uncertain whether *A. occidentalis* was in fact, a distinct species from *A. tomalensis*. Bowman, concluding that *C. tomalensis* is a freshwater species, and accordingly searched adjacent creeks and ponds of Tomales Bay for it but without success. However, E. Iverson and J. T. Carlton later found specimens in a shallow pond adjacent to Bolinas Lagoon, less than 24 km south of Tomales Bay. Bowman’s (1974) compared these topotypes with *A. occidentalis* and concluded that the two species are valid. However, the synonymies proposed by Bowman (1974) are for dates prior to Williams 1970 since the specimens were not examined.

The discovery of *A. racovitzai* in the Columbia River (see below) and its recent appearance in San Francisco Bay, since its discovery in Echo Lake in 1955, indicate that it is spreading on the Pacific coast. The inability of William’s colleagues and of Bowman to find and *A. tomalensis* around Tomales Bay suggests that this species has a restricted or limited distribution in the region. Toft et al. (2002) could not confirm previous records of *A. tomalensis* in San Francisco Bay its absence the bay delta prior to European settlement while occurring in surrounding drainages is unlikely. The exclusive occurrence of *A. racovitzai* and *A. hilgendorfii* and complete absence of *A. tomalensis* in thousands of samples from the San Francisco Bay delta may indicate the local extinction of *A. tomalensis* and perhaps its replacement by *A. racovitzai* and *A. hilgendorfii*.

Native to eastern Pacific but perhaps confused in the Columbia River with native or nonindigenous species.

BOPYRIDAE

*Argeia pugettensis* Dana, 1853
Syn: *Argeia pauperata* Stimpson, 1857; *Argeia calmani* Bonnier, 1900; *Argeia pingi* Yu 1935.
LIT
Origin: Native

Ranging from the Bearing Sea to southern California, Japan and Korea, *Argeia pugettensis* is a branchial parasite of Crangonid shrimps.

CHAETILIIDAE

*Mesidotea entomon* (Linnaeus, 1767).
LCRANS, LIT

Appendices: page 105
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

Origin: Native

*Mesidotea entomon* was formerly placed under *Oniscus* and several other genera. However, the identity of this large isopod has remained clear in the literature. In the northeast Pacific this species has been commonly known as *Saduria entomon*. The species is rare in muddy sands and gravels of coastal rivers, bays and beaches of Washington and Oregon but attracts attention due to its large size, reaching 30 mm in length. Distribution - Circumpolar, western coast of North America to Pacific Grove, CA; Stockholm, Germany, Labrador, Kara Sea.

CIROLANIDAE
*Excirolana chiltoni* (Richardson, 1905)
LCRANS
Origin: Cryptogenic

(Formerly placed in *Cirolana*). British Columbia to CA; Japan, Taiwan, Hong Kong. Intertidal. = *E. kincaidi* (Hatch, 1947); = *E. vancouverensis* (Fee, 1926); = *E. japonica* Richardson, 1912 (See Brusca et al. 2004)

An open coastal and marine bay species of clean sand. Northeast Pacific species of these environments are commonly considered to be native due to the vast majority of other species in those habitats that are native. However, the spread of the introduced Asian clam *Nuttallia obscurata* in these same environments from along the coast (see below) and the probable introduction of the surf zone diatom *Chaetocerus armatum* (Lewin, J. and Norris, R.E. 1970, Lewin, J. and Rao, V.N.R. 1975, Lewin, J. and Schaefer, C.T. 1983) indicate that the origins of many of these species should be examined more carefully.

CRYPTONISCIDAE
*Liriopsis pygmaea* (Rathke, 1843)
LIT
Origin: Native– probably misidentified

An obscure nearly cosmopolitan hyperparasite of rhizocephalin barnacles that infect lithodid crabs and hermit crabs (Lovrich et al 2004). The occurrence of this species in the LOWER COLUMBIA RIVER should be held in doubt since none of the hosts are reported from the LCR.

IDOTEIDAE
*Idotea fewkesi* Richardson, 1905
LIT
Origin: Native

Appendices: page 106
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea


A common inhabitant of shallow water and rocky intertidal macrophytes from Alaska to southern California. *Idotea fewkesi* is a probable incidental species of the LOWER COLUMBIA RIVER and unlikely permanent resident.

**Synidotea angulata** Benedict, 1897

LIT

Origin: Native - possibly misidentified

Benedict 1897:395-396, fig. 6; Richardson 1899a:847-848, Richardson 1899b:268; Richardson 1905:376, figs. 418-419; Hatch 1947:220, fig. 97; Schultz 1969:68, fig. 77; Kussakin 1982: 245-247, figs. 181-182; Rafi & Laubitz 1990:2674, figs. 19-20;

The range of *Synidotea angulata* is British Columbia to Northern California and it occurs in full marine deep waters (57-69 m) that would not be expected in the LCR. However, *S. angulata* resembles and could be confused with the introduced *Synidotea laevidorsalis* Meirs, 1881. *Synidotea laevidorsalis* is a full estuarine low salinity species introduced over 100 years ago, (Chapman and Carlton 1991, 1994) but is known in the eastern Pacific only from San Francisco Bay, California and Willapa Bay, Washington. Origin: Native if correctly identified. *Synidotea laevidorsalis* was reported for the first time in the northeast Pacific along with the original description of *S. angulata* (Benedict, 1897).

**LIGIIDAE**

**Ligia pallasi** Brandt, 1833

LCRANS

Origin: Native

Van Name 1936:46-44, fig. 7 (with synonymy); Hatch 1947:187-188.

*Ligia pallasi* is a cockroach-like isopod that scavenges decaying plant and animal material. It occurs in deep crevices of high intertidal rocky areas predominantly on open coasts and often near freshwater seeps. Females reach 2.5 cm in length. Distribution - Alaska to Santa Cruz, California.

**LIMNORIIDAE**

**Limnoria lignorum** (Rathke, 1799)

LIT

Origin: Native


*Limnoira lignorum* is conspicuous where it occurs because it bores into wood.
Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea

Distribution – Kodiak, Island, Alaska to Pt. Arena, California, 0-20 m, tolerant of low salinities.

ONISCIDAE

*Porcellio scaber* Latreille, 1804  
LIT  
Origin: Introduced

Van Name 1936:226-227 (with synonomyies)


SPHAEROMATIDAE

*Bathycopea daltonae* (Menzies and Barnard, 1959)  
LIT  
Origin: Native

*Ancinus daltonae* - Menzies and Barnard, 1959:31, fig. 25; *Ancinus granulosus* - Holmes & Gay; Schultz 1969:115; *Bathycopea daltonae* – Lyola & Silva 1971:217-222, fig. 5-7. Subtidal marine species of medium course grey sands. Monterey Bay to San Miguel Islands, CA. 19-20 m. Occurrence of this species in the Columbia River would be a range extension and thus is more likely to be a misidentification. Distribution – Monterey to Santa Cruz Island, California, unless this record stands.

*Gnorimosphaeroma insulare* (Van Name, 1940)  
LCRANS  
Origin: Native

Syn: *Gnorimosphaeroma lutea* (Van Name, 1940). The species was formerly placed also in *Exosphaeroma* (Brusca et al. 2004, Kussakin 1979:409-410, figs. 263-264).

Distinguished from *G. oregonense* by pointed rather than square hinge notches between telson and 3rd pleonite, by the projection of the 3rd pleonite short of the lateral edge of the pleon. Morphological differences between *Gnorimosphaeroma insulare* and *G. oregonense* are subtle (especially comparing 4.897x and 5.898x of 10 July 2002, Young’s Bay Rip rap). The shape of hinge notches vary with angle of perspective and the only illustrations are at different angles. The extension of the third pleonite and the body length are also variable. There seems to be no salinity gradation associated with their distributions in the Columbia River and they seem doubtfully distinct species. Distribution - Popof Island, Alaska to San Nicolas Island, California. Fresh and brackish water estuaries and lagoons along the northeast Pacific coast. = *G. oregonensis lutea* Menzies, 1954; = *G. lutea* Menzies, 1954.
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

Hoestlandt, H. 1977. Description complementaire de l'isopode flabellifere
Gnorimosphaeroma insulare Van Name et synonymie de G. luteum Menzies avec cette
especie. Crustaceana 32:45-54.

Gnorimosphaeroma oregonense (Dana, 1852)
LCRANS, LIT
Origin: Native

Syn: Sphaeroma oregonensis, Sphaeroma olivacea, Exosphaeroma oregonensis,
Neosphaeroma oregonensis, Gnorimosphaeroma oregonensis oregonensis
(Dana, 1852); Sphaeroma oregonense Dana, 1852:778; Atlas, 1855:pl.52; Stimpson,
1857:509; Richardson, 1899:836; Richardson, 1900:223; Richardson, 1904b:214;
Richardson, 1904c:659; Richardson, 1905:216; Sphaeroma olivacea Lockington,
1877:45; Exosphaeroma oregonensis Richardson, 1905b:296-298, figs.315,316;
Richardson, 1909:92; Van Name, 1936:450-451, fig.282; Hatch, 1947:213, figs.82-83;
Neosphaeroma oregonensis Monod, 1932:67-82, fig.74; Monod, 1936:123-
124(partim:fig.70); Gnorimosphaeroma oregonensis oregonensis Menzies, 1954:8-11,
fig.5,7A-E, 12; Riegel, 1959:272-284; Gnorimosphaeroma oregonense Hoestlandt,
1964:872-877; Miller, 1968:12-13; Schultz, 1969:129, fig.187a; Hoestlandt, 1973b:355-
369, figs.1-9; Kussakin, O., 1979:406-407,409, figs.260-262.

Distinguished from G. insulare by square rather than pointed hinge notch between telson
and 3rd pleonite, by the projection of the 3rd pleonite to the lateral edge of the pleon.
This is one of the most ubiquitous northeast Pacific coastal isopods.
Distribution - Central California to Alaska, intertidal to 22 m.

Tecticeps convexus Richardson, 1899
LIT
Origin: Native

Tecticeps convexus - Richardson, 1899:837; Richardson 1905b:278, figs. 290-291;
Kussakin 1979:347-350, figs. 210-211.

The previously known range of T. convexus is Oregon border to Point Conception,
California (Brusca et al. 2004). Thus, specimens from the Columbia River would be a
range extension or, the specimens could also be misidentified. Tecticeps convexus is a
full marine species that occurs at depths of 0- 9 m
The large order Amphipoda is represented locally by the suborders, Gammaridea, Caprellidea and Hyperiidea but only the Gammaridea permanently occupy the lower Columbia River. The Gammaridea however, are by far the most abundant and familiar suborder of benthic Crustacea in the fresh, brackish and marine waters of the lower Columbia River and occupy even the supralittoral fringe and in a few almost terrestrial habitats. Gammaridean amphipods, brood their eggs in a pericaridial pouch from which the fully formed young emerge. The juveniles do not have a specialized larval dispersal stage. The native *Corophium salmonis* and *Corophium spinicorne* are critical food sources of juvenile salmon in the lower Columbia River.

### Amphipoda

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**Isaenidae**

- *Photis macinerneyi* (LIT) Native
- *Photis* spp. (LIT)

**Lysianassidae**

- *Hippomedon columbianus* (LIT) Native

**Melitidae**

- *Melita cf. nitida* (LCRANS) Introduced

**Oedicerotidae**

- *Americhelidium shoemakeri* (LIT) Native
- *Americhelidium* spp. (LIT)
- *Pacifoculodes spinipes* (LIT) Native
- *Pacifoculodes* spp. (LIT)

**Phoxocephalidae**

- *Foxiphalus obtusidens* (LIT) Native
- *Grandifoxus grandis* (LCRANS, LIT) Native
- *Mandibulophoxus gilesi* (LIT) Native
- *Paraphoxus* sp. (LIT)
- *Rhepoxynius abronius* (LIT) Native
- *Rhepoxynius daboius* (LIT) Native
- *Rhepoxynius heterocuspida* (LIT) Native
- *Rhepoxynius tridentatus* (LIT) Native
- *Rhepoxynius* spp. (LIT)

**Talitridae**

- *Megalorchestia pugettensis* (LCRANS) Native
- *Traskorchestia traskiana* (LCRANS) Native

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**ANSIOGAMMARIDAE**

Only two native species of Anisogammaridae appear to exist in the present lower Columbia River, *Eogammarus confervicolus* and *Ramellogammarus sp. A*. *Ramellogammarus sp. A* appears to be a new species, distinct from *Ramellogammarus oregonensis* and *R. vancouverensis*.

**Eogammarus confervicolus** (Stimpson, 1856)

LCRANS, LIT

Origin: Native


Appendices: page 111
Among the most prevalent species of estuary samples sites in the LCR. Sample 14.1135x has a particularly large specimen. Distribution - Southeastern Alaska to southern California, 0-30m.

*Eogammarus oclairi* Bousfield, 1979

LIT

Origin: Native


The presence of two spines rather than one on the distal ends of the telson lobes are the primary feature distinguishing *Eogammarus oclairi* from *E. confervicolus*. Whether differences between *E. confervicolus* and *E. oclairi* are due to speciation or intraspecific allometric variation is unclear. The largest specimens in the collections (samples, 28.725x, 17.1229x, 12.1249x, 40.1252x) are mixed in with *E. confervicolus* morphotypes. This largest specimen has two stout distal spines on one telson lobe and one on the other. *Eogammarus oclairi* is thus a doubtful species.

*Ramellogammarus* sp. A

LCRANS, LIT

Specimen 1.1164x (female, Ft. Canby interior, 25 June 2003) has tiny pleonal spines that might be considered spines. This species occurs only in completely fresh water and appeared to be replaced by *E. confervicolus* occurred where salinities exceeded about 5 PSU. The possibility that this "new" *Ramellogammarus* is the long lost *Rammellogammarus ramellus* seems remote. (Weckel, 1907) reports *Ramellogammarus (Gammarus) ramellus* from Portland, Oregon. But also that: “These specimens were larger and stouter than those from California.” Possibly Weckel misidentified his material and had *Rammellogammarus sp. A* of this study. Either we did not find *Ramellogammarus ramellus* or Weckel's illustrations are misleading.

