Aquatic macro-invertebrate monitoring at Paull Holme Strays, East Yorkshire May 2008

A report for the Environment Agency

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Summary

The creation of new inter-tidal habitat at Paull Holme Strays (East Yorkshire) necessitated the loss of an established borrow pit with a rich invertebrate fauna but resulted in the creation of a new pond and dykes behind the re-aligned Humber Bank in 2003. The macro-invertebrates of these new water bodies have been monitored during spring visits since 2004. The four regular sampling points were re-visited in May 2008.

In 2004, the car park pond (SP1) supported a freshwater assemblage including several water beetles and water bugs which are highly characteristic 'pioneer' species. Sampling in May 2005 showed that the pond has become highly saline and supported only a very impoverished fauna. Indeed by May 2006, the only 'core' species[1] of macro-invertebrate recorded was the brackish water amphipod *Gammarus zaddachi*. By May 2007, there had been a marked recovery with seven core taxa present, four of which are obligately brackish water species and three of which are freshwater species which tolerate some salinity. This trend continued into 2008 with 14 core taxa recorded, only three of which are closely associated with brackish water. Electrical conductivity (which is related to salinity) has fallen to around 10% of the 2005 level.

In May 2006, the car park dyke (SP2), which is hydrologically connected to the pond, had also become saline. This water body was by then dominated by *Gammarus zaddachi* and the lesser water-boatman *Sigara stagnalis* with additional brackish water indicators including the amphipod *Corophium volutator*. By May 2007, the dyke showed some amelioration in salinity but remained markedly brackish, as shown by the presence of additional brackish water specialists such *Nereis* sp. (a marine polychaete) and the Lagoon Slater *Idotea chelipes*. In May 2008 the fauna appeared to be characteristic of only mildly brackish conditions and species such as *C. volutator*, *I. chelipes* and *Nereis* could not detected.

Table 1: pH and electrical conductivity measurements from the car park pond and ditch

		pH	Conductivity (mS/cm^{-1})
May 2006	SP1	---	27
21st August 2006	SP2	8.7	24.4
8th May 2007	SP2	8.4	12.68
16th May 2008	SP1	---	2.72

Sampling Point 3, the western soke dyke, continues to support by the far the richest diversity of aquatic macroinvertebrates, a trend which has been clear throughout the five years of monitoring. This is a section of dyke with complex vegetation structure

[1] **Core** taxa are here defined as aquatic and semi-aquatic Coleoptera, aquatic Heteroptera, larval Odonata, Trichoptera and Ephemeroptera, aquatic Isopoda, Amphipoda and Decapoda, aquatic Molluscs, leeches and polychaetes. A few other taxa are listed in Appendix 1 (e.g. spiders, soldier fly larvae) for the sake of completeness.

including a mosaic of shallow pools and patches of tall emergents. This sampling point yielded 43 core taxa in May 2008, comparing extremely closely with 42 in May 2007, 44 in May 2006 and 48 in May 2005.

The most easterly dyke section (Sampling Point 4) has a species-poor brackish water invertebrate fauna containing a few tolerant freshwater taxa. This community continues to be characterised by the lesser water-boatman *Sigara stagnalis*, the snail *Potamopyrgus antipodarum*, the amphipods *Gammarus duebeni* and *G. zaddachi* and the translucent prawn *Palaeomonetes varians*. The latter species seemed to be less abundant than in 2007.

Numbers of brackish water specialists peaked in 2006-2007, largely as a result of saline conditions in the car park ditch and pond. The reduced number of brackish water indicators in May 2008 reflects the reversion to freshwater conditions in these habitats.

The number of core taxa listed as Nationally Scarce has varied from year to year (see Table 2) and trends are probably not very significant. All the Nationally Scarce species have been aquatic beetles, although the scarce soldier fly *Stratiomys singularior* (not a core taxon) was also recorded in 2006 and 2007.

Table 2: Brackish water indicator taxa and scarce species (core taxa) recorded from the new water bodies at Paull Holme Strays.

Survey	**Brackish water species**	**Scarce species**
April 2004	6	6
May 2005	5[2]	2
May 2006	11	7
May 2007	11	6
May 2008	7	3

Five core species were newly recorded for the site in May 2008, including the common lesser water-boatman *Hesperocorixa sahlbergi*, the common water beetles *Hydroporus incognitus*, *Agabus sturmii* and *Anacaena lutescens* and the local semi-aquatic weevil *Thryogenes festucae*.

