Broads Authority
The Broads - a member of the National Park family

Broads Annual Water Plant Monitoring Report 2010

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Cover Photograph. Bladderwort (*Utricularia*) from Cromes North.

1 EXECUTIVE SUMMARY

This report presents and discusses the findings from the annual water plant surveys carried out during 2010, which covered 30 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." This publication should be read alongside this report.

Key results from the 2010 survey can be summarised as: -

- Hickling and Horsey Mere continue to have a very low number of species present and low abundance. Those plants collected appeared to be in poor condition. The holly leaved naiad record from Hickling was only a small single plant.
- Heigham Sound's plant community, although poor, has remained relatively stable over the last 5 years predominately found off the main navigation channels.
- Wroxham Broad showed no indication of continuing to improve or maintain the surprising increase in species numbers found in the 2008 survey. Species numbers and abundance dropped in 2009, in a similar manner to Barton Broad, which may have been a result of wet summer weather.
- Ranworth appears to show little change in plant community. However, those plants present tended to cover a wider proportion of the broad unlike the patchy presence found previously.
- The Trinity Broads continue to have thriving plant communities overall. Rollesby and Lily are now similar to the historically rich Ormesby in diversity. Ormesby Little continues to improve.
- Martham North and South continue to have good plant diversity, stable in terms of long term abundance and richness. However the patches of bare sediment in Martham South require close monitoring to detect any negative changes.
- Little Broad and Mautby Decoy both mud pumped in the last two years show improved plant communities, with Little Broad containing the carnivorous Greater Bladderwort.

As a classification and assessment tool the water plant surveys inform ways in which lake restoration works can be targeted and the outcome of management interventions assessed. The water plant monitoring also provides an early means to identify possible sites of deterioration. The results of the water plant surveys also 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. Broads where mud pumping has been completed show a marked switch back to diverse plant communities. 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 an important part of targeting and measuring the success of such 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. Other broads that are not receiving 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 2009 and will refer to the long-term data from 1983 to 2010 (Table 1).

Table 1. Sites surveyed for water plants from 1983 to 2010.

	# 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
Alderfen	28																												
Bargate	2																												
Barnby	5																												
Barton	28																												
Belaugh	19																												
Blackfleet	3																												
Bridge	12																												
Buckenham	7																												
Burntfen	4																												
Calthorpe	1																												
Catfield	2																												
Cockshoot	28																												
Cockshoot Dyke	27																												
Cromes South	27																												
Cromes North	27																												
Decoy	8																												
Filby	22																												
Flixton Decoy	3																												
Fritton Lake	1																												
Hassingham	7																												
Heigham Sound	20																												
Hickling	28																												
Horsey Mere	24																												
Hopton 1 (Lound)	1																												
Hopton 2 (Lound)	1																												
Hopton 3 (Lound)	1																												
Hopton 4 (Lound)	1																												
Hoveton Great	27																												
Hoveton Little	13																												
Hudson's Bay	7																												
Irstead	2																												
Lily	22																												
Little	4																												
Malthouse	7																												
Martham North	27																												
Martham South	26																												
Mautby Decoy	4																												
Mill Water (Lound)	1																												
Norton	3																												
Ormesby	25																												
Ormesby Little	24																												
Pound End	14																												
Ranworth	26																												
Reedham Water	2																												
Rockland	21																												
Rollesby	23																												
Round water	1																												
Salhouse Great	12																												
Salhouse Little	6																												
Spratts Water	2																												
Strumpshaw	6																												
Upton Great	28																												
Upton Little	5																												
Wheatfen	4																												
Whitlingham Great	7																												
Whitlingham Little	6																												
Wroxham	28																												
# per year		21	20	21	21	22	13	22	20	21	21	15	12	24	26	24	28	20	24	17	21	19	35	33	38	40	30	31	30

Table 2 Sampling dates and transect lengths (metres) (2008-2010).

Broad	Date Sampled			Total Transect Length (m)		
	2008	2009	2010	2008	2009	2010
Alderfen	15-Aug	19-Aug	03-Aug	850	850	758
Barnby	-	14-Aug	-	-	360	-
Barton	06-Aug	12-Aug	21-Jul	5234	4942	4782
Belaugh	-	-	-	-	-	254
Bridge Broad	23-Jul	-	-	430	-	-
Buckenham Broad	22-Jul	28-Aug	30-Jul	331	270	333
Burntfen	-	-	12-Aug	-	-	431
Calthorpe	-	-	03-Sep	-	-	155
Cockshoot Broad	14-Aug	03-Sep	01-Sep	1125	938	817
Catfield	-	03-Sep	-	-	345	-
Crome's	13-Aug	19-Aug	03-Aug	1049	964	1087
Decoy Broad	29-Jul	05-Aug	-	1512	1567	-
Filby	-	-	26-Aug	-	-	1669
Flixton Decoy	-	-	06-Aug	-	-	781
Hassingham Broad	22-Jul	28-Jul	30-Jul	232	254	327
Heigham Sound	07-Aug	07-Aug	23-Aug	2684	2180	1670
Hickling	07-Aug	13-Aug	23-Jul	8964	8423	8751
Horsey Mere	08-Aug	07-Aug	28-Jul	2999	3520	3426
Hoveton Great	30-Jul	06-Aug	05-Aug	3237	3039	3158
Hoveton Little	29-Jul	-	-	2421	-	-
Lily	-	26-Aug	-	-	1149	-
Irstead	-	04-Aug	-	-	165	-
Little Broad	12-Sep	09-Sep	02-Sep	231	216	293
Malthouse	-	-	17-Aug	-	-	1118
Martham Broad North	28-Jul	30-Jul	29-Jul	833	814	760
Martham Broad South	28-Jul	30-Jul	29-Jul	752	772	758
Mautby Decoy	02-Sep	09-Sep	02-Sep	462	498	389
Mill Water	-	-	-	-	-	-
Nortons	-	29-Jul	05-Aug	-	242	192
Ormesby	19-Aug	24-Aug	25-Aug	4641	4267	3446
Ormesby Little	22-Aug	10-Sep	-	3699	2480	-
Pound End	29-Jul	-	-	710		-
Ranworth	12-Aug	21-Aug	31-Aug	4416	4399	4600
Rockland	09-Sep	-	30-Aug	1518	-	1359
Reedham	-	04-Aug	-	-	421	-
Rollesby	21-Aug	26-Aug	-	2391	2537	-
Round Water	10-Sep	-	-	33	-	-
Spratt's Water	10-Sep	-	-	83	-	-
Strumpshaw	22-Jul	-	30-Jul	447	-	299
Upton Great	12-Aug	18-Aug	13-Aug	977	986	1006
Upton Little	-	18-Aug	13-Aug	-	173	223
Wheatfen	-	-	-	-	-	-
Whitlingham Great	14-Aug	28-Aug	-	4884	2990	-
Whitlingham Little	14-Aug	28-Aug	30-Aug	689	672	712
Wroxham	23-AJul	04-Aug	04-Aug	1913	1933	1757

3 BROADS MACROPHYTE RESULTS.

Each broad that was surveyed in 2010 is reviewed in terms of species richness and abundance. Species recorded in 2008 and 2009 are starred to enable recent trends to be readily seen. For 2010 the macrophyte index is listed to allow the relative amounts of each species that year to be seen. Please see "Broads Annual Water Plants. Monitoring Methods." for 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 group of similar form/structure and these grouping are used to generate the graphs in Appendix 2. Appendix 3 lists the common and Latin names for all plants found to date during river and broads surveys.