*Rammellogammarus sp. A* also does not appear to be *Ramellogammarus oregonensis* (Shoemaker, 1944) or *Ramellogammarus vancouverensis* Bousfield, 1979. Dorsal pleon spines of *E. sp. A* are 6-12 and variable in number and positioned on the extreme posterior edge of the pleonites. The pleonal spines of *R. oregonensis* and *R. vancouverensis* are clearly more anterior to the posterior pleonal edge than the spines of *R. sp. A*. Moreover, *R. ramellus* is without pleonal spines and *R. vancouverensis* have only 1-2 spines. Previous reports of *Ramellogammarus ramellus*, *R. oregonensis* and *R. vancouverensis* from the Columbia River are probably in fact, *Ramellogammarus sp. A*. Only a single species seems to be involved whether it is a new species cannot be addressed here.

The eyes lack pigment and spines occur on the absolute posterior edges of pleonites 3, 2 and sometimes 1 which do not occur on *E. confervicolus*. Specimens 4.1085x (Gray's Appendices: page 112
Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea

River Log scrape, 6/26/2003); specimens 3.1329x (Sportsmens Club boat launch, Kalama, 6/27/2002, sample 9.3). A large male with typical *Eogammarus* peg-spines was found among specimens 7.1013x (Creek below Lewis & Clark Falls, Gravel bucket swirl, 26 June 2003). An ovigerous female, the largest specimen is in sample 6.1153x (Gray's River, bryozoans etc. scraped from a log, 26 June 2003). The posterodorsal pleonites of this specimen are lined only with setae but the remaining 25 specimens have stouter spines.

**Rammellogammarus oregonensis** (Shoemaker, 1944)  
LIT  
Origin: Native


Bousfield (1979) reports *R. oregonensis* from Creeks and lakes of Lincoln and Lane Counties in Oregon and Lake Oswego (Bousfield 1979). However, this species was also not observed in the survey.

**Distribution** – Known only known freshwater reaches of the Columbia River.

**Origins** – Presumed native, if it is indeed a good species, due to its extreme similarity to the native *Ramellogammarus* species and *Eogammarus confervicolous*.

**AORIDAE**  
**Grandidierella japonica** Stephensen, 1938  
LCRANS, LIT  
Origin: Introduced


**Distribution** - Japan: Eastern coast of Japan, from Nakaminata, Honshu to southern Point of Kyushu, and southern coast of Korea between Pusan and Wando, including islands of Korea Strait. North America: Frasier River estuary, British Columbia, south to Bahia de San Quintin, Baja California, Mexico. Australia: Sydney, from Port Macquarie south to Cape Howe at New South Wales on the Victoria border. Europe: southern
England. The Fraser River and English populations are at the highest latitudes any other populations of *Grandidierella* and far exceed the maximum latitude of the native *Grandidierella japonica* is an estuarine species transferred around the world most likely with transplanted oysters and ballast water.

**ATYLIDAE**

*Atylus tridens* (Alderman, 1936)

LIT

Origin: Native


Distribution - Queen Charlotte Islands south along the outer coasts of British Columbia to Oregon and central California (Bousfield & Kendella 1994:22), 0-135m. *Atylus tridens* is an entirely marine species that is only likely to occur in the lower Columbia River incidentally.

**COROPHIIDAE**

*Americorophium brevis* (Shoemaker, 1949)

LCRANS, LIT

Origins: Native


*Americorophium brevis* is a predominantly shallow water marine and high salinity estuary species that usually occurs in fouling communities and open coasts and marine bays.

Distribution - Prince William Sound, Alaska to San Francisco Bay, California, subtidal to 35 m (Bousfield & Hoover 1997:98).

*Americorophium salmonis* (Stimpson, 1857)

LCRANS, LIT

Origin: Native

Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea


Distribution - Its northeast Pacific range extends from south Alaska to Humboldt Bay, California. ***Americorophium salmonis*** is an endemic estuary species that has been introduced above the tidal range of the Columbia River dams and into Putah Creek, California. ***Americorophium salmonis*** does not attach its tubes to solid substrata and occurs exclusively on muddy to sandy bottoms in of estuaries, and slow moving rivers. Native to coastal regions and introduced inland.

***Americorophium spinicorne*** (Stimpson, 1856c)  
LCRANS, LIT  
Origin: Native


An endemic polyhaline species endemic to tidal bays, estuaries and freshwater river mouths of the northeast Pacific that ranges between Amchitka Island, Alaska to Morro Bay, California. ***Americorophium spinicorne*** has been introduced above the tidal range of the Columbia River (e.g., Thorp & Covich 2000) and up other rivers by human activities. ***Americorophium spinicorne*** occurs on fouling surfaces and mud bottoms in association with the NZMS. Native to coastal areas.

***Monocorophium acherusicum*** (Costa, 1851)  
LIT  
Origin: Introduced


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Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea  


Distribution – One of the most widely distributed and reported medium to high salinity estuary organisms, Monocorphium acherusicum occurs in all large estuaries at all latitudes less than 50° (north or south).

In the northeast Pacific, its presence in central Alaska is not confirmed. However, it occurs in nearly every estuary from the Strait of Georgia to the Panama Canal and has likely been in the northeast Pacific for 200+ years. Not to finding it in the lower Columbia River survey was a surprise.

CRANGONYCTIDAE

Reports of Crangonyx floridanus subgroup and Crangonyx spp. in the lower Columbia River are likely to comprise a single species, Crangonyx pseudogracilis.

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Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

**Crangonyx floridanus**
LIT
Origin: Introduced – probably misidentified


This Gulf coast species differs from *C. pseudogracilis* only by subtle, mostly microscopic characters that are seldom examined in routine synoptic surveys. The Columbia River records of this species are doubtful. More likely it is *Crangonyx pseudogracilis*.

Distribution - Gulf coast, sloughs, swamps, caves, and ponds, San Francisco Bay, California. Introduced into San Francisco Bay but doubtful in the lower Columbia.

**Crangonyx pseudogracilis**  Bousfield 1958

LCRANS
Origin: Introduced


Bousfield (1963) described *C. pseudogracilis* from the Napanee River, Ontario and from other material from Quebec, Vermont and Missouri. In the same paper, Bousfield reports the introduction of *C. pseudogracilis* to the British Isles based on specimens from Gloucestershire, England. Bousfield (1958:105) further reports that Holme’s (1905:94, fig.) “*Melita parvimana*” from Connecticut is “unquestionably a Crangonyx and very probably a pseudocrangonyx”. Bousfield (1958) distinguishes *C. pseudogracilis* from the superficially similar C. gracilis Smith 1871, “hence the specific name.”

*Crangonyx pseudogracilis* “breeds in spring and throughout the summer” Bousfield (1958) and is frequently taken “along with *Gammarus fasciatus* and *Hyalella azteca*, though less often with *C. gracilis* and *G. pseudolimnaeus* (in northern areas)”. The distribution and ecology of the species is “rivers, river mouths, lakes, sloughs, quarry ponds, dams, and other larger freshwaters that tend to be somewhat turbid and warm in summer”.

The combination of bifid spines lining the palm, and singly inserted simple setae on lateral anterior edge of the propodus of female gnathopod 1 place specimens 31.503x, outside of Holsinger (1972) couplet 1. However, Bousfield (1958, fig. 17) clearly indicates the presence of these characters. Bousfield’s (1973, pl. VIII) illustration of *P. pseudocrangonyx*. Figure 2A of *Crangonyx floridanus* from San Francisco Bay.

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Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

Toft et al. (2002) is an unpublished illustration of *Crangonyx forbesi* (Hubricht and Mackin 1940) from the Subterranean Amphipod Database (http://web.odu.edu/sci/biology/amphipod/cc_pictu.htm).

The combination of comb setae lining the dorsal lateral edge of the outer ramus of male uropod 2, and special ventral spines on the inner margin of the outer ramus of male uropod 2 (unique among species of *Crangonyx*) distinguish this species from all others (Zhang 1998). However, Zhang’s illustrations of *C. floridanus* and *C. pseudogracilis* indicate that morphological differences are subtle if they are real. Distribution - Introduced to Great Britain and Ireland (Costello 1993), NW and NE North America, Oregon. Inhabits aquatic vegetation in still an slow flowing waters, including organically polluted and saline waters (Holmes 1975, Gledhill et al. 1976, Pinkster et al. 1992, Costello 1993). It clings to plants when removed from water and is thus further distributed in Ireland (O'Connor et al. 1991).

**HAUSTORIIDAE**

*Eohaustorius brevicuspis* Bosworth, 1973

LCRANS, LIT

Origin: Native


Samples 11.1389x, (Baker Bay, Fort Columbia Tide flats, 11 June 2002), specimens do not have a cusp on the dorsal posterior of basis of pereopod 7 and pereopod 6 have only a single seta on the lateral faces of articles 5 and 6. These differences are consistent and suggest that these populations are a new species. However, a single individual of specimens 7.993x (Sand Island, Outer Beach, High Intertidal 25 June 2003) has the dorsal cusp and all specimens have two or more setae on the lateral faces of articles 5 and 6 of pereopod 6. Size, instar, age, seasonal differences in morphology should be examined in these species.

Distribution - Central California north to the Strait of Juan de Fuca (Bousfield & Hoover 1995:50) in high beach pools, river mouths, and estuaries in clean sand, 0-1 m.

*Eohaustorius estuarius* Bosworth 1973

LCRANS, LIT

Origin: Native


Distribution - Occurring in clean sand areas of estuaries and freshwater seeps and is very abundant in sandy areas of the lower Columbia River. Does not occur in completely

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Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea

fresh water. Sample 120.991 (inside Coast Guard Jetty 25 June 2002). *Eohaustorius estuarius* was the most abundant *Eohaustorius* and the only species other than *E. brevicuspis* encountered in the LCR. Since *Eohaustorius* are difficult to distinguish, the other species identified previously from the LCR, *Eohaustorius sawyeri* and *Eohaustorius washingtonianus* are more likely to be *E. estuarius*. Distribution - Oregon, Eureka, California north to Cape Flattery, Washington, 0-7m.

**Monoporeia sp.**  
Syn: Previously misidentified as *Pontoporeia affinis*.  
LIT  
Origin: Cryptogenic

The Columbia River population is the only population of the genus reported south of Alaska. This disjunct distribution has all appearances of a cold-water introduction, which would be unique among NE Pacific amphipods. However, the rapidly evolving state of the taxonomy of pontoporeiids prevents a definitive identification of this species presently. This species is reported only from lower Columbia River, however, Jeff Cordell has seen it in other adjacent estuaries.

**HYALELLIDAE**  
*Hyalella azteca* (Saussure, 1858)  
LCRANS, LIT  
Origin: Cryptogenic

*Amphithoe azteca* - Saussure 1858:474; *Allorchestes knickerbockeri* - Bate 1862:250; *Hyalella dentata* - Smith 1874:609, fig.1; *Lockingtonia fluvialis* - Harford 1877:54; *Hyalella knickerbockeri* - Weckel 1907:54, fig.15; *Hyallela Hyalella azteca* - Bousfield 1996:183; Bousfield 2001:104; *Hyallela azteca* - Stebbing 1906:575; Stout, V.R. 1913:635; Saunders 1933:245, fig.1; Shoemaker 1942b:80,82; Bulycheva 1957:181, figs.66a-b; Bousfield 1958b:109, fig.20; Bousfield 1961:5; Bousfield 1973:154, pl 43.2; Thomas, J.D. 1976:91-92; Barnard & Barnard 1983:708; Austin, 1985:595; Bousfield 1996:206, 207-209, figs. 3, 12, 17E; Hendrycks & Bousfield 2001:28, figs.4-5,6a,14; Bousfield 2001:104; Gonzalez & Watling 2002:173-183, figs. 1-5.

Specimen from 7.767x Carroll’s Channel Log raft, 26 June 2002 has particularly prominent dorsal carina on pleonites. This distinctive species, or species complex, has eluded taxonomist for 150 years and I am unable to resolve it here. Its very broad geographic distribution and many associations with introduced species, including introduced aquatic plants, suggest the almost certain possibility that populations have been moved about. However, the existence of many species within this complex is also likely. Resolution of the evolutionary origins of these populations and the role of humans in their distributions is not yet possible. Figure 2A of *Hyalella* from San Francisco Bay Toft *et al.* (2002) is an illustration from (Cole & Watkins 1977) of a specimen from Montezuma Well, Yavapai Co., Arizona.

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Distributions - Fresh waters of north and central America and Caribbean islands north to the tree line of North America and in larger rivers seaward into tidal fresh waters, and fresh-water barrier beach lagoons (Bousfield 1973:154) and freshwater and slightly brackish waters of lakes, rivers, upper estuaries of Mexico and California north to Alaska (Hendrycks & Bousfield 2001:28).

**Hyalidae**

*Allorchestes angusta* Dana, 1856

LIT

Origin: Native

*Allorchestes angusta* - Dana 1856:177; Barnard 1952:20-23, pl. 5, figs. 2-6; *Allorchestes angusta* - Barnard 1974:42; Barnard, J.L. 1975:343(key),358; Barnard 1979:91, figs. 50-52 (part); Bousfield 1981:81, figs. 12, 13; Bousfield 1996:178, fig. 1; Barnard; Bousfield 1996:181; Hendrycks & Bousfield 2001:10, 24-25, 1-6h, 12; non *Allorchestes angustus* - Barnard 1954c:21-23, Pl. 21 (=A. bellabella); *Allorchestes oculatus* - Stout 1913:651?

Distribution - Japan northward through Kuriles, across Aleutian Chain to Alaska then southward to California, generally intertidal, phycophilous, rarely subtidal (Barnard, 1979), high rocky intertidal and among algae wrack in protected bays and high salinity estuaries, 0-4m

**ISAEIDAE**

*Photis macinerneyi* Conlan, 1983

LIT

Origin: Native


Distribution - Lady Ellen Point, Broughton Strait, Vancouver Island south to Neah Bay, Clallam County, Washington (Conlan 1983) and southern California (Cadien, 2001), 0-45m. A probable incidental species in the LCR.