1. Introduction

This report refers to new inland water bodies formed as part of the Paull Holme Strays managed realignment scheme in 2003. This scheme necessitated the loss of a large borrow pit behind the old Humber bank which had supported a rich aquatic insect fauna including several scarce water beetles associated with mildly brackish conditions. The

[2] *Gammarus duebeni* has recently been found amongst material collected at Paull Holme Strays in 2004 and it is considered very likely that it has been present continuously since, so figures for 2005-2007 have been adjusted accordingly.

new scheme created a pond and extensive new dykes immediately inland of the new flood bank.

A baseline macro-invertebrate survey of the new water bodies was undertaken in mid April 2004. Collectively, the pond and dykes were found to support several brackish water specialists including the amphipod *Gammarus zaddachi*, the caddis *Limnephilus affinis / incisus* and the water beetles *Haliplus apicalis*, *Agabus conspersus* and *Enochrus bicolor*. Most other taxa were freshwater or ecologically wide-ranging species. The pond supported a notable suite of small diving beetles characteristic of raw, early-successional standing waters including the scarce *Hygrotus nigrolineatus* and *Scarodytes halensis*.

The survey was repeated on 4th May 2005 to assess subsequent changes, using the same four sampling points. The pond had become much more saline with a corresponding loss of invertebrate diversity but the dyke at Sampling Point (SP) 3 was species-rich and productive. A further monitoring visit on 3rd May 2006 confirmed that the pond had become highly saline with *Gammarus zaddachi* being the only 'core' taxon detected; no beetles, water bugs, Odonata or molluscs could be found. The car park dyke also had a markedly brackish fauna dominated by *G. zaddachi* and the lesser water-boatman *Sigara stagnalis*. Increased salinity was also indicated in the eastern soke dyke (SP4) but the western soke dyke again produced a species-rich fauna dominated by water beetles. Although salinity had reduced somewhat at SP1/SP2 by May 2007, conditions remained strongly brackish and additional indicators of brackish/saline water were recorded.

On 16th May 2008, each sampling point was surveyed using the same methodology as in previous years. At each sampling point, all meso-habitats present (e.g. open water, submerged vegetation, trailing grasses) were worked vigorously with the pond net until no further taxa could be found. Fieldwork was undertaken by R. Merritt and M. Hammond. Material was identified either in the field or by RM in the laboratory. Species lists for each sampling point are provided at Appendix 1. An aggregated species list for core taxa recorded in May 2008 is provided at Appendix 2. Appendix 3 is a list of all core taxa recorded from April 2004 onwards.

2. Sampling sites

◄ SP1: Car Park Pond. A steep-sided pond near the visitors' car park (TA 1800 2512), created in 2003. In 2006 and 2007, the water had a strong salty tang and contained little submerged vegetation. Following a marked reduction in salinity, spiked water milfoil (*Myriophyllum spicatum*) was abundant in May 2008 with lesser amounts of horned pondweed (*Zannichellia palustris*). Common reed (*Phragmites australis*) had established along one bank in sufficient quanitity to

provide cover for a Little Grebe nest. A small stand of sea club-rush (*Bolboschoenus maritimus*) had also developed in one corner.

SP2: Car Park Dyke (TA 1798 2515). This dyke has aquatic vegetation dominated by fennel pondweed (*Potamogeton pectinatus*) and spiked water milfoil with some horned pondweed with smaller amounts of spiked water-milfoil. There are also extensive stands of grey club-rush (*Schoenoplectus tabernaemontani*) with more restricted patches of common reed and sea club-rush. At the western end of the ditch there are patches of saltmarsh plants such as sea aster (*Aster tripolium*), common cord-grass (*Spartina anglica*) and common saltmarsh grass (*Puccinellia maritima*) fringing an area of deep anoxic mud.

SP3: Western Soke Dyke. This covers about 100 metres of new dyke to the east of South Pasture Drain (TA 1819 2477). This section of dyke supports diverse and structurally-complex vegetation including submerged macrophytes such as spiked water-milfoil and water-crowfoots, trailing grasses and emergent swamp comprising common reed, sea club-rush, greater reedmace (*Typha latifolia*) and grey club-rush. Recently there has been some consolidation of *Phragmites* growth (breeding Reed Warblers are now present) and a decline in pioneer macrophytes such as the stonewort *Chara*. A water sample produced a pH of 7.1 with electrical conductivity of 1450 $\mu S/cm^{-1}$; this is similar to values recorded in 2007 (pH 7.3, conductivity 2,090 $\mu S/cm^{-1}$).

