Broads Annual Water Plant Monitoring Report 2021

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Cover photos of Hedgehog stonewort, taken by Hannah Southon

Executive Summary

The Broads Authority and its contractors have surveyed the water plant communities within the Broads since 1983. The Broads Annual Water Plant Monitoring programme provides information on the diversity of species and a measure of abundance. The programme has consistently surveyed key broads, such as Hickling Broad (a prime navigation site with high recreational value) and Cockshoot Broad (undergone restoration measures), providing long term datasets. Between 1983 and 2013, a transect-based technique was used for the monitoring programme. Due to limitations in the efficiency of the methodology along with the improvements in water plants generally across the Broads, a new point -based technique was developed and implemented. Point sample surveys have been conducted since 2014.

Macrophytes in the Broads are inherently highly variable in both abundance and species richness between years, so limited significance should be attached to variation in these parameters between one individual year and the next.

This report presents and discusses the findings from the annual water plant surveys carried out during 2021, which covered **18** Broads with a total of **466** survey points.

- Overall in 2021, 50% (9/18) of the Broads surveyed showed an increase in total species abundance. 22% (4/18) Broads showed a decrease and 28% (5/18) showed very little change. This is in contrast to 2020 when 17 out of the 21 broads surveyed saw an increase in overall species abundance.

- Summary abundance for Intermediate stonewort has increased from previous years in the Thurne System.

- The Broads in the Yare Valley showed increases in summary abundance levels and the water clarity in all three Broads was very good.

- Stonewort's were dominant in Hickling Broad, Martham North and Martham South this year. There were also recorded in Alderfen Broad, Cockshoot Broad, Heigham Sound, Rockland Broad, Upton Great Broad and Wroxham Broad.

- Holly-leaved naiad did not flourish this year as in previous years, with Cockshoot and Upton Broad seeing big decreases in summary abundance. In contrast, abundance increased in Martham Broad North and remained stable in Heigham Sound. Other section 41 species, such as Intermediate stonewort increased, especially in the Thurne Valley. In general, Section 41 species (conservation priority species) were found in 8 out of the 18 broads surveyed; Holly-leaved naiad being present in all 8.

Introduction

Background information

The Broads Authority (the Authority hereafter) has monitored aquatic macrophytes (water plants hereafter) annually at numerous broads within its Executive Area since 1983. The water plant monitoring programme has provided data on species richness (number of species) and a measure of abundance of the water plants present in each of the broads surveyed. The surveys have created long-term datasets, provided vital information in monitoring the response of a number of broads to restoration measures such as suction dredging and / or biomanipulation and are contributing to scientific reviews of key broads (http://www.broads-authority.gov.uk/__data/assets/pdf_file/0006/549114/Broads-Lake-Review.pdf).

Following increased water plant growth across many of the broads, it was acknowledged that the transect methodology (employed until 2013), was difficult to implement in a robust and consistent manner required for analysis of long-term trends. Following consultation with Natural England, Environment Agency, Dr Nigel Wilby (University of Stirling) and other researchers, a point-based survey methodology was developed. Between 2011 and 2013, the point sample survey was conducted alongside the transect surveys. The purposes of the concurrent surveys was to understand if the data gathered was directly comparable and would allow long-term trend analysis. Whilst research undertaken by Dr Nigel Wilby, revealed the data gathered by the two techniques was not directly comparable, the point-based technique was adopted as the method for the Broads Annual Water Plant Monitoring programme from 2014 onwards.

Aims & objectives

The main objectives of the annual programme are to monitor key broads with long-term datasets, those that have undergone restoration measures or those that are known to be experiencing a change in their water plant community. Broads that have not received restoration efforts or are stable (with or without water plants) are monitored on a less frequent basis. When resources allow, the monitoring of sites not previously surveyed is an ongoing objective.

The general aim of the monitoring programme is to monitor water plant growth and provide an assessment of the condition, or health, of the broads and waterways within the Broads. The monitoring programme also provides an assessment of Section 41 species, Species “of principal importance for the purpose of conserving biodiversity” covered under section 41 (England) of the NERC Act (2006) and therefore need to be taken into consideration by a public body when performing any of its functions.

Two types of surveys are undertaken as part of the monitoring programme, point sample surveys to assess species diversity and provide a measure of abundance within a broad or stretch of river and hydroacoustic surveys, which use sonar technology to estimate cover and volume of water plants along transects.

The purpose of this report is to present the results of the 2021 survey season.

The data gathered through the water plant and hydroacoustic surveys and presented within these reports are used to:

- Report the status of conservation priority species, e.g. certain stoneworts and Holly-leaved naiad (Section 41 priority species)
- Assess the condition of designated sites (SSSIs) and WFD waterbodies in partnership with NE and EA respectively.
- Assess the success of restoration measures such as catchment or in-lake projects by managers and research scientists as well as assessing long-term trends
- Assess the impact of and ability to cut water plants to allow the safe passage of boats.

Methodology

Survey design

The point sample survey was designed in consultation with Dr Nigel Wilby using Broad's species accumulation data. The data generated a relationship (y = 4.6242ln(x) + 17.149) between the area of the open water of a broad and the required number of points to be sampled (see Figure 1). Using ArcGIS, the area of open water of each broad to be surveyed was measured in hectares (ha) and the number of sample points calculated. Once the required number of points was calculated, a grid system was applied over an aerial image of the open water areas of each broad. Sample points were set equidistant from each other and the co-ordinates generated (see Figure 2). The maps and sample point co-ordinates were loaded onto a Samsung tablet for the survey teams to use.

Figure 1

The relationship between the area of open water and the required number of points sampled.

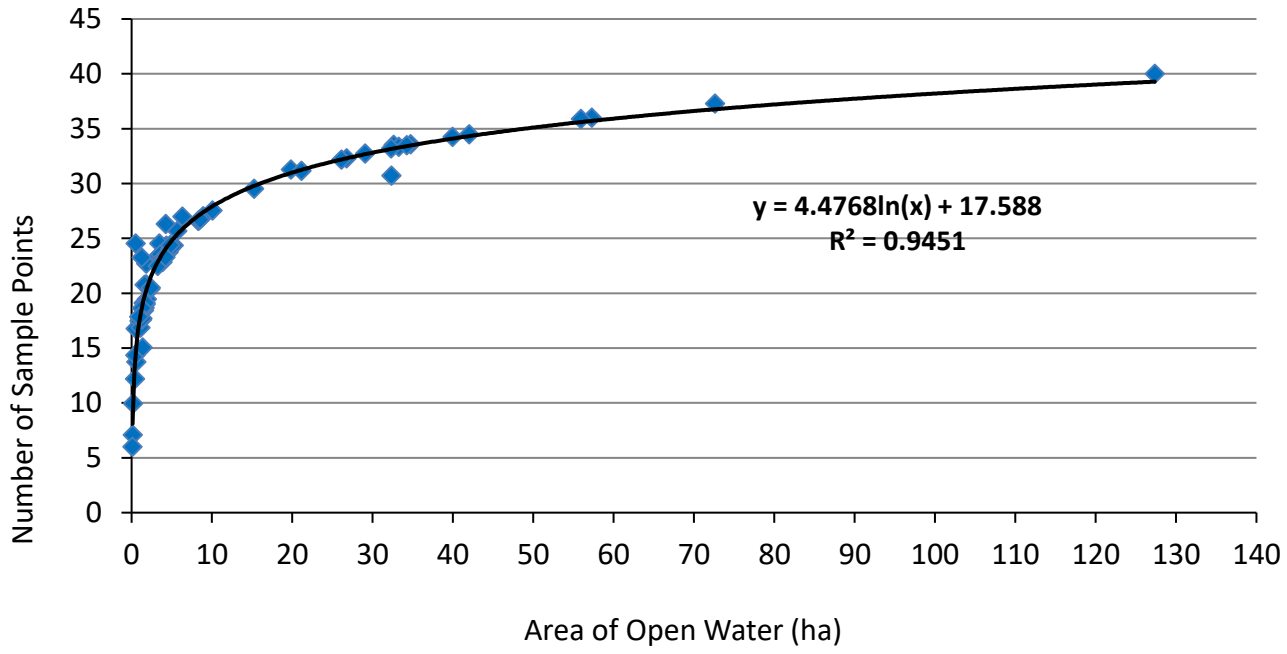
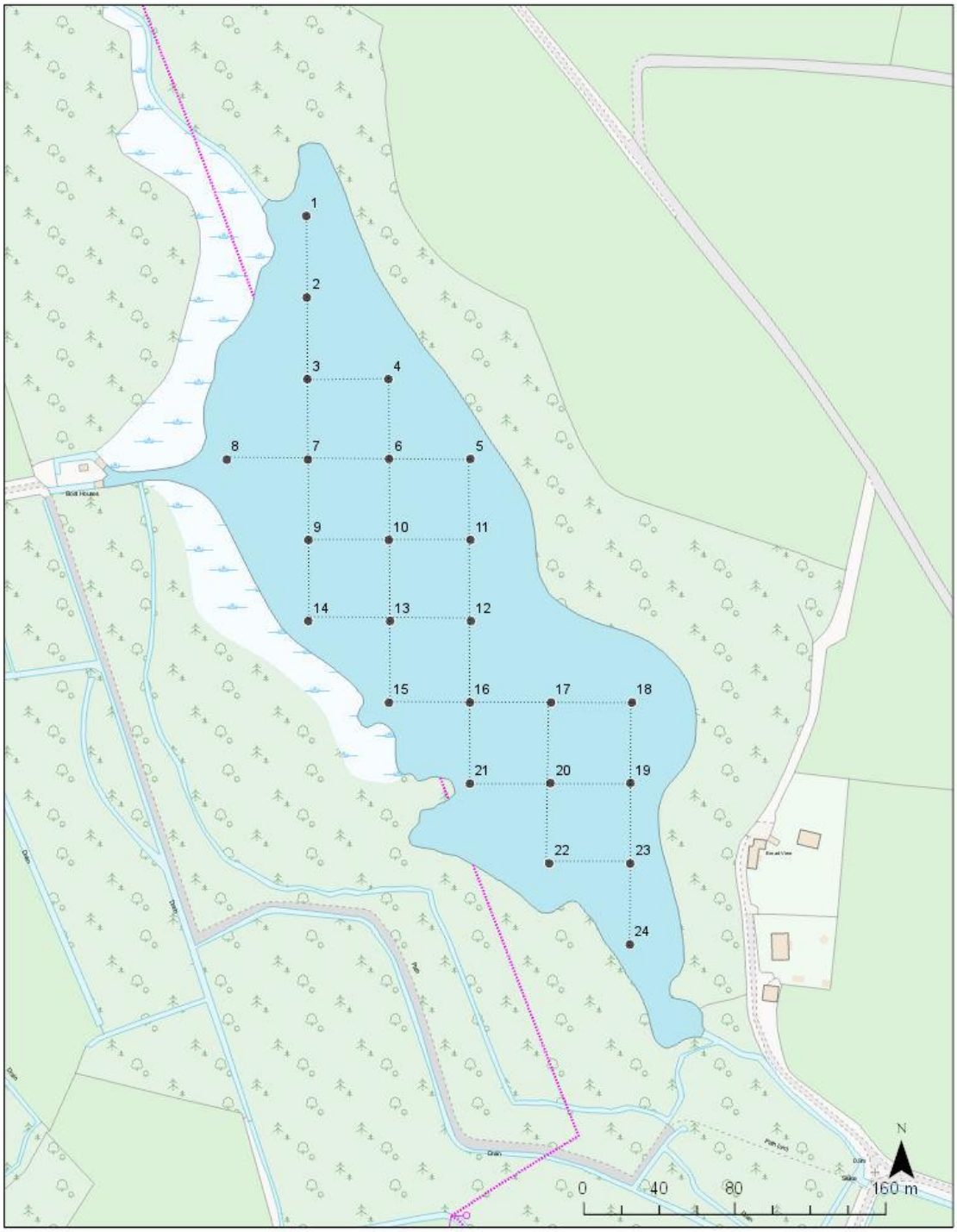


