

## 2.6 NON-NATIVE SPECIES

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### EXECUTIVE SUMMARY

Non-native plant and animal species are of concern to efforts to help protect and recover salmonids in the Green River Watershed, because non-native species can potentially affect native species by occupying similar ecological niches and competing for food and habitat; inhibiting reproduction; interbreeding with native species; being sources of parasites and pathogens; and even modifying, reducing, or eliminating habitat used by native species (Moyle et al. 1986). In the Green River Watershed, there is not a program that routinely monitors for non-native species, but rather they are discovered as a part of other programs. One exception, the Puget Sound Expedition, documented non-indigenous marine invertebrate and plant species in all of Puget Sound, including Elliott Bay. This survey found 38 non-native species in the sound, although it is not known what proportion of these species were found in Elliott Bay. Observations indicate that relatively few non-native fish species occur in Elliott Bay, the Green/Duwamish Estuary, or adjacent to the mainstem Green River upstream of tidal influence. Perhaps the most notable non-native fish species that sometimes occurs in the Green River is the adult Atlantic salmon (*Salmo salar*) that swim up the river after having escaped from the commercial net-pen fishery in Puget Sound. King County maintains a database of Atlantic salmon observations in the Green River (Nelson 2000).

Other non-native fish species other than salmonids that could potentially occur in the Green River include warmwater game fish that are found in several of the lakes that drain to tributaries of the Green River (WDFW 1999). These species include yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*), smallmouth bass (*Micropterus dolomieu*), and largemouth bass (*Micropterus salmoides*). Although these warmwater game fish typically prefer waters which are relatively warm and slow moving several of these fish are occasionally observed in Soos Creek at the Soos Creek Fish Hatchery (Wilson 2000).

Relatively few non-native animal species other than fish potentially occur in or adjacent to the Green River. Nutria (*Myocastor coypus*), an aquatic mammal, is believed to occur in the Green River (Cassidy et al. 1997; Johnson and Cassidy 1997). Other non-native species that are potentially in the Green River include: the slider turtle (also known as the red-eared slider) (*Trachemys scripta*); snapping turtle (*Chelydra serpentina*); painted turtle (*Chrysemys picta*), which, although native to most of Washington state, is believed to have extended its range to the coast as a result of introductions (MELP 1998); spiny softshell turtle (*Apalone spiniferus*); bullfrog (*Rana catesbeiana*); green frog (*Rana clamitans*); Asian clam (*Corbicula fluminea*); and New Zealand mudsnail (*Potamopyrgus antidiarium*). In addition to the species listed above, other non-native animals in and adjacent to the Green River include cattle, horses, and other livestock.

A number of non-native plant species are known to occur within the riparian zone of the Green/Duwamish estuary, the mainstem Green River, and its major tributaries. Of most concern along the river are a variety of non-native herbaceous and shrubby plants that tend to form dense colonies, which exclude the establishment of a more diverse or natural vegetative community. Species of particular concern include a variety of pasture grasses, reed canary grass (*Phalaris*

*arundinacea*), Himalayan and evergreen blackberry (*Rubus discolor* and *R. laciniatus*), and Japanese knotweed (*Polygonum cuspidatum*).

## KEY FINDINGS

The key findings on non-native plants and animals in the Green/Duwamish estuary, mainstem Green River, and major tributaries are listed below:

- Although adult Atlantic salmon, which have escaped from the commercial net pen industry, occasionally swim into the estuary and up the Green River, no juvenile Atlantic salmon have been observed in the system.
- Non-native warmwater fish are known to be present in lakes that drain to the mainstem Green River, but observations of these fish in the river are limited.
- Nutria and bullfrogs are the only non-native aquatic animal species other than fish observed in the Green River watershed upstream of the tidally influenced zone.
- In the Green/Duwamish Estuary, three non-native benthic invertebrates are known to occur - the amphipod *Grandidierella japonica*, the tanaid *Sinelobus stanfordi*, and the cumacean *Nippoleucon hinumensis*.
- Some riparian areas are dominated by dense colonies of non-native vegetation, such as blackberry, reed canary grass, and Japanese knotweed.