SP4: Eastern Soke Dyke. This is a section of the same dyke east of a sluice which receives inflow from agricultural drains (TA 1890 2411). This is a steep-sided trapezoidal channel with a simple vegetation structure: submerged weed beds are dominated by horned pondweed with some spiked water-milfoil and patches of emergent swamp dominated by common reed.

3. Results

3.1 Invertebrate assemblages

Aquatic Coleoptera (beetles)

32 species of water beetle were recorded in May 2008, compared to 28 in May 2007, 33 in May 2006, 30 in May 2005 and 38 in April 2004. Of 55 species recorded from April 2004 onwards, 58% were found during the most recent survey. Water beetles newly recorded for the site included two widespread diving beetles associated with well-vegetated standing waters (*Agabus sturmii* and *Hydroporus incognitus*), one very

common scavenger water beetle (*Anacaena lutescens*) and the semi-aquatic weevil *Thryogenes festucae*. The latter is a local species which feeds on sea club-rush and spike-rushes in both freshwater and brackish wetlands. It reaches the northern limit of its British range on the Humber estuary. Specimens of *T. festucae* were collected from both the car park pond and the adjacent ditch (SP 1&2). The wetland ladybird *Coccidula scutellata* (not counted as a water beetle) was found on *Phragmites* at SP4. This is a widespread but local aphid-predator, found mainly in the southern half of Britain.

As usual, by far the richest sampling point was SP3, with 26 species (exactly the same number as in 2007). However, there was a marked recovery in the car park pond associated with decreasing salinity. Seven water beetle species were recorded there in the most recent survey compared to just two in May 2007 and none in May 2006.

Three water beetles recorded in May 2008 are currently listed as Nationally Scarce[3] (*Haliplus apicalis*, *Agabus conspersus*, *Enochrus bicolor*). All three are brackish water specialists and are clearly well-established on the site, having been recorded recurrently. In previous surveys the equivalent number of Nationally Scarce beetles was six in April 2004, two in May 2005, seven in May 2006 and six in May 2007. The smaller number of scarce water beetles in May 2008 is probably not significant as species such as *Ochthebius marinus* and *Phytobius leucogaster* are probably still present on the site.

There is probably some genuine turnover of water beetle species from year to year and some variation in those recorded due simply to chance. However, in terms of species-richness the fauna appears to be stable at present. Reduction in salinity has enhanced re-colonisation of the car park pond and dyke, although the severely-profiled pond provides poor habitat quality for aquatic insects in general.

Water bugs (Hemiptera – Heteroptera)

13 water bugs were recorded, with one new species for the site (the common lesser water-boatman *Hesperocorixa sahlbergi*, which is associated with mature standing water habitats with dense vegetation or organic matter). *Sigara stagnalis*, a broadly tolerant brackish water Corixid, was recorded from all four locations. The water bug fauna appears to be relatively stable at present but some pioneer species may re-colonise the car park pond now that salinity has greatly reduced.

Caddis flies (Trichoptera) and mayflies (Ephemeroptera)

Nymphs of the ubiquitous standing water mayfly *Cloeon dipterum* (Baetidae) were recorded at two locations and empty cases of undetermined caddis sp./spp. were recorded at SP3.

[3] Based on Foster (2000).

Damselflies and dragonflies (Odonata)

Only undetermined immature larvae of 'blue' damselflies (Coenagriidae) and darters or chasers (Libellulidae) were recorded. However, it was notable that a very-recently hatched damselfly, so fresh that it lacked pigmentation, was found on a stem at the car park pond (SP1). This confirms that the pond is now of sufficiently low salinity for damselflies to fully complete their life cycle. In 2006 the pond had a salinity approaching half the strength of oceanic water and no Odonata were present.

Mollusca

Jenkin's Spire Snail (*Potamopyrgus antipodarum*) remains the most widespread and abundant mollusc in these water bodies, occuring at all four sampling points. At SP3 there has been a decline in the abundance of Wandering Snail (*Radix balthica*), a 'weedy' pioneer species, presumably reflecting the development of more mature vegetation cover.

SP3 remains the richest sampling point for molluscs, with five species recorded in May 2008. These included one addition to the site list, the small orb mussel *Musculium lacustre*.