**LYSIANASSIDAE**

*Hippomedon columbianus* Jarrett and Bousfield, 1982

LIT

Origin: Native


Distribution - Oregon, 100-150m (Barnard 1971:34), British Columbia (Jarrett & Bousfield 1982), Southern California (Cadien 2001), 4-320m, probably incidental marine species of the LCR.
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

MELITIDAE

Melita cf. nitida (Smith, 1874)

Origin: Introduced


This is the first likely record of M. nitida from the Columbia River. The two damaged specimens, one male and one female are similar to M. nitida in the nearly bare posterior urosome, quadrate epimeron and general shape of male gnathopod 1, but the female coxa 5 does not have the extended posterior that appears to be a stridulating organ on M. nitida s.s.

Distribution - Southern British Columbia and northern Washington, also in Columbia estuary, parts of San Francisco Bay and south of Point Conception, in summer-warm brackish localities (Jarrett & Bousfield 1996). North-western Atlantic distribution is from New England to at least the southern Gulf of Mexico, 0-20m. It may also occur in Japan if Melita setiflagella Yamato, 1988 proves to be a junior synonym.

OEDICEROTIDAE

Americhelidium shoemakeri (Mills, 1962)

Origin: Native


Americhelidium shoemakeri occurs in full marine sandy sediments from British Columbia to southern California and in the intertidal to 183m (Thomas & McCann 1997). Its occurrence within the LOWER COLUMBIA RIVER is likely to be incidental.
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

**Pacifoculodes spinipes** (Mills, 1962)
LIT
Origin: Native


**Distribution** - British Columbia to southern California, intertidal to 98m (Thomas & McCann 1997); North-eastern Pacific boreal, 0-50m. Occurrences of this fully marine species in the LOWER COLUMBIA RIVER are probably incidental.

**PHOXOCEPHALIDAE**

**Grandifoxus grandis** (Stimpson, 1856)
LITCRANS, LIT
Origin: Native


**Distribution** – The range of *Grandifoxus grandis* is Dixon Entrance, Alaska to Pacific Grove, California, often occurring in reduced or brackish salinities (Jarrett & Bousfield 1994a:67) at depths of 0-1m. *Grandifoxus grandis* may permanently reside in the LCR.

**Mandibulophoxus gilesi** Barnard, J.L., 1957
LIT
Origin: Native


**Distribution** - Central British Columbia to southern California, intertidal to shallow subtidal depths and subtidally in substrata exposed to tidal currents (Jarrett & Bousfield 1994b:80) boreal, 0-14m

**Foxiphalus obtusidens** (Alderman, 1936)
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

LIT
Origin: Native


*Rhepoxynius abronius* (Barnard, J.L. 1960)

LIT
Origin: Native


*Rhepoxynius daboiius* (Barnard 1960)

LIT
Origin: Native


*Rhepoxynius heterocuspisidatus* (Barnard, J.L., 1960)

LIT
Origin: Native
Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea

Distribution - Point Conception, California to Bahia de Los Angeles, Baja California, 0-146m (Thomas & McCann 1997). Occurrences of *R. heterocuspidatus* in the LOWER COLUMBIA RIVER are doubtful.

*Rhepoxynius tridentatus* (Barnard 1954)  
LIT  
Origin: Native

Distribution - Puget Sound, Washington to vicinity of Point Conception, California, 0-89m (Barnard & Barnard 1982a). Occurrences of *R. tridentatus* in the LOWER COLUMBIA RIVER are probably incidental.

**TALITRIDAЕ**

*Megalorchestia pugettensis* (Dana, 1853)  
LCRANS  
Origin: Native

*Orchestia (Talitrus) pugettensis* - Dana, 1853&1855:859, t.57, fig.3a-d; Stimpson 1857:516; *Orchestoidae pugettensis* - Thorsteinson, 1941:pl.1, figs.1-9; Bousfield 1958:890, fig.2a,10i; Bousfield, 1961:7, fig.3; Bowers, 1963:317, figs.3e,4; Bousfield, 1975:355,364, fig.232; Bowers, 1975:357, fig.228; Staude et al., 1977:12, fig.20a; Klink, R.W., 1980:249; Bousfield, 1981:fig.18; *Orchestoida corniculata* - Thorsteinson, 1941:55; *Talorchestia tridentata* - Stebbing, 1899:398, t.30b(male); *Megalorchestia pugettensis* - Bousfield, 1982b:37-38, fig.16; Austin, 1985:596; Staude, 1997:353, 355, 380; Bousfield 2001:106; Not - *O. Pugettensis* - Stebbing 1906a:528.  
Distribution - Southern Alaska to central California, high intertidal coastal beaches and estuaries in high salinities and brackish water areas.

*Traskorchestia traskiana* (Stimpson, 1854)  
LCRANS  
Origin: Native

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Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

*Orchestia traskiana* - Stimpson 1854:98; Stimpson 1856:90; Stimpson 1957:517-518; Bate, S. 1862:19, pl.3, fig.4; Stebbing 1906a:534; Stout 1912:134, figs.74-75; Stout, V.R. 1913:635; Thorsteinson, E.D. 1941:54-55, pl.1, figs.1-9; Shoemaker 1942:13; Barnard, J.L. 1952b:23; Barnard, J.L., 1954a:23; Bousfield 1958a:885-887, figs.2d,10d; Bousfield 1961:3, fig.1-2; Barnard 1964a:116; Bousfield 1975:363, fig.236; Klink, R.W. 1980:249; Bousfield 1981:83, fig.17; *Orchestia sp.* - O'Clair 1977:446; *Traskorchestia traskiana* - Bousfield 1982b:10-13, fig.5; Staude, 1997:355, 380; Bousfield 2001:105; not *Orchestia taskiana* - Bulycheva 1957:166, fig.60.

Distribution - Amchitka Island, Alaska to Bahia de San Quintin, Baja California.

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**Phylum: Arthropoda**

**Subphylum: Crustacea**

**Class: Malacostraca**

**Peracarida – Mysida**

Section write up by John Chapman

Mysids are integral components of nearshore, estuary and freshwater food-webs of western North America both as predators of and food for many commercially and recreationally important fishes. Mysids, being peracaridan crustaceans, brood their eggs in a brood pouch (thus the vernacular name "opossum shrimp"). The brood pouch is formed by inner lamellae extending from the walking legs and the hatched young emerge from the pouch after they are fully formed. And the young emerge fully formed. Although half of all mysid species in San Francisco Bay are introduced, no introduced mysids were found in this survey of the lower Columbia River.

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<thead>
<tr>
<th>Mysidae</th>
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<tr>
<td><em>Acanthomysis macropsis</em></td>
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<td>Native</td>
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<tr>
<td><em>Archaeomysis grebnitzkii</em></td>
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<tr>
<td><em>Exacanthomysis</em> spp.</td>
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<tr>
<td><em>Neomysis integer</em></td>
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<tr>
<td><em>Neomysis kadiakensis</em></td>
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<tr>
<td><em>Neomysis mercedis</em></td>
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<tr>
<td><em>Neomysis rayii</em></td>
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</tr>
<tr>
<td><em>Neomysis</em> spp.</td>
<td>LIT</td>
<td></td>
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</table>

*Acanthomysis macropsis* (Tattersall, 1932)

LIT

Alenacanthomysis macropsis Tattersall 1932; Neomysis macropsis Tattersall 1932; Li 1936; Alienacanthomysis macropsis Tattersall 1932; Holmquist 1981; Daly & Holmquist 1986:1208.

Distribution – California to Alaska in shallow water among eelgrass and algae, "not uncommon".

Origin: Native.

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Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea

*Archaemysis grebnitzkii* Czerniasky, 1882  
LIT  
*Callomysis maculata* - Holmes 1894; non *Archaemysis maculata* - (Holmes 1894); Tattersall 1932 (see Holmquist 1975).  
Distribution – California to western Alaska and Japan. Intertidal, common to abundant in open coastal, unprotected inland waters above sandy bottoms, uncommon in brackish waters.  
Origins: native.

*Neomysis integer* (Leach, 1815)  
LIT  

*Neomysis integer* is a dominant mysid shrimp in the upper reaches of estuaries in Europe where it occurs in non-tidal lagoons, isolated bodies of nearly freshwater, and in high shore hypersaline pools, but is rare in fully marine habitats. There are no other reports of this species in the lower Columbia. This record is either an unrecognized introduction into the lower Columbia River or a misidentification.  
Origins: Introduced (not seen)

*Neomysis awatchensis* see *N. mercedis*  
LIT

*Neomysis kadiakensis* Ortmann, 1908  
LIT  
Distribution – southern Alaska to southern California, neritic, to 200 m.  
Origin: Native (not seen):

*Neomysis mercedis* Holmes, 1897  
LCRANS, LIT  
Distribution - Southern Alaska to southern California, euryhaline, fresh to marine, littoral and shallow neritic marine waters.

A few 15 mm specimens (the greatest length observed), had a pointed antennal scale, quadrangular or rounded rostrum, widely separated spines of the telson of both sexes, and by the 4th male pleopod which has a short terminal article of the exopod (less than 1/3 length first article) and the thick, short lateral extension of the endopod.  
Origin: Native

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Neomysis rayii

LIT

A probable misidentification or incidental species in the LCR.
Distribution – Kamchatka Peninsula, Russia and central California to northern Alaska, neritic to 300 m.
Origins: native.

Phylum: Arthropoda
Subphylum: Crustacea
Class: Malacostraca
Decapoda

Section write up by John Chapman

Decapoda have ten feet and a carapace that covers the united head and thorax. Decapoda are the most important crustacean food source for humans. Cancer magister is the most important commercially fished crustacean in the northeast Pacific. Decapod juveniles hatch out of the booded eggs at the nauplius stage (expt in peneid shrimps) and undergo extended larval dispersal before metamorphsis and settling back to the benthos.

* - unsuccessful introduction

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<tr>
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<td>Astacidae</td>
<td>Pacifastacus leniusculus klamathensis</td>
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<td>Pacifastacus leniusculus trowbridgii</td>
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<td>Pacifastacus leniusculus leniusculus</td>
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<td>Callianassidae</td>
<td>Neotrypaea californiensis</td>
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<td>Cancridae</td>
<td>Cancermagister</td>
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<td>Cancer oregonensis</td>
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<td></td>
<td>Cancerspp.</td>
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<td>Crangonidae</td>
<td>Crangon franciscorum franciscorum</td>
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<tr>
<td></td>
<td>Crangon nigromaculata</td>
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</tr>
<tr>
<td></td>
<td>Crangon spp.</td>
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<td></td>
<td>Lissocrangon stylirostris</td>
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<td></td>
<td>Neocrangon alaskensis</td>
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<td>Grapsidae</td>
<td>Eriocheir japonica</td>
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<td>Hemigrapsus oregonensis</td>
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<td>Hippolytidae</td>
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Appendices: page 127
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

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<tr>
<td><em>Exopalaemon modestus</em></td>
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<td>Porcellanidae</td>
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<td>Upogebiidae</td>
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<tr>
<td><em>Upogebia pugettensis</em></td>
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</table>

ASTACIDAE

*Pacifastacus leniusculus klamathensis* (Stimpson 1857a)

LIT
Hobbs 1989:7, fig. 6 (with synonymy)
Distribution – British Columbia and Idaho south to central California, in cold, swift streams.
Origins: Native.

*Pacifastacus leniusculus trowbridgii* (Dana, 1852)

LIT
Hobbs 1989:7-8, fig. 5 (with synonymy)
Origins: Native.

*Pacifastacus leniusculus leniusculus* (Dana, 1852)

LCRANS, LIT
Hobbs 1989:7, fig. 6 (with synonymy)
Distribution – British Columbia and Idaho south to central California, in cold, swift streams.
Origins: Native.

NEPHROPIDAE

*Homerus americanus* Milne-Edwards, 1837

LIT
Many unsuccessful introductions have been attempted in the region since 1874 without success Carlton 1979:691-695.
Not established*

THALASSINIDEA

CALLIANASSIDAE

*Callianassidae* see *Neotrypaea*

*Neotrypaea californiensis* (Dana, 1854)
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Crustacea

LCRANS, LIT
Callianassa californiensis – Dana 1854; Hart 1982:58, 60, fig. 15; Neotrypaea californiensis - Manning & Felder 1991:771, fig. 10 (with synonomy); Jensen 1995:43, 78, fig. 158.
Distribution – Mutiny Bay, Alaska to Punta Banda, Baja California, 0 – 50 m.
Origins: Native.

UPOGEBIIDAE
Upogebia pugettensis (Dana, 1852)
LIT
Upogebia pugettensis - Schmitt 1921:115-116, fig. 77 (with synonymy); Williams 1986 (with synonymy); Hart 1982:52-53, fig. 12; Jensen 1995:43, 78, fig. 160.
Distribution – Valdez Narrows, Alaska to Morrow Bay, California.
Origins: native.
Williams, A. B. 1986. Mud shrimps, Upogebia, from the eastern Pacific (Thalassinidea: Upogebiidae), San Diego Natural History, Memoir 14:1-60.

BRACHYURA
CANCRIDAE
Cancer magister Dana, 1852
LIT
Hart 1982:23, 33, 34, 212, fig. 87; Jensen 1995:14, 27, 28, fig. 31.
Distribution – Pribilof Islands, Alaska to Santa Barbara, California, 0 – 179 m.
Origin: Native

Cancer oregonensis (Dana, 1852)
LIT
Cancer oregonensis - Schmitt 1921:234-235, Pl. 36, figs. 3-4 (with synonymy); Hart 1982:23, 33, 34, 210, fig. 87; Jensen 1995:36, fig. 29.
Distribution – Bering Sea to Santa Barbara, California, 0- 436 m.
Origin: native

CARIDEA
CRANGONIDAE
Crangon franciscorum franciscorum Stimpson, 1856
LCRANS, LIT
Specimen #1120x, Ft. Canby, Jetty exterior, 25 June 2003, has C. nigricauda antenna scale and palm of leg 1 but short tooth on abdominal segment 5 rather than prominent long tooth.