Figure 2

Map showing the sample points of Alderfen Broad



Sample points at Alderfen Broad

Point sample survey technique

At each broad, the surveyors used the maps and grid references on the Samsung tablet and GPS to navigate by boat to each of the sample points. Once within 5 m of the plotted grid reference, mud weights were deployed to keep the boat in the correct location.

At each sample point, a double headed survey rake was thrown north and south, at each sample point, at a distance of 5 m from the boat edge. The rake was left for 10 seconds to sink to the bottom after which the rake was pulled slowly and steadily back towards the boat. For points that were in known deeper water, additional rope was thrown to allow the rake to sink and rest on the bed of the lake at a distance of 5m from the edge of the boat.

On retrieval of the rake, the plants attached to the rake head were collected in a white survey tray. If necessary, plants were washed to remove excess sediment to aid identification. All the live plant material was identified to species level wherever possible. For example, some particularly difficult groups e.g. any non-fruiting starworts *Callitriche* sp. were only identified to genus level. Any unidentified plant specimens (or where identification was uncertain) were collected in plastic bags and labelled using the station number reference. These samples were then taken for subsequent observation using a high-powered microscope, or sent for expert identification. Wherever possible, voucher specimens were pressed and dried using standard herbarium techniques.

To assign a level of abundance for each species, the total volume of live water plant material was scored based on the maximum trap-ability on the rake. Scores attributed to each species present range from 10% (low abundance) and 100% (the maximum trappable) in increments of 10%. For example, if the maximum plant volume was present on the rake, but split equally between two species then each species would be scored 50%. In addition, scores of 1% were given to trace and very small amounts of identifiable plant material.

The ‘trap-ability’ of a particular species on the rake, was taken into account so that a score of 100% represents the maximum amount trappable on the rake. For example, a fine leaved species such as Unbranched bur-reed *Sparganium emersum* is not as ‘trappable’ on the rake as a more structured species such as Spiked water milfoil *Myriophyllum spicatum*. Surveyor experience and judgement is therefore important in scoring the less trappable species based on the likelihood of being retrieved in the rake and possibly other visual indications. The risk being that high abundances of less trappable species are routinely under-scored compared to more easily retrieved species. Other less trappable water plant families include duckweeds Lemna sp. and water lilies.

The maximum total of all species abundance scores on an individual rake sample cannot really be more than 100%, although ± 10% is considered acceptable to account for the varying trap-ability of different species.

The broads that have been sampled between 2014 and 2021 are presented in Table 1. Surveys are conducted during the summer period, July to September.

Table 1

Sites surveyed as part of the monitoring programme between 2014 and 2021.

Broad	2014	2015	2016	2017	2018	2019	2020	2021
Alderfen Broad	X	X	X	X	X	X	X	X
Bargate Broad	X			X			X	
Barnby Broad		X						
Barton Broad	X	X	X	X	X	X	X	X
Belaugh Broad				X				
Blackfleet broad			X					
Bridge Broad		X					X	
Buckenham Broad		X		X				
Burntfen Broad			X					
Calthorpe Broad	X							X
Catfield Broad		X						
Cockshoot Broad	X	X	X	X	X	X	X	X
Cromes Broad	X	X	X	X	X	X	X	X
Decoy Broad	X		X		X		X	
Hassingham Broad		X		X				
Heigham Sound	X	X	X	X	X	X	X	X
Hickling Broad	X	X	X	X	X	X	X	X
Horsey Mere	X	X	X	X	X	X	X	X
Hoveton Great Broad	X	X	X	X	X	X	X	X
Hoveton Little Broad	X			X			X	
Hudson's Bay		X			X		X	X
Little Broad			X					
Malthouse Broad							X	
Martham Broad North	X	X	X	X	X	X	X	X
Martham Broad South	X	X	X	X	X	X	X	X
Mautby Decoy			X					
Norton's Broad			X					
Oulton Broad			X					
Pound End		X					X	
Ranworth Broad	X	X		X		X	X	X
Reedham Water								
Rockland Broad	X	X	X	X	X	X	X	X

Broad	2014	2015	2016	2017	2018	2019	2020	2021
Round Water Broad			X					
Sotshole Broad			X					
Sprat's Water			X					
Strumpshaw broad		X			X			X
Upton Broad	X	X	X	X	X	X	X	X
Upton Little Broad	X		X		X			
Wheatfen Broad & Channels		X			X			X
Whitlingham Great Broad	X	X	X	X	X			
Whitlingham Little Broad		X	X	X	X	X		
Woolner's Carr			X					
Wroxham Broad	X	X	X	X	X	X	X	X

Data processing

For each sample point, an abundance score for each species was calculated, derived from the data from the north and south throws;

$$\frac{\text{(Score from north + Score from south)}}{2}$$

The abundance score for each species was then totalled to produce an abundance score for each sample point. An overall mean abundance for each species for the whole broad was then calculated by summing the scores from each sample point and dividing by the number of sample points. The overall mean abundance score for each species was then added together to give the overall total abundance score for the broad. Assuming maximum plant abundance on the site, the site abundance score should have a maximum of 100 (± 10%).

The water plants present in the surveys were also categorised into groups, such as stoneworts or macro-algae, and abundance scores were calculated for each group in each broad, as described above. The water plant groups and the species within them are presented in Appendix I.

Results

Section 41 Species

Species “of principal importance for the purpose of conserving biodiversity” covered under section 41 (England) of the NERC Act (2006) and therefore need to be taken into consideration by a public body when performing any of its functions.

Table 2

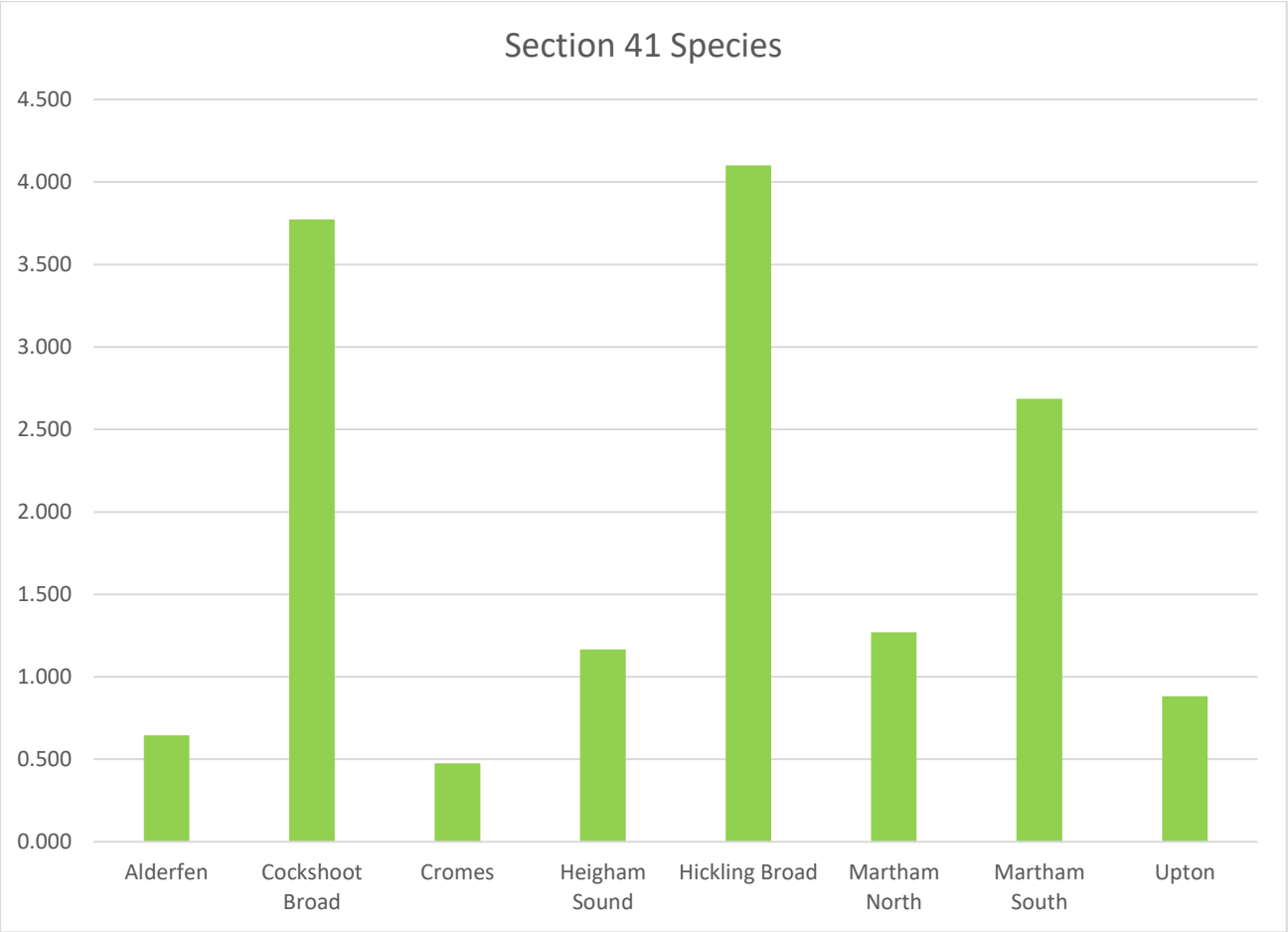
Ten Broads were found to have Section 41 species in 2021. Abundance changes noted in the executive summary.

