

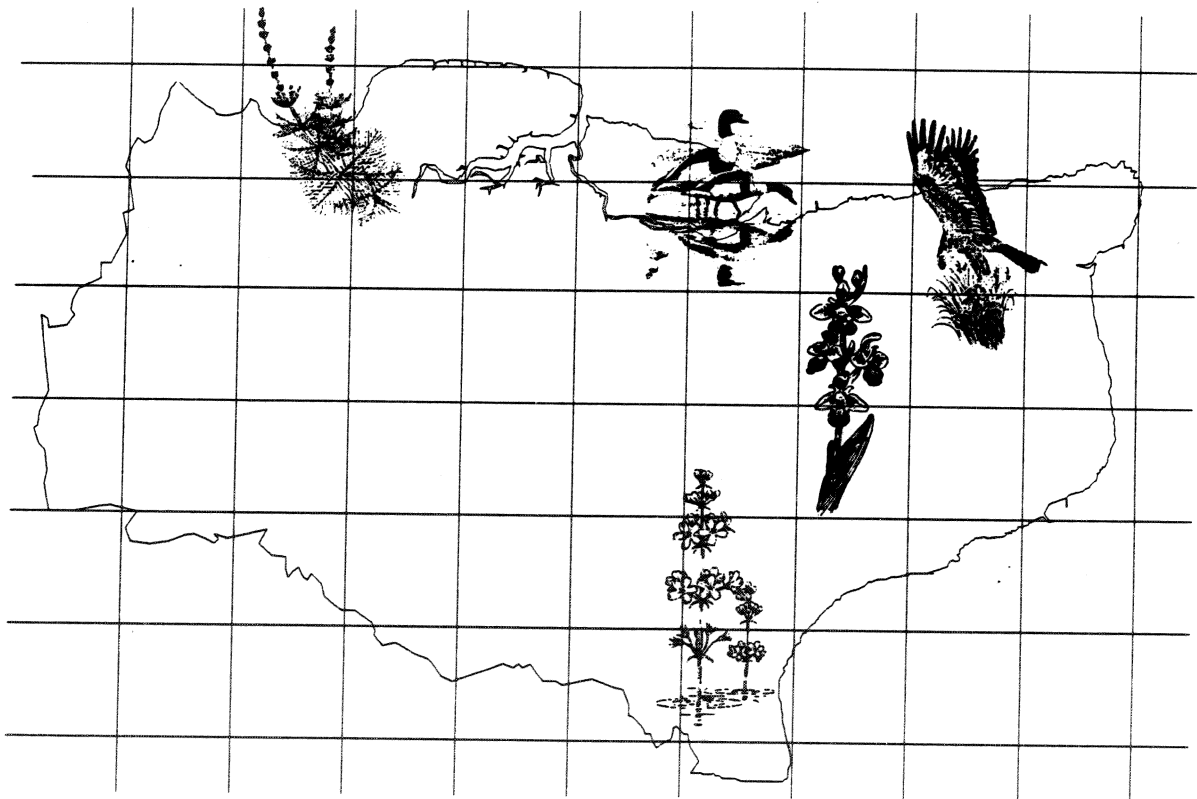
Survey and monitoring in Kent

Collected reports

1994

P Williams

SURVEY AND MONITORING IN KENT
COLLECTED REPORTS
1994



ENGLISH NATURE RESEARCH REPORT No 140

PREFACE TO REPORTS

This collection of reports relating to survey and monitoring in Kent has been produced with the following aims:

1. To collate small reports that relate to survey and monitoring in Kent.
2. To provide supplementary and updated information on previous reports.
3. To present the results of monitoring on NNRs.

Some of the reports in this collection have been produced separately earlier in the year, but are included here in order to bring them together under one English Nature Research Report title. Two large reports completed this year, the phase 2 survey of neutral grassland and the survey of Walland Marsh, have been produced separately. (These are Research Reports No 119 and 132 respectively.) Routine monitoring work on NNRs carried out as part of national monitoring schemes, such as ITE butterfly monitoring, and the results of student projects have also not been included.

Phil Williams
Survey and Monitoring Officer
Kent Team

28 March 1995

SURVEY AND MONITORING IN KENT 1994

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The autecology of the black-veined moth Siona Lineata
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*The autecology of the late spider orchid Ophrys fuciflora:
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BOTANICAL SURVEY OF DITCHES AT SHORNE MARSHES 1994

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SUMMARY

This is a preliminary report on a survey of ditch flora at Shorne Marshes, part of Thames Estuary and Marshes SSSI, carried out during August 1994. Survey work on this SSSI will continue in 1995 as part of a comprehensive survey of ditches on the North Kent Marshes.

The results of the survey provide information on species abundance and distribution, important for assessing both the status of key species (those species which define the botanical interest of the site) and the threat posed by invasive species. Ditches were assigned to communities recognized by R Morris (ESA report, 1993). The distribution of these communities shows that the diversity of the site is mainly dependant on the larger drainage channels, while subsidiary ditches, particularly on the east side of the site, are generally in a state of neglect.

In addition ten ditches surveyed by the England Field Unit in 1981 were resurveyed along their entire length, following the original survey method. However a comparison of the results has limited value because of the small sample size and changes in the ditch system. The EFU method was primarily aimed at ditch classification and has limited use for monitoring purposes.

This preliminary report does not put Shorne marshes into context with the rest of the north Kent marshes, though comparison with the results of the survey of selected sites by R Morris et al in 1993 suggests that the predominance of very saline and inherently species-poor ditches is a typical feature of the north Kent marshes.

1. INTRODUCTION

Shorne Marshes comprises approximately 1.5 km of grazing marsh at the eastern end of the Thames Estuary and Marshes SSSI. It is owned and leased for grazing (by cattle) by the MOD, though it is now up for sale as the adjacent rifle range is no longer used. Shorne Marshes is characterised by a high proportion of scrub, associated with many dry ditches. This appears to have been the case in 1981, when the England Field Unit carried out a survey of some of the ditches. The ditch system has however been modified since then, with the instatement of a main drainage channel running the length of the site from east to west.

Even with the work carried out by the EFU in 1981, the ditches at Shorne Marshes, like most of the North Kent marshes, have not been surveyed in enough detail in the past to allow an accurate assessment of changes in the aquatic flora since notification.

The aims of this survey were to:

1. Assess the present quality of the ditches, providing information on the abundance and distribution of ditch plants, particularly key species and invasive species.
2. Provide a base line for monitoring floristic changes in future.
3. Map the distribution of ditch communities, using the system developed by R Morris (1993). This is particularly useful as a management tool, as species-poor, emergent dominated ditch communities indicate the need for management.

2. METHOD

Individual ditches across the site were identified and numbered on a site map. Within each ditch a representative 20m section was then sampled, recording presence\absence of all aquatic, emergent and bank species. To increase coverage DAFOR abundance ratings were not used, though dominance by any species was recorded. (This is a modification of the standard method for recording ditches set out by Alcock and Parmer, 1985). It was also recorded if the ditch was dry or choked, as was the presence of hawthorn at the top of the bank.

This method was used in the 1993/4 survey of Walland Marsh SSSI. It is a quicker method than that used on the North Kent Marshes ESA by R Morris et al in 1993, which provided more quantitative data on the abundance of species within each ditch section. This purpose of that survey was to develop a ditch classification system for use in the North Kent ESA, but for the purposes of this survey the priorities are different:

1. In order to achieve greater coverage the method needs to be as rapid as possible.
2. Only the most significant variables should be monitored.
3. The method should not collect more data than is necessary or cost-effective to analyze and interpret.

2.1 REPEAT SURVEY OF EFU DITCHES

The England Field Unit collected quantitative data for 10 ditches on Shorne Marshes in 1981, recording species along the entire length of the ditch. The remaining ditches were visually classified using a system based on results from a total of 128 ditches recorded across selected areas of the North Kent Marshes. This system recognised three major ditch types and two bank types, and although this was useful for characterising different areas of grazing marsh has now been superseded by the recent work of R Morris (1993).

The 10 ditches recorded in 1981 were resurveyed along their entire length during the present survey, as there is potential using the 1981 survey for monitoring these ditches. However there are a number of problems with the EFU comparison:

- 1 Individual ditches change through the management cycle, so it is difficult to detect significant change within the same ditch unless it is at the same stage in the management cycle when re-recorded.
- 2 Modifications to the ditch system may result in a significant alteration to an individual ditch, such that it can no longer be regarded as the same ditch.
3. The sample size is too small to encompass the full range of ditch types, or provide an assessment of the overall status of species. If all 128 EFU ditches across the North Kent Marshes were resurveyed, more reliable conclusions could be drawn for all areas combined, but not for separate areas.

3. RESULTS

3.1 SUMMARY RESULTS

The full results of ditch sampling are contained in spreadsheets in Appendix I. Results are summarised in Table 1 below, which gives the frequency of occurrence of some of the key species and all the invasive aliens, listed in order of frequency.

Distribution maps have also been produced for the key species. These are given in Appendix III.

Table 1 Frequency of occurrence of species

Key Species	no of ditches	% frequency
<i>Ranunculus baudottii</i>	19	28.4
<i>Carex divisa</i> *	13	19.4
<i>Ceratophyllum submersum</i>	12	17.9
<i>Potamogeton pectinatus</i>	11	16.4
<i>Hydrocharis morsus-ranae</i>	9	13.4
<i>Zannichellia palustris</i>	7	10.4

<i>Juncus maritima</i>	5	7.5
<i>Myriophyllum spicatum</i>	4	6.0
<i>Triglochin palustre</i>	4	6.0
<i>Chenopodium chenopodioides</i> *	3	4.5
<i>Stratiotes aloides</i> *	2	3.0
<i>Potamogeton berchtoldii</i>	2	3.0
<i>Potamogeton pusillus</i>	1	1.5

* = nationally scarce

Alien/problem species

<i>Lemna gibba</i>	18	26.9
<i>Elodea nuttallii</i>	16	23.9
<i>Lemna minuscula</i>	6	9.0
<i>Azolla filiculoides</i>	4	6.0
<i>Myriophyllum aquaticum</i>	1	1.5

3.2 CLASSIFICATION OF DITCHES

From the results of ditch sampling ditches have been assigned to communities recognized by R Morris et al (*A ditch survey method for use in the North Kent Marshes ESA* 1993).

The following ditch communities were recorded. (Further description of these can be found in the ESA report. Community tables derived from the 1993 survey data are given in *A comparison of twinspan analysis of Walland Marsh and North Kent Marshes ditch data*, 1995).

Community Code

CA1	Species-poor brackish community with <i>Scirpus maritimus</i> and <i>Phragmites australis</i> both constant.
CA2	Species-poor brackish community with constant <i>Scirpus maritimus</i> and abundant <i>Agrostis stolonifera</i> .
DA	Species-rich brackish community with constant <i>Ceratophyllum submersum</i> and <i>Lemna</i> spp, and abundant <i>Berula erecta</i> , <i>Phragmites australis</i> and <i>Scirpus</i>

maritima.

DB Species-rich less saline community with *Hydrocharis morsus-ranae*, *Berula erecta*, *Phragmites australis* and *Typha angustifolia*.

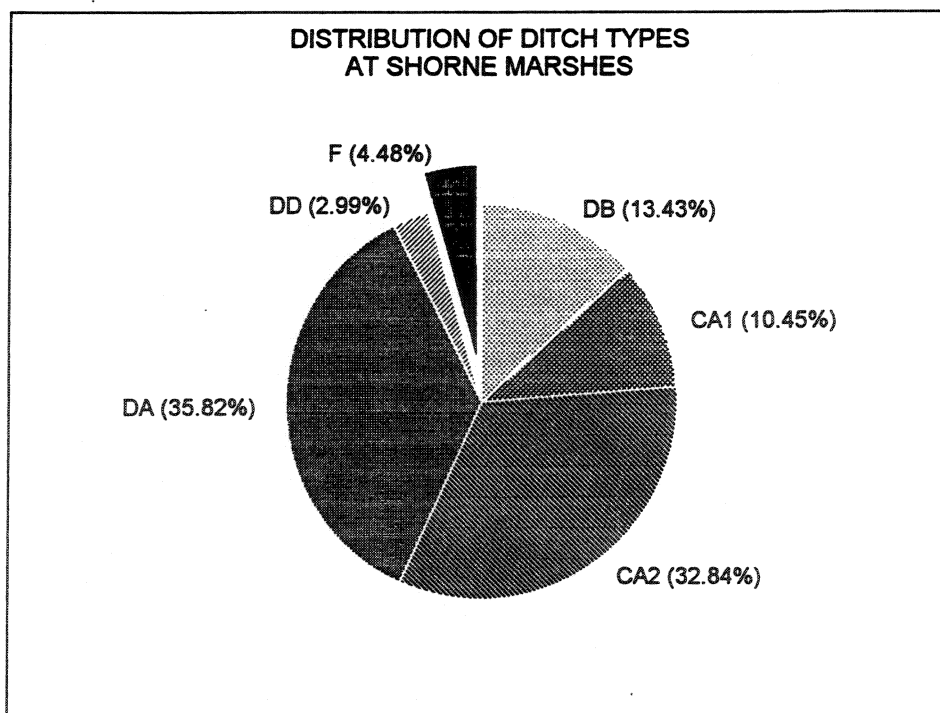
DD Species-poor less saline community dominated by *Phragmites australis* or with *Typha angustifolia*.

OTHER TYPES

CA2* A variation of CA2 was recorded, which had *Juncus maritimus* along the banks, indicating a very high level of salinity.

F A freshwater type with *Typha latifolia* and *Lemna minuscule* was recorded along the southern edge of the marsh, not represented in the classification.

The following pie graph shows the proportion of ditches in each community.



3.3 EFU RESULTS

The results for the ten EFU ditches for both 1981 and 1994 are given in Appendix II. Changes in the frequency of occurrence of species are given in Table 2 below.

Table 2 Changes in frequency in EFU ditch lengths

monitoring year	1981	1994	change
<i>Juncus inflexus</i>	4	9	+5
<i>Carex otrubae</i>	3	8	+5
<i>Lemna minor</i>	6	10	+4
<i>Lemna trisulca</i>	5	9	+4
Filamentous algae	1	5	+4
<i>Hydrocharis morsus-ranae</i>	-	4	+4
<i>Callitriche obtusangula</i>	3	6	+3
<i>Oenanthe lachenalii</i>	-	3	+3
<i>Solanum dulcamara</i>	2	4	+2
<i>Phragmites australis</i>	2	4	+2
<i>Elodea nuttallii</i>	1	3	+2
<i>Alisma plantago-aquatica</i>	1	3	+2
<i>Ceratophyllum demersum</i>	1	3	+2
<i>Lemna minuscula</i>	-	2	+2
<i>Enteromorpha</i> sp	4	5	+1
<i>Berula erecta</i>	4	5	+1
<i>Lycopus europaeus</i>	2	3	+1
<i>Myriophyllum aquaticum</i>	-	1	+1
<i>Typha latifolia</i>	-	1	+1
<i>Senecio aquaticus</i>	-	1	+1
<i>Scirpus maritimus</i>	10	10	0
<i>Lemna gibba</i>	5	5	0
<i>Glyceria fluitans</i>	2	2	0
<i>Sparganium erectum</i>	2	2	0
<i>Typha angustifolia</i>	1	1	0
<i>Potamogeton pusillus</i>	1	1	0
<i>Eleocharis palustris</i>	6	5	-1
<i>Epilobium hirsutum</i>	2	1	-1
<i>Ranunculus trichophyllus</i>	1	-	-1
<i>Apium graveolens</i>	1	-	-1
<i>Juncus effusus</i>	1	-	-1
<i>Elodea canadensis</i>	1	-	-1
<i>Iris pseudocorus</i>	1	-	-1
<i>Oenanthe fistulosa</i>	1	-	-1
<i>Scutellaria galericulata</i>	1	-	-1
<i>Schoenoplectus tabernaemontani</i>	1	-	-1
<i>Glaux maritima</i>	1	-	-1
<i>Callitriche stagnalis/spp</i>	1	-	-1
<i>Potamogeton natans</i>	1	-	-1
<i>Stratiotes aloides</i>	1	-	-1
<i>Rorippa nasturtium-aquaticum</i>	5	3	-2
<i>Ranunculus sceleratus</i>	5	3	-2
<i>Rumex hydrolapathum</i>	2	-	-2
<i>Chenopodium chenopodioides</i>	2	-	-2
<i>Myosotis scorpioides</i>	2	-	-2
<i>Ranunculus baudotti/seedling</i>	6	3	-3
<i>Carex divisa</i>	5	2	-3
<i>Ceratophyllum submersum</i>	5	2	-3
<i>Apium nodiflorum</i>	4	1	-3
<i>Atriplex hastata</i>	4	1	-3
<i>Potamogeton crispus</i>	3	-	-3
<i>Zannichellia palustris</i>	5	-	-5
<i>Juncus gerardii</i>	6	-	-6
<i>Myriophyllum spicatum</i>	7	1	-6
<i>Potamogeton pectinatus</i>	8	1	-7

4. DISCUSSION

The distribution of ditch communities indicates clearly that the botanical interest of the site is mainly associated with deep, wide and well-maintained drainage channels. The subsidiary ditches, particularly in the east side of the site, are in contrast species-poor and in a state of neglect, with 20% of ditches recorded as either choked or dry, and nearly 50% with hawthorn present on the bank.

Three nationally scarce species were recorded on the site, *Carex divisa*, *Chenopodium chenopodioides* and *Stratiotes aloides*. The site supports a range of other key species, ie. those which define the botanical interest associated with north Kent grazing marsh. These are predominantly brackish species, such as *Ranunculus baudottii*, which was recorded in over 25% of ditches. The majority of key species occur in relatively few ditches, though comparison with the ESA survey results suggests these frequencies are probably typical of the north Kent marshes overall. There is however a wide salinity gradient across the site, ranging from very saline ditches with *Juncus maritimus* along the banks at the eastern end of the site through to more fresh water ditches with *Hydrocharis morsus-ranae* and *Stratiotes aloides* to the south and west. The ditches on the west side, extending into Higham Marshes, are generally the best.

4.1 CHANGES IN EFU DITCHES

Two of the ditches surveyed in 1981 (no 19 and 41) have been modified by the instatement of a main drainage channel, and a further two (no 13 and 21) have dried out to such an extent that they no longer seem part of the system. These changes and the small sample size make it impossible to draw reliable conclusions from the changes in frequency of species as shown Table 2.

Within the ten EFU ditches there appears to have been a general decrease in saline species, accounted for mainly by the two ditches which are now part of the same main drainage channel (no 19 and 41), and the three connected to it (no 18, 42, 44), which appear to be less saline, with the fresh water species *Hydrocharis morsus-ranae* now present in all five. The bank species *Juncus inflexus* and *Carex otrubae* have also appeared

along these ditches. Though no wider conclusions can be drawn, the large decrease in *Zannichellia palustris*, *Myriophyllum spicatum* and *Potamogeton pectinatus* is at least reflected in the low frequency of these species across the rest of the site. The instatement of the main drainage channel has probably not affected the overall salinity gradient across the site, but could have reduced water levels in subsidiary ditches, at least on the east side of the site, resulting in a decline in frequency of these key species.

There has certainly been a change in the botanical interest of the ten EFU ditches, but it is not possible to relate these changes reliably to the rest of the site. Monitoring the EFU ditches has limited value therefore and it probably not worth re-recording EFU ditches in other areas.

4.2 ALIEN/PROBLEM SPECIES

Five alien/problem species were recorded, the commonest of which, *Lemna gibba* and *Elodea nutallii*, occur in about 25% of the ditches, and where they occur are occasionally quite dominant. *Lemna minuscula* is limited to 6 fresh water ditches, along the southern edge of the site, and is probably intolerant of saline conditions, but where does occur it is dominant and often the only aquatic species present. *Azolla filiculoides* is infrequent across the site and does not appear to pose much of a threat. Of more concern is the occurrence of *Myriophyllum aquaticum* (parrot's feather) in two small clumps in one ditch along the southern boundary. This is the second locality for this plant on the SSSI, the other being the well established population in the Higham canal about 2 km away.

The alien/problem species may have reached a stable abundance, though this needs to be monitored. The small amount of *Myriophyllum aquaticum* should be removed if possible. It is likely to increase in size and may spread to other, more species-rich ditches such as the main drainage channel to which it is connected.

5. CONCLUSIONS

1. The results of ditch by ditch sample recording provide an accurate assessment of the frequency and distribution of species across the survey area. This will be put into context with the rest of the SSSI following further survey work. In addition the recording of ditch communities provides information both on the salinity gradient and the level of ditch management.
2. Monitoring of the EFU ditches is probably not feasible given the changes that occur to individual ditches and the small sample size.
3. Further survey work should be based on the methods adopted during this survey, though additions to the method could include recording physical features of the ditches, adjacent land use, and salinity levels.
4. Survey data should also be linked to ownership details in order to be able to extract data for individual owner/occupiers.

ACKNOWLEDGEMENTS

We would like to thank the MOD for allowing access to their land to carry out this survey. We would also like to thank KCC for providing digitised GIS information, which was kindly transferred to DMAP format by Dr Alan Morton.

