

The invertebrate population of a created reedbed after seven years: Lakenheath Fen RSPB reserve, Suffolk, England

Vivienne Booth* & Malcolm Ausden

Royal Society for the Protection of Birds, The Lodge, Sandy, Bedfordshire, SG19 2DL, UK

*Corresponding author: vivienne.booth@rspb.org.uk

SUMMARY

Created reedbed at Lakenheath Fen (southeast England) supports an abundant and diverse invertebrate population, including rare Diptera and reedbed specialists, just seven years after it was transformed from agricultural land.

BACKGROUND

Phragmites-dominated reedbed is a UK Biodiversity Action Plan priority habitat, important for nationally rare bird and invertebrate species. Historically many wetlands have been drained and converted to agriculture, remaining areas are often small, prone to scrub invasion and in coastal areas may be threatened by saline incursion.

Reedbed creation projects have been driven in part by the decline of the Eurasian bittern *Botaurus stellaris* in the UK, sometimes creating the perception that created reedbeds provide poor habitat for other taxonomic groups. This study examines the invertebrate populations of both created reedbed, and the old, established reedbed at Lakenheath Fen.

ACTION

Study site: Lakenheath Fen, once part of the ancient Fens of eastern England, was drained in the 17th and 18th centuries to be used for arable land, grazing and timber production. One historically uncultivated area exists within the site: Botany Bay (Stallode Wash Site of Special Scientific Interest; SSSI) a 31 ha area of regularly flooded wash land, notified as an SSSI for its botanical species and bird life. Rare invertebrate species were recorded there in 1988 and 1997 surveys.

In 1995, the Royal Society for the Protection of Birds (RSPB) initiated a project to recreate a wetland on a 300 ha area of agricultural land with low ecological value, comprising large arable fields separated by drainage ditches. Major earthworks were begun in 1996 and completed in 2001, creating six large compartments separated by earth banks, and incorporating at least 100 metres of channel per hectare and 30% open water. By 2003, over 250,000 *Phragmites australis* reed stems (had been planted).

Invertebrate survey: In August 2008, water traps were positioned at 15 randomly selected points within the created reedbed in New Fen North. Within the old reedbed in Botany Bay the vegetation is more heterogeneous, therefore areas dominated by reed were first identified, and a water trap located at 15 randomly selected points within these areas. Water traps were yellow in colour and contained a solution of 25% propylene glycol. Traps were left in position for two weeks and samples stored in a solution of 70% IMS (Industrial Methylated Spirit). Samples were sorted to order and the Diptera from 14 samples in each reedbed were sent to a specialist for identification.

Water levels were recorded at each sampling point on each visit, vegetation height, live and dead stem density, and percentage cover of plant species, were measured at each sampling point on the final visit.

CONSEQUENCES

Seven years after the completion of works, the created reedbed in New Fen North consists of a network of channels and pools, surrounded by abundant reed. The density of reed stems is greater than that of the old reedbed in Botany Bay (Mann Whitney: $W = 288.5$ $P = 0.02$ $N = 15$) due to a higher density of live stems (Botany Bay: 62.5 per m^2 ; New Fen North: 95.6 per m^2 ; $W = 310.0$ $P = 0.001$ $N = 15$). The density of dead stems did not differ between the areas (Botany Bay: 51.7 per m^2 ; New Fen North: 47.6 per m^2). An apparent difference in reed height can be accounted for by deeper water in the created reedbed (an average of 29 cm compared with 19 cm in the old reedbed) despite river water flooding into the old reedbed in summer 2008.

The created reedbed is less botanically diverse, with five plant species present in 15 quadrats, while in the old reedbed, nine species were found. *P. australis* and common duckweed *Lemna minor* occurred at both sites. Ivy-leaved duckweed *Lemna trisulca*, amphibious bistort *Persicaria amphibia*, lesser bulrush *Typha angustifolia* occurred only in the created reedbed, while great pond-sedge *Carex riparia*, reed sweet-grass *Glyceria maxima*, woody nightshade *Solanum dulcamara*, greater duckweed *Spirodela polyrhiza*, purple loosestrife *Lythrum salicaria*, yellow flag *Iris pseudacorus*, and water horsetail *Equisetum fluviatile* occurred only in the old reedbed. Both sites contained a median of three plant species per 2 x 2m quadrat.