3.1 Thurne Valley

These broads contain the richest population of stoneworts in the UK. Several of which 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 but 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, Starry stonewort, one 'Rare': 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.

Hickling

	2008	2009	2010	2010 MI
Spiked water milfoil	*	*	*	0.2341
Curled pondweed			*	0.0151
Holly-leaved naiad	*	*	*	0.0141
Filamentous algae			*	0.0076
Fragile/convergent stonewort			*	0.0075
Fennel-leaved pondweed	*	*	*	0.0069
Rigid hornwort		*	*	0.0020
Delicate stonewort			*	0.0009
Canadian waterweed			*	0.0008
Mare's tail		*		

Since peaking in the late 1990s/early 2000s, macrophyte diversity in Hickling Broad has been declining. Species richness dramatically decreased from 11 species in 2005 to just three in 2008. Species numbers appear to be increasing again with nine species found in 2010 including two stoneworts and an increased amount of Holly leaved naiad.

Horsey Mere

	2008	2009	2010	2010 MI
Spiked water milfoil	*	*	*	0.080
Filamentous algae			*	0.072
Mares tail	*	*	*	0.048
Fennel-leaved pondweed		*	*	0.002

There has been a gradual decline in macrophyte species richness and abundance since 2002. The abundance of spiked water milfoil has remained relatively constant over the last 6 years. Stonewort species were last present in Horsey Mere in 2005, showing a similar decline to that of Hickling Broad. In 2010 there was little change in plant richness or abundance.

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 continue and are reflected in the high diversity of the plant communities found in the most recent surveys.

Martham North

	2008	2009	2010	2010 MI
Holly-leaved naiad	*	*	*	0.414
Starry stonewort	*	*	*	0.410
Baltic stonewort	*	*	*	0.144
Intermediate stonewort		*	*	0.087
Filamentous algae		*	*	0.085
Fennel-leaved pondweed			*	0.062
Bristly stonewort	*	*	*	0.052
Mare's tail	*	*	*	0.046
Opposite stonewort			*	0.008
Perfoliate pondweed	*		*	0.004
Horned pondweed	*	*	*	0.004
Enteromorpha sp.			*	0.003
Common stonewort		*		
Convergent stonewort	*			
Lesser pondweed	*			
Nuttall's waterweed		*		
Pointed stonewort	*	*		
Spiked water milfoil	*	*		
Starwort sp.		*		
Yellow water lily	*			

Recent surveys have recorded a dominance of stonewort compared to vascular plants, comprised primarily of Bristly stonewort and Starry stonewort, the latter species classified as a vulnerable Red Data Book species. Fewer pondweeds were recorded in 2009 and 2010; however 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.

Martham South

	2008	2009	2010	2010 MI
Bristly stonewort	*	*	*	0.448
Starry stonewort	*	*	*	0.258
Holly-leaved naiad	*	*	*	0.192
Mare's tail	*	*	*	0.105
Baltic stonewort	*	*	*	0.088
Intermediate stonewort	*	*	*	0.075
Fennel-leaved Pondweed	*	*	*	0.049
Spiked water milfoil	*	*	*	0.040
Filamentous algae	*	*	*	0.037
Enteromorpha sp.	*	*	*	0.033
Rough stonewort	*	*	*	0.021
Opposite stonewort			*	0.016
Convergent stonewort	*		*	0.012
Crowfoot sp.		*	*	0.012
Canadian waterweed	*	*	*	0.006
Hedgehog Stonewort	*	*	*	0.006
Stringy moss			*	0.006
Horned pondweed	*	*	*	0.006
Perfoliate pondweed	*	*	*	0.005
Starwort sp.	*	*	*	0.003
Rigid hornwort	*	*	*	0.003
Crowfoot sp.		*	*	0.003
Arrowhead			*	0.003
Common water moss	*			
Enteromorpha	*	*		
Fan-leaved water crowfoot	*	*		
Filamentous algae	*	*		
Lesser pondweed	*			
Perfoliate pondweed	*	*		
Whorled water milfoil	*			
Willow-leaved Pondweed	*			
Yellow water lily		*		

Surveys show that bristly stonewort, holly-leaved naiad, starry stonewort and mare's tail remain abundant across the broad. Areas of clear sediment within *Chara* beds were seen in 2009 and 2010. These phenomenon have been noted in previous years and at other sites. The cause is not yet understood. As with Martham North there has been a decline in recorded pondweeds in Martham South.

Heigham Sound

	2008	2009	2010	2010 MI
Spiked water milfoil	*	*	*	0.516
Filamentous algae			*	0.072
Curled pondweed	*	*	*	0.072
Rigid hornwort	*	*	*	0.071
Mare's tail	*	*	*	0.038
Fennel leaved pondweed			*	0.003
Nuttall's waterweed			*	0.002
Canadian waterweed			*	0.001
Holly-leaved naiad	*			
Whorled water milfoil		*		

The gradual decrease in species numbers since 2005 to a low of 5 in 2009 appears to have been temporarily halted with eight species sampled in 2010. Plant abundance was high and the dredging in the main channel and trial creation of the Duck Broad Island baskets appears to have little or no effect on the macrophyte community of the surrounding area. The BAP species holly-leaved naiad was found in 2010.

Calthorpe

	2010 MI
Bristly stonewort	0.331
Yellow water lily	0.273
Baltic stonewort	0.062
Fragile/Convergent stonewort	0.013
Broad-leaved pondweed	0.003

Prior to suction dredging in the summer of 2009 Calthorpe broad was very shallow and dominated by water lilies. As it can be seen the seed bank was adequately exposed by the restoration works and resulted in the germination of three stoneworts. Abundance was low and the plants were found only in the west and middle sections of the broad. The east end still remains very shallow, possibly inhibiting colonisation.

3.2 Muck Fleet Valley - Trinity Broads

The Trinity Broads are a series of five lakes draining into the River Bure via the Muck Fleet. Ormesby Broad has the most abundant and diverse population of aquatic plants with stoneworts being present, the lake having benefited from the recent restoration programme. During the last three years of surveying, the plant communities in the Trinity Broads have either remained stable or have increased in both richness and abundance.

Surveying took place late in the season and die back was already starting. This made identification and quantification difficult and may account for the apparent losses of some species from the list.

Ormesby

	2008	2009	2010	2010 MI
Canadian waterweed	*	*	*	0.441
Rigid hornwort	*	*	*	0.259
Filamentous algae	*	*	*	0.203
Flat-stalked pondweed	*	*	*	0.144
Fennel-leaved pondweed	*	*	*	0.092
Lesser pondweed	*	*	*	0.078
Opposite stonewort		*	*	0.076
Ivy-leaved duckweed	*	*	*	0.071
Fragile/Convergent stonewort	*	*	*	0.070
Horned pondweed	*	*	*	0.066
Holly-leaved naiad	*	*	*	0.063
Delicate stonewort		*	*	0.044
Water net	*	*	*	0.020
Enteromorpha	*	*	*	0.008
Nuttall's waterweed	*	*	*	0.001
Common duckweed	*	*		
Common stonewort	*	*		
Common water moss		*		
Curled pondweed		*		
Least duckweed		*		
Yellow water lily	*	*		

Since 2006 the macrophyte community in Ormesby has been very stable. The east arm of Ormesby has typically been less diverse compared to the rest of the broad. It was not surveyed in 2010 due to the mud pumping project which was in operation at the time. It is hoped that the excellent plant community found in the rest of the broad will extend into the east arm once the excess nutrient rich sediment is removed.

