ASSESSMENT OF THE SPECIES COMPOSITION OF TESTATES AND INVERTEBRATES IN THE RIVER ADUR (RE-ALIGNMENT KNEPP PROJECT)

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SUMMARY

Sampling. Benthic testate amoeba (Protozoa) and invertebrates were collected from 3 different sites within the western branch of the River Adur catchment which include (a) Samples 1-4: River section canalised and straightened during the 19th century to improve drainage, (b) Samples 5-6: Tenchford Bridge riverine area and (c) Samples 7-9: Bay Bridge riverine area downstream the A24. At each site, randomly located samples were collected with a modified Hess-sampler (mesh net 20 µm) down to sediment depth of 10 cm where possible. Samples were preserved with 70% ethanol, after sorting for soft-bodied meiofaunal species (taxa < 500µm) and testates that were identified live. All specimens were examined with an Olympus BX50 microscope at 40–400x· magnification. Taxa specific keys were used to identify species belonging to the following groups: Testacea (Clarke 2003; Odgen & Hedley 1980), Turbellaria (Young, 2001), Gastrotricha (Schwank & Bartsch 1990), Rotifera (Donner 1965, Koste, 1978), Nematoda (Bongers, 1988), Oligochaeta (Brinkhurst, 1971), Crustacea (Copepoda: Kiefer, 1960; Cladocera: Amoros, 1984, Ostracoda: Henderson 1990), Diptera: Chironomidae (Schmid, 1993, Wiederholm 1983), Ephemeroptera (Elliot & Humpesch 2010), Odonata (Hammond 1994), Trichoptera (Edington & Hildrew 1995, Wallace et al. 1990), Acari (Di Sabatino et al., 2002).

Results. A total of 173 different species were identified with 41 species/morphotypes belonging to the testate amoebae (Protozoa), 27 species to larval chironomids (Diptera), 14 species to the Oligochaeta and the remaining species to a variety of other taxa (see Table 1). In terms of species composition, it is important to note the presence of the ostracod *Lymnocythere sanctipatricii* (Brady & Norman) at the Tenchford Bridge site which constitutes a new species record for the South East. Henderson (1990) recorded the species only from the West Midlands. He also mentioned that the species is rare within the British Isles which coincides with our findings. A species of the oligochaete *Ophidonais serpentina* (Müller) was previously recorded as south as Cambridge (Brinkhurst 1963), thus, the record in the Adur catchment constitutes a new finding for the South East. Another species worth mentioning is the harpacticoid copepod *Mesochra* sp. found in both riverine sections. The Genus is known to occur in brackish and freshwater systems; it is likely that

this finding is a first and rare record. Apparently, no research has been conducted on this comparatively rare genus in freshwater systems of the UK.

Overall more species were found in the streambed of swiftly flowing riverine sections of the Adur rather than in the straightened, canalised, stagnant sections (Fig. 1). The species found in the canalised-stretch were planktonic life cycles (e.g. copepods and cladocerans like the waterflea *Daphnia*) or benthic associated to aquatic plants such as gastropods (i.e. snails). 20% of the total number of species occurred only in the canal section and nowhere else, while 30% of the species occurred only at the riverine section downstream the A24. The largely dissimilar species composition between sites is reflected in a low similarity value (< 0.25) of the Jaccard index (Fig. 2). This result stresses that **each site has its unique species composition**. In order to achieve a high species diversity in any revitalised stream section ('realignment'), a high habitat diversity and consequently a wide range of flow regimes must be considered and consequently implemented.