Isopoda and amphipoda

Amongst the 'macro' crustaceans, the amphipod *Gammarus zaddachi* was definitely recorded at 3 locations and probably at all 4 because large numbers of indeterminate juvenile *Gammarus* were present at SP2. However, this species has possibly declined in abundance the car park pond and ditch (SP1/2), where it was considered the dominant invertebrate in 2006. This is only a subjective observation since samples are not quantitative, but it would concur with decreasing salinity in these water bodies.

To complicate matters, critical re-examination of amphipods collected in April 2004 indicates that *Gammarus duebeni*, another brackish water shrimp, was present in small numbers amongst much larger numbers of *G. zaddachi*. *G. duebeni* was identified from all four sampling points in 2008 and has presumably been present continuously since 2004. This species appears to be more localised than *G. zaddachi* on the Humber but has been recorded from Blacktoft Sands (Fryer, 1993) and the Trent foreshore at Alkborough Flats (by R. Merritt in 2007).

The brackish water prawn *Palaeomonetes varians* continues to be fairly plentiful in the eastern soke-dyke at SP4, although it did not seem as abundant as in 2007.

The most notable change in the crustacean assemblage was the apparent absence of the saline lagoon species *Corophium volutator* and *Idotea chelipes* from the car park ditch (SP2). This could reflect changes in physical habitat structure such as the accumulation of deep anoxic mud at the western end of the dyke, but it is probably associated with much reduced salinity in 2008. If this reduction in salinity is permanent, it will presumably

mark the demise of the nascent lagoonal invertebrate fauna noted in the two previous monitoring reports.

Other taxa

The common Horse Leech (*Haemopis sanguisuga*) was recorded at SP3. No ragworms (*Nereis* spp.) could be found in the car park dyke, probably due to the reduction in salinity.

3.2 Vertebrate records

Three-spined Stickleback was present at all four sampling points. Ten-spined Stickleback, Common Frog tadpoles and Smooth Newt were also present at SP3.

3.3 Ecological trends

In the 2007 monitoring report it was noted that there had been a doubling of the number of brackish water invertebrate species recorded from the new water bodies between 2004 and 2006/2007, from five to ten. Given that *Gammarus duebeni* has probably been present since 2004 (see above), these numbers can be adjusted to six brackish water indicators in 2004 compared to 11 in 2006 & 2007. In 2008, only seven brackish water indicators were recorded (Table 3).

Table 3: Brackish water indicator species recorded 2004-2008

Species	2004	2005	2006	2007	2008
Corophium volutator			●	●	
Gammarus duebeni	●	?	?	?	●
Gammarus zaddachi	●	●	●	●	●
Palaeomonetes varians			●	●	●
Idotea chelipes				●	
Limnephilus affinis / incisus	●		●		
Sigara stagnalis		●	●	●	●
Haliplus apicalis	●	●	●	●	●
Agabus conspersus	●	●	●	●	●
Enochrus bicolor	●		●	●	●
Enochrus halophilus			●		
Ochthebius marinus			●	●	
Nereis sp.				●	

When the proportion of brackish water specialists as a percentage of all core taxa is considered (Table 4), it is apparent that community composition in the car park pond and ditch shifted from predominantly freshwater species in 2004 to a brackish water fauna in 2005-2007. This has now shifted back to mainly freshwater species or those tolerant of mildly brackish conditions. The western soke dyke (SP3) has a small but stable proportion of species associated with mildly brackish conditions amongst a

predominantly freshwater fauna. The eastern soke dyke (SP4) has a stable fauna in which brackish water species make up 33-40% of the taxa recorded, though the brackish species probably dominate in terms of biomass and abundance.

Table 4: Brackish water indicator species by Sampling Point (number of indicators and percentage of all core taxa recorded per sample)

Species	2005	2006	2007	2008
SP1 (car park pond)	1 (13%)	1 (100%)	4 (57%)	3 (21%)
SP2 (car park dyke)	2 (14%)	7 (64%)	6 (67%)	5 (19%)
SP3 (soke dyke west)	3 (7%)	5 (11%)	4 (10%)	4 (9%)
SP3 (soke dyke east)	3 (23%)	6 (33%)	3 (33%)	4 (40%)

As in previous years, SP3 (the western soke dyke) was by far the most species-rich sampling point, although the differential between this and the other sites was less pronounced than it had been in 2007 Table 5). The low salinity of SP3 and the presence of complex and varied aquatic and emergent vegetation is clearly associated with high diversity of aquatic macroinvertebrates.

