Aquatic Macroinvertebrates at Jackson Bottom Wetland: April, 2006 to April, 2007

Nick Engelfried Email: nengel1@verizon.net

September 3, 2007

Sample Sites and Sampling Methods

Over the course of a year, I visited five sampling sites, each at a different body of water in Jackson Bottom Wetland. Each site was visited roughly once each week, and at each visit the aquatic macroinvertebrates in the body of water were sampled. This study was to build on a similar study conducted from March, 2005 to February, 2006, which included three sampling sites. All three bodies of water sampled in the earlier study were included in this one, as well as two additional sites not included in 2005-06 year.

Of the five bodies of water, one was a large, fast-moving stream: the Tualatin River (included in the study of the previous year). Two other were smaller, generally slow-moving streams: Jackson Bottom Slough (included in the study of the previous year), and Miller's Swale (not included in last year's study). The Slough, however, was significantly wider and deeper than the Swale. Two other sites were for the most part stagnant ponds: the Gene Pool, and Kingfisher Marsh (both included in last year's study). Of the two ponds, Kingfisher Marsh was considered seasonal, drying up during the summer, while the Gene Pool was a deeper, permanent body of water.

During each visit to the sample sites, a small net was used to collect invertebrates from shallow water. Invertebrates hidden in aquatic plants were netted, as well as benthic (bottom-dwelling) species on the sediment or rock surfaces. When medium-sized rocks were accessible, they were lifted to uncover invertebrates clinging to their undersides. These organisms were often brushed from the lower surface of the rock with the edge of a piece of screen. All of the macroinvertebrates collected were deposited in a sampling tray for identification.

With some exceptions, aquatic insects were identified to the family level. Other invertebrates, such as mollusks, annelids, and crustaceans, often could only be identified to the level of order or class. Most of the insects belonged to families that have been given a Family Biotic Index (FBI) value; this index rates organisms on a scale of 0.00, or very pollution-sensitive, to 10.00, or pollution tolerant (Rideau Valley Conservation Authority). After identification, all invertebrates were released at the sample site where they were found. The great majority of insects were found in their larval or nymphal stages; unless stated otherwise, insect names in this study refer to immature stages.

Tualatin River

Spring, 2006 (April, May)

During the first season of the study, three families of insects stood out as appearing in samples from the Tualatin River more commonly than any others. One of these families was the Baetidae, or small minnow mayflies, which were found in comparatively large numbers on ever sampling day during the months of April and May. In addition to Beaetids, two other families of mayflies were found in the Tualatin during the spring, though much less commonly. Two Heptageniid, or flat head mayflies were found on May 12th, and a single Ephemerellid, or spiny crawler mayfly appeared in the sample tray that same day. This last find was especially significant, as the Ephemerellid mayfly was one of the most pollution-sensitive organisms found throughout this study in any body of water.

The other two very common groups of insects, during the spring, were the Simulids, or black flies, and the Chironomids, or common midges. Like the Baetid mayflies, both these groups were present on every sampling day. Other insects found in smaller numbers included a single Corixid, or water boatman, three Hydropsychids or net-spinner caddisflies—all found on the same day, and a single midge from the family Dixidae—a group found in this study much less frequently than the more common Chironomid midges.

As well as insects, a variety of other invertebrates were found at the Tualatin site in the spring. These consisted of two aquatic mites found on different days, and relatively small numbers of planktonic crustaceans—members of the Copepoda, Ostracoda, and Cladocera. Benthic, or bottom-dwelling crustaceans were present, too, the most common being Amphipod crustaceans, with the Isopods, or aquatic sow bugs, appearing on two occasions. Aquatic snails were very common during this time period, and aquatic earthworms were found during two of the five sampling sessions.

Summer, 2006 (June, July, August)

Though not found as frequently or in as great of numbers as in spring, Baetid mayflies were apparently present at the Tualatin site throughout the second season of the study. Other mayfly families were also present: one Heptageniid mayfly was found near the end of August, and a single Ephemerellid was found at the beginning of June. In addition, a member of a fourth family of mayflies—the Leptophlebiid, or prong gill mayflies—appeared during the first week of August.

Hydropsychid caddisflies were also found through the summer, appearing in the sampling tray during five of ten sampling sessions. Simullid flies, however, became less common—or at least appeared in the sampling tray much less frequently; a single Simullid was found on June 2nd, but that was the only individual netted during the summer months. Chironomid midges also declined, being found on only two sampling days; this last trend was no unexpected, as the river becomes, at the sampling site in question, considerably clearer during the summer, and less hospitable to pollution-tolerant insects like Chironomids. A single stonefly (family unknown) was found near the end of June.

Other organisms which would be expected to decline as particulate matter in the Tualatin decreased include planktonic crustaceans. Indeed, Copepods, Ostracods, and

Cladocerans were not found at all during the summer. The Benthic Amphipods, however, remained, and a single aquatic mite was found near the end of August. Aquatic snails remained common throughout the summer; in August, freshwater limpets were also found. It is likely that these last animals were present in the Tualatin for most or all of the year, but were found only in August because the water level was low enough for the rocks that make up their main habitat to be reached during sampling sessions.

Fall, 2006 (September, October, November, December)

Unfortunately, sampling was less continuous during the fall portion of the study than in other seasons, and no data at all was recorded during the month of October. Baetid mayflies seem to have been present in the river throughout the fall months, despite the fact that they were not found during every sampling session; these organisms seem to have been perhaps the most consistently numerous insects family in the Tualatin, and were comparatively common throughout the year of the study. A single Leptophlebiid mayfly was also found at the beginning of September, and a Heptageniid appeared later that same month.

Hydropsychid caddisflies appeared in samples less often as the season went on, but their apparent disappearance likely reflects the rising of the Tualatin's water level, and the consequent inaccessibility of their rocky habitat. Chironomid midges and Simullid flies were again present, the former being found on two occasions in September, and the latter appearing once that same month. A single aquatic beetle adult was found on September 30th.

Among non-insect invertebrates, all three groups of planktonic crustaceans, especially the Cladocerans and Copepods, became much more numerous during the fall months. Numbers Amphipods and freshwater snails apparently declined, but this may again reflect the inaccessibility of their habitat due to rising water levels. Isopod crustaceans were found on two occasions during the month of September, and aquatic mites also appeared occasionally.