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Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea

**Distribution** – Resurrection Bay, Alaska to San Diego, California, intertidal to 91 m.  
*Crangon franciscorum franciscorum* is the estuarine form that occasionally occurs in nearly fresh water and was once the basis of a commercial fishery in San Francisco Bay. This was the only form found in the survey.  
**Origin**: Native

*Crangon nigromaculata* Stimpson, 1856  
**LIT**  
Holthuis 1980:150-151 (with synonymy); Butler 1980:95, 102; Jensen 1995:41, fig. 60.  
*Crangon nigromaculata* was once fished commercially along with *Crangon franciscorum franciscorum* in San Francisco Bay (Holthuis 1980).  
**Distribution** – Northern California to Baja California, sand bottoms 5 – 174 m. Probably not correctly identified in the LCR.  
**Origins**: Native.

*Lissocrangon stylirostris* (Holmes 1900)  
**LIT**  
**Distribution** – Chirikov Island, Alaska to San Louis Obisbo Bay, California.  
**Origins**: Native.

*Neocrangon alaskensis* (Lockington, 1877)  
**LIT**  
*Crangon alaskensis* and *C. nigricauda* may be hybrids (Jensen 1995).  
**Distribution** – Bering Sea to San Diego, 0 – 555 m.  
**Origins**: Native.  

**HIPPOLYTIDAE**  
*Heptacarpus brevirostris* (Dana, 1852)  
**LIT**  
Abundant in rocky intertidal full marine areas in salinities 9-31 PSU.  
**Distribution** – Attu, Aleutian Islands, Alaska to Bahia Magdalina, Baja California, intertidal to 128 m.  
**Origins**: Native

**PALAEMONIDAE**  
*Exopalaemon modestus* Heller, 1862  
**LIT**

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Kingdom: Animalia  
Phylum: Arthropoda  
Subphylum: Crustacea

*Leander modestus* - Heller, 1862; *Leander czerniavskyi* - Brashnikov, 1907; *Leander czerniavskyi lacustris* - Brashnikov, 1907; *Palaemon leander* - modestus Gee 1925; *Leander modestus sibirica* - Brashnikov, 1907; *Exopalaemon modestus* – Holthius 1980:83.

*Exopalaemon modestus* is distinguished from *E. carinicauda* (introduced into San Francisco Bay Wicksten 1997) by its smaller chelae of the second pereopod and by two distal spines which extend beyond the tip of the median telson process, in contrast to the small distal spines of *E. carinicauda* which are short of the median telson process.

Distribution – In Asia, siberian prawn ranges from northern Korea to southern China in freshwater lakes and rivers. *Exopalaemon modestus* is presently known in the eastern Pacific only from the Columbia River and the Willamette River (Emmett *et al.* 2002:447-450).

[Ed. Note: CDFG reports *E. modestus* from the Sacramentor River see [http://www.dfg.ca.gov/cabw/camlnetste.pdf](http://www.dfg.ca.gov/cabw/camlnetste.pdf) but the author of this sectior is doubtful of correct identification]

Origins: Most probably introduced into the Columbia River with ballast water traffic from Asia sometime before 1995.

**GRAPSIDAE**

*Eriocheir japonica* de Haan, 1835  
Japanese mitten crab  
LIT  
Abundant in San Francisco Bay, California and in northern Europe. One male specimen was caught on a line by a sturgeon fisherman in the Columbia River near Astoria in the summer of 1998. No other crabs of the genus *Eriocheir* have been captured since.  
Origins: Introduced but not established in LCR.*

*Hemigrapsus oregonensis* (Dana, 1851)  
LCRANS, LIT  
Schmitt 1921:274-276, fig. 162 (with synonymy); Hart 1982:220-221, fig. 91; Jensen 1995:17, fig. 18.  
Distribution – Resurection Bay, Alaska to Baja California, Mexico, almost exclusively intertidal, tolerates reduced salinities and fresh water for brief periods.  
Origin: Native.

Phylum: Chordata  
Subphylum: Vertebrata  
Superclass: Osteichthyes  

* - resulted in an unsuccessful introduction

*Acipenseridae*
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<th>Phylum: Chordata</th>
<th>Superclass: Osteichthyes</th>
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<td>Acipenseridae</td>
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<td>Acipenser or Scaphirhynchus</td>
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<th>Family</th>
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### Superclass: Osteichthyes

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**ACIPENSERIDAE**

*Acipenser mediostris* Ayres, 1854  green sturgeon
LIT
Origin: Native

Origin: Native
distribution: Pacific Coast of North America from Alaska to Baja California. In estuaries, the lower reaches of large rivers, and in salt or brackish water off of river mouths (Froese and Pauly 2003).

*Acipenser transmontanus* Richardson, 1836  white sturgeon
LIT
Origin: Native

Native distribution: Pacific Coast of North America from Alaska to Monterey, California. Considered landlocked in parts of the Columbia River drainage. Spends most of its time in the sea, usually close to shore then enters estuaries of large rivers and moves inland to spawn (Froese and Pauly 2003).

*Acipenser or Scaphirhynchus sp. - unk.*  Eastern sturgeon
LIT

At the conclusion of the 1905 Lewis and Clark Exhibition held in Portland, Oregon two specimen of Eastern sturgeon from the Atlantic coast of North America (exact species unknown) were released into Guild’s Lake on the Willamette River (Lampman 1946). However, no sightings or catches of Eastern sturgeon have been reported in the lower Columbia River since then. It is likely that these fish perished naturally or were caught prior to the opening of Guild’s Lake to the Willamette River in 1909.

**AGONIDAE**

*Occella verrucosa* (Lockington, 1880)  warty poacher
Synonyms: *Brachyopsis verrucosus*
LIT
Origin: Native

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Marine species, distributed throughout the Eastern Pacific from Bristol Bay, Alaska to California (Froese and Pauly 2003). Probably an infrequent visitor to the lower Columbia River estuary.

**Pallasina barbata** (Steindachner, 1876)  
tubenose poacher

Synonyms: *Siphagonus barbatus*  
LIT  
Origin: Native

Intertidal species often found in eelgrass or seagrass beds. Native distribution: North Pacific from the Sea of Japan to the Bering Sea and to Central California (although this may represent two subspecies) (Froese and Pauly 2003).

**Stellerina xyosterna** (Jordan & Gilbert, 1880)  
pricklebreast poacher

Synonyms: *Brachyopsis xyosternus*  
LIT  
Origin: Native


**AMMODYTIDAE**

**Ammodytes hexapterus** Pallas, 1814  
Pacific sand lance

LIT  
Origin: Native

Origin: Native  
Distribution: Arctic and Pacific south to Southern California, and the Western Atlantic (although this may be a separate species) (Froese and Pauly 2003).  
Found in brackish and marine waters in schools or buried in the sand.

**ANGUILLIDAE**

**Anguilla sp.**  
eel

LIT  
Origin: Introduced

Unsuccessful introduction. Reports of *Anguilla* on the west coast of North America were reviewed by Williamson and Tabela (1991) following the capture of several eels presumed to have escaped or released after importation as live seafood. J.L. Galbreath captured three unidentified eels of the genus Anguilla in the Willamette River at Portland in 1981, 1982 and 1983. Williamson and Tabela (1991) concluded that all of the eels captured on the West Coast were the result of intentional or unintentional introductions.
and do not represent natural spread via oceanic currents. In addition, *Anguilla* eels are catadromous, spawning in areas of the open ocean where temperatures and salinities are consistently high. Such areas are not available to eels on the west coast of North America and introduced *Anguilla* would be unable to successfully reproduce upon reaching maturity. With no further reports of eels we assume that this limited introduction has been naturally extirpated from the lower Columbia River basin.

CATOSTOMIDAE

*Catostomus macrocheilus* Girard, 1856    largescale sucker  
LIT  
Origin: Native

Native to Western North America (Froese and Pauly 2003).

*Catostomus platyrhynchus* (Cope, 1874)    mountain sucker  
Synonyms: *Minomus platyrhynchus*, *Pantosteus jordani*, *Pantosteus columbianus*  
LIT  
Origin: Native

Native to Western North America (Froese and Pauly 2003).

CENTRARCHIDAE

Note: Identification of specific dates and mechanisms of introductions of Centrarchidae and other spiny-rayed fishes into the lower Columbia River Basin is complicated by several poorly documented intentional fish releases. In 1893 the United States Fish Commission (USFC, predecessor of the U.S. Fish and Wildlife Service) released 50 largemouth bass, *Micropterus salmoides*, along with “various sunfish” into the Willamette River just north of Salem from a shipment of fishes captured in the Illinois River (Lampman 1946). Anecdotal information compiled by Lampman (1946) suggests that the “various sunfish” included *Pomoxis annularis*, *Pomoxis nigromaculatus*, *Lepomis gibbosus*, *Ambloplites rupestris*, and other juvenile sunfish as well as several types of catfish and channel cats. Twelve years later, at the 1905 Lewis and Clark Centennial Exhibition in Portland, the USFC displayed a tank of spiny-rayed fishes. At the conclusion of the Exhibition these fishes were reportedly released into the waters of Guild’s Lake on the Willamette River (Lampman 1946). An accurate inventory of the exhibit is unavailable but one exhibitor recalled that the collection of freshwater fishes included large- and smallmouth bass (*Micropterus salmoides, M. dolomieu*), crappies (*Pomoxis annularis, P. nigromaculatus*), bluegill (*Lepomis macrochirus*) and two eastern sturgeon (*Acipenser or Scaphirhynchus* sp.) (Lampman 1946). The waters of the lake were dammed for the exhibition but the dam leading to the Willamette River was removed in 1909 after which the lake was filled in and turned into an industrial site. Between 1905 and 1909 the lake was a popular fishing hole, especially for local youth.
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Phylum: Chordata  
Superclass: Osteichthyes

Many of these repeatedly introduced species became established and continued to be captured in fish surveys of the Willamette and parts of the lower Columbia (Hutchinson and Aney 1964, Farr and Ward 1993, North et al. 2002).

**Ambloplites rupestris** (Rafinesque, 1817)  
rock bass  
Synonyms: Bodianus rupestris  
LIT  
Origin: Introduced

Unsuccessful introduction. Native to the Great Lakes region of North America, *Ambloplites rupestris* was first introduced unsuccessfully into the Willamette River near Salem, Oregon along with large mouth bass imported from Ohio around 1888 by Gideon Steiner, a local fish and poultry businessman (Lampman 1946). In 1893 the USFC may have also unsuccessfully introduced the rock bass into the Willamette River (see overview of the Centrarchidae above). Since that time sporadic records of *A. rupestris* in the Willamette have been attributed to misidentifications of the successfully introduced warmouth *Lepomis gulosus* (Lampman 1946). *A. rupestris* has been introduced in several lakes and rivers in Washington (Wydoski and Whitney 1979) but it is unknown if any of these introductions have been spread into the lower Columbia River basin. However, intentional stocking of *A. rupestris* for sportfishing was widespread in the late 1800s through the 1940s with successfully established populations common in the Mid-West and the Mid-Atlantic states (NAS 2003).

**Lepomis cyanellus** Rafinesque, 1819  
green sunfish  
LIT  
Origin: Introduced

Native to many river basins in central and eastern North America, *Lepomis cyanellus* may have been intentionally introduced in 1893 when the USFC released “various sunfish” captured in Illinois into the Willamette River just north of Salem (Lampman 1946). *L. cyanellus* may also have been introduced into Blue Lake (Hutchinson and Aney 1964), a small lake along the bank of the Columbia River near Troutdale, Oregon that continues to be popular with sport fishermen, but the date of that introduction is not known. *L. cyanellus* has been widely introduced throughout the west and, in California, has been held partially responsible for the decline of many native amphibians and fishes (NAS 2003, Moyle 1976). In the 1960s, an attempt by the Washington Department of Fish and Wildlife to extirpate *L. cyanellus* from Satcheen Lake, Washington failed (Wydoski and Whitney 1979). The status of *L. cyanellus* as an invasive species in the lower Columbia River Basin is elusive. Lampman (1946) reported that *L. cyanellus* might occur in the river basin and noted that while previous surveys of the Willamette River failed to capture this species a suspicious hybrid *Lepomis* (green sunfish hybridizes readily with other *Lepomis* (Moyle 1976)) had been caught. In addition, *L. cyanellus* has long been documented in Washington and Oregon at locations outside of the lower Columbia River drainage basin (Chapman 1942, Wydoski and Whitney 1979, Bond 1994) and Altman et al.
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Phylum: Chordata
Superclass: Osteichthyes

al. (1997) report green sunfish present in two major rivers, the Pudding and the Tualatin, both which converge with the Willamette River

*Lepomis gibbosus* (Linnaeus, 1758) pumpkinseed
Synonyms: *Perca gibbosa*, *Eupomotis gibbosus*, *Pomotis vulgaris*
LIT
Origin: Introduced

*Lepomis gibbosus*, a sport fish native to many river basins in central and eastern North America, may also have been introduced in 1893 when the USFC released “various sunfish” captured in Illinois into the Willamette River (Lampman 1946). Although no records of this introduction exist with the USFC an editorial in *The Oregonian* makes special mention of this event reporting that *L. gibbosus* had been captured during a salvage operation on the overflowing waters of the Illinois River and released later in Oregon waters (Lampman 1946). A popular sport fish *L. gibbosus* has been widely and successfully introduced in the waters of Oregon and Washington and has been found in the Willamette and the lower Columbia River (Chapman 1942, Lampman 1946, Hutchinson and Aney 1964, Wydoski and Whitney 1979, Farr and Ward 1993, Bond 1994, Altman et al. 1997, and North et al. 2002).

*Lepomis gulosus* (Cuvier, 1829) warmouth
Synonyms: *Pomotis gulosus*, *Chaenobryttus gulosus*
LIT
Origin: Introduced

Easily misidentified as various other species of sunfish *Lepomis gulosus*, native to many river basins in central and eastern North America, may have been released into the Willamette in 1893 by the USFC but records of this species in the lower Columbia River basin were sporadic until the later half of the 20th Century. Chapman and DeLancy (1933) published the first report of warmouth from Washington State having capturing several fish during a survey in 1930 in a slough of the Kalama River near Kalama, Washington. It is worth noting the conspicuous absence of any mention of this species in Lampman (1946) as *The Coming of the Pond Fishes* is one of the most thorough reports of intentional and unintentional fish introductions into the Willamette and lower Columbia rivers prior to the 1950s. Current populations of warmouth may be derived from numerous plantings. Discussions of *L. gulosus* in Bond (1994) and Altman et al. (1997) indicate that the popular sport fish is widely established in the freshwaters of the lower Columbia Basin. Most recently Farr and Ward (1993) and North et al. (2002) confirmed the presence of *L. gulosus*, capturing it in fish surveys along the lower Willamette.