Species	**Broads**
Holly-leaved naiad- *Najas marina*	Alderfen Broad, Cockshoot Broad, Cromes Broad, Heigham Sound, Hickling Broad, Martham South, Martham North, Upton Great Broad
Baltic stonewort - *Chara baltica*	Heigham Sound, Hickling Broad, Martham North, Martham South
Intermediate stonewort - *Chara intermedia*	Heigham Sound, Hickling Broad, Martham North, Martham South
Convergent stonewort - Chara connivens	Heigham Sound, Hickling Broad, Martham South
Starry stonewort *Nitellopsis obtusa*	Heigham Sound, Hickling Broad, Martham South

As can be seen from this table the broads in the Thurne are an important site for section 41 species. In this survey, the Ant and Thurne Broads were a particular stronghold for Holly-leaved naiad.

Graph 1

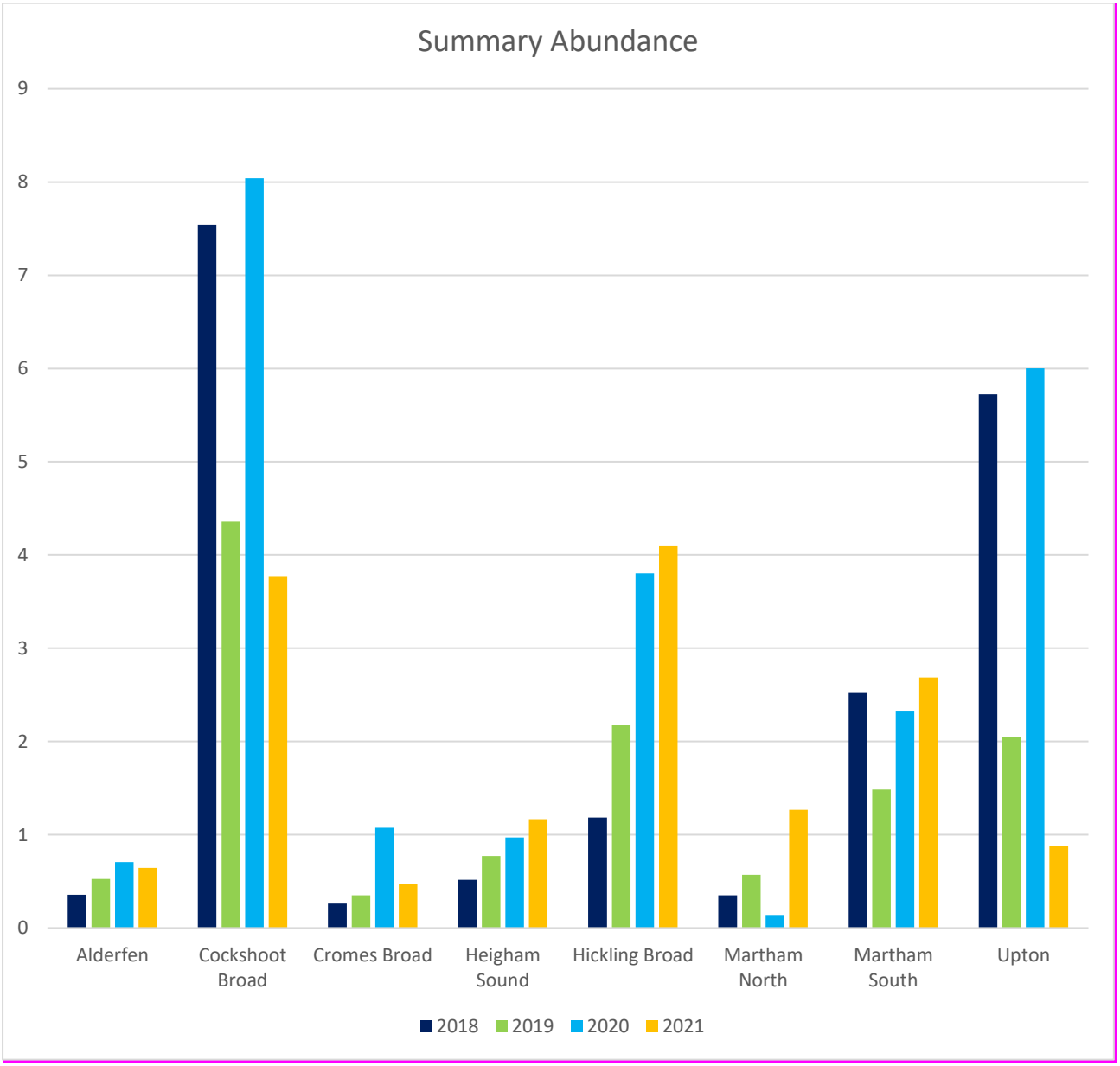
Broads with Section 41 species and their abundance scores in 2021. See main report for specific abundance levels.



Summary abundance axis usually sees ranges up to 10 in score, but to show the smaller values for section 41 species the axis has been halved for this graph.

Graph 2

Section 41 species abundance between 2018 - 2021.



This year saw Holly leaved naiad decrease in many broads which is reflected in the corresponding areas most prolific with the plant, Cockshhot Broad and Upton Great Broad. The Broads more dominant with Stoneworts in the Upper Thurne Valley actually saw increases in the overall section 41 species this year. See main results for more details.

Table 3

Holly-leaved naiad distribution

Broad	2020 Number of Points with Holly-leaved naiad	2020 Summary abundance	2021 Number of Points with Holly-leaved naiad	2021 Summary abundance
Alderfen	30/48	0.708	19/48	0.646
Cockshoot	47/48	7.958	36/48	3.773
Cromes	31/40	1.074	18/42	0.476
Heigham	2/66	0.045	2/66	0.030
Hickling	11/80	0.213	5/80	0.075
Martham North	/	/	10/52	0.231
Martham South	17/54	0.356	24/54	0.796
Upton	44/48	6.002	18/42	0.883

Martham North (absent in 2020) has returned to the list this year as a location for Holly-leaved naiad, although it is clear from the table that 2021 was not a good year in general across the whole Broads system.

Main Survey Results

The data collected from each broad is presented as species richness (the number of species recorded) and abundance (the amounts of each species recorded) according to the point survey and scoring method (outlined in Section 2.2).

The results tables also illustrate the number of points at which each species was recorded, giving an indication of the frequency of occurrence.

Appendix 1 lists the common and Latin names for all plants found to date during water plant surveys in the Broads.

Thurne Valley

The Thurne valley broads contain two Annex I habitats and form a key part of the Broads Special Area of Conservation (SAC) designation. (Hard oligo-mesotrophic waters with benthic vegetation of stonewort species (3140), and Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation (3150)).

These bodies of water are a sanctuary for vulnerable and rare species which are stated in the Joint Nature Conservation Committee (JNCC) Red Data Book, they include three vulnerable species: Baltic stonewort, Convergent stonewort and Starry stonewort, and one Rare species: Intermediate stonewort (Stewart and Church, 1992). They also provide a safe haven for the rare Holly-leaved naiad, which is a section 41 priority species, as well as more common vascular plants such as Spiked water milfoil and Mare's tail.

2021 Summary

This year there has been an assortment of results with increases, decreases and results staying steady. Hickling and Heigham have stayed similar in their overall abundances. Martham North and South broads showed increases whereas Horsey saw a decrease again this year. The Broads at Martham have both recorded abundance level increases compared to the previous year and similar to levels seen prior to 2019. The high variability of plant abundance between years highlights the importance of surveys carried out frequently and looking across multiple years to establish trends. Horsey Mere continues to show low macrophyte levels compared to the other broads in the Thurne Valley.

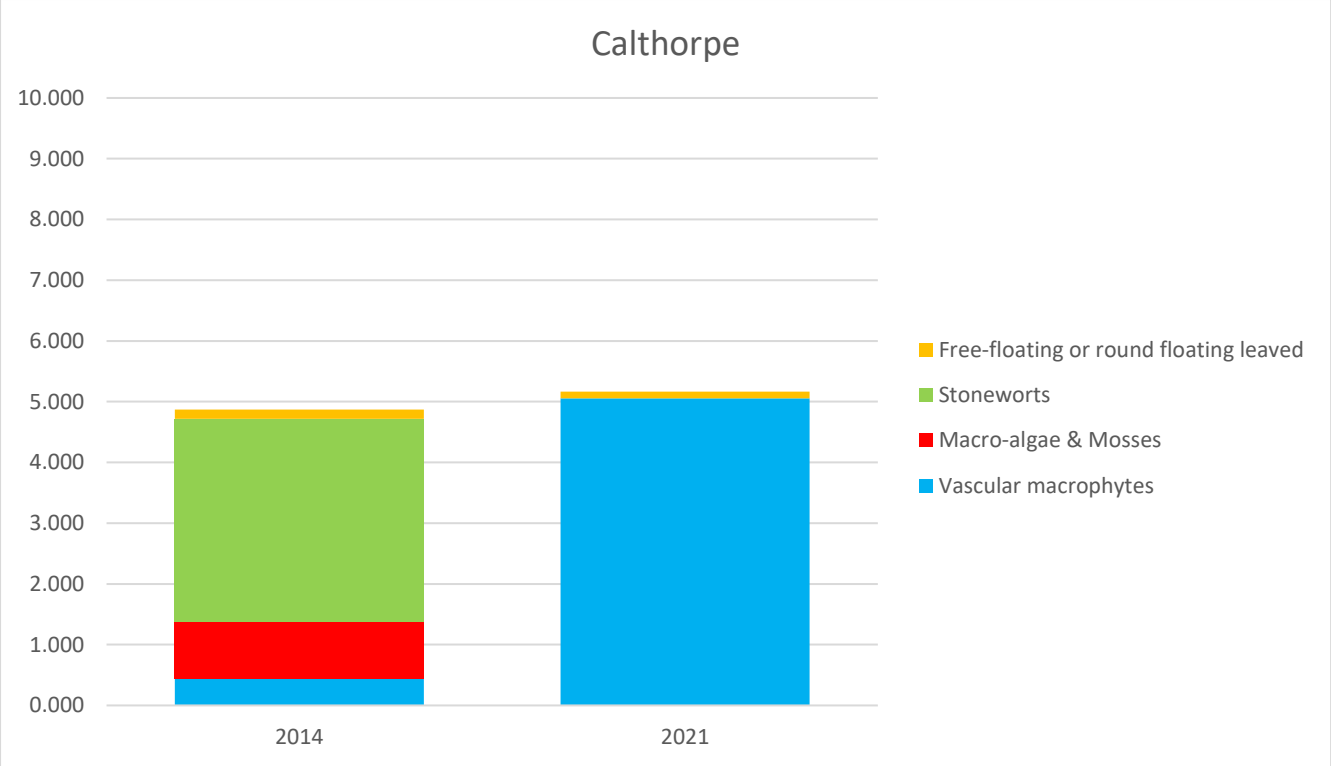
Calthorpe

Table 4

Common Name	Scientific Name	Summary Abundance	Occurrences
Canadian waterweed	*Elodea canadensis*	4.167	18
Broad –leaved pondweed	*P. natans*	0.556	7
Water violet	*Hottonia palustris*	0.167	3
Yellow water lily	*Nuphar lutea*	0.111	2
Common water-plantain	*Alisma plantago-aquatica*	0.056	1
Blunt-leaved pondweed	*P. obtusifolius*	0.056	1
Arrowhead	*Saggitaria sagittifolia*	0.056	1
Total number of species recorded		**7**	**Total samples taken: 18**