Table 5: Comparison of species-richness between sampling points*

SP	◄		2005		►	◄		2006		►	◄		2007		►	◄		2008		►
	No. of core taxa	Co	He	Mo	Cr	No. of core taxa	Co	He	Mo	Cr	No. of core taxa	Co	He	Mo	Cr	No. of core taxa	Co	He	Mo	Cr
1	8	0	4	2	2	1	0	0	0	1	7	2	2	1	1	14	8	2	1	2
2	14	5	6	1	1	16	8	2	2	2	9	3	0	1	3	26	14	6	1	2
3	48	25	10	4	2	44	28	6	3	2	42	26	8	4	1	43	26	7	5	2
4	13	2	7	2	1	18	9	5	1	2	9	1	4	1	2	10	2	2	1	3

*Co – aquatic Coleoptera, He – aquatic Hemiptera-Heteroptera, Mo– aquatic molluscs; aquatic macro-crustacea (Amphipoda, Isopoda, Decapoda)

4. Comments on conservation

During the period 2005-2007, elevated salinity in the car park pond and drain was presumably the result of salt water percolating below the new floodbank. *If* there has been engineering work which will prevent intrusion of saline water in future, there is potential to enhance habitat quality in these water bodies:

- The pond has a severe, steep-sided profile (originally intended to benefit Water Voles). As well as creating something of a public safety hazard, this greatly reduces the space available for marginal habitat. Consideration should be given to re-grading at least part of the pond perimeter to allow more extensive development of water margin vegetation.

- Although areas of shallow mud colonized by saltmarsh plants at the western end of the car park drain are worthy of retention, the accumulation of deep anoxic mud within the channel probably has little value as a habitat resource. Removal of

some of this sediment would encourage regeneration of aquatic and emergent vegetation.

It should be noted that the western soke dyke (SP3) will need some management, probably within the next one to three years, to maintain its complex and varied vegetation structure. As noted in previous reports, this should comprise small scale excavations with a digger bucket, and the removal of sediment and vegetation over extensive lengths should be avoided.

5. References

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Appendix 1: Sample data, May 2008

(L) – larvae; *n* – not a core taxon

SP1 (pond by car park)		
Coleoptera	Dytiscidae	*Laccophilus minutus*
		Hygrotus impressopunctatus
		Liopterus haemorrhoidalis
	Hydrophilidae	*Helophorus griseus* (1♂)
		Helophorus minutus
	Hydrophilidae	*Enochrus bicolor* (1)
	Hydraenidae	*Ochthebius minimus*
	Curculionidae	*Thryogenes festucae* (1)
Hemiptera-Heteroptera	Notonectidae	*Notonecta viridis*
	Corixidae	*Sigara stagnalis* (several)
Odonata	Coenagriidae	Several immature larvae
Mollusca	Hygrobiidae	*Potamopyrgus antipodarum*
Amphipoda	Gammaridae	*Gammarus duebeni* (2)
		Gammarus zaddachi
SP2 (dyke nr car park)		
Coleoptera	Dytiscidae	*Hygrotus impressopunctatus*
		Hydroporus incognitos
		Hydroporus palustris
		Agabus conspersus (3)
		Rhantus suturalis (ca. 20)
		Dytiscus sp. (2 larvae)
	Helophoridae	*Helophorus minutus*
	Hydrophilidae	*Hydrobius fuscipes*
		Anacaena lutescens
		Helochares lividus
		Enochrus bicolor (2)
		Cymbiodyta marginellus
	Hydraenidae	*Ochthebius minimus*
	Curculionidae	*Thryogenes festucae* (1)
Hemiptera-Heteroptera	Gerridae	*Gerris thoracicus*
	Corixidae	*Corixa punctata*
		Hesperocorixa linnaei
		Sigara dorsalis
		Sigara falleni
		Sigara stagnalis
Odonata	Coenagriidae	Several immature larvae
Ephemeroptera	Baetidae	*Cloeon dipterum* larvae
Diptera	Chironomidae (n)	indet larvae
Amphipoda	Gammaridae	*Gammarus duebeni* (2)
		Gammarus zaddachi (3)