*Lepomis macrochirus* Rafinesque, 1819 bluegill, bluegill sunfish
LIT
Introduced
Similar in history to *Lepomis gulosus, L. macrochirus*, native to many river basins in central and eastern North America (Page and Burr 1991), is widely distributed throughout the Willamette and parts of the lower Columbia River Basin. *L. macrochirus* was likely to have first been intentionally introduced into the system during the 1893 USFC release of fish near Salem. Chapman and DeLancy (1933) captured two specimens of bluegill, along with *L. gulosis*, in 1930 near Kalama, Washington. Pond stocking and plantings by individuals may also have contributed to the successful establishment of the bluegill. *L. macrochirus* are regularly reported in fish surveys of the lower Willamette (North et al. 2002, Altman et al. 1997, and Farr and Ward 1993). According to Froese and Pauly (2003) several countries (South Africa, Kenya, Venezuela, Panama, Japan and Mexico) have reported adverse ecological effects after establishment of this widely introduced species sportfish.

**Lepomis microlophus** (Günther, 1859)  redear sunfish

**Synonyms:** *Pomotis microlophus*

**LIT**

**Origin:** Introduced

Unlike many of the above sunfish, *L. microlophus* is native to the south-eastern United States (Page and Burr 1991). According to Mills et al. (1993), redear sunfish were first introduced into the Great Lakes Basin in 1928 and then spread into inland areas of the basin, making it less likely that the redear was introduced into the Willamette in the assortment of Illinois sunfish released by the USFC in 1893. Bond (1994) lists *L. microlophus* as found in parts of western Oregon including ponds in the Willamette Valley but includes no additional location information. Altman et al (1997) reports that *L. microlophus* has been recorded in the lower Willamette however none were captured in surveys by Farr and Ward (1993) or North et al. (2002). It is possible that reports of this species may be misidentifications of other introduced *Lepomis* or hybrids, and that introduced redear have not escaped the ponds mentioned in Bond (1994). If redear sunfish are present in the Columbia River Basin they might be considered a threat to endemic mollusks of concern as *L. microlophus* is a more voracious molluscivore than other sunfishes (NAS 2002). Ecological effects are unknown from introductions in other countries (Froese and Pauly 2003).

**Micropterus dolomieu** Lacepède, 1802  smallmouth bass, smallie, black bass, brown bass, white trout, green trout

**Synonyms:** *Centrarchus fasciatus*

smallmouth bass, smallie, black bass, brown bass, white trout, green trout

Established in the lower Columbia River basin. Native to the Midwestern United States (Scott and Crossman 1973), *Micropterus dolomieu* has been intentionally introduced throughout the world to enhance sport fishing (Froese and Pauly 2003). In 1874, Livingston Stone, inventor of the “aquarium car” used by the USFC to transport fish stock by rail across the U.S., transported 99 *M. dolomieu* from the east coast to California releasing the surviving 85 fish into tributaries of San Francisco Bay (Smith 1896). The first reported introductions of *M. dolomieu* to the lower Columbia River Basin took place
Kingdom: Animalia  
Phylum: Chordata  
Superclass: Osteichthyes

Nearly 50 years later in the 1920s. In 1923, fish from Wisconsin were introduced by a local game warden without the approval of the USFC into Lake Oswego, Oregon (Lampman 1946). The survival of these fish is uncertain however in 1924 the same game warden imported bass from a lake in the Puget Sound region and released them into the Willamette River (Lampman 1946). In 1925 *M. dolomieu* were planted in the middle stretch of the Columbia River Basin as well. *M. dolomieu* continue to be caught by recreational fishermen and in regional fish surveys (Farr and Ward 1993). In other states introduced *M. dolomieu* have been implicated in the decline or elimination of native fishes (Minckley 1973, Jenkins and Burkhead 1994). Smallmouth bass, which have been shown to prey on smolts of Pacific salmonids under laboratory conditions, may pose a threat to declining populations of wild salmon in the lower Columbia River Basin (Dentler 1993).

**Micropterus salmoides** (Lacepède, 1802) largemouth bass, black bass, green trout  
Synonyms: *Labrus salmoides*, *Huro salmoides*, *Aplites salmoides*, *Perca nigricans*, *Huro nigricans*, *Grystes megastoma*  
LIT  
Origin: Introduced

With a native range stretching from the Great Lakes to the Gulf Coast of North America (Page and Burr 1991), *M. salmoides* is a popular sport fish and has been introduced widely throughout the world (Froese and Pauly 2003). The first largemouth bass were introduced to the Willamette River in 1888 in two separate plantings. Gideon Steiner (a fish and poultry businessman), feeling that the area lacked the “splendid eastern game fish of his childhood”, imported and released a shipment of *M. salmoides* and *Ambloplites rupestris* from Toledo, Ohio into Willamette River near Salem, Oregon (Lampman 1946). The same year a prominent Portland lawyer, Edward Bingham, released 25 bass into the Willamette River, presumably near his home in Lake Oswego, Oregon (Lampman 1946). Four years later, the USFC released 500 *M. salmoides* in the Willamette River with subsequent smaller releases throughout the lower Willamette River basin in 1895 (Smith 1896). Between 1890 and 1895 the USFC also planted 5442 largemouth bass throughout the state of Washington and 1597 largemouth bass in the Boise River (a population that was subsequently boosted by a private release of 2240 bass the same year in the middle stretch of the Columbia River basin) (Smith 1896, Lampman 1946). In early August 1898, *The Oregonian* reported the capture of the first largemouth bass in the Columbia River just downstream of where Bonneville Dam now stands. It is not known which of the aforementioned releases led to the establishment of largemouth bass throughout the lower Columbia River basin.

Along with other introduced predatory centrarchids *M. dolomieu* may also be responsible for declines in native amphibian populations (NAS 2003). Adult fish feed on other fishes, crayfish and frogs while immature *M. dolomieu* feed on crustaceans, insects and small fishes (Page and Burr 1991). Adverse ecological effects have also been reported from France, Italy, Japan, South Africa, Cuba, Guatemala, and Mexico (Froese and Pauly 2003).
Kingdom: Animalia  
Phylum: Chordata  
Superclass: Osteichthyes

*Pomoxis annularis* Rafinesque, 1818  white crappie, calico bass  
*Pomoxis nigromaculatus* (Lesueur, 1829)  black crappie, calico bass  
Synonyms: *Cantharus nigromaculatus, Pomoxis sparoides*  
LIT  
Origin: Introduced

It is largely impossible to discuss these two established species separately as they are often lumped together and referred to solely as “crappie,” as *Pomoxis* spp., and/or misidentified as a single species (Dill and Cordone 1997). *Pomoxis* spp. are native to North America spanning the Great Lakes, Hudson Bay and Mississippi River basins, Ontario, Canada west to Minnesota and South Dakota, and south to the Gulf of Mexico (Page and Burr 1991). Two prominent releases of crappie into the lower Columbia River system were made by the USFC in 1893 and in 1905. In 1893 the USFC released 50 largemouth bass, *Micropterus salmoides*, along with “various sunfish,” including crappie, into the Willamette River (Lampman 1946). At the 1905 Lewis and Clark Centennial Exhibition in Portland, the USFC displayed a tank of spiny-rayed fishes that were later released into the waters of Guild’s Lake on the Willamette River (Lampman 1946). According to a member of the Oregon Game Commission the crappie were so abundant in Guild’s Lake during their four year impoundment that small boys were catching large quantities of them using fish books baited with paraffin chewing gum (Lampman 1946). These fish are considered “harmless” by the IUCN and no ecological impacts have been reported from introduced locations around the world (Froese and Pauly 2003)

**CHARACIDAE**

*Piaractus brachypomus* (Cuvier, 1818)  pirapatinga, pacu, red bellied pacu  
Synonyms: *Myletes brachypomus, Colossoma brachyphemum*  
LIT  
Origin: Introduced

One of several reoccurring but unsuccessful exotic aquarium species in the lower Columbia River Basin, *Piaractus brachypomus* is a tropical South American fish popular in the aquarium trade (Froese and Pauly 2003). The pacu is a member of the Serrasalminae family, a family that includes piranha, and these fish are often imported and sold under the misnomer "vegetarian piranhas." Pacu have a rapid growth rate and voracious appetite, and may readily outgrow the hobby tank they were originally housed in. These characteristics may lead frustrated fish owners to dispose of the fish in nearby waters. Pacu have developed a reputation as the species most often found in non-native waters that creates a piranha scare in the local media especially as juveniles are readily mis-identified as the traumatogenic red-bellied piranha (NAS 2003). The first *P. brachypomus* found in Oregon waters was a specimen caught in July 1988 by a fisherman in the Willamette River near the Port of Portland’s Terminal Four (Logan et al. 1996). Since that time two additional *P. brachypomus* have been collected from the Willamette River in 1992 and 1995 respectively and two additional unverified sightings were
reported from Hood River and Salem, Oregon in 1990 and 1991 (Logan et al. 1996). It is highly unlikely that all of these fish were the result of one single release but rather represent five separate releases. Logan et al. (1996) tested the thermal tolerance of *Piaractus* and determined that it is not low enough to tolerate to survive normal water temperatures found in the lower Columbia River basin from November through April making it impossible for these fish to overwinter in these waters. As these fish have a primarily herbivorous and insectivorous diet no adverse effects on local fish populations have been reported (Froese and Pauly 2003).

*Pygocentrus nattereri* Kner, 1858  red piranha, red-belly piranha

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*Pygocentrus nattereri* Kner, 1858  red piranha, red-belly piranha

*Serrasalmus nattereri*, *Pygocentrus altus*, *P. ternetzi*.

Unsuccessful introduction. *Pygocentrus nattereri*, a common aquarium species, is notorious for its reputation as a traumatogenic species (Froese and Pauly 2003). Concern about the establishment of this species in Florida or Texas in Gulf of Mexico drainages (where water temperatures are high enough for them to overwinter) is high. While the waters of Oregon and Washington are too cold in winter for *P. nattereri* to become established, this species could pose a threat to salmon smolts and other small fishes (Quinn 2003). In August 2003, a single *P. nattereri* was caught by a teenager in Johnson Creek, Oregon (a stream that drains to the lower Willamette) (Quinn 2003).

CLUPEIDAE

*Alosa sapidissima* (Wilson 1811)  American shad, common shad, white shad

Native to the Atlantic coast of North America from Labrador to Florida (Scott and Crossman 1973), shad were planted in the Sacramento River, California in 1871 having been transported across country from the Atlantic coast (Smith 1896). Although the Columbia River was intentionally stocked several times in the late 1880s (Smith 1896, Linder 1963, Wydoski and Whitney 1979) anecdotal evidence suggests that shad began showing up in the Columbia River as early as 1876 (Smith 1896) with the first published capture of a shad made by the ichthyologist David Starr Jordan in 1880 (Jordan 1916). Due to repeated introductions into the Sacramento and Columbia Rivers, *Alosa sapidissima* is now established on the west coast from Alaska to Baja California (Froese and Pauly 2003). Large runs of shad are common in the Columbia River and the impoundment of the Columbia may have improved conditions for spawning and rearing (Sherwood and Creager 1990, Weitkamp 1994, Petersen unpublished). Returns of introduced *A. sapidissima* to the Columbia River increased significantly between 1960 and 1990, and as a result, shad have become so abundant in the fish ladders that they may interfere with the passage of other fishes (NAS 2003). Although there is a commercial
fishery for shad it is considered under-harvested (~9% of the population that passes through Bonneville Dam is caught annually by limited commercial and recreational fishing) because the timing coincides with an endangered summer Chinook salmon (Petersen et al. unpublished).

The ecological effects of *A. sapidissima* in the lower Columbia River are poorly understood. It has been speculated that juveniles could alter the zooplankton community, enhance the diet of resident predators, and/or compete with native salmon for habitat or food resources however data to support or dismiss these theories are limited (Petersen et al. unpublished).

**COBITIDAE**

*Misgurnus anguillicaudatus* (Cantor, 1842) Oriental weatherfish, pond loach

Synonyms: *Cobitis anguillicaudata*

LIT

Origin: Introduced

Native to Eastern Asia, *Misgurnus anguillicaudatus* has been introduced into Hawaii, the U.S. mainland, the Philippines, Australia, Palau, Turkmenistan, and Mexico (Froese and Pauly 2003). The earliest records of *M. anguillicaudatus* in the continental United States date back to the 1930s when escapes from aquarium fish culture facilities were reported (Courtenay and Hensley 1980). While it is a popular aquarium fish and many introductions may be attributable to aquarium dumping this species has been introduced for the purposes of aquaculture in several countries where it is reared as a food fish, for bait, and for the aquarium industry (Froese and Pauly 2003, NAS 2003). *M. anguillicaudatus* has several life-history traits that may contribute to successful establishment – wide tolerance of physiological parameters, low vulnerability to predation, a flexible diet, and a high reproductive potential (Logan et al. 1996). In Oregon, an established population of *M. anguillicaudatus* has been reported from a diked secondary channel of the Clackamas River where it was discovered in the mid 1980s (Logan et al 1996). Several fish were also collected in 1997 from Multnomah Channel near the Columbia River (NAS 2003). Reports of *M. anguillicaudatus* are likely to under-represent their populations as these fish are typically found in shallow, muddy waters with dense vegetation, i.e. even when abundant they are difficult to capture with standard fish survey gear (NAS 2003). The dispersal ability of the Clackamas population of *M. anguillicaudatus* (and its relation to the population in Multnomah Channel) is unknown (Logan et al. 1996). It may be likely that these two occurrences are the result of separate aquarium releases. Adverse ecological impacts have been reported in Hawaii and Australia (Froese and Pauly 2003, NAS 2003) where these species are suspected of being carriers of fish pathogens and predators on native aquatic species.

**COTTIDAE**

*Artedius fenestralis* Jordan & Gilbert, 1883 padded sculpin

LIT

Appendices: page 144
Intertidal marine species native to the eastern Pacific: from Alaska to Southern California (Froese and Pauly 2003).