There has been a shift in the plant community from stoneworts to vascular macrophytes. Macro algae & mosses were not found this year but abundance stayed very similar. The waters were very clear with a nice community of plants.

Graph 3



Heigham Sound

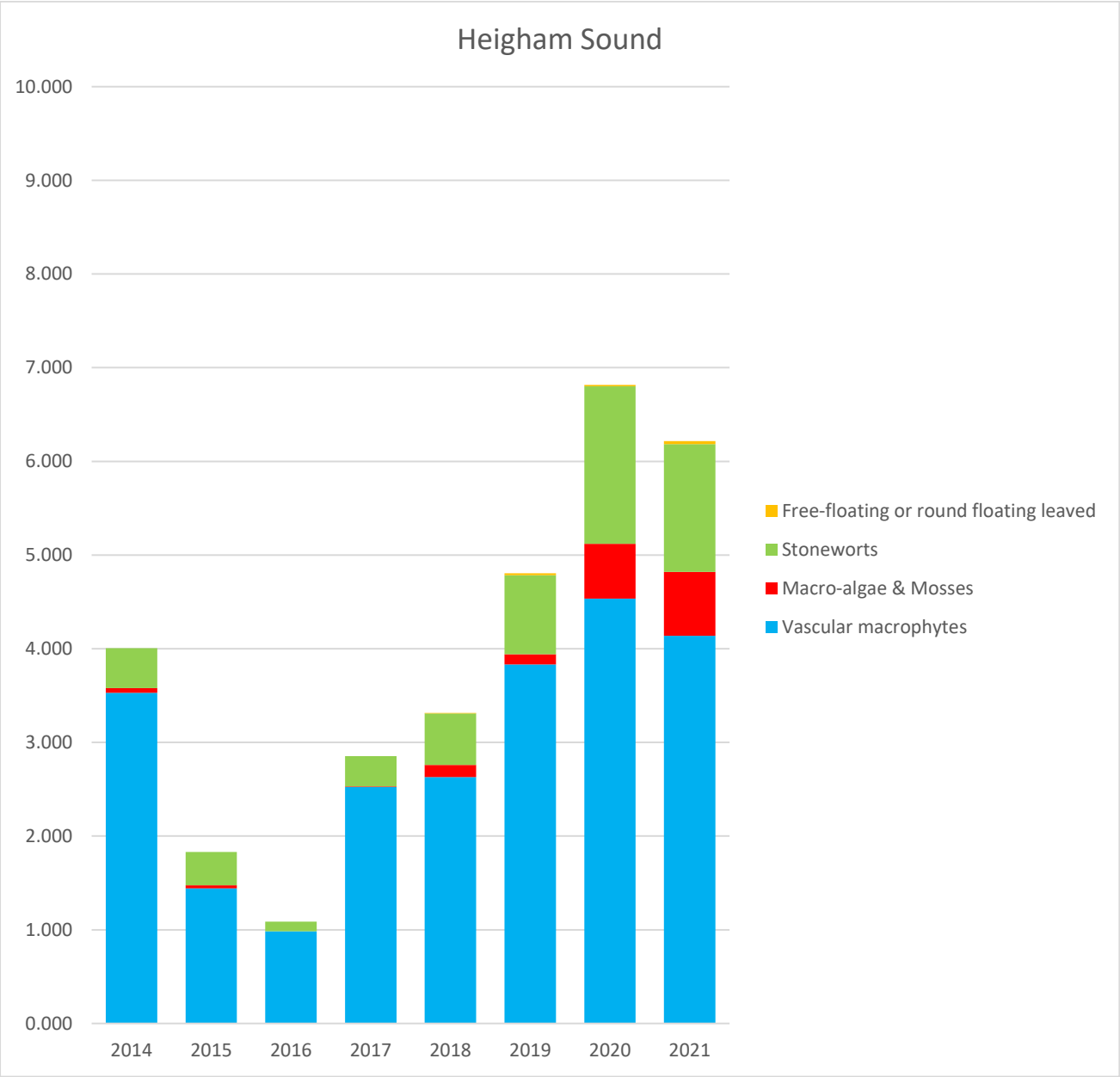
Table 5

Common Name	Scientific Name	Summary Abundance	Occurrences
Spiked water milfoil	*Myriophyllum spicatum*	1.576	51
Mare's tail	*Hippuris vulgaris*	1.485	30
Intermediate stonewort	*C. intermedia*	0.818	13
Filamentous algae	*Zygnematales*	0.682	20
Rigid hornwort	*Ceratophyllum demersum*	0.439	28
Bristly stonewort	*C. hispida*	0.227	6
Starry stonewort	*Nitellopsis obtusa*	0.182	10
Canadian waterweed	*Elodea canadensis*	0.182	10
Nuttall's waterweed	*Elodea nuttallii*	0.136	9
Convergent stonewort	*C. connivens*	0.121	2
Willow-leaved pondweed	*P. x salicifolius*	0.121	2
Fan-leaved water crowfoot	*Ranunculus circinatus*	0.077	5
Curled pondweed	*P. crispus*	0.062	4
Ivy-leaved duckweed	*Lemna trisulca*	0.030	2
Holly-leaved naiad	*Najas marina*	0.030	2
Baltic stonewort	*C. baltica*	0.015	1
Starwort species	*Callitriche sp*	0.015	1
Long-stalked Pondweed	*Potamogeton praelongus*	0.015	1
No plants	*No plants*	0.000	6
Total number of species recorded		**18**	**Total samples taken: 66**

This has been a steady year for Heigham Sound as the summary abundance has stayed similar to last year even though the number of species has decreased from 22 to 18. Intermediate stonewort doubled in occurrences and abundance has gone from 0.212 to 0.818 from last year.

Graph 4

Abundance shown in plant groups (see Appendix 1 for more detail)