SP3 (soke dyke, W end)		
Coleoptera	Haliplidae	*Haliplus apicalis* (1♂) *H. lineatocollis* (several) *H. obliquus* (1)
	Noteridae	*Noterus clavicornis*
	Dytiscidae	*Hydroglyphus geminus* (1) *Hygrotus impressopunctatus* *H. inaequalis* *Hydroporus angustatus* *H. palustris* *H. planus* *Liopterus haemorrhoidalis* *Agabus conspersus* (2) *A. sturmii* (2) *Rhantus suturalis* (abundant) *Colymbetes fuscus* *Dytiscus marginalis* (1)
	Helophoridae	*Helophorus griseus* (1♂)
	Hydrophilidae	*Cercyon marinus* (1) *Hydrobius fuscipes* *Anacaena limbata* *Laccobius bipunctatus* *Laccobius colon* (1♂) *Helochares lividus* (2) *Enochrus testaceus* (1) *Cymbiodyta marginellus* (several)
	Hydraenidae	*Ochthebius minimus*
	Coccinelidae	*Anisosticta novemdecimpustulata (n)*(2)
Hemiptera – Heteroptera	Hydrometridae	*Hydrometra stagnorum*
	Gerridae	*Gerris odontogaster*
	Nepidae	*Nepa cinerea*
	Naucoridae	*Ilyocoris cimicoides*
	Corixidae	*Hesperocorixa sahlbergi*
		Sigara dorsalis
		Sigara stagnalis (4)
Odonata	Coenagriidae	Coenagriidae larvae
Trichoptera		indet empty cases
Diptera	Chironomidae	indet larvae (*n*)
Gnathobdellida	Hirudinidae	*Haemopis sanguisuga* (1)
Mollusca	Hydrobiidae	*Potamopyrgus antipodarum*
	Lymnaeidae	*Lymnaea stagnalis* *Radix balthica*[4]
	Planorbidae	*Gyraulus crista* (2)
	Sphaeriidae	*Musculium lacustre* (2)
Amphipoda	Gammaridae	*Gammarus sp.* (20+ indet juveniles)

[4] Formerly known as *Lymnaea peregra*; mollusc names have been revised following Anderson (2005)

		Gammarus duebeni (2)
Isopoda	Asellidae	*Asellus aquaticus*

SP4 (soke dyke)		
Coleoptera	Helophoridae	*Helophorus griseus* (1♂)
	Hydrophilidae	*Hydrobius fuscipes*
	Coccinelidae	*Coccidula scutellata* (1) *(n)*
Hemiptera-Heteroptera	Gerridae	*Gerris thoracicus*
	Corixidae	*Sigara stagnalis* (numerous)
Odonata	Coenagriidae	several indet larvae
Mollusca	Hygrobiidae	*Potamopyrgus antipodarum*
	Lymnaeidae	*Radix balthica*
Amphipoda	Gammaridae	*Gammarus duebeni* (2) *G. zaddachi* (common)
Decapoda	Palaemonidae	*Palaeomonetes varians* (several)

Appendix 2: Core taxa recorded in May 2008 (all records)

Coleoptera	Haliplidae	*Haliplus apicalis* *H. lineatocollis* *H. obliquus*
	Noteridae	*Noterus clavicornis*
	Dytiscidae	*Hydroglyphus geminus* *Hygrotus impressopunctatus* *H. inaequalis* *Hydroporus angustatus* *H. incognitus* *H. palustris* *H. planus* *Agabus conspersus* *A. sturmii* *Liopterus haemorrhoidalis* *Rhantus suturalis* *Colymbetes fuscus* *Dytiscus marginalis* *Laccophilus minutus*
	Helophoridae	*Helophorus griseus* *H. minutus*
	Hydrophilidae	*Cercyon marinus* *Hydrobius fuscipes* *Anacaena limbata* *Anacaena lutescens* *Laccobius bipunctatus* *Laccobius colon* *Helochares lividus* *Enochrus bicolor* *Enochrus testaceus* *Cymbiodyta marginellus*
	Hydraenidae	*Ochthebius minimus*
	Curculionidae	*Thryogenes festucae*
Hemiptera – Heteroptera	Gerridae	*Gerris odontogaster* *G. thoracicus*
	Veliidae	*Microvelia reticulate*
	Naucoridae	*Ilyocoris cimicoides*
	Nepidae	*Nepa cinerea*
	Notonectidae	*Notonecta viridis*
	Corixidae	*Paracorixa concinna* *Sigara dorsalis* *S. stagnalis*
Odonata	Coenagriidae	*Ischnura elegans* adults Indet Coengriidae larvae
	Libellulidae	*Libellula quadrimaculata*, L
Trichoptera	Limnephilidae	*Limnephilus marmoratus* L
Mollusca	Hydrobiidae	*Potamopyrgus antipodarum*
	Lymnaeidae	*Lymnaea stagnalis* *Radix balthica*