Winter, 2007 (January, February, March)

Baetid mayflies remained common during the winter months, though no other mayfly families were netted. Chironomid midges were less plentiful, being found in small numbers on four out of eleven sampling days. Black flies were also found on four out of eleven sampling days; for these insects, however, this represented an increase to a level of abundance not seen since early summer.

Planktonic crustaceans began to appear in samples more commonly during the summer months, with copepods becoming more numerous than any others. The benthic amphipods continued to appear occasionally. In addition, for the first time during the year of the study, planarian flatworms were found on two different sampling days, with five individuals counted in the tray on one day (January 21st).

Gene Pool

Spring, 2006 (April, May)

Members of the mayfly group were, in general, netted much less frequently in the Gene Pool than in the Tualatin River, with no mayflies at all being found in the former

site during the months of April or May. The single most common insect family was that of the Chironomid midges, which were found on every sampling day during the spring. A single damselfly nymph was found on April 28th; as these insects are mostly characteristic of still or slow-moving bodies of water, it was unsurprising that they were found in the Gene Pool but not the Tualatin.

Other insects found in the Gene Pool during this season included adult Corixids, or water boatmen, found on two occasions, as well as adult Dytiscids (diving beetles), found on one sampling day, and a total of four Dytiscid larvae, two of which were found on each of May 21st and May 26th. An insect found only once during the spring was a Haliplid beetle larva netted on May 21st; this family of organisms was found in no body of water except the Gene Pool for the year of this study.

Aquatic mites, which appeared to be more common in the Gene Pool than any other body of water during this study, were found on all five sampling days during the months of April and May. Planktonic crustaceans were also very common, especially Copepods and Cladocerans. Other non-insect invertebrates included aquatic snails and aquatic earthworms, as well as a single Amphipod crustacean, found on May 26th.

Summer, 2006 (June, July, August)

Baetid mayflies were found in the Gene Pool on two occasions during the summer. This suggests that these insects were probably present for all or most of the year, but in lower numbers than in the Tualatin, resulting in fewer of them being caught in the sampling tray. Damselflies were comparatively common throughout these months, and were found on six out of ten sampling days, with as many as three individuals appearing in the sampling tray on some days. Chironomid were about equally common. In addition, a single dragonfly nymph was found on August 6th. Other insects found included Dytiscid beetle adults and larvae (each life stage being on two out of ten sampling days), adult Corixids (found on six sampling days), and Notonectid, or backswimmer, adults (found on three sampling days).

Aquatic mites were found on three sampling days, and benthic Isopod crustaceans on two. A single leech was found in on June 2nd—the only time during the year of the study that this group of organisms was recorded in the Gene Pool. Planktonic crustaceans started out very common, as they had been during the spring months. By the end of June, however, Cladocerans and Ostracods had both undergone significant declines, with only the Copepods remaining numerous; even the Copepods disappeared from the data during the later part of August. This decline in planktonic crustaceans may possibly be explained by the annual build up of algae in the Gene Pool during the summer, and the decrease in dissolved oxygen that normally accompanies the decay of large quantities of algae. Such a decline in oxygen levels would be likely to affect many types of aquatic life—and, indeed, most groups of organisms became less common in the Gene Pool during the late summer.

Fall, 2006 (September, October, November, December)

Perhaps, but not definitely, owing in part to the apparent die-off of aquatic invertebrates owing to the buildup of algae in the summer, most invertebrate groups were comparatively uncommon during the fall months. On September 2nd, a single adult Corixid was found; indeed, these insects appeared to survive the entire summer in the

Gene Pool, which makes sense in light of the fact that they are air-breathing, and do not rely on dissolved oxygen from the water. Significant numbers of Copepods and Cladocerans were found on November 15th, though they had not yet reached the same levels of abundance apparent in early summer. Otherwise, the only invertebrates recorded during the fall in the Gene Pool were two aquatic mites netted on September 2nd, an occasional snail or aquatic earthworm

Winter, 2007 (January, February, March)

The Gene Pool sampling site was inaccessible on two sampling day in the winter (as well as two in the fall), due to the flooding of the water body by the Tualatin River. This annual event occurred as the Tualatin's water level grew much higher than at other times of the year, and one result was that all bodies of water in Jackson Bottom Wetland Preserve were mixed together by the floodwaters of the Tualatin. A natural assumption would be that this process would have an effect on the aquatic organisms found in some bodies of water; invertebrates normally confined to the river would be expected to be washed into the smaller streams and ponds. Indeed, it seems likely that this happened as the flooding of the Gene Pool was followed by a noticeable increase in the diversity and sheer number of organisms recorded at the site.

On March 14th, a Baetid mayfly was recorded in the Gene Pool for the first time since July. Even more noteworthy, a stonefly nymph (family unknown) was found on January 21st; this was the only time during the year of this study that members of this insect family—normally confined to moving water—were found in the Gene Pool. A variety of other insects also appeared during the winter months, albeit in small numbers. A Limnephilid, or northern casemaker caddisfly, as well as a single Dytiscid beetle larva, and a total of four crane fly larvae (spread over two sampling days), and three Chironomid midge larvae (all found on the same day) comprised the other insects found during the winter.

Copepod crustaceans had again become exceedingly numerous by January 21st, and many Ostracods, also, were found on that day. Cladocerans apparently took more time to rebuild their populations, but were again found in very large numbers by March 21st. In March, the benthic Amphipods increased their appearances noticeably. Other invertebrates found occasionally included aquatic snails, aquatic earthworms, and planarian flatworms—the latter appearing in the sampling tray quite regularly during late January and the first half of February.

Kingfisher Marsh

Spring, 2006 (April, May)

Three groups of immature insects stood out as more common than any others during the spring months in Kingfisher Marsh. Damselfly nymphs appeared in samples on three out of five sampling days; this was unsurprising as the Marsh, like the Gene Pool, was stagnant water, making it prime habitat for these insects. Even more numerous were Chironomid midges, which were found on four out of five sampling days, with as many as six individuals counted in the tray on a single day. The larvae of aquatic beetles (probably Dytiscids), too, appeared on four out five sampling days; beetle larvae were, in

fact, found more often in Kingfisher Marsh than in any other body of water during this study.