Hickling Broad

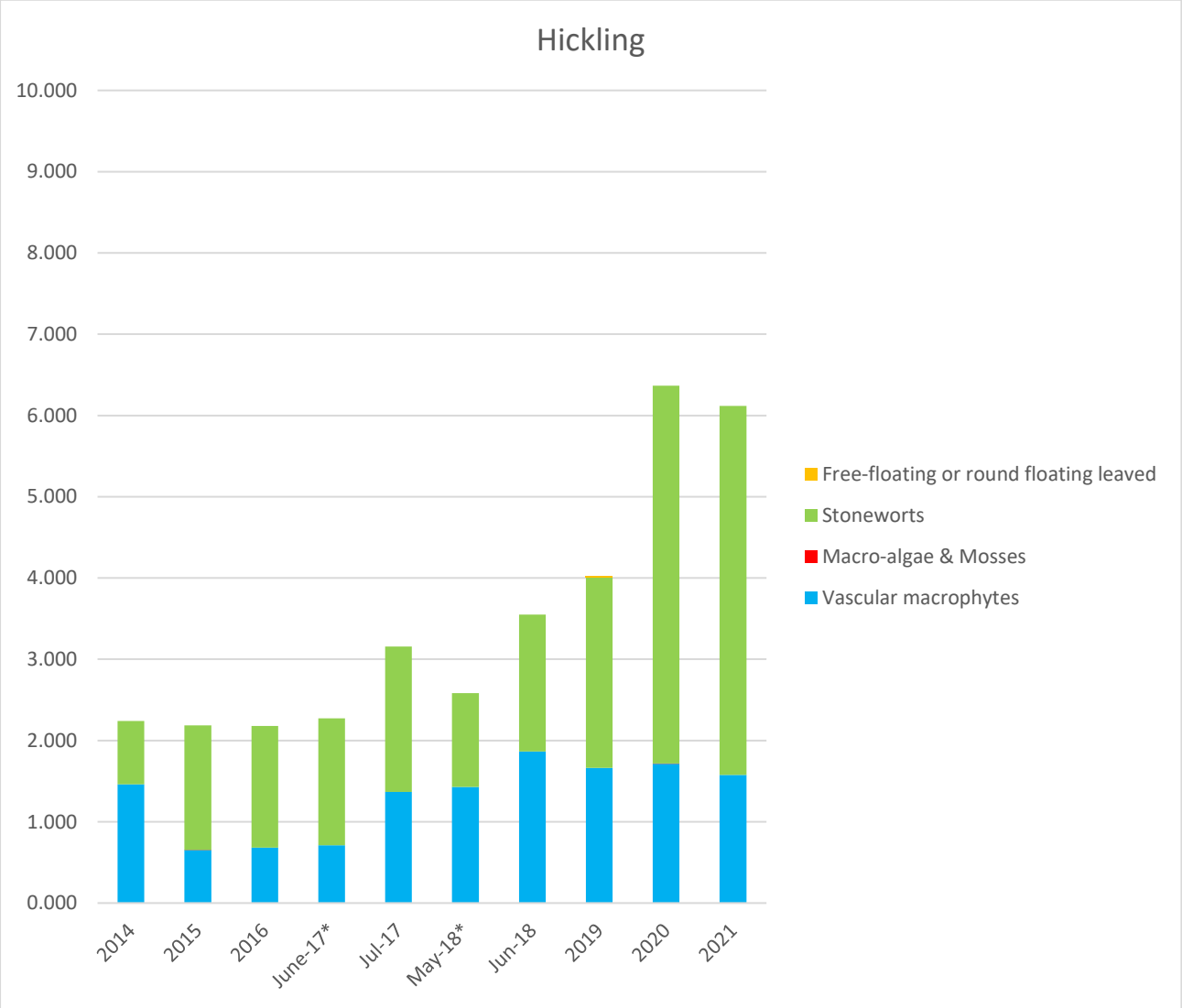
Table 6

Common Name	Scientific Name	Summary Abundance	Occurrences
Intermediate stonewort	*C. intermedia*	3.376	44
Spiked water milfoil	*Myriophyllum spicatum*	0.913	51
Baltic stonewort	*C. baltica*	0.563	31
Fennel-leaved pondweed	*P. pectinatus*	0.351	22
Hedgehog stonewort	*C. aculeolata*	0.213	2
Mare's tail	*Hippuris vulgaris*	0.163	3
Bristly stonewort	*C. hispida*	0.150	9
Starry stonewort	*Nitellopsis obtusa*	0.088	6
Holly-leaved naiad	*Najas marina*	0.075	5
Fragile/convergent stonewort	*C. globularis/connivens*	0.075	6
Rigid hornwort	*Ceratophyllum demersum*	0.075	6
Rough stonewort	*C. aspera*	0.063	3
Lesser bearded stonewort	*C. curta*	0.013	1
Stonewort (Chara) species	*Chara sp.*	0.001	1
Total number of species recorded		**14**	**Total samples taken: 80**

This year, although the summary abundance is similar, there were four dominant species compared with six in 2020. Intermediate stonewort is the most dominant with other Stonewort (Chara) species this year having less dominance. There were 16 species found last year compared with the 14 last year and three no plant points were had. The vascular macrophytes decreased this year which has been seen in many broads in 2021.

Graph 5

Abundance shown in plant groups (see Appendix 1 for more detail)



Horsey Mere

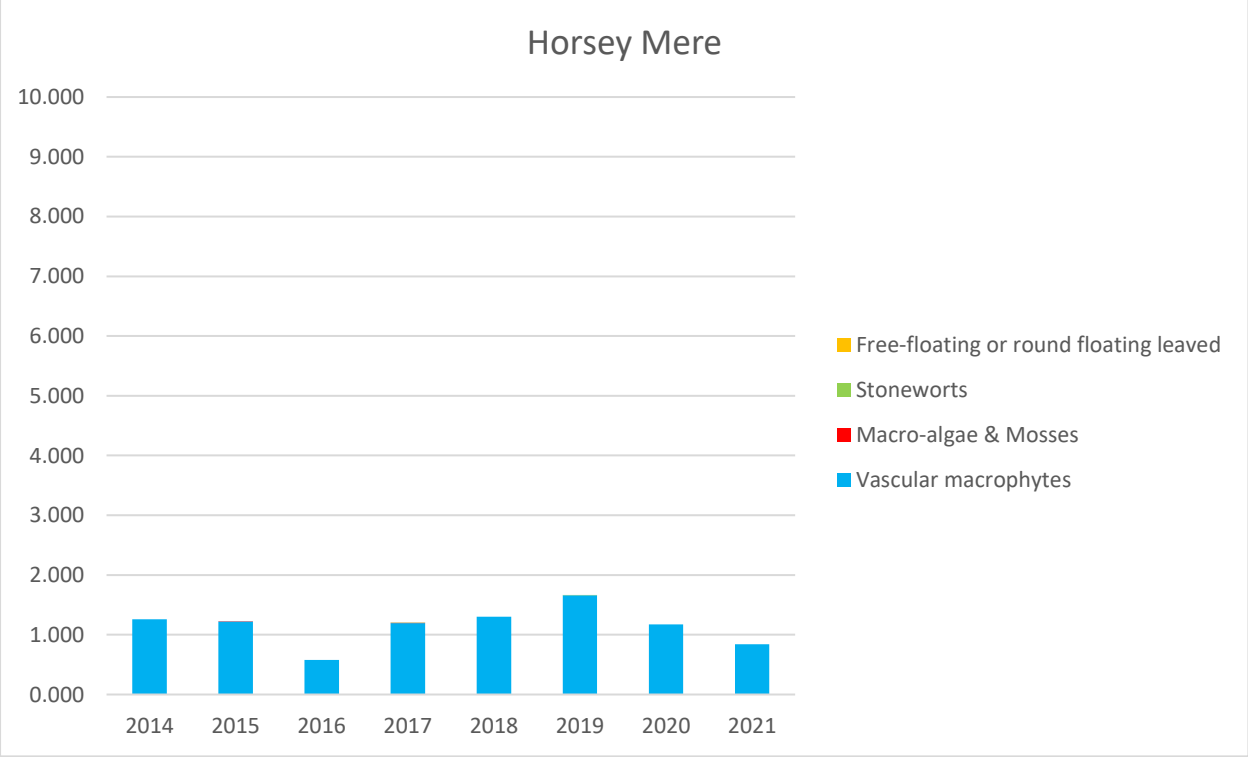
Table 7

Common Name	Scientific Name	Summary Abundance	Occurrences
Mare's tail	Hippuris vulgaris	0.486	17
Spiked water milfoil	Myriophyllum spicatum	0.294	20
Willow-leaved pondweed	P. x salicifolius	0.045	3
Curled pondweed	P. crispus	0.015	1
Fennel-leaved pondweed	P. pectinatus	0.002	1
No plants	No plants	0.000	38
Total number of species recorded		**5**	**Total samples taken: 66**

No plant points increased this year to 38 compared with 29 last year. There is still very little growth in the Mere itself as most of the plants were found around the edges. Summary abundance has decreased overall this year even though two more species were found this year compared with 2020.

Graph 6

Abundance shown in plant groups (see Appendix 1 for more detail)



Martham North

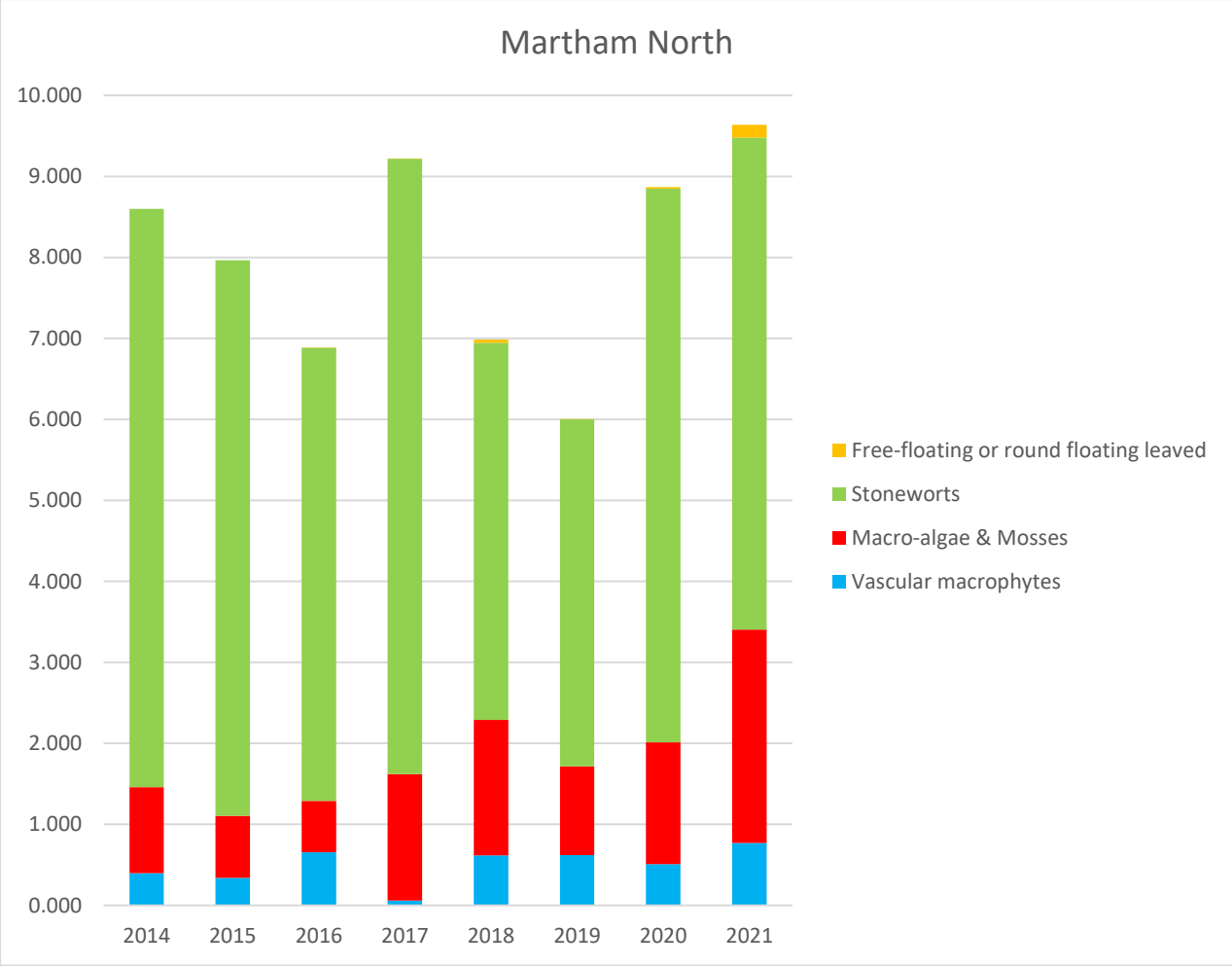
Table 8

Common Name	***Scientific Name***	**Summary Abundance**	**Occurrences**
Bristly stonewort	*C. hispida*	5.038	40
Filamentous algae	*Zygnematales*	2.519	34
Intermediate stonewort	*C. intermedia*	0.904	15
P. pectinatus - Fennel-leaved pondweed	*P. pectinatus*	0.423	14
Najas marina - Holly-leaved naiad	*Najas marina*	0.231	10
Lemna trisulca - Ivy-leaved duckweed	*Lemna trisulca*	0.154	8
Baltic stonewort	*C. baltica*	0.135	5
Common water moss	*Fontinalis antipyretica*	0.115	6
Potamogeton praelongus - long-stalked Pondweed	*Potamogeton praelongus*	0.038	2
Nuttall's waterweed	*Elodea nuttallii*	0.019	1
Hippuris vulgaris - Mare's tail	*Hippuris vulgaris*	0.019	1
Myriophyllum verticillatum - Whorled water milfoil	*Myriophyllum verticillatum*	0.019	1
P. crispus - Curled pondweed	*P. crispus*	0.019	1
Yellow water lily	*Nuphar lutea*	0.002	1
Total number of species recorded		**14**	**Total samples taken: 52**

Vascular and stonewort abundances are similar to 2020 however the increase in macro-algae & mosses probably accounts for the overall increase in 2021. Filamentous algae increased from 1.446 to 2.519 and doubled in occurrences; it is the highest level seen in 8 years, matching reports of the algae spreading. Bristly stonewort still dominated but as seen in the Thurne Valley generally, Intermediate stonewort increased in abundance this year from 0.038 to 0.904. Holly-leaved naiad was also seen this year being the 5th most abundant species in the broad.

