

## **Broads Annual Water Plant Monitoring Report 2013**



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Cover Photograph. Aquatic plant community from Waveney Valley.

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# 1 EXECUTIVE SUMMARY

This report presents and discusses the findings from the annual water plant surveys carried out during 2013, which covered 25 waterbodies. The methodology, data gathering and analysis employed in the annual water plant surveys undertaken by the Broads Authority is detailed in “Broads Annual Water Plant Monitoring Methods.”

Key results from the 2013 survey can be summarised as: -

- Hickling and Heigham Sound supported increasing abundances of a number of stonewort species, including the RDB vulnerable starry stonewort *Nitellopsis obtusa* at Heigham Sound. The RDB species listed as endangered, intermediate stonewort *Chara intermedia* was the second most abundant species in Hickling. Horsey Mere continues to have a very low number of species present and low abundance, although a small sample of stonewort was found this year.
- Plant communities in the Martham Broads appear to be stable, continuing to support diverse, species rich plant communities generally dominated by variety of stonewort species. There continue to be localised bare patches devoid of plants in both broads which may need to be monitored.
- Those broads on the Bure with good connectivity to the river continued to show the lowest levels of species richness and abundance, however, there were number of sites that showed improving levels in 2013 including Wroxham. Cockshoot broad supported an increase in the abundance of stoneworts with 3 species recorded in 2013.
- Following recent mudpumping Upton Little broad was surveyed once again. The species composition is dominated by stoneworts with the occurrence of bristly stonewort a new species in 2013.
- In 2013, there have been a number of cases where additional species have been noted in visual observations or alternate surveys that have been missed as part of the transect survey. These instances add further weight to the argument that the methodology of the annual macrophyte survey needs to be revised to reflect the improving water quality and resultant increases in plant growth and density.
- There appears to be a general trend that plant growth and species diversity has increased across the broads surveyed since 2012. The cold, wet summer in 2012 resulted in poor plant growth in many locations. Following a very cold period in the early spring of 2013 where bitterly easterly winds buffeted the east coast for more than 6 weeks, water temperatures were very slow to warm up which pushed back the aquatic plant growing season. But following the cold spell, the weather for the remainder of the summer was much warmer and drier which resulted in increased productivity, reflected in the trend of increased species richness and abundance recorded in 2013.

As a classification and assessment tool the water plant surveys inform ways in which lake restoration works can be targeted and allow the success of any management to be assessed. The water plant monitoring also provides an early means to identify possible sites of deterioration. The results of the water plant surveys contribute to the classification and monitoring of SSSI waterbodies in partnership with Natural England. The detection of invasive, non-native plant species within the Broads is also important function of the annual survey if the risks posed by these plants are to be effectively managed.

Steady progress is clearly being made through the Lake Restoration Strategy, however much work remains to be done across the Broads to bring degraded broads back to health, in line with national and EU drivers and to increase and subsequently maintain the diversity

of those broads lacking in species richness. The annual water plant survey therefore continues to be a valuable part of targeting and measuring the success of restoration efforts.

## 2 AIMS AND OBJECTIVES

The aim of the Broads annual survey is to monitor water plants within specified broads, along previously defined transects between late July and early September, using the methodology outlined by Kennison *et al* (1998). Where broads have historically been sampled around a particular date, it is aimed that the survey takes place as near as possible to that date.

The main objectives in the annual programme are to monitor key broads with long-term datasets, those that have had restoration measures put in place or those that are known to be experiencing a change in their macrophyte community. Broads that have not received restoration efforts or are stable and/or are generally without plants, are monitored on a less frequent basis. When resources allow, a rolling program of monitoring sites not previously surveyed is also an ongoing aim.

This report will collate the data collected since the last survey report in 2012 and will refer to the long-term data from 1983 to 2013 (Table 1).

Table 1. Sites surveyed for water plants from 1983 to 2013.

	# of years	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13		
Alderfen	31																																	
Bargate	3																																	
Barnby	6																																	
Barton	31																																	
Belaugh	20																																	
Blackfleet	3																																	
Bridge	12																																	
Buckenham	8																																	
Burntfen	6																																	
Calthorpe	3																																	
Catfield	2																																	
Cockshoot	31																																	
Cockshoot Dyke	28																																	
Cromes South	30																																	
Cromes North	28																																	
Decoy	9																																	
Filby	22																																	
Flixton Decoy	3																																	
Fritton Lake	1																																	
Hassingham	9																																	
Heigham Sound	23																																	
Hickling	31																																	
Horsey Mere	27																																	
Hopton 1 (Lound)	1																																	
Hopton 2 (Lound)	1																																	
Hopton 3 (Lound)	1																																	
Hopton 4 (Lound)	1																																	
Hoveton Great	31																																	
Hoveton Little	13																																	
Hudson's Bay	8																																	

	# of Years	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13		
Irstead	2																																	
Lily	22																																	
Little	5																																	
Malthouse	7																																	
Martham North	30																																	
Martham South	29																																	
Mautby Decoy	4																																	
Mill Water (Lound)	1																																	
Norton	4																																	
Ormesby	25																																	
Ormesby Little	24																																	
Pound End	13																																	
Ranworth	29																																	
Reedham Water	2																																	
Rockland	23																																	
Rollesby	24																																	
Round water	2																																	
Salhouse Great	13																																	
Salhouse Little	7																																	
Spratts Water	3																																	
Strumpshaw	9																																	
Upton Great	31																																	
Upton Little	7																																	
Wheatfen	5																																	
Whitlingham Great	10																																	
Whitlingham Little	9																																	
Woolners Carr	1																																	
Wroxham	31																																	
# per year		23	22	23	23	24	16	24	22	23	23	17	13	26	26	25	30	21	26	19	22	21	37	35	40	42	28	32	31	28	28	25		



Table 2 Sampling dates and transect lengths (metres) (2010-2013).

Broad	Survey Date				Transect Length			
	2010	2011	2012	2013	2010	2011	2012	2013
Alderfen	03-Aug	09-Aug	14-Aug	14-Aug	758	761	866	899
Bargate	-	-	31-Aug	-	-	-	942	-
Barnby	-	-	19-Jul	-	-	-	384	-
Barton	21-Jul	04-Aug	06-Aug	09-Aug	4782	4039	4903	5085
Belaugh	05-Aug	11-Aug	-	-	254	264	-	-
Bridge Broad	-	-	03-Aug	-	-	-	403	-
Buckenham Broad	30-Jul	20-Jul	-	26-Jul	333	299	-	240
Burntfen	12-Aug	01-Sep	-	20-Aug	431	403	-	475
Calthorpe	03-Sep	17-Aug	11-Sep	-	155	160	143	-
Cockshoot Broad	01-Sep	18-Aug	29-Aug	05-Sept	817	1066	1063	1122
Catfield	-	-	-	-	-	-	-	-
Crome's	03-Aug	08-Aug	14-Aug	08-Aug	1087	1137	956	1050
Decoy Broad	-	-	-	23-Aug	-	-	-	1373
Flixton Decoy	06-Aug	-	-	-	781	-	-	-
Hassingham Broad	30-Jul	20-Jul	-	26-Jul	327	220	-	242
Heigham Sound	23-Aug	29-Jul	26-Jul	02-Aug	1670	2385	2334	2072
Hickling	23-Jul	05-Aug	25-Jul	31-Jul	8751	9455	8799	8508
Horsey Mere	28-Jul	29-Jul	31-Jul	30-Jul	3426	3309	3418	3341
Hoveton Great	05-Aug	03-Aug	06-Sep	13-Aug	3158	3042	3310	3196
Hoveton Little	-	-	-	15-Aug	-	-	-	2499
Hudsons Bay	-	-	06-Sep	-	-	-	376	-
Irstead	-	-	-	-	-	-	-	-
Little Broad	-	-	-	20-Aug	-	-	-	245
Malthouse	17-Aug	-	-	-	1118	-	-	-
Martham Broad North	29-Jul	25-Jul	24-Jul	25-Jul	760	743	744	729
Martham Broad South	29-Jul	26-Jul	24-Jul	24-Jul	758	714	551	532
Mautby Decoy	02-Sep	-	-	-	389	-	-	-
Mill Water	-	-	-	-	-	-	-	-
Nortons	05-Aug	11-Aug	-	-	192	92	-	-
Pound End	-	-	-	23-Aug	-	-	-	527
Ranworth	31-Aug	16-Aug	02-Aug	28-Aug	4600	4426	4590	4671
Rockland	30-Aug	25-Aug	30-Aug	-	1359	1551	1559	-
Reedham	-	-	-	-	-	-	-	-
Round Water	-	23-Aug	-	-	-	26	-	-
Salhouse Great	-	-	08-Aug	-	-	-	770	-
Salhouse Little	-	-	08-Aug	-	-	-	0	-
Spratt's Water	-	23-Aug	-	-	-	67	-	-
Strumpshaw	30-Jul	20-Jul	27-Jul	01-Aug	299	441	392	253
Upton Great	13-Aug	10-Aug	22-Aug	21-Aug	1006	1071	943	829
Upton Little	13-Aug	-	22-Aug	22-Aug	223	-	229	211
Wheatfen	-	-	30-Aug	-	-	-	677	-
Whitlingham Great	-	19-Jul	18-Jul	17-Jul	-	2936	2736	2683
Whitlingham Little	30-Aug	19-Jul	18-Jul	17-Jul	712	614	660	648
Woolners Carr	-	23-Aug	-	-	-	26	-	-
Wroxham	04-Aug	21-Jul	03-Aug	06-Aug	1757	1433	1667	1734

### 3 BROADS MACROPHYTE RESULTS.

Each broad that was surveyed in 2013 is reviewed in terms of species richness and abundance. Species recorded in 2009 to 2011 are starred to illustrate recent trends. For 2012 and 2013 the macrophyte index is also listed to show recent species abundances. The abundance figures, here expressed as the semi-quantitative “Macrophyte Index” (MI), indicate the relative amount of each plant species recorded based on an estimate of the relative volume of each species on the rake. Please see “Broads Annual Water Plants. Monitoring Methods.” for further explanation of the macrophyte index. Where data or key events are relevant to the current status of the broad they will be highlighted. The broads are grouped by the river catchment in which they are situated.

Appendix 1 classifies the plants into groups of similar form/structure and these groupings are used to generate the graphs in Appendix 2. Appendix 3 lists the common and Latin names for all plants found to date during broads surveys.

#### 3.1 Thurne Valley

These broads contain one of the richest populations of stoneworts in the UK. Several of the stoneworts present in this river valley are on the list of high conservation importance plants and have Biodiversity Action Plans attached to them. Stoneworts are recorded in some broads outside of the Thurne catchment these tend to be found in lower abundances. Species present in the Thurne broads that are included in the Joint Nature Conservation Committee (JNCC) Red Data Book included, three ‘Vulnerable’ species: Baltic stonewort, Convergent stonewort and Starry stonewort, one ‘Rare’ species: Intermediate stonewort (Stewart and Church, 1992). The Thurne broads also provide a stronghold for the rare BAP species holly-leaved naiad, as well as more common vascular plants such as spiked water milfoil and mare’s tail.

##### 3.11 Heigham Sound

	2009	2010	2011	2012MI	2013MI
Spiked water milfoil	*	*	*	0.414	0.590
Curled pondweed	*	*	*	0.033	0.073
Rigid hornwort	*	*	*	0.031	0.042
Lesser pondweed					0.022
Mare’s tail	*	*		0.015	0.017
Fan-leaved water crowfoot			*		0.014
Nuttall’s waterweed		*			0.004
Canadian waterweed		*			0.004
Starry stonewort			*		0.002
Stonewort ( <i>Chara</i> ) species				0.005	
Stonewort ( <i>Nitella</i> ) species				0.005	
Fennel leaved pondweed		*	*		
Filamentous algae		*			
Holly-leaved naiad					
Whorled water milfoil	*				
<b>Total number of species</b>	<b>5</b>	<b>8</b>	<b>6</b>	<b>6</b>	<b>9</b>

Following two relatively poor years in relation to species richness, 2013 was a better year with 9 species being recorded. Notably, the Red Data book species listed as vulnerable, starry stonewort was recorded again, albeit in low abundances.

The overall abundance of plants in Heigham Sound was also slightly higher than the abundance recorded in the previous 2 years. Lesser pondweed was recorded during the surveys for the first time since 1997, being the fourth most abundant plant in 2013. The abundance of the 3 commonest plants in Heigham Sound increased slightly from 2012.

The presence of *Chara* fragments found in 2012 was encouraging. Although no further fragments were found during the 2013 transect surveys, 3 charophyte species were identified during a point based survey, specifically *Chara baltica*, *Chara vulgaris* and the rare *Chara intermedia*.

The most diverse areas of macrophyte growth were found in the sheltered bays and inlets away from the main boating channel which was mostly largely devoid of plants.

### 3.12 Hickling

	2009	2010	2011	2012MI	2013MI
Spiked water milfoil	*	*	*	0.339	0.273
Intermediate stonewort			*	0.001	0.068
Curled pondweed		*	*	0.020	0.051
Fennel-leaved pondweed	*	*	*	0.058	0.030
Holly-leaved naiad	*	*	*	0.004	0.022
Fragile/convergent stonewort		*			0.002
Baltic stonewort					0.011
Rigid hornwort	*	*	*	0.002	0.006
Opposite stonewort					0.006
Willow leaved pondweed					0.001
Convergent stonewort					0.001
Stonewort ( <i>Chara</i> ) species			*	0.013	
Delicate stonewort		*		0.001	
Mare's tail	*			0.001	
Common reed			*		
Fragile stonewort			*		
Starwort sp.			*		
Stonewort ( <i>Nitella</i> ) species			*		
Filamentous algae		*			
Canadian waterweed		*			
<b>Total number of species</b>	<b>5</b>	<b>9</b>	<b>11</b>	<b>9</b>	<b>11</b>

Macrophyte diversity in Hickling Broad has been declining since the early 2000s and over a 3 year period the species richness dropped dramatically from 11 in 2005 to 3 in 2008. The last few years have started to see a gradual recovery with 11 species recorded in 2013. The relative abundance of macrophytes is still low compared to pre-2006 levels where the abundance of stoneworts generally comprised over half the volume of plants recorded. However (see Macrophyte abundance trends in Appendix 2), 2013 showed a big increase in the relative abundance of stoneworts in comparison to other macrophyte species.

Baltic stonewort is listed as vulnerable and was recorded for the first time since 2005. Opposite stonewort was suspected last year, but the species was confirmed as present in 2013. Opposite stonewort has not been recorded previously as part of the Annual Macrophyte Survey. The rare intermediate stonewort was the second most abundant species in 2013 after spiked water milfoil and the abundance of this species and holly leaved naiad was the highest recorded since 2005. The relative abundance of curled pondweed was also the highest since surveys began in 1983.

### 3.13 Horsey Mere

	2009	2010	2011	2012 MI	2013 MI
Mares tail	*	*	*	0.157	0.148
Spiked water milfoil	*	*	*	0.091	0.134
Fennel-leaved pondweed	*	*	*		0.004
Stonewort sp ( <i>Chara</i> )					0.002
Filamentous algae		*	*		
<b>Total number of species</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>2</b>	<b>4</b>

Following a similar trend to Hickling, the species richness and abundance of macrophytes in Horsey Mere has been declining since 2002 and still remains very low. However since 2009 there has been a suggestion that the relative abundance of plants is gradually increasing with the highest relative abundance of plants in 2013 since 2007. Of particular note is the fact that a stonewort was recorded this year for the first time since 2005 although it was not identified to species.

### 3.14 Little Broad

	2005	2008	2009	2010 MI	2013 MI
Filamentous algae	*	*	*	0.234	0.750
Bladderwort sp		*	*	0.016	0.016
Bristly stonewort		*	*	0.551	
Common stonewort			*		
Opposite stonewort				0.009	
Ivy-leaved duckweed				0.002	
Horned pondweed	*	*			
<i>Enteromorpha</i> sp		*			
Baltic stonewort				0.006	
Hedgehog stonewort				0.046	
<b>Total number of species</b>	<b>2</b>	<b>5</b>	<b>4</b>	<b>7</b>	<b>2</b>

Little Broad is, as the name implies, a small broad located on Burgh Common on land adjacent to the Trinity Broads system. This broad has suffered from sedimentation and historically has been mudpumped. The broad was last surveyed in 2010 where 7 species were recorded including 4 stonewort species and bladderwort sp.

Unfortunately the broad appears to have suffered a decline since 2010 with only 2 species recorded in 2013 with the vast majority of the broad smothered in filamentous algae. A tiny fragment of bladderwort was identified amongst the algae. The water depth was surprisingly

low considering that mudpumping occurred within the last 10 years, The broad is connected to dykes draining the surrounding common and fen and the slow flowing dyke system may have contributed to the apparent re-accumulation of sediment.

### Martham North and South

For many years, the Martham Broads have been characterised by sustained clear water conditions, resulting from the plentiful supply of good quality freshwater draining from the northeast of the broads. These conditions generally continue and are reflected in the high diversity of the plant communities found in the most recent surveys, but there has been a gradual decline in water clarity over the last 6 years.