Despite the late surveying time and difficulty of species ID the species richness and abundance remain high in Ormesby Broad.

Filby

	2006	2007	2010	2010 MI
Canadian waterweed		*	*	0.400
Rigid hornwort			*	0.373
Lesser pondweed		*	*	0.213
Filamentous algae		*	*	0.160
Enteromorpha	*	*	*	0.049
Nuttall's waterweed			*	0.047
Fennel leaved pondweed			*	0.046
Ivy-leaved duckweed		*	*	0.044
Common duckweed			*	0.004
Flat-stalked pondweed		*	*	0.003
Fragile/Convergent stonewort	*	*	*	0.003
Common water moss			*	0.002
Mare's tail			*	0.001
Horned pondweed		*		
Water net		*		

Filby has generally been species poor compared to the rest of the Trinity system. However a marked change in richness was observed in 2007, with seven additional species found which has continued through to the 2010 survey. It can clearly be seen that species richness is now high with several pondweeds present.

Little Broad

	2008	2009	2010	2010 MI
Bristly stonewort	*	*	*	0.551
Filamentous algae	*	*	*	0.234
Hedgehog stonewort			*	0.046
Greater bladderwort	*	*	*	0.016
Opposite stonewort			*	0.009
Baltic stonewort			*	0.006
Ivy-leaved duckweed			*	0.002
Common stonewort		*		
Enteromorpha	*			
Horned pondweed	*			

This broad was sampled for the first time in 2005. During winter of 2007/08 restorative suction dredging was carried out to deepen the lake and remove the upper layers of nutrient rich sediment. Approximately nine months later, the broad was surveyed for the second time and found to have clear water and quantities of stonewort and pondweed. The 2010 survey showed continued clear water and the continued presence of the stoneworts.

3.3 Ant Valley

In the Ant Valley, Alderfen, Crome's and Barton 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. Aquatic plants are numerous within the clear water areas of Barton Broad, which have been created through zooplanktivorous fish removal behind temporary barriers. The success of these restoration areas has now reached out into the main broad itself.

Barton

	2008	2009	2010	2010 MI
Fennel-leaved pondweed	*	*	*	0.082
Rigid hornwort	*	*	*	0.005
Nuttall's waterweed	*	*	*	0.004
Curled pondweed	*		*	0.003
Arrowhead	*			
Bulrush	*			
Common duckweed	*			
Filamentous algae	*	*		
Greater duckweed	*			
Unbranched bur-reed	*			
Water soldier		*		
White water lily		*		
Yellow water lily	*	*		

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. However, in 2009 abundances were relatively low and only seven species were recorded, suggesting the improvement seen from 2004 to 2008 is not a stable state. This unstable state appears to have been confirmed by the poor species richness and large drop in abundance recorded in 2010.

Alderfen

	2008	2009	2010	2010 MI
Filamentous algae	*	*	*	1.000
Rigid hornwort	*	*	*	0.444
Enteromorpha		*	*	0.347
Ivy-leaved duckweed			*	0.020
Holly-leaved naiad	*	*	*	0.012
Common duckweed			*	0.005

The abundance of macrophytes in Alderfen appears to be cyclical with years of near absence of plants followed by several years where rigid hornwort, macro-algae and sometimes duckweeds occur, such as was found in 2010. Holly-leaved naiad first recorded 2006 and has remained present albeit in relatively small patches.

Crome's

	2008	2009	2010	2010 MI
Filamentous algae	*	*	*	0.491
Canadian waterweed	*	*	*	0.343
Nuttall's waterweed	*	*	*	0.217
Ivy-leaved duckweed		*	*	0.177
Enteromorpha		*	*	0.143
Rigid hornwort	*	*	*	0.111
Common duckweed		*	*	0.044
Bladderwort			*	0.035
Fragile/Convergent stonewort	*	*	*	0.031
White water lily	*	*	*	0.013
Delicate stonewort	*	*	*	0.007
Lesser pondweed			*	0.006
Fennel-leaved pondweed			*	0.005
Frogbit			*	0.001
Water-soldier				

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. The positive effects of increased water depth from the mud pumping continue in the South basin, reflected in good species richness. The North basin continues to be less diverse compared to the South basin but is gradually improving with species richness and abundance with large fronds of bladderwort seen.

3.4 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 Broad is a stronghold for the rare holly-leaved naiad. Those broads connected to the river, such as Nortons and Ranworth, have minimal plant diversity.

Belaugh

	2006	2007	2010	2010 MI
Rigid hornwort	*	*	*	0.790
Nuttall's waterweed	*	*	*	0.378
Starwort sp.		*	*	0.022
Common duckweed		*	*	0.008
White water lily	*			
Enteromorpha		*		
Yellow water lily		*		
Filamentous algae	*	*		

Belaugh continues to have poor species richness although there are significant amounts of rigid hornwort to be found.

Burntfen

	2010
Yellow water lily	0.038
Common duckweed	0.003
White water lily	0.003

Suction pumped in 2009 which increased depth and removed a large amount of the water lilies. The broad continues to be very poor with only surface macrophytes surveyed and water visibility continuing to be low.

Cockshoot

	2008	2009	2010	2010 MI
Holly-leaved naiad	*	*	*	0.983
Filamentous algae	*	*	*	0.017
Yellow water lily			*	0.009
Rigid hornwort	*	*	*	0.009
Canadian waterweed	*	*	*	0.002
Common stonewort		*		
Enteromorpha	*	*		

Horned pondweed		*	
Lesser pondweed		*	
Water net	*		
White water lily		*	

Holly-leaved naiad remains the dominant species in Cockshoot, with very high abundance covering virtually the entire waterbody in 2010. The large volume of filamentous algae in Cockshoot dyke prevented boat access down the dyke in 2010.

Hoveton Great

	2008	2009	2010	2010 MI
Filamentous algae	*	*	*	0.1310
Rigid hornwort	*	*	*	0.0379
Fennel-leaved pondweed	*	*	*	0.0218
Yellow water lily	*	*	*	0.0186
Horned pondweed			*	0.0019
Canadian waterweed			*	0.0016
White water lily		*	*	0.0011
Curled pondweed	*			
Holy leaved naiad		*		
Starwort	*			

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. Disused fish barriers provide increased shelter from the strong wind-induced waves that can disturb the bottom sediments in this broad. No holly leaved naiad was found in 2010 but this could be as a result of the sampling method rather than the loss of the species from the broad.

Mautby Decoy

	2008	2009	2010	2010 MI
Fragile/Convergent stonewort	*	*	*	0.5829
Filamentous algae	*	*	*	0.5348
Rigid hornwort	*	*	*	0.2057
Opposite stonewort			*	0.0071
Enteromorpha	*		*	0.0071
Common duckweed	*			
Holly-leaved naiad	*			
Ivy-leaved duckweed	*	*		
Least duckweed	*	*		
Lesser pondweed	*			

Mautby Decoy was surveyed in 2007 and 2008 prior to and in preparation for suction dredging, which was carried out during the winter of 2008/09. Although the eastern end of the broad was of adequate depth, the western end was no more than 20 cm deep in parts. As a result, the distribution of macrophytes was largely confined to the deeper eastern end. The 2009 & 2010 surveys show a gradual colonisation of plants at the western end.