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- ENGLAND FIELD UNIT *A botanical survey of ditches in selected areas of the North Kent Marshes.* (1981)
EFU report No.14
- R Morris et al *A ditch survey method for use in the North Kent Marshes Environmentally Sensitive Area.*
(1993) EN/NRA
- P. Williams *A comparison of twinspan analysis of Walland Marsh and North Kent Marshes ditch data.*
(1995) ENGLISH NATURE

APPENDIX I SURVEY RESULTS

ditch number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
<i>Azolla filiculoides</i>			1									1											
<i>Callitriche obtusangula</i>						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Callitriche stagnalis</i> /spp																							
<i>Ceratophyllum demersum</i>					1							1											
<i>Ceratophyllum submersum</i>												1											
<i>Elodea nuttallii</i>					1							1											
<i>Enteromorpha</i> sp					1							1											
Filamentous algae				1	1			1	1	1		1			1			1					
<i>Hydrocharis morsus-ranae</i>	1											1											
<i>Lemna gibba</i>		D	1	1								1											
<i>Lemna minor</i>	D											1											
<i>Lemna trisulca</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	D
<i>Myriophyllum aquaticum</i>																							
<i>Myriophyllum spicatum</i>					1																		
<i>Potamogeton berchtoldii</i>						1																	
<i>Potamogeton pectinatus</i>					1																		
<i>Potamogeton pusillus</i>			1																				
<i>Ranunculus baudotii</i> /seedling									1	1	1					1	1						
<i>Stratiotes aloides</i>																							
<i>Zannichellia palustris</i>									1				1							1			
<i>Alisma plantago-aquatica</i>																							
<i>Berula erecta</i>		1	1									1											
<i>Eleocharis palustris</i>			1																				
<i>Glyceria fluitans</i>				D		1		1							1	1	D		1	1	1	D	1
<i>Nasturtium officinale</i> agg																							
<i>Phragmites australis</i>	1			1								1					1	1			1	1	1
<i>Ranunculus sceleratus</i>																							
<i>Rumex hydrolapathum</i>																							
<i>Scirpus maritimus</i>		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	D	1	1	1	1	1
<i>Sparganium erectum</i>																							
<i>Typha angustifolia</i>																							
<i>Typha latifolia</i>												1											1
<i>Atriplex hastata</i>																							
<i>Carex divisa</i>						1			1														
<i>Carex otrubae</i>	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Chenopodium chenopodioides</i>																							
<i>Epilobium hirsutum</i>									1			1											
<i>Eupatorium cannabinum</i>																							1
<i>Juncus effusus</i>																							
<i>Juncus inflexus</i>	1	1	1	1	1	1																	
<i>Juncus maritima</i>												1		1	1			1	1	1	1	1	1
<i>Lycopus europaeus</i>																							
<i>Oenanthe lachenalii</i>									1		1					1							
<i>Pulicaria dysenterica</i>																							
<i>Scutellaria galericulata</i>																							
<i>Solanum dulcamara</i>							1									1							
<i>Spergularia marina</i>																							
<i>Triglochin palustre</i>																							
<i>Crataegus monogyna</i>	1		1	1	1	1	1	1							1	1	1	1			1	1	1
ditch choked				1		1												1				1	1
ditch dry															1	1	1						
number of aquatic species	4	3	9	3	7	2	9	5	6	3	3	9	2	4	3	2	2	1	3	0	1	1	1
number of emergent species	1	2	5	3	1	2	2	2	1	1	1	6	1	1	2	3	2	3	2	3	3	4	1
number of bank species	2	1	2	2	2	1	3	1	5	1	3	2	2	2	1	2	0	1	2	2	1	2	2
total number of species	7	6	16	8	10	5	14	8	12	5	7	17	5	7	6	7	4	5	6	7	5	5	7
DITCH TYPE	DB	CA2	DB	CA1	DA	CA2	DA	CA2	CA2*	CA2*	CA2*	DB	CA2*	CA2*	CA2	CA1	CA2	CA1	CA1	CA2	CA1	CA1	TL*

ditch number	24	25	26	27	28	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
<i>Azolla filiculoides</i>												1									1		
<i>Callitriche obtusangula</i>	1					1	1		1		1			1	1								
<i>Callitriche stagnalis</i> spp																							
<i>Ceratophyllum demersum</i>				1		D		D							1	D	1	1	D	1	1		
<i>Ceratophyllum submersum</i>																							
<i>Elodea nuttallii</i>			1																				
<i>Entieromorpha</i> sp			1																				
<i>Filamentous algae</i>			1	1				1	1		1			1	1	1	1	1	1				
<i>Hydrocharis morsus-ranae</i>			1																				
<i>Lemna gibba</i>			1		1		1														1		
<i>Lemna miniscula</i>	D	D																					
<i>Lemna minor</i>			1	1	D	1	D	1	1	1	1	1	1	1	1	1	1	1	1	1	1	D	1
<i>Lemna trisulca</i>	1	1	1	1	1		1	1	1					1	1	1	1	1	1	1	1	D	1
<i>Myriophyllum aquaticum</i>	1																						
<i>Myriophyllum spicatum</i>																							
<i>Potamogeton berchtoldii</i>																							
<i>Potamogeton pectinatus</i>									1						1		1	1			1		
<i>Potamogeton pusillus</i>																							
<i>Ranunculus baudotti</i> /seedling										1	1	1	1	1	1	1	1	1	1	1			1
<i>Stratiotes aloides</i>																							
<i>Zannichellia palustris</i>												1									1		
<i>Alisma plantago-aquatica</i>	1	1																					
<i>Berula erecta</i>			1	1	1		1	1	1					1	1	1	1	1	1	1	1	1	1
<i>Eleocharis palustris</i>														1	1	1	1	1	1	1	1		
<i>Glyceria fluitans</i>			1									1	1										
<i>Nasturtium officinale</i> agg			1	1																			
<i>Phragmites australis</i>				D					1	1													
<i>Ranunculus sceleratus</i>																							
<i>Rumex hydrolapathum</i>	1																						
<i>Scirpus maritimus</i>			1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Sparganium erectum</i>																							
<i>Typha angustifolia</i>	1																						D
<i>Typha latifolia</i>	1	1																					
<i>Atriplex hastata</i>																							
<i>Carex divisa</i>																							1
<i>Carex otrubae</i>	1	1	1	1																			1
<i>Chenopodium chenopodioides</i>																							
<i>Epilobium hirsutum</i>	1											1											
<i>Eupatorium cannabinum</i>			1																				
<i>Juncus effusus</i>																							
<i>Juncus inflexus</i>	1	1	1	1	1	1		1	1	1	1		1		1				1	1	1	1	1
<i>Juncus maritima</i>																							
<i>Lycopus europaeus</i>	1	1	1																				
<i>Oenanthe lachenalii</i>																							
<i>Pulicaria dysenterica</i>	1			1	1		1			1	1			1		1					1	1	
<i>Scutellaria galericulata</i>																							
<i>Solanum dulcamara</i>					1																		
<i>Spergularia marina</i>																		1					
<i>Triglochin palustre</i>																							
<i>Crataegus monogyna</i>			1	1	1		1		1	1	1	1	1	1	1			1				1	1
ditch choked	1										1												
ditch dry													1										

number of aquatic species	4	2	7	4	3	5	4	4	6	2	3	5	1	5	5	5	8	5	5	6	9	2	3
number of emergent species	1	4	7	3	2	2	2	4	3	1	2	4	1	2	3	3	3	3	5	6	2	2	2
number of bank species	4	4	4	3	3	1	2	1	1	4	3	2	2	2	1	2	1	1	2	1	2	2	3
total number of species	9	10	18	10	8	8	8	8	9	10	7	8	11	4	8	10	9	12	11	10	13	6	8
DITCH TYPE	TL*	TL*	DB	DD2	CA1	DA	CA2	DA	DA	CA2	CA2	DA	CA2	CA2	DA	DA	DA	DA	DA	DA	DA	CA2	DD1

ditch number	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	tot	%
<i>Azolla filiculoides</i>	1																					4	6.0%
<i>Callitriche obtusangula</i>				1							1											26	38.8%
<i>Callitriche stagnalis</i> /spp							1			1									1			2	3.0%
<i>Ceratophyllum demersum</i>	1									1	1	1	1		1	1						11	16.4%
<i>Ceratophyllum submersum</i>					D													1			D	12	17.9%
<i>Elodea nuttalli</i>	1											1	1	D	1				1			16	23.9%
<i>Enteromorpha</i> sp	1				1							1		1	1				1		1	17	25.4%
<i>Filamentous algae</i>									1			1				1					1	23	34.3%
<i>Hydrocharis morsus-ranae</i>	1									1	1	1										9	13.4%
<i>Lemna gibba</i>	1	1	D						1	D	D	1	1				1					18	26.9%
<i>Lemna minor</i>						D				1												6	9.0%
<i>Lemna trisulca</i>	1	1	D	1	1		1	1	1	1	1	1	1		1	1	D	1	1	1	52	77.6%	
<i>Myriophyllum aquaticum</i>							1								1	D	1	1	1	1	1	45	67.2%
<i>Myriophyllum spicatum</i>																		1				1	1.5%
<i>Potamogeton berchtoldii</i>																		1				4	6.0%
<i>Potamogeton pectinatus</i>															1			1			1	2	3.0%
<i>Potamogeton pusillus</i>																		1				11	16.4%
<i>Ranunculus baudottii</i> /seedling									1					1	1			1	1			1	1.5%
<i>Stratiotes aloides</i>										1	1								1			19	28.4%
<i>Zannichellia palustris</i>														1								2	3.0%
<i>Alisma plantago-aquatica</i>																						7	10.4%
<i>Berula erecta</i>	1			1		1	1	1		1	1	1			1	1		1	1	1	1	33	49.3%
<i>Eleocharis palustris</i>	1			1						1	1	1	1	1	1	1	1	1	1	1		24	35.8%
<i>Glyceria fluitans</i>	1	1		1			1	1	1	1	1	1	1		1	1				D		21	31.3%
<i>Nasturtium officinale</i> agg		1					1	1						1	1	1					1	13	19.4%
<i>Phragmites australis</i>									1									1			1	17	25.4%
<i>Ranunculus sceleratus</i>														1	1	1			1			6	9.0%
<i>Rumex hydrolapathum</i>										1	1	1	1								1	10	14.9%
<i>Scirpus maritimus</i>	1	1	1	1	1							1	1	1	1	1	1	1	1	1	52	77.6%	
<i>Sparganium erectum</i>	1								1	1	1	1	1								9	13.4%	
<i>Typha angustifolia</i>																						2	3.0%
<i>Typha latifolia</i>																						4	6.0%
<i>Atriplex hastata</i>																	1					2	3.0%
<i>Carex divisa</i>				1												1			1		1	13	19.4%
<i>Carex otrubae</i>	1	1			1	1	1		1	1			1	1	1			1	1	1	32	47.8%	
<i>Chenopodium chenopodioides</i>																						3	4.5%
<i>Epilobium hirsutum</i>						1			1													4	6.0%
<i>Eupatorium cannabinum</i>																						1	1.5%
<i>Juncus effusus</i>			1					1														2	3.0%
<i>Juncus inflexus</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	52	77.6%	
<i>Juncus maritima</i>																						5	7.5%
<i>Lycopus europaeus</i>									1	1	1	1	1	1								10	14.9%
<i>Oenanthe lachenalii</i>	1						1								1							16	23.9%
<i>Pulicaria dysenterica</i>						1																1	1.5%
<i>Scutellaria galericulata</i>																						1	1.5%
<i>Solanum dulcamara</i>							1	1	1													6	9.0%
<i>Spergularia marina</i>												1										4	6.0%
<i>Triglochin palustre</i>									1			1			1	1	1			1	32	47.8%	
<i>Crataegus monogyna</i>	1		1		1		1		1			1					1			1	9	13.4%	
ditch choked																						5	7.5%
ditch dry																		1					
number of aquatic species	3	8	3	3	5	1	2	3	5	8	8	8	6	5	6	4	3	9	3	2	6	avg	4.3
number of emergent species	3	8	1	4	1	1	1	3	3	5	5	6	7	4	4	5	2	2	5	4	4	21	
number of bank species	2	4	2	1	2	4	4	3	5	4	2	3	4	3	4	3	2	1	3	2	3	12	
total number of species	8	20	6	8	8	6	7	9	13	17	15	17	16	13	14	12	7	12	11	8	13	49	
DITCH TYPE	CA2	DB	CA2	CA2	DA	DA	DA	DA	DA	DA	DB	DB	DB	DB	CA2	DA	CA2	DA	DA	DA	DA	DA	

APPENDIX II EFU RESULTS

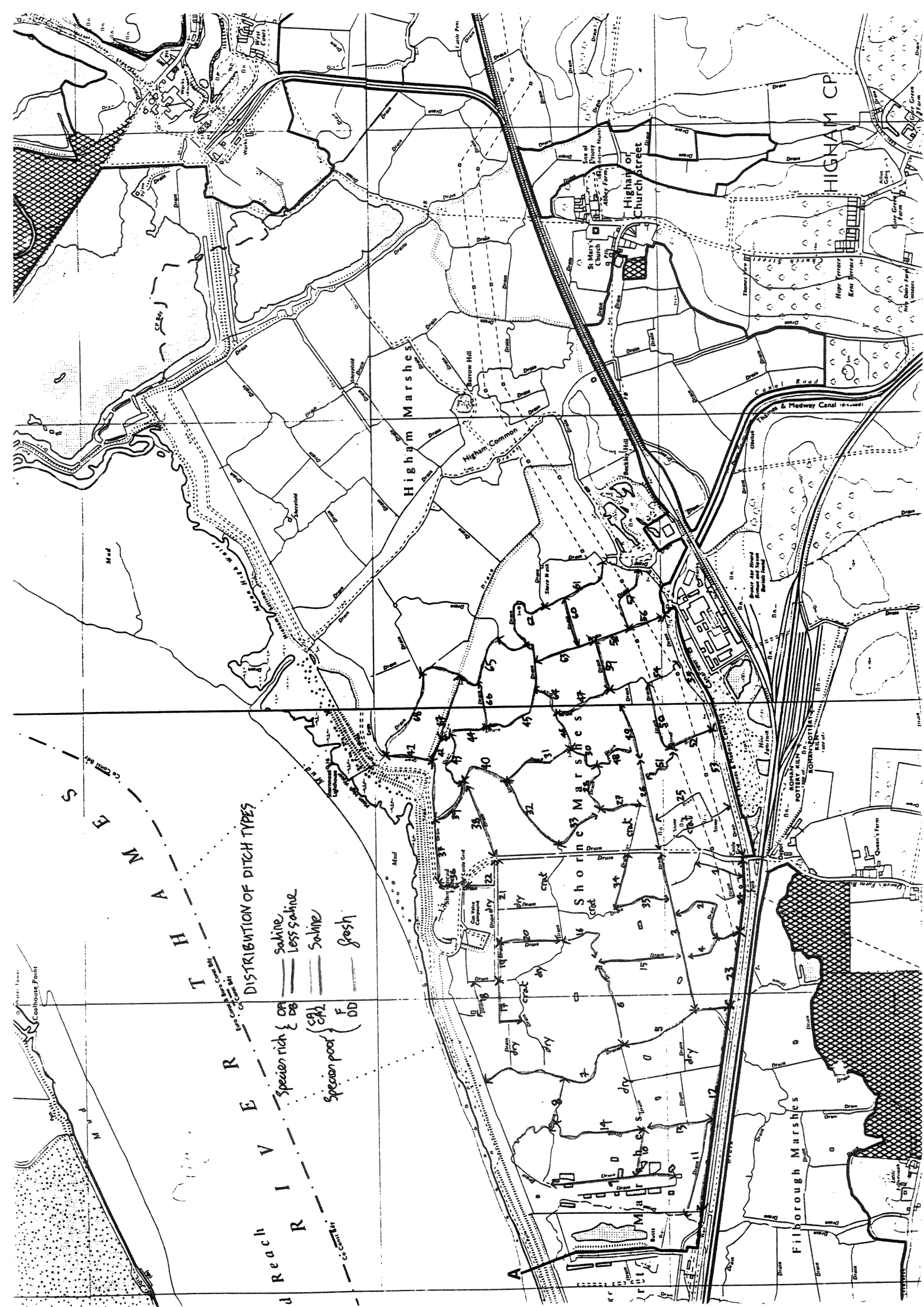
EFU ditch lengths 1981

ditch number	13	14	18	19	21	41	42	44	48	90	total	freq
<i>Scirpus maritimus</i>	1	1	1	1	1	1	1	1	1	1	10	100%
<i>Potamogeton pectinatus</i>	1	1		1	1	1	1	1		1	8	80%
<i>Myriophyllum spicatum</i>	1	1		1	1	1		1		1	7	70%
<i>Lemna minor</i>	1	1	1	1	1					1	6	60%
<i>Juncus gerardii</i>					1	1	1	1	1	1	6	60%
<i>Eleocharis palustris</i>	1	1	1	1	1			1			6	60%
<i>Ranunculus baudotti/seedling</i>	1			1	1			1	1	1	6	60%
<i>Lemna gibba</i>	1	1	1	1	1						5	50%
<i>Ranunculus sceleratus</i>	1	1	1	1			1				5	50%
<i>Rorippa nasturtium-aquaticum</i>	1	1	1	1	1						5	50%
<i>Zannichellia palustris</i>	1	1		1	1					1	5	50%
<i>Lemna trisulca</i>	1	1	1	D	1						5	50%
<i>Ceratophyllum submersum</i>	1		1	D	D					1	5	50%
<i>Carex divisa</i>	1	1		1				1	1		5	50%
<i>Juncus inflexus</i>	1	1	1				1				4	40%
<i>Atriplex hastata</i>					1	1			1	1	4	40%
<i>Berula erecta</i>	1	1	1	1							4	40%
<i>Enteromorpha sp</i>	1	1	1		1						4	40%
<i>Apium nodiflorum</i>	1	1		1	1						3	30%
<i>Carex otrubaea</i>	1	1		1							3	30%
<i>Potamogeton crispus</i>	1	1	1								3	30%
<i>Callitriche obtusangula</i>		1	1		1						3	30%
<i>Glyceria fluitans</i>		1			1						2	20%
<i>Lycopus europaeus</i>		1	1								2	20%
<i>Phragmites australis</i>		1	1				1				2	20%
<i>Epilobium hirsutum</i>			1								2	20%
<i>Rumex hydrolapathum</i>		1	1								2	20%
<i>Chenopodium chenopodioides</i>						1		1			2	20%
<i>Sparganium erectum</i>		1	1								2	20%
<i>Solanum dulcamara</i>			1	1							2	20%
<i>Myosotis scorpioides</i>		1	1								1	10%
<i>Apium graveolens</i>	1										1	10%
<i>Ranunculus trichophyllus</i>					1			1			1	10%
<i>Typha angustifolia</i>											1	10%
<i>Stratiotes aloides</i>			1								1	10%
<i>Schoenoplectus tabernaemontani</i>								1			1	10%
<i>Scutellaria galericulata</i>			1								1	10%
<i>Alisma plantago-aquatica</i>			1								1	10%
<i>Glaux maritima</i>										1	1	10%
<i>Iris pseudocorus</i>			1								1	10%
<i>Filamentous algae</i>					1						1	10%
<i>Elodea nuttallii</i>		D									1	10%
<i>Elodea canadensis</i>			1								1	10%
<i>Juncus effusus</i>			1								1	10%
<i>Callitriche stagnalis/spp</i>										1	1	10%
<i>Potamogeton natans</i>			1								1	10%
<i>Potamogeton pusillus</i>		1									1	10%
<i>Ceratophyllum demersum</i>		1									1	10%
<i>Oenanthe fistulosa</i>					1						1	10%
number of species	20	27	27	17	20	6	6	10	5	11	avg = 14.9	

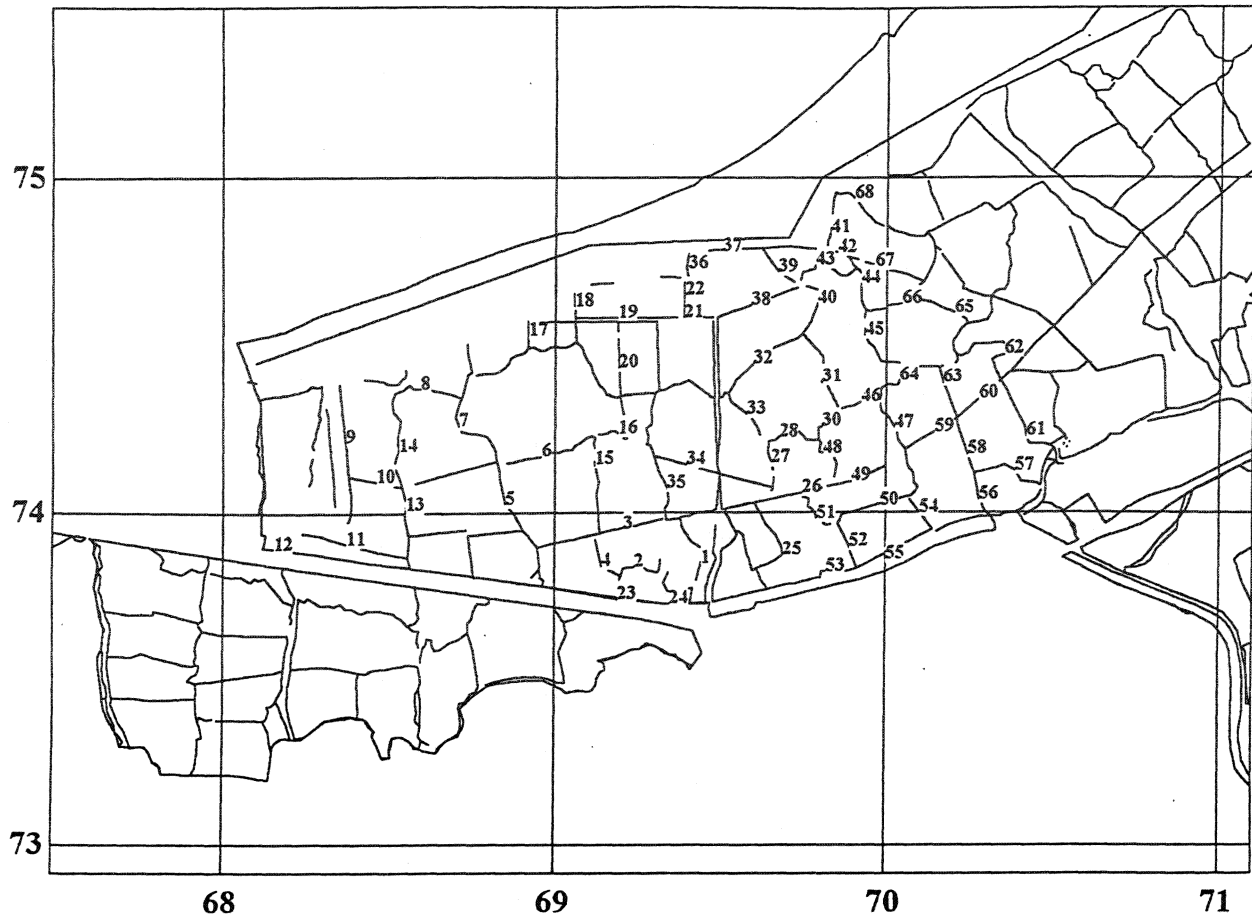
EFU DITCH LENGTHS 1994

ditch number	13	14	18	19	21	41	42	44	48	90	total	freq
<i>Lemna minor</i>	1	1	1	1	1	1	1	D	1	1	10	100%
<i>Scirpus maritimus</i>	1	1	1	1	1	1	1	1	1	1	10	100%
<i>Juncus inflexus</i>	1	1	1	1		1	1	1	1	1	9	90%
<i>Lemna trisulca</i>	1	1	1	1		1	1	1	1	1	9	90%
<i>Carex otrubaea</i>	1	1	1	1		1		1	1	1	8	80%
<i>Callitriche obtusangula</i>	1	1	1	1	1				1	1	6	60%
<i>Enteromorpha sp</i>	1	1	1	1		1					5	50%
<i>Filamentous algae</i>	1			1		1		1	1	1	5	50%
<i>Lemna gibba</i>				1		1	D	1		1	5	50%
<i>Eleocharis palustris</i>			1	1		1			1	1	5	50%
<i>Berula erecta</i>			1	1		1	1				4	40%
<i>Hydrocharis morsus-ranae</i>			1	1		1				1	4	40%
<i>Phragmites australis</i>			1	1				1	1		4	40%
<i>Solanum dulcamara</i>		1			1			1	1		4	40%
<i>Ceratophyllum demersum</i>		1	1	1							3	30%
<i>Elodea nuttallii</i>		1		D		1					3	30%
<i>Oenanthe lachenalii</i>		1	1					1			3	30%
<i>Lycopus europaeus</i>		1	1						1		3	30%
<i>Ranunculus baudotti/seedling</i>	1				1					1	3	30%
<i>Ranunculus sceleratus</i>	1		1						1		3	30%
<i>Alisma plantago-aquatica</i>			1			1				1	3	30%
<i>Rorippa nasturtium-aquaticum</i>		1		1					1		3	30%
<i>Ceratophyllum submersum</i>										1	2	20%
<i>Carex divisa</i>	1										2	20%
<i>Glyceria fluitans</i>	1				1						2	20%
<i>Sparganium erectum</i>				1		1					2	20%
<i>Lemna minuscula</i>								1	1		2	20%
<i>Senecio aquaticus</i>									1		1	10%
<i>Typha angustifolia</i>										D	1	10%
<i>Typha latifolia</i>									1		1	10%
<i>Atriplex hastata</i>	1										1	10%
<i>Apium nodiflorum</i>			1								1	10%
<i>Epilobium hirsutum</i>						1					1	10%
<i>Myriophyllum spicatum</i>		1									1	10%
<i>Potamogeton pectinatus</i>		1									1	10%
<i>Potamogeton pusillus</i>				1							1	10%
<i>Myriophyllum aquaticum</i>									1		1	10%
total number of species	15	21	22	19	9	17	8	12	19	19	avg = 16.1	
<i>Crataegus monogyna</i>	1	1			1	1		1	1	1	7	70%
ditch choked	1									1	2	20%
ditch dry					1						1	10%