#### 3.15 Martham North

	2009	2010	2011	2012MI	2013 MI
Bristly stonewort	*	*	*	0.253	0.484
Starry stonewort	*	*	*	0.062	0.254
Intermediate stonewort	*	*	*	0.254	0.093
Baltic stonewort	*	*	*	0.245	0.086
Holly-leaved naiad	*	*	*	0.280	0.079
Mare's tail	*	*	*	0.069	0.073
Starwort sp.	*		*		0.073
Fennel-leaved pondweed		*	*	0.044	0.035
Opposite stonewort		*	*	0.017	0.007
Horned pondweed	*	*	*	0.012	0.007
Spiked Water Milfoil	*			0.005	0.007
Common water moss					0.007
Whorled Water Milfoil			*		0.007
Filamentous algae	*	*			0.007
Yellow water lily					0.007
White water lily					0.007
Stonewort ( <i>Nitella</i> ) species			*	0.005	
Fragile/Convergent Stonewort				0.005	
Common stonewort	*		*	0.004	
Stonewort ( <i>Chara</i> ) species			*		
Perfoliate pondweed		*			
Enteromorpha sp.		*			
Convergent stonewort					
Lesser pondweed					
Nuttall's waterweed	*				
Pointed stonewort	*				
<b>Total number of species</b>	<b>13</b>	<b>12</b>	<b>14</b>	<b>13</b>	<b>16</b>

Between 1997 and 2010 surveys recorded a dominance of stonewort species compared to vascular plants comprised primarily of bristly stonewort and starry stonewort, the latter species classified as a vulnerable Red Data Book species. In 2011 the data suggested an unusual reduction in the dominance of stoneworts with a shift towards the dominance of vascular macrophytes. However 2012 and 2013 data indicates that a gradually increasing abundance of stoneworts was at its highest level since 2009.

Species diversity remains very high. There continues to be plant volume (or biomass) variations that are poorly detected by the rake trawl method, especially in broads with generally high macrophyte abundance.

### 3.16 Martham South

	2009	2010	2011	2012MI	2013 MI
Starry stonewort	*	*	*	0.101	0.297
Bristly stonewort	*	*	*	0.381	0.244
Intermediate stonewort	*	*	*	0.336	0.178
Fennel-leaved Pondweed	*	*	*	0.009	0.139
Spiked water milfoil	*	*	*	0.015	0.114
Mare's tail	*	*	*	0.160	0.090
Holly-leaved naiad	*	*	*	0.193	0.069
Starwort sp.	*	*	*	0.015	0.040
Willow-leaved Pondweed			*	0.015	0.038
Filamentous algae	*	*	*		0.031
Fan leaved water crowfoot					0.031
Canadian waterweed	*	*	*	0.003	0.022
Yellow water lily	*			0.015	0.015
Opposite stonewort		*	*		0.009
Rigid hornwort	*	*	*		0.008
Baltic stonewort	*	*	*	0.056	0.007
Arrowhead		*			0.004
Pondweed sp					0.004
Whorled water milfoil					0.004
Horned pondweed	*	*		0.027	
Crowfoot sp.	*	*		0.003	
Ivy-leaved Duckweed				0.003	
Fan-leaved water crowfoot	*		*		
Convergent stonewort		*	*		
Stringy moss		*	*		
Hedgehog Stonewort	*	*	*		
Lesser pondweed			*		
Curled Pondweed			*		
Rough stonewort	*	*	*		
Enteromorpha sp.	*	*			
Perfoliate pondweed	*	*			
Common water moss					
Perfoliate pondweed	*				
<b>Total number of species</b>	<b>20</b>	<b>23</b>	<b>21</b>	<b>15</b>	<b>18</b>

As in recent years, records indicate that starry stonewort, bristly stonewort, and intermediate stonewort remain abundant across the broad, although the relative abundance of bristly and intermediate stonewort was slightly lower than in 2012. Fennel leaved pondweed displayed an increase in relative abundance compared to 2012 with the highest levels recorded since 2007.

Notably the gradual decline in species richness of the broad over the last 6 years shows some slight signs of recovery in 2013 with 18 species (not including the *Potamogeton*

fragment that wasn't identified to species level) recorded. Baltic stonewort was recorded but in much lower abundances than in recent years.

It must be noted again that the trawl survey method is not suited to the high plant abundance conditions of these broads and some species may have been missed as a result. Transect E was not surveyed due to shallow water conditions and the presence of breeding terns on the raft nearby.

### 3.2 Ant Valley

In the Ant Valley, Alderfen, Crome's and Barton broad have been regularly surveyed. These water bodies have been subject to extensive restoration effort over the last 25 years and all have improved water quality and macrophyte populations as a result. Alderfen and Crome's have good populations of rigid hornwort. In recent years, aquatic plants have been numerous within the clear water areas of Barton Broad, which have been restored through the removal of zooplanktivorous fish from exclusion areas. However, in 2013 visual observations indicated that water quality within the restoration zones was poorer than the broad itself with high turbidity levels.

#### 3.21 Alderfen

	2009	2010	2011	2012 MI	2013 MI
Rigid hornwort	*	*	*	0.122	0.608
Holly-leaved naiad	*	*		0.013	0.362
Filamentous algae	*	*	*	0.073	0.271
Fragile stonewort					0.124
Ivy-leaved duckweed		*	*	0.010	0.045
Lesser pondweed					0.007
Stonewort ( <i>Chara</i> ) species				0.007	
Fragile/convergent stonewort				0.007	
<i>Enteromorpha</i>	*	*			
Common duckweed		*			
<b>Total number of species</b>	<b>4</b>	<b>6</b>	<b>3</b>	<b>6</b>	<b>6</b>

As in 2012, rigid hornwort remained the dominant species in 2013 however the abundance of this species has been gradually declining and may be a reflection of the gradual establishment of other species within the broad. Notably the relative abundance of holly-leaved naiad was greatly increased 2013 where it was recorded at the highest relative abundance since the species was initially identified in 2006. Fragile stonewort was confirmed as being present this year and was the fourth most abundant species and lesser pondweed was recorded for the first time since 2005. Bare patches remain present on the bed of the broad and the marginal areas are increasingly shallow making it difficult to survey certain transect lengths.

### 3.22 Barton

	2009	2010	2011	2012 MI	2013 MI
Fennel-leaved pondweed	*	*	*	0.091	0.214
Nuttall's waterweed	*	*	*	0.017	0.038
Rigid hornwort	*	*	*	0.020	0.029
Curled pondweed		*		0.007	0.004
Canadian waterweed					0.004
Lesser pondweed					0.004
Frogbit					0.004
Yellow water lily	*		*	0.002	0.003
Water soldier	*			0.005	
Filamentous algae	*		*		
Starry stonewort			*		
Enteromorpha sp.			*		
White water lily	*				
<b>Total number of species</b>	<b>7</b>	<b>4</b>	<b>7</b>	<b>6</b>	<b>8</b>

Barton Broad historically had a very low abundance and occasional complete absence of recorded aquatic macrophytes. Between 2003 and 2008 more than 10 macrophyte species have been recorded each summer, with steadily increasing abundance and richness; 2013 recorded the highest relative abundance levels since 2007. Lesser pondweed and Canadian waterweed were also recorded for the first time since 2007.

### 3.23 Burntfen

	2006	2010	2013 MI
Yellow water lily	*	*	0.190
Smooth stonewort			0.008
Nuttall's waterweed			0.006
Filamentous algae	*		
White water lily		*	
Curled pondweed	*		
Common water moss	*		
Common duckweed		*	
<b>Total number species</b>	<b>4</b>	<b>3</b>	<b>3</b>

Following the removal of excessive sediment from Burntfen Broad the plant diversity and abundance has remained very poor, apart from the large lily beds that inhabit the broad margins including both white and yellow water lily. Plant abundance remained very low in 2013, but encouragingly small samples of smooth stonewort and nuttall's waterweed were both recorded for the first time in the 5 years it has been surveyed since 1998.



### 3.24 Cromes North

	2009	2010	2011	2012 MI	2013 MI
Nuttall's waterweed	*	*		0.021	0.452
Filamentous algae	*	*	*	0.251	0.371
Bladderwort		*		0.047	0.279
Rigid hornwort	*	*	*	0.203	0.206
<i>Hydrodichtion</i> sp					0.190
<i>Enteromorpha</i>	*	*	*		0.075
Lesser pondweed		*			0.032
Ivy-leaved duckweed	*	*	*	0.037	0.012
Canadian waterweed	*	*	*		0.010
Water soldier					0.009
Common water moss					0.006
Common duckweed	*	*	*	0.029	
Lesser duckweed				0.039	
Frogbit		*	*	0.013	
Lesser reedmace					
Fragile/Convergent stonewort		*			
White water lily	*	*			
Delicate stonewort					
Yellow water lily			*		
Fennel-leaved pondweed		*			
<b>Total number of species</b>	<b>8</b>	<b>13</b>	<b>8</b>	<b>8</b>	<b>11</b>

Crome's Broad is divided into north and south basins by a reed strip on top of an old peat baulk. Both the basins have been dredged/mud pumped in the past and historically the south broad has had a greater diversity of plants than the north broad. However in the last few years, the positive effects of increased water depth as a result of the mud pumping have been reflected by increasing species richness in the north basin, whilst the southern broad has undergone a decline in species richness and abundance.

2013 was a good year for plant abundance levels in the north broad following a very poor year in 2012. 11 species were recorded with 2 new examples being common water moss and water soldier which had not been recorded on the transects in the last 5 years. Filamentous algae was still the second most abundant species, but nuttall's waterweed and rigid hornwort had increased in abundance from 2012, whilst bladderwort was recorded at the highest abundance in 2013 since it was first recorded in 2010.

### 3.25 Cromes South

	2009	2010	2011	2012 MI	2013 MI
Bladderwort		*	*	0.630	0.762
Rigid hornwort	*	*	*	0.183	0.186
Filamentous algae	*	*	*	0.017	0.101
Canadian waterweed	*	*	*		0.101
Ivy-leaved duckweed	*	*	*	0.126	0.050
Nuttall's waterweed	*	*	*	0.183	0.017
<i>Enteromorpha</i>			*	0.036	
Lesser pondweed		*			
Common duckweed	*			0.026	
Frogbit				0.010	
Lesser reedmace				0.010	
Fragile/Convergent stonewort	*	*			
Delicate stonewort	*	*			
White water lily		*			
<b>Total number of species</b>	<b>8</b>	<b>10</b>	<b>7</b>	<b>9</b>	<b>6</b>

Cromes Broad south has suffered in the past with high inputs of phosphate from surrounding runoff and ground water. To attempt to reduce the levels a project was developed in conjunction with Natural England to use a product called Phoslock which binds phosphate particles in the water column, reducing the availability for plant growth. The aim was to improve water quality and reduce the growth of undesirable algae. This project was completed over the 2012/13 winter.

The 2013 survey was the first since the Phoslock project and indications are that abundance of the most common species in the broad have been unaffected. In fact the relative abundance of bladderwort and rigid hornwort have increased since 2012 but as has filamentous algae.

### 3.3 Bure Valley

The hydrological connection to the River and the position of the Bure Valley broads within the catchment affects both ecological condition and restoration potential of these waterbodies. In recent years Upton and Cockshoot Broads, both isolated from the river, have had the highest populations of aquatic plants present in the Bure Broads. Upton Great Broad is a stronghold for the rare holly-leaved naiad. Upton Little Broad was surveyed for the second time following mudpumping in 2011. Those broads directly connected to the river, such as Ranworth, tend to have minimal plant diversity.

#### 3.31 Cockshoot

	2009	2010	2011	2012 MI	2013 MI
Holly-leaved naiad	*	*	*	0.731	0.670
Filamentous algae	*	*	*	0.206	0.210
<i>Enteromorpha</i>	*		*	0.012	0.154
Horned pondweed	*		*		0.022
Fragile / convergent stonewort					0.019
Rigid hornwort	*	*	*	0.026	0.016
Canadian waterweed	*	*	*	0.002	0.015
Common duckweed			*		0.015
Opposite stonewort					0.011
Lesser pondweed	*		*		0.007
Common stonewort	*				0.006
Fragile stonewort					0.001
White water lily	*		*	0.012	
Yellow water lily		*	*	0.012	
<b>Total number of species</b>	9	5	9	7	11

Holly-leaved naiad remains the dominant species in Cockshoot, with very high abundance covering virtually the entire waterbody in the last 3 years. . Cockshoot dyke was mudpumped in the winter 2011/2012 and in 2013 there appeared to be a further reduction in the abundance of filamentous algae compared to 2011 & 2012 with holly leaved naiad being recorded there.

The overall levels of relative plant abundance were the highest since 2009 and notably stoneworts (see Abundance Trends in Appendix 2) formed a large part of the overall plant abundance levels. Opposite, common and fragile stoneworts were all recorded in 2013 having not been present since 2007. The overall number of species totalled 11, also the highest levels for at least 5 years.

### 3.32 Decoy

	2007	2008	2009 MI	2013 MI
Rigid hornwort	*	*	0.068	0.783
Yellow water lily	*	*	0.011	0.062
Nuttall's waterweed				0.044
Filamentous algae	*	*		
Holly-leaved naiad	*		0.003	
Unbranched bur-reed				
<i>Enteromorpha</i>				
Canadian waterweed	*			
Branched bur-reed				
Starwort sp.				
<b>Total number of species</b>	<b>5</b>	<b>3</b>	<b>3</b>	<b>3</b>

Decoy Broad has not been surveyed since 2009 where historically the overall abundance and species richness of plants was very low. The results of the surveys in 2013 show a dramatic rise in the abundance of macrophytes in the broad albeit the abundance being dominated by a single species namely rigid hornwort. Species diversity remains very low, although nuttall's waterweed was newly recorded.

### 3.33 Hoveton Great

	2009	2010	2011	2012 MI	2013 MI
Filamentous algae	*	*	*	0.052	0.104
Rigid hornwort	*	*	*	0.091	0.098
Yellow water lily	*	*		0.025	0.033
Fennel-leaved pondweed	*	*	*	0.016	0.029
Nuttall's waterweed				0.004	0.005
Curled pondweed				0.012	0.003
Canadian waterweed		*	*		
Horned pondweed		*			
White water lily	*	*			
Holy leaved naiad	*				
Starwort					
<b>Total number of species</b>	<b>6</b>	<b>7</b>	<b>4</b>	<b>6</b>	<b>6</b>

Hoveton Great Broad generally has low macrophyte abundance with remnant patches of water lilies in sheltered bays. The species richness of this broad continues to be stable, at a low level, with only slight changes in species composition over the years. The list of species recorded in 2013 and 2012 is exactly the same, but the relative abundance of all these species has shown a slight increase since 2012. This is probably a result of the fairer summer weather in 2013.

### 3.34 Hoveton Little

	2006	2007	2008 MI	2013 MI
Rigid hornwort				0.245
Fennel-leaved pondweed	*	*	0.094	0.139
Canadian waterweed			0.003	0.019
Nuttall's waterweed		*		
Curled pondweed	*	*	0.002	
<b>Total number of species</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>

Hoveton Little Broad has historically been a broad with low species diversity and low abundance levels. Rigid hornwort was recorded in 2013 but had not been recorded since 2005. Abundance and diversity remains very low, although the abundance of plants was greater than previously recorded.

### 3.35 Pound End

	2006	2007	2008 MI	2013 MI
Filamentous algae		*	0.019	0.043
Fennel leaved pondweed		*	0.028	0.043
Holly-leaved naiad	*	*	0.009	0.035
Rigid hornwort			0.011	0.022
Curled pondweed	*	*		
<b>Total number of species</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>4</b>

Pound End broad is located immediately adjacent to Hoveton Little Broad and is interesting to note the difference in species recorded, particularly taking into consideration that there is no boating access to Pound End. Of particular note is the presence of holly-leaved naiad which was recorded from all transects but has not been recorded in Hoveton Little Broad since 2004.

### 3.36 Ranworth

	2009	2010	2011	2012 MI	2013 MI
Rigid hornwort	*	*	*	0.009	0.026
Fennel-leaved pondweed	*	*	*	0.011	0.005
Common water moss					0.002
Curled pondweed	*	*	*	0.008	
Nuttall's waterweed			*		
Holly-leaved naiad			*		
Filamentous algae	*				
<b>Total number of species</b>	<b>4</b>	<b>3</b>	<b>5</b>	<b>3</b>	<b>3</b>

Following the historical trend, plant abundance and species diversity was very low in Ranworth Broad in 2013. Rigid hornwort and fennel-leaved pondweed were recorded having been present in low abundances every year since 2009. Curled pondweed has been frequently present but was not recorded in 2013. Overall plant abundance was at its lowest level since 2008.