Among adult insects found in the Marsh, Corixid bugs were also especially numerous, and were found on every sampling day during the month of May, with seventeen individuals being counted on May 12th. Notonectid bugs, or backswimmers, were also found on two sampling days—May 21st and May 26th. Other insects recorded consisted of two individual Culcid, or mosquito larvae, on May fifth, and two [deer fly] larvae, on April 28th.

All three major groups of planktonic crustaceans—Ostracods, Copepods, and Cladocerans—were recorded in large numbers throughout the spring, with the latter two group being especially common. Benthic Amphipods, however, were recorded only once, on May 21st. The remaining invertebrates were aquatic snails, present on ever sampling day in the spring.

Summer, 2006 (June, July, August)

The annual drying out of Kingfisher Marsh occurred during the summer of this study; the first date that ordinarily would have been a sampling day during which the Marsh was dry was July 9th. During the four sampling days in summer that occurred before this date, the populations of many of the insect families found in spring appeared fairly stable. Beetle larvae were found on two sampling days, damselfly nymphs on one, Corixid bugs on three, and Notonectid bugs on two. One unexpected trend, however, was the disappearance of Chironomid midges from the data. One group of insects found in summer that had not appeared in spring was the Tipulidae, or crane flies; a single crane fly larva was recorded on June 16th.

Ostracods and, especially, Cladocerans declined significantly during the summer, vanishing from the data before the Marsh dried out. The disappearance of these and other organisms as the summer went on may possibly have been related to the falling water level of Kingfisher Marsh, and associated impacts on water quality, such as higher water temperatures. Copepods remained exceedingly common longer than the other two groups of planktonic crustaceans, but even they were severely reduced in numbers by late June. Aquatic snails, also, remained very common to the end.

Fall, 2006 (September, October, November, December)

By early November, rainwater had filled the Marsh again. The flooding of the Marsh be waters from the Tualatin River, in the fall, also helped restore this body of water. In addition, the Tualatin water doubtlessly brought many types of aquatic life forms that re-populated Kingfisher Marsh, along with whatever organisms survived the drought by taking shelter in the mud. The new assemblage of invertebrates was, however, noticeably different from the populations that had predominated in the Marsh before the annual drying-out; for the first several weeks, the diversity of organisms recorded was also decidedly lower. Adult Dytiscid beetles were among the first insects to arrive back in the Marsh, appearing on three out of five sampling days in the fall. Planktonic crustaceans also made a quick comeback, with Copepods being the most common group. The only other invertebrate group recorded was that of the Oligochaet worms, or aquatic earthworms, found on November 15th.

Winter, 2007 (January, February, March)

The only time that Baetid mayflies were recorded in Kingfisher Marsh, during the year of this study, was when a single individual was found on January 21st. Other insects found occasionally during the winter months included a single Corixid bug found on Februaury 14th, a Limnephilid, or northern casemaker caddisfly, found on March 7th, and eighteen Chironomid midges, all recorded on the same day—February 14th. From late February through the end of March Tipulid fly larvae became more numerous than ever before, with twenty or more individuals being recorded during some sampling sessions.

Though Ostracods and Cladocerans were both present throughout the winter months, Copepods were, again, by far the most common of the planktonic crustaceans. Other invertebrates included Oligocheate worms and planarian flatworms, both recorded infrequently.

Miller's Swale

Spring, 2006 (April, May)

Only a few different groups of larval insects were found at this study site during the spring months. A single stonefly nymph (family unknown) was found in Miller's Swale on May 12th, and two individual beetle larvae—probably Dytiscids—were found on May 26th. In addition, Chironomid midges were found on two out of five sampling days—May 21st and May 26th. In addition to these larval insects, adult Corixid bugs appeared in samples on four out of five sampling days.

Aquatic mites were found in the Swale on three out of five sampling days during the spring. These organisms represent one of several groups present in the Swale which are not normally associated with swiftly flowing water. And indeed, although the Swale is a moving stream, its current was considerably slower during most of the year than that of the much larger Tualatin River. In many ways, the invertebrates found in the Swale resembled those present in the stagnant Gene Pool and Kingfisher Marsh more than the prevalent organisms of the Tualatin.

Planktonic crustaceans of all three major groups—Cladocerans, Ostracods, and Copepods—were moderately common in the Swale during the weeks of spring. Also numerous were the benthic crustaceans; Amphipods were found on four out of five sampling days, and Isopods on three out of four days. Other invertebrates that appeared frequently in samples included Oligochaete annelid worms, Planarian flatworms, and aquatic snails. A single Hydra appeared in the sample taken on May 21st.

Summer, 2006 (June, July, August)

A single damselfly nymph—another group of organisms characteristic of still or slow-moving bodies of water—was found in the Swale on June 23rd. The only other insects found during the summer months were adult Corixid bugs, single individuals of which were found on four out of ten sampling days. Despite this relative low diversity of insects, however, a wide variety of other invertebrate groups were found during the summer. Aquatic mites continued to appear occasionally, as they had done in spring. All three groups of planktonic crustaceans were also present, though the Ostracods were by far the most abundant during the summer months. Amphipod crustaceans were found on seven out of ten sampling days, and Isopods on nine out of ten. In fact, Isopods turned

out to be more numerous in Miller's Swale than in any other body of water during this study.

Besides Isopod crustaceans, two other invertebrate groups were noticeably more common in the Swale—especially during the summer—than in any other body of water. One of these groups was that of the Planarians, was present in samples on nine out of ten sampling days. It was not at all uncommon for twenty or more individual Planarians to be counted on a single day; around the end of July and beginning of August, over seventy individuals were sometimes recorded. A third group—the Hirudinids, or leeches—was recorded in much lower numbers than the Planarians, but was still considerably more common in the Swale than at any other study sight. During the summer, Hirudinids were found on three out of ten sampling days. Other invertebrate groups found at this site during the summer included Oligochaete annelid worms, aquatic snails, Hydras, and—occasionally—non-native freshwater clams.

Fall, 2006 (September, October, November, December)

On four out of the nine days that would otherwise have been sampling days during the fall, the Swale was inaccessible due to the flooding of most of Jackson Bottom Preserve by the Tualatin River.