## DATA GAPS

- No program exists that routinely monitors for or documents the presence and location of non-native species in the Green River watershed.
- The overall implications of non-native species invasions are not well understood.

## INTRODUCTION

Non-native species are organisms whose natural distribution did not originally include the area in which they are now found. Non-native species are also commonly referred to as non-native, non-indigenous, or introduced species. Sometimes they also are known as invasive species, alien species, or weeds. In WRIA 9 freshwater environment, non-native species identified to date include organisms that originated in Europe, Asia, and the eastern and southern regions of the American continents. For example, in North America, the Rocky Mountains are a physical barrier that naturally separates the ranges of many plants and animals. A species that is native to only the eastern United States is considered a non-native species when it occurs in the west, and conversely, many native western species are non-native in the eastern states.

Species can be introduced to areas outside their natural range through intentional transfers, movements through altered waterways (i.e., canals or diversions) or land cover (i.e., conversion of forest to pasture), and as a result of accidental or unintentional releases. In the Pacific

Northwest, non-native aquatic species have been introduced primarily through: 1) fishery management stocking; 2) intentional introductions of gamefish by anglers; 3) intentional or unintentional baitfish liberation by anglers; and 4) bilge pumping of ballast water in estuaries and large rivers (Spence et al. 1996). In the Pacific Northwest, the first recorded stocking of non-native fish was in 1880 when German carp were brought in to stock a nursery pond in Troutdale, Oregon (WDFW 1999). Other fish species soon followed, and many were brought by rail under the direction of the U.S. Fish Commission as part of an effort to provide enhanced recreational angling opportunities (WDFW 1999).

Human-caused alterations to habitats and habitat-sustaining functions can produce favorable new habitats in areas that were otherwise ecologically unsuited to non-native species (MacCrimmon and Robbins 1975, Spence et al. 1996). An introduced species may fare better than native species when conditions deviate significantly from historic. For example, dams can transform riverine habitat from free-flowing to lacustrine conditions, change the flow regime from relatively steady to rapidly fluctuating flows, alter characteristic water temperatures and dissolved oxygen concentrations, and disrupt sediment transport and deposition processes. Relatively small changes to a native species' environment may sometimes be sufficient to stress or weaken the native population and favor the introduced species, resulting in a significant shift in aquatic community structure. This community shift can also occur among native species.

Not all non-native species can persist as self-sustaining populations in new locations. Some non-native species are unable to successfully reproduce in the Pacific Northwest due to temperatures or other environmental factors that are unfavorable to their life history requirements. Species that do not successfully reproduce may be occasionally present, but otherwise, they do not persist in the region without continual reintroduction. However, some introduced species can thrive and outcompete native species directly even without changes to the latter's environment simply because they are better adapted or more adaptable.

## **POTENTIAL EFFECTS OF NON-NATIVE SPECIES**

Aquatic ecosystems can be especially susceptible to invasion and alteration by non-native species, and the presence of non-native species in aquatic systems is sometimes used as an indicator of ecosystem degradation (Karr 1991). The presence of non-native species can negatively affect native species by occupying similar ecological niches and competing for food and habitat; inhibiting reproduction; interbreeding with native species; being sources of parasites and pathogens; and even modifying, reducing, or eliminating habitat used by native species (Moyle et al. 1986).

## **NON-NATIVE SPECIES POTENTIALLY OCCURRING IN THE GREEN RIVER WATERSHED**

In the Green River Watershed, there is not a program that routinely monitors for non-native species, but rather they are discovered as a part of other programs. In the Green River Watershed, anthropogenic alterations have created several new distinct habitats, which could be favorable to self-sustaining populations of non-native species. These ecologically altered regions include: 1) areas of the riparian zone that have been converted from its original dense floodplain forest to cleared or developed land; 2) the approximately 32 miles of river that have been dredged and/or channelized; 3) the creation of numerous farm and residential fish ponds, which

drain to the main river; and 4) the alternating riverine and lacustrine habitat upstream of the Howard Hanson Dam.