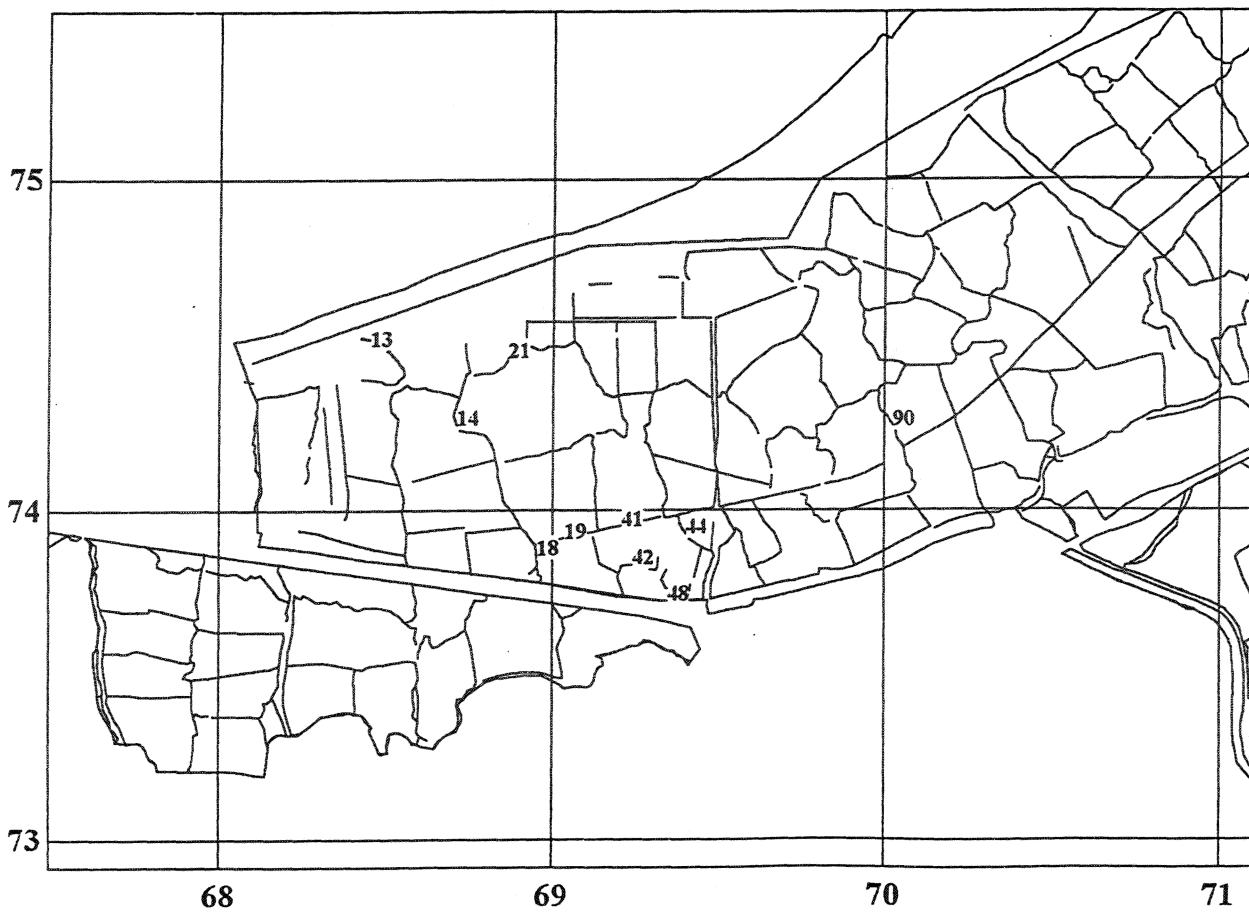
APPENDIX III DISTRIBUTION MAPS



Shorne Marshes - surveyed ditches



Shorne Marshes - EFU ditches



Choked ditches



Dry ditches



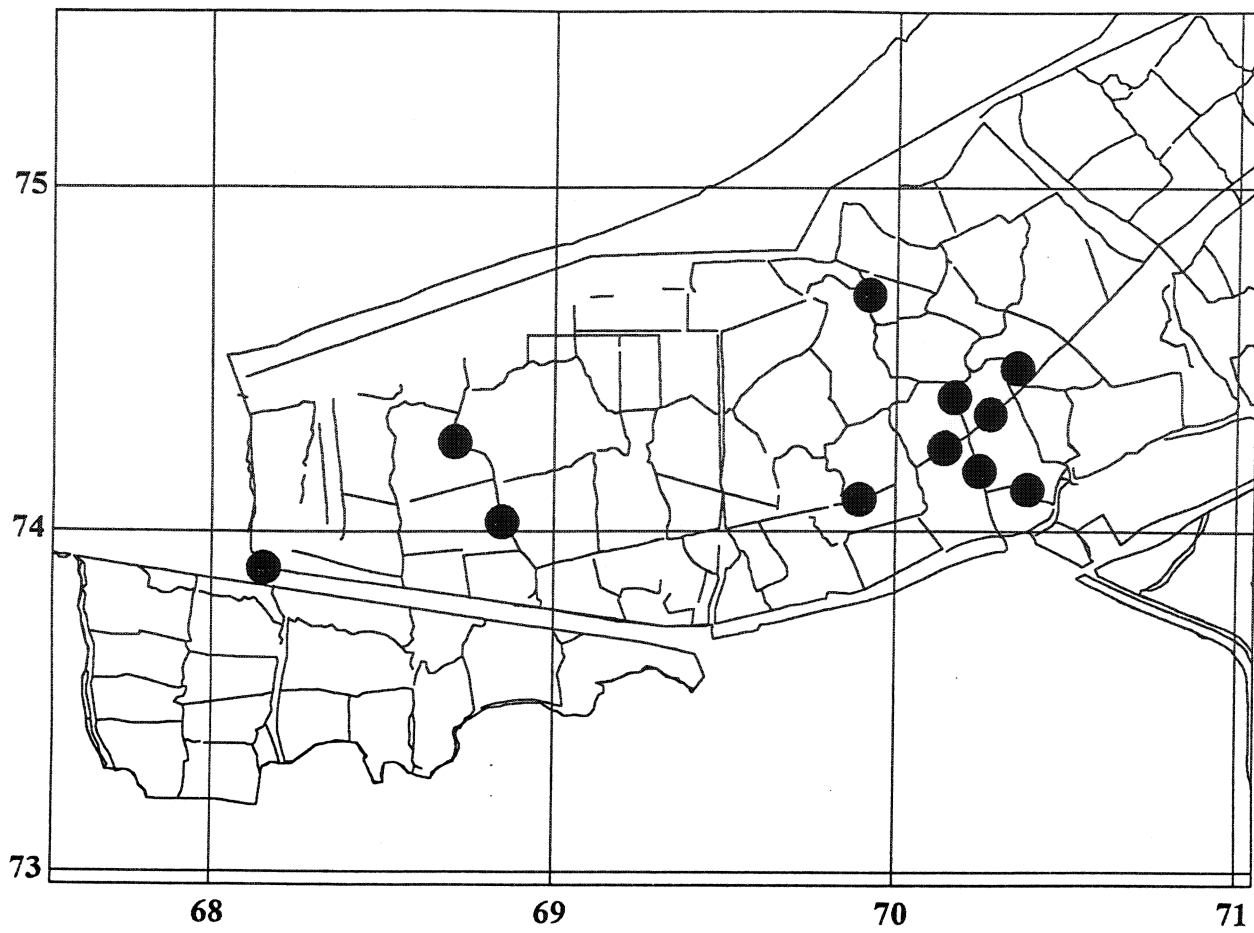
Crataegus monogyna



Azolla filiculoides



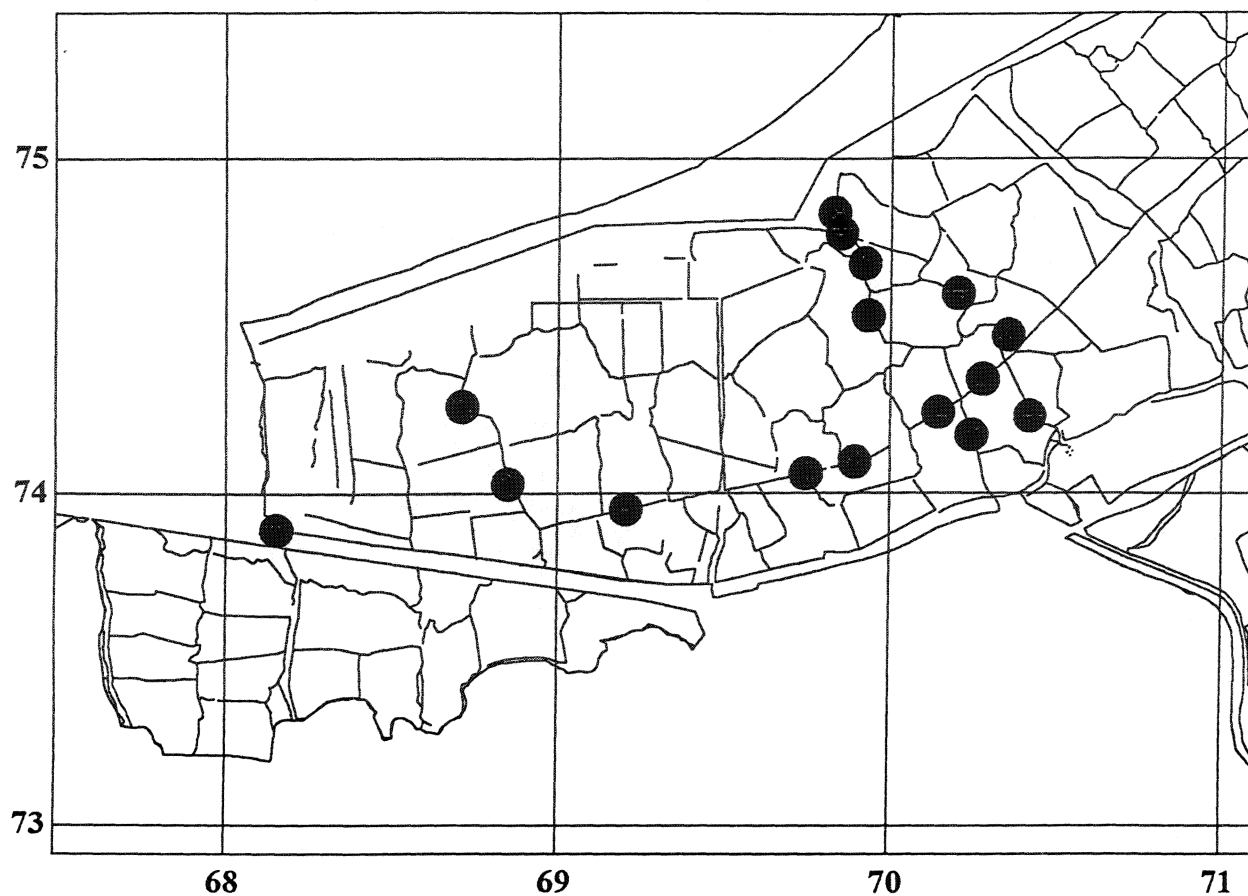
Ceratophyllum demersum



Ceratophyllum submersum



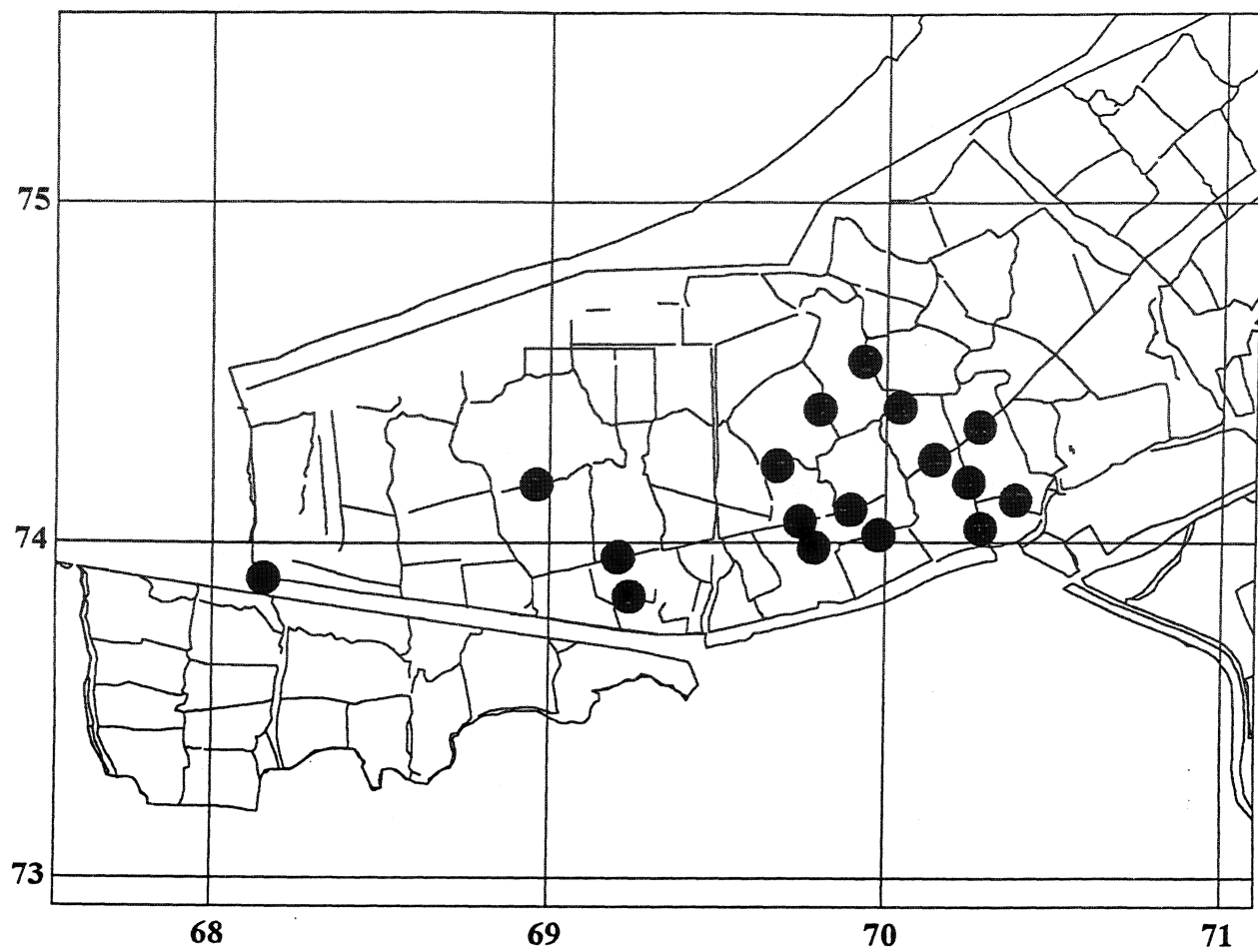
Elodea nutallii



Hydrocharis morsus-ranae



Lemna gibba



Lemna miniscula



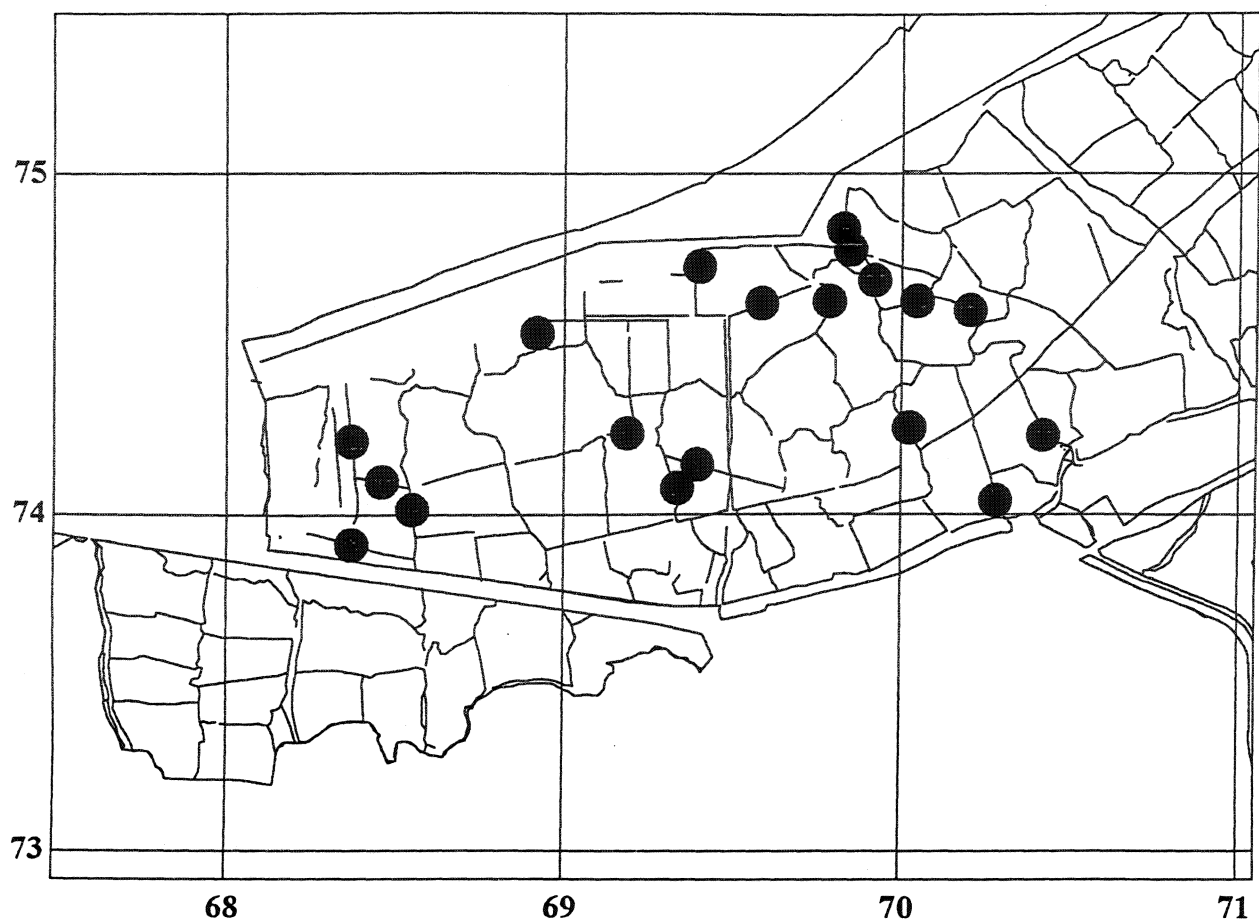
Myriophyllum aquaticum



Myriophyllum spicatum



Ranunculus baudotii



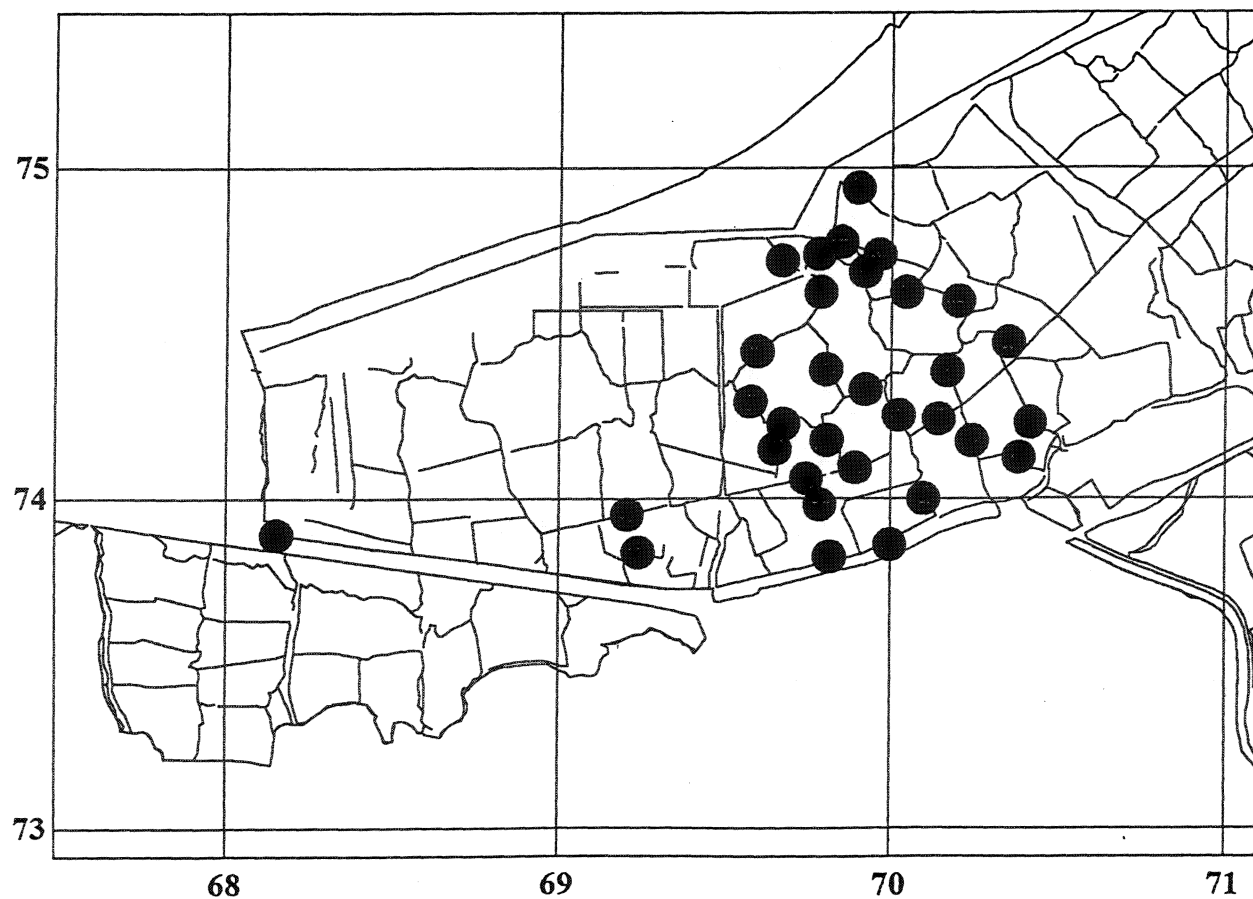
Zannichellia palustris



Alisma plantago-aquatica



Berula erecta



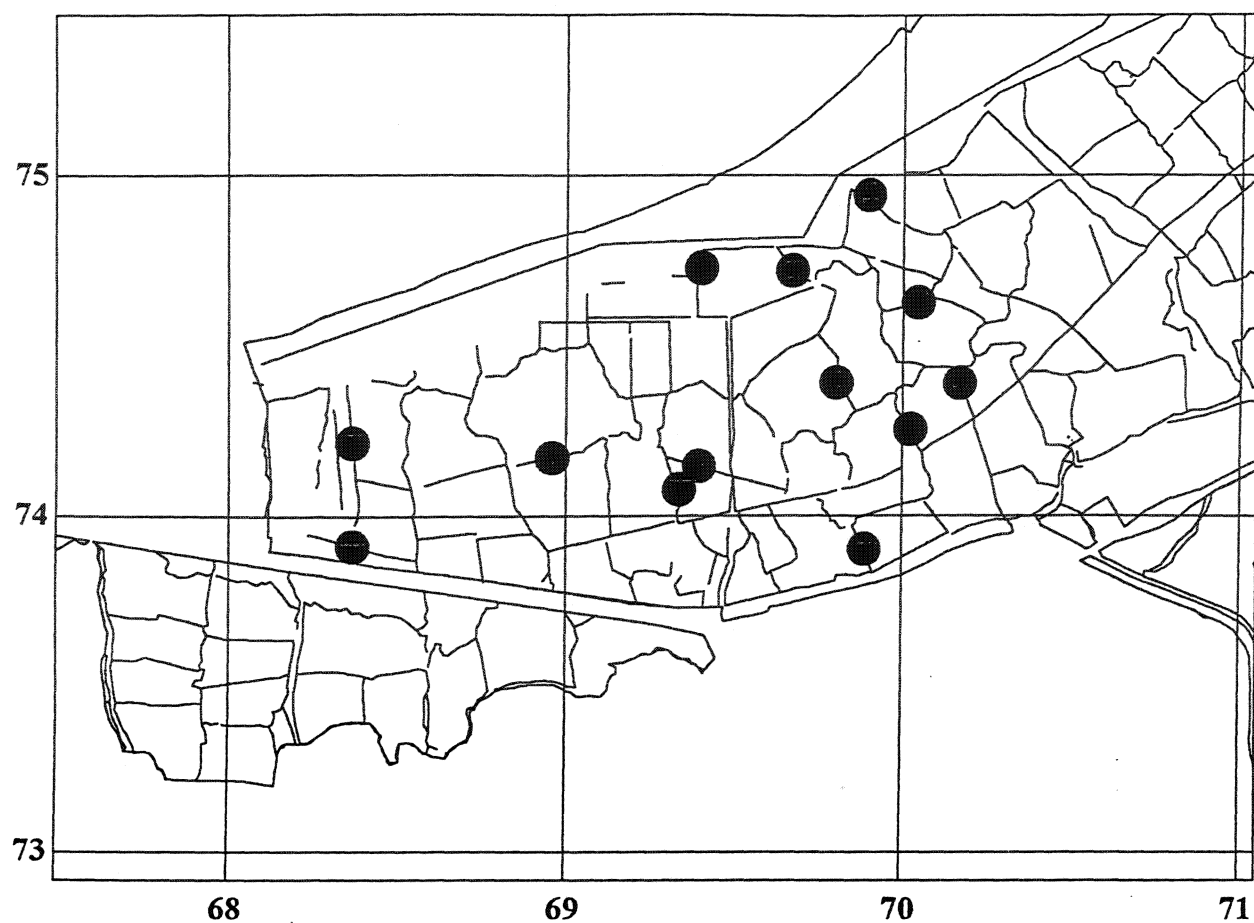
Nasturtium officinale



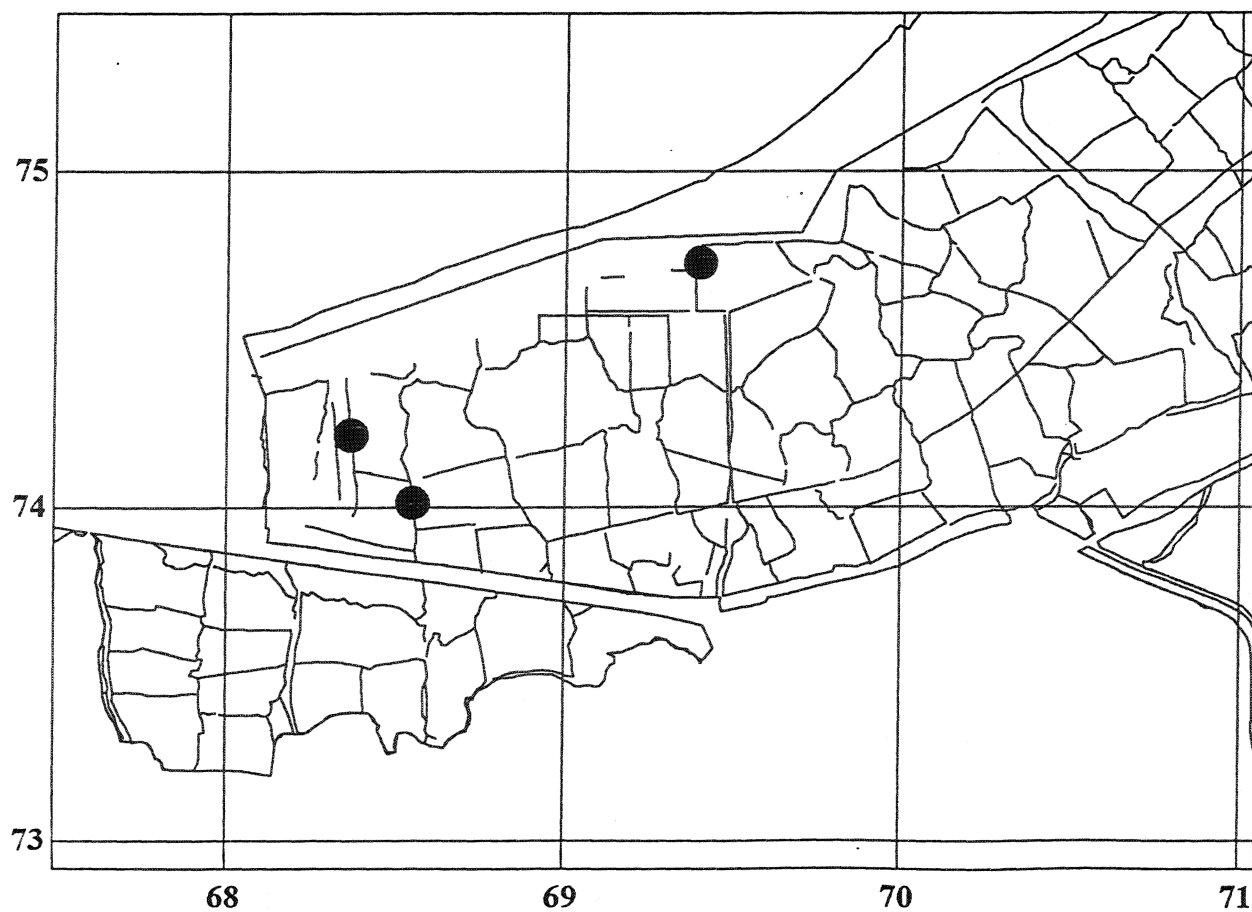
Rumex hydrolaphathum



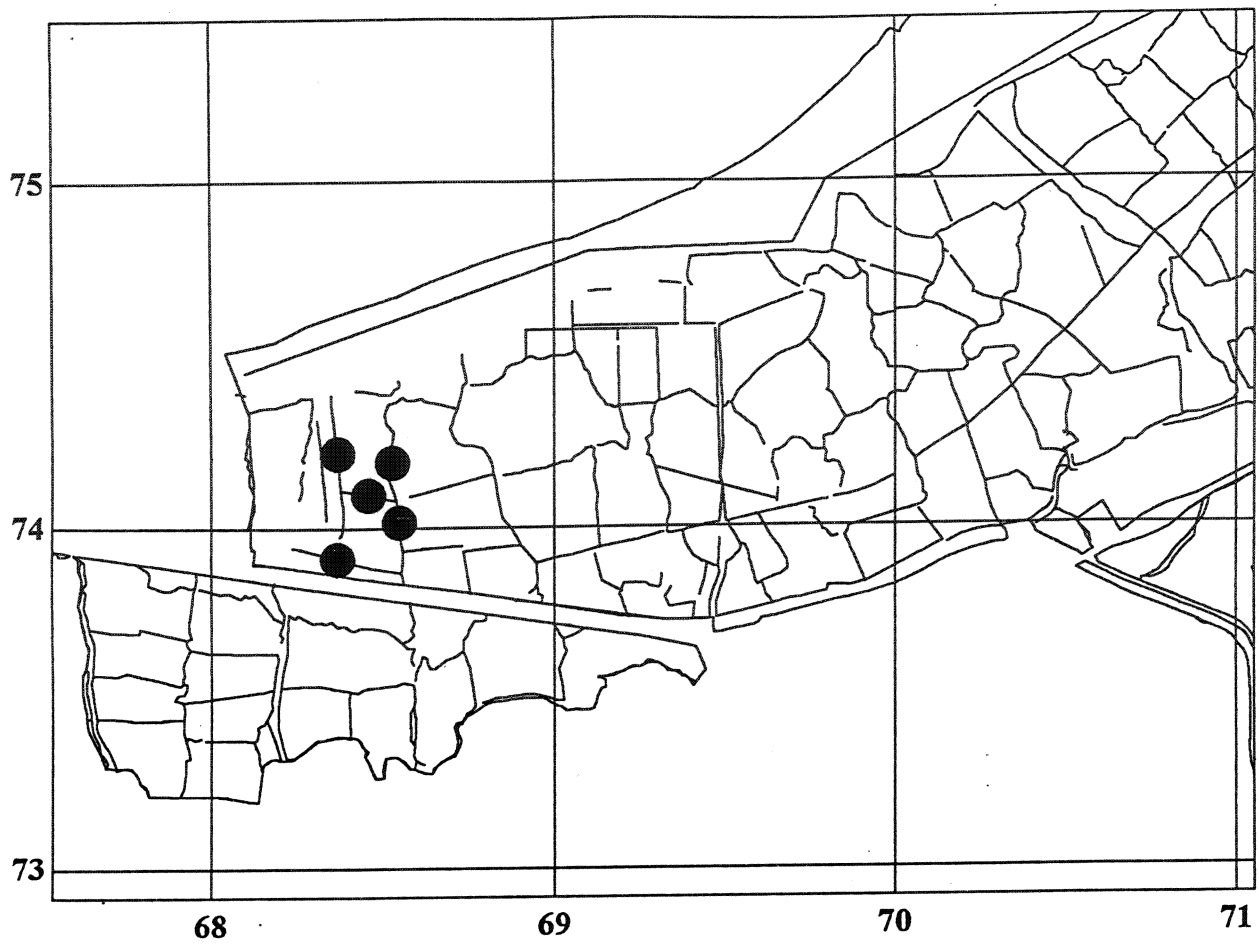
Carex divisa



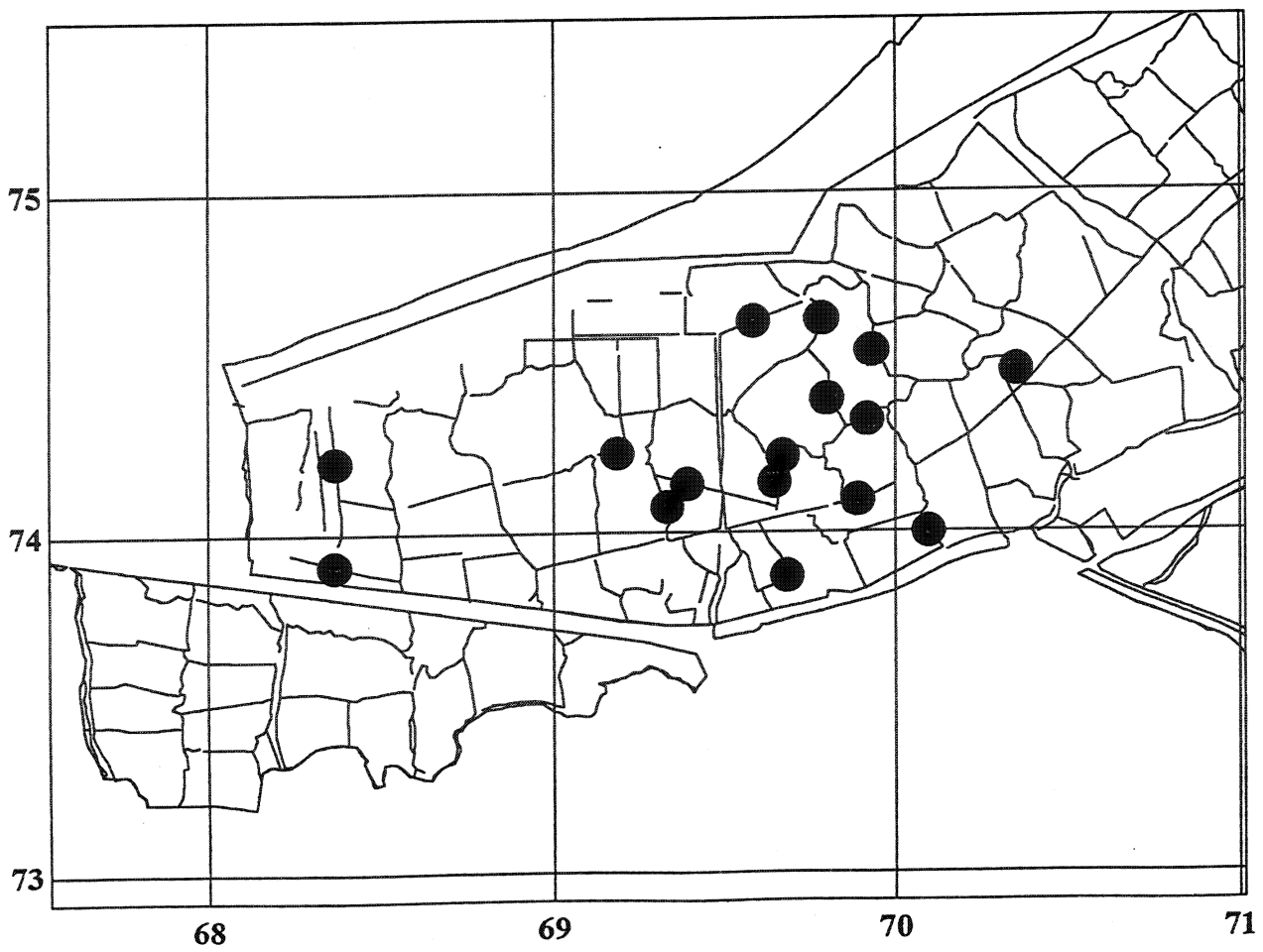
Chenopodium chenopodioides



Juncus maritimus



Oenanthe lachenalii



Triglochin palustris



BOTANICAL SURVEY OF CHETNEY MARSHES - 19&20/7/94 PHIL WILLIAMS

INTRODUCTION

English Nature holds land (not declared as NNR) at the northern end of the Chetney peninsula (part of Medway Marshes SSSI). The site comprises about 40ha of grazing marsh and a larger area of about 90ha of saltmarsh, including Deadman's Island, amounting to approximately 130ha in total. The site has not previously been surveyed in detail and a full NVC survey of all habitats was therefore necessary, in order to inform the NNR review process.

METHOD

The following habitats were surveyed and assessed separately:

1. Ditches and rills
2. Grazing sward
3. Sea and counter walls
4. Saltmarsh

Ditches and rills

A 20m section of each ditch in the grazing marsh was sample for aquatic and bank species, and any additional species along the full length of the ditch and associated rills were recorded. Species within the ditch section were given DAFOR abundance ratings.

Grazing sward

Five quadrats were recorded from the grazing sward, from which a community table was produced. In addition a full species list for the sward was recorded and overall abundance assessed using DAFOR.

Sea and counter walls

A separate species list was recorded for both the sea and the counter wall and abundance assessed using DAFOR.

Saltmarsh

Five quadrats were recorded from the saltmarsh and analysed separately for NVC community. Species were recorded separately in four areas and abundance assessed using DAFOR.

RESULTS AND ASSESSMENT

1. Ditches and rills