Four individual Baetid mayflies were found in the Swale on December 7th. Also found on that same day were a single Limnephilid caddisfly, and three Chironomid midges. December 7th was the first day on which the Swale was accessible, following two when flooding prevented any sampling at the site. The recent flooding of the Swale by the Tualatin River, which would have carried many invertebrates more normally found in that body of water, may account for the more unusual findings on the 7th.

Two individual aquatic mites were found in the Swale on September 2nd. Cladocerans and Copepods were recorded infrequently during the fall. Ostracods were relatively common during the month of September—though less numerous than they had been in the summer—but disappeared from the data after the end of that month. Amphipod Isopod crustaceans, as well as Planarian flatworms, were also recorded regularly during September, but not at all in the following months. A single Hirudinid was recorded on September 2nd, and none after that. The disappearance of these bottom-dwelling organisms from the data may be partly due to rising water levels that made their habitat less accessible for sampling.

Winter, 2007 (January, February, March)

The Swale site was inaccessible due to flooding on four sampling days in winter, and the continued floods from the Tualatin River may account for the appearance of some additional invertebrates more normally characteristic of the River. Single stonefly individuals (family unknown) were found on both January 21st, and March 14th—sampling days that occurred directly after periods of flooding. Other insects recorded consisted of Limnephilid caddisflies found on two out of seven successful sampling days; a single adult Corixid found on January 28th, and Chironomid midges—found on two out of seven days.

Ostracods never re-appeared in the data during the winter months, but Cladocerans and Copepods had both apparently re-established themselves by mid-March, with the Copepods being by far the more common group. Amphipods were found on four out of

sampling days, and a single Isopod on one. Oligochaete annelids, Planarians, and aquatic snails were all found during the winter, but none of them regularly.

Jackson Bottom Slough

Spring, 2006 (April, May)

The two insect groups that appeared most commonly in samples during these months were Chironomid midge larvae, and damselfly nymphs, both of which groups appeared in the data on three out of five sampling days. Another type of midge, belonging to the family Dixidae, was appeared on May 21st; a single Culcid, or mosquito larva, was recorded on that same day. Single Limnephilid caddisflies were found on each of May 21st and May 26th; on both of these days, the caddisfly recorded was quite large for a caddisflies in the Preserve. Although insects were not identified to the species level during this study, is quite likely that these large caddisfly larvae belonged to a different Limnephilid species than the type normally found in other water bodies.

A single individual aquatic mite was recorded on May 26th. All three groups of planktonic crustaceans—Copepods, Cladocerans, and Ostracods—were present in the Slough during the springtime, although the Copepods appeared the most common. Members of all three groups grew increasingly common as the weeks progressed. The number of benthic Amphipods recorded also grew steadily, peaking when twenty individuals were counted in the sampling tray on May 26th. Amphipods were recorded on every sampling day during the spring; the less abundant Isopods, on the other hand, were recorded on two out of five days, a single individual being present in the sample on both May 26th and May 12th. Other invertebrates recorded consisted of aquatic snails, and a single Oligochaete annelid found on April 28th.

Summer, 2006 (June, July, August)

Three individual Baetid mayflies were found in the Slough on June 16th. Damselfly nymphs continued to be appear regularly in samples; these insects were recorded on eight out of ten sampling days, in numbers ranging from one to three individuals. Chironomid midges were likewise very common, and were recorded on every sampling day in the summer. The much rarer Dixid midges were only recorded once, on July 2nd. The last remaining insect group found in the summer was that of the Culcid mosquitoes, which appeared in samples on June 2nd, June 16th, and July 9th.

Aquatic mites were recorded in the early summer, on June 2nd and June 16th. Numbers of Cladocerans and Copepods remained about the same—and very high—throughout the summer; Ostracods, formerly the least abundant of the planktonic crustaceans, showed a marked increase in numbers. Among the benthic crustaceans, Amphipods were recorded on every sampling day, in numbers ranging from four to ten individuals, were Isopods appeared on only two out of ten days. Both aquatic snails and Oligochaete annelids were found fairly regularly, while a single Planarian flatworm was recorded on August 27th. One individual Hydra was found in the sampling tray on June 2nd.

Fall, 2006 (September, October, November, December)

Baetid mayflies were recorded in the Slough on two out of seven successful fall sampling days (on two days on which sampling would have occurred, floodwaters made

the Slough inaccessible). A single stonefly nymph (family unknown) was recorded on November 15th; as in some other water bodies, this insect, normally characteristic of the swift-flowing Tualatin River, was found in the Slough very soon after the retreat of Tualatin floodwaters, which probably inoculated the site with organisms usually restricted to the River.

Both damselflies and Chironomid midges were found on every sampling day during September; after that month, however, both groups disappeared from the data. The decline of these insects—both of which prefer still or slow-moving water—likely due partly to higher water levels in the Slough, and an associated increase in current speed.

The Slough's increased water levels also appear to have affected other organisms, besides the above insects. The numbers of Copepods and Cladocerans, too, were cut off sharply after September (although the decline of all organisms affected at this time may have been less abrupt than it seemed, because no data was collected during the month of October). Amphipods and Isopods, both of which were found regularly, in September, had similarly disappeared by November; the absence of these benthic crustaceans from the data, however, likely reflects the inaccessibility of their habitat caused by rising water levels, rather an actual decrease in numbers. The same may be true of Oligochaete annelids and Planarian flatworms—also benthic creatures—which vanished from the data at the same time.

Winter, 2007 (January, February, March)

After a time in which the sight remained inaccessible from mid-December until late January, sampling began again at the Slough on January 28th. Unsurprisingly, stonefly nymphs, probably washed into the Slough from the Tualatin River, were recorded in comparatively large numbers on both that day and the next sampling day, February 4th. A single stonefly was again found on March 21st; this indicates that, if these organisms did indeed come originally from the Tualatin, some individuals were still survived in the Slough months after the floodwaters receded.

Baetid mayflies were recorded on three out of eight successful sampling days during the winter. In addition, caddisfly larvae—probably various species of Limnephilids—were found on six days, in numbers of individuals ranging from one to seven. Damselflies and Chironomid midges both re-populated the Slough quite quickly after the recession of the floods; a Chironomid was found on January 28th, and a damselfly on February 4th. After these initial reappearances, both groups were found regularly throughout the remaining weeks of winter. Other insects found at the site during this time consisted of an adult Dytsicid beetle, found of February 28th, and crane fly larvae, recorded on both February 4th and February 14th.