### 3.37 Upton Great

	2009	2010	2011	2012 MI	2013 MI
Opposite stonewort	*	*	*	0.206	0.499
Holly-leaved naiad	*	*	*	0.774	0.458
Common Stonewort				0.048	0.307
Filamentous algae					0.004
Water net		*			
Convergent stonewort	*				
Yellow water lily	*				
<b>Total number of species</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>4</b>

Upton Great Broad continues to be a stable stronghold for holly-leaved naiad, where in 2013 it continued to occupy much of the water column, although the relative abundance of opposite stonewort was calculated to be slightly higher in 2013. This reflects a shift (illustrated in the abundance graphs in Appendix 2) in 2013 to a dominance of stonewort rather than macrophytes. Encouragingly the overall levels of plant abundance were the highest recorded here since 1997.

As in previous years, the stonewort population is generally found around the shallower, marginal areas rather than the deeper, central basin where holly-leaved naiad dominates. Common stonewort was recorded again in 2013 following its identification in 2012 for the first time since 2003.

Interestingly, 2 additional stonewort species were identified from observations in the south east corner of the broad which were not covered by the transects; these are bristly stonewort which has not been recorded as part of the transect survey since 1991 and fragile/convergent stonewort, most likely convergent stonewort as it has been recorded in the past.

### 3.38 Upton Little

	2009	2010	2011	2012 MI	2013 MI
Bristly stonewort					0.880
Opposite stonewort		*		1	0.250
Filamentous algae	*	*			
Najas marina	*	*			
Common stonewort	*				
<b>Total number of species</b>	<b>3</b>	<b>3</b>		<b>1</b>	<b>2</b>

Following the completion of mudpumping in autumn 2011, opposite stonewort rapidly colonised the bare sediment in 2012, however 2013 has seen a shift in the dominance of opposite stonewort to bristly stonewort, a species which has not been present historically. Again, holly-leaved naiad plants were observed within the broad but not picked up on the transects. The plants were more robust and covered a larger area than in 2012. It is predicted that the occurrence of holly-leaved naiad will continue to increase in subsequent years.

### 3.49 Wroxham

	2009	2010	2011	2012 MI	2013 MI
Rigid hornwort		*	*	0.059	0.212
Fennel-leaved pondweed	*	*	*	0.087	0.106
Nuttall's waterweed	*		*		0.084
Filamentous algae	*	*			0.057
Yellow water lily	*				0.006
Unbranched bur-reed					0.005
Starwort sp					0.005
Common water moss					0.005
Horned pondweed		*	*		
Smooth stonewort		*			
Canadian waterweed		*			
Pointed stonewort					
<b>Total number of species</b>	<b>4</b>	<b>6</b>	<b>4</b>	<b>2</b>	<b>8</b>

Following many years of poor plant growth, surveys in 2013 showed that overall plant abundances had increased to the highest levels since 1998, with 8 species being recorded. Fennel-leaved pondweed and rigid hornwort are often present but the relative abundance of both species had increased in 2013. The greatest coverage of plants was found along the transects at the northern end of the broad. It will be interesting to see whether the improvements in diversity and abundance are lasting or if they are a temporary anomaly that's come about due to a mild warm summer.

### 3.4 Yare Valley

Waterbodies surveyed in the Yare Valley are generally of good condition in terms of their submerged macrophyte populations; submerged plants are frequent in Rockland and Wheatfen Broads. Whitlingham Great and Little Broads originated from gravel extraction and despite their 'youth' have abundant submerged plant growth and a diverse species assemblage.

#### 3.41 Buckenham

	2008	2009	2010	2011 MI	2013 MI
Filamentous algae	*	*	*	0.663	0.467
Rigid hornwort	*	*	*	0.352	0.336
Whorled water milfoil		*	*	0.014	0.126
Ivy-leaved duckweed	*	*	*	0.050	0.046
Fragile/convergent stonewort	*		*		0.019
Common water moss				0.007	0.017
Fennel-leaved pondweed		*	*		0.010
Yellow water lily					0.007
Common duckweed	*				0.007
Fragile stonewort		*			
Nuttall's waterweed		*			
<i>Enteromorpha</i> sp		*	*		
Curled pondweed		*	*		
Fan-leaved water crowfoot		*		0.006	
Horned pondweed		*			
<b>Total number of species</b>	<b>5</b>	<b>11</b>	<b>8</b>	<b>6</b>	<b>9</b>

There was a slight increase in species richness at Buckenham Broad since the last survey in 2011. The relative abundance of those species which are regularly recorded was slightly lower than in the previous surveys apart from the whorled water milfoil. Filamentous algae continues to dominate the water column, however the occurrence of a stonewort species is positive. Plant communities in Buckenham Broad appear to be relatively stable.

#### 3.42 Hassingham

	2008	2009	2010	2011 MI	2013 MI
Filamentous algae	*	*	*	0.211	0.457
Rigid hornwort	*	*	*	0.584	0.282
Fragile stonewort		*	*	0.073	0.261
Bristly stonewort	*				0.055
Ivy-leaved duckweed	*	*	*	0.015	0.029
Fragile/convergent stonewort	*	*		0.107	0.019
Common water moss				0.006	
Fennel-leaved pondweed				0.013	
Common duckweed	*				
Nuttall's waterweed			*		
<i>Enteromorpha</i> sp			*		



Curled pondweed	*		*	0.102	
Pink water-speedwell			*		
<b>Total number of species</b>	<b>7</b>	<b>5</b>	<b>8</b>	<b>8</b>	<b>6</b>

2013 saw a slight decline in the species richness of this broad and the summary abundance charts in Appendix 2 illustrate a slight shift towards the dominance of mosses and algae, with an increase in the proportion of stoneworts and a reduction in the relative abundance of macrophytes.

Notably, bristly stonewort was recorded for the first time since 2008 whilst being the fourth most abundant species in 2013. Whorled water milfoil was observed in parts around the broad but again was not recorded as part of the transect surveys.

### 3.43 Strumpshaw

	2008	2010	2011	2012 MI	2013 MI
Filamentous algae	*	*	*	0.985	0.824
Rigid hornwort	*	*	*	0.029	0.352
Ivy-leaved duckweed		*	*	0.038	0.050
<i>Enteromorpha</i>		*		0.003	0.035
Holly-leaved naiad	*	*	*		0.035
Common reed				0.015	
Least duckweed				0.003	
Lesser pondweed	*				
Common duckweed			*		
Frogbit			*		
Stonewort ( <i>Chara</i> ) species			*		
Opposite stonewort			*		
Bladderwort	*				
Common stonewort					
Convergent stonewort	*				
Fragile/Convergent stonewort	*				
Unbranched bur-reed					
<b>Total number of species</b>	<b>7</b>	<b>5</b>	<b>8</b>	<b>6</b>	<b>5</b>

Surveying at Strumpshaw has become increasingly difficult as water levels decrease with an increase in sediment level and an increase in the growth of filamentous algae. Transect C was not surveyed in 2013 as boat access was not possible from the main broad. Saline incursions are considered to be the reason behind the significant loss of species and the very high amounts of filamentous algae found since 2010.

The results from 2013 (see Appendix 2) show an increase in the abundance of macrophyte species with proportions of algae and floating species remaining fairly stable since 2010. This shift is largely a result of the increased abundance of rigid hornwort.

### 3.44 Whitlingham Great

	2008	2009	2011	2012 MI	2013 MI
Nuttall's waterweed	*	*	*	0.347	0.379
Small pondweed					0.104
Common stonewort	*	*	*	0.052	0.072
Curled pondweed			*	0.001	0.054
Rigid hornwort			*	0.054	0.030
Hair like pondweed			*	0.007	0.026
Filamentous algae			*	0.012	0.021
Fan-leaved water crowfoot	*		*	0.027	0.015
Canadian waterweed	*	*		0.029	0.007
Lesser pondweed	*		*	0.034	0.004
Unbranched bur-reed					0.004
Delicate stonewort			*		0.004
Ivy-leaved duckweed		*	*	0.0004	0.001
Amphibious bistort	*	*	*		0.000
Opposite stonewort			*	0.008	
Water net		*	*		
Crowfoot sp.			*		
Fragile / Convergent stonewort			*		
<i>Enteromorpha</i>		*	*		
Filamentous algae	*	*			
Fragile stonewort	*				
Pointed stonewort	*	*			
Smooth stonewort	*				
<b>Total number of species</b>	<b>10</b>	<b>9</b>	<b>16</b>	<b>11</b>	<b>14</b>

Since the first survey in 2003, the abundance of plants in Whitlingham Great broad has remained relatively high. As the graphs in Appendix 2 illustrate, the abundance of plants in 2013 has increased since 2011 along with the total number of species recorded.

The broad continues to support a good variety of fine-leaved pondweed species including small pondweed which has not been recorded at the Great broad since 2004. It is worth noting that it is not easy separating this small pondweed from lesser pondweed without a high powered microscope and therefore one or other species may have been overlooked in the past.

In general Whitlingham Great broad continues to support a diverse and relatively stable plant community with good abundance / coverage.

### 3.45 Whitlingham Little

	2009	2010	2011	2012 MI	2013 MI
Nuttall's waterweed		*	*	0.038	0.391
Rigid hornwort	*	*	*	0.188	0.299
Small pondweed					0.178
Ivy-leaved duckweed	*	*	*	0.012	0.072
Canadian waterweed		*	*		0.026
Unbranched bur-reed					0.012
Fennel leaved pondweed	*	*			0.011
Filamentous algae	*	*	*	0.044	0.003
Fragile/Convergent stonewort	*	*	*		0.003
Common stonewort	*	*			0.003
Curled pondweed					
Water net			*		
Delicate stonewort		*			
Amphibious bistort		*			
<i>Enteromorpha</i>	*				
Fan-leaved water crowfoot					
<b>Total number of species</b>	<b>7</b>	<b>10</b>	<b>7</b>	<b>4</b>	<b>10</b>

Following a very poor year in 2012, the 2013 survey saw a recovery in the relative abundance and number of species present with the highest levels recorded since 2010. The abundance of the dominant nuttall's waterweed and rigid hornwort increased in 2013. There were a number of species that re-appeared following a poor growing season in 2012 including Canadian waterweed and fragile/convergent stonewort.

There were 2 species present that had not been identified since 2010 specifically fennel-leaved pondweed and common stonewort. As with the Great broad, small pondweed was identified to be the third most abundant species having not been recorded previously.

## **4 ACKNOWLEDGEMENTS**

The Broads Authority wishes to thank all those individuals and organisations who assisted during the 2013 survey season by providing their time, boats, identification skills or permissions.

## 5 REFERENCES

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Kennison, G.C.B., Dunsford, D.S. & Schutten, J. (1998) Stable or changing lakes? A classification of aquatic macrophyte assemblages from a eutrophic shallow lake system in the United Kingdom. *Aquatic Conservation : Marine & Freshwater Ecosystems*, 8 669-684.

Stewart, N.F. and Church, J.M. (1992) Red Data Book of Britain and Ireland: Stoneworts, The Joint Nature Conservation Committee, Peterborough.

## **6 APPENDICIES.**

Appendix 1. Macrophyte groupings based on physical form.

Appendix 2. Long term macrophyte abundance trends (1983 – 2010)

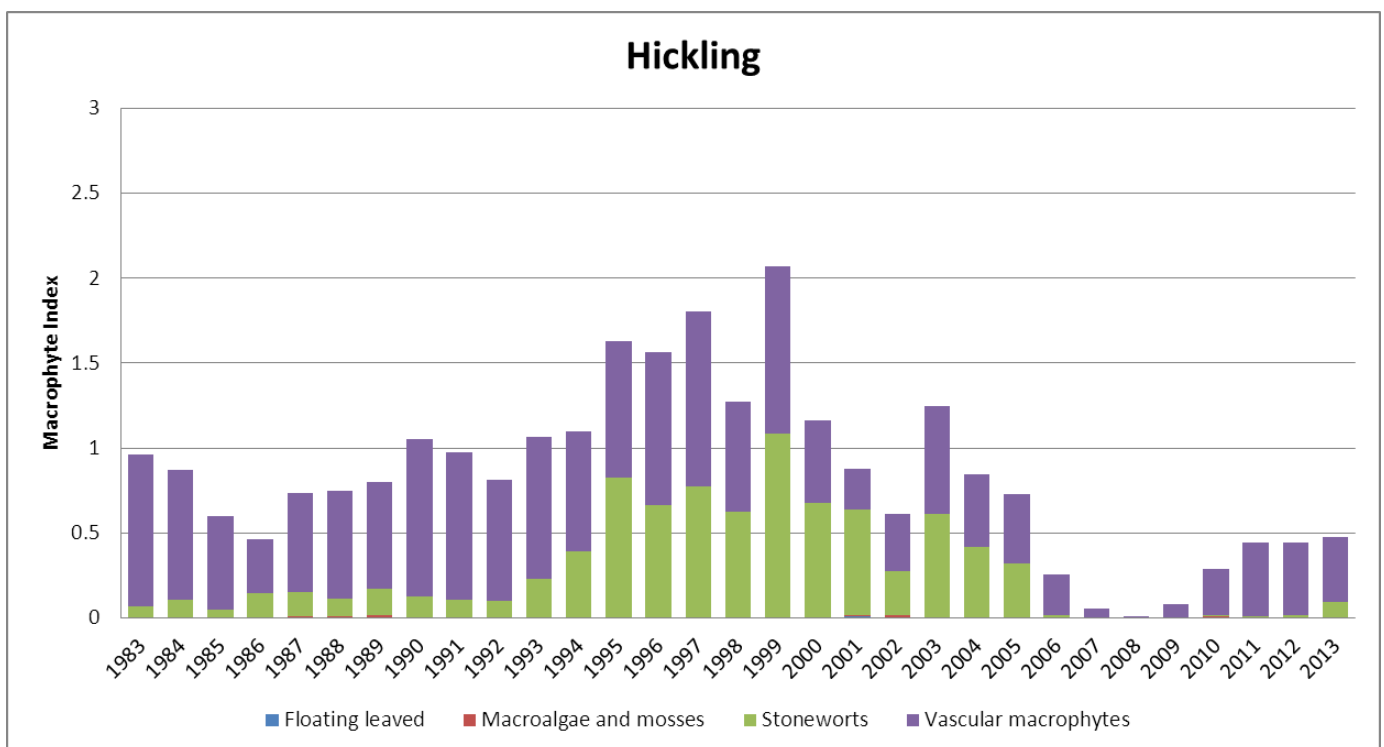
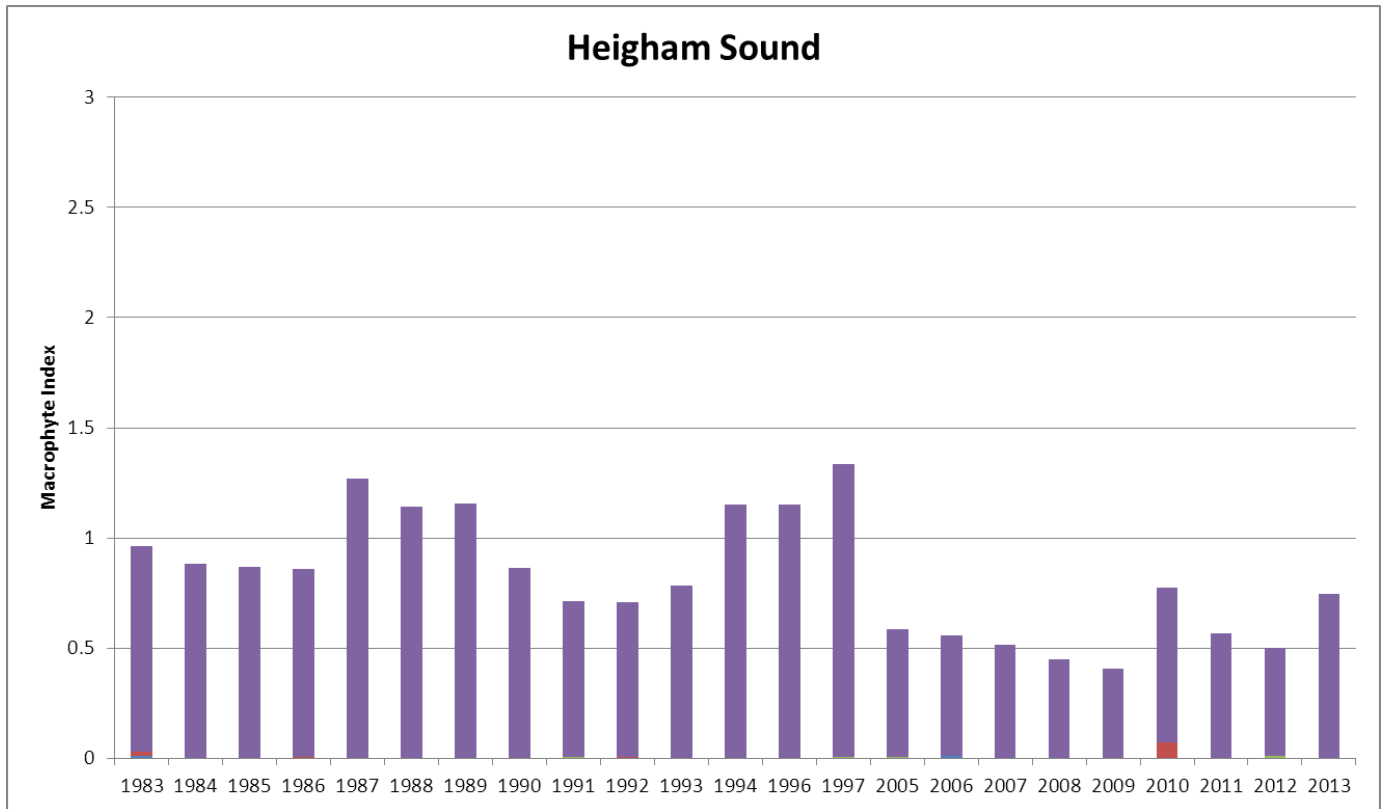
Appendix 3a & b. Plant common and Latin names.