Relatively few non-native fish species are known to occur in or adjacent to the mainstem Green River upstream of tidal influence. Perhaps the most notable non-native species is the adult Atlantic salmon (*Salmo salar*) that swim up the Green River after having escaped from the commercial net-pen fishery in Puget Sound. King County maintains a fish distribution map of Atlantic salmon in the Green River (Nelson 2000).

In addition to escaped Atlantic salmon, other salmon species and stocks of salmon species have been introduced to the Green River and its tributaries. These introductions including kokanee and sockeye salmon (*Oncorhynchus nerka*), steelhead (summer and winter stocks) and rainbow trout (*O. mykiss*), chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), chum salmon (*O. keta*), cutthroat trout (*O. clarki*) and eastern brook trout (*Salvelinus fontinalis*). Of these six species, only the eastern brook trout is considered to be a non-native species in the Green River watershed and the historic presence of summer steelhead is not known.

- For the purposes of this assessment, released and existing kokanee, cutthroat, steelhead, rainbow trout, and chinook, coho, and chum salmon are not considered to be non-native species in the Green River. Information stocks of salmonids present in the Green River watershed is discussed in Part I: Chapter 3.

Non-native fish species other than salmonids that could potentially occur in the Green River include warmwater game fish that are found in several of the lakes that drain to tributaries of the Green River (WDFW 1999). These species include yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*), smallmouth bass (*Micropterus dolomieu*), and largemouth bass (*Micropterus salmoides*). Warmwater game fish typically prefer waters which are relatively warm and slow moving.

Information on non-native animal species other than fish that could potentially occur in or adjacent to the Green River was compiled primarily from the USGS GAP Analysis of Washington (Cassidy et al. 1997), the Washington State Aquatic Nuisance Species Management Plan (WANSPC 1998), and interviews with local habitat and fisheries biologists. Potential non-native species in the Green River include: the slider turtle (also known as the red-eared slider) (*Trachemys scripta*); snapping turtle (*Chelydra serpentina*); painted turtle (*Chrysemys picta*), which, although native to most of Washington state, is believed to have extended its range to the coast as a result of introductions (MELP 1998); spiny softshell turtle (*Apalone spiniferus*); bullfrog (*Rana catesbeiana*); green frog (*Rana clamitans*); Asian clam (*Corbicula fluminea*); and New Zealand mudsnail (*Potamopyrgus antedarium*).

Nutria (*Myocastor coypus*), an aquatic mammal, is also believed to occur in the Green River (Cassidy et al. 1997; Johnson and Cassidy 1997). Although nutria is more abundant further south in Washington state, it first escaped here via a fur-farm along the Green River during a flood in 1935 (Johnson and Cassidy 1997).

In addition to the species listed above, other non-native animals in and adjacent to the Green River include cattle, horses, and other livestock. Although these animals are not aquatic, livestock pastures routinely provide access for the animals to streams and rivers for water. Because these animals congregate in herds, riparian areas that they frequent to access the water are often highly disturbed as a result of trampling and foraging.

A number of non-native plant species are found within the riparian zone of the Green River and some non-native plant species also occur within the lakes and waterways that drain to the river. Of most concern along the river are a variety of non-native herbaceous and shrubby plants that tend to form dense colonies, which exclude the establishment of a more diverse or natural vegetative community. These invasive plants species tend to become established in highly disturbed sites that have been modified either by clearing activities or by flooding. Species of particular concern include a variety of pasture grasses, reed canary grass (*Phalaris arundinacea*), Himalayan and evergreen blackberry (*Rubus discolor* and *R. laciniatus*), and Japanese knotweed (*Polygonum cuspidatum*). Other non-native plants that are more common to the lakes that drain to the Green River than to the river itself are purple loosestrife (*Lythrum salicaria*) and Eurasian watermilfoil (*Myriophyllum spicatum*). On the Washington State list of freshwater plant species that are aquatic nuisance species, only purple loosestrife (*Lythrum salicaria*), an emergent plant species has been identified in Green River watershed.