Graph 7

Abundance shown in plant groups (see Appendix 1 for more detail)



Martham South

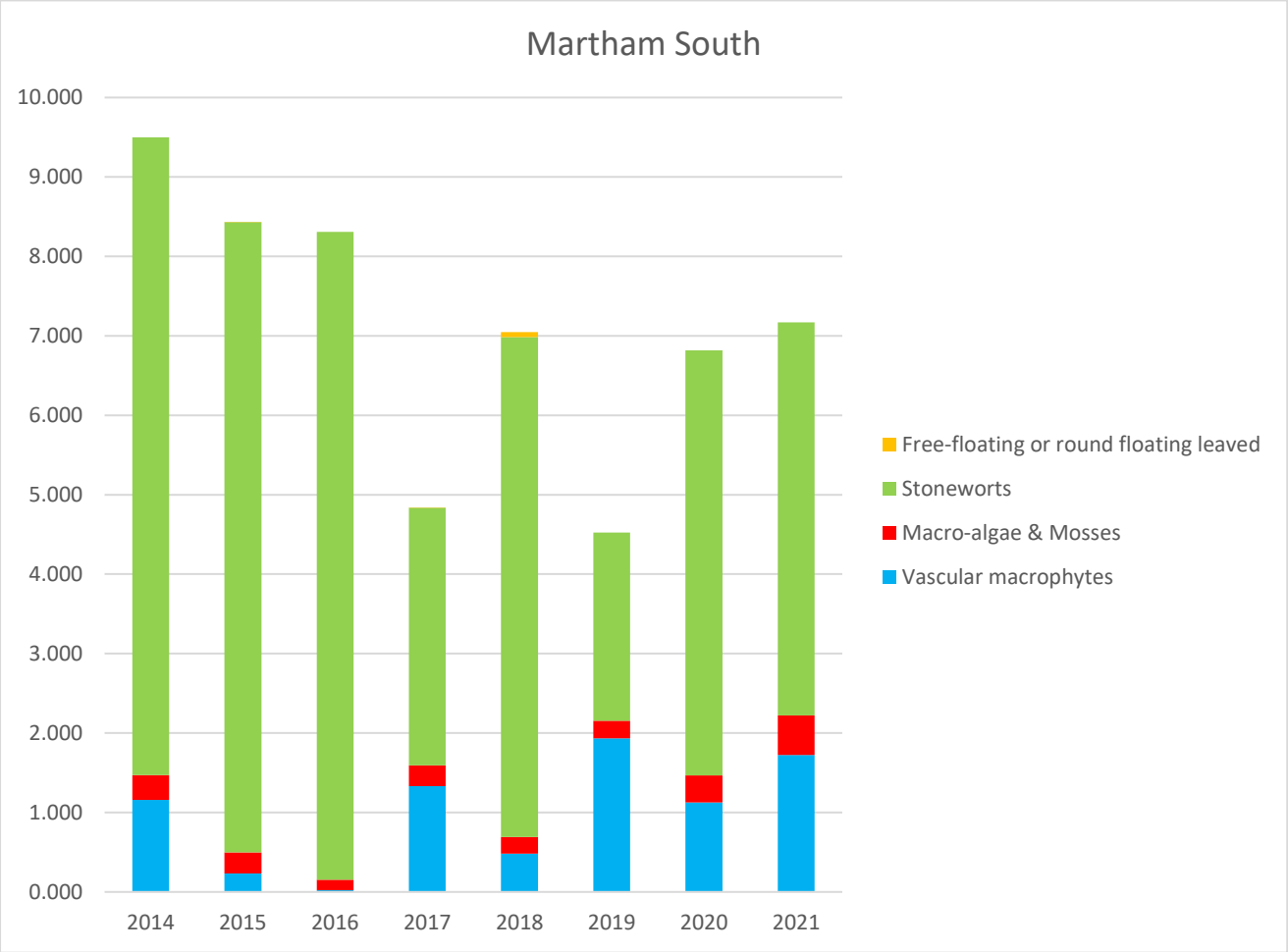
Table 9

Common Name	Scientific Name	Summary Abundance	Occurrences
Bristly stonewort	*C. hispida*	3.169	37
Intermediate stonewort	*C. intermedia*	0.815	19
Holly-leaved naiad	*Najas marina*	0.796	24
Starry stonewort	*Nitellopsis obtusa*	0.685	14
Mare's tail	*Hippuris vulgaris*	0.500	5
Filamentous algae	*Zygnematales*	0.370	3
Baltic stonewort	*C. baltica*	0.333	13
Hedgehog stonewort	*C. aculeolata*	0.241	3
Spiked water milfoil	*Myriophyllum spicatum*	0.222	12
Fennel-leaved pondweed	*P. pectinatus*	0.204	9
Common stonewort	*C. vulgaris*	0.148	6
Common water moss	*Fontinalis antipyretica*	0.130	6
Fragile/convergent stonewort	*C. globularis/connivens*	0.074	4
Convergent stonewort	*C. connivens*	0.056	3
Delicate stonewort	*C. virgata*	0.056	3
Rough stonewort	*C. aspera*	0.039	3
Ivy-leaved duckweed	*Lemna trisulca*	0.037	2
Fresh water sponge	*Spongillidae*	0.037	2
Lesser bearded stonewort	*C. curta*	0.019	1
Total number of species recorded		**17**	**Total samples taken: 54**

In contrast to many broads this year vascular macrophytes increased with the other groups keeping similar levels to 2020. Stoneworts were still dominant this year with Starry and Intermediate stoneworts increasing in abundance. Hedgehog stonewort also made an appearance even if in small numbers. Although not to the level seen in 2019, Holly-leaved naiad doubled in abundance in 2021. Freshwater sponge was also noted at 2 points.

Graph 8

Abundance shown in plant groups (see Appendix 1 for more detail)



Ant Valley

In the Ant Valley, Alderfen, Cromes and Barton broad were some of the first broads to be surveyed, starting in 1983 and have been regularly surveyed since. These water bodies have been subject to extensive restoration effort over the last 25 years and all have experienced improved water quality.

2021 Summary

2021 has seen the majority of the Broads in the Ant increase in plant abundance. Seven out of the eleven Broads surveyed showed an increase with two staying similar and two showing a decrease. Seven of the Broads also recorded their highest abundances levels since the new method began.

Alderfen

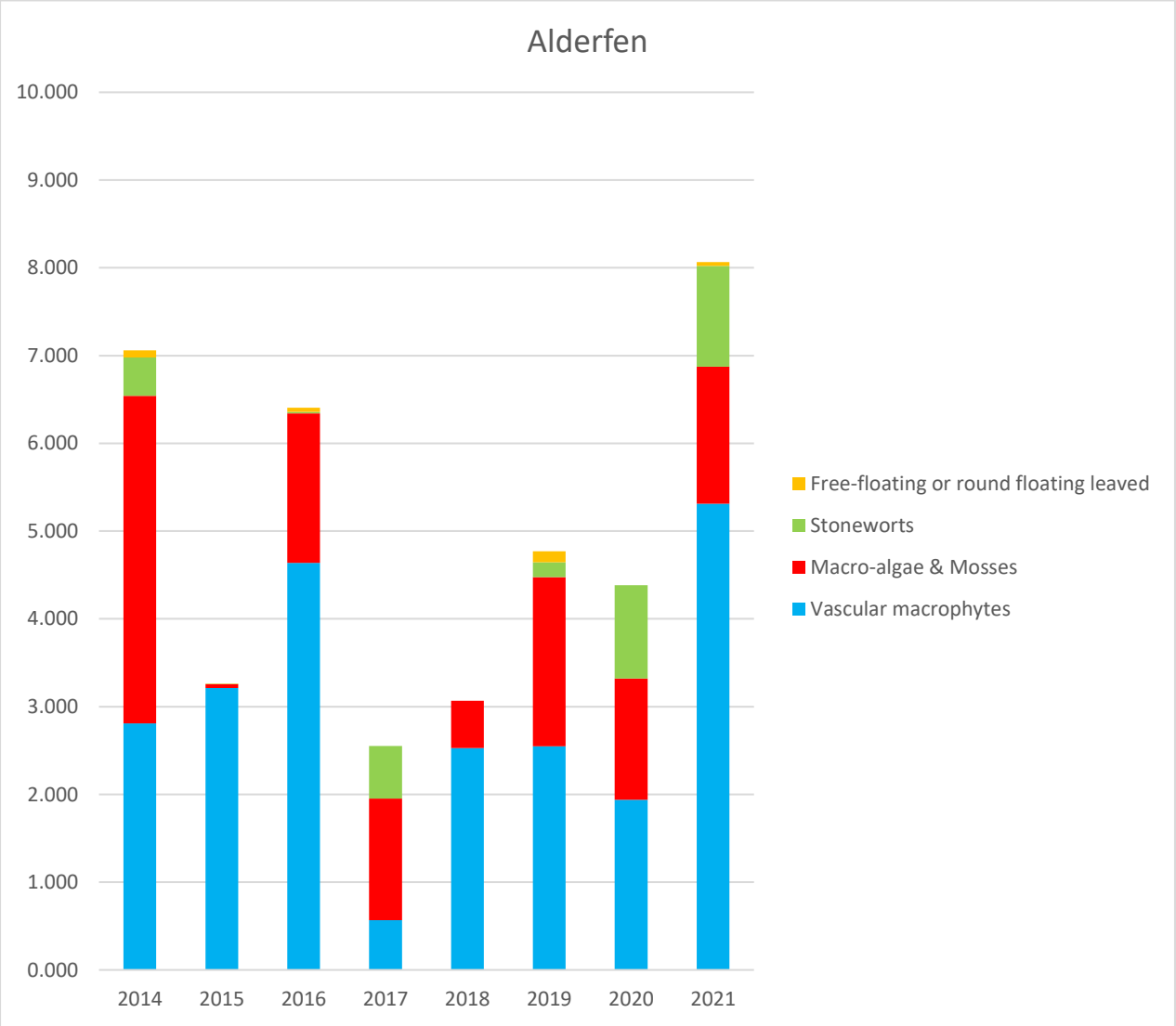
Table 10

Common Name	Scientific Name	Summary Abundance	Occurrences
Rigid hornwort	Ceratophyllum demersum	4.667	46
Filamentous algae	Zygnematales	1.313	23
Delicate stonewort	C. virgata	1.085	19
Holly-leaved naiad	Najas marina	0.646	19
Fragile/convergent stonewort	C. globularis/connivens	0.063	2
Ivy-leaved duckweed	Lemna trisulca	0.042	2
Total number of species recorded		**6**	**Total samples taken: 48**