*Cottus aleuticus* Gilbert, 1896 coastrange sculpin
LIT
Origin: Native

*Cottus aleuticus* is a catadromous sculpin, native to the Pacific Coast of North America from Alaska to Northern California (Froese and Pauly 2003). It inhabits gravel and rubble riffles of medium to large rivers and rocky shores of lakes and occasionally enters estuaries (Froese and Pauly 2003).

*Cottus asper* Richardson, 1836 prickly sculpin
LIT
Origin: Native

Native to Pacific coast drainages of North America. The coastal form of this species is catadromous. Sometimes used as a bait species. May have been introduced east of the Rockies in Canada (Froese and Pauly 2003).

*Enophrys bison* (Girard, 1854) buffalo sculpin
Synonyms: *Aspicottus bison*
LIT
Origin: Native

Native to the eastern Pacific from Alaska to central California, *Enophrys bison* is a marine species commonly found in inshore rocky and sandy areas (Froese and Pauly 2003).

*Hemilepidotus hemilepidotus* (Tilesius, 1811) Red Irish lord
Synonyms: *Cottus hemilepidotus*
LIT
Origin: Native

A commercially and recreationally harvested marine sculpin, *Hemilepidotus hemilepidotus* is native to the North Pacific from Kamchatka, Russia to central California (Froese and Pauly 2003).

*Hemilepidotus spinosus* Ayres, 1854 Brown Irish lord
LIT
Origin: Native

A marine species, *Hemilepidotus spinosus* is native to the eastern Pacific from southeastern Alaska to southern California (Froese and Pauly 2003).
Kingdom: Animalia
Phylum: Chordata
Superclass: Osteichthyes

**Leptocottus armatus** Girard, 1854  Pacific staghorn sculpin
LIT
Origin: Native

A brackish to marine species, *Leptocottus armatus* is native to the west coast of North America from Alaska to Baja California (Froese and Pauly 2003).

**Scorpaenichthys marmoratus** Girard, 1854  cabezon
LIT
Origin: Native

A marine species, *Scorpaenichthys marmoratus* is native to the west coast of North America from Alaska to Baja California (Froese and Pauly 2003).

**CYPRINIDAE**

**Acrocheilus alutaceus** Agassiz & Pickering, 1855  chiselmouth
LIT
Origin: Native

Native to the Pacific Northwest, *Acrocheilus alutaceus* is a freshwater fish that inhabits flowing pools, creeks and small to medium rivers (Froese and Pauly 2003).

**Carassius auratus** (Linnaeus, 1758)  goldfish
Synonyms: *Cyprinus auratus, Cyprinus langsdorfi, Cyprinus thoracatus, Carassius chinensis, Cyprinus maillardi*
LIT
Origin: Introduced

Origin: Introduced throughout the world, goldfish are native to central Asia. *Carassius auratus* is cultured widely by the aquarium and ornamental pond trades. It is occasionally reared for use as bait and less frequently as a food item (Froese and Pauly 2003). Goldfish have been widely and repeatedly stocked in the United States from many points of origin, including both Asia and Europe. Having been bred for a range of body forms and colors there are many varieties of goldfish in U.S. waters. It is common for goldfish to hybridize with common carp *Cyprinus carpio* (another introduced species)(NAS 2003). During the late 1800s the USFC breed goldfish and distributed them to states as fish suitable for aquaria, fountains, and ornamental ponds (McDonald 1887, 1893 in NAS 2003). Introductions in the Pacific Northwest may represent escapes from private ponds (Smith 1896) as well as from aquarium releases by individuals (Courtenay and Hensley 1979). The earliest report of goldfish in the lower Columbia River basin comes from Lampman (1946) who notes seeing goldfish feeding in the Willamette River in 1933. Chapman (1942) reports capturing goldfish in surveys at the mouth of the Columbia River and near Kalama, Washington. In the 1960s, Hutchinson...
and Aney (1964) report goldfish scattered throughout the lower Willamette Basin. Wydoski and Whitney (1979) note that the distribution of goldfish in the northwest is “subject to constant change because people thoughtlessly discard goldfish into various waters,” and also observed that a small number of goldfish were being raised locally for bait.

*Ctenopharygodon idella* (Valenciennes, 1844) | grass carp, white amur
---|---
Synonyms: *Leuciscus idella*
LCRANS, LIT
Origin: Introduced

Grass carp (*Ctenopharyngodon idella*), also known as the white amur, is an herbivorous fish native to parts of eastern Asia from the Amur River of eastern Russia to southern China (NAS 2003). Grass carp have been widely introduced throughout the world although not all populations have become established (Froese and Pauly 2003). Rationalization for intentional stocking includes commercial aquaculture and exploration of aquaculture potential, research, establishment of a food resource, and biological control (Froese and Pauly 2003). First introduced from Malaysia into the U.S. by the USFWS Fish Farming Experimental Station in 1962, established populations of *C. idella* exist in parts of the Mississippi and Missouri Rivers, as well as in Alabama and Florida (Courtenay et al. 1984). Grass carp are reported to occur in 45 states (although establishment of populations is uncertain because of their primarily triploid status) where they can cause significant changes in macrophyte, phytoplankton and invertebrate communities, etc. The loss of aquatic vegetation caused by grass carp has been implicated in the decline of waterfowl habitat (NAS 2003). Stocking of triploid (functionally sterile) grass carp, both authorized and unauthorized, is a widely implemented biological control method used to reduce unwanted aquatic vegetation. According to NAS (2003) “the species has spread rapidly as a result of widely scattered research projects, stockings by federal, state, and local government agencies, legal and illegal interstate transport and release by individuals and private groups, escapes from farm ponds and aquaculture facilities; and natural dispersal from introduction sites (e.g., Pflieger 1975; Lee et al. 1980 et seq.; Dill and Cordone 1997).” However, the effectiveness of grass carp as biological control has been criticized on several levels; grass carp often consume non-target native plants as well as or in preference to unwanted weeds (Taylor et al. 1984), the reproductive potential of triploids has been questioned (as has the success of suppliers in creating truly triploid fish), and the potential for negative interactions between grass carp and both invertebrates and fishes has been raised as an unwanted cost (Courtenay et al. 1984).

Grass carp will seek out and follow flowing water, so that all inlets and outlets of the pond or lake where they have been introduced for biological control must be screened. During flood events grass carp may escape even screened ponds. Loch and Bonar (1999) observed 49 adult grass carp migrating up the Columbia River in 1996 and 1997, emphasizing the need for the carp to be truly sterile. Although they may not be established (i.e. reproducing) in the lower Columbia River a repeated pattern of escape into the river, combined with the potential for non-triploid introductions, and the
longevity of the species (10-40 years) have created an “artifically established” population in the lower river. Large grass carp are regularly caught in Youngs Bay and other parts of the lower Columbia River, and have been recorded passing through the fish ladders at Bonneville Dam (Jim Athern personal communication).

_Cyprinus carpio_ Linnaeus, 1758  
common carp  
LIT  
Origin: Introduced

Native to Eurasia (Page and Burr 1991) _Cyprinus carpio_, better known as the common carp, has been introduced into every state in the United States except Alaska (and it is believed to be established in all but Maine) (NAS 2003). Records disagree as to when and where the first carp were introduced. DeKay (1842 in NAS 2003) reported that the species was first brought into New York from France by a private citizen and released into the Hudson River a few years later but debate over the species identification exists for this and other early reports (NAS 2003). Smith (1896) reported that common carp first appeared in the United States in 1872 when several fish imported from Germany, planted in private ponds in Sonoma, California, propagated for commercial rearing, and distributed to individuals on the west coast for rearing as food fish (Lampman 1946). In 1880, one Captain Harlow of Portland, Oregon imported 35 mature German carp from San Francisco to breed and sell carp for stocking private ponds. In spring 1881, the Sandy River flooded and washed an estimated 3000 immature carp from Captain Harlow’s breeding pond into the Columbia River (Lampman 1946). This may not have been an isolated event as reports show that in 1877 the USFC imported carp from Germany and began shipping domestically breed carp to private applicants in Oregon and Washington as early as 1882 (Smith 1896, Lampman 1946). Within ten years of Captain Harlow’s carp escape _C. carpio_ had established itself throughout the lower Columbia River basin and was no longer popular with the local fishermen. The Oregonian newspaper reported that locals were offering carp for sale for use as fertilizer at a price of $5/ton (Lampman 1946). In the Columbia River _C. carpio_ continue to be abundant in the sloughs and inlets of the lower river (often hybridizing with _Carassius auratus_ ) and populations supported a small commercial fishery in Lake Vancouver, Washington through the late 1930s (Chapman 1942). Today, _C. carpio_ is regarded as a potential pest species because of its widespread introduction and establishment, and because its feeding behavior (rooting in soft sediment) often leads to the loss of vegetation and increased sediment suspension (Laird and Page 1996). Of primary concern is the destruction of submerged and emergent aquatic vegetation that provide habitat for native fish and food for waterfowl (Dentler 1993). There is also evidence that _C. carpio_ will prey on fish eggs (Moyle 1976). In the Pacific Northwest, Miller and Beckman (1996) documented white sturgeon _Acipenser transmontanus_ eggs in the stomachs of common carp in the Columbia River.

_Mylocheilus caurinus_ (Richardson, 1836)  
peamouth  
Synonyms: _Clarkina caurina, Cyprinus caurinus_  
LIT  
Origin: Native
Native to the Pacific Slope of North America (Froese and Pauly 2003).

**Oregonichthys crameri** (Snyder, 1908)  Oregon chub
Synonyms: *Hybopsis crameri*
LIT
Origin: Native, endangered

Endemic to the Willamette and Umpqua River drainages in Oregon. It is rare in Willamette because of habitat alteration (Froese and Pauly 2003). Loss of habitat combined with the introduction of non-native fish species to the Willamette Valley such as largemouth bass, smallmouth bass, crappie, bluegill, and mosquitofish has resulted in a sharp decline in Oregon chub abundance. The chub was given "endangered" status under the federal Endangered Species Act in 1993.

**Ptychocheilus oregonensis** (Richardson, 1836)  Northern pikeminnow
Synonyms: *Cyprinus oregonensis*
LIT
Origin: Native

Although native to Pacific drainages of North America (Froese and Pauly 2003), *Ptychocheilus oregonensis*, is considered a pest species because large concentrations of squawfish near hydroelectric projects are responsible for substantial salmonid predation and may further increase salmonid mortality by reducing the fish guidance efficiency of submersible traveling screens (NOAA 1994). *P. oregonensis*, a lake-adapted fish, has responded favorably the creation of reservoirs and other slow moving water habitat creation along the Columbia River. In free-flowing areas the bottom- and bank-hugging pikeminnow is not as problematic a predator for salmonid smolts.

**Rhinichthys cataractae** (Valenciennes, 1842)  longnosed dace
Synonyms: *Gobio cataractae, Rhinichthys marmoratus*
LIT
Origin: Native, sensitive

The longnose dace is present on both sides of the Continental Divide and is one of the most widely distributed of the western fishes (Froese and Pauly 2003). *Rhinichthys cataractae* ssp. is listed by the ODFW as a sensitive species or “Species of Concern” in Oregon waters.

**Rhinichthys falcatus** (Eigenmann & Eigenmann, 1893)  leopard dace
Synonyms: *Agosia falcata*
LIT
Origin: Native
The leopard dace is native to the Fraser and Columbia River drainages (Froese and Pauly 2003). It is primarily found in slow streams and gravel runs in the upper Columbia R. drainage.

Richardsonius balteatus (Richardson, 1836) redside shiner
LIT
Origin: Native

Native to Pacific Slope drainage British Columbia to southern Oregon, including the Columbia Basin (Froese and Pauly 2003), the redside shiner has been introduced (probably as bait) to drainages in Arizona, Colorado, Montana and Utah (NAS 2003).

Tinca tinca (Linnaeus 1758) tench, green tench, golden tench
Synonyms: Cyprinus tinca
LIT
Origin: Introduced

Native to Eurasia as well as the British Isles (Berg 1949), Tinca tinca was introduced to numerous locations in Africa, Australia, Japan, and North America with no known adverse ecological impacts (Froese and Pauly 2003). Prized by recreational fishermen for their tasty flesh, tench are omnivorous, feeding on benthic invertebrates, aquatic insect larvae, and algae some other invertebrates. In Great Britain tench are popular ornamental pond species but a search of ornamental pond websites in the United States did not reveal a similar opinion. Wydoski and Whitney (1979) write, in reference to the Washington tench population, “to our knowledge it has not created any particular problems.” In the late 1800s, spurred by the success in Australia with tench breeding and introduction programs, the USFC imported tench from Europe (Baughman 1947). Raised in fish ponds in Washington State, 450 T. tinca were introduced into several lakes and ponds in the lower Columbia River basin between 1895-1896 (Smith 1896, Baughman 1947). The current status of T. tinca in the lower Columbia River basin remains uncertain. Tench appear to have spread (or were transplanted) from their original introduction sites and into the lower Columbia within 40 years of the USFC planting. Chapman (1942), in a paper on introduced fishes in the Pacific Northwest, noted that tench, while found in the Columbia River, were nowhere near as abundant as were Cyprinus carpio (habitat requirements of tench are similar to that of C. carpio, and the two species are superficially similar, with tench being the smaller of the two). Hutchinson and Aney (1964) list T. tinca on their list of known fish species in the Willamette basin, and note their distribution as “Columbia mainstem, probably lower Willamette. Wydoski and Whitney (1979) report T. tinca as present in the Columbia River system, Spokane River, and Lake Washington. Bond (1961) noted tench as introduced to the Columbia River and the Willamette River but in later revisions (Bond 1973, 1994) stated that the species was in the Columbia River and was once present in lower Willamette River. No further captures of tench have been reported in the lower

Appendices: page 150
Kingdom: Animalia
Phylum: Chordata
Superclass: Osteichthyes

Columbia but tench are occasionally captured in the middle Columbia River (USFWS http://hanfordreach.fws.gov/fish.html)

EMBIOTOCIDAE

**Amphistichus rhodoterus** (Agassiz, 1854)  redtail surfperch  
Synonyms: *Holconotus rhodoterus*, *Cymatogaster pulchellus*, *Cymatogaster larkinsis*, *Amphistichus heermanni*  
LIT  
Origin: Native

Brackish, marine species native to the Eastern Pacific (Froese and Pauly 2003), popular with commercial and recreational anglers.