Opposite stonewort was seen in 2010 after an absence in 2009. The water body is heavily used for wildfowl shooting and as a result there is heavy disturbance and grazing by birds which may be delaying the return of species post mud pumping.

Ranworth

	2008	2009	2010	2010 MI
Rigid hornwort	*	*	*	0.026
Fennel-leaved pondweed	*	*	*	0.010
Curled pondweed		*	*	0.005
Filamentous algae		*		
Nuttall's waterweed	*			

The plants in Ranworth Broad have nearly always been limited to a few sickly-looking individuals on some of the transects. There appears to be little change in plant community with the broad's plant community being very stable.

Malthouse

Malthouse was dredged as part of the navigation in 2009 and average depth was increased. The survey resulted in no plants being found, this being consistent with casual observations at the site, and past surveys.

Upton Great

	2008	2009	2010	2010 MI
Holly-leaved naiad	*	*	*	0.930
Opposite stonewort	*	*	*	0.287
Water net			*	0.019
Convergent stonewort	*	*		
Filamentous algae	*			
Yellow water lily		*		

Upton Broad is a stable stronghold for holly-leaved naiad, where it occupies much of the water column and area of the lake. The stonewort population fluctuates throughout the survey period, but is generally restricted to the shallower, marginal areas rather than the deeper, central basin where holly-leaved naiad dominates.

Upton Little

	2007	2009	2010	2010 MI
Holly-leaved naiad	*	*	*	0.913
Opposite stonewort		*	*	0.442
Filamentous algae	*	*	*	0.023
Common stonewort		*		
Fennel-leaved pondweed	*			

Holly-leaved naiad has been the most abundant species over the four years of surveys, although with less vigorous growth than in the neighbouring Upton Great. Water depth, particularly on the western side of the broad is very shallow, with bare mud exposed during periods of low rainfall. Macrophytes are limited to the deeper areas, which are no more than 70 cm depth at any point. Restorative suction dredging in 2010 is planned and it is expected that the increased water depth will result in an increase in species richness.

Wroxham

	2008	2009	2010	2010 MI
Rigid hornwort	*		*	0.026
Fennel-leaved pondweed	*	*	*	0.007
Horned pondweed			*	0.006
Smooth stonewort			*	0.004
Canadian waterweed			*	0.003
Filamentous algae	*	*	*	0.002
Nuttall's waterweed	*	*		
Pointed stonewort	*			
Yellow water lily	*	*		

Despite improvement in water quality (both lower nutrient and improved water clarity) since the early nineties there has been no development of the aquatic plant community. Wroxham Broad showed no indication of reaching a stable state although the surprising increase in species numbers found in the 2008 survey was repeated in 2010.

Nortons

	2009	2010	2010 MI
Canadian waterweed		*	0.304
Filamentous algae	*	*	0.160
Common duckweed		*	0.011
Starwort sp.	*		

Nortons was suction dredged late summer 2008. Water depth was significantly increased with the encroaching alder carr pushed back. The survey in 2010 showed minimal plant

colonisation two years later. It is possible that Nortons will follow the same re-colonisation pattern as Belaugh and plant communities will slowly return over a number of years.

3.5 Yare Valley

Waterbodies surveyed in the Yare Valley are generally of good condition in terms of their submerged macrophyte populations. Despite high nutrient concentrations, 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.

Whitlingham Little

	2008	2009	2010	2010 MI
Nuttall's waterweed	*		*	0.607
Filamentous algae	*	*	*	0.368
Ivy-leaved duckweed	*	*	*	0.120
Fragile/Convergent stonewort	*	*	*	0.070
Delicate stonewort			*	0.065
Rigid hornwort	*	*	*	0.056
Canadian waterweed			*	0.047
Fennel leaved pondweed		*	*	0.047
Common stonewort		*	*	0.006
Amphibious bistort			*	0.002
Enteromorpha		*		
Fan-leaved water crowfoot	*			

Species richness continued to rise in 2010 with the most dominant plants changing from filamentous algae to Nuttall's waterweed and no Enteromorpha being found.

Rockland

	2007	2008	2010	2010 MI
Yellow water lily	*	*	*	0.340
Rigid hornwort	*	*	*	0.095
Un-branched bur-weed		*	*	0.023
Filamentous algae	*	*	*	0.003
Fennel-leaved pondweed		*	*	0.002
Common water moss			*	0.001
Fan-leaved water crowfoot	*			
Bulrush	*			

Rockland's water plant community remains relatively stable at a low species richness and abundance.

Buckenham

	2008	2009	2010	2010 MI
Filamentous algae	*	*	*	0.521
Rigid hornwort	*	*	*	0.479
Whorled water milfoil		*	*	0.159
Ivy-leaved duckweed	*	*	*	0.065
Curled pondweed		*	*	0.051
Enteromorpha		*	*	0.018
Fennel-leaved pondweed		*	*	0.010
Fragile/Convergent stonewort	*	*	*	0.002
Common duckweed	*			
Horned pondweed		*		
Fan leaved water crowfoot		*		
Nuttall's waterweed		*		

Buckenham was surveyed for the first time in 2004. Species richness has declined steadily between 2004 and 2008. However, 2009 showed a significant increase in species richness with pondweeds, stonewort and crowfoot being recorded in relatively good abundances. This increase was seen to fall again in 2010, although not significantly.

Hassingham Broad

	2008	2009	2010	2010 MI
Rigid hornwort	*	*	*	0.544
Filamentous algae	*	*	*	0.401
Fragile stonewort		*	*	0.304
Curled pondweed	*		*	0.175
Ivy-leaved duckweed	*	*	*	0.094
Enteromorpha			*	0.026
Nuttall's waterweed			*	0.006
Pink water speedwell			*	0.004
Bristly stonewort	*			
Common duckweed	*			
Fragile/Convergent stonewort	*	*		

Hassingham Broad was surveyed for the first time in 2004. Water clarity continues to be very good resulting in abundant stonewort populations. Species composition is possibly less stable than previously thought with the loss of two pondweed species and a stonewort for 2009 only to be found in 2010.

Strumpshaw

	2007	2008	2010	2010 MI
Filamentous algae	*	*	*	0.753
Holly-leaved naiad	*	*	*	0.302
Ivy-leaved duckweed	*		*	0.161
Rigid hornwort	*	*	*	0.135
Enteromorpha			*	0.058
Bladderwort	*	*		
Common stonewort	*			
Convergent stonewort		*		
Fragile/Convergent stonewort	*	*		
Frogbit	*			
Lesser pondweed	*	*		
Unbranched bur-reed	*			

Saline incursions are considered to be the reason behind the significant loss of species and the very high amounts of filamentous algae found in 2010.

3.6 Waveney Valley

There are six broads along the Waveney valley that lay within the Broads Authority executive area. These are Barnby, Spratt's Water, Woolner's Carr, Round Water, Flixton Decoy and Oulton Broad. Surveying and monitoring of these broads has been limited in the past, however restoration programmes are now being developed at some of these sites.