Invertebrate abundance: The created reedbed in New Fen North supported abundant invertebrate populations, with a higher total number of invertebrates per sample than the old reedbed ($W = 297.0$ $P < 0.001$). In particular, numbers of Diptera ($W = 298.0$ $P < 0.001$), Hymenoptera ($W = 290.0$ $P < 0.001$), Araneae ($W = 255.0$ $P = 0.01$) and Thysanoptera ($W = 246.0$ $P = 0.048$) were higher than in the old reedbed ($N = 14$ in all cases). Numbers of Hemiptera and Coleoptera were similar in both reedbeds and Neuroptera, Acari, Collembola, Mollusca and Trichoptera were also present in small numbers.

Diptera abundance and diversity: Across the site, 122 Diptera species were identified (see Appendix 1); 39 of these occurred at both sites, 35 were found only in old reedbed at Botany Bay, and 48 were found only in created reedbed at New Fen North. The number of Diptera species per trap was significantly

greater in New Fen North than in Botany Bay ($W = 271.5$ $P = 0.001$ $N = 14$).

Eighty-seven Diptera species were found in the created reedbed in New Fen North, including six nationally notable species, one nationally scarce species, two nationally vulnerable species and two nationally rare (Red Data Book 3) species (Table 1). Forty of these are considered wetland species, and five are associated with *Phragmites*. In the old reedbed at Botany Bay, 74 species occurred, of which seven were nationally notable species, one was a nationally scarce species, and one a nationally vulnerable (Red Data Book 2) species (see Table 1). Thirty-one of the Botany Bay Diptera species are considered wetland species and seven are associated with *Phragmites*.

Only one of these species, *Sciomyza simplex*, has been previously recorded at the site, in a 1988 survey. Five other Red Data Book (RDB) species recorded in the 1988 survey, and one in a 1997 survey were not found on this occasion. This may be due to the time of year of the survey, which was restricted by the presence of breeding birds in the reedbed. A simple weighted rarity score was devised for the Diptera, assigning a score of eight to RDB species, four to nationally scarce or notable species, and one to all other species. This produces a rarity score of 105 for Botany Bay, and 136 for New Fen North.

Conclusions: New Fen North has developed into a valuable wetland habitat just seven years since it was created from agricultural land. Although less botanically diverse than the old reedbed in Botany Bay, the reed is dense and supports an abundant and diverse population of invertebrates.

ACKNOWLEDGEMENTS

With thanks to David Gibbs for identification and analysis of Diptera samples, and Norman Sills and Steve Wiltshire for assistance in setting up water traps.

REFERENCES

Akers P. & Allcorn R.I. (2006) Reedbed creation through excavation of dry grassland and infilling of former gravel workings at Dungeness RSPB reserve, Kent, England. *Conservation Evidence*, 3, 94-95.

able 1. Nationally notable, nationally scarce and Red Data Book Diptera occurring in 14 samples from Botany Bay and 14 samples from New Fen North, Lakenheath Fen RSPB Reserve, August 2008.

Family	Species	Botany Bay	New Fen North	National status
Limoniidae	<i>Dicranomyia danica</i>		✓	Rare
Limoniidae	<i>Helius pallirostris</i>		✓	Notable
Stratiomyidae	<i>Stratiomys singularior</i>	✓	✓	Notable
Hybotidae	<i>Platypalpus articulatus</i>	✓		Scarce
Hybotidae	<i>Platypalpus infectus</i>	✓	✓	Vulnerable
Hybotidae	<i>Platypalpus niger</i>	✓		Notable*
Empididae	<i>Rhamphomyia caliginosa</i>		✓	Scarce
Sciomyzidae	<i>Pteromicra glabricula</i>	✓	✓	Notable
Sciomyzidae	<i>Pherbellia argyra</i>		✓	Vulnerable
Sciomyzidae	<i>Sciomyza simplex</i>	✓	✓	Notable
Sciomyzidae	<i>Psacadina</i> sp.		✓	Notable
Chloropidae	<i>Cryptonevra nigratarsis</i>	✓		Notable
Chloropidae	<i>Lipara rufitarsis</i>	✓		Notable
Chloropidae	<i>Trachysiphonella scutellata</i>	✓	✓	Notable
Ephydriidae	<i>Ochthera manicata</i>		✓	Rare

* in 1991, excluded from 2005 review due to lack of data.

Appendix 1. Diptera species in 14 water trap samples from Botany Bay and 14 from New Fen North, Lakenheath Fen RSPB Reserve, August 2008.