Six ditch sections were recorded from the grazing marsh. The results are given in Table 1. This shows that the range of aquatic species is limited; sea club-rush *Scirpus maritima* is the only emergent species and only two submerged species were recorded, fennel pondweed *Potamogeton pectinatus* and brackish water-crowfoot *Ranunculus baudotii*. This may reflect very high salinity in the ditches, in addition to which most are shallow and tend to dry out in late summer.

Those ditches with a wide muddy margin however, including the rills, support a range of bank species generally associated with upper salt-marsh, such as Gerards rush *Juncus gerardii*, lesser sea-spurrey *Spergularia marina*, sea milk wort *Glaux maritima*, halberd-leaved orache *Atriplex prostrata*, glasswort *Salicornia sp.*, and annual beard grass *Polypogon monspeliensis*. There is also an abundance of the nationally scarce small red goosefoot *Chenopodium chenopodioides*, colonising areas of bare mud. The main interest of the ditches and rills is therefore associated with the muddy margin.

2. Grazing sward

The quadrat results for the grazing sward are given in Table 2, and the full species list is given in Table 3. The composition of the sward is very typical of North Kent grazing marsh, with a wide range of grass species but a limited number of forbs. The NVC community is MG6c, the *Trisetum flavescens* sub-community of *Lolium perenne* - *Cynosurus cristatus* grassland. In addition to yellow oat-grass *Trisetum flavescens* this sub-community is also characterised by an abundance of small leaved timothy *Phleum bertolonii*. Characteristic species of the grazing sward include white clover *Trifolium repens*, common bird's-foot trefoil *Lotus corniculatus*, autumn hawkbit *Leontodon autumnalis*, lesser hawkbit *L. taraxacoides*, lesser stitchwort *Stellaria graminea* and, particularly in grassy rills, hairy buttercup *Ranunculus sardus*.

3. Sea and counter walls

Table 3 gives the species list for the sea and counter walls. Though the list is very similar to the grazing sward, there are a number of species, on both the sea and counter walls, which were not recorded elsewhere. Most of these species are however associated with the seaward side of the seawall, which represents a strandline community characterised by grass leaved orache *Atriplex littoralis*, sea beat *Beta vulgaris* and scentless mayweed *Tripleurospermum maritimum*, with some buck's-horn plantain *Plantago coronopus* and sea wormwood *Artemisia maritima*. Annual sea-blite *Suaeda maritima* occurs at the base of the sea wall and forms a fringe with the saltmarsh. There are a number of scarce *Trifolium* species which occur on the seawalls along the North Kent marshes but these were not recorded here, though they may not have been so evident at this time of year.