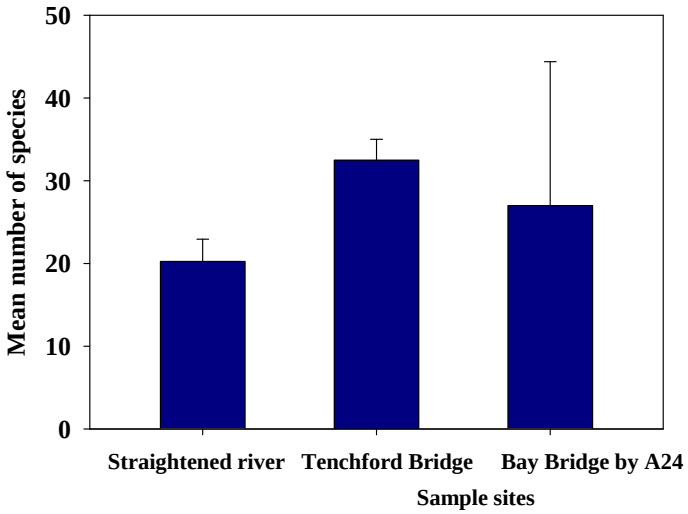

Fig. 1. Mean number (±SE) of testate and invertebrate species found at each sampling site of the River Adur in October 2011.

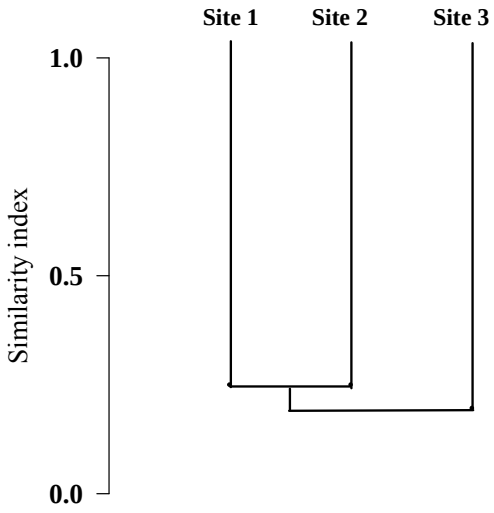

Fig. 2. Species similarity (based on Jaccard's index) between sampling sites of the River Adur in October 2011.

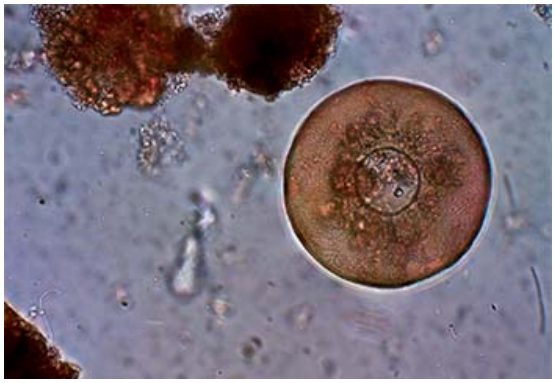

Plate 1. Representative species of the Genus *Arcella* that are mostly found on macrophytes.

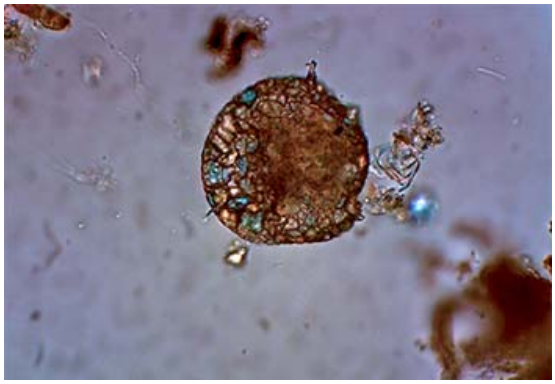

Plate 2. Representative species of the Genus *Centropyxis* that can reach high species diversity and abundances in benthic freshwater systems.

Plate 3. *Difflugia elegans*a typical testate representative of fluvial systems.

Plate 4. A rare specimen of a gastrotrich (common name ‘hairy backs’) of the Genus *Chaetonotus* found at the Tenchford Bridge area of the River Adur.

Plate 5, 6. An oligochaete of the genus *Ophidonais serpentina* (right) and the characteristic single simple dorsal chaeta (below).

Plate 7. Specimen of *Stylaria lacustris* (Oligochae ta) found at the straightened river section that was rich in fine organic matter.

Plate 8. Specimen of *Pristina longiseta* with its characteristic elongate hair chaetae.