## 6.1 Appendix 1. Macrophyte groupings based on form

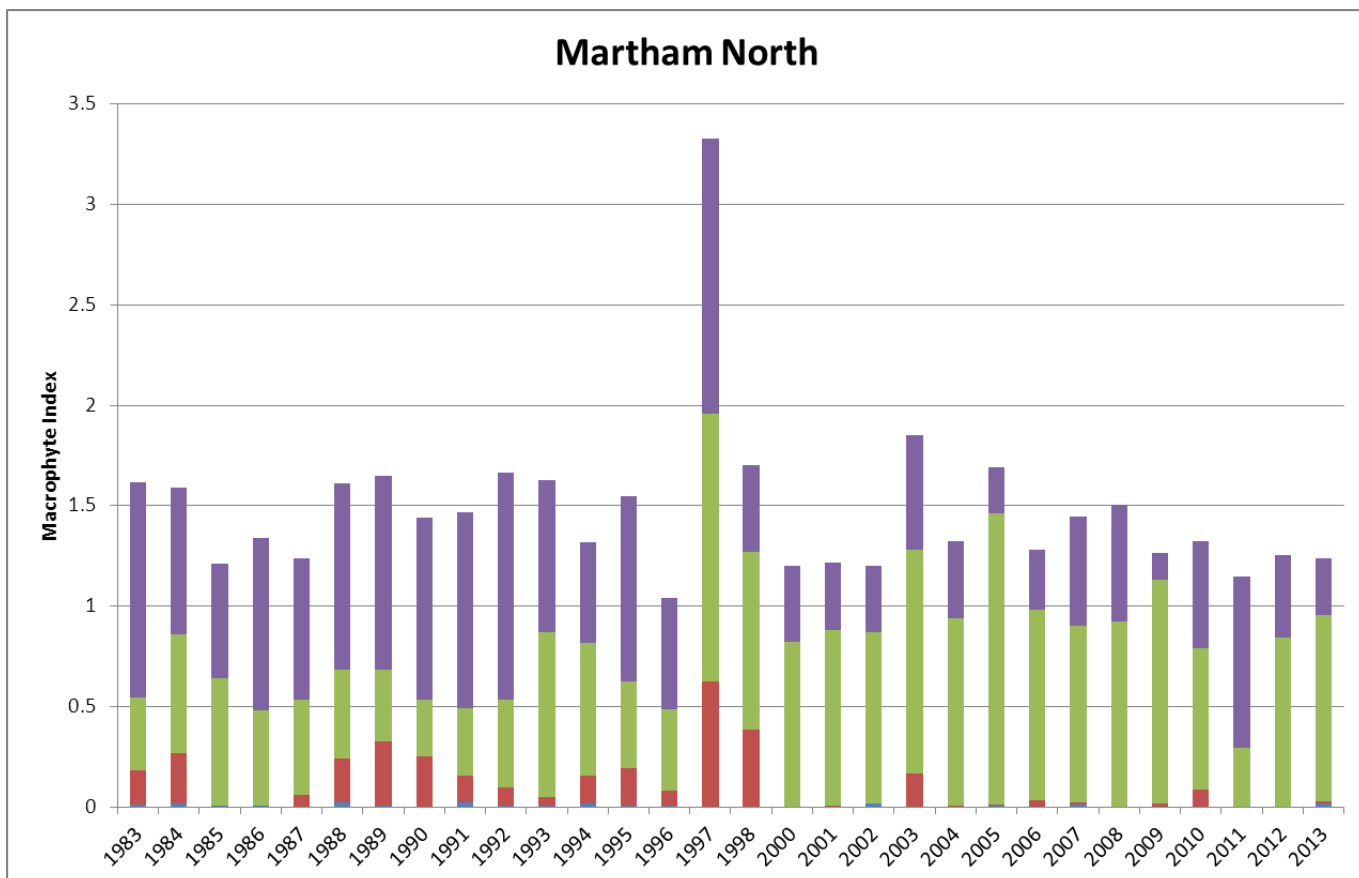
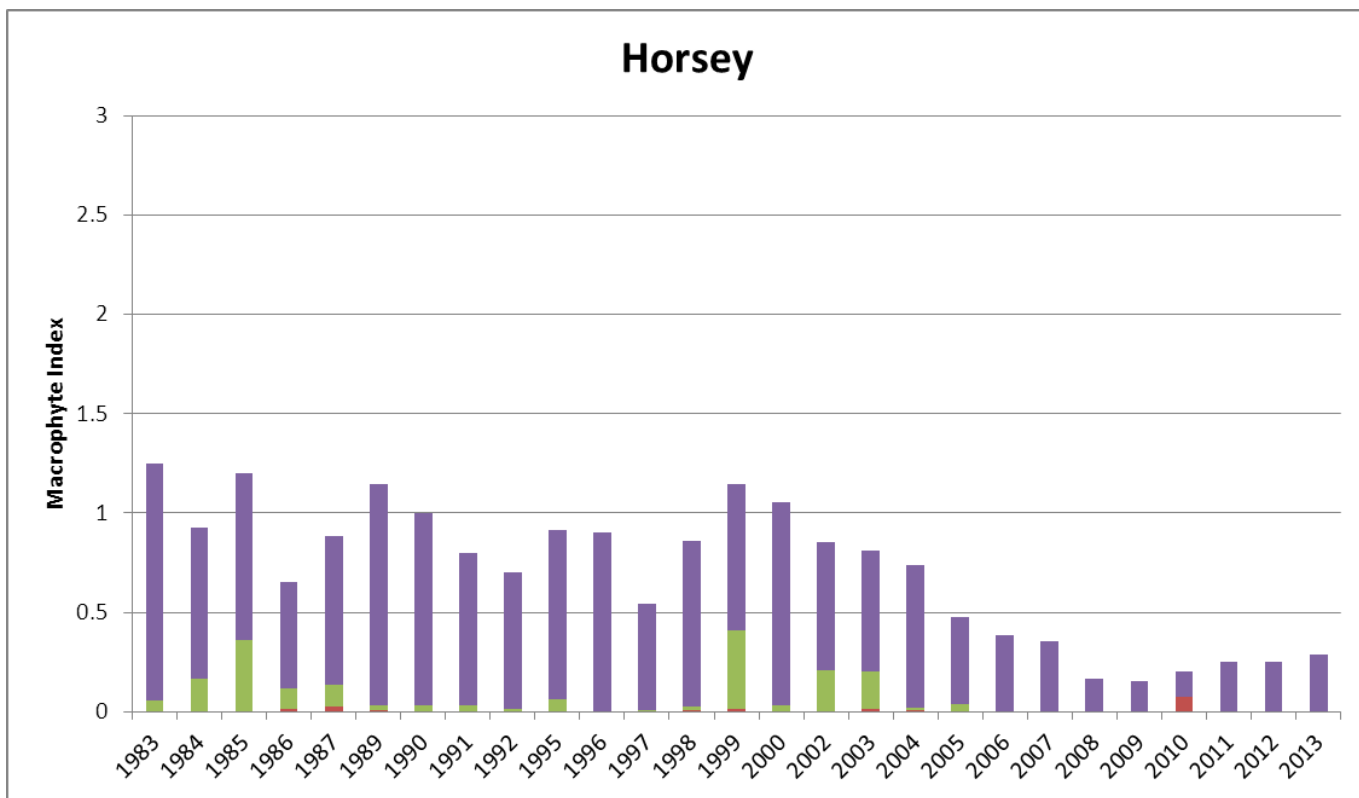
<b>Stoneworts</b>	<b>Free-floating or round floating-leaved</b>	<b>Vascular Macrophytes</b>	
Baltic stonewort	Amphibious bistort	Arrowhead	Lesser pondweed
Bristly stonewort	Common duckweed	Australian swamp stonecrop	Lesser reedmace
Common stonewort	Frogbit	Blunt-leaved pondweed	Mare's tail
Convergent stonewort	Greater duckweed	Branched bur-reed	Nuttall's waterweed
Delicate stonewort	Inflated duckweed	Broad –leaved pondweed	Perfoliate pondweed
Fragile stonewort	Ivy-leaved duckweed	Bulrush	Reed sweet grass
Hedgehog stonewort	Least duckweed	Canadian waterweed	Rigid hornwort
Intermediate stonewort	White water lily	Common reed	Sharp-leaved pondweed
Lesser bearded stonewort	Yellow water lily	Crowfoot sp.	Shining Pondweed
Opposite stonewort		Curled pondweed	Small pondweed
Pointed stonewort		Fan-leaved water crowfoot	Spiked water milfoil
Rough stonewort	<b>Macro-algae and mosses</b>	Fennel-leaved pondweed	Starwort sp.
Starry stonewort	<i>Enteromorpha</i>	Flat-stalked pondweed	Sweet flag
Translucent stonewort	Common water moss	Floating club-rush	Unbranched bur-reed
	Filamentous algae	Greater bladderwort	Water cress
	Stringy moss	Greater reedmace	Water-soldier
	Water net	Hair like pondweed	Whorled water milfoil
		Holly-leaved naiad	Willow-leaved pondweed
		Horned pondweed	

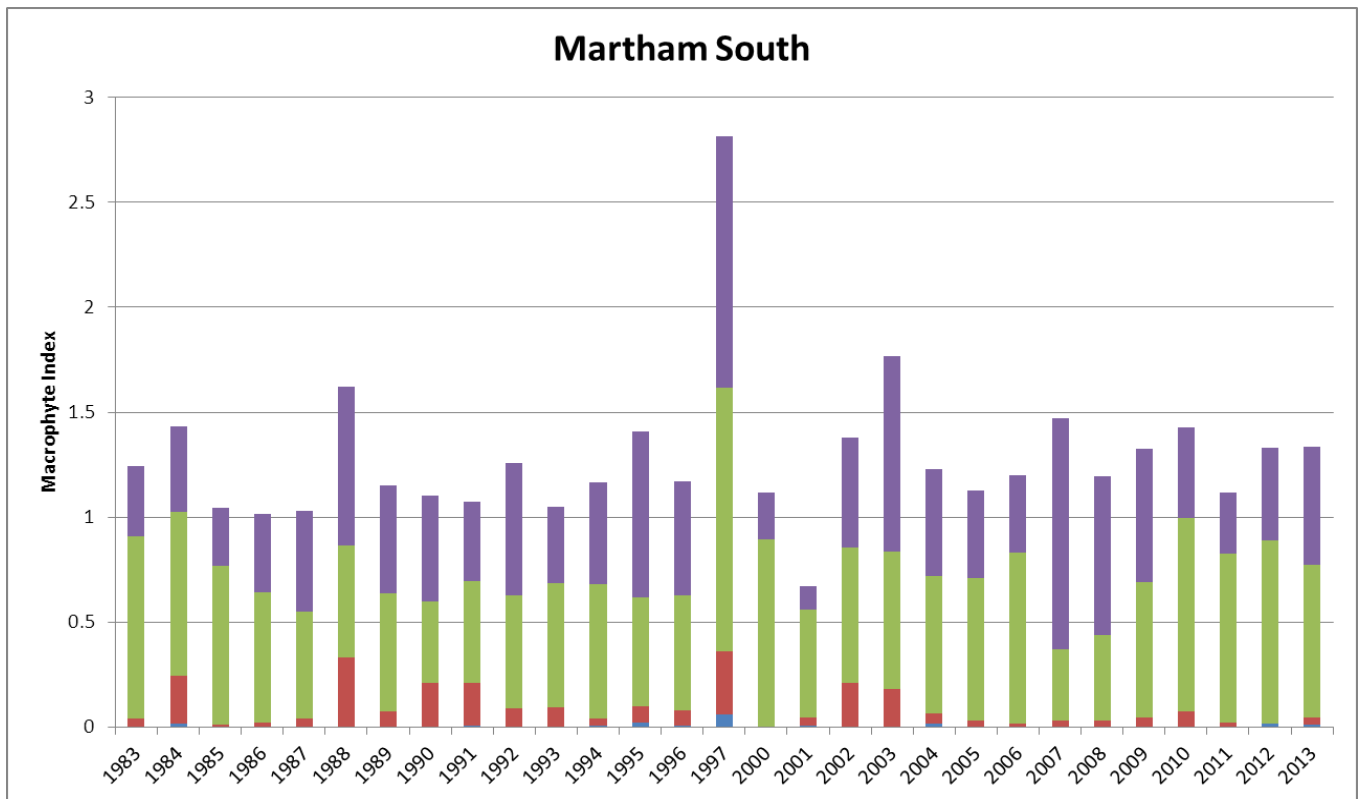
## 6.2 Appendix 2. Macrophyte abundance trends (1983 – 2013)