4. Saltmarsh

Results from the saltmarsh are given in Table 4. The following NVC communities occur:

SM6 *Spartina anglica* saltmarsh

SM13 *Puccinellia maritima* saltmarsh

13c *Limonium vulgare* - *Armaria maritima* sub-community

SM14 *Halimione portulacoides* saltmarsh

14a *Halimione portulacoides* sub-community

14b *Juncus maritimus* sub-community

SM6 represents low-saltmarsh, whereas SM13 and SM14 represent mid-saltmarsh. Their relative position with regard to the major salt marsh communities in the south-east is shown in figure 1. SM13 occurs lower down the salt marsh than SM14, and is characterised by a dominance of common saltmarsh grass *Puccinellia maritima*, often with abundant common sea lavender *Limonium vulgare*, interspersed with glasswort *Salicornia* sp. In SM14, common saltmarsh grass is codominant with sea purslane *Halimione portulacoides*. Other species include sea plantain *Plantago maritima*, sea arrow grass *Triglochin maritima* and sea aster *Aster tripolium*, with golden samphire *Inula crithmoides* and sea wormwood *Artemisia maritima* on the ridges. Glasswort is much less frequent. Sea rush *Juncus maritimus* is abundant in places, indicating SM14b.

It is probable that other *Puccinellia* species also occur, such as reflex saltmarsh grass *Puccinellia natans*, but were not distinguished from common saltmarsh grass. Another grass that may have been present (but more evident earlier in the year) is the maritime subspecies of red fescue *Festuca rubra* subsp. *litoralis*.

The majority of the saltmarsh is SM13 and SM14, with a relatively small amount of SM6 around the edges of the creeks. There is no gradation of communities along the seaward side of the saltmarsh, where vertical cliff faces indicate that erosion is occurring. Deadmans's Island, which is separated from the rest of the saltmarsh by Shepherds Creek, was not visited as access is difficult on foot. It appears however to contain the same communities as the rest.

Figure 1: Relative positions of major saltmarsh communities

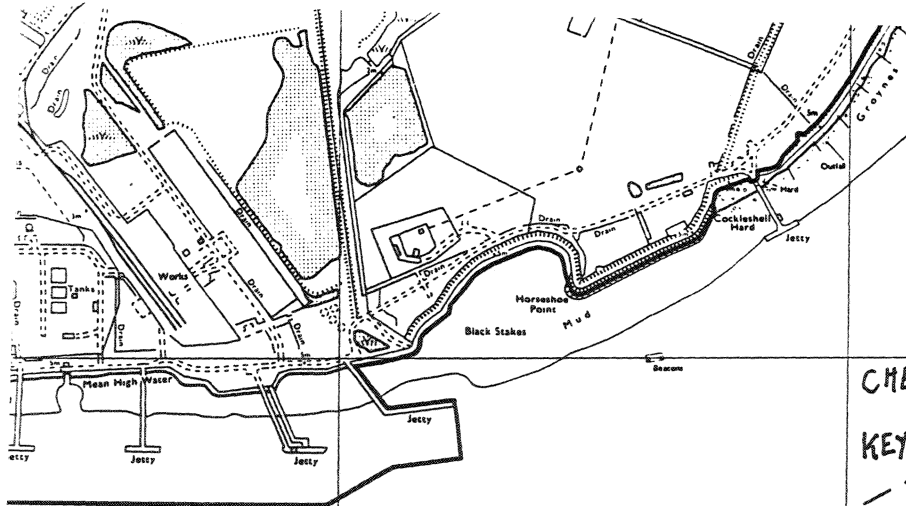
The relative positions of some major salt-marsh communities on the south-east and west coasts with an indication of zonation into low-, mid- and upper-marsh (after Adam 1981).

1. *Spartinetum townsendii*
2. *Salicornietum europaeae*
3. *Asteretum tripolii*
4. *Puccinellietum maritimae*
5. *Halimionetum portulacoidis*
6. *Juncus maritimus*-*Triglochin maritima* salt-marsh
7. *Juncetum gerardi*
8. *Artemisietum maritimae*
9. *Juncus maritimus* salt-marsh
10. *Atriplici-Elymetum pycnanthi*
11. *Elymetum repentis*

OVERALL ASSESSMENT

The relatively small area of grazing marsh within the site is nevertheless very typical of North Kent grazing marsh. Though the number of species associated with the ditches and rills is limited, those that occur are notable species and represent an important saline community which is inherently species poor. The muddy margins in particular are the most important aspect of the habitat. The invertebrate fauna in the ditches is also likely to be significant. Numbers of breeding birds however are not high, as water levels are difficult to maintain.

The much larger area of saltmarsh is of course of high botanical interest and is also important for breeding birds and invertebrates, as well as being of historical interest with regard Deadman's Island. The future protection of eroding saltmarsh is a priority along the whole of the south-east coast.



CHETNEY MARSHES SURVEY

KEY:

- Q1-6 Location of grassland quadrats
- D1-6 Location of ditch sections
- A1-4 Saltmarsh sample areas

 Site boundary

pan Reach
MEDWAY

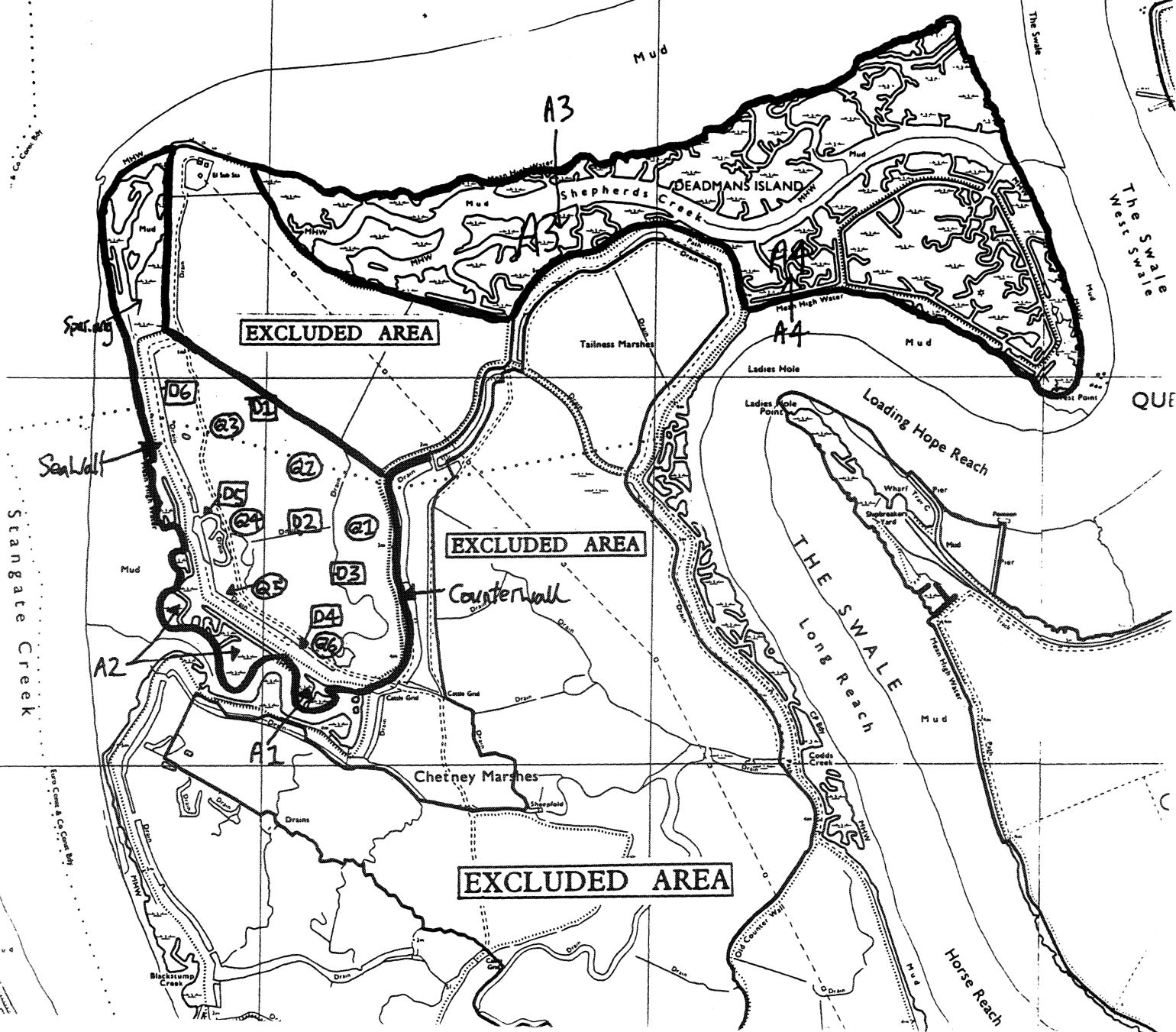


Table 1: Ditch species

Ditch number	1	2	3	4	5	6
<i>Potamogeton pectinatus</i>	A	LF	R	O	LA	
<i>Ranunculus baudotii</i>	F			O	O	
Filamentous algae		O				
<i>Scirpus maritima</i>	A	F	O	D	F	A
<i>Juncus maritimus</i>	R					
<i>Juncus gerardii</i>	F	F			F	O
<i>Atriplex prostrata</i>	O		F	O	O	F
<i>Chenopodium chenopodioides</i>			F	F	O	O
<i>Spergularia marina</i>			O	O	O	O
<i>Glaux maritima</i>			F			
<i>Salicornia</i> sp					LF	O
<i>Polypogon monspeliensis</i>				O	O	R
<i>Hordeum maritimum</i>			LF	O	LF	F
<i>Elmus pungens</i>						O

Table 2: Grassland quadrats

Quadrat number	1	3	4	5	6	constancy	2*
<i>Hordeum secalinum</i>	4	3	5	6	5	V(3-6)	2
<i>Agrostis capillaris</i>	4	5	6	3	2	V(2-6)	
<i>Tritolium repens</i>	5	4	5	4	3	V(3-5)	
<i>Phleum bertolonii</i>	4	3	4	4	4	V(3-4)	
<i>Lotus corniculatus</i>	3	4	3	4	3	V(3-4)	
<i>Lolium perenne</i>	2	2	1	4	4	V(1-4)	
<i>Holcus lanatus</i>	6	6	6	2		IV(2-6)	2
<i>Cynosurus cristatus</i>		3	4	4	3	IV(3-4)	
<i>Festuca rubra</i>	4	3	3		2	IV(2-4)	
<i>Plantago lanceolata</i>	3		3		4	III(3-4)	
<i>Agrostis stolonifera</i>	2			4	2	III(2-4)	9
<i>Stellaria graminea</i>	3	2	2			III(2-3)	
<i>Cerastium fontanum</i>	1	1	2			III(1-2)	
<i>Poa trivialis</i>	1		1		1	III(1)	2
<i>Leontodon autumnalis</i>	2			3		II(2-3)	
<i>Leontodon taraxacoides</i>			3	3		II(3)	
<i>Cirsium arvense</i>	2				2	II(2)	1
<i>Trisetum flavescens</i>					3	I(3)	
<i>Dactylis glomerata</i>					3	I(3)	
<i>Elymus repens</i>			2			I(2)	
<i>Bromus hordeaceus</i>					2	I(2)	
<i>Alopecurus geniculatus</i>					1	I(1)	
<i>Polygonum arivulare</i>						-	1
<i>Ranunculus sardus</i>						-	4

NVC - MG6c

Lolium perenne - Cynosurus cristatus grassland

Trisetum flavescens sub-community

* *Agrostis stolonifera* dominated damp rill

Table 3: Grassland and Sea/counter wall species - DAFOR distribution

	grassland	seawall	counterwall	
<i>Agrostis capillaris</i>	F	F	A	
<i>Agrostis stolonifera</i>	F	O	O	
<i>Alopecurus geniculatus</i>	O			
<i>Bromus hordeaceus</i>	O	F	F	
<i>Cynosurus cristatus</i>	O	F	O	
<i>Dactylis glomerata</i>	O	O		
<i>Elymus pungens</i>	LO	F	F	
<i>Elymus repens</i>	O	O		
<i>Festuca rubra</i>	F	F	F	
<i>Holcus lanatus</i>	A	F	O	
<i>Hordeum secalinum</i>	A	A	A	
<i>Hordeum murinum</i>	LF	F	F	
<i>Lolium perenne</i>	F	A	O	
<i>Phleum bertolonii</i>	A	F	F	
<i>Poa trivialis</i>	O	O	O	
<i>Achillea millefolium</i>	R			
<i>Artemisa maritima</i>		O		
<i>Arctium minus</i>	R			
<i>Atriplex littoralis</i>		F		*
<i>Atriplex prostrata</i>		O	O	
<i>Beta vulgaris</i>		F		*
<i>Cerastium fontanum</i>	O	O	O	
<i>Cirsium arvense</i>	F	F	F	
<i>Cirsium vulgare</i>	F	F	F	
<i>Coronopus didymus</i>	R			
<i>Geranium dissectum</i>	O	R		
<i>Lathyrus nissloia</i>			R	*
<i>Leontodon autumnalis</i>	F	F	F	
<i>Leontodon taraxacoides</i>	F	F	F	
<i>Lotus corniculatus</i>	F	F	F	
<i>Malva sylvestris</i>	R		R	
<i>Picris echioides</i>	O	O	O	
<i>Plantago coronopus</i>		O		*
<i>Plantago lanceolata</i>	F	F	F	
<i>Plantago major</i>	LO			
<i>Polygonum ariculare</i>	R	O		
<i>Potentilla reptans</i>	R			
<i>Ranunculus sardus</i>	LF		R	
<i>Rumex acetosella</i>			LF	*
<i>Rumex crispus</i>	O	O	O	
<i>Senecio jacobaea</i>	R	R	R	
<i>Soncus oleraceus</i>	R	O	O	
<i>Stellaria graminea</i>	F	O	O	
<i>Torilis nodosa</i>		O	O	*
<i>Trifolium repens</i>	A	A	A	
<i>Trifolium pratense</i>	R			
<i>Trifolium dubium</i>			R	*
<i>Tripleurospermum maritimum</i>		O		*
<i>Urtica dioica</i>	LF			
<i>Vicia sativa</i>	R		R	

* recorded only on sea/counter wall (not saltmarsh or ditch margins)

Table 4: Saltmarsh quadrats

Quadrat number	1	2	3	4	5
<i>Puccinella maritima</i>	9	5	7	7	6
<i>Limonium vulgare</i>	5	2	4	7	1
<i>Halimione portulacoides</i>	1	6	1	2	6
<i>Juncus maritimus</i>		5	6	3	
<i>Salicornia</i> sp	5		3		4
<i>Aster tripolium</i>		3	4	2	
<i>Spergularia media</i>	3		2	2	
<i>Suaeda maritima</i>			2		2
<i>Triglochin maritima</i>				3	
<i>Inula crithmoides</i>		2			
<i>Spartina anglica</i>	2				
<i>Plantago maritima</i>				2	
NVC Community	SM13c	SM14b			SM14a

DAFOR distribution	A1	A2	A3	A4
<i>Armeria maritima</i>				O
<i>Artemisia maritima</i>		O	O	
<i>Aster tripolium</i>	R	F	F	F
<i>Halimione portulacoides</i>	F	A	LF	A
<i>Inula crithmoides</i>	R	F	O	O
<i>Juncus maritimus</i>		F	LF	
<i>Limonium vulgare</i>	A	F	LF	LF
<i>Plantago maritima</i>		O	O	O
<i>Puccinella maritima</i>	A	A	A	A
<i>Salicornia</i> sp	F	F	F	F
<i>Spartina anglica</i>	O	O	LF	O
<i>Spergularia media</i>	F	F	F	F
<i>Suaeda maritima</i>	O	O	O	O
<i>Triglochin maritima</i>	O			F

COMPARISON OF TWINSpan ANALYSIS OF WALLAND MARSH AND NORTH KENT
MARSHES ESA DITCH SURVEY DATA P Williams, March 1995

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MAP 1	Distribution of communities at The Dowels and Snargate
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SUMMARY

This report presents and compares the results of twinspan analysis of ditch survey data from two sources:

1. The 1993/4 survey of Walland Marsh SSSI. (*Ditch Monitoring at Walland Marsh SSSI 1993/4*, P Williams et al.)
2. The 1993 survey of selected areas of the North Kent Marshes. (*A survey method for use in the North Kent Marshes ESA*, R Morris et al.)

The report presents the results of twinspan analysis of the 1993/4 Walland Marsh survey data. This includes the following:

- i. Ditch survey data re-organised into community tables.
- ii. A constancy table for Walland ditch communities.
- iii. A key to Walland ditch communities and a description of each community.
- iv. A community model showing possible relationships between communities, land management and salinity.
- v. Maps showing distribution of communities at The Dowels, Snargate, Fairfield and Woolpack (excludes areas in East Sussex where digitised data is not yet available.)

The 1993 survey of the North Kent Marshes ESA provided a ditch classification system for monitoring ESA management prescriptions. The following supplements the ESA report:

- i. The full ditch survey data, organised into community tables.
- ii. A constancy table for the ESA ditch communities.

1. INTRODUCTION

The survey data contained in this report comes from the 1993 ESA survey of North Kent Marshes and the 1993/4 survey of Walland Marsh. Analysis and presentation of the results has been standardised, thus allowing comparisons to be made between the two sites. Further comparison will be possible following a complete survey of ditches on the North Kent Marsh SSSIs planned for 1995, and comparisons with other grazing marsh sites should eventually lead to a common ditch classification system for all the grazing marsh SSSIs in the county.

Ditch communities have a number of uses:

1. Rapid visual monitoring of ditches to assess:
 - i. The likely botanical interest of a ditch
 - ii. Its position in the management cycle
 - iii. Salinity levels and other environmental factors
2. As a tool for monitoring the effects of management changes, such as altering the volume and flow pattern of water.
3. Investigating environmental factors and developing community models.
4. Sampling community types for associated invertebrate interest.
5. Providing a local context for national (NVC) community types.

2. METHODS

The methods used in the North Kent Marshes ESA and Walland Marsh surveys are given in their respective reports. The only significant difference in the two methods is that more quantitative data was gathered in the ESA survey. This additional information is reflected in the spreadsheet data, but does not significantly affect the comparison of twinspan analysis for the two sites.

Twinspan analysis of the Walland Marsh survey data has been achieved by transferring data from spreadsheet (QPW) format to Vespan format. Data from the ESA survey, originally entered into Vespan, has been transferred to spreadsheet format, allowing full presentation of results.

The wider significance of being able to transfer data between different formats is illustrated in Figure 1, which shows how an integrated database facilitates a much greater use of the survey data. The database will eventually contain survey data for all grazing marsh SSSIs in the county, providing the means for monitoring the botanical interest of ditches in relation to management, ownership, and environmental factors.

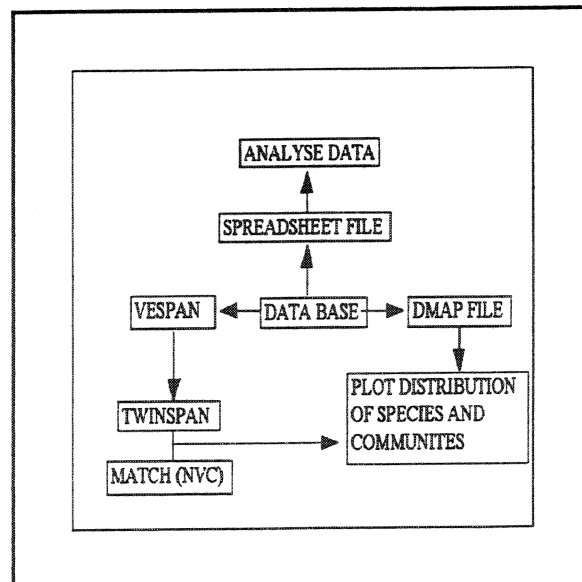


Figure 1

3. RESULTS

Ditch survey data for both North Kent Marshes ESA and Walland Marsh, arranged into community tables, is contained in Appendices I & II. Summary information is provided in Table 1, and the data is summarised as community constancy tables in Tables 2(a) and 3. Descriptions of the Walland Marsh communities are provided in Table 4; this clarifies much of the information contained in the constancy table. The constancy table for North Kent Marshes is much simpler to interpret, and supplements the description of the communities provided in the ESA report. A key to the Walland Marsh communities is given at the back of Table 4.