Table 1. Species list of Testate amoeba (Protozoa) and invertebrates found in the three sampling sites of the River Adur. Sites 1-4: Old straightened river section; sites 5-6: Tenchford Bridge and sites 7-9: Bay Bridge downstream the A24.

SITES	1	2	3	4	5	6	7	8	9
PROTOZOA									
TESTACEA									
1. *Arcella bathystoma* Deflandre									1
2. *A. hemispherica* Perty	1				1			1	
3. *A. vulgaris* Ehrenberg			1	1		1		1	1
4. *Centropyxis aculeata* (Ehrenberg)			1					1	
5. *C. aerophila* Deflandre						1		1	
6. *C. ecornis* (Ehrenberg)					1				
7. *C. cassis* (Wallich)						1	1		1
8. *C. constricta* (Ehrenberg)			1						1
9. *C. hirsuta* Deflandre				1	1	1	1	1	1
10. *C. minuta* Deflandre				1					
11. *C. orbicularis* Deflandre				1					
12. *C. plagiostoma* Bonnet & Thomas							1		
13. *C. platystoma* Penard				1					
14. *C. spinosa* Cash					1				
15. *Cyclopyxis kahli* Deflandre	1								
16. *Cyclopyxis eurystoma* Deflandre				1		1			
17. *Difflugia avellana* Penard							1		
18. *D. bacillifera* Penard						1	1		
19. *D. bacillarium* Perty					1				
20. *D. dentistoma* Penard								1	
21. *D. elegans* Penard	1		1				1		
22. *D. elegans* var. *teres* Penard							1		
23. *D. globulosa* Dujardin	1			1	1	1			
24. *D. oblonga* Ehrenberg									1
25. *D. penardi* Hopkinson	1		1		1	1	1	1	1
26. *D. pulex* Penard								1	1
27. *D. lithophila* Penard						1			
28. *D. lucida* Penard									1
29. *D. manicata* Penard							1		
30. *D. minuta* Rampi			1						
31. *D. gramen* Penard				1					
32. *D. longicollis* Gassowski						1			
33. *Difflugia* sp. F			1						
34. *Euglypha rotunda* (Ehrenberg)			1	1	1	1			
35. *Hyalosphenia subflava* Cash									1
36. *Nebela penardiana* Deflandre			1						
37. *N. tincta* (Leidy)							1		
38. *Phryganella acropodia* Hertwig			1				1	1	
39. *P. acropoda* var. *penardi* Decloitre				1	1				
40. *Pseudodifflugia gracilis* Schlumberger	1		1	1	1	1	1	1	1
41. *Trinema lineare* Penard				1				1	
TURBELLARIA									
42. *Macrostomum rostratum* Papi									1
43. *Dugesia* cf. *lugrubis*				1					

Table 1. cont. Species list of the Testate amoeba (Protozoa) and invertebrates found in the three sampling sites of the River Adur. Sites 1-4: Straightened river 19th century; sites 5-6: Tenchford Bridge and sites 7-9: Bay Bridge above A24.

SITES	1	2	3	4	5	6	7	8	9
GASTROTRICHA									
44. *Chaetonotus* cf. *longispina*					1				
ROTIFERA									
45. *Trichotria tetractis* (Ehrb.)					1				
46. *Colurella uncinata* (Müller)									1
47. *L. closterocerca* (Schmarda)				1					
48. *Lecane flexilis* (Gosse)			1		1				
49. *Lecane lunaris* (Ehrb.)					1				
50. *Lecane patella* (Müller)									1
51. *Lepadella ovalis* (Müller)									1
52. *Cephalodella* sp.					1				
53. *Encentrum* sp.							1		
54. *Rotaria rotatoria* (Pallas)	1	1	1		1				
NEMATODA									
55. *Tobrilus* sp.	1								
56. *Mononchus* sp.	1								
57. *Mesodorylaimus* sp.	1								
OLIGOCHAETA									
58. *Aelosoma variegatum* Vejdovsky						1			
59. *Chaetogaster* sp.									1
60. *C. diastrophus* (Gruithuisen)							1		
61. *Nais alpina* Sperber									1
62. *Stylaria lacustris* (L.)		1				1			
63. *Homochaeta* sp.			1	1				1	1
64. *Pristina idrensis* Sperber			1	1					
65. *P. longiseta* Cernosvitov				1				1	
66. *Pristinella osborni* (Walton)							1		
67. *P. jenkinae* (Stephenson)								1	
68. *Pristinella* sp.						1			
69. *Ophidonais serpentina* (Müller)						1		1	
70. *Psammoryctides albicola* Michaelsen								1	1
71. Tubificidae juvenile				1				1	
HIRUDINEA									
72. *Erpobdella testacea* (Savigny)				1					
73. *Helobdella stagnalis* (L.)									1
74. *Glossiphonia complanata* (L.)									1
MOLLUSCA									
75. *Pisidium* sp.				1	1	1	1	1	1
76. *Anodonta anatina* L.							1		