Vascular macrophytes increased by more than double this year, largely due to the increase in Rigid hornwort, (1.229 to 4.667; 38-46 occurrences). Stoneworts stayed at a similar level along with macro algae & mosses. Free floating or round floating leaved plants made an appearance again after a year of absence. Delicate stonewort was more abundant this year being more dominant than Fragile/convergent stonewort in the past. Jelly algae was also found at twelve sites this year. Filamentous algae decreased in occurrences from 32 – 23 this year. Although Holly-leaved naiad decreased in occurrences summary abundance remained the same as 2020.

Graph 9

Abundance shown in plant groups (see Appendix 1 for more detail)



Barton Broad

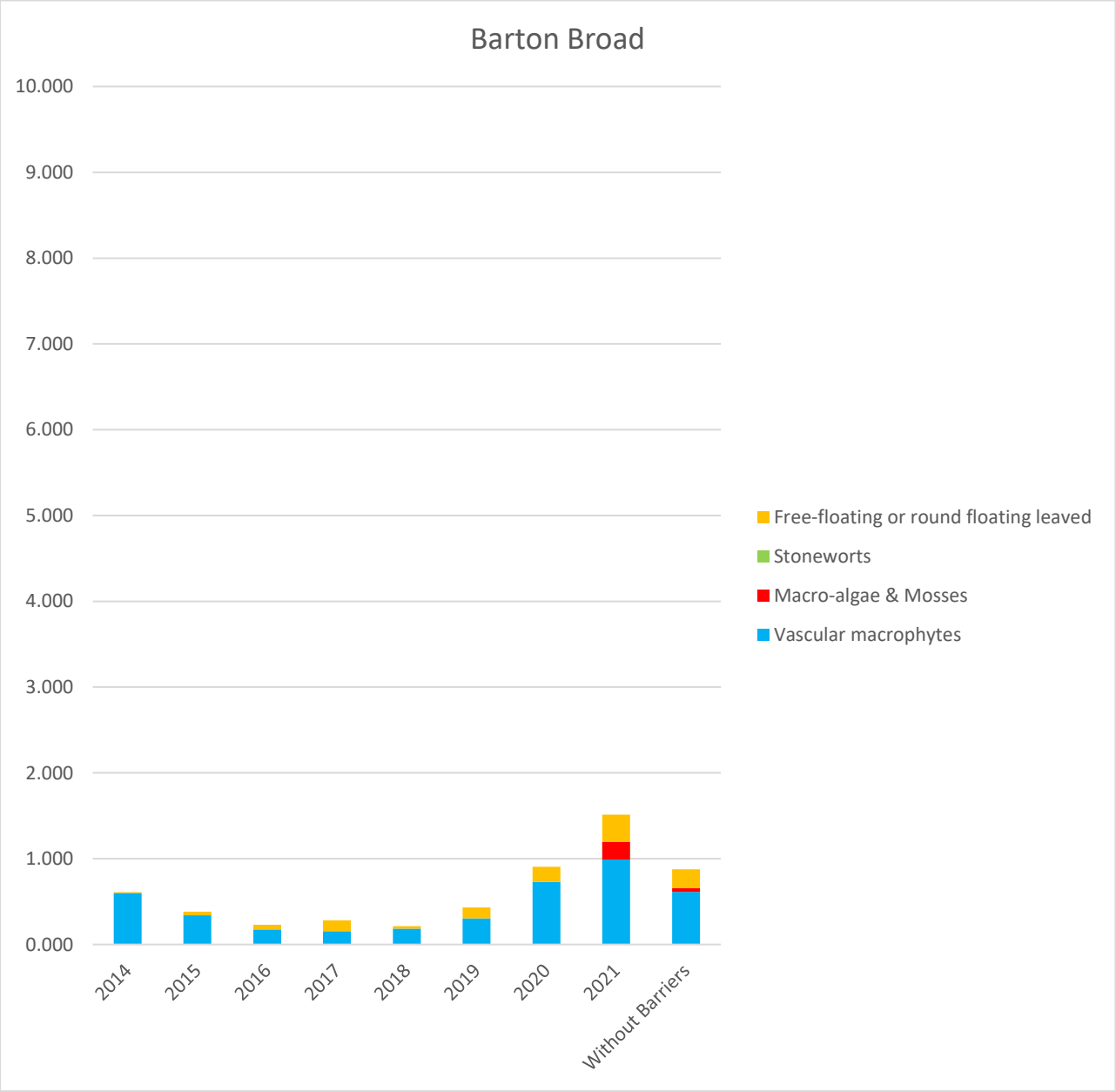
Table 11

Common Name	Scientific Name	Summary Abundance	Occurrences
Rigid hornwort	Ceratophyllum demersum	0.425	27
Yellow water lily	Nuphar lutea	0.283	11
Nuttall's waterweed	Elodea nuttallii	0.272	6
Filamentous algae	Zygnematales	0.185	5
Hair like pondweed	P. trichoides	0.185	14
Fennel-leaved pondweed	P. pectinatus	0.043	3
Horned pondweed	Zannichellia palustris	0.033	2
Water net	Hydrodictyon	0.022	2
Greater duckweed	Spirodela polyrhiza	0.022	2
Frogbit	Hydrocharis morsus-ranae	0.011	1
Curled pondweed	P. crispus	0.011	1
Shining pondweed	P. lucens	0.011	1
Fan-leaved water crowfoot	Ranunculus circinatus	0.011	1
Fresh water sponge	Spongillidae	0.011	1
No plants	No plants	0.000	48
Total number of species recorded		**14**	**Total samples taken 92**

Barton Broad recorded vascular macrophytes, free floating or round floating leaved plants and macro algae & mosses. The increase seen this year can be attributed to the plant growth found in the fish barriers which were installed in 2019. One of the barriers had clear water and 100% plant coverage was found there at one of the points. There were 5 more plant species found this year than in 2020. Yellow water lily occurrence has doubled but abundance has stayed the same. The plants were found in the shallower areas and nearer the edges around the Broad. There were numerous freshwater mussels caught in rake throws and freshwater sponge. The species abundance level is the highest seen since the new method started even though there were 48 no plant points. The graph shows the 2021 plant data with and without the barrier data. The barriers were installed in 2019 after the plant survey was undertaken and in 2020, only outside the barriers was surveyed due to Covid limitations.

Graph 10

Abundance shown in plant groups (see Appendix 1 for more detail)



Cromes Broad

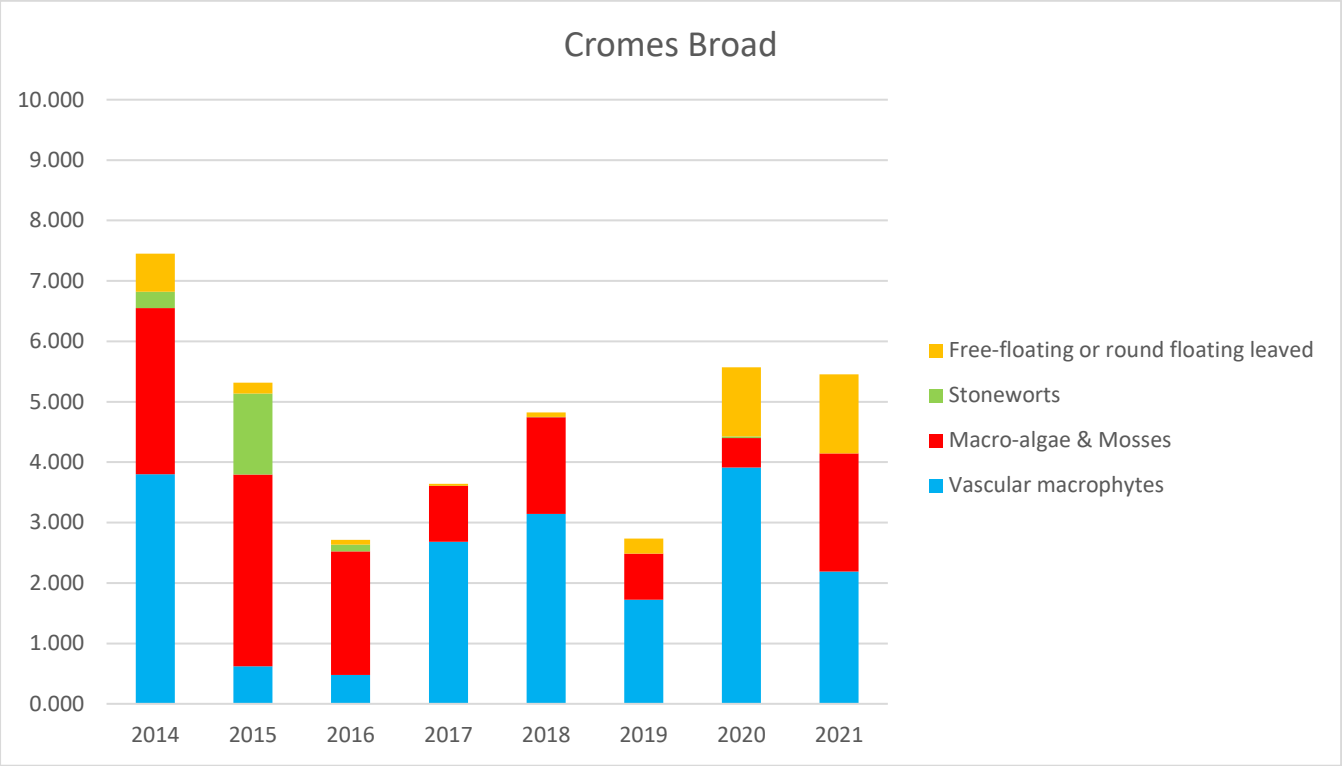
Table 12

Common Name	Scientific Name	Summary Abundance	Occurrences
Zygnematales	Zygnematales	1.810	24
Rigid hornwort	Ceratophyllum demersum	1.619	39
White water lily	Nymphaea alba	0.905	7
Holly-leaved naiad	Najas marina	0.476	18
Common duckweed	Lemna minor	0.214	9
Inflated duckweed	Lemna gibba	0.119	5
Enteromorpha	Enteromorpha	0.095	4
Least duckweed	Lemna minuta	0.071	3
Bladderwort	Utricularia vulgaris	0.071	2
Water net	Hydrodictyon	0.024	1
Fennel-leaved pondweed	P. pectinatus	0.024	1
Total number of species recorded		**13**	**Total samples taken: 42**