The following Sections briefly review known observations by subwatershed of non-native fish, animal, and plant species in and along the mainstem Green River.

## UPPER GREEN RIVER SUBWATERSHED (RM 64.5 – RM 93)

### FISH

The only non-native fish known to occur in the Upper Green River subwatershed is the eastern brook trout. Eastern brook trout were stocked by the state in the Green River and several of its tributaries as early as 1919 (WDFG 1920). These early records are not specific as to the locations of these releases.

Eastern brook trout have been documented to currently occur in two tributaries of Howard Hanson Reservoir - Page Mill Creek and Sunday Creek (Goetz, 2000). Sunday Creek drains Lizard Lake, which has not been stocked with eastern brook trout for many years, but which is believed to support a reproducing population of brook trout (Pfeifer 2000). Brook trout are usually of most concern where they co-occur with native bull trout. Bull trout and brook trout, two related char species, are thought to directly compete for limited habitat resources. Brook trout tend to be more aggressive than bull trout and may displace bull trout from optimal foraging areas. In addition to direct competition for resources, brook trout pose an additional threat to bull trout since the two species are capable of interbreeding (Leary et al. 1983, Scott and Crossman 1973, Markle 1992). The hybrid offspring typically do not reproduce (Leary et al. 1991), however, eastern brook trout tend to eventually replace bull trout when interbreeding occurs, as a result of differences in their life history strategies (e.g., brook trout mature earlier than bull trout) (Leary et al. 1991). Numerous surveys have failed to locate any bull trout in the

Upper Green River Watershed (Jeff Light 2000; USFS 1998; Watson and Hillman 1997; Goetz 1998).

## **OTHER ANIMALS**

No non-native animals other than fish are known to occur in or adjacent to the Green River in the Upper Green River subwatershed.

## **PLANTS**

Non-native plant species often colonize new habitats in disturbed areas such as roadsides, right-of-ways, clearcuts and gravel pits. The upper Green River subbasin has not been surveyed for non-native plant species as of the date of this report. However, the following Non-native plant species have been documented in this subwatershed: spotted knapweed, Scot's broom, Bull thistle, Poison hemlock, common St. John's wort, oxeye daisy, white campion, tansy ragwort and flannel mullein (USFS 1996). Non-native aquatic freshwater plants are not believed to be prevalent in the Upper Green River subwatershed (for example, see Shapiro and Associates 1985).

## **MIDDLE GREEN RIVER SUBWATERSHED (RM 31 – RM 64.5)**

### **FISH**

Adult Atlantic salmon that have escaped from the commercial aquaculture net-pen industry in Puget Sound have been seen as far upstream as RM 40 in the Middle Green River subwatershed (Tom Cropp 2000), and occasional adult Atlantic salmon have been captured at the hatchery trap at the Soos Creek Hatchery. The WDFW hatchery manager indicated that he has seen only 1 or 2 Atlantic salmon at the fish rack within the last ten years (Wilson 2000).

Atlantic salmon are farmed in marine net pens in both Washington and British Columbia waters. The salmon net pen industry in British Columbia is ten times larger than Washington (Amos and Appleby 1999). Annual escapes from British Columbia pens are estimated to be approximately 60,000 fish. Estimated escapes from Washington state marine net pens in 1996, 1997, and 1999 were reported 107,000, 369,000, and 115,000 Atlantic salmon, respectively (Amos and Appleby 1999). Although previous attempts had been made by the state to establish Atlantic salmon in several state waters (not including any waters in King County), these efforts were unsuccessful (Amos and Appleby 1999). Naturally-produced Atlantic salmon in Pacific coast streams were not discovered until 1998 and 1999, when juveniles were found in streams on Vancouver Island, British Columbia. It is unknown if juvenile Atlantic salmon that are the progeny of spawning Atlantic salmon adults in Pacific Northwest rivers are capable of maturing and returning to spawn in the wild (Amos and Appleby 1999). To date, no juveniles or naturally-produced Atlantic salmon have been identified in the Green River (Warner 2000; Cropp 2000).