### River Thurne

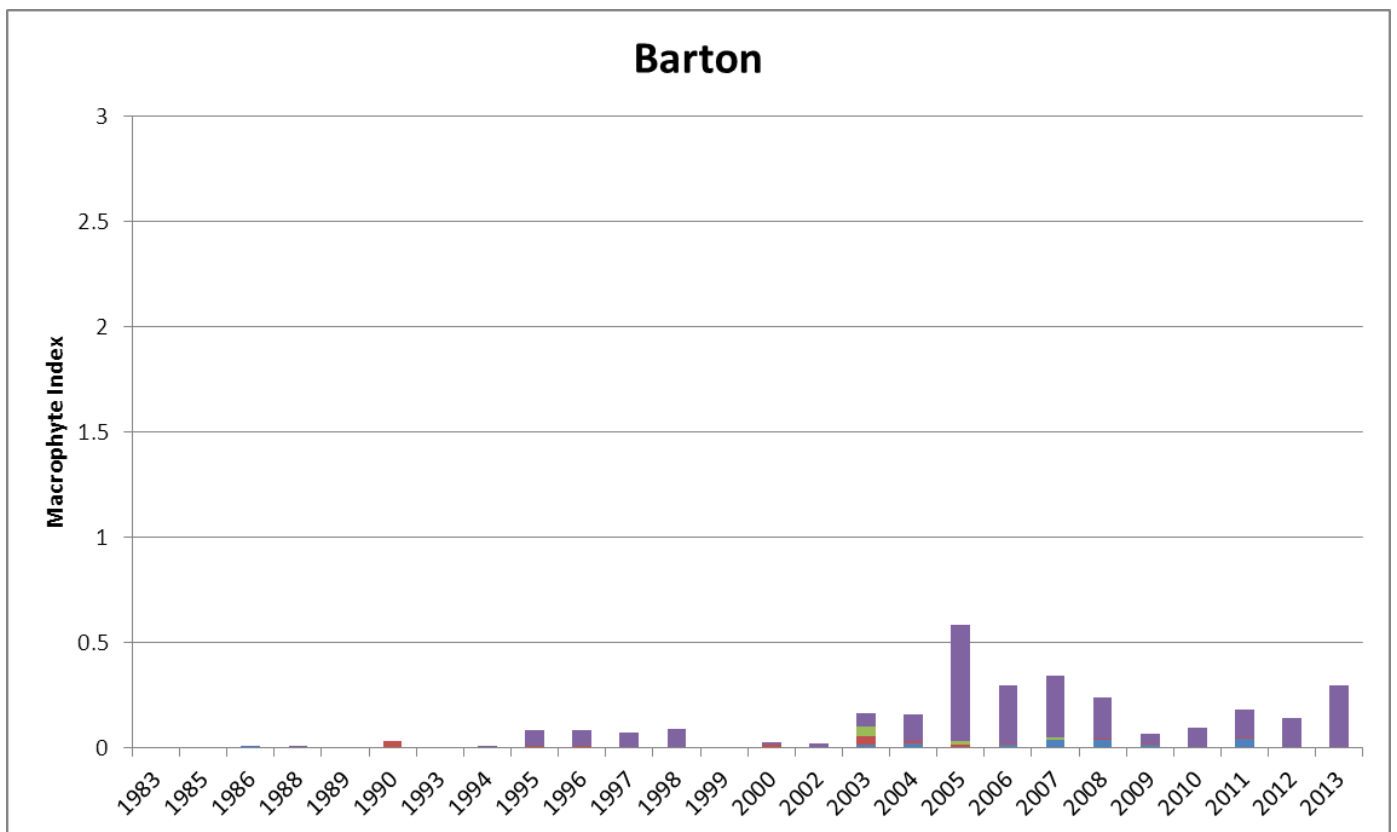
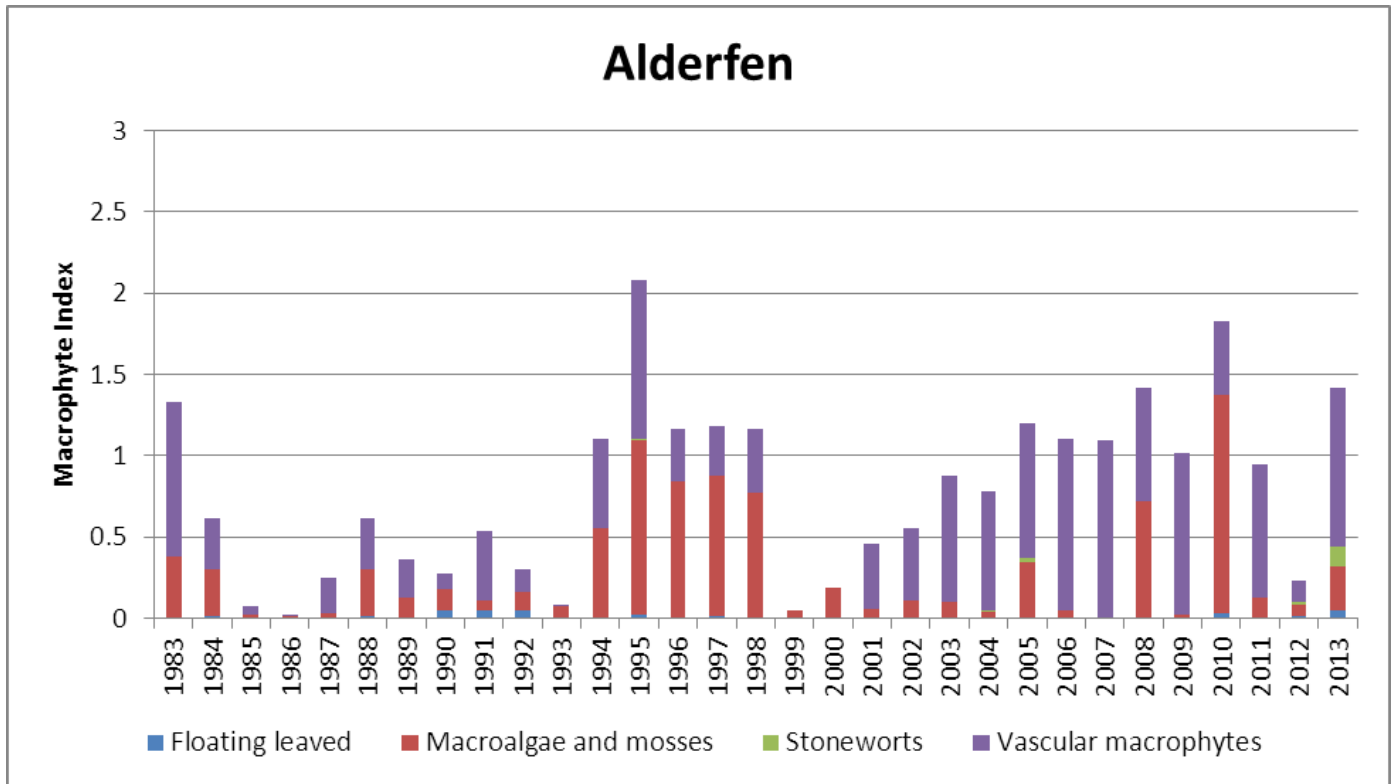


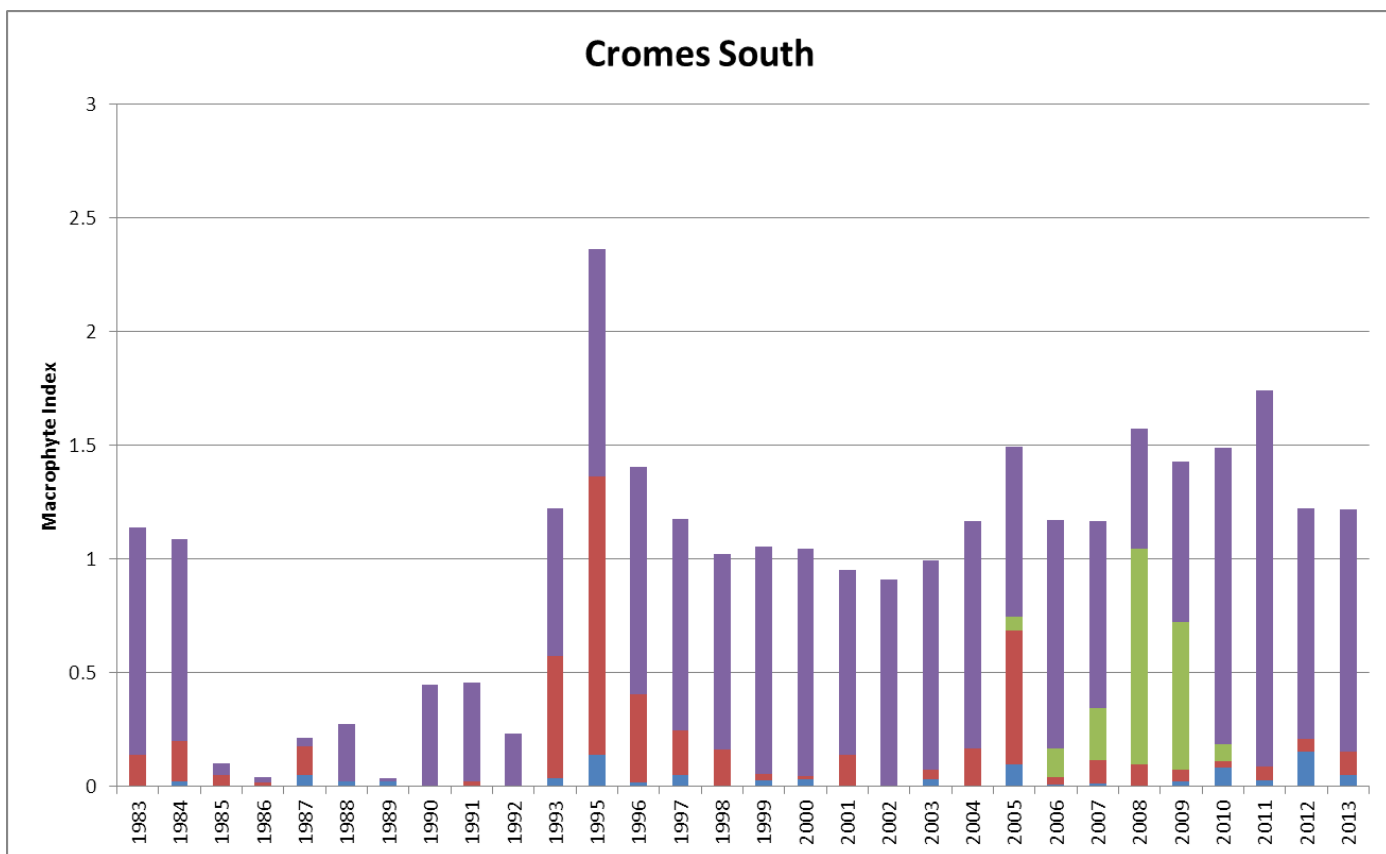
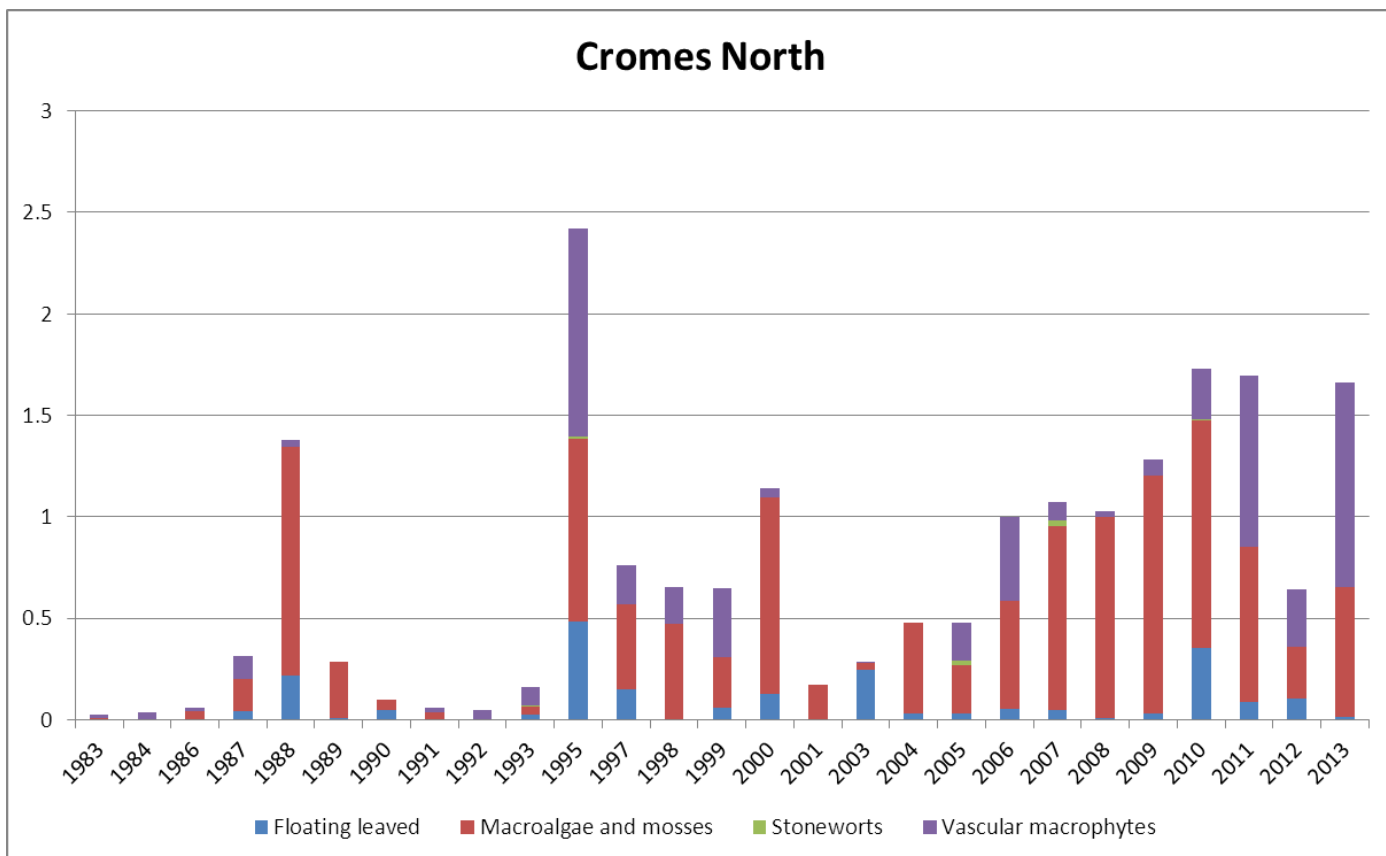




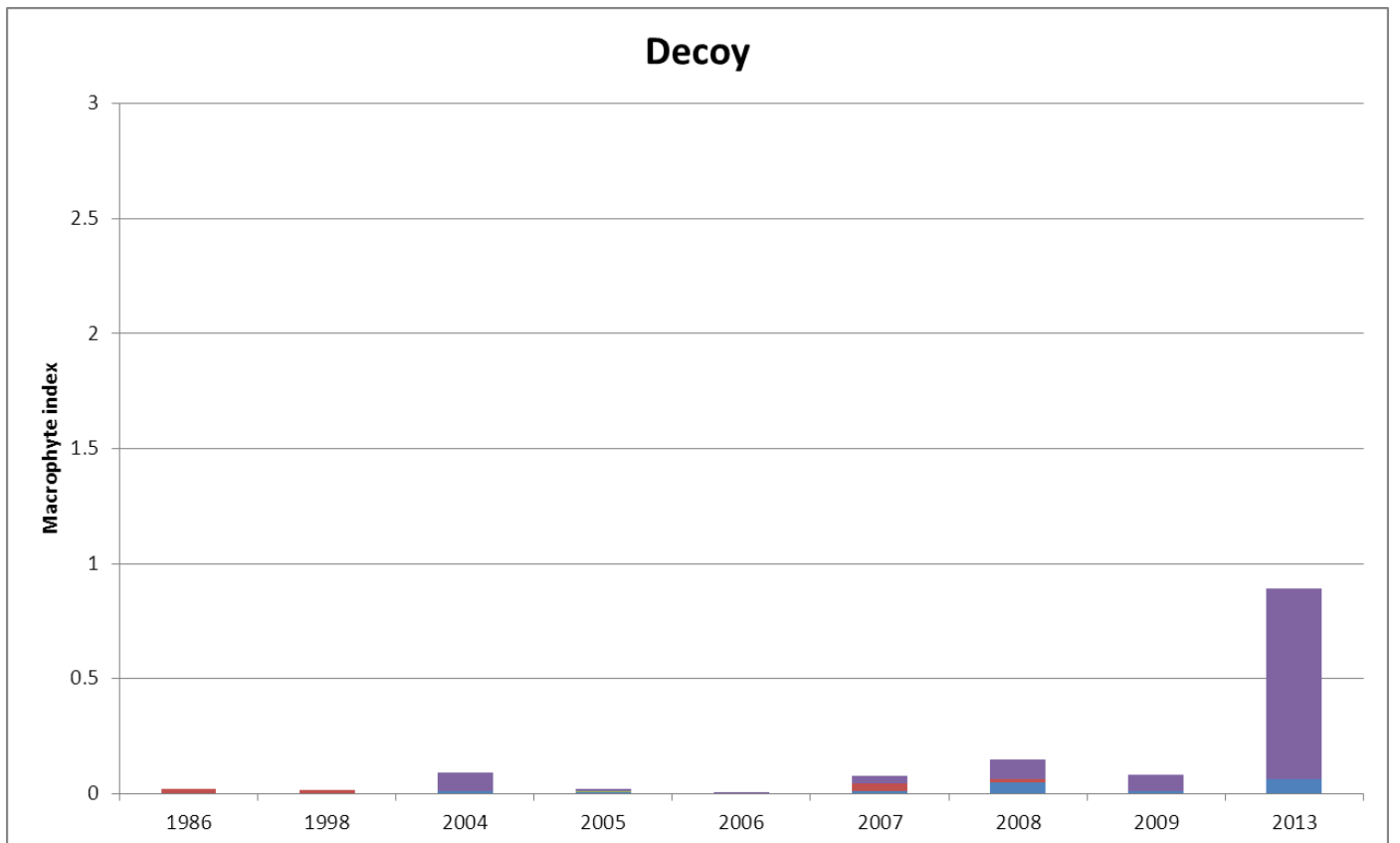
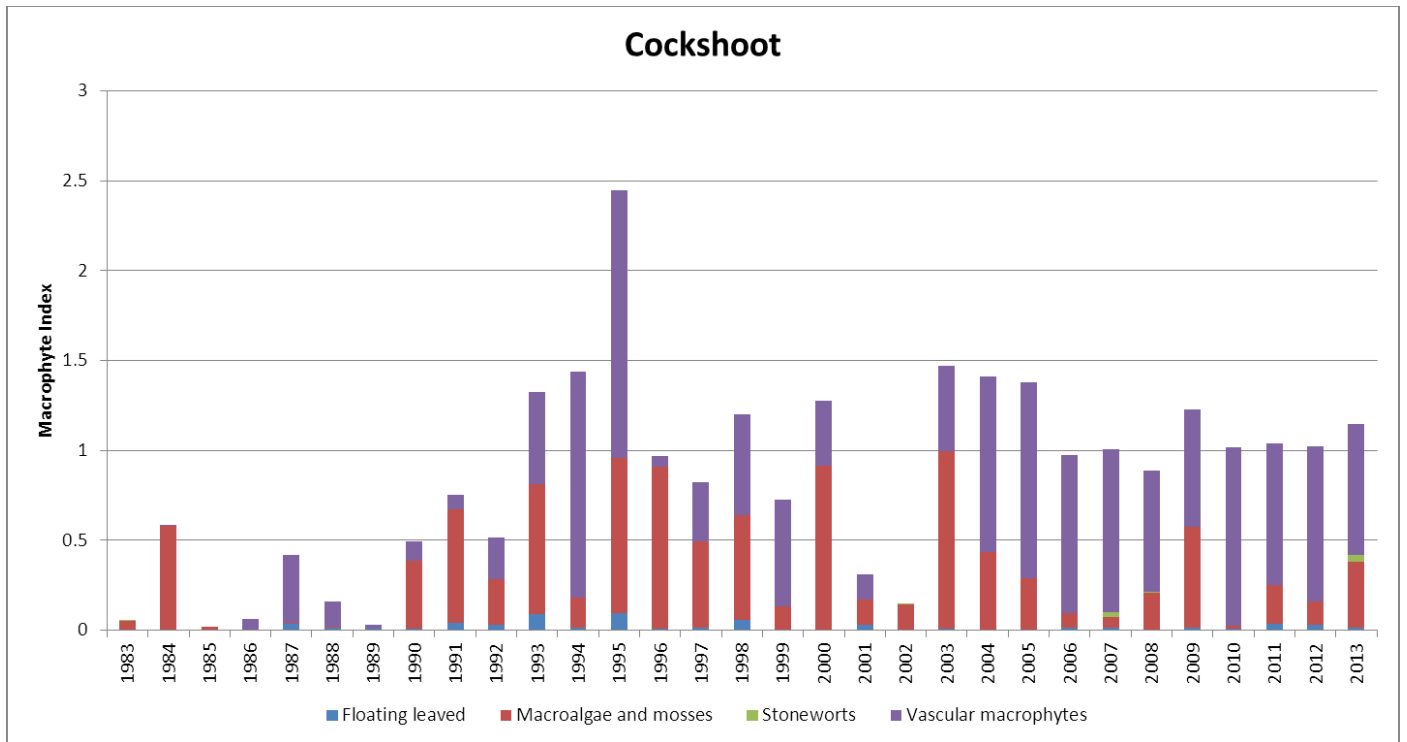