Copepods appeared in large numbers immediately after recession of the floods, with Cladocerans and Ostracods increasing much more slowly. Amphipods, meanwhile, were found on five out of eight successful sampling days. Oligochaete annelids and aquatic snails were recorded in relatively low numbers, though the latter had increased somewhat by mid-March. Finally, two individual Hydras were found on March 28th.

Final Summary

As was also concluded in the 2005-2006 study of the Tualatin River, the Gene Pool, and Kingfisher Marsh, the 2006-2007 study shows the Tualatin to probably the most bio-diverse of the water bodies sampled (including the Slough and the Swale, which were not part of the 2005-2006 study). This result is unsurprising, as the Tualatin is a fast-flowing river, rather a stagnant or slow-moving body of water, like the other sites.

The variety of insects found in the Tualatin, the Gene Pool, and Kingfisher Marsh were for the most part quite similar to those found during the 2005-2006 study. Some new families of organisms were found, such as Emphemerellid mayflies, and Dixid midges; these relatively uncommon groups were almost certainly present the preceding year, and simply did not appear in the data gathered. A notable group of animals which was found in the 2005-2006 study, but not in 2006-2007, was that of the freshwater mussels—previously found in the Tualatin. Since mussels were found on only a few occasions in 2005-2006, however, they were probably present the following year as well, but again simply happened not to appear in the data.

Of the two new water bodies added to the study, the invertebrate fauna of Jackson Bottom Slough resembled those present in the Gene Pool and Kingfisher Marsh much more than fauna of the Tualatin River. This was not unexpected; though the Slough is a stream, rather than a stagnant pond, it is slow-moving enough during much of the year that it lacks the characteristics of a fast-flowing stream like the Tualatin.

Miller's Swale is unique in being a thin, for the most part slow-moving stream, shallower for most of the year than any other body of water except—at times—for Kingfisher Marsh. Whether due to these unusual characteristics or not, the invertebrate assemblage present in the Swale was noticeably different from that at any of the other sites. Though home to a relatively quite low diversity of insects (seven taxa, some of which were found only occasionally), the Swale contained the highest diversity (twelve taxa) of non-insect invertebrates found in and body of water, the Tualatin included. Two groups—the planarians and leeches—were consistently more common in the Swale than any at any other site where they were recorded.

In the final analysis, though some sites were more unique in their invertebrate faunas than others, each body of water had a slightly different assemblage of insects, crustaceans, mollusks, and other organisms. The varied aquatic ecosystems of Jackson Bottom Preserve give rise to a much greater diversity of invertebrate than would likely be found in a uniform series of ponds or streams.

Appendix A: Tualatin River Invertebrate Data

Insects with Incomplete Metamorphosis

Date	Mayflies Baetidae	Mayflies Heptageniidae	Mayflies Leptophlebiidae	Mayflies Ephemerellidae	Stoneflies	True Bugs Corixidae
4/28/2006	7					1
5/5/2006	28					
5/12/2006	7	2		1		
5/21/2006	7					
5/26/2006	6					
6/2/2006				1		
6/16/2006	1					
6/23/2006					1	
7/2/2006	3					
7/9/2006						
7/16/2006	3					
7/30/2006						
8/6/2006			1			
8/20/2006	3					
8/27/2006	1	1				
9/2/2006			1			
9/10/2006	5					
9/24/2006	1	1				
9/30/2006	7					
11/9/2006						
11/15/2006						
11/24/2006						
12/7/2006						
12/17/2006						
1/7/2007	1					
1/14/2007	1					
1/21/2007	4				2	
1/28/2007	4				1	
2/4/2007	4					
2/14/2007	6					
2/28/2007	1					
3/7/2007						
3/14/2007						
3/21/2007					3	
3/28/2007	7				1	

Appendix A Continued

Insects with Complete Metamorphosis

Date	Caddisflies Hydropsychidae	Caddisflies Limnephilidae	Beetles (Adults) Hydrophilidae	Flies Chironomidae	Flies Dixidae	Flies Simuliidae
4/28/2006				4		2
5/5/2006				35		3
5/12/2006	3			3		1
5/21/2006				6		4
5/26/2006				7	1	6
6/2/2006						1
6/16/2006				1		
6/23/2006				1		
7/2/2006	1					
7/9/2006	3					
7/16/2006				1		
7/30/2006	1					
8/6/2006						
8/20/2006	1					
8/27/2006	3					
9/2/2006	1					
9/10/2006						1
9/24/2006	3			1		
9/30/2006			1	3		
11/9/2006						
11/15/2006						
11/24/2006						
12/7/2006						
12/17/2006						
1/7/2007						
1/14/2007				2		
1/21/2007				2		1
1/28/2007				1		
2/4/2007						2
2/14/2007						3
2/28/2007						
3/7/2007						
3/14/2007						
3/21/2007		1				
3/28/2007				4		3

Appendix A Continued

Arachnids and Crustaceans

Date	Mites	Cladocerans	Ostracods	Copepods	Amphipods	Isopods
4/28/2006		10	5	15	5	
5/5/2006	1	1		2	6	
5/12/2006	1				16	4
5/21/2006		1	1		2	1
5/26/2006						
6/2/2006					3	
6/16/2006						
6/23/2006					4	
7/2/2006						
7/9/2006					2	
7/16/2006						
7/30/2006						
8/6/2006					1	
8/20/2006					1	
8/27/2006	1				1	1
9/2/2006	1					
9/10/2006		20-100	20-100	50-100	10	3
9/24/2006					6	1
9/30/2006	5					
11/9/2006						
11/15/2006		50-100		50-100		
11/24/2006		1				
12/7/2006		2		20-100		
12/17/2006						
1/7/2007				10		
1/14/2007		1	5	20-100		
1/21/2007				10-60		
1/28/2007		1		1	3	
2/4/2007			1	10		
2/14/2007		1	1	4		
2/28/2007						
3/7/2007		1		5		
3/14/2007		10-60		20-100		
3/21/2007		10		10		
3/28/2007		2			1	