Interviews with regional biologists identified no other known observations of non-native fish species in the mainstem Green River between RM 31 and RM 64.5. However, the Middle Green River subwatershed contains several lakes known to support non-native warmwater species (Section 5.2.6), thus it is possible that such species are sometimes able to access the tributaries

and mainstem. However, no records or observations of warmwater gamefish in the mainstem Green River were located.

## **OTHER ANIMALS**

Other than domestic livestock, no non-native non-fish animals have been recently reported to occur in or adjacent to the Green River in the Middle Green River subwatershed. It is possible, however, that nutria (Johnson and Cassidy 1997; Cassidy et al. 1997), slider (Cassidy et al. 1997) and painted turtle (Cassidy et al. 1997) and bullfrog (Cassidy et al. 1997) exist in and alongside the mainstem river in the Middle Green River subwatershed.

Bullfrogs were introduced into the Puget Sound lowlands in the 1930's from their native range in the eastern United States. Bullfrogs prey on juvenile salmon where they co-exist. Bullfrogs have been observed in the Green River Watershed and could potentially exist in ponds and off-channel habitats along the mainstem Green River, and could represent an important predator for native salmonids in the middle Green River.

## **PLANTS**

Several non-native plants are common and widespread throughout King County and are likely to be present in the Middle Green River subwatershed.; however, the most highly invasive ANS prefer either lake or estuarine environments (WANSPC 1998). A variety of non-native herbaceous and shrubby plants that tend to form dense colonies are known to occur along the river, and may preclude the establishment of the natural riparian community. Species of particular concern include a variety of pasture grasses, reed canary grass (*Phalaris arundinacea*), Himalayan and evergreen blackberry (*Rubus discolor* and *R. laciniatus*), and Japanese knotweed (*Polygonum cuspidatum*).

## **LOWER GREEN RIVER SUBWATERSHED (RM 11 – RM 31)**

### **FISH**

Adult Atlantic salmon that have escaped from marine net pens are known to enter the Lower Green River (Tom Cropp 2000). Except for the rare stray (i.e., barracuda in the Duwamish River [Warner 200]), interviews with regional biologists indicate that there are no other known observations of non-native fish species in the lower mainstem Green River. However, because the Lower Green River subwatershed contains several lakes known to contain non-native warmwater species (Section 5.2.6), it is possible that these fish are sometimes able to access the tributaries and mainstem.

### **OTHER ANIMALS**

Only a few non-native animals other than fish potentially occur in the Lower Green River Watershed. These species include livestock, nutria (Johnson and Cassidy 1997; Cassidy et al. 1997), bullfrog (Cassidy et al. 1997; McAllister 2000), slider turtle (Cassidy et al. 1997; McAllister 2000), painted turtle (Cassidy et al. 1997; McAllister 2000), snapping turtle (McAllister 2000), and spiny softshell turtle (McAllister 2000).



Both the snapping turtle and spiny softshell turtle are now found in Lake Washington (McAllister 2000). Although there is no documentation of sliders and painted turtles in WRIA 9, it is likely that they are present (McAllister 2000).

## **PLANTS**

Several non-native plants are common and widespread throughout King County and are likely to be present in the Lower Green River subwatershed. A variety of non-native herbaceous and shrubby plants that tend to form dense colonies are known to occur along the river. Species of particular concern include a variety of pasture grasses, reed canary grass (*Phalaris arundinacea*), Himalayan and evergreen blackberry (*Rubus discolor* and *R. laciniatus*), and Japanese knotweed (*Polygonum cuspidatum*). Two non-native plant species, blackberry and reed canarygrass, form a virtual biculture along the levees and revetments adjacent to the Lower Green River (Schaefer 2000).