Flixton Decoy

	2006	2007	2010	2010 MI
Nuttall's waterweed	*	*	*	0.401
Rigid hornwort	*	*	*	0.365
Blunt-leaved pondweed			*	0.214
Ivy-leaved duckweed			*	0.197
Filamentous algae	*	*	*	0.115
Common duckweed	*	*	*	0.062
Least duckweed			*	0.021
Lesser pondweed		*	*	0.015
White water lily	*	*	*	0.006
Yellow water lily	*	*	*	0.002
Curled pondweed	*	*		
Flat-stalked pondweed	*	*		
Small pondweed	*			

The continued dominance of a range of vascular plants, rather than stoneworts, at this clear water broad, suggest that some nutrient enrichment is present, but not at sufficiently high concentrations to allow the dominance of microscopic algae.

3.7 Summary of the lakes surveys.

The number of broads sampled has increased from an average of 20 broads per year between 1983 and 2003, to over 30 per year from 2004 onwards, with previously un-surveyed broads now included.

The division between high and low species number is based on whether a broad has an average of eight or more species over the period.

However 2006 – 2008 Hickling and Cockshoot Broad have suffered a significant loss of richness with Hickling being reclassified from 'high' in 2006 to 'low' richness in 2008. Declines in species recorded at Cockshoot Broad in the last two years have been due to the vigorous growth of holly-leaved naiad, which has become dominant. Buckenham Broad has also suffered an annual decline in the number of species recorded.

The broads with a low number of plant species remain the most numerous group. These broads are sometimes dominated by one or two vigorous species such as rigid hornwort or Nuttall's waterweed. Alderfen, Hickling, Upton Great and Upton Little are generally species poor, with only two to three species recorded in recent years. Broads with low species number can have periods of relative stability in the water plant community and clear water, such as at Upton Great, which is dominated by holly-leaved naiad. More often than not, the clear water periods are linked to the total plant abundance rather than the actual number of species.

4 RIVER SURVEY MACROPHYTE RESULTS

Background

River macrophytes were previously surveyed in 1992, with the following stretches sampled; Dilham Canal (Honing Lock to Tonnage Bridge); River Waveney (Outney Common to Dunburgh Hill); River Wensum in Norwich (New Mills to Foundry Bridge); and the West Somerton channel (village staithe to first bend) (Kennison 1992). River surveys have again been repeated annually from 2005 to 2009 with slightly different stretches sampled to the 1992 surveys (Table 3). A seventh survey stretch on the Waxham New Cut was included in the 2009 river surveys. A rake-trawl method was used, similar to that used in the broads and abundances of individual species were recorded.

No river plant surveys were undertaken in 2010.

Table 3 River stretches and dates sampled

River	Start point	End point	2005	2006	2007	2008	2009
Ant	Honing Lock	Wayford Bridge	13-Sept	31-Aug	8-Sep	-	8-Sep
Bure	Horstead canal	Wroxham Bridge	-	6-Sept	7-Sep	28-Aug	13-Sept
Thurne	West Somerton staithe	Dungeon corner	9-Aug	7-Sept	6-Sep	4-Sep	6-Sept
Waxham Cut	Bridge Farm	Brograve Mill					6-Sept
Waveney	Geldeston Lock	Beccles New Bridge	14-Sept	-	12-Sep	5-Sep	28-Aug
Wensum	New Mills	Foundry Bridge	9-Aug	-	-	8-Sep	19-Sept
Yare	Carrow Bridge	Thorpe Rail Bridge	9-Oct	-	-	5-Sep	26-Sept

5 GENERAL DISCUSSION

The Broad's annual macrophyte survey is the longest time series and most complete macrophyte data set for a series of shallow lakes in the UK. It is important that this data set is maintained through regular monitoring to inform the managers and scientists of ecological health and restoration progress or necessity thereof.

It is planned that the key broads remain surveyed on an annual basis, with a rolling programme of sampling other sites to gain maximum coverage. The survey outputs are used to:

- Inform the impact of restoration efforts
- Continue the long-term change data set
- Monitor macrophyte recovery
- Inform waterspace management plans
- Inform the Water Framework Directive target setting at a National and European level

The Rivers and Broads Strategy (RaBS) database incorporates scores for the status of broads based on their macrophyte populations. These scores combine the abundance and richness of macrophytes. This scoring system classifies the broads into four groups (Table 6). Lakes with high macrophyte abundance (plant cover) and richness score 1 and those with low abundances and low richness score 4. The cut-off value between low and high abundance is based on whether the broad scores greater or less than 0.5 for the sum of all species mean % cover. The cut-off for high and low diversity is arbitrary, but the mid-point of 7.5 is usually greater than the average number of species per broad.

Table 6 Water plant classification for broads based on abundance and number of species

Score	Total transect score abundance	Number of species
1	High abundance	> 7.5 species
2	High abundance	< 7.5 species
3	Low abundance	> 7.5 species
4	Low abundance	< 7.5 species

In both abundance and species richness scores macro-algae (Filamentous Algae and *Enteromorpha*) are not included for the classification of broads in Table 7. Although indicative of a favourable underwater light climate, 100% cover of filamentous algae may not be seen as an ecologically desirable water plant population.

Table 7. Water plant classification for broads sampled in 2010 excluding all records of Filamentous algae and *Enteromorpha* algae.

High Abundance		**Low Abundance**	
High Richness	**Low Richness**	**High Richness**	**Low Richness**
1	**2**	**3**	**4**
Buckenham Broad Martham Broad North Martham Broad South Ormesby Broad	Alderfen Cockshoot Cromes South Hassingham Broad Little Broad Mautby Decoy		Barton Cromes North Heigham Sound Hickling Horsey Mere Hoveton Great Broad Nortons Ranworth Broad Upton Grt Broad Upton Little Broad Wroxham Broad Whitlingham Little

Table 8 Trends in abundance of macrophytes over last 5 years for the most frequently surveyed broads. Abundances are listed as either stable (S) or Fluctuating (F).

Improving	**With abundant macrophytes**	**Without abundant macrophytes**	**Declining**
Belaugh Filby Ormesby Little	Alderfen (F) Cockshoot (S) Crome's (F) Martham North (S) Martham South (S) Rollesby (F) Ormesby (F) Upton Great (S)	Hoveton Great (S) Pound End (S) Ranworth (S) Rockland (S) Wroxham (S)	Barton Hickling Horsey

It is evident from this report that much more restoration work is required to improve the condition of the shallow lakes in Broadland to a more favourable ecological status. Where lake restoration efforts such as sediment removal and biomanipulation have been undertaken, lake ecological condition has steadily improved. There are also early signs that continued phosphorus reduction from sewage treatment works discharges has benefited macrophytes, especially in the more upstream broads, like Belaugh and Barton. This positive response demonstrates the measurable benefit of lake restoration and management.

Some of the permanent water bodies in Broadland have not been surveyed for macrophytes. It is hoped that future extension of the monitoring programme to all water bodies will enable assessment of the status of the open water in the Broads. This, in turn, will inform the integrated management of the total open water resource in Broadland.

6 ACKNOWLEDGEMENTS

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7 REFERENCES

Begon M, Harper JL, Townsend CR (1996) Ecology individuals populations and communities. Blackwell, Oxford.

Boorman, Fuller and Boar (1979) Recent changes in the distribution of reedswamp in

Broadland. Final Report on Project No 605. Institute of Terrestrial Ecology, Colney Research Station Norwich.

Kelly, A. (2003) Broads Annual Macrophyte Monitoring Report 2003. Broads Authority report.