Appendix A Continued

Non-Arthropod Invertebrates

Date	Planarians	Aquatic Earthworms	Snails	Limpets	Clams
4/28/2006			3		
5/5/2006		3	2		
5/12/2006		1	9		
5/21/2006			10		
5/26/2006		2	2		
6/2/2006			2		
6/16/2006		1	16		1
6/23/2006			6		
7/2/2006		1	9		
7/9/2006			16		
7/16/2006			32		
7/30/2006			22	2	
8/6/2006			23	1	
8/20/2006			62	1	
8/27/2006			38		
9/2/2006			8		
9/10/2006		1	1		
9/24/2006			33		
9/30/2006			1		
11/9/2006					
11/15/2006					
11/24/2006					
12/7/2006					
12/17/2006					
1/7/2007		1			
1/14/2007					
1/21/2007	5				
1/28/2007			2		
2/4/2007					
2/14/2007	1				
2/28/2007		1			
3/7/2007					
3/14/2007					
3/21/2007			3		
3/28/2007					

Appendix B: Kingfisher Marsh Invertebrate Data

Insects with Incomplete Metamorphosis

Date	Mayflies Baetidae	Damselflies	True Bugs Corixidae	True Bugs Notonectidae
4/28/2006		3		
5/5/2006			5	
5/12/2006		1	17	
5/21/2006			1	1
5/26/2006		1	7	2
6/2/2006				
6/16/2006		1	4	1
6/23/2006			8	
7/2/2006			6	3
7/9/2006				
7/16/2006				
7/30/2006				
8/6/2006				
8/20/2006				
8/27/2006				
9/2/2006				
9/10/2006				
9/24/2006				
9/30/2006				
11/9/2006				
11/15/2006				
11/24/2006				
12/7/2006				
12/17/2006				
1/7/2007				
1/14/2007				
1/21/2007	1			
1/28/2007				
2/4/2007				
2/14/2007			1	
2/28/2007				
3/7/2007				
3/14/2007				
3/21/2007				
3/28/2007				

Appendix B Continued

Insects with Complete Metamorphosis

Date	Caddisflies Limnephilidae	Beetles (Adults) Dytiscidae	Beetles (Larvae) Dytiscidae	Flies Chironomidae	Flies Tipulidae	Flies Culcidae	Flies Deer flies
4/28/2006			1	5			2
5/5/2006			1	6		2	
5/12/2006							
5/21/2006			7	5			
5/26/2006			6	3			
6/2/2006			1				
6/16/2006					1		
6/23/2006			1				
7/2/2006							
7/9/2006							
7/16/2006							
7/30/2006							
8/6/2006							
8/20/2006							
8/27/2006							
9/2/2006							
9/10/2006							
9/24/2006							
9/30/2006							
11/9/2006		2					
11/15/2006		3					
11/24/2006		1					
12/7/2006							
12/17/2006							
1/7/2007							
1/14/2007							
1/21/2007					4		
1/28/2007					2		
2/4/2007					45		
2/14/2007				18			
2/28/2007							
3/7/2007	1						
3/14/2007					9		
3/21/2007					20		
3/28/2007					7		

Appendix B Continued

Arachnids and Crustaceans

Date	Mites	Cladocerans	Ostracods	Copepods	Amphipods
4/28/2006		10-60	20-100	20-100	
5/5/2006		10-60		20-100	
5/12/2006		10-60	10	50-100	
5/21/2006		50-100	20-100	20-100	3
5/26/2006					
6/2/2006		10	10	20-100	
6/16/2006	1			20-100	
6/23/2006					
7/2/2006			1	20	
7/9/2006					
7/16/2006					
7/30/2006					
8/6/2006					
8/20/2006					
8/27/2006					
9/2/2006					
9/10/2006					
9/24/2006					
9/30/2006					
11/9/2006					
11/15/2006				20-100	
11/24/2006		20-100		20-100	
12/7/2006		5		20-100	
12/17/2006					
1/7/2007				3	
1/14/2007		2		10-60	
1/21/2007		1	1	20-100	
1/28/2007				10-60	
2/4/2007		2	15	10-60	
2/14/2007		5	10	10-60	
2/28/2007		10		10-60	
3/7/2007				20-100	
3/14/2007		15	15	10-60	
3/21/2007					
3/28/2007		20-100	30	50-100	

Appendix B Continued

Non-Arthropod Invertebrates

Date	Planarians	Aquatic Earthworms	Aquatic Snails
4/28/2006		1	4
5/5/2006			6
5/12/2006			7
5/21/2006			10
5/26/2006		1	10
6/2/2006		1	6
6/16/2006			24
6/23/2006			14
7/2/2006		1	24
7/9/2006			
7/16/2006			
7/30/2006			
8/6/2006			
8/20/2006			
8/27/2006			
9/2/2006			
9/10/2006			
9/24/2006			
9/30/2006			
11/9/2006			
11/15/2006		4	
11/24/2006			
12/7/2006			
12/17/2006			
1/7/2007			
1/14/2007			
1/21/2007			
1/28/2007			
2/4/2007	2		
2/14/2007			
2/28/2007		7	
3/7/2007			
3/14/2007			
3/21/2007			
3/28/2007			

Appendix C: Gene Pool Invertebrate Data

Insects with Incomplete Metamorphosis

Date	Stoneflies	Mayflies Baetidae	Damselflies	Dragonflies	True Bugs Corixidae	True Bugs Notonectidae
4/28/2006			1		2	
5/5/2006						
5/12/2006						
5/21/2006						
5/26/2006					1	
6/2/2006					3	2
6/16/2006			2		4	7
6/23/2006			3		1	1
7/2/2006			1		1	
7/9/2006			2		2	
7/16/2006		3				
7/30/2006		2	1			
8/6/2006			1	1		
8/20/2006					4	
8/27/2006						
9/2/2006					1	
9/10/2006						
9/24/2006						
9/30/2006						
11/9/2006						
11/15/2006						
11/24/2006						
12/7/2006						
12/17/2006						
1/7/2007						
1/14/2007						
1/21/2007	1					
1/28/2007						
2/4/2007						
2/14/2007						
2/28/2007						
3/7/2007						
3/14/2007		1				
3/21/2007						
3/28/2007						