Table 1 Summary Information

SITE	Walland	NKM
Number of ditches in sample	525	449
Total number of species recorded	78	52
Number of communities	12	9

3.1 COMBINED TWINSpan ENDGROUPS

Most of the Walland Marsh communities correspond to a single twinspan endgroup, taken either from the 2nd, 3rd, 4th or even 5th level of division. However in community C two endgroups have been combined and three have been combined in community I. This has been done firstly because the distinctions between these combined endgroups are less important than their similarities, and secondly because of the need to produce a straight forward key to community identification. However because these endgroups are not directly linked in the division (their combination is therefore artificial) a breakdown of the two communities into the separate endgroups is provided in Table 2(b). The two communities C and I are discussed further in section 4.3.1

Table 2(a) Community Constancy Table
Walland Marsh ditch data 1993/4

	Freshwater to moderately brackish communities							Brackish communities				
Community	A	B	C	D	E	F	G	H	I	J	K	L
<i>Azolla filiculoides</i>			I			I	I					
<i>Callitriche obtusangula</i>	III	II	I	I	II	IV	II	IV	II	II	I	
<i>Ceratophyllum demersum</i>	IV	III	I	I		I			I			I
<i>C. submersum</i>	III	I	I	I	I	I		II	III		IV	I
<i>Chara</i> sp	III	I	I			I	I	I	I			
<i>Crassula helmsii</i>								I				
<i>Elodea nuttallii</i>	II	V	I	I				I	I		I	
<i>Enteromorpha</i> sp	III	III	I		I	III	I	II	II		V	
Filamentous algae	III	IV	II	I	I	IV	II	IV	III			I
<i>Fontinalis antipyretica</i>		I	I					I	I		I	
<i>Glyceria fluitans</i>	III	III	III	I	II	IV	V	II	I		I	
<i>Hottonia palustre</i>	III	I	I	I					I			
<i>Hydrocharis morsus-ranae</i>	IV	IV	III	II	I	I			I	I	I	I
<i>Lemna minor</i>	V	V	IV	II	IV	IV	II	IV	V	I	IV	II
<i>L. trisulca</i>	V	V	IV	II	V	IV	I	V	V	I	IV	IV
<i>L. gibba</i>						I	I	I		I	I	
<i>Myriophyllum spicatum</i>	I	IV	I			I		I	IV		IV	
<i>Myriophyllum verticillatum</i>		I										
<i>Nymphaea alba</i>		I										
<i>Potamogeton berchtoldii</i>	I	I							I		I	
<i>P. lucens</i>	I	II							I			
<i>P. crispus</i>	II					I			I			
<i>P. natans</i>	II	I	I			I	I	I	I			
<i>P. pectinatus</i>	I	III	I					I	IV	I	IV	
<i>P. pusillus</i>	I	I				I			I		I	
<i>P. trichoides</i>	I	I	I						I			
<i>Polygonum amphibium</i>	I	I		I	I	I			I			
<i>Ranunculus circinatus</i>	II	II							I		I	
<i>R. baudotti</i>		I				I			I		I	
<i>Ranunculus trichophyllus</i>	I	I	I	I	I	IV	II	III	I	I		I
<i>Sparganium emersum</i>		I										
<i>Utricularia</i> sp	II	I	I									
<i>Wolffia arrhiza</i>	I								I			
<i>Zannichellia palustris</i>		I				I		I		I	II	
<i>Alisma plantago-aquatica</i>	IV	III	III	I	III	V	II	I	I	II		
<i>Apium nodiflorum</i>		I	I			II		I	II	I		
<i>Berula erecta</i>		I										
<i>Butomus umbellatus</i>	I	I									I	
<i>Carex riparia</i>	I	I	I	I					I			
<i>Eleocharis palustris</i>	III	I	III			IV	III	IV	IV	II	I	I
<i>Glyceria maxima</i>	I	I	I	II	I	I	I			I		
<i>Hippuris vulgaris</i>											I	
<i>Iris pseudocorus</i>	I	I	I	I				I				
<i>Juncus articulatus</i>	I	I	II		I	II	I		I	I		
<i>Nasturtium officinale</i> agg.	IV	II	II	I	I	IV	II	III	II	I	I	
<i>Oenanthe aquatica</i>	I		I	I	II	II	II	III	II	II	I	I
<i>O. fistulosa</i>	IV	III	IV		II	IV	II	I	II	I	I	II
<i>Phalaris arundinacea</i>		I	I			I			I			
<i>Phragmites australis</i>	I	III	I	III	I	I	I	II	II	I	V	IV
<i>Ranunculus sceleratus</i>				I		I		I	I			
<i>Rumex hydrolapathum</i>	II	I	II	II	I		I		I			
<i>Sagittaria sagittifolia</i>		I										
<i>Samolus valerandi</i>	I					I	I	I	I	I		
<i>Schoenoplectus tabernaemontani</i>	II	I	I			I	I				II	
<i>Scirpus maritimus</i>	I	I	I	I	I	II	II	III	III	III	V	IV
<i>Sparganium erectum</i>	V	III	III	II	IV	III	III	II	II	III	I	I
<i>Typha angustifolia</i>	I	I	II	III	II		I		I	I	I	I
<i>Veronica catenata</i>		I				II	II	III	I		I	
<i>Typha latifolia</i>	I			I					I	I		
<i>Agrostis stolonifera</i>	I	I	II		I	I	I	I				
<i>Althaea officinalis</i>	I	I	I	I		I		I	I	III	I	II
<i>Carex divisa</i>										I	I	I
<i>Carex distans</i>		I	I						I	I		
<i>Carex otrubae</i>	I	II	II		IV	III	III	III	II	IV	II	II
<i>Epilobium hirsutum</i>		I	I	I		I		I	I	I		I
<i>Equisetum palustre</i>		I		I			I			I		I
<i>Galium palustre</i>	II		II		II	III	III	III	I	II	I	
<i>Glaux maritima</i>						I			I	I	I	II
<i>Hydrocotyle vulgaris</i>	I	I	II			I	I	I	I	I		
<i>Juncus effusus</i>	II	I	III	I								
<i>Juncus inflexus</i>	V	IV	III	IV	V	IV	V	III	II	III	II	
<i>J. gerardii</i>		I				I	I	I	I	I	I	I
<i>Lycopus europaeus</i>	I	I	I	I			I		I	I	I	
<i>Lythrum salicaria</i>	I		I	I	I							
<i>Mentha aquatica</i>	I	I	I	I	I	I	I	I				
<i>Myosotis laxa</i>	I		I		II	II	II					
<i>Oenanthe lachenalii</i>	I	II	I	I	I	I	I	I	II	I	III	II
<i>Pulicaria dysenterica</i>	I	I	I	I	I			I	I	I	I	I
<i>Sium latifolium</i>	I	I	I									
<i>Solanum dulcamara</i>	I		I	II	I		I			II		II
<i>Triglochin maritima</i>								I				I
<i>Triglochin palustris</i>						I		I	I		I	
choked ditches		II	III	V	IV	I	III	I	I	III	I	II

Community	A	B	C	D	E	F	G	H	I	J	K	L
average number of aquatics	8.8	8.6	3.6	1.5	2.6	5.5	2.4	5.4	5.9	0.8	5.4	2.9
average number of emergents	5.3	4.1	4.1	2.6	3	5.4	3.4	4	3.7	2.4	2.4	2.2
average number of bank species	3.8	2.3	3	2	3.4	2.9	3.2	2.6	1.7	3.5	1.3	1.7
average number of all species	16.9	14.9	10.6	6	8.9	13.8	9	12	11.3	6.7	9.2	6.8

total number of species	58	67	58	39	38	54	43	53	65	40	42	26
number of species per 20m	11-25	8-21	1-18	2-11	7-13	9-19	3-15	4-21	1-21	3-12	2-18	3-12
number of ditches in sample	16	34	56	26	20	41	32	65	148	30	43	14

Table 2(b) Percentage frequency of species for combined endgroups in communities I and C

Community I

number of ditches	37	55	55
twinspan endgroup	0011	0101	01100
<i>Azolla filiculoides</i>			1.8
<i>Callitriche obtusangula</i>		32.7	25.0
<i>Ceratophyllum demersum</i>	5.4	36.4	5.4
<i>C. submersum</i>	45.9	58.2	53.6
<i>Chara</i> sp		1.8	
<i>Elodea nuttallii</i>		30.9	1.8
<i>Enteromorpha</i> sp	29.7	50.9	32.1
Filamentous algae	10.8	63.6	48.2
<i>Fontinalis antipyretica</i>	2.7	7.3	
<i>Glyceria fluitans</i>	2.7	25.5	26.8
<i>Hottonia palustre</i>			1.8
<i>Hydrocharis morsus-ranae</i>		18.2	8.9
<i>Lemna minor</i>	81.1	81.8	82.1
<i>L. trisulca</i>	70.3	100	89.3
<i>L. gibba</i>	5.4	1.8	1.8
<i>Myriophyllum spicatum</i>	56.8	87.3	55.4
<i>Potamogeton berchtoldii</i>	2.7	5.5	5.4
<i>P. lucens</i>		1.8	
<i>P. crispus</i>		12.7	1.8
<i>P. natans</i>		1.8	
<i>P. pectinatus</i>	73.0	85.5	64.3
<i>P. pusillus</i>	5.4	5.5	
<i>P. trichoides</i>		7.3	1.8
<i>Polygonum amphibium</i>		1.8	1.8
<i>Ranunculus circinatus</i>		3.6	
<i>R. baudotti</i>		12.7	
<i>Ranunculus trichophyllus</i>	10.8	27.3	19.6
<i>Wolffia arrhiza</i>		1.8	
<i>Zannichellia palustris</i>		5.5	5.4
<i>Alisma plantago-aquatica</i>	2.7	38.2	8.9
<i>Apium nodiflorum</i>	2.7	41.8	23.2
<i>Carex riparia</i>			1.8
<i>Eleocharis palustris</i>	54.1	76.4	87.5
<i>Iris pseudocorus</i>		1.8	
<i>Juncus articulatus</i>	5.4	5.5	5.4
<i>Nasturtium officinale</i> agg		30.9	28.6
<i>Oenanthe aquatica</i>	2.7	32.7	23.2
<i>O. fistulosa</i>	13.5	52.7	48.2
<i>Phalaris arundinacea</i>	2.7		
<i>Phragmites australis</i>	37.8	25.5	12.5
<i>Ranunculus sceleratus</i>		1.8	1.8
<i>Rumex hydrolapathum</i>		7.3	
<i>Samolus valerandi</i>	5.4	1.8	10.7
<i>Schoenoplectus tabernaemo</i>	35.1	23.6	8.9
<i>Scirpus maritimus</i>	78.4	56.4	51.8
<i>Sparganium erectum</i>		30.9	37.5
<i>Typha angustifolia</i>		9.1	
<i>Veronica catenata</i>	2.7	23.6	8.9
<i>Agrostis stolonifera</i>		7.3	5.4
<i>Althaea officinalis</i>	10.8	10.9	12.5
<i>Carex distans</i>			3.6
<i>Carex divisa</i>	2.7	1.8	
<i>Carex otrubae</i>	27.0	29.1	17.9
<i>Epilobium hirsutum</i>	2.7		
<i>Galium palustre</i>	5.4	18.2	10.7
<i>Glaux maritima</i>	8.1	3.6	3.6
<i>Hydrocotyle vulgaris</i>		7.3	1.8
<i>Juncus inflexus</i>	35.1	50.9	57.1
<i>J. gerardii</i>	13.5	18.2	12.5
<i>Lycopus europaeus</i>	2.7	1.8	
<i>Myosotis laxa</i>		9.1	
<i>Oenanthe lachenalii</i>	40.5	29.1	10.7
<i>Solanum dulcamara</i>	2.7	9.1	3.6
<i>Solanum dulcamara</i>			1.8
<i>Triglochin palustris</i>	16.2	3.6	3.6

number of aquatic species	14	27	21
number of emergent species	12	17	15
number of bank species	12	14	13
total number of species	38	58	49

Community C

number of ditches	32	24
twinspan endgroup	01110	1000
<i>Azolla filiculoides</i>	12.5	
<i>Callitriche obtusangula</i>	18.8	12.5
<i>Ceratophyllum demersum</i>	21.9	
<i>C. submersum</i>	12.5	4.2
<i>Chara</i> sp	6.3	
<i>Elodea nuttallii</i>	3.1	
<i>Enteromorpha</i> sp	9.4	
Filamentous algae	40.6	25.0
<i>Fontinalis antipyretica</i>		8.3
<i>Glyceria fluitans</i>	40.6	54.2
<i>Hottonia palustre</i>	6.3	16.7
<i>Hydrocharis morsus-ranae</i>	65.6	41.7
<i>Lemna minor</i>	87.5	33.3
<i>L. trisulca</i>	90.6	29.2
<i>Myriophyllum spicatum</i>	3.1	
<i>P. natans</i>		16.7
<i>P. pectinatus</i>	3.1	
<i>P. trichoides</i>	6.3	
<i>Ranunculus trichophyllus</i>		8.3
<i>Utricularia</i> sp	6.3	
<i>Alisma plantago-aquatica</i>	37.5	58.3
<i>Apium nodiflorum</i>	3.1	
<i>Carex riparia</i>	3.1	4.2
<i>Eleocharis palustris</i>	53.1	45.8
<i>Glyceria maxima</i>	12.5	8.3
<i>Iris pseudocorus</i>	3.1	
<i>Juncus articulatus</i>	28.1	50.0
<i>Nasturtium officinale</i> agg	40.6	29.2
<i>Oenanthe aquatica</i>	15.6	
<i>O. fistulosa</i>	75.0	87.5
<i>Phalaris arundinacea</i>	3.1	
<i>Phragmites australis</i>	9.4	
<i>Rumex hydrolapathum</i>	31.3	8.3
<i>Samolus valerandi</i>	9.4	
<i>Schoenoplectus tabernaemo</i>	18.8	12.5
<i>Scirpus maritimus</i>	9.4	4.2
<i>Sparganium erectum</i>	59.4	37.5
<i>Typha angustifolia</i>	25.0	16.7
<i>Veronica catenata</i>	3.1	4.2
<i>Agrostis stolonifera</i>	15.6	41.7
<i>Althaea officinalis</i>	6.3	
<i>Carex distans</i>	3.1	4.2
<i>Carex otrubae</i>	21.9	33.3
<i>Epilobium hirsutum</i>	6.3	4.2
<i>Equisetum palustre</i>		4.2
<i>Galium palustre</i>	34.4	50.0
<i>Hydrocotyle vulgaris</i>	15.6	54.2
<i>Juncus effusus</i>	37.5	45.8
<i>Juncus inflexus</i>	56.3	45.8
<i>J. gerardii</i>		4.2
<i>Lycopus europaeus</i>	6.3	8.3
<i>Lythrum salicaria</i>	3.1	
<i>Mentha aquatica</i>	15.6	12.5
<i>Myosotis laxa</i>	15.6	16.7
<i>Oenanthe lachenalii</i>	12.5	8.3
<i>Pulicaria dysenterica</i>	6.3	8.3
<i>Sium latifolium</i>	3.1	
<i>Solanum dulcamara</i>	9.4	

number of aquatic species	17	12
number of emergent species	19	13
number of bank species	17	15
total number of species	53	40

Table 3 Community Constancy Table
NKM 1993 ESA ditch data

twinspan end group	CA1	CA2	CB1	CB2	DA	DB	DC	DD1	DD2
<i>Azolla filiculoides</i>		I	I	I	I			I	
<i>Callitriche obtusangula</i>		I	I	II	I	I	I		I
<i>Callitriche stagnalis</i>		I		I	I	I	II		I
<i>Ceratophyllum demersum</i>			I	I	I	II			
<i>Ceratophyllum submersum</i>		I	II	IV	V	I	I	I	
<i>Chara</i>					I	I	I		
<i>Elodea canadensis</i>					I		I		
<i>Elodea nuttallii</i>						I			
<i>Hydrocharis morsus-ranae</i>						IV	I		
<i>Lemna gibba</i>			I	I	II	II			
<i>Lemna minor</i>		I		III	V	IV	III	I	I
<i>Lemna trisulca</i>		I	I	III	V	IV	II	II	
<i>Myriophyllum spicatum</i>	II	I	I	II	I	II	I		I
<i>Myriophyllum verticillatum</i>							I		
<i>Potamogeton crispus</i>					I				
<i>Potamogeton pectinatus</i>	II	I	V	III	II	I	I		I
<i>Potamogeton pusillus</i>	I	I	I		I		I		
<i>Ranunculus baudotii</i>	II	I	III	III	I	I		I	
<i>Spirodela polyrhiza</i>				I	I	I			
<i>Zannichellia palustris</i>			II	I	I				I
<i>Alisma plantago-aquatica</i>				I	I	II	I		
<i>Apium nodiflorum</i>		I		I	I		III		
<i>Berula erecta</i>		I	I		III	V	I		
<i>Eleocharis palustris</i>	I	I	I	IV	IV	I	III		
<i>Eleocharis uniglumis</i>	I								
<i>Equisetum fluviatile</i>				I					
<i>Glyceria fluitans</i>		I		I	I				
<i>Glyceria maxima</i>						I	IV		I
<i>Hippuris vulgaris</i>	II			I	I		I		
<i>Nasturtium officinale</i>	I		I	I	II	I	IV	I	I
<i>Oenanthe crocata</i>							I		
<i>Oenanthe fistulosa</i>		I	I	II	I	II	II		I
<i>Phragmites australis</i>	IV	I	I	I	III	V	III	V	V
<i>Ranunculus sceleratus</i>	I	I		I	I				
<i>Rumex hydrolapathum</i>				I	I	I	I		
<i>Sagittaria sagittifolia</i>						I			
<i>Scirpus lacustris lacustris</i>						I			
<i>Scirpus lacustris tabernaemonti</i>	I	I	I	I	I	II	I		
<i>Scirpus maritimus</i>	V	V	V	V	III	III	II	III	
<i>Sparganium erectum</i>	I		I	II	II	II	III		
<i>Typha angustifolia</i>	I	I		I	I		I	IV	
<i>Typha latifolia</i>		I			I				I
<i>Veronica anagallis-aquatica</i>				I	I				
<i>Veronica catenata</i>	I		I	I	I	I	II	I	
<i>Agrostis stolonifera</i>	I	III	I	II	I	I	I	I	I
<i>Aster tripolium</i>	I	I	I		I				I
<i>Iberis amara</i>			I						
<i>Lycopus europaeus</i>		I		I	I				
<i>Mentha aquatica</i>				I	I	I			
<i>Myosotis scorpioides</i>				I	I		I	I	
<i>Oenanthe lachenalii</i>		I							
<i>Rumex maritimus</i>	I								

twinspan end group	CA1	CA2	CB1	CB2	DA	DB	DC	DD1	DD2
average number of aquatics	0.9	0.3	2.2	3.4	3.9	3.6	1.9	0.7	0.3
average number of emergents	2.4	1.3	1.3	3.3	3.8	4.3	4.6	2.3	1.1
average number of bank species	0.2	0.5	0.1	0.3	0.1	0.2	0.2	0.1	0.1
average number of all species	3.5	2.1	3.6	7	7.8	8	6.6	3.2	1.5

total number of all species	18	25	23	34	40	31	30	12	13
number of species per ditch	2-9	1-6	2-7	3-13	5-14	3-19	3-13	2-7	1-5
number of ditches in sample	36	109	76	82	58	25	14	15	34

WALLCOMM

Community code	Average No of species	Min-max	Choked ditches	Salinity range	Community constants	Description of community
A	16.9	11-25		FRESH	Key characteristic species: Sparganium erectum, Hottonia palustre, Hydrocharis morsus-ranae, Chara sp Ceratophyllum demersum, Alisma plantago-aquatica, Nasturtium officinale Others: Callitriche obtusangula, C. submersum, Enteromorpha, Filamentous algae Glyceria fluitans, Lemna minor, L. trisulca, Eleocharis palustris Oenanthe fistulosa, Juncus inflexus Potamogeton crispus, P natans, Utricularia sp preferential	An exceptionally species-rich community comprising a relatively small number of freshwater ditches. The dominant aquatic species include Hydrocharis morsus-ranae and Ceratophyllum demersum, and Hottonia palustris. Ceratophyllum submersum, and Chara sp are also notably frequent. Fairly frequent are Potamogeton crispus, P. natans, Ranunculus circinatus and Utricularia sp. The dominant emergent species is Sparganium erectum, though Alisma plantago-aquatica, Nasturtium officinale and Oenanthe fistulosa are also constant. Juncus inflexus is the only constant species on the bank. This community probably develops into communities E and D at a later stage in the management cycle.
B	14.9	8-21	II	FRESH	Key characteristic species: Elodea nuttallii, Hydrocharis morsus-ranae Myriophyllum spicatum, Potamogeton pectinatus Others: Ceratophyllum demersum, Enteromorpha, Filamentous algae Glyceria fluitans, Lemna minor, L. trisulca, Alisma plantago-aquatica Oenanthe fistulosa, Phragmites australis, Sparganium erectum, Juncus inflexus	A species-rich freshwater community closely related to A. The dominant aquatic species in this community however include Elodea nuttallii, Myriophyllum spicatum and Potamogeton pectinatus, and the emergent Phragmites australis is more frequent in this community. The Phragmites dominant ditches in this community probably develop into community D at a later stage in the management cycle, while ditches with Sparganium probably develop into communities C and E.
C	10.6	1-18	III	FRESH	Key characteristic species: Oenanthe fistulosa, Hydrocharis morsus-ranae, Eleocharis palustris Juncus effusus Others: Lemna minor, L. trisulca, Glyceria fluitans, Alisma plantago-aquatica Sparganium erectum, Juncus inflexus Hydrocotyle vulgaris preferential	A moderately species-rich community comprising the largest group of freshwater ditches, intermediate between the species-rich communities A and B and the predominantly choked ditches in community E. The most frequent aquatic species are Lemna minor, L. trisulca, Glyceria fluitans and Hydrocharis morsus-ranae, with the emergents Oenanthe fistulosa, Sparganium erectum and Eleocharis palustre. On the banks, Juncus effusus is co-dominant with J. inflexus and Hydrocotyle vulgaris is notably frequent.

Community code	Average No of species	Min-max	Choked ditches	Salinity range	Community constants	Description of community
D	6.0	2-11	V	FRESH	Key characteristic species: Phragmites australis, Typha angustifolia Others: Juncus inflexus Glyceria maxima preferential	A species-poor freshwater community comprising ditches predominantly choked by Phragmites australis and/or Typha angustifolia, and less frequently by Glyceria maxima or Carex riparia. The aquatic species Lemna minor, L. trisulca and Hydrocharis morsus-ranae occur with limited frequency.
E	8.9	7-13	IV	FRESH	Key characteristic species: Sparganium erectum, Typha angustifolia Others: Lemna minor, L. trisulca, Alisma plantago-aquatica Carex otrubae, Juncus inflexus	A species-poor freshwater community, generally dominated by Sparganium erectum and/or Typha angustifolia. Alisma plantago-aquatica is also frequent. Lemna minor and L. trisulca are the dominant aquatic species, with few other aquatics present. On the banks Juncus inflexus and Carex otrubae are dominant. This community probably develops from the species-rich freshwater communities A and B at a later stage in the management cycle.
F	13.8	9-19	I	MODERATE	Key characteristic species: Alisma plantago-aquatica, Ranunculus trichophyllus Oenanthe fistulosa, Glyceria fluitans Others: Callitriche obtusangula, Enteromorpha, Filamentous algae Lemna minor, L. trisulca, Eleocharis palustris, Nasturtium officinale Sparganium erectum, Carex otrubae, Galium palustre, Juncus inflexus	A species-rich moderately brackish community which probably develops into community G at a later stage in the management cycle. A wide range of aquatic species frequently occur; particularly frequent are Callitriche obtusangula and Ranunculus trichophyllus. Filamentous algae and Enteromorpha are also noticeably frequent. The most frequent emergent species are Alisma plantago-aquatica, Eleocharis palustris, Nasturtium officinale and Oenanthe fistulosa, with Scirpus maritima less frequent than Sparganium erectum. The same species occur on the bank as in community G.
G	9.0	3-15	III	MODERATE	Key characteristic species: Glyceria fluitans Others: Eleocharis palustris, Sparganium erectum Carex otrubae, Juncus inflexus	A species-poor moderately brackish community dominated by Glyceria fluitans and Juncus inflexus. In some ditches the dominant species is Sparganium erectum. Quite a wide range of emergent species occur fairly frequently, including Eleocharis palustris and Nasturtium officinale. In addition to Juncus inflexus, Carex otrubae, Galium palustre and Myosotis laxa are frequent on the banks.