**Cymatogaster aggregata** Gibbons, 1854  shiner perch  
LIT  
Origin: Native

Brackish, marine species native to the Northeastern Pacific (Froese and Pauly 2003).

**Embiotoca lateralis** Agassiz, 1854  striped seaperch, blue seaperch  
LIT  
Origin: Native

Marine species found in coastal areas, native to the Eastern Pacific (Froese and Pauly 2003). Minor commercial importance, often targeted by aquarium enthusiasts.

**Hyperprosopon anale** Agassiz, 1861  spotfin surfperch  
LIT  
Origin: Native

Marine species native to the Eastern Pacific (Froese and Pauly 2003) often found in surf on sandy beaches.

**Hyperprosopon argenteum** Gibbons, 1854  walleye surfperch  
LIT  
Origin: Native

Marine gamefish native to the Eastern Pacific (Froese and Pauly 2003).

**Hyperprosopon ellipticum** (Gibbons, 1854)  silver surfperch  
Synonyms: *Cymatogaster ellipticus*  
LIT  
Origin: Native

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Phylum: Chordata
Superclass: Osteichthyes

Small marine fish native to the Eastern Pacific (Froese and Pauly 2003).

Phanerodon furcatus
LIT
Origin: Native

Marine fish native to the Eastern Pacific, usually found offshore (Froese and Pauly 2003).

Rhacochilus vacca (Girard, 1855) pile perch
Synonyms: Damalichthys vacca, Ditrema vacca, Damalichthys argyrosomus
LIT
Origin: Native

Marine fish native to the Eastern Pacific, usually found along the rocky shore (Froese and Pauly 2003).

ENGRAULIDAE

Engraulis mordax Girard, 1854 Northern anchovy, California anchovy
LIT
Origin: Native

Pelagic, marine species native to the Northeast Pacific (Froese and Pauly 2003). Commercially harvested along the West Coast.

ESOCIDAE

Esox lucius x masquinongy tiger muskellunge, tiger musky
LIT
Origin: Introduced

Hybrid freshwater species Esox lucius x Esox masquinongy. Tiger muskellunge have been bred artificially and stocked by state fish and game agencies for sport fishing throughout North America. Populations are often maintained by stocking as male tiger muskellunge are always sterile, but females are often fertile (Becker 1983). This hybrid predator is probably deleterious to smaller fish. Tiger musky in the lower Columbia River basin were reported by the Warmwater Fisheries Resource Manager, Washington Department of Wildlife, Olympia, WA in 1992 (NAS 2003).

FUNDULIDAE

Fundulus diaphanous (Lesueur, 1817) banded killifish
Synonyms: Hydrargira diaphana, Fundulus multifaciatus
LIT

Appendices: page 152
Kingdom: Animalia  
Phylum: Chordata  
Superclass: Osteichthyes  

Origin: Introduced

Note: Froese and Pauly (2003) treats *F. diaphanous* and *F. diaphanous diaphanous* as valid synonyms while NAS (2003) lists *F. d. diaphanous* and *F. d. menona* as eastern and western subspecies.

*Fundulus diaphanous* is native to Atlantic slope drainages in North America (Froese and Pauly 2003) and has been introduced to parts of Ohio, Pennsylvania, South Dakota, Oregon and Washington (NAS 2003). Banded killifish are grown commercially for aquariums and for use as bait (Froese and Pauly 2003). The ecological implications of introduced populations are not known. Banded killifish were first recorded from the upper Columbia River estuary at Jones Beach in 1971 (Misitano and Sims 1974) but were not consistently captured in fish surveys until the late 1980s (Hinton et al 1990). The source of the Columbia River introduction is unknown but thought to be the result of a bait dump (NAS 2003). Other introductions across the United States have been attributed to accidental introduction along with stocked largemouth bass (South Dakota) or as the result of an aquarium release (Ohio) (NAS 2003). The continued presence of *F. diaphanous* in the Willamette River as well as the lower Columbia River is well documented (see Misitano and Sims 1974, Hjort et al 1984, Hinton et al 1990, Hinton et al. 1992b, Farr and Ward 1993, Weitkamp 1994, Hinton and Emmett 2000, and North et al. 2002).

**GADIDAE**

*Lotia lota* (Linnaeus, 1758) burbot
Synonyms: *Gadus lota*, *Gadus lacustris*, *Gadus maculosus*

Origin: Native

*Lotia lota* is the only freshwater member of the Gadidae family. Congregate in deep pools of large rivers and lakes. Circumarctic distribution (Froese and Pauly 2003).

*Microgadus proximus* (Girard, 1854) Pacific tomcod
Synonyms: *Gadus proximus*, *Morrhua californica*, *Gadus californicus*

Origin: Native

Brackish and marine species native to the Eastern Pacific (Froese and Pauly 2003). Minor commercial and recreational species.

**GASTEROSTEIDAE**

*Gasterosteus aculeatus* stickleback

Origin: Cryptogenic
Kingdom: Animalia  
Phylum: Chordata  
Superclass: Osteichthyes

Wide distribution may indicate that this species should be considered cryptogenic although previous studies consider this to be a native species. Large salinity tolerance can range from freshwater to marine salinities. Distributed along the West Coast of North America from Baja California to the Bering Sea (Fishbase 2004), as well as throughout the coastal regions in the North Pacific and North Atlantic.

**GOBIIDAE**

*Lepidogobius lepidus*  
bay goby  
LIT  
Origin: Native

Intertidal marine demersal species, likely only found near the mouth of the Columbia.

**HEXAGRAMMIDAE**

*Hexagrammos decagrammus*  
kelp greenling  
LIT  
Origin: Native

Marine species, likely not a resident of the lower Columbia River estuary.

*Ophiodon elongatus*  
lingcod  
LIT  
Origin: Native

Marine species, likely not a resident of the lower Columbia River estuary.

**ICTALURIDAE**

Catfish, popular as both food and sport fish, were among the first fishes introduced to the West Coast (Smith 1896). In 1874, Livingston Stone and his USFC aquarium car are responsible for the first western movement of catfish and bullhead across the Rocky Mountains, their natural westernmost boundary (Smith 1896). Present on this train were three species, *Ameiurus catus, Ameiurus nebulosus* and *Ictalurus punctatus* (Smith 1896). It is unknown if the first catfish stocked in the Pacific Northwest were descended from this original population or the result of later importations. By the 1880s catfish (of many unreported species) had become successfully established in Silver Lake, Washington (stocked by an unknown person). Fearing that the catfish would be “another enemy to our salmon” a former Fish Commissioner of Oregon asked the Washington Commissioners of Fish for permission to rid Silver Lake (which connects to the Columbia via Cowlitz River) of its catfish population (Smith 1896). It has been theorized that fishermen’s fears were heightened by speculation that the introduced catfish population included specimen of *Ictalurus furcatus*, blue catfish, native to the

Appendices: page 154
Mississippi, growing to over 100 lbs (the maximum recorded weight of a blue catfish is 186 lbs), and theoretically capable of consuming 20 lb salmon (Lampman 1946). However, due to importation and release of a variety of catfish species by private parties into the lower Willamette and Columbia Rivers in the 1880s, extirpation of the Silver Lake population would not have kept catfish out of the Columbia River (Lampman 1946). By 1890, The Oregonian newspaper carried an article on the newly arrived catfish stating, “The ponds and lakes of Sauvie Island are literally alive with catfish which have been carried in by the late flood waters. By every appearance our waters will soon be swarming with these fish, as they increase at an appalling rate” (Lampman 1946). By 1894 catfish were thoroughly established throughout the lower Columbia and Willamette Rivers and by the 1890s a commercial harvest of catfish had begun (Lampman 1946) however, by 1938 only 2.5 percent of the recorded catch of game fish in Washington was catfish (Chapman 1942). Due to the voracious and predatory nature of catfish most are considered ecological pests. Several species of introduced North American freshwater catfish have been implicated in the decline of native fish (Marsh and Douglas 1997, Froese and Pauly 2003) and amphibians (Rosen et al. 1995) both in the United States and elsewhere. Declared a game species by the State of Oregon in 1913, catfish are no longer commercially harvested in the Pacific Northwest. The three most common catfish species in the lower Columbia River are A. nebulosus, A. natalis and I. punctatus.

**Ameiurus catus** (Linnaeus, 1758) ESTABLISHED

Ictalurus catus, Silurus catus

white catfish, white bullhead

Native to the Atlantic and Gulf slope drainages of the United States, *Ameiurus catus* were first released in California in the San Joaquin River in 1874 (Smith 1896). It is likely that they were part of the population planted in Silver Lake, Washington in the early 1880s and became distributed throughout the lower Columbia River basin by 1894 (Lampman 1946). In spite of this planting and at least one additional intentional introduction in 1930 by an Oregon hatchery superintendent (Lampman 1946) *A. catus* has never been a plentiful species in the lower Columbia River basin (Wydoski and Whitney 1979). In Bond’s (1994) revision of his key to Oregon fishes he is uncertain of their establishment, however a report by the Oregon Department of Fish and Wildlife lists a 15lb white cat was caught in Tualatin River in 1989 by Wayne Welch and setting a new state record ([http://www.dfw.state.or.us/ODFWh/ml/InfoCntrFish/FishRecords.html](http://www.dfw.state.or.us/ODFWh/ml/InfoCntrFish/FishRecords.html)) indicating that their may indeed still be an established population of *A. catus* in the lower Columbia River basin.

**Ameiurus melas** (Rafinesque, 1820) ESTABLISHED

Ictalurus melas, Ictalurus melas, melas, Aneiurus melas melas, Silurus melas

black bullhead, black catfish

Native to North America east of the Rockies excluding the Atlantic slope, *Ameiurus melas* has been intentionally stocked throughout the west coast and other parts Europe for sport and as a food fish (Froese and Pauly 2003, NAS 2003). Countries such as Germany, Spain and Hungary report adverse ecological impact after introduction (Froese
and Pauly 2003). Voracious predators, black bullhead, along with other catfish, have been implicated in the decline of native fish (Marsh and Douglas 1997) and amphibians (Rosen et al. 1995) in the United States. In addition, the black bullhead is considered a nuisance fish by anglers targeting other gamefish (Froese and Pauly 2003). The first *A. melas* in the Columbia River basin was caught in the Willamette in 1894 (Smith 1896, Lampman 1946) but it is not known when or where this species was first introduced. A 1945 Oregon State College surveyed the fishes of the Willamette River system and reported the presence of three species of bullhead catfish: *A. nebulosis*, *A. natalis* and *A. melas* (Lampman 1946). Although it is not one of the commonly captured catfish, Bond (1994) continues to list it as present in the Columbia River drainage.

*Ameiurus natalis* (Lesueur, 1819)  
*Pimelodus natalis, Ictalurus natalis*  
yellow bullhead

Native to the North America from the Mississippi basin east (Page and Burr 1991), *Ameiurus natalis* has been widely and successfully stocked throughout the western United States (NAS 2003). It has been introduced into Italy and Mexico where adverse ecological impacts have been reported from the later country where it has replaced several endemic species (Froese and Pauly 2003). Although *A. natalis* is a popular sport and food fish, predation by it and other catfish may have an impact on its introduced habitat. Lampman (1946) asserts that the first introduction of yellow bullheads in the region was probably in 1905, when tanks of warm water display fish were released following the Lewis and Clark Centennial exposition in Portland see centrarchidae discussion above for more information. *A. natalis* have been common in the Willamette Valley since then. They were captured by the 1945 Oregon State College survey of the Willamette River (Lampman 1946), as well during the Farr and Ward 1993 survey of the lower Willamette.

*Ameiurus nebulosus*  (Lesueur, 1819)  
*Ictalurus nebulosus, Pimelodus nebulosus*  
brown bullhead, brown catfish

Native to Atlantic and Gulf slope drainages and parts of the Mississippi River drainage basin (NAS 2003), *Ameiurus nebulosus* is the most common catfish in the lower Columbia River basin and is especially abundant in the sloughs and slack waters of the basin (Chapman 1942, Wydoski and Whitney 1979). During the 1890s and up until catfish were declared game species by the state of Oregon (thus not open to commercial harvest) in 1913, there was a thriving commercial fishery for *A. nebulosus*, mostly in the shallow lakes of Sauvie Island. At its peak, this fishery annually produced over 100,000 pounds of catfish (Lampman 1946). Collections of *A. nebulosus* span most of the lower Columbia River basin (see Smith 1896, Chapman 1942, Lampman 1946, Bond 1973, 1994, Wydoski and Whitney 1979, Hjort 1984, Farr and Ward 1993, and USFWS 1993)

*Ictalurus furcatus* (Valenciennes, 1840)  
*Pimelodus furcatus, Ictalurus meridionalis*  
UNKNOWN

Appendices: page 156
Kingdom: Animalia  
Phylum: Chordata  
Superclass: Osteichthyes  

blue catfish  

Native to the Mississippi River basin, the status of *Ictalurus furcatus*, is unknown. However, it seems unlikely that this species of catfish is established in the lower Columbia River. Unlike many of the above catfish, *I. furcatus* prefers deeper, clear, flowing water habitats, and it is not considered a pest species by Froese and Pauly (2003). Bond (1994) describes *I. furcatus* as “introduced, Columbia River, not common” but it is unclear which portion of the Columbia River he is referring to. *I. furcatus* are present in both the Snake and the middle reach of the Columbia River but are rarely reported below the Bonneville Dam. It seems that the dreaded salmon-eating blue catfish of Silver Lake never materialized in the lower Columbia River, see above discussion of Ictaluridae. It is interesting to note however that blue catfish have been intentionally stocked in parts of California for biological control of *Corbicula fluminea*, the non-native Asian clam under the hope that, even if clam populations were not controlled, the biomass of the clams would at least be significant enough to create trophy-sized catfish (Dill and Cordone 1997).