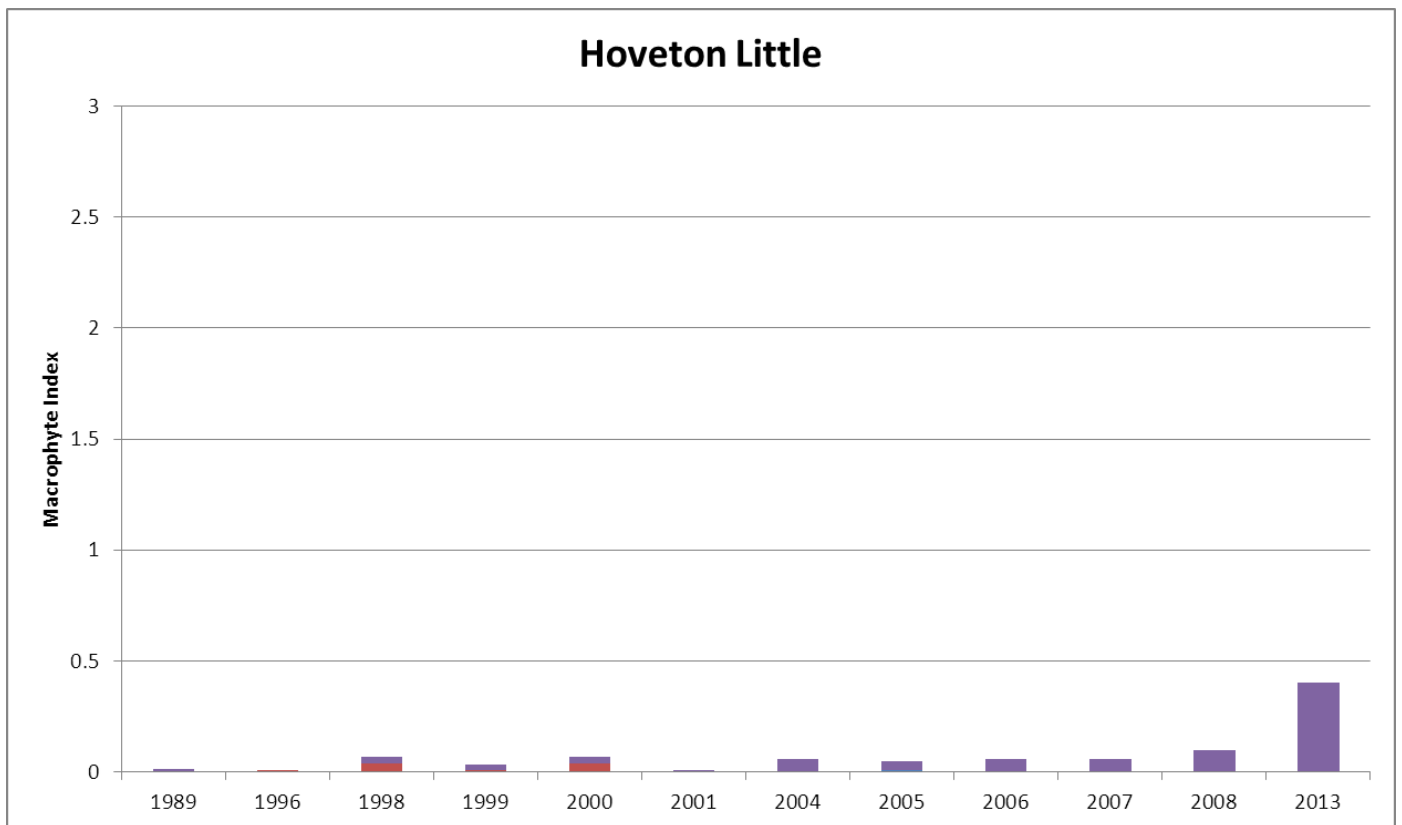
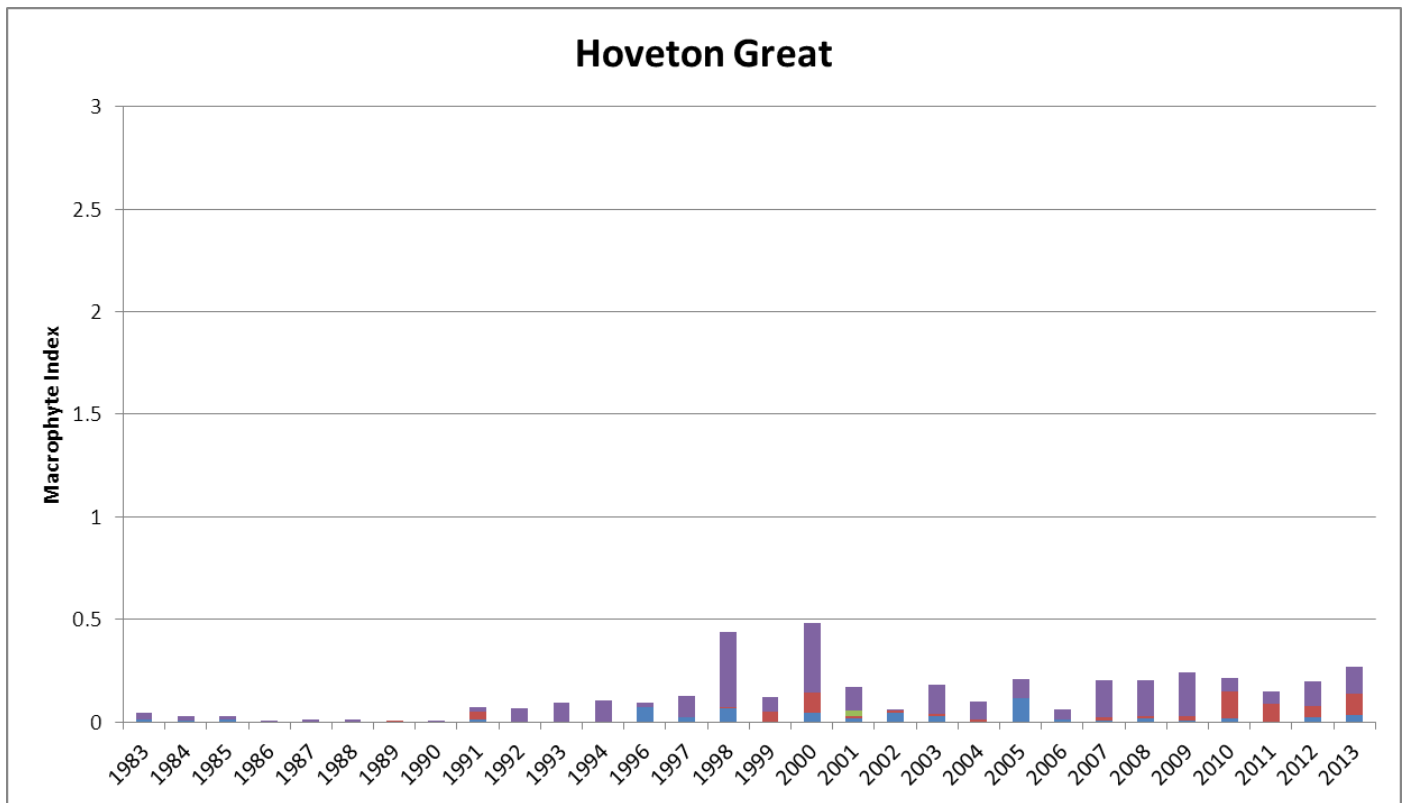
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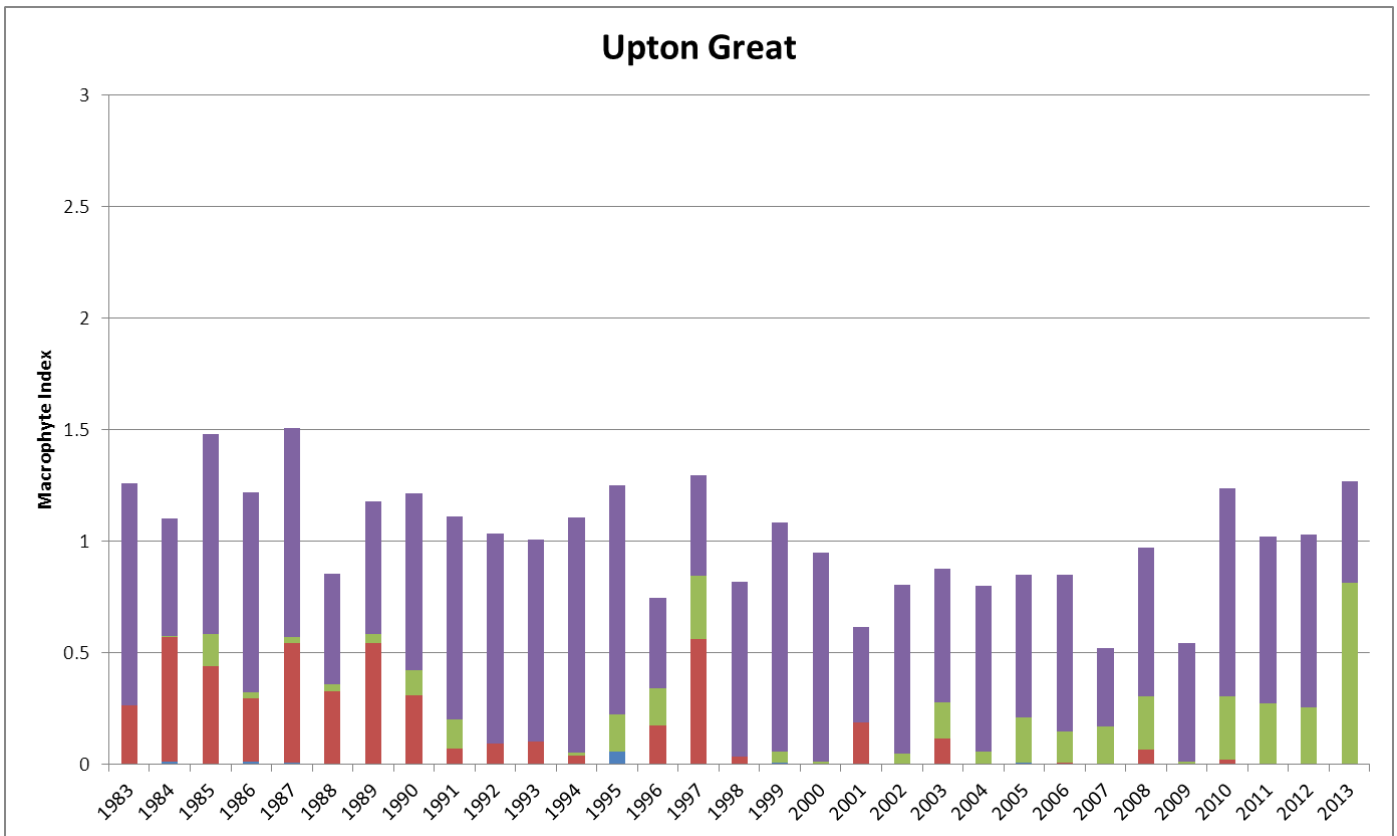
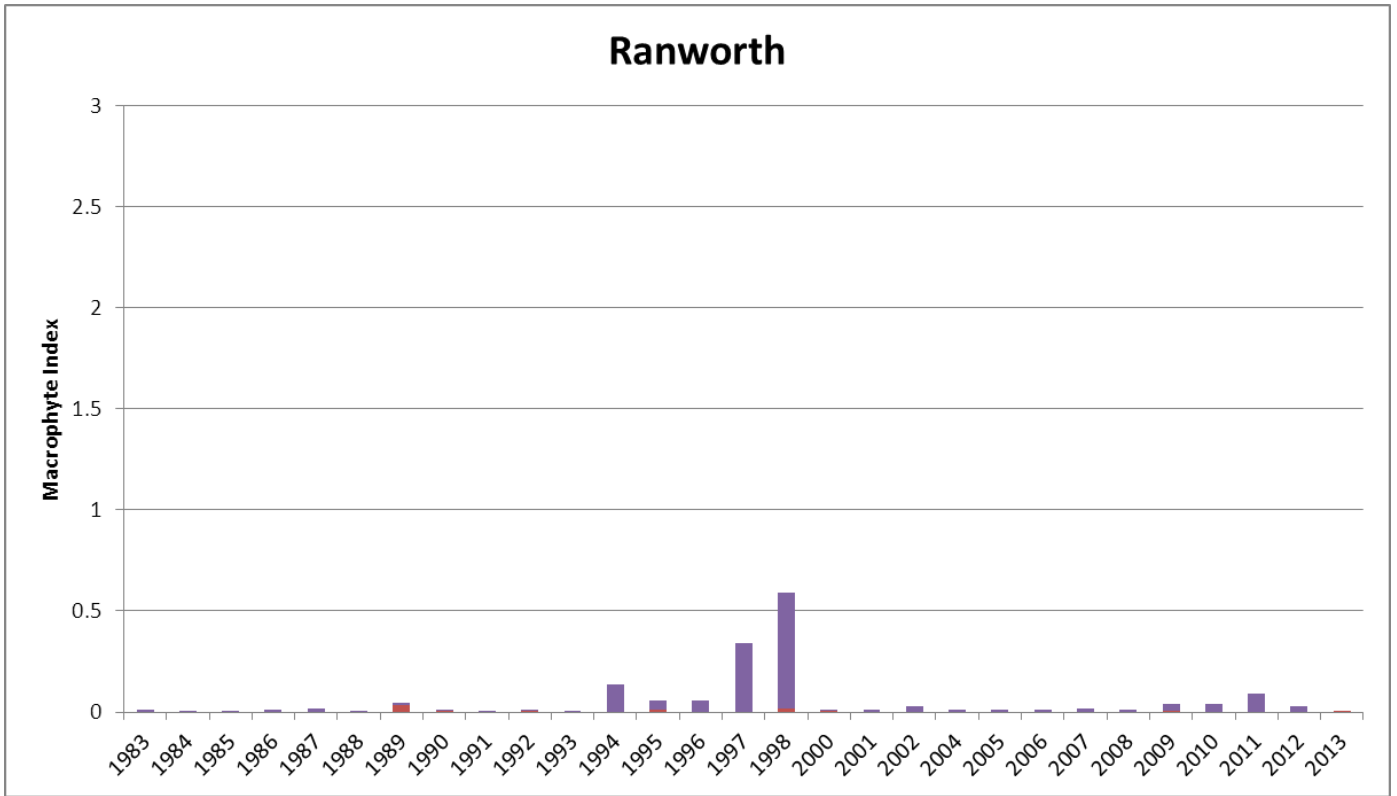