Family	Species	Species frequency			National status
		Botany Bay	New Fen North	TOTAL	
Tipulidae	<i>Nephrotoma cornicina</i>	1		1	
Limoniidae	<i>Dicranomyia danica</i>		1	1	Rare
Limoniidae	<i>Helius pallirostris</i>		6	6	Notable
Bibionidae	<i>Dilophus febrilis</i>	1		1	
Anisopodidae	<i>Sylvicola punctatus</i>	1		1	
Ptychopteridae	<i>Ptychoptera contaminate</i>		1	1	
Rhagionidae	<i>Chrysopilus asiliformis</i>	1		1	
Stratiomyidae	<i>Chloromyia Formosa</i>	2	1	3	
Stratiomyidae	<i>Oplodontha viridula</i>	1	3	4	
Stratiomyidae	<i>Stratiomys singularior</i>	2	2	4	Notable
Hybotidae	<i>Bicellaria simplicipes</i>		2	2	
Hybotidae	<i>Platypalpus articulatus</i>	1		1	Scarce
Hybotidae	<i>Platypalpus flavicornis</i>	2		2	
Hybotidae	<i>Platypalpus infectus</i>	1	1	2	Vulnerable
Hybotidae	<i>Platypalpus interstinctus</i>		3	3	
Hybotidae	<i>Platypalpus longiseta</i>	1	2	3	
Hybotidae	<i>Platypalpus niger</i>	1		1	Notable
Hybotidae	<i>Platypalpus pallidiventris</i>	5	7	12	
Empididae	<i>Dolichocephala irrorata</i>	1		1	
Empididae	<i>Rhamphomyia caliginosa</i>		2	2	Scarce

Empididae	<i>Hilara subpollinosa</i>		1	1	
Dolichopodidae	<i>Microphor anomalus</i>	1		1	
Dolichopodidae	<i>Microphor holosericeus</i>	1		1	
Dolichopodidae	<i>Chrysotus gramineus</i>		1	1	
Dolichopodidae	<i>Dolichopus latilimbatus</i>	1	10	11	
Dolichopodidae	<i>Dolichopus nubilus</i>		8	8	
Dolichopodidae	<i>Dolichopus plumipes</i>		5	5	
Dolichopodidae	<i>Dolichopus unguatus</i>		1	1	
Dolichopodidae	<i>Poecilobothrus chrysozygos</i>	1	3	4	
Dolichopodidae	<i>Campsicnemus curvipes</i>		2	2	
Dolichopodidae	<i>Campsicnemus loripes</i>		1	1	
Dolichopodidae	<i>Syntormon denticulatum</i>		2	2	
Dolichopodidae	<i>Syntormon pallipes</i>		1	1	
Opetiidae	<i>Opetia nigra</i>	1		1	
Lonchopteridae	<i>Lonchoptera bifurcata</i>	1	1	2	
Lonchopteridae	<i>Lonchoptera lutea</i>		5	5	
Syrphidae	<i>Platycheirus peltatus</i>	1		1	
Syrphidae	<i>Episyrphus balteatus</i>	12	10	22	
Syrphidae	<i>Eupeodes corollae</i>	1		1	
Syrphidae	<i>Syrphus ribesii</i>	1	2	3	
Syrphidae	<i>Syrphus vitripennis</i>	1	1	2	
Syrphidae	<i>Neoascia tenur</i>	2		2	
Syrphidae	<i>Eristalinus sepulchralis</i>	3	5	8	
Syrphidae	<i>Chalcosyrphus nemorum</i>	5		5	
Pipunculidae	<i>Tomosvaryella sylvatica</i>		1	1	
Lonchaeidae	<i>Setisquamalonchaea fumosa</i>	4	1	5	
Ulidiidae	<i>Ceroxys urticae</i>	1	10	11	
Tephritidae	<i>Tephritis formosa</i>		1	1	
Tephritidae	<i>Philophylla caesio</i>		2	2	
Lauxaniidae	<i>Minettia fasciata</i>		1	1	
Sciomyzidae	<i>Pteromicra glabricula</i>	1	1	2	Notable
Sciomyzidae	<i>Pherbellia argyra</i>		4	4	Vulnerable
Sciomyzidae	<i>Sciomyza simplex</i>	1	1	2	Notable
Sciomyzidae	<i>Elgiva cucularia</i>		2	2	
Sciomyzidae	<i>Pherbina coryleti</i>	1		1	
Sciomyzidae	<i>Psacadina</i> sp.		1	1	Notable
Sciomyzidae	<i>Tetanocera ferruginea</i>	8	12	20	
Sepsidae	<i>Sepsis flavimana</i>		1	1	
Sepsidae	<i>Sepsis punctum</i>	2	1	3	
Sepsidae	<i>Themira putris</i>		2	2	
Agromyzidae	<i>Agromyza nigripes</i>	5	14	19	
Agromyzidae	<i>Agromyza pseudoreptans</i>		1	1	
Agromyzidae	<i>Ophiomyia melandricaulis</i>	1		1	
Agromyzidae	<i>Amauromyza flavifrons</i>		1	1	