Table 1. cont. Species list of Testate amoeba (Protozoa) and invertebrates found in the three sampling sites of the River Adur. Sites 1-4: Old straightened river section; sites 5-6: Tenchford Bridge and sites 7-9: Bay Bridge downstream the A24.

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SITES	1	2	3	4	5	6	7	8	9
GASTROPODA									
77. *Ancylus fluviatilis* Müller	1		1	1		1			
78. *Lymnaea peregra* (O.F.M.)	1								
79. *Bithynia leachi* (Sheppard)	1								
80. *Planorbis* (*Tropidiscus*) *planorbis* L.	1								
81. *Physa fontinalis* (L.)					1	1			
82. *Hydrobia ulvae* (Pennant)									1
OSTRACODA									
83. *Lymnocythere sanctipatricii* (Br. & N.)						1			
84. *Herpetocypris reptans* (Baird)			1			1			
85. *Herpetocypris chevreuxi* (Sars)			1	1	1	1			
86. *Cypridopsis vidua* O.F.Müller	1		1	1	1	1			1
87. *Cypridopsis* sp.						1			
88. *Candona angulata* G. W. Müller									1
89. *Candona candida* O.F.Müller						1		1	
90. *Candona* sp.			1					1	
91. *Pseudocandona sarsi* (Hartwig)						1			
92. *Cryptocandona reducta* (Alm)									1
COPEPODA									
93. *Macrocyclops albidus* (Jurine)	1	1	1	1	1	1		1	
94. *Acanthocyclops vernalis* (Fischer)								1	1
95. *Eucyclops serrulatus* (Fischer)	1	1	1	1	1				
96. *Tropocyclops prasinus* Kiefer			1						
97. *Attheyella* (*M.*) *dentata* (Poggenpol)		1			1	1			
98. *Bryocamptus* (*B.*) *mrázeki* (Mikiewicz)							1		
99. *Mesochra* sp.						1	1	1	
CLADOCERA									
100. *Daphnia ambigua* Scourfield		1							
101. *Simocephalus exspinosus* (DeGeer)	1		1	1				1	
102. *Eurycercus lamelatus* (O. F. M.)	1	1	1	1					
103. *Chydorus sphaericus* (O. F. M.)		1				1		1	
104. *Pleuroxus truncatus* (O. F. M.)		1		1					
105. *Alona affinis* Leydig								1	
106. *A. guttata* G. O. Sars			1						
107. *A. quadrangularis* (O.F.M.)							1		
108. *A. rectangula* Sars							1		
109. *A. rustica* Scott		1	1						
110. *Peracantha truncata* (O.F.M.)									1

Table 1. cont. Species list of Testate amoeba (Protozoa) and invertebrates found in the three sampling sites of the River Adur. Sites 1-4: Old straightened river section; sites 5-6: Tenchford Bridge and sites 7-9: Bay Bridge downstream the A24.