Community code	Average No of species	Min-max	Choked ditches	Salinity range	Community constants	Description of community
H	12.0	4-21	I	BRACKISH	Key characteristic species: Oenanthe aquatica, Veronica catenata, Scirpus maritima Others: Callitriche obtusangula, Filamentous algae, Lemna minor L. trisulca, Ranunculus trichophyllus, Eleocharis palustris Nasturtium officinale, Carex otrubae, Galium palustre Juncus inflexus	This species-rich community is probably a more brackish version of community F, with Scirpus maritima and Veronica catenata more frequent in this community and Glyceria fluitans, Alisma plantago-aquatica and Oenanthe fistulosa much less frequent. Eleocharis palustris is the most frequent emergent species, and Oenanthe aquatica is also notably frequent. The range of aquatic species is very similar to community F, though Ceratophyllum submersum is more frequent. The bank species are the same in this community as in communities F and G.
I	11.3	1-21	I	BRACKISH	Key characteristic species: Myriophyllum spicatum, Potamogeton pectinatus Eleocharis palustris, Scirpus maritima Others: Ceratophyllum submersum, Filamentous algae, Lemna minor L. trisulca	This moderately species-rich brackish community comprises the largest group of ditches, classified by the NVC as A11. It is characterised by the predominance of the aquatic species Myriophyllum spicatum and Potamogeton pectinatus, and the emergent species Eleocharis palustris and Scirpus maritima. Generally the number of bank species is low, but Oenanthe lachenalii is fairly frequent.
J	6.7	3-12	III	BRACKISH	Key characteristic species: Scirpus maritimus, Sparganium erectum, Althea officinalis Others: Carex otrubae, Juncus inflexus	A species-poor brackish community dominated by Scirpus maritima, Sparganium erectum, Carex otrubae, Juncus inflexus and, more importantly, Althea officinalis. Aquatic species are very infrequent; only Callitriche obtusangula occurs with any frequency. The principle difference between this community and community L is the infrequency in this community of Phragmites australis and Lemna trisulca.
K	9.2	2-18	I	BRACKISH	Key characteristic species: Ceratophyllum submersum, Enteromorpha, Myriophyllum spicatum Potamogeton pectinatus, Phragmites australis, Scirpus maritima Others: Lemna minor, L. trisulca, Oenanthe lachenalii Zannichellia palustris preferential	A species-poor brackish community which may represent either a more brackish or eutrophic version of community I. Scirpus maritima, Phragmites australis and Enteromorpha are the dominant species, with Potamogeton pectinatus, Myriophyllum spicatum and Ceratophyllum submersum also frequent. Zannichellia palustris and Schoenoplectus tabernaemontani are also fairly frequent. Emergent and bank species are limited, though Oenanthe lachenalii is noticeably frequent.

Community code	Average No of species	Min-max	Choked ditches	Salinity range	Community constants	Description of community
L	6.8	3-12	II	BRACKISH	Key characteristic species: Lemna trisulca, Phragmites australis, Scirpus maritima	A species-poor brackish community with only three constant species: Scirpus maritima, Phragmites australis and Lemna trisulca. Phragmites australis is often the dominant species.

KEY TO WALLAND MARSH DITCH COMMUNITIES

1. *Potamogeton pectinatus* and *Myriophyllum spicatum* 2
 frequent or constant..... 2
 Both species absent or very infrequent..... 4
2. *Scirpus maritima* and *Ceratophyllum submersum* 3
 frequent or constant..... 3
Hydrocharis morsus-ranae and *Sparganium erectum*
 frequent or constant B
3. *Phragmites australis* and *Enteromorpha* constant,
Zanichellia palustre preferential..... K
Eleocharis palustris frequent or constant,
Apium nodiflorum preferential..... I
4. *Scirpus maritimus* frequent or constant..... 5
Scirpus maritimus absent or infrequent, *Sparganium*
erectum and/or *Typha angustifolia* frequent or constant.. 6
5. *Phragmites australis* co-dominant with *Scirpus*..... L
Eleocharis palustris, *Nasturtium officinale*,
 and *Veronica catenata* frequent or constant..... H
Althea officinalis frequent, ditch often choked..... J
6. *Phragmites australis* and *Typha angustifolia* frequent
 or constant, *Glyceria maxima* preferential..... D
Hydrocharis morsus-ranae and/or *Glyceria fluitans*
 frequent or constant..... 7
7. *Glyceria fluitans* frequent or constant,
Scirpus maritimus occasional..... 8
Hydrocharis morsus-ranae frequent or constant..... 9
8. *Lemna* spp, *Alisma plantago-aquatica*, *Oenanthe fistulosa*
 and *Nasturtium officinale* frequent or constant..... F
Glyceria fluitans dominant, mainly choked ditches..... G
9. *Ceratophyllum* spp, *Chara* sp, *Nasturtium officinale*
 and *Hottonia palustre* frequent or constant..... A
 These species not frequent, ditch frequently choked.... 10
10. *Sparganium erectum* and *Lemna* spp frequent or constant... E
Oenanthe fistulosa, *Eleocharis palustris*, *Juncus* spp
 and *Hydrocotyle vulgaris* frequent or constant..... C

4. DISCUSSION

4.1 COMMUNITY MODELLING

The constancy table for Walland Marsh (Table 2(a)) shows a clear link between certain communities and the frequency of choked ditches. In turn these communities appear to be species-poor versions of other communities. Another major environmental factor reflected in the community divisions is salinity, which can be broadly assessed by the relative frequency of brackish or fresh water species in each community. From such comparisons a model of the relationships between communities and environmental factors can be developed and then tested. Figure 2 shows the communities in relation to each other, salinity and the management cycle.

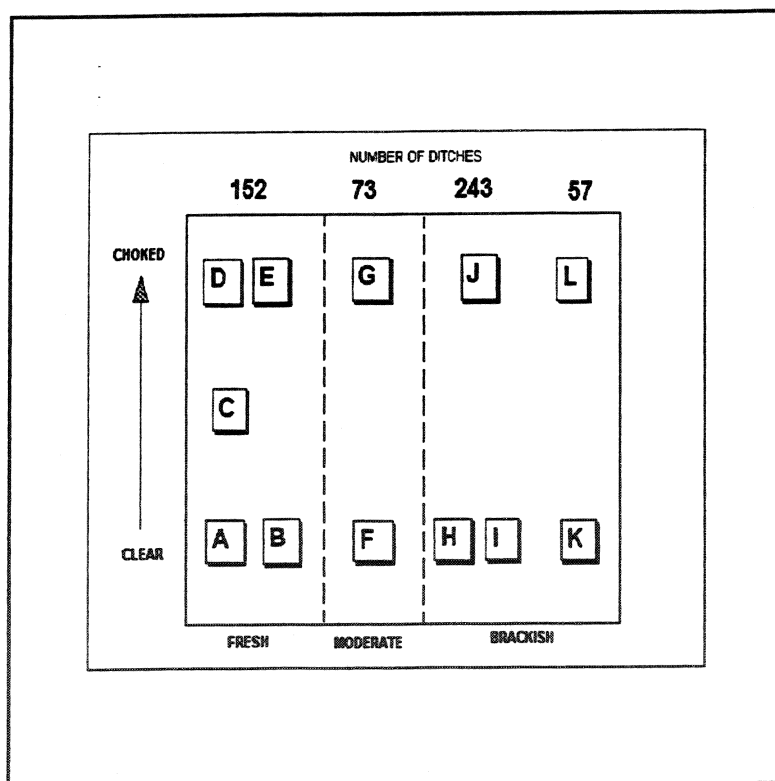


Figure 2

It has been possible to partially test this model using salinity values taken from a sample of brackish and freshwater ditches, and the communities have also been correlated with information on adjacent land use.

4.2 SALINITY RANGES

Salinity readings from a sample of 85 ditches at Fairfield and The Dowels were collected in February 1995. These values have been correlated with ditch communities in Figure 3. (Only those communities covered by the sample of ditches are represented.)

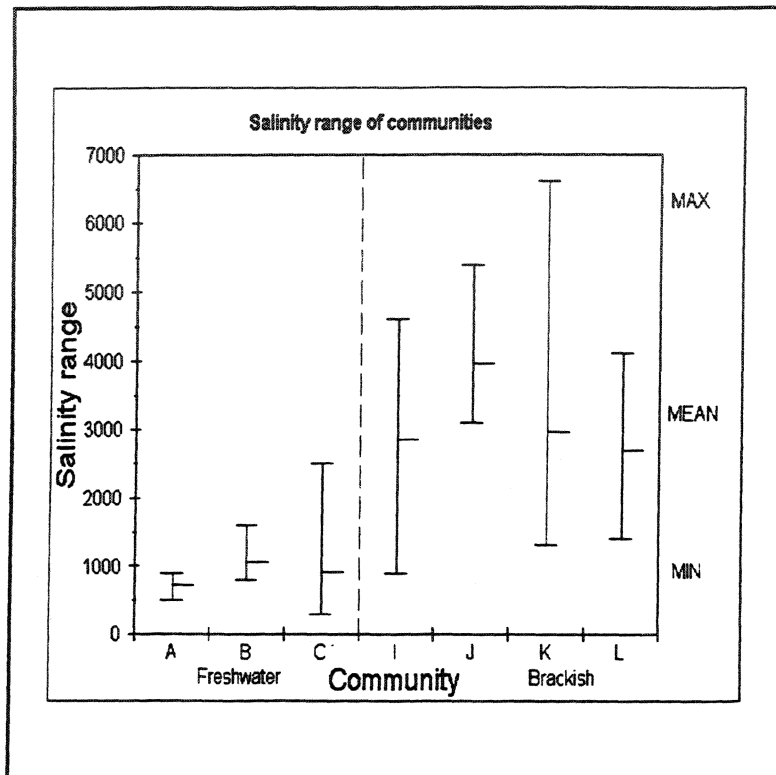


Figure 3

Though their salinity ranges overlap, there is a clear distinction between the mean values for the freshwater communities A, B and C and the brackish communities I, J, K and L. There is no apparent difference in salinity between communities I and J on the one hand and K and L on the other. However more salinity data, collected in summer when salinity levels are likely to be at their highest, is required to provide more comprehensive and reliable results.

4.3 COMMUNITY DISTRIBUTION AND ADJACENT LAND USE

Ditch communities have been correlated with adjacent land use using the χ^2 significance test. The overall proportion of ditches in pasture, adjacent arable land and within arable land provides the expected distribution for each community across these three types of adjacent land use, while the observed is the actual distribution of ditches in each land use type.

Table 5 shows the results of the χ^2 test for:

- i. Each individual community
- ii. Freshwater, moderate and brackish communities combined
- iii. The individual endgroups in communities C and I

Significant deviations from the expected values are shown by four communities. Two of these communities, C and I, are significantly more frequent in pasture than expected, while communities K and J are significantly more frequent in ditches adjacent arable land.

4.3.1 Communities more common in pasture

Community C comprises the largest group of freshwater ditches, while community I is the largest brackish community. Both communities combine more than one endgroup, and a χ^2 test has been carried out on the separate endgroups to determine which of these is most affecting the results. As Table 5 shows, two of the three endgroups in community I show significant deviation, while one does not. However all three occur more frequently than expected in pasture and have a cumulative effect on the overall result, which is significant at just over the 1% level. The same pattern is shown by community C, where one of the two endgroup shows significant deviation, but both are more frequent in pasture and have a cumulative effect on the overall result, which is significant at the 4% level.

Table 5 χ^2 test for association between community distribution and adjacent land use

COMMUNITY	WITHIN ARABLE		ADJACENT ARABLE		IN PASTURE		total
	Observed	Expected	Observed	Expected	Observed	Expected	
A	1	1.04	6	4.27	9	10.70	16
B	5	2.21	10	9.08	19	22.75	34
C	1	3.64	9	14.95	46	37.46	56
D	3	1.69	8	6.94	15	17.39	26
E		1.30	4	5.34	16	13.38	20
F	3	2.67	13	10.95	25	27.43	41
G		2.08	9	8.54	23	21.41	32
H	1	4.29	24	17.62	41	44.15	66
I	8	9.56	24	39.25	115	98.34	147
J	4	1.95	14	8.01	12	20.07	30
K	6	2.80	17	11.48	20	28.77	43
L	2	0.91	2	3.74	10	9.37	14
ALL	34	6.5%	140	26.7%	351	66.9%	525

FRESH	10	9.88	37	40.58	105	101.69	152
MODERATE	3	4.75	22	19.49	48	48.84	73
BRACKISH	21	19.50	81	80.10	198	200.70	300

Observed - Expected values

COMMUNITY	ARABLE	ADJACENT	PASTURE	chi test	chi dist	Significant
A	-	1.73	-1.70	0.97	32.46%	
B	-	0.92	-3.75	0.71	39.93%	
C	-	-5.95	8.54	4.31	3.78%	
D	-	1.06	-2.39	0.49	48.36%	
E	-	-1.34	2.62	0.85	35.68%	
F	-	2.05	-2.43	0.60	43.85%	
G	-	0.46	1.59	0.14	70.56%	Significant
H	-	6.38	-3.15	2.53	11.14%	
I	-1.56	-15.25	16.66	9.00	1.11%	
J	-	5.99	-8.07	7.72	0.54%	
K	3.21	5.52	-8.77	9.00	1.11%	
L	-	-	0.63	0.04	83.59%	

FRESH	0.12	-3.58	3.31	0.43	80.82%
MODERATE	-1.75	2.51	-0.84	0.98	61.29%
BRACKISH	1.50	0.90	-2.70	0.16	92.23%

Community I and C endgroups

endgroup	WITHIN ARABLE		ADJACENT ARABLE		IN PASTURE		total
	observed	expected	observed	expected	observed	expected	
0011	2	2.41	4	9.88	31	24.75	37
0101	4	3.58	11	14.69	40	36.80	55
01100	2	3.58	9	14.69	44	36.80	55
I	8	9.56	24	39.25	115	98.34	147
1000	1	1.56	2	6.41	21	16.06	24
01110		2.08	7	8.54	25	21.41	32
C	1	3.64	9	14.95	46	37.46	56

Observed - Expected values

endgroup	ARABLE	ADJACENT	PASTURE	chi test	chi dist	Significant
0011	-0.40	-5.88	6.25	5.08	2.43%	
0101	0.42	-3.68	3.20	1.20	27.25%	
01100	-1.58	-5.68	7.20	3.61	5.74%	
I	-1.55	-15.25	16.66	9.00	1.11%	Significant
1000	-0.56	-4.41	4.94	4.55	3.28%	Significant
01110	-2.08	-1.54	3.59	0.88	34.77%	Significant
C	-	-5.95	8.54	4.31	3.78%	

Note χ^2 is not test where Expected < 5
degrees of freedom = n - 1

The two endgroups in the freshwater community C are characterised by the aquatic species *Lemna spp*, *Hydrocharis morsus-ranae*, and *Glyceria fluitans*, and the emergents *Oenanthe fistulosa*, *Alisma plantago-aquatica* and *Eleocharis palustris*. The community corresponds either to the NVC *Lemna minor* community (A3) or possibly to the *Spirodela polyrhiza* - *Hydrocharis morsus-ranae* community (A4). (At present the NVC aquatic communities are not widely used within English Nature and no precise evaluation of the Walland Marsh communities with the NVC has been attempted in this report.)

As a group the three endgroups in the brackish community I are characterised by the aquatic species *Myriophyllum spicatum* and *Potamogeton pectinatus*, and the emergents *Scirpus maritimus* and *Eleocharis palustris*. The community appears to correspond to the NVC *Potamogeton pectinatus* - *Myriophyllum spicatum* community (A11), which is the main reason for combining these endgroups. As indicated in the Walland Marsh survey report, both *Potamogeton pectinatus* and *Myriophyllum spicatum* occur more frequent in pasture ditches than in ditches adjacent arable. This would appear to suggest that a greater proportion of the ditches surrounding pasture land are freshwater. However this is not supported by the results of the χ^2 test for combined freshwater, moderate and brackish communities, which show no significant deviation from the expected distribution across the three land use types. (The observed values are in fact very close to the expected.)

While some areas of Walland Marsh may in fact contain a higher proportion of freshwater ditches on the margins of the pasture, this result indicates that overall there is no unequal division of freshwater and brackish ditch communities between pasture and adjacent arable land. There is however an unequal division in the distribution of the brackish community I and its endgroups.

It should be noted that community K is similar to one of the endgroups in community I (endgroup 0011), but is characterised by a greater dominance of *Enteromorpha* and appears to be a more eutrophic version of endgroup 0011. On a national scale community K would be combined with community I as NVC A11. However it has not been combined here because of its potential as an indicator for eutrophication. Particularly with regard this potential the results of the χ^2 test show an important distinction; while all the endgroups in community I occur more frequent in pasture, community K is significantly less frequent in pasture and more frequent in ditches adjacent arable.

The fact that communities C and I comprise the largest groups of freshwater and brackish ditches respectively suggest that ditches within pasture tend to be more uniform and 'typical' than those adjacent arable land (which are protected from grazing along one side). This presumably reflects the levelling effect of intense grazing. This result supports the idea of encouraging more diversity in pasture ditches, for example by the use of temporary electric fences along ditch banks to encourage emergent species.

4.3.2 Communities more common in ditches adjacent arable land

Communities J and K occur significantly less frequently in pasture and more frequently adjacent and within arable land than expected. Community J is a species-poor brackish community with a very low average number of aquatic species and a high proportion of choked ditches, and is characterised in particular by a high frequency of *Althea officinalis*. As reported in the Walland Marsh report, this species is 25% more frequent along ditches adjacent arable land than in pasture. This community has limited floristic interest other than the abundance of the nationally scarce species *Althea officinalis*.

Community K is also a species-poor brackish community, but is neither as species-poor nor as frequently choked as community J. It is however characterised by a dominance of *Scirpus maritima*, *Phragmites australis* and *Enteromorpha*. *Enteromorpha* was earlier reported to be 8% more frequent in ditches adjacent arable land. With no indication as yet that this community is any more brackish than other types it may be that this community is

indicating more eutrophic conditions in ditches adjacent and within arable land.

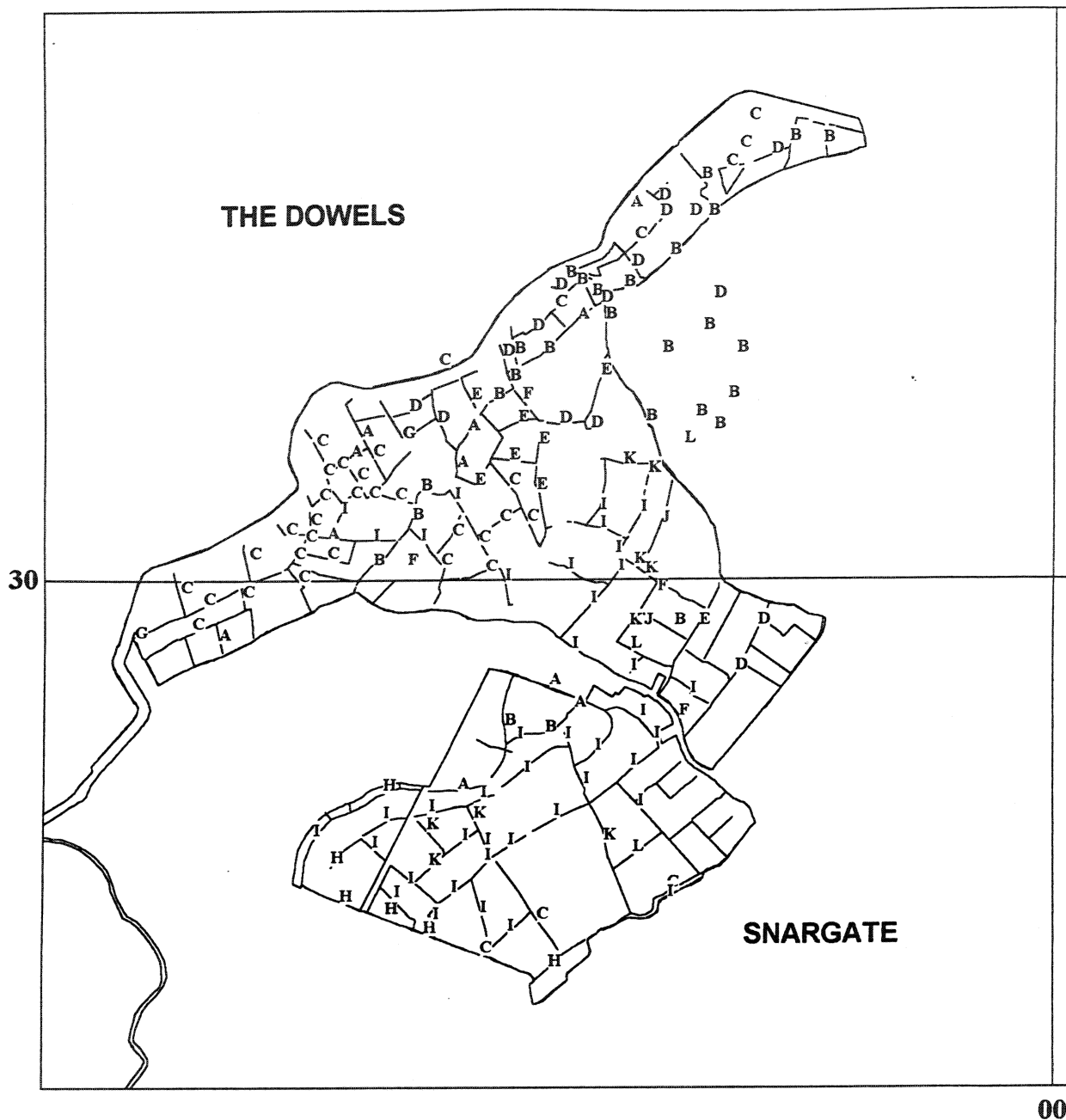
Results presented in the Walland Marsh survey suggested that ditches adjacent arable were not more frequently choked than ditches in pasture. However, these results place a greater emphasis than before on the significant threat to ditches adjacent arable land from poor management and possible nutrient enrichment. Monitoring the abundance of communities J and K along these ditches could provide a good way of assessing this threat.