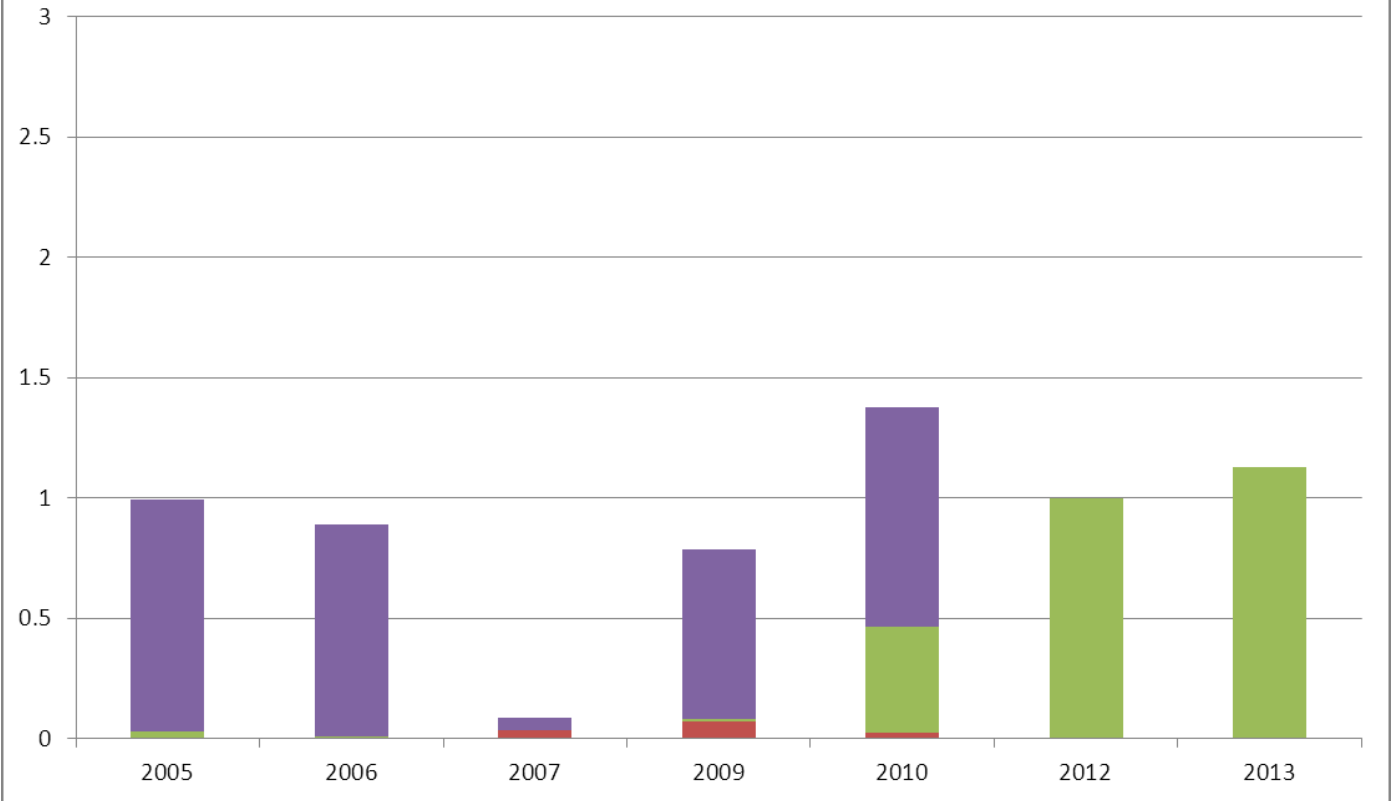
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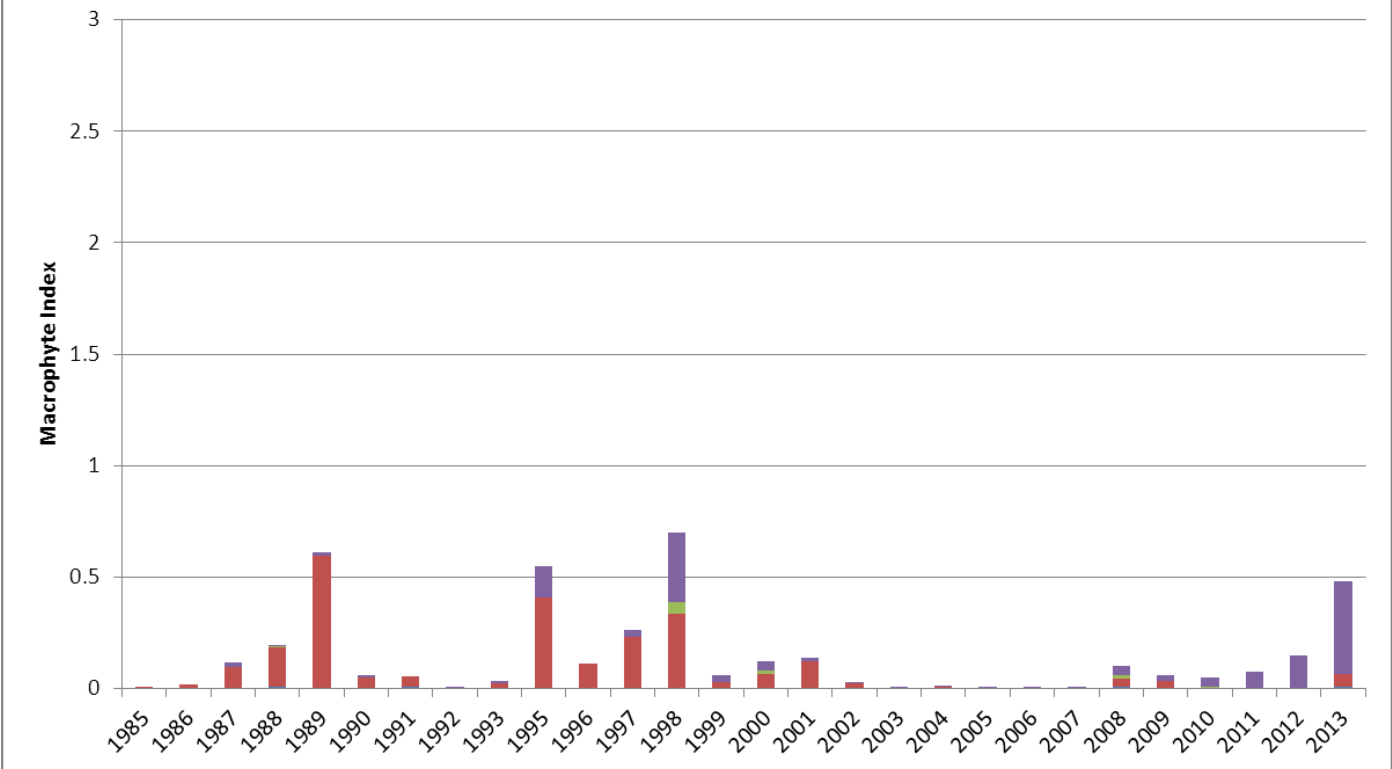




## Upton Little

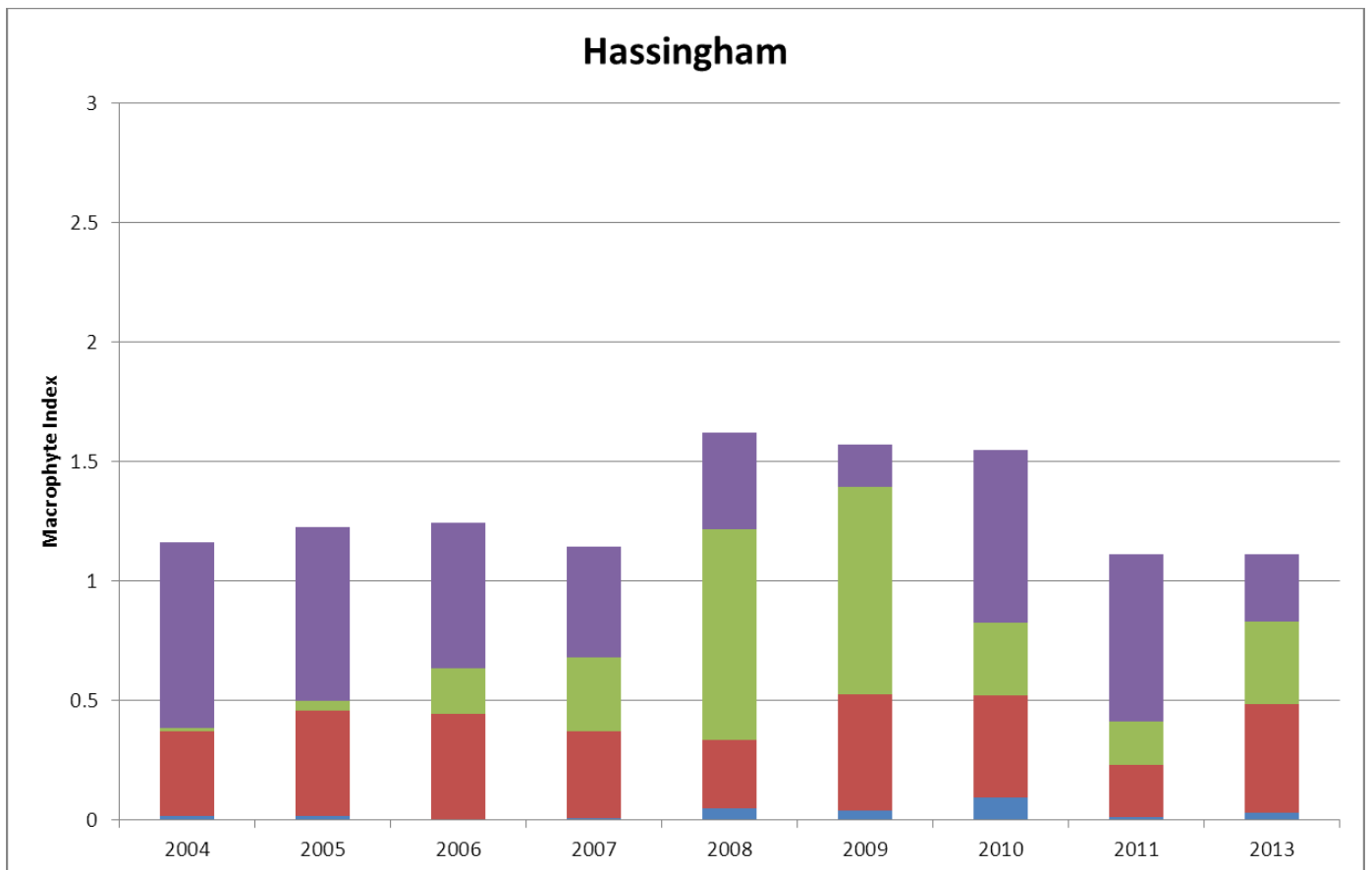
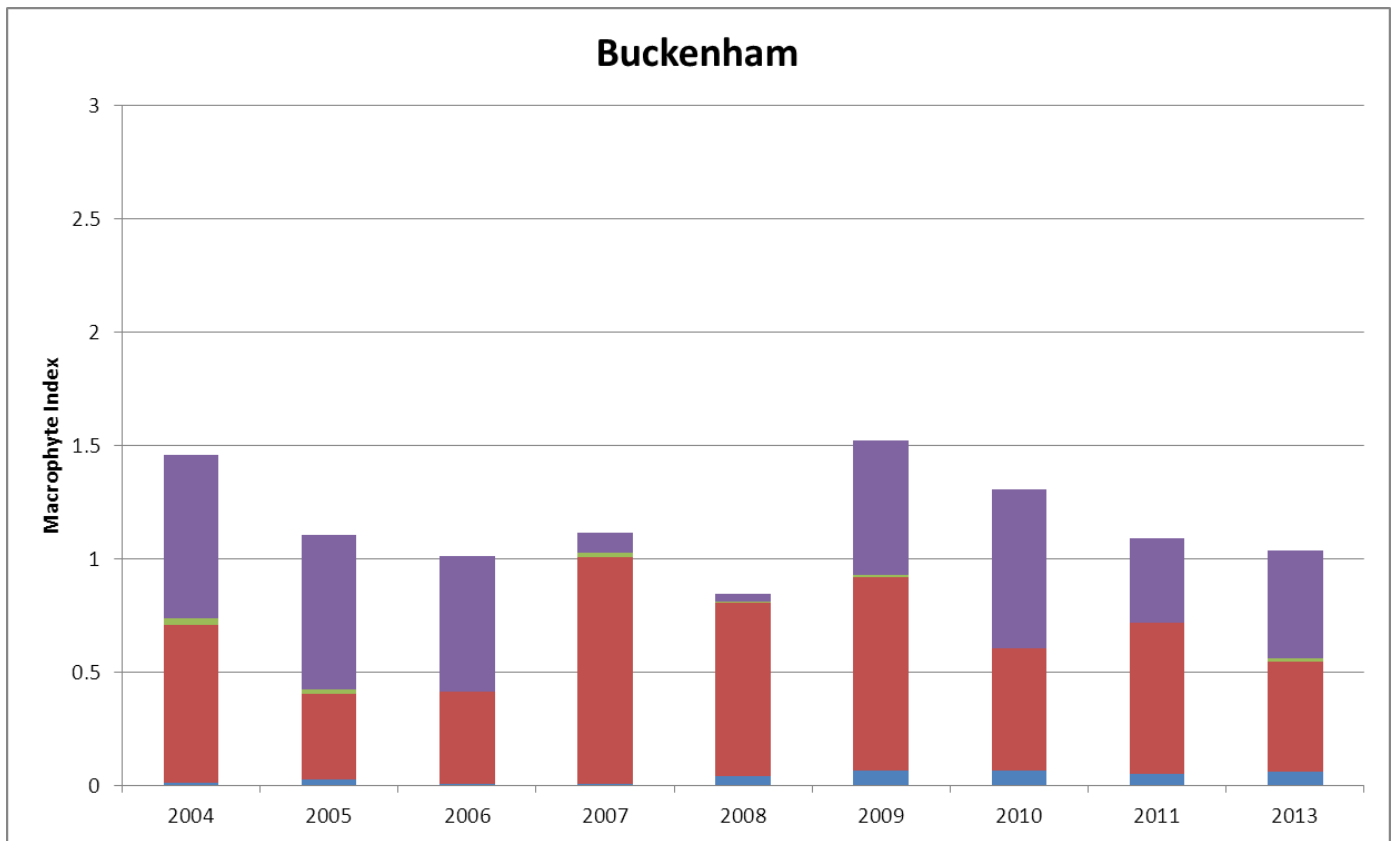