## **GREEN/DUWAMISH ESTUARY**

### **FISH**

Adult Atlantic salmon that have escaped from marine net pens are known to occur in Elliott Bay and occasionally enter the Green/Duwamish Estuary, but there is no evidence that the species has propagated in the basin. With the exception of the occasional stray fish (e.g., barracuda), interviews with regional biologists indicate that there are no other known observations of non-native fish species in Elliott Bay or the Green/Duwamish Estuary (Cropp 2000; Geist 2000; Cordell 2000).

The potential freshwater non-natives discussed in previous sections would be limited to areas of the upper estuary. Warner and Fritz (1995) found fresh water at all depths and tides at RM 10.4, but salinities between 25 and 28 ppt were found at RM 7.5 at depths below 3 ft.

### **OTHER ANIMALS**

Cordell (Cordell 2000) documented three non-native benthic invertebrates in the Green/Duwamish Estuary—the amphipod *Grandidierella japonica*, the tanaid *Sinelobus stanfordi*, and the cumacean *Nippoleucon hinumensis*. The Puget Sound Expedition, which documented non-indigenous marine invertebrate and plant species in all of Puget Sound, found 38 non-indigenous species in the sound as presented in Table 5.1.6-1. It is not known what proportion of these species were found in Elliott Bay. Non-native animals other than fish and invertebrates are not expected to occur in the Green/Duwamish Estuary or Elliott Bay area. The estuary and bay are highly developed and provide very little natural terrestrial or riparian habitat. The potential presence of nutria, bullfrog, and turtle species is diminished in the estuary because these species are common to freshwater habitats.

## **PLANTS**

Several non-natives plant species are known to occur in the Green/Duwamish Estuary, including common reed (*Phragmites australis*), Himalayan blackberry (*Rubus discolor*), evergreen

blackberry (*R. laciniatus*), Japanese knotweed (*Polygonum cuspidatum*), and reed canarygrass (*Phalaris arudinacea*). During a May 1999 field reconnaissance, Pentec Environmental found that blackberry shrubs (likely a mixture of *R. discolor* and *R. laciniatus*) were well established in the upper riparian zone of the estuary between RM 11.0 and RM 5.3. It is the most common shrub species present along the Duwamish River. Common reed has become well established in two locations in the Green/ Duwamish Estuary-Kellogg Island, located between RM 2.0 and RM 1.0, and the 509 marsh area located between RM 3.0 and RM 2.5. Other species of concern in the estuary include common tansy (*Tanacetum vulgare*), yellow iris (*Iris pseudacorus*), and Scots broom (*Cytisus scoparius*) (Dean 2000).

**Table RIP-1. Non-native marine invertebrate and plant species found in Puget Sound by the 1998 Puget Sound Expedition.**