Agromyzidae	<i>Calycomyza artemisiae</i>	1		1	
Agromyzidae	<i>Cerodontha denticornis</i>		1	1	
Agromyzidae	<i>Cerodontha muscina</i>		1	1	
Agromyzidae	<i>Cerodontha phragmitidis</i>	2	2	4	
Agromyzidae	<i>Chromatomyia milii</i>	2	10	12	
Agromyzidae	<i>Liriomyza congesta</i>	3		3	
Agromyzidae	<i>Liriomyza flaveola</i>		1	1	
Agromyzidae	<i>Liriomyza sonchi</i>	1		1	
Agromyzidae	<i>Liriomyza strigata</i>	4		5	
Agromyzidae	<i>Phytomyza pastinacae</i>	1		1	
Opomyzidae	<i>Opomyza florum</i>		1	1	
Anthomyzidae	<i>Anthomyza collini</i>	2	7	9	
Anthomyzidae	<i>Anthomyza gracilis</i>		2	2	
Carnidae	<i>Meoneura flavifacies</i>	3		3	
Carnidae	<i>Meoneura vagans</i>	6		6	
Chloropidae	<i>Chlorops hypostigma</i>	2		2	
Chloropidae	<i>Chlorops pumilionis</i>	2		2	
Chloropidae	<i>Cryptonevra flavitarsis</i>	4	6	10	
Chloropidae	<i>Cryptonevra nigratarsis</i>	4		4	Notable
Chloropidae	<i>Meromyza nigriventris</i>	2		2	
Chloropidae	<i>Thaumatomyia notata</i>			0	
Chloropidae	<i>Calamoncosis aprica</i>		1	1	
Chloropidae	<i>Calamoncosis duinensis</i>		8	8	
Chloropidae	<i>Calamoncosis glyceriae</i>	9	1	10	
Chloropidae	<i>Elachiptera cornuta</i>		1	1	
Chloropidae	<i>Elachiptera</i> sp. nr. <i>cornuta</i>	5	14	19	
Chloropidae	<i>Eribolus hungaricus</i>	8	14	22	
Chloropidae	<i>Lipara rufitarsis</i>	1		1	Notable
Chloropidae	<i>Oscinella cariciphila</i>	14	13	27	
Chloropidae	<i>Oscinella frit</i>	10	8	18	
Chloropidae	<i>Conioscinella frontella</i>		2	2	
Chloropidae	<i>Trachysiphonella scutellata</i>	1	1	2	Notable
Chloropidae	<i>Tricimba cincta</i>	2		2	
Drosophilidae	<i>Drosophila picta</i>	2	10	12	
Drosophilidae	<i>Drosophila subobscura</i>	3	7	10	
Drosophilidae	<i>Scaptomyza flava</i>		4	4	
Drosophilidae	<i>Scaptomyza pallida</i>	8	12	20	
Ephydriidae	<i>Psilopa nitidula</i>	1		1	
Ephydriidae	<i>Coenia curvicauda</i>	2		2	
Ephydriidae	<i>Coenia palustris</i>	6	12	18	
Ephydriidae	<i>Paracoenia fumosa</i>	1	4	5	
Ephydriidae	<i>Parydra fossarum</i>		1	1	
Ephydriidae	<i>Parydra aquila</i>		1	1	
Ephydriidae	<i>Scatella tenuicosta</i>		4	4	

Ephydridae	<i>Scatophila noctula</i>	1	1	2	
Ephydridae	<i>Discocerina obscurella</i>		9	9	
Ephydridae	<i>Ochthera manicata</i>		3	3	Rare
Ephydridae	<i>Hydrellia albilabris</i>	7	4	11	
Ephydridae	<i>Hydrellia tarsata</i>	1		1	
Ephydridae	<i>Hydrellia thoracica</i>	1	1	2	
Ephydridae	<i>Notiphila guttiventris</i>		1	1	
Ephydridae	<i>Notiphila riparia</i>	9	14	23	
Ephydridae	<i>Axysta cesta</i>		1	1	
Scathophagidae	<i>Chaetosa punctipes</i>		1	1	
Scathophagidae	<i>Cleigastra apicalis</i>	2		2	
Scathophagidae	<i>Cordilura ciliata</i>	2		2	
Scathophagidae	<i>Scathophaga stercoraria</i>		1	1	
Scathophagidae	<i>Scathophaga suilla</i>		3	3	
Scathophagidae	<i>Trichopalpus fraternus</i>		6	6	

Conservation Evidence is an open-access online journal devoted to publishing the evidence on the effectiveness of management interventions. The pdf is free to circulate or add to other websites. The other papers from Conservation Evidence are available from the website www.ConservationEvidence.com