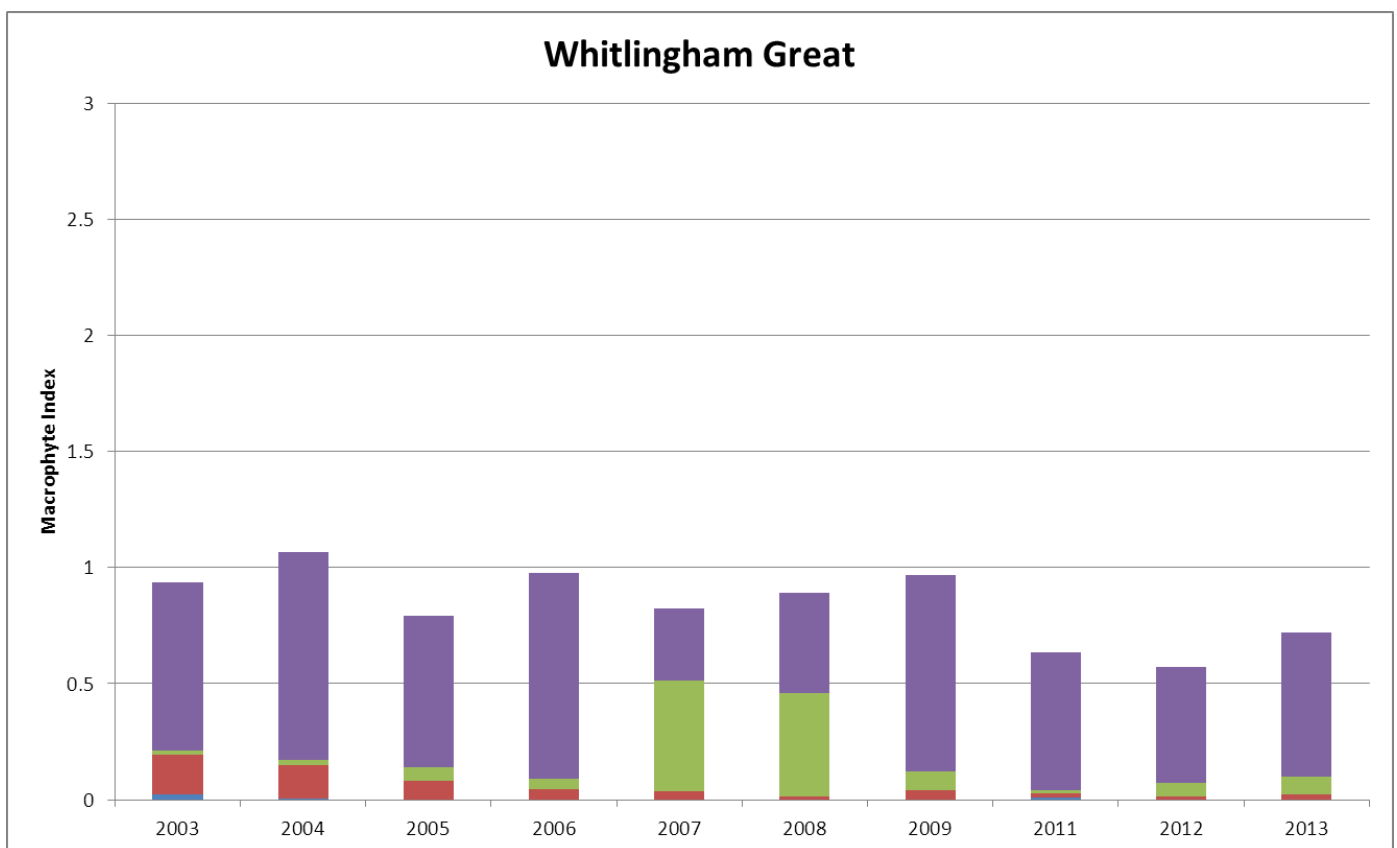
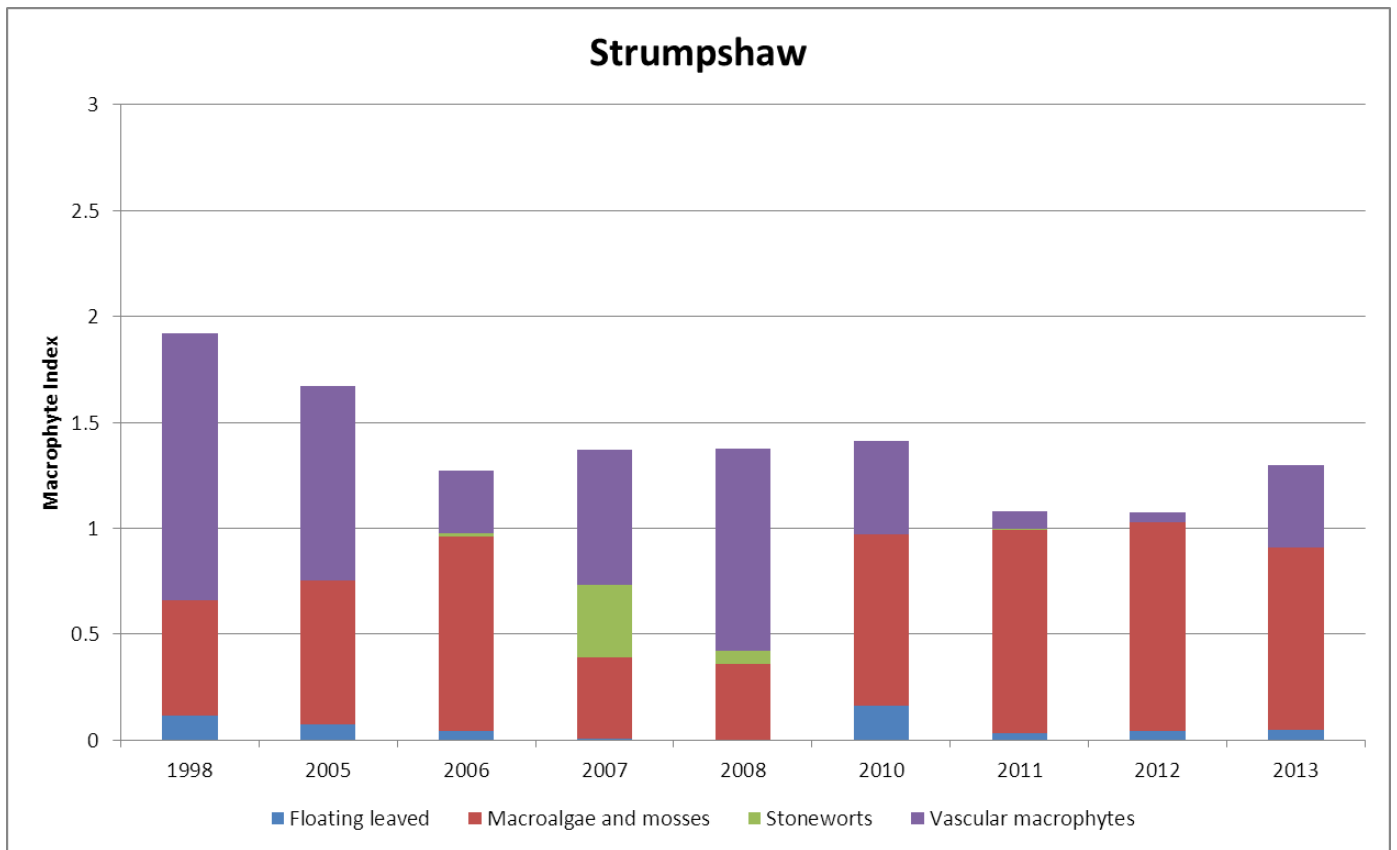
## Wroxham



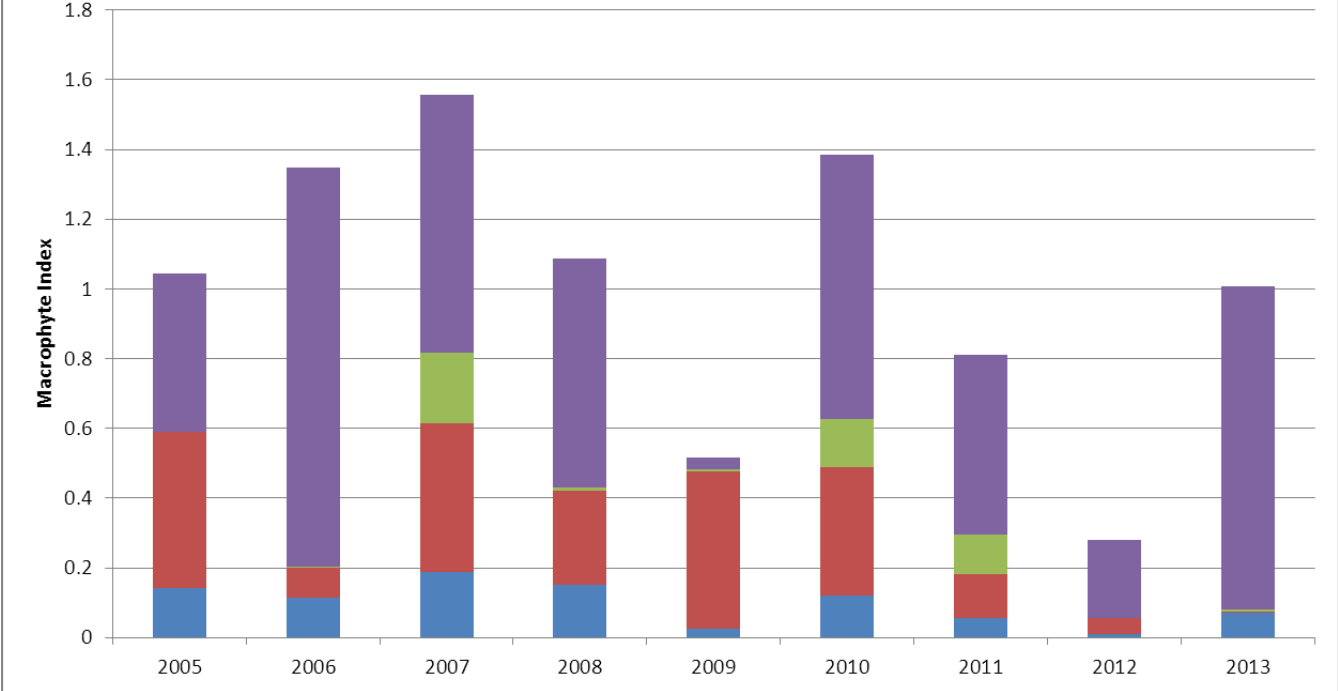


## River Yare





### Whitlingham Little



### 6.3 Appendix 3a. Latin to Common plant names.

<b>Latin</b>	<b>Common</b>	<b>Latin</b>	<b>Common</b>
<i>Acorus calamus</i>	Sweet flag	<i>Potamogeton pectinatus</i>	Fennel-leaved pondweed
<i>Alisma plantago-aquatica</i>	Common water-plantain	<i>Potamogeton perfoliatus</i>	Perfoliate pondweed
<i>Chara aculeolata</i>	Hedgehog stonewort	<i>Potamogeton pusillus</i>	Lesser pondweed
<i>Callitriche stagnalis</i>	Intermediate water-starwort	<i>Potamogeton x salicifolius</i>	Willow-leaved pondweed
<i>Callitriche sp</i>	Starwort sp.	<i>Potamogeton sp.</i>	Pondweed sp.
<i>Ceratophyllum demersum</i>	Rigid hornwort	<i>Potamogeton trichoides</i>	Hair like pondweed
<i>Chara pedunculata</i>	Hedgehog stonewort	<i>Phragmites australis</i>	Common reed
<i>Chara aspera</i>	Rough stonewort	<i>Ranunculus circinatus</i>	Fan-leaved water crowfoot
<i>Chara baltica</i>	Baltic stonewort	<i>Ranunculus fluitans</i>	River water crowfoot
<i>Chara connivens</i>	Convergent stonewort	<i>Ranunculus sp.</i>	Crowfoot sp.
<i>Chara contraria</i>	Opposite stonewort	<i>Rorippa nasturtium-aquaticum</i>	Water cress
<i>Chara curta</i>	Lesser bearded stonewort	<i>Sagittaria sagittifolia</i>	Arrowhead
<i>Chara globularis/connivens</i>	Fragile/convergent stonewort	<i>Schoenoplectus lacustris</i>	Bulrush
<i>Chara globularis</i>	Fragile stonewort	<i>Sparganium emersum</i>	Unbranched bur-reed
<i>Chara hispida</i>	Bristly stonewort	<i>Sparganium erectum</i>	Branched bur-reed
<i>Chara intermedia</i>	Intermediate stonewort	<i>Spirodela polyrhiza</i>	Greater duckweed
<i>Chara sp.</i>	Stonewort ( <i>Chara</i> ) species	<i>Stratiotes aloides</i>	Water-soldier
<i>Chara virgata</i>	Delicate stonewort	<i>Typha angustifolia</i>	Lesser reedmace
<i>Chara vulgaris</i>	Common stonewort	<i>Typha latifolia</i>	Greater reedmace
<i>Crassula helmsii</i>	Swamp stonecrop	<i>Utricularia vulgaris</i>	Bladderwort
<i>Elodea canadensis</i>	Canadian waterweed	<i>Veronica catenata</i>	Pink water speedwell
<i>Eleogiton fluitans</i>	Floating club-rush	<i>Zanichellia palustris</i>	Horned pondweed
<i>Elodea nuttallii</i>	Nuttall's waterweed		
<i>Enteromorpha</i>	<i>Enteromorpha</i>		
<i>Filamentous algae</i>	Filamentous algae		
<i>Fontinalis antipyretica</i>	Common water moss		
<i>Glyceria maxima</i>	Reed sweet grass		
<i>Hippuris vulgaris</i>	Mare's tail		
<i>Hydrocharis morsus-ranae</i>	Frogbit		
<i>Hydrodictyon</i>	Water net		
<i>Lemna gibba</i>	Inflated duckweed		
<i>Lemna minor</i>	Common duckweed		
<i>Lemna minuta</i>	Least duckweed		
<i>Lemna trisulca</i>	Ivy-leaved duckweed		
<i>Leptodictyum riparium</i>	Stringy moss		
<i>Myriophyllum spicatum</i>	Spiked water milfoil		
<i>Myriophyllum verticillatum</i>	Whorled water milfoil		
<i>Najas marina</i>	Holly-leaved naiad		
<i>Nitella flexilis</i>	Smooth stonewort		
<i>Nitella mucronata</i>	Pointed stonewort		
<i>Nitellopsis obtusa</i>	Starry stonewort		
<i>Nitella translucens</i>	Translucent stonewort		
<i>Nitella sp.</i>	Stonewort ( <i>Nitella</i> ) species		
<i>Nuphar lutea</i>	Yellow water lily		
<i>Nymphaea alba</i>	White water lily		
<i>Persicaria amphibia</i>	Amphibious bistort		
<i>Potamogeton acutifolius</i>	Sharp-leaved pondweed		
<i>Potamogeton berchtoldii</i>	Small pondweed		
<i>Potamogeton crispus</i>	Curled pondweed		
<i>Potamogeton friesii</i>	Flat-stalked pondweed		
<i>Potamogeton lucens</i>	Shining pondweed		
<i>Potamogeton natans</i>	Broad -leaved pondweed		
<i>Potamogeton obtusifolius</i>	Blunt-leaved pondweed		

## 6.4 Appendix 3b. Common to Latin plant names.

Common	Latin	Common	Latin
Amphibious bistort	<i>Persicaria amphibia</i>	Rigid hornwort	<i>Ceratophyllum demersum</i>
Arrowhead	<i>Sagittaria sagittifolia</i>	River water crowfoot	<i>Ranunculus fluitans</i>
Baltic stonewort	<i>Chara baltica</i>	Rough stonewort	<i>Chara aspera</i>
Bladderwort	<i>Utricularia vulgaris</i>	Sharp-leaved pondweed	<i>Potamogeton acutifolius</i>
Blunt-leaved pondweed	<i>Potamogeton obtusifolius</i>	Shining pondweed	<i>Potamogeton lucens</i>
Branched bur-reed	<i>Sparganium erectum</i>	Small pondweed	<i>Potamogeton berchtoldii</i>
Bristly stonewort	<i>Chara hispida</i>	Smooth stonewort	<i>Nitella flexilis</i>
Broad –leaved pondweed	<i>Potamogeton natans</i>	Spiked water milfoil	<i>Myriophyllum spicatum</i>
Bulrush	<i>Schoenoplectus lacustris</i>	Starry stonewort	<i>Nitellopsis obtusa</i>
Canadian waterweed	<i>Elodea canadensis</i>	Starwort sp.	<i>Callitriche sp.</i>
Common duckweed	<i>Lemna minor</i>	Stonewort ( <i>Chara</i> ) species	<i>Chara sp.</i>
Common reed	<i>Phragmites australis</i>	Stonewort ( <i>Nitella</i> ) species	<i>Nitella sp.</i>
Common stonewort	<i>Chara vulgaris</i>	Stringy moss	<i>Leptodictyum riparium</i>
Common water moss	<i>Fontinalis antipyretica</i>	Swamp stonecrop	<i>Crassula helmsii</i>
Common water-plantain	<i>Alisma plantago-aquatica</i>	Sweet flag	<i>Acorus calamus</i>
Convergent stonewort	<i>Chara connivens</i>	Translucent stonewort	<i>Nitella translucens</i>
Crowfoot sp.	<i>Ranunculus sp.</i>	Unbranched bur-reed	<i>Sparganium emersum</i>
Curled pondweed	<i>Potamogeton crispus</i>	Water cress	<i>Rorippa nasturtium-aquaticum</i>
Delicate stonewort	<i>Chara virgata</i>	Water net	<i>Hydrodictyon</i>
<i>Enteromorpha</i>	<i>Enteromorpha</i>	Water-soldier	<i>Stratiotes aloides</i>
Fan-leaved water crowfoot	<i>Ranunculus circinatus</i>	White water lily	<i>Nymphaea alba</i>
Fennel-leaved pondweed	<i>Potamogeton pectinatus</i>	Whorled water milfoil	<i>Myriophyllum verticillatum</i>
Filamentous algae	<i>Filamentous algae</i>	Willow-leaved pondweed	<i>Potamogeton x salicifolius</i>
Flat-stalked pondweed	<i>Potamogeton friesii</i>	Yellow water lily	<i>Nuphar lutea</i>
Floating club-rush	<i>Eleogiton fluitans</i>		
Fragile stonewort	<i>Chara globularis</i>		
Fragile/convergent stonewort	<i>Chara globularis/connivens</i>		
Frogbit	<i>Hydrocharis morsus-ranae</i>		
Greater duckweed	<i>Spirodela polyrhiza</i>		
Greater reedmace	<i>Typha latifolia</i>		
Hair like pondweed	<i>Potamogeton trichoides</i>		
Hedgehog stonewort	<i>Chara aculeolata/pedunculata</i>		
Holly-leaved naiad	<i>Najas marina</i>		
Horned pondweed	<i>Zanichellia palustris</i>		
Inflated duckweed	<i>Lemna gibba</i>		
Intermediate stonewort	<i>Chara intermedia</i>		
Intermediate water-starwort	<i>Callitriche stagnalis</i>		
Ivy-leaved duckweed	<i>Lemna trisulca</i>		
Least duckweed	<i>Lemna minuta</i>		
Lesser bearded stonewort	<i>Chara curta</i>		
Lesser pondweed	<i>Potamogeton pusillus</i>		
Lesser reedmace	<i>Typha angustifolia</i>		
Mare's tail	<i>Hippuris vulgaris</i>		
Nuttall's waterweed	<i>Elodea nutalli</i>		
Opposite stonewort	<i>Chara contraria</i>		
Perfoliate pondweed	<i>Potamogeton perfoliatus</i>		
Pink water speedwell	<i>Veronica catenata</i>		
Pointed stonewort	<i>Nitella mucronata</i>		
Pondweed sp.	<i>Potamogeton sp.</i>		
Reed sweet grass	<i>Glyceria maxima</i>		