Kennison, G.C.B. (1992) Aquatic macrophyte surveys of the Norfolk Broads 1992. Broads Authority report.

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.

Dunsford, D. (1995) Aquatic macrophyte surveys of the Norfolk Broads (1995) Broads Authority report.

Harris, J. (2003) Hickling Broad aquatic plant cutting and monitoring programme. Unpublished report to the Broads Authority, Norwich

Harris, J. (2003) SCUBA survey of Barton Broad exclosures 2003. Unpublished report to the Broads Authority, Norwich

Hoare, D. (2002) Upper Thurne Water Quality Monitoring Report**.** Unpublished report to the Environment Agency, Norwich

Moss, B., Madgwick, J. & Phillips. G. (1996) Guide to the restoration of nutrient-enriched shallow lakes. Broads Authority, Environment Agency and EU LIFE programme, Norwich.

Natural England (2006) Condition of SSSI units. Database compiled 01/11/06. http://www.englishnature.org.uk/special/sssi/reportAction.cfm?Report=sdrt13&Category=CF &Reference=1028. Database accessed 27/11/06.

Perrow, M and Tomlinson, M. L., (2003) Extent and status of the designated features in the Trinity Broads (Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation and hard oligo-mesotrophic waters with benthic vegetation of Chara sp). Unpublished report to the Broads Authority, Norwich

PRIMER-E Ltd (2005). Plymouth Routines In Multivariate Ecological Research. Plymouth Marine Laboratory, Plymouth

Schutten, J. (2001) Macrophyte development in the Trinity Broads: a statistical analysis of aquatic macrophyte monitoring data 1997-2000. Unpublished report to the Broads Authority, Norwich

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

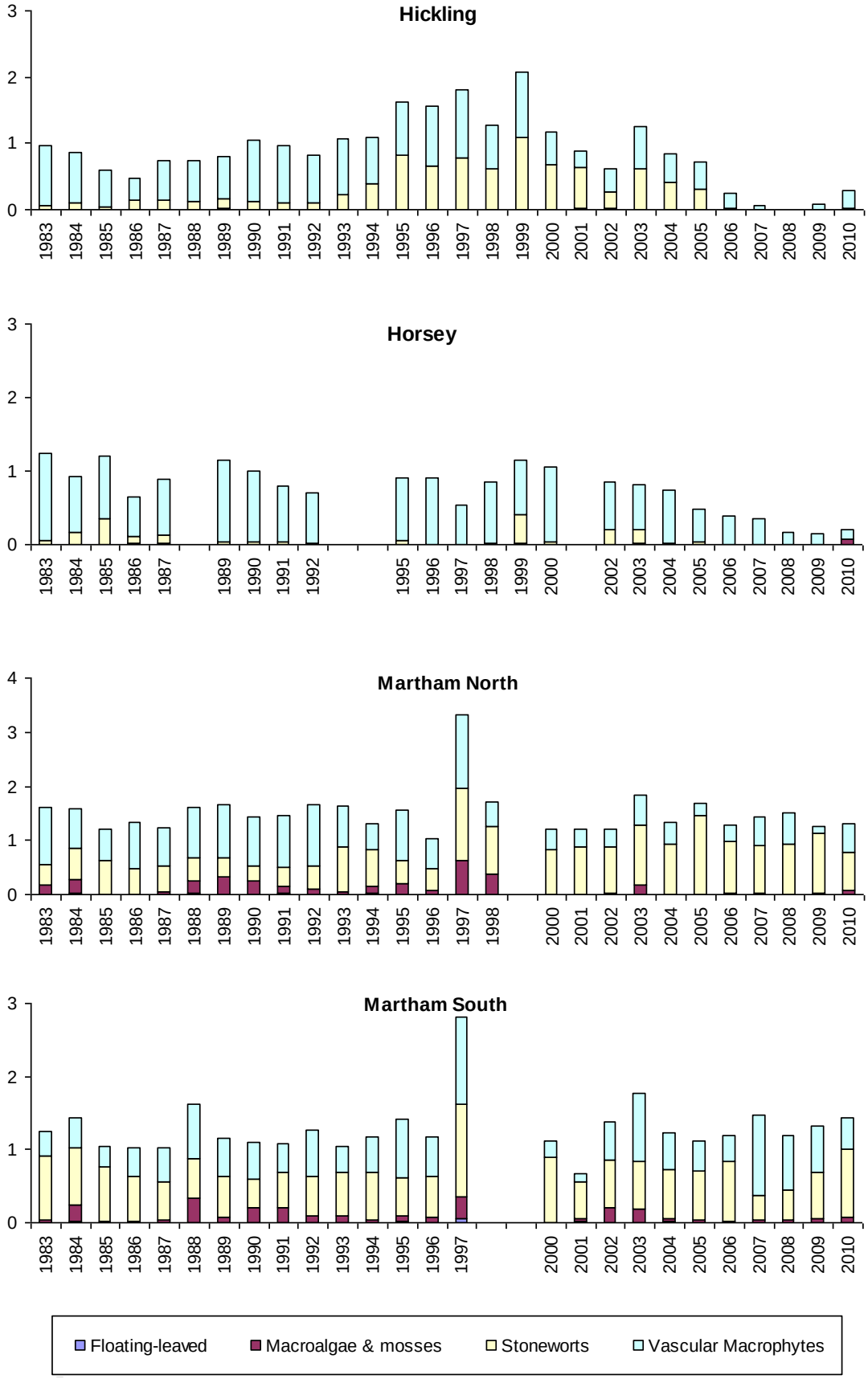
8 APPENDICIES.