SITES	1	2	3	4	5	6	7	8	9
AMPHIPODA									
111. *Gammarus pulex* (L.)	1	1		1	1	1	1	1	
112. *Asellus aquaticus* Odenwall				1					
113. *Asellus meridianus* Racovitza						1			
INSECTA									
COLLEMBOLA									
114. *Entomobrya muscorum* (Nicolet)	1								
115. Isotomatidae juvenile					1				
MEGALOPTERA									
116. *Sialis lutaria* (L.)			1				1		1
EPHEMEROPTERA									
117. *Procloeon pennulatum* (Eaton)	1				1				
118. *Procleon* sp.		1		1		1		1	
119. *Procleon* cf. *bifidum*						1		1	1
120. *Cloeon dipterum* (L.)							1		
121. *Caenis horaria* (Linne)				1					
122. *Caenis rivulorum* Eaton						1			1
123. *Ephemera vulgata* L.						1	1		
ODONATA									
124. *Platycnemis pennipes* (Pallas)				1					
125. *Ischnura elegans* (Vander Linden)				1					
126. *Calopteryx splendens* (Harris)					1				
COLEOPTERA									
127. *Platambus maculatus* L.					1				
128. *Oulimnius* sp					1	1			1
129. *Elmis aenea* (Müller)					1	1			1
DIPTERA									
CHIRONOMIDAE									
130. *Chironomus* sp.					1				
131. *Dicrotendipes nervosus* Staeger					1				
132. *Micropsectra* sp.					1				
133. *Microtendipes pedellus* (Degeer)	1	1	1		1	1		1	1
134. *Polypedilum albicorne* Meigen					1				
135. *P. cultellatum* Goetghebuer					1				
136. *P. nubeculosum* Meigen				1	1				1
137. *Phaenopsectra flavipes* Meigen			1			1		1	
138. *Rheotanytarsus* sp.				1		1			
139. *Brillia modesta* Meigen									1

Table 1. cont. Species list of Testate amoeba (Protozoa) and invertebrates found in the three sampling sites of the River Adur. Sites 1-4: Old straightened river section; sites 5-6: Tenchford Bridge and sites 7-9: Bay Bridge downstream the A24.

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SITES	1	2	3	4	5	6	7	8	9
140. *Brillia longifurca* Kieffer									1
141. *Corynoneura lobata* Edwards					1				
142. *C. scutellata* Winnertz			1		1	1			1
143. *Cricotopus* (*I.*) *trifasciatus* Meigen							1		
144. *Cricotopus* sp.							1		
145. *Metriocnemus obscuripes* (Holmgren)					1	1			
146. *Metriocnemus* sp.							1		
147. *Orthocladius* sp. B							1		
148. *O. thienemanni* Kieffer & Thienemann							1		
149. *Psectrocladius sordidellus* Zetterstedt					1				
150. *Rheocricotopus effusus* Walker									1
151. *Thienemanniella vittata* (Edwards)									1
152. *Prodiamesa olivacea* Meigen									1
153. *Ablabesmyia longistyla* Fittkau	1	1	1			1			
154. *Clinotanypus nervosus* Meigen				1					
155. *Procladius* sp.					1		1	1	1
156. *Trissopelopia longimana* Staeger					1				1
DIPTERA									
DIXIDAE									
157. *Dixia* sp.				1					
SIMULIIDAE									
158. *Simulium reptans* L.									1
CERATOPOGONIDAE									
159. *Bezzia* sp.							1		
160. *Sphaeromias* sp.							1		
161. *Culicoides* sp.							1		
TRICHOPTERA									
162. *Polycentropus flavomaculatus* (Pictet)	1							1	1
163. *Cheumatopsyche lepida* (Pictet)									1
164. *Notidobia ciliaris* (L.)				1					
165. *Limnephilus griseus* (Kolenati)				1					
166. *L. subcentralis* Brauer				1					
167. *L. flavicornis* (Fabricius)						1			
168. *Cyrnus trimaculatus* (Curtis)							1		1
169. *Athripsodes bilineatus* (L.)							1		
170. *Hydropsyche angustipennis* Pictet									1
ACARI									
HYDRACHNIDIA									
171. *Sperchon violaceus* Walter,			1						
172. *Hygrobates fluviatilis* (Strom)					1	1			
173. *Lebertia* sp.						1			

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