4.4 DISTRIBUTION MAPPING OF COMMUNITIES

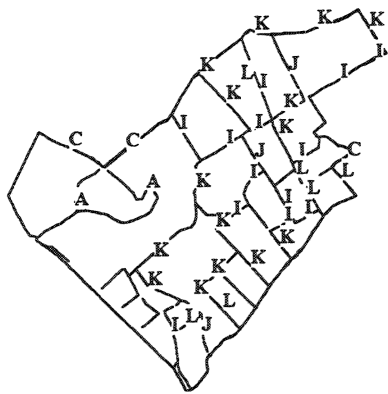
Distribution maps (using DMAP) are provided for those areas of Walland Marsh which lie within the Kent county boundary. This includes The Dowels, Snargate (Map 1), Fairfield and Woolpack (Map 2). Digitised information is not yet available for areas in East Sussex (which includes most of East Guldeford).

These maps show clearly the distribution of fresh and brackish communities in the different areas. They also illustrate the preponderance of communities C and I within pasture and communities K and J around the margins with adjacent arable land.

Some ditches outside the boundary of the site were surveyed; their communities are shown on the distribution maps although the ditches themselves are not shown. The area shown to the east of The Dowels is dominated by the species-rich community B, and could therefore be considered of SSSI quality.

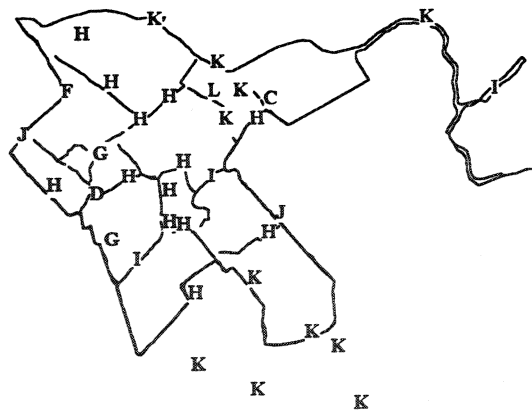


MAP 1 DISTRIBUTION OF COMMUNITIES AT THE DOWELS AND SNARGATE



FAIRFIELD

WOOLPACK



00

MAP 2 DISTRIBUTION OF COMMUNITIES AT FAIRFIELD AND WOOLPACK

4.5 COMPARISON OF DITCH COMMUNITIES AT WALLAND AND NORTH KENT MARSHES

Comparison of the community constancy tables for Walland Marsh and North Kent Marshes ESA shows that Walland Marsh contains a wider range of ditch types, reflecting above all a greater range of salinity. In addition the Walland Marsh communities are more species-rich; the highest average number of species at Walland is 16.9, associated with an exceptionally species-rich freshwater community, and the average number of species for the main brackish community is 11.3. In contrast to this the highest average number of species for the North Kent Marshes ESA ditch communities is 8.0, associated with a relatively freshwater community characterised by *Hydrocharis morsus-ranae* and *Berula erecta*. (However account should be taken of the fact that a few bank species, such as *Juncus inflexus/effusus* appear not to have been recorded during the ESA survey.)

The range of communities and their species-richness is by comparison significantly greater at Walland Marsh than the sampled areas of the North Kent Marshes, which contain predominantly very brackish and inherently species-poor ditch communities. *Scirpus maritimus* is dominant or frequent in all but two of the nine ESA communities, and much of the distinction between communities depends on which species are associated with *Scirpus*.

The comparison of the results of twinspan analysis indicates that the two classifications are sufficiently distinct to warrant separate communities at this stage. No attempt has yet been made to combine communities. However, Figure 4 shows those communities at Walland Marsh and North Kent Marshes which are broadly comparable.

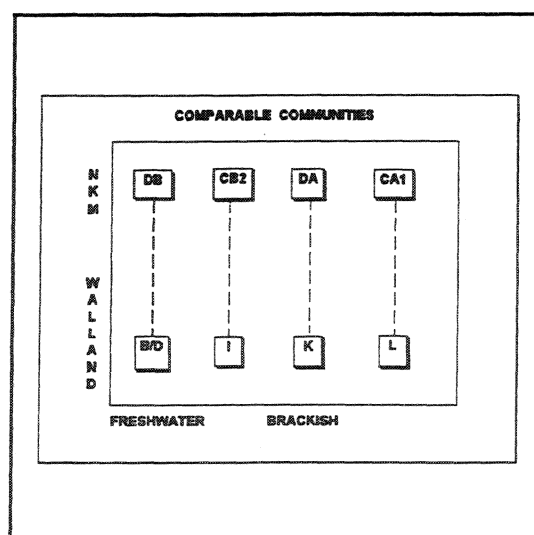


Figure 4

5. CONCLUSIONS

1. Walland Marsh contains a wider range of ditch communities than North Kent Marshes, reflecting a much wider salinity range on this site.
2. The brackish ditch communities at Walland Marsh are more species-rich than the ESA communities, probably reflecting lower mean salinity levels than at North Kent Marshes.
3. The two classifications for Walland Marsh and North Kent Marshes are distinct from each other, though some communities are comparable between the two sites.
4. The ESA communities are characterised by a restricted number of very brackish species. High salinity levels are an inherent and characteristic feature of North Kent grazing marsh.
5. Further survey work on the North Kent Marshes during 1995 will provide more comprehensive data for twinspan analysis. A common ditch classification system should evolve from similar comparisons with other grazing marsh sites across the county.

REFERENCES

- | | | |
|--|--|--|
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Authority |

APPENDIX I

1993/4 Survey data for Walland Marsh arranged into Community
Tables

number of aquatic species	8	15	9	7	7	7	8	5	10	11	9	9	10	7	8.8	25
number of emergent species	7	6	5	3	3	8	7	5	5	6	7	5	5	5	3	18
number of bank species	5	4	1	1	4	3	1	3	2	2	1	6	4	5	2	15
total number of species	20	25	15	11	14	18	16	12	17	18	19	20	18	20	12	16.9

[illegible]

Choked ditch		9	39	55	56	67	68	69	85	86	90	95	96	97	160	175	195	501	599	600	607	610	612	613	7	102
Ditch number																										
<i>Azolla filiculoides</i>																										
<i>Callitriche obtusangula</i>																										
<i>Ceratophyllum demersum</i>																										
<i>C. submersum</i>																										
<i>Chara</i> sp																										
<i>Elodea nuttallii</i>																										
<i>Enteromorpha</i> sp																										
<i>Filamentous algae</i>																										
<i>Fontinalis antipyretica</i>																										
<i>Fontinalis fluitans</i>																										
<i>Hottonia palustris</i>																										
<i>Hydrocharis morsus-ranae</i>																										
<i>Lemna minor</i>																										
<i>L. trisulca</i>																										
<i>Myriophyllum spicatum</i>																										
<i>P. natans</i>																										
<i>P. pectinatus</i>																										
<i>P. trichoides</i>																										
<i>Ranunculus trichophyllus</i>																										
<i>Utricularia</i> sp																										
<i>Alisma plantago-aquatica</i>																										
<i>Apium nodiflorum</i>																										
<i>Carex riparia</i>																										
<i>Eleocharis palustris</i>																										
<i>Glyceria maxima</i>																										
<i>Iris pseudocorus</i>																										
<i>Juncus articulatus</i>																										
<i>Nasturtium officinale</i> agg																										
<i>Oenanthe aquatica</i>																										
<i>O. fetidosa</i>																										
<i>Phalaris arundinacea</i>																										
<i>Phragmites australis</i>																										
<i>Rumex hydrolapathum</i>																										
<i>Samolus valerandi</i>																										
<i>Schoenoplectus tabernaemontani</i>																										
<i>Scirpus maritimus</i>																										
<i>Sparganium erectum</i>																										
<i>Typha angustifolia</i>																										
<i>Veronica catenata</i>																										
<i>Agrostis stolonifera</i>																										
<i>Althaea officinalis</i>																										
<i>Carex distans</i>																										
<i>Carex olivacea</i>																										
<i>Epilobium hirsutum</i>																										
<i>Equisetum palustre</i>																										
<i>Galium palustre</i>																										
<i>Hydrocotyle vulgaris</i>																										
<i>Juncus effusus</i>																										
<i>Juncus inflexus</i>																										
<i>J. gerardi</i>																										
<i>Lycopus europaeus</i>																										
<i>Lythrum salicaria</i>																										
<i>Mentha aquatica</i>																										
<i>Myosotis laxa</i>																										
<i>Oenanthe lachenalii</i>																										
<i>Pulicaria dysenterica</i>																										
<i>Sium latifolium</i>																										
<i>Solanum dulcamara</i>																										

number of aquatic species	3	3	4	4	4	4	4	1	3	2	1	1	4	0	0	1	4	3	2	2	4	3	3	0	3
number of emergent species	5	4	5	3	4	5	4	0	7	5	3	4	4	2	1	1	4	3	5	5	6	3	5	0	5
number of bank species	4	4	2	3	5	4	4	1	4	5	4	3	3	0	0	1	5	4	2	6	6	6	6	0	1
total number of species	12	11	11	10	13	13	12	12	14	12	8	8	11	2	1	3	13	10	9	13	16	12	14	0	9

Choked ditch		103	104	105	158	16	223	225	350	357	416	592	593	594	627	632	66	694	71	72	73	74	75	78	79	8	80	87	88	89	93	98	25	44.6
Ditch number		D	D	D																														
Azolla filiculoides																																		
Callitriche obtusangula																																		
Ceratophyllum demersum	1	1						1							1																			
C. submersum											1																							
Chara sp																		1																
Elodea nuttallii																																		
Enteromorpha sp																																		
Filamentous algae																																		
Foninalis antipyrrelca																																		
Glyceria fluitans	1	1													1	1																		
Hottonia palustris																																		
Hydrocharis morsus-ranae																																		
Lemna minor	1	1	D																															
L. trisulca	1	1	1																															
Myriophyllum spicatum																																		
P. natans																																		
P. pectinatus																																		
P. trichoides																																		
Ranunculus trichophyllus																																		
Utricularia sp																																		
Alisma plantago-aquatica	1																																	
Apium nodiflorum																																		
Carex riparia																																		
Eleocharis palustris	1	1	1																															
Glyceria maxima																																		
Iris pseudoconus																																		
Juncus articulatus	1																																	
Nasturtium officinale agg	1																																	
Oenanthe aquatica																																		
O. fistulosa	1																																	
Phalaris arundinacea																																		
Phragmites australis																																		
Rumex hydrospatum	1																																	
Samolus valerandi																										</								

		3	5	4	1	5	2	5	5	4	4	4	4	3	5	6	4	2	4	4	5	5	6	7	5	4	3	5	5	6	5	3.6	20
number of aquatic species		8	3	4	1	7	7	8	4	4	4	5	7	7	6	4	5	2	5	4	4	3	4	4	4	3	3	5	2	4	3	4.1	19
number of emergent species		2	0	0	0	4	7	5	1	5	4	5	6	5	4	4	4	1	3	2	1	3	4	0	2	1	0	3	4	2	1	3.0	19
total number of species		13	8	8	2	16	16	18	10	14	12	14	17	15	15	14	13	5	12	10	11	12	12	11	11	8	6	13	11	10	9	10.6	58

Choked ditch	Choked ditch																										22	84.6		
	Ditch number	12	128	129	13	15	17	25	3	301	311	32	35	353	40	44	45	48	579	583	586	587	599	61	62	640			662	
Callitriche obtusangula																				1					1				26	7.7
Ceratophyllum demersum									1																				1	3.8
C. submersum																1				1				1					3	11.5
Elodea nuttallii									1																				1	3.8
Filamentous algae																												1	3.8	
Glyceria fluitans																									1				1	3.8
Hottonia palustris															1														1	3.8
Hydrocharis morsus-ranae	D		1	1			1								1	1					1		1					8	30.8	
Lemna minor	D		1		1			D		D	1				1	1	1											9	34.6	
L. trisulca	1							1			1				1	1	1		1		1							9	34.6	
Polygonum amphibium																	1											2	7.7	
Ranunculus trichophyllus																											1	1	3.8	
Alisma plantago-aquatica	1								1				1															3	11.5	
Carex riparia	D					D	1																					8	30.8	
Glyceria maxima						1		1				D			D			D										4	15.4	
Iris pseudocorus	1	1											1					1				1						1	3.8	
Nasturtium officinale agg																												1	3.8	
Oenanthe aquatica																										1		1	3.8	
Phragmites australis						1	D	D		D				D		D			D	D								14	53.8	
Ranunculus sceleratus										1																		1	3.8	
Rumex hydrolapathum	1	1	1	1				1				1									1		1					9	34.6	
Scirpus maritimus	1																									1		2	7.7	
Sparganium erectum								1					1		D	1	1			1	1		1				9	34.6		
Typha angustifolia																D	D				D	D	1			1	11	42.3		
Typha latifolia		1	1	1											1													1	3.8	
Agrostis stolonifera												1																1	3.8	
Althaea officinalis											1																	1	3.8	
Epilobium hirsutum																										1		3	11.5	
Equisetum palustre						1	1																					3	11.5	
Galium palustre															1						1						1	3	11.5	
Juncus effusus													1		1	1		1									4	15.4		
Juncus inflexus	1					1		1	1	1			1	1	1	1	1	1	1	1	1	1	1		D	1	17	65.4		
Lycopus europaeus	1																			1							2	7.7		
Lythrum salicaria						1																						1	3.8	
Mentha aquatica													1			1												2	7.7	
Myosotis laxa																										1		2	7.7	
Oenanthe lachenalii										1																		2	7.7	
Pulicaria dysenterica											1										1							3	11.5	
Solanum dulcamara	1										1	1		1										1			1	7	26.9	

number of aquatic species	3	0	2	1	1	0	1	4	0	2	1	0	0	4	4	3	0	1	3	0	2	3	3	0	0	1	1.5	12
number of emergent species	5	5	3	3	3	2	2	4	1	2	2	4	1	3	3	2	2	1	2	4	2	3	2	1	4	1	2.6	13
number of bank species	3	0	1	2	2	3	0	1	2	3	2	3	2	2	2	1	2	1	2	4	1	4	2	1	2	3	2.0	14
total number of species	11	5	6	6	6	5	3	9	3	7	5	7	3	9	9	6	4	3	7	8	5	10	7	2	6	5	6.0	39

Walland Marsh 1993/4 ditch data
Community E
twinspan endgroup 10010

Choked ditch																																							
Ditch number	127	288	300	310	351	*	*	43	*	*	49	*	*	495	*	*	52	*	*	53	*	*	532	*	*	54	*	*	57	58	584	588	*	608	609	619	*	14	70
Callitriche obtusangula					1			1									1			1																		5	25
C. submersum				1																											1						2	10	
Enteromorpha sp																													1								1	5	
Filamentous algae																																					1	5	
Glyceria fluviatilis		1															1	1																			5	25	
Hydrocharis morsus-ranae					1																																1	5	
Lemna minor	1	1	1	D	1			D			1	1	1	1	1	1	1	1	1	1		1									1	1	1	1	1	16	80		
L. trisluta	1	1	1	1	1			1			1	1	1	1	1	1	1	1	1	1		1														1	17	85	
Polygonum amphibium											1																											1	5
Ranunculus circinatus																																					1	5	
Ranunculus trichophyllus																																					1	5	
Alisma plantago-aquatica	1	1	1		1						1	1	1	1	1	1	1	1	1	1		1														12	60		
Apium nodiflorum																																					1	5	
Eleocharis palustris	1																																				3	15	
Glyceria maxima									D																												1	5	
Juncus articulatus	1																																				3	15	
Nasturtium officinale agg																	1																				2	10	
Oenanthe aquatica					1																																1	6	30
O. fistulosa	1	1	1						1											1																	2	10	
Phragmites australis								1																														2	10
Rumex hydrolapathum																	1																					2	10
Scirpus maritimus														1																								1	5
Sparganium erectum		D	1						1	1	1			1						1	D															1	13	65	
Typha angustifolia	D			D	D																																8	40	
Agrostis stolonifera		1	D		1																																4	20	
Althaea officinalis				1																																		2	10
Carex otrubae	1	1	1	1				1			1	1	1	1	1	1																				14	70		
Epiobium hirsutum																																					2	10	
Equisetum palustre				1										1																								2	10
Galium palustre			1	1	1															1																	8	40	
Juncus inflexus	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1		1														20	100		
Lycopus europaeus																																					1	5	
Lythrum salicaria																	1																				1	5	
Mentha aquatica																																					1	5	
Myosotis laxa		1	1	1																																	7	35	
Oenanthe lachenalii		1	1																																		2	10	
Pulicaria dysenterica			1																																		2	10	
Solanum dulcamara				1																																	1	5	
tot																																							
number of aquatic species	2	2	2	3	4	3	3	3	2	4	3	3	1	2	4	3	1	2	4	3	1	2	2	1	2	3	1	2	4	3	3	1	2	2	3	2.6	11		
number of emergent species	5	2	3	1	3	2	3	3	3	4	3	3	3	3	4	3	2	3	4	3	3	1	4	4	4	3	1	3	1	4	4	4	4	4	3	3.0	13		
number of bank species	2	5	7	7	3	2	1	3	2	3	2	2	3	2	3	2	3	2	3	2	2	2	3	7	2	4	3	2	2	4	4	4	4	4	4	3.4	14		
total number of species	9	9	12	11	10	7	7	7	8	11	8	7	7	7	7	9	8	13	8	9	10	8.9	38																

[illegible]

	2	2	1	3	3	3	4	3	2	1	4	2	1	2	2	3	1	4	1	1	3	5	2	1	4	4	avg	tot
number of aquatic species	2	2	1	3	3	3	4	3	2	1	4	2	1	2	2	3	1	4	1	1	3	5	2	1	4	4	2.4	11
number of emergent species	2	6	4	2	3	5	2	4	3	4	5	2	4	3	4	5	1	4	3	1	4	3	9	0	3	1	3.4	16
number of bank species	2	3	2	1	4	1	2	2	1	3	2	3	5	4	3	5	1	5	4	3	4	6	3	3	5	2	3.2	16
total number of species	6	11	7	6	10	9	6	10	8	7	9	8	9	9	11	14	4	7	10	11	15	3	13	8	5	11	90	43

Ditch number	148	150	151	152	157	159	286	313	317	318	319	344	348	378	383	389	392	397	424	426	454	456	457	458	459
<i>Callitriche obtusangula</i>	1	1	1	1	1	1					1	1	1		1	1	1	1	1	1	1	1	1	1	1
<i>C. submersum</i>	1	1	1		1												1								
<i>Chara sp</i>																	1								
<i>Crassula helmsii</i>																									
<i>Elodea nuttallii</i>																									
<i>Enteromorpha sp</i>	D		D	1	1			1						D	D	D	1	1	1	1	1	1	A	A	A
<i>Filamentous algae</i>	1	1			D	D	A	1		1	1	1	1		1	1		D	1	1	1	1	1	A	A
<i>Fontinalis antipyretica</i>																									
<i>Glyceria fluitans</i>	1						1							1		1									
<i>Hydrocharis morsus-ranae</i>																									
<i>Lemna minor</i>	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>L. trisulca</i>	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>L. gibba</i>																									
<i>Myriophyllum spicatum</i>																1									
<i>P. crispus</i>								1																	
<i>P. natans</i>																									
<i>P. pectinatus</i>																									
<i>R. baudouii</i>																									
<i>Ranunculus trichophyllus</i>	1	1	1	1	1	1	1	1	1		1	1	1	1	1										
<i>Zannichellia palustris</i>								1											1						
<i>Alisma plantago-aquatica</i>							1																		
<i>Apium nodiflorum</i>												1													
<i>Eleocharis palustris</i>	1	1	1	1	1		1				1	1	1		1										
<i>Iris pseudocorus</i>																									
<i>Juncus articulatus</i>																									
<i>Nasturtium officinale agg</i>	1	1			1	1			1	1	1	1	1	1	1										
<i>Oenanthe aquatica</i>								1	1	1	1	1	1	1	1										
<i>O. fistulosa</i>																									
<i>Phragmites australis</i>																									
<i>Ranunculus sceleratus</i>	1	D	D							D	1	D					1								
<i>Samolus valerandi</i>																									
<i>Schoenoplectus tabernaemontani</i>																									
<i>Scirpus maritimus</i>																									
<i>Sparganium erectum</i>	1				1		1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Typha angustifolia</i>																									
<i>Veronica catenata</i>																									
<i>Agrostis stolonifera</i>																									
<i>Althaea officinalis</i>																									
<i>Carex otrubae</i>																									
<i>Epilobium hirsutum</i>																									
<i>Galium palustre</i>																									
<i>Glaux maritima</i>																									
<i>Hydrocotyle vulgaris</i>																									
<i>Juncus inflexus</i>	1	1	1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>J. gerardii</i>																									
<i>Lycopus europaeus</i>																									
<i>Mentha aquatica</i>																									
<i>Myosotis laxa</i>																									
<i>Oenanthe lachenalii</i>																									
<i>Pulicaria dysenterica</i>																									
<i>Solanum dulcamara</i>																									
<i>Triglochin maritima</i>																									
<i>Triglochin palustris</i>																									
number of aquatic species	6	7	6	4	7	5	5	7	4	3	4	3	6	5	6	5	6	7	6	3	7	10	8	5	6
number of emergent species	2	4	2	2	4	1	3	2	5	2	5	4	6	3	7	2	5	4	3	6	4	5	3	2	3
number of bank species	1	1	1	0	1	0	5	3	7	2	6	1	3	5	4	3	5	5	3	2	6	5	0	0	1
total number of species	9	12	9	6	12	6	13	12	16	7	15	8	15	13	17	10	16	16	12	11	17	20	11	7	10