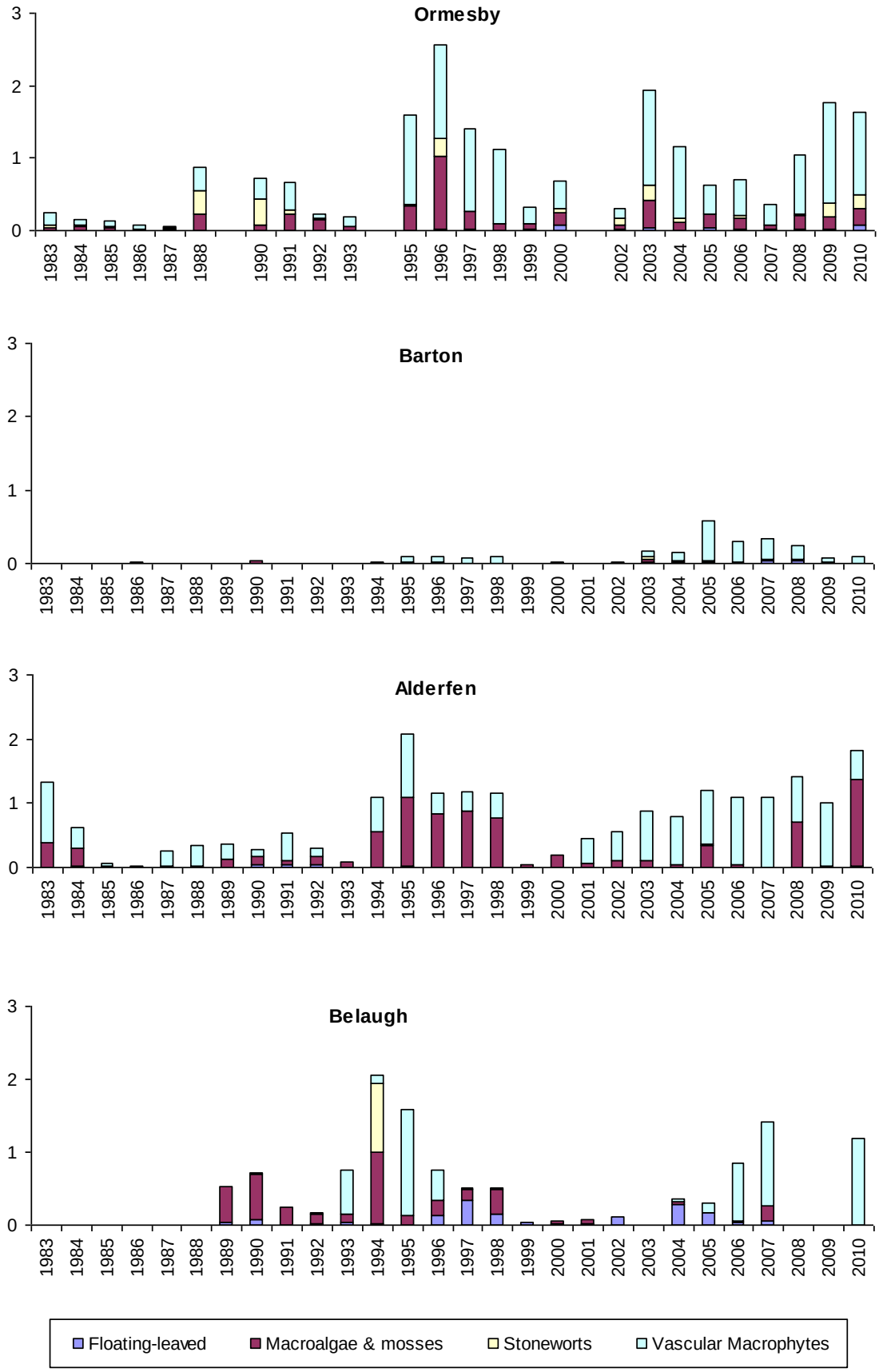
Appendix 1. Macrophyte groupings based on physical form.
Appendix 2. Long term macrophyte abundance trends (1983 – 2010)
Appendix 3a & b. Plant common and Latin names.

8.1 Appendix 1. Macrophyte groupings based on form

Stoneworts	**Free-floating or round floating-leaved**	**Vascular Macrophytes**	
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	**Macro-algae and mosses**	Fennel-leaved pondweed	Starwort sp.
Starry stonewort	*Enteromorpha*	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	

8.2 Appendix 2. Macrophyte abundance trends (1983 – 2010)

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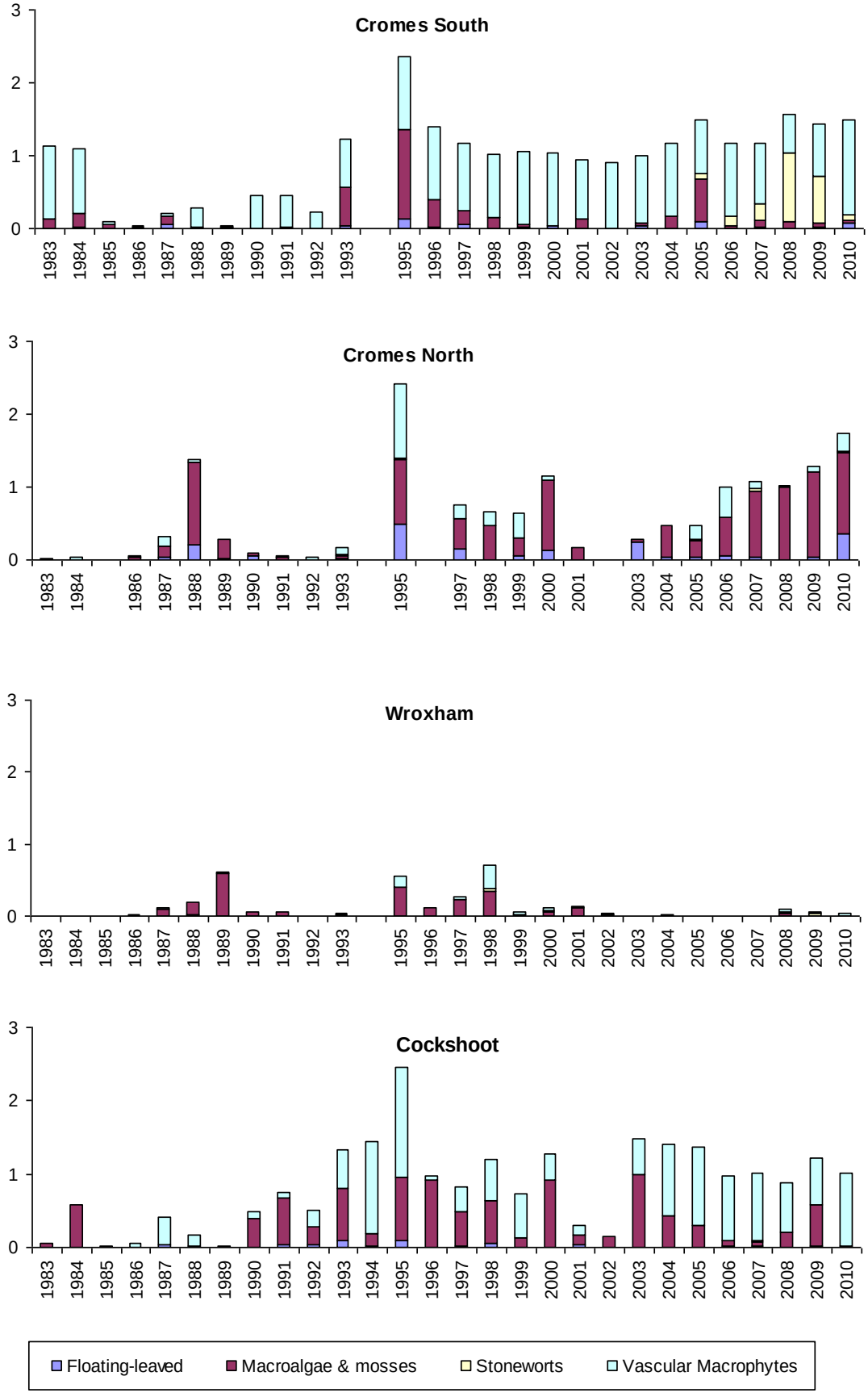
Barton
Alderfen
Belaugh
Floating-leaved
Macroalgae & mosses
Stoneworts
Vascular Macrophytes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Cromes North
Wroxham
Cockshoot
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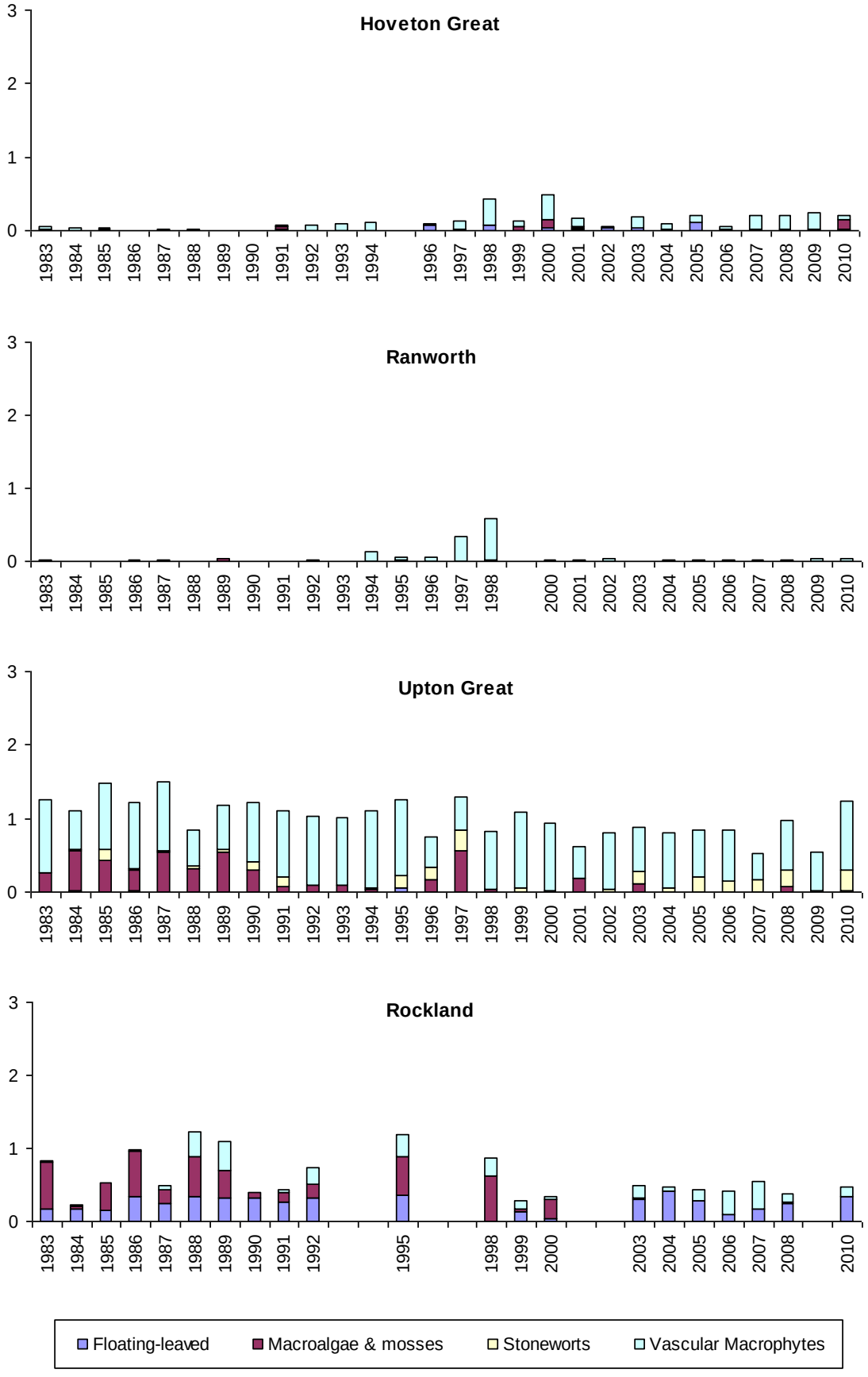
Macroalgae & mosses
Stoneworts
Vascular Macrophytes