Appendix C Continued

Insects with Complete Metamorphosis

Date	Caddisflies Limnephilidae	Flies Chironomidae	Flies Tipulidae	Beetles (Adults) Dytiscidae	Beetles (Larvae) Dytiscidae	Beetles (Larvae) Haliplidae
4/28/2006		1				
5/5/2006		1				
5/12/2006		21				
5/21/2006		10		2	2	1
5/26/2006		6			2	
6/2/2006		2			2	
6/16/2006		6			1	
6/23/2006		1				
7/2/2006		1		4		
7/9/2006						
7/16/2006				1		
7/30/2006		3				
8/6/2006		3				
8/20/2006						
8/27/2006						
9/2/2006						
9/10/2006						
9/24/2006						
9/30/2006						
11/9/2006						
11/15/2006						
11/24/2006						
12/7/2006						
12/17/2006						
1/7/2007						
1/14/2007						
1/21/2007			3			
1/28/2007						
2/4/2007			1			
2/14/2007					1	
2/28/2007						
3/7/2007	1					
3/14/2007		3				
3/21/2007						
3/28/2007						

Appendix C Continued

Arachnids and Crustaceans

Date	Mites	Cladocerans	Ostracods	Copepods	Amphipods	Isopods
4/28/2006	3	20-100	1	10		
5/5/2006	6	50-100	50-100	20-100		
5/12/2006	27	20-100	10	20-100		
5/21/2006	7	10-60		10-60		
5/26/2006	4	20-100			1	
6/2/2006	9	20-100	50-100	10-60	5	
6/16/2006		20-100	50-100	50-100		1
6/23/2006		20-100	50-100	50-100	1	1
7/2/2006				50-100		
7/9/2006		20-100		20-100		
7/16/2006				10-60		
7/30/2006	1	10-60		10-60		
8/6/2006	1			10-60	2	
8/20/2006						
8/27/2006						
9/2/2006	2					
9/10/2006						
9/24/2006						
9/30/2006						
11/9/2006						
11/15/2006		50-100		50-100		
11/24/2006				1		
12/7/2006						
12/17/2006						
1/7/2007						
1/14/2007						
1/21/2007			20-100	50-100		
1/28/2007				20-100	2	
2/4/2007		1	2	10-60		
2/14/2007			5	50-100		
2/28/2007				1		
3/7/2007				3		
3/14/2007		10		10-60	4	
3/21/2007	2	10-60		20-100	2	
3/28/2007		20-100		20-100	3	

Appendix C Continued

Non-Arthropod Invertebrates

Date	Planarians	Aquatic Earthworms	Leeches	Aquatic Snails
4/28/2006		3		
5/5/2006		1		1
5/12/2006				1
5/21/2006		2		
5/26/2006	1	2		4
6/2/2006		5	1	7
6/16/2006		2		10
6/23/2006		2		
7/2/2006		1		
7/9/2006		1		
7/16/2006		1		1
7/30/2006		1		1
8/6/2006				
8/20/2006				
8/27/2006		1		
9/2/2006				
9/10/2006				
9/24/2006				
9/30/2006				1
11/9/2006				
11/15/2006				
11/24/2006		1		
12/7/2006				
12/17/2006				
1/7/2007				
1/14/2007				
1/21/2007	3			
1/28/2007	1			
2/4/2007	5			
2/14/2007	1			
2/28/2007				
3/7/2007				
3/14/2007				1
3/21/2007				
3/28/2007		2		

Appendix D: Jackson Bottom Slough Invertebrate Data

Insects with Incomplete Metamorphosis

Date	Mayflies Baetidae	Damselflies	Stoneflies
4/28/2006			
5/5/2006		4	
5/12/2006		2	
5/21/2006			
5/26/2006		2	
6/2/2006		1	
6/16/2006	3	1	
6/23/2006			
7/2/2006			
7/9/2006		1	
7/16/2006		2	
7/30/2006		3	
8/6/2006		1	
8/20/2006		3	
8/27/2006		2	
9/2/2006		4	
9/10/2006		7	
9/24/2006		6	
9/30/2006		1	
11/9/2006			
11/15/2006	2		1
11/24/2006			
12/7/2006	1		
12/17/2006			
1/7/2007			
1/14/2007			
1/21/2007			
1/28/2007			8
2/4/2007	1	1	5
2/14/2007		3	
2/28/2007			
3/7/2007	2		
3/14/2007	4	1	
3/21/2007		3	1
3/28/2007		1	

Appendix D Continued

Insects with Complete Metamorphosis

Date	Caddisflies Limnephilidae	Beetles (Adults) Dytiscidae	Flies Chironomidae	Flies Dixidae	Flies Tipulidae	Flies Culcidae
4/28/2006						
5/5/2006						
5/12/2006			1			
5/21/2006	1		5	1		1
5/26/2006	1		9			
6/2/2006			15			1
6/16/2006			4			2
6/23/2006			4			
7/2/2006			3	2		
7/9/2006			5			1
7/16/2006			1			
7/30/2006			3			
8/6/2006			7			
8/20/2006			4			
8/27/2006			3			
9/2/2006			3			
9/10/2006			1			
9/24/2006			3			
9/30/2006			1			
11/9/2006						
11/15/2006						
11/24/2006						
12/7/2006						
12/17/2006						
1/7/2007						
1/14/2007						
1/21/2007						
1/28/2007	4		1			
2/4/2007	2		2		2	
2/14/2007	7		1		1	
2/28/2007		1				
3/7/2007						
3/14/2007	2		1			
3/21/2007	2		1			
3/28/2007	3					