*Ictalurus punctatus* (Rafinesque, 1818)  

*Silurus punctatus*  

channel catfish, graceful catfish  

*Ictalurus punctatus*, native to the central drainages of North America from Southern Canada to Northern Mexico, is a commercially important species, is heavily aquacultured species and an Albino form is commonly encountered in the aquarium trade (Froese and Pauly 2003). In 1893, 100 channel cats were released into the Boise River in Idaho (Smith 1896). Reports of *I. punctatus* caught in the lower Columbia River were sporadic up until the 1940s, but it is suspected that channel cats were stocked in the Willamette River in the 1920s by an Oregon hatchery superintendent (Lampman 1946). Additional releases were made in ponds, lake, and rivers throughout Washington and Oregon as many species of catfish became established. Now they exist primarily in mid-Columbia and Snake River although they are established in the Willamette River as well (Hjort et al 1984, Farr and Ward 1993). Sterile populations of channel cats have been stocked in Washington lakes by the Washington Department of Fish and Wildlife, introduced to increase predation on over-abundant forage fish populations, and to add diversity to gamefish populations (WDFW 2003).

MORONIDAE  

*Morone chrysops* (Rafinesque, 1820)  

*Perca chrysops, Roccus chrysops*  

white bass  

Native to the Mississippi River drainage basin, *Morone chrysops*, have been stocked legally and illegally throughout much of the United States (NAS 2003). First transported
west in 1895 by the USFC with a shipment of black bass from Illinois, *M. chrysops* were introduced into California waters for breeding purposes (Smith 1896). Lee et al. (1980) reports a population of *M. chrysops* with a limited range in the lower Lewis River drainage basin in Washington.

**Morone chrysops x saxatilis**

wiper, sunshine bass, whiterock, palmetto, Cherokee

An artificial hybrid, *Morone chrysops x saxatilis* has no native range. This cultivated sport fish has been introduced to numerous watersheds in central and eastern United States. Where one or both parent species exists with *M. chrysops x saxatilis* backcrosses are often present and are considered detrimental to the native parent population (NAS). specimen turned into ODF during Farr and Ward sampling? (Morone hybrid?). Populations of *M. chrysops x saxatilis* are artificially maintained in all locations where they have been intentionally stocked for sport. An experimental stocking program using *M. chrysops x saxatilis* exists in southwestern Oregon in Ten Mile Lakes (Farr and Ward 1993, Bond 1994). The three *M. chrysops x saxatilis* hybrids caught by anglers in the Willamette River and turned over to the fish surveys of Farr and Ward (1993) may have been migrants from this program or were illegally introduced specimen.

**Morone saxatilis** (Walbaum, 1792)

*Perca saxatilis, Roccus saxatilis*

striped bass, striper, rock, rockfish

*Morone saxatilis* is a highly prized sportfish native to Atlantic slope drainages and the northeastern Gulf slope of the United States (Page and Burr 1991). Striped bass have been widely stocked for sportfishing in coastal waters from New York to California (landlocked stocked populations exist also) (NAS 2003). In addition, between 1886 and 1992, *M. saxatilis* has been introduced to and become established in Mexico, South Africa, Iran, Russia, Ecuador, and British Columbia (Froese and Pauly 2003). According to Chapman (1942) there are no records of stripped bass introduced into the coastal waters of the Pacific Northwest however in 1879, 135 fingerlings from New Jersey were introduced into San Francisco Bay by Livingston Stone (Smith 1896). Supplemented in 1882 with 300 additional fish from New Jersey (Smith 1896), *M. saxatilis* spread up and down the West Coast and now range from British Columbia to Baja California (NAS 2003, Froese and Pauly 2003). As this is a highly valued sportfish it is interesting to note that detrimental ecological and nuisance effects of ANS on *M. saxatilis*, itself an ANS, have been described and along the West Coast (e.g. *Potamocorbula amurensis* reducing striped bass food availability, and bait theft by *Eriocheir sinensis* of anglers targeting this species). The distribution of *M. saxatilis* in the Columbia River is well documented (see Moyle 1976; Wydoski and Whitney 1979; Grabowski et al. 1984; Bond 1994) and stripped bass is closed to commercial fishing throughout the state. Impacts of striped bass are unknown – however Morgan and Gerlach (1950) reported finding numerous trout and salmon fry as well as fingerlings in gut content surveys in Coos Bay, Oregon.

PERCIDAE
**Perca flavescens** (Mitchill, 1814)     
*Morone flavescens*
yellow perch, American perch, lake perch

Native to much of the Atlantic, Great Lakes, and Mississippi River basins (Wydoski and Whitney (1979), *Perca flavescens* is introduced or native in all but five U.S. states. The introduction of yellow perch to West Coast habitats by Livingstone Stone and his Aquarium Car was justified by Stone who wrote, “*Perca flavescens* is at all events far preferable to most of the fish at present existing in the freshwaters of California, and even if it destroyed four-fifths of the other fish there it would replace them by a better kind” (Smith 1896). Established in the Willamette and lower Columbia River (Farr and Ward 1993, NAS 2003), yellow perch are often considered a nuisance in lakes and rivers where they compete with adult trout for food resources and prey upon younger trout (Coots 1966). The Columbia River population may have been the result of several intentional introductions. In 1894, the USFC planted *Perca flavescens* in Silver Lake (on the Cowlitz River) and over the next ten years almost 1000 perch were planted in Washington lakes (Wydoski and Whitney 1976). In 1905, yellow perch were believed to be present in the aquarium exhibit released into Guild Lake (Lampman 1946). In the 1930s, *Perca flavescens* was an important species in regional lake fisheries in the 1930s but it sustainable population levels were rapidly exceeded and most fish were reported to appear “stunted” (Lampman 1946).

**Sander vitreus** (Mitchill, 1818)  
*Stizostedion vitreum, Perca vitrea*
walleye, walleye pike  
LIT  
Introduced

Although *Sander vitreus* were first transplanted to the West Coast in 1874 by Livingston Stone (Smith 1896), walleye were not captured in the lower Columbia River basin until 1980 (Li et al 1979, Farr and Ward 1993, NAS 2003). It is believed that, since their introduction into the upper Columbia near Lake Roosevelt in the 1940s or 1950s, walleye have gradually spread downriver and may have established a limited population in the lower Columbia (Dentler 1993, Farr and Ward 1993, NAS 2003). Native to the Great Lakes through the Mississippi basin (Froese and Pauly 2003), *S. vitreus* is a popular gamefish that lives in aquatic habitats from ponds to large rivers. A recent literature review by McMahon and Bennett (1996) found that the effects of walleye introductions in the Pacific Northwest were complex but posed a threat to salmonids through smolt predation. Because of this *S. vitreus* is banned from introduction into Oregon waters (McMahon and Bennett 1996).

POECLIIDAE

**Gambusia affinis** (Baird & Girard, 1853)
Kingdom: Animalia
Phylum: Chordata
Superclass: Osteichthyes

Syn: Heterandria affinis, Gambusia affinis affinis
Mosquitofish
Introduced
LIT

Previously reported as the sub-species Gambusia affinis affinis but now recognized as a full species (Moyle and Davis 2000), the western mosquitofish is native to the Atlantic and Gulf Slope drainages from New Jersey to Mexico and the Mississippi River basin (Froese and Pauly 2003, NAS 2003). Gambusia affinis is one of the most successful introduced fish species in the world having gained a near global distribution (Welcomme 1988). Adverse ecological impacts have been reported from Europe, Asia, India, Australia, Africa and South America as well as from numerous island counties where G. affinis has been extensively introduced for mosquito control (see Froese and Pauly 2003). While G. affinis was introduced to much of the United States and to countries around the world for mosquito control starting in the 1960s, recent critical reviews of this practice suggest that this fish may not be any more successful than native minnows at consuming mosquito larvae and reducing mosquito-borne disease (Courtenay and Meffe 1989). However, adverse ecological effects have resulted from mosquitofish predation on the eggs, larvae, and juveniles of various native fishes. Although still distributed to private parties for mosquito control, in the Western United States G. affinis has been implicated in the extirpation and/or decline of populations of federally endangered and threatened species of minnow and chub (Courtenay and Meffe 1989). In Oregon, the sharp decline in the population of Oregonichthys crameri, the Oregon chub - an endangered species, has been attributed to habitat loss and predation by introduced fishes including G. affinis (Scheerer 1999)

SALMONIDAE

Oncorhynchus clarki x mykiss
Artificially? ESTABLISHED
cutbow trout

The status of cutbow trout as a nonindigenous species is non-straightforward. Oncorhynchus clarki x mykiss, the result of a cross between O. clarki x O. mykiss, is considered an artificial hybrid occurring in the wild where parent species come in contact with one another through stocking, and not present (or rare) where both parents occur naturally together in their native range (Sigler and Miller 1963). While both parent species are native to the lower Columbia River basin both species have been widely stocked throughout the Columbia River, the result of fish enhancement and hatchery programs (Froese and Pauly 2003). Further complicating matters, the hybrid cutbow has also been intentionally stocked in the western U.S. as sport fish (NAS 2003). The ease of hybridization between the two parent species may be contributing to a reduction in genetic integrity of these species and the replacement of threatened cutthroat trout populations by hybridization and competition (NAS 2003).
**Salmo trutta** Linnaeus, 1758
brown trout, German brown trout

*Salmo trutta* is native to Europe and western Asia (Page and Burr 1991). First introduced to the inland waters of North America in 1883 by the USFC, *S. trutta* is now present throughout the U.S. (Courtenay et al. 1984, NAS 2003). Natural reproduction rates in North America are poor thus many states actively stock this popular gamefish to maintain desirable population sizes (NAS 2003). Chapman (1942) reports that while *S. trutta* was widely planted in Oregon and Washington it was successful in only a few locations.

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**Ranidae**

*Rana catesbeiana* LCRANS, LIT Introduced

**Native to eastern and central North America, Rana catesbeiana, the bullfrog, is widely introduced in the western states including Hawaii. Speculation as to the intent of early introductions includes plantings intended for food (to provide frog legs for the West Coast frog leg market which declined in the 1930s) (ODFW 2001) as well as for aesthetic purposes (i.e. for their distinctive croaking sound) (Lampman 1946). In 1914, the Oregon Fish and Game Commission granted permission to a private individual to introduce this frog into the mid-Columbia River basin below John Day (Lampman 1946). In 1924 or 1925, reports Lampman (1946), bullfrogs resulting from the above planting were shipped to Portland for further distribution in the lower Columbia River basin. Mature bullfrogs are responsible for significant levels of predation on native aquatic species, including the spotted frog (*Rana pretiosa*), the Western pond turtle (*Clemmys marmorata*) and the Oregon chub (*Oregonichthys crameri*) (ODFW 2001, Crayon 2002).**
Reptiles were not collected or identified over the course of this study. Nonnative turtles have been introduced numerous times over the years, likely both intentionally to enhance wildlife and through aquarium/terrarium disposal. The introduced species pose a threat to native species whose populations are in decline.

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<th>Phylum: Chordata</th>
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<tr>
<td>Subphylum: Vertebrata</td>
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<td>Class: Reptilia</td>
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<td>Order: Testudines</td>
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<th>CHELYDRIDAE</th>
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<tr>
<td><em>Chelydra serpentina serpentina</em></td>
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<td>(Gray, 1831)</td>
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<td>Eastern snapping turtle</td>
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Native to eastern North America several established populations of this snapping turtle have been reported from the Willamette Valley including Portland, OR (see [http://nas.er.usgs.gov/queries/SpFactSheet.asp?speciesID=1226](http://nas.er.usgs.gov/queries/SpFactSheet.asp?speciesID=1226) for more information).

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<tr>
<td><em>Chrysemys picta bellii</em></td>
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<td>(Gray, 1831)</td>
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<td>Western painted turtle</td>
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This turtle is found primarily in northern Willamette Valley and ranges east through the Columbia River Gorge and Columbia Basin.

| *Clemmys marmorata*  |
| (Baird and Girard, 1852)  |
| Western pond turtle  |
| Native  |

*Clemmys marmorata* is considered to be rare throughout its range. It is almost extirpated in Washington State, and the current western pond turtle population in Oregon is thought to be less than 10% of its historical population. [https://www.nwp.usace.army.mil/op/V/western.htm](https://www.nwp.usace.army.mil/op/V/western.htm)

| *Trachemys scripta elegans*  |
| (Weid-Neuwied, 1838)  |
| red-eared slider  |

Appendices: page 162
Native to the Southeastern United States and popular as an aquarium species since the 1930s, *T. scripta elegans* has been introduced throughout the western United States primarily through aquarium releases and escapes. NAS attributes part of the the turtle’s recent popularity and subsequent releases/escapes to the Teenage Mutant Ninja Turtle television cartoon craze of the late 1980s - see http://nas.er.usgs.gov/queries/SpFactSheet.asp?speciesID=1261.

Native to South America, *Myocastor coypus* - an aquatic rodent, is a textbook example of how far astray well-intentioned importation and release of nonnative species can go. Introduced numerous times into the United States, beginning as early as 1899 in California (USGS 2000), most releases (and escapes) of nutria were intended to enhance the fur trade. For example, in 1938, twenty nutria were imported from Argentina to Louisiana by Tabasco sauce tycoon E.A. McIlhenny; these nutria reportedly escaped captivity during a hurricane in the early 1940s and subsequently spread along the Gulf Coast (NAS 2003). Other introductions of nutria in North America were made for biological control of unwanted aquatic weeds such as water hyacinth (*Eichhornia crassipes*) and alligator weed (*Alternanthera philoxeroides*) (USGS 2000) - a program that failed to significantly reduce the target plants. Nutria are considered an economic liability in many areas as their burrowing activity can damage earthen dams and dikes and because they often feed on the young shoots of crop plants (ODFW 2001). The burrowing activity of nutria may also contribute to streambed erosion in the lower Columbia River basin. Severe ecological impacts have been reported in the southern Atlantic states where nutria has caused extensive loss of marshland (NAS 2003). Nutria may also compete with native muskrat populations for food and habitat. ODFW (2001) reports that anecdotal evidence suggests that in locations where nutria are abundant, muskrat populations decline. Nutria were introduced into the wilds of the Pacific Northwest in 1937 when an unknown number escaped from a fur farm in
Kingdom: Animalia
Phylum: Chordata
Class: Reptilia

Tillamook Co. aided by a large flood. Today, nutria can be found throughout the lower Columbia River basin and much of western Oregon and Washington (ODFW 2001).