Hoveton Great
Ranworth
Upton Great
Rockland
Floating-leaved
Macroalgae & mosses
Stoneworts
Vascular Macrophytes

8.5 Appendix 3a. Latin to Common plant names.

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

8.6 Appendix 3b. Common to Latin plant names.

Common	*Latin*
Amphibious bistort	*Persicaria amphibia*
Arrowhead	*Saggitaria sagittifolia*
Baltic stonewort	*Chara baltica*
Bladderwort	*Utricularia vulgaris*
Blunt-leaved pondweed	*Potamogeton obtusifolius*
Branched bur-reed	*Sparganium erectum*
Bristly stonewort	*Chara hispida*
Broad –leaved pondweed	*Potamogeton natans*
Bulrush	*Schoenoplectus lacustris*
Canadian waterweed	*Elodea canadensis*
Common duckweed	*Lemna minor*
Common reed	*Phragmites australis*
Common stonewort	*Chara vulgaris*
Common water moss	*Fontinalis antipyretica*
Common water-plantain	*Alisma plantago-aquatica*
Convergent stonewort	*Chara connivens*
Crowfoot sp.	*Ranunculus sp.*
Curled pondweed	*Potamogeton crispus*
Delicate stonewort	*Chara virgata*
Enteromorpha	*Enteromorpha*
Fan-leaved water crowfoot	*Ranunculus circinatus*
Fennel-leaved pondweed	*Potamogeton pectinatus*
Filamentous algae	*Filamentous algae*
Flat-stalked pondweed	*Potamogeton friesii*
Floating club-rush	*Eleogiton fluitans*
Fragile stonewort	*Chara globularis*
Fragile/convergent stonewort	*Chara globularis/connivens*
Frogbit	*Hydrocharis morsus-ranae*
Greater duckweed	*Spirodela polyrhiza*
Greater reedmace	*Typha latifollia*
Hair like pondweed	*Potamogeton trichoides*
Hedgehog stonewort	*Chara aculeolata/pedunculata*
Holly-leaved naiad	*Najas marina*
Horned pondweed	*Zanichellia palustris*
Inflated duckweed	*Lemna gibba*
Intermediate stonewort	*Chara intermedia*
Intermediate water-starwort	*Callitriche stagnalis*
Ivy-leaved duckweed	*Lemna trisulca*
Least duckweed	*Lemna minuta*
Lesser bearded stonewort	*Chara curta*
Lesser pondweed	*Potamogeton pusillus*
Lesser reedmace	*Typha angustifolia*
Mare's tail	*Hippuris vulgaris*
Nuttall's waterweed	*Elodea nutalli*
Opposite stonewort	*Chara contraria*
Perfoliate pondweed	*Potamogeton perfoliatus*
Pink water speedwell	*Veronica catenata*
Pointed stonewort	*Nitella mucronata*
Pondweed sp.	*Potamogeton sp.*
Reed sweet grass	*Glyceria maxima*

Common	*Latin*
Rigid hornwort	*Ceratophyllum demersum*
River water crowfoot	*Ranunculus fluitans*
Rough stonewort	*Chara aspera*
Sharp-leaved pondweed	*Potamogeton acutifolius*
Shining pondweed	*Potamogeton lucens*
Small pondweed	*Potamogeton berchtoldii*
Smooth stonewort	*Nitella flexilis*
Spiked water milfoil	*Myriophyllum spicatum*
Starry stonewort	*Nitellopsis obtusa*
Starwort sp.	*Callitriche sp*
Stonewort *(Chara)* species	*Chara sp.*
Stonewort *(Nitella)* species	*Nitella sp.*
Stringy moss	*Leptodictyum riparium*
Swamp stonecrop	*Crassula helmsii*
Sweet flag	*Acorus calamus*
Translucent stonewort	*Nitella translucens*
Unbranched bur-reed	*Sparganium emersum*
Water cress	*Rorippa nasturtium-aquaticum*
Water net	*Hydrodictyon*
Water-soldier	*Stratiotes aloides*
White water lily	*Nymphaea alba*
Whorled water milfoil	*Myriophyllum verticillatum*
Willow-leaved pondweed	*Potamogeton x salicifolius*
Yellow water lily	*Nuphar lutea*