Appendix D Continued

Arachnids and Crustaceans

Date	Aquatic Mites	Cladocerans	Ostracods	Copepods	Amphipods	Isopods
4/28/2006		5		20-100	1	
5/5/2006		20-100		10-60	3	
5/12/2006		20-100		10-60	3	1
5/21/2006		50-100	20-100	20-100	11	
5/26/2006	1	10-60	20	10-60	20	1
6/2/2006	2	20-100	20-100	20-100	10	3
6/16/2006	3	20	20	10-60	6	
6/23/2006		20-100	20-100	20-100	6	
7/2/2006		20-100	50-100	20-100	9	
7/9/2006		10-60	10-60	10-60	7	
7/16/2006		20-100	10-60	20-100	6	
7/30/2006		20-100	20-100	10-60	6	
8/6/2006		10-60	10-60	10-60	4	
8/20/2006		10-60	10-60	10-60	8	1
8/27/2006		10-60	20-100	20-100	7	
9/2/2006		10-60	20-100	50-100	7	8
9/10/2006		20-100	20-100	50-100	10	3
9/24/2006		20-100		50-100	11	5
9/30/2006		20-100		10-60	9	1
11/9/2006						
11/15/2006		50-100		50-100		
11/24/2006						
12/7/2006						
12/17/2006						
1/7/2007						
1/14/2007						
1/21/2007						
1/28/2007				10-60		
2/4/2007		1	4	10-60	4	
2/14/2007		1	5	10-60	2	
2/28/2007						
3/7/2007				10-60		
3/14/2007		10-60	10	50-100	1	
3/21/2007		50-100	20-100	10-60	3	
3/28/2007		2	10	30-100	3	

Appendix D Continued

Non-Arthropod Invertebrates

Date	Hydras	Planarians	Aquatic Earthworms	Aquatic Snails
4/28/2006			1	
5/5/2006				8
5/12/2006				5
5/21/2006				10
5/26/2006				9
6/2/2006	1		2	9
6/16/2006			1	4
6/23/2006				3
7/2/2006				
7/9/2006				
7/16/2006			2	
7/30/2006			4	
8/6/2006			2	1
8/20/2006				
8/27/2006		1	2	
9/2/2006			2	1
9/10/2006			1	1
9/24/2006		4		
9/30/2006		1	1	
11/9/2006				
11/15/2006				
11/24/2006				
12/7/2006				
12/17/2006				
1/7/2007				
1/14/2007				
1/21/2007				
1/28/2007				1
2/4/2007				
2/14/2007				
2/28/2007				
3/7/2007			1	
3/14/2007				2
3/21/2007				5
3/28/2007	2			2

Appendix E: Miller's Swale Invertebrate Data

Insects with Incomplete Metamorphosis

Date	Mayflies Baetidae	Stoneflies	Damselflies	True Bugs Corixidae
4/28/2006				1
5/5/2006				1
5/12/2006		1		1
5/21/2006				1
5/26/2006				
6/2/2006				
6/16/2006				
6/23/2006			1	1
7/2/2006				1
7/9/2006				
7/16/2006				
7/30/2006				1
8/6/2006				1
8/20/2006				
8/27/2006				
9/2/2006				
9/10/2006				
9/24/2006				
9/30/2006				
11/9/2006				
11/15/2006				
11/24/2006				
12/7/2006				
12/17/2006				
1/7/2007				
1/14/2007	1			
1/21/2007		1		
1/28/2007				1
2/4/2007				
2/14/2007				
2/28/2007				
3/7/2007	1			
3/14/2007		1		
3/21/2007				
3/28/2007				

Appendix E Continued

Insects with Complete Metamorphosis

Date	Caddisflies Limnephilidae	Beetles (Larvae) Dytiscidae	Flies Chironomidae
4/28/2006			
5/5/2006			
5/12/2006			
5/21/2006			1
5/26/2006		2	3
6/2/2006			
6/16/2006			
6/23/2006			
7/2/2006			
7/9/2006			
7/16/2006			
7/30/2006			
8/6/2006			
8/20/2006			
8/27/2006			
9/2/2006			
9/10/2006			
9/24/2006			
9/30/2006			
11/9/2006			
11/15/2006			
11/24/2006			
12/7/2006	1		3
12/17/2006			
1/7/2007			
1/14/2007			
1/21/2007			1
1/28/2007	2		
2/4/2007	1		1
2/14/2007			
2/28/2007			
3/7/2007			
3/14/2007			
3/21/2007			
3/28/2007			

Appendix E Continued

Arachnids and Crustaceans

Date	Aquatic Mites	Cladocerans	Ostracods	Copepods	Amphipods	Isopods
4/28/2006	1		10-60	10-60	6	
5/5/2006						
5/12/2006	4		Inestimable	15	7	1
5/21/2006	1	50-100	50-100	50-100	6	3
5/26/2006		5	5	10	2	2
6/2/2006			20-100	20-100	3	3
6/16/2006			50-100		26	13
6/23/2006		10-60	20-100	10-60	7	10
7/2/2006			Inestimable	Inestimable		4
7/9/2006		20-100	Inestimable	20-100	4	4
7/16/2006	1			10	4	6
7/30/2006			Inestimable		2	6
8/6/2006	1		Inestimable		5	7
8/20/2006	1		20-100			2
8/27/2006			10			
9/2/2006	2		50-100			
9/10/2006			50-100		1	4
9/24/2006			10-60		2	1
9/30/2006			5	4	5	1
11/9/2006						
11/15/2006						
11/24/2006						
12/7/2006		20		20		
12/17/2006						
1/7/2007						
1/14/2007						
1/21/2007		20-100		10-60	1	
1/28/2007					1	
2/4/2007				5		1
2/14/2007						
2/28/2007						
3/7/2007						
3/14/2007		10		Inestimable		
3/21/2007		3		Inestimable	3	
3/28/2007		2		Inestimable	1	

Appendix E Continued

Non-Arthropod Invertebrates

Date	Hydras	Planarians	Aquatic Earthworms	Leeches	Aquatic Snails	Clams
4/28/2006		2	2			
5/5/2006						
5/12/2006		1	1			
5/21/2006	1	7			10	
5/26/2006		6	2		3	
6/2/2006	17	29	1		2	
6/16/2006	1	33	1	5		
6/23/2006					2	
7/2/2006		32			1	
7/9/2006		19	2		2	
7/16/2006		33	3			
7/30/2006		73	2	2	2	1
8/6/2006		70		3		
8/20/2006		15				1
8/27/2006		20			1	
9/2/2006		12		1		
9/10/2006		10				
9/24/2006		5				
9/30/2006		5				
11/9/2006						
11/15/2006						
11/24/2006						
12/7/2006						
12/17/2006						
1/7/2007						
1/14/2007						
1/21/2007						
1/28/2007						
2/4/2007		1			2	
2/14/2007						
2/28/2007						
3/7/2007						
3/14/2007						
3/21/2007		2				
3/28/2007		2	1		1	