	Planorbidae	*Gyraulus crista*
Amphipoda	Gammaridae	*Gammarus zaddachi*
	Corophiidae	*Corophium volutator*
Isopoda	Idoteidae	*Idotea chelipes*
Decapoda	Palaemoniidae	*Palaeomonetes varians*
Polychaeta	Nereidae	*Nereis* sp.

Appendix 3: cumulative list of core taxa, April 2004 – May 2008

Coleoptera	Haliplidae	*Haliplus apicalis* *H. confinis* *H. flavicollis* *H. fluviatilis* *H. immaculatus* *H. lineatocollis* *H. obliquus* *H. ruficollis*
	Noteridae	*Noterus clavicornis*
	Dytiscidae	*Laccophilus minutus* *Hydroglyphus geminus* *Hygrotus confluens* *H. impressopunctatus* *H. inaequalis* *H. nigrolineatus* *Hydroporus angustatus* *H. incognitus* *H. memnonius* *H. palustris* *H. planus* *H. tessellatus* *Scarodytes halensis* *Liopterus haemorrhoidalis* *Agabus bipustulatus* *A. conspersus* *A. sturmii* *Rhantus suturalis* *Colymbetes fuscus* *Dytiscus circumflexus* *D. marginalis*
	Helophoridae	*Helophorus aequalis* *H. grandis* *H. griseus* *H. minutus* *H. obscurus*
	Hydrophilidae	*Cercyon marinus* *Megasternum concinnum* *Hydrobius fuscipes* *Anacaena limbata* *A. lutescens* *Laccobius bipunctatus* *L. colon* *Helochares lividus* *Enochrus bicolor* *E.halophilus* *E. melanocephalus* *E. testaceus* *Cymbiodyta marginellus*

	Hydraenidae	*Ochthebius dilatatus* *O. marinus* *O. minimus*
	Scirtidae	*Cyphon laevipennis*
	Heteroceridae	*Heterocerus fenestratus*
	Curculionidae	*Phytobius leucogaster* *Thryogenes festucae*
Hemiptera – Heteroptera	Gerridae	*Gerris lacustris* *G. odontogaster* *G. thoracicus*
	Hydrometridae	*Hydrometra stagnorum*
	Veliidae	*Microvelia reticulate*
	Naucoridae	*Ilyocoris cimicoides*
	Nepidae	*Nepa cinerea*
	Notonectidae	*Notonecta viridis*
	Pleidae	*Plea minutissima*
	Corixidae	*Corixa panzeri* *C. punctata* *Callicorixa praeusta* *Arctocorisa germari* *Hesperocorixa linnaei* *H. sahlbergi* *Sigara concinna* *S. distincta* *S. dorsalis* *S. falleni* *S. lateralis* *S. nigrolineata* *S. stagnalis*
Odonata	Coenagriidae	*Coenagrion puella /pulchellum*, L *Ischnura elegans*, L
	Libellulidae	*Libellula quadrimaculata*, L *Sympetrum* sp., imm L
	Aeshnidae	*Anax imperator* L
Ephemeroptera	Baetidae	*Cleon dipterum* L
Trichoptera	Limnephilidae	*Limnephilus marmoratus*, L *L. affinis* / *incisus*
Mollusca	Hydrobiidae	*Potamopyrgus antipodarum*
	Lymnaeidae	*Lymnaea stagnalis* *Radix balthica*
	Planorbiidae	*Gyraulus crista*
	Sphaeriidae	*Musculium lacustre*
Amphipoda	Gammaridae	*Gammarus duebeni*
		Gammarus zaddachi
	Corophiidae	*Corophium volutator*
Isopoda	Asellidae	*Asellus aquaticus*
	Idoteidae	*Idotea chelipes*
Decapoda	Palaemonidae	*Palaemonetes varians*

Annelida	Glossiphonidae	*Glossiphonia complanata*
		Haemopis sanguisuga
Polychaeta	Nereidae	*Nereis* sp.