General Taxon	Scientific Name	Native Range	First Puget Sound Record
Seaweed	<u><i>Sargassum muticum</i></u>	Japan	1948
Seagrass	<i>Spartina anglica</i>	England	1961-1962
Seagrass	<i>Zostera japonica</i>	Japan	1974
Foraminifera	<i>Trochammina hadai</i>	Japan	1971
Cnidaria - Hydroid	<i>Cordylophora caspia</i>	Black Sea	ca. 1920
Cnidaria - Anemone	<i>Diadumene lineata</i>	Asia	< 1939
Annelida	<i>Hobsonia florida</i>	NW Atlantic	1940
Annelida	<i>Pseudopolydora paucibranchiata</i>	Japan	1993
Mollusca – snail	<i>Batillaria attranmentaria</i>	Japan	1924
Mollusca – snail	<i>Crepidula fornicata</i>	NW Atlantic	1905
Mollusca – snail	<i>Myosotella mysotis</i>	Europe?	1927
Mollusca – bivalve	<i>Crassostrea gigas</i>	Japan	1875
Mollusca – bivalve	<i>Mya arenaria</i>	NW Atlantic	1888-1889
Mollusca – bivalve	<i>Nuttallia obscurata</i>	Japan, Korea	1993
Mollusca – bivalve	<i>Ruditapes philippinarum</i>	NW Pacific	1924
Copepoda	<i>Choniostomatid copepod</i>	Unknown	1998
Cumacia	<i>Nippoluecon hinumensis</i>	Japan	mid-1990s
Isopoda	<i>Limnoria tripunctata</i>	Unknown	1962
Amphipoda	<i>Ampithoe valida</i>	NW Atlantic	1966
Amphipoda	<i>Caprella mutica</i>	Japan	1998
Amphipoda	<i>Corophium acherusicum</i>	N Atlantic	1974-1975
Amphipoda	<i>Corophium insidiosum</i>	N Atlantic	1949
Amphipoda	<i>Eochelidium</i> sp.	Japan or Korea	1997
Amphipoda	<i>Grandidierella japonica</i>	Japan	1977
Amphipoda	<i>Jassa marmorata</i>	NW Atlantic	1990?
Amphipoda	<i>Melita nitida</i>	NW Atlantic	1998
Amphipoda	<i>Parapleustes derzhavini</i>	W Pacific	1998
Entoprocta	<i>Barentsia benedeni</i>	Europe	1998
Bryozoa	<i>Bowerbanki gracilis</i>	NW Atlantic?	< 1953
Bryozoa	<i>Bugula</i> sp.	Unknown	1993
Bryozoa	<i>Bugula</i> sp.	Unknown	1998
Bryozoa	<i>Bugula stolonifera</i>	N Atlantic	1998
Bryozoa	<i>Cryptosula pallasiana</i>	N Atlantic	1998
Tunicata	<i>Botrylloides violaceus</i>	Japan	1973
Tunicata	<i>Botryllus schlosseri</i>	NE Atlantic	1970s
Tunicata	<i>Molgula manhattensis</i>	NW Atlantic	1998
Tunicata	<i>Ciona savignyi</i>	Japan	1998
Tunicata	<i>Styela clava</i>	China	1998

## MAJOR TRIBUTARIES TO THE GREEN RIVER

### **SOOS CREEK**

#### FISH

Soos Creek drains several lakes and tributaries that are known to contain non-native warmwater fish (Section 5.2.6). Informal observations of non-native fish at the Soos Creek Fish Hatchery include occasional bass, bluegill, and catfish [probably bullhead] (Wilson 2000). As mentioned previously, occasional Atlantic salmon have been captured and removed from hatchery's fish rack.

#### OTHER ANIMALS

Non-native animals other than fish that may be present in and along Soos Creeks include livestock, nutria (Johnson and Cassidy 1997; Cassidy et al. 1997), slider turtle (Cassidy et al. 1997), painted turtle (Cassidy et al. 1997), and bullfrog (Cassidy et al. 1997).

#### PLANTS

Several non-native plants are common and widespread throughout King County and are likely to be present in and along Soos Creeks. Where the banks along the stream have been modified by agriculture and other land uses dense stands of blackberry and reed canarygrass are common. Some sections of these streams are bordered by lawns that may include ornamental plants and pasture grasses.

### **NEWAUKUM CREEK**

#### FISH

There are no documented observations of non-native fish in Newaukum Creek. However, it is likely that warmwater fish originating from upstream ponds and lakes are occasionally present in the stream.

#### OTHER ANIMALS

Non-native animals other than fish that may be present in and along Newaukum Creek include livestock, nutria (Johnson and Cassidy 1997; Cassidy et al. 1997), slider turtle (Cassidy et al. 1997), painted turtle (Cassidy et al. 1997), and bullfrog (Cassidy et al. 1997).

#### PLANTS

Several non-native plants are common and widespread throughout King County and are likely to be present in and along Newaukum creeks. Where the banks along the stream have been modified by agriculture and other land uses, dense stands of blackberry and reed canarygrass are common. Some sections of these streams are bordered by lawns that may contain ornamental plants and pasture grasses.

## LIST OF TABLES

Table RIP-1: Non-native marine invertebrate and plant species found in Puget Sound by the 1998 Puget Sound Expedition.