There was a noticeable difference in Filamentous algae this year, with abundance levels up three times compared to that seen in 2020 but only up by 7 occurrences. A small increase in free floating species was recorded this year compared with 2020. Vascular macrophyte abundance decreased quite drastically this year but the increase in algae has made up for the loss in the overall abundance. White water lilies have decreased in abundance but not occurrences this year however visually they seem to be in greater abundance than last year. Bladderwort made an appearance this year and although only found in two spots, was easily seen in the southern end of the broad from the surface where it was quite prevalent. Jelly algae was found at one point.

Graph 11

Abundance shown in plant groups (see Appendix 1 for more detail)



Cockshoot

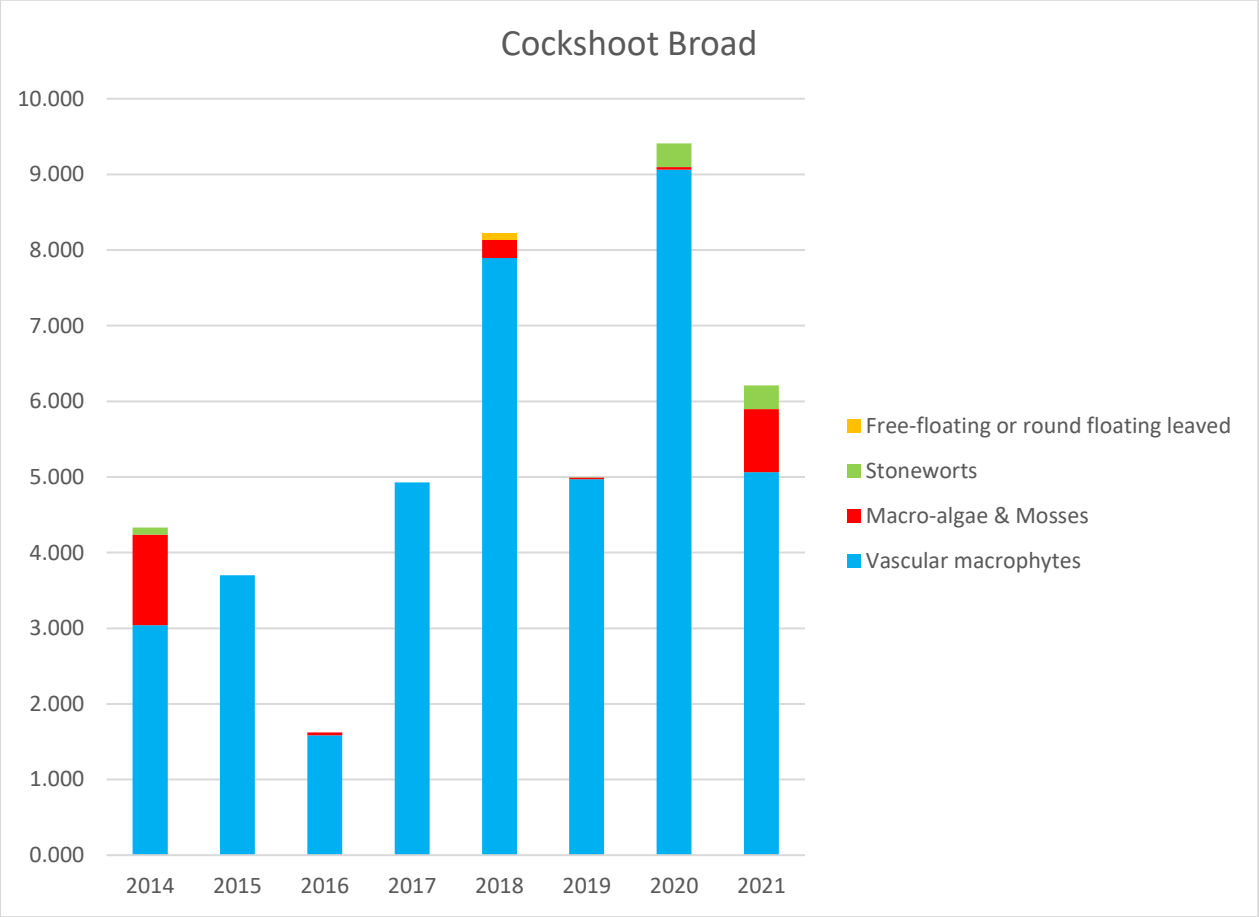
Table 13

Common Name	Scientific Name	Summary Abundance	Occurrences
Holly-leaved naiad	*Najas marina*	3.773	36
Rigid hornwort	*Ceratophyllum demersum*	1.083	35
Filamentous algae	*Zygnematales*	0.708	20
Rough stonewort	*C. aspera*	0.250	5
Canadian waterweed	*Elodea canadensis*	0.104	5
Enteromorpha	*Enteromorpha*	0.104	5
Horned pondweed	*Zannichellia palustris*	0.063	3
Lesser bearded stonewort	*C. curta*	0.042	1
Nuttall's waterweed	*Elodea nuttallii*	0.042	2
Common stonewort	*C. vulgaris*	0.021	1
Total number of species recorded		**10**	**Total samples taken: 48**

Vascular plants decreased in 2021 shown by the significant reduction in abundance of Holly-leaved naiad from 7.958 to 3.773. Macro algae increased to a level not seen for quite a few years. Stoneworts had a very similar abundance to 2020. Rough and Lesser-bearded stonewort made and appearance which has not been identified for quite some years. Species numbers went up from eight to ten this year and Jelly algae was present at one point.

Graph 12

Abundance shown in plant groups (see Appendix 1 for more detail)



Hoveton Great Broad

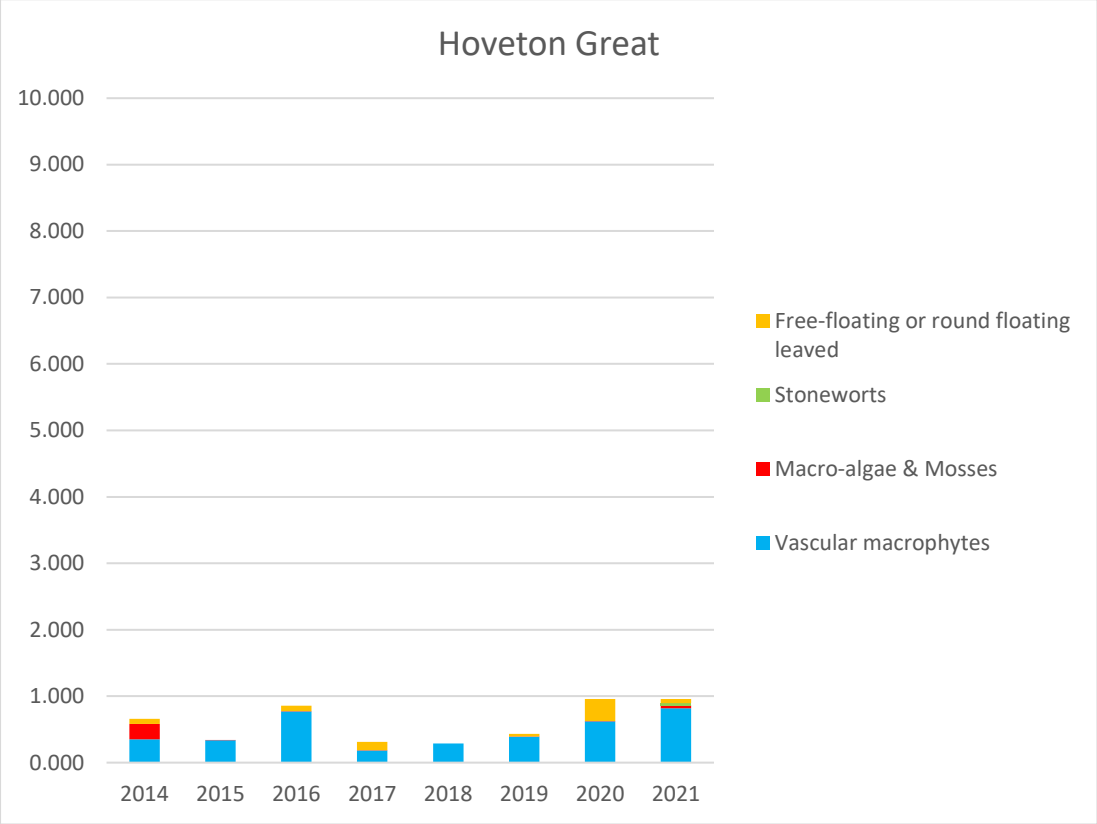
Table 14

Common Name	Scientific Name	Summary Abundance	Occurrences
Nuttall's waterweed	*Elodea nuttallii*	0.298	15
Fennel-leaved pondweed	*P. pectinatus*	0.284	18
Rigid hornwort	*Ceratophyllum demersum*	0.220	15
Yellow water lily	*Nuphar lutea*	0.064	3
Filamentous algae	*Zygnematales*	0.044	10
Pointed stonewort	*Nitella mucronata*	0.031	2
Canadian waterweed	*Elodea canadensis*	0.016	1
Total number of species recorded		7	Total samples taken: 64

A minor increase in abundance of vascular plants was recorded this year with a slight increase of species from four to five. Pointed stonewort also made an appearance this year. There are a few key places like the eastern edge of the Broad near one of the new reedbed installations which shows encouraging signs of plants establishing in the area. The edges are still where the plants are found the vast majority of the time and the centre points usually remain plant free.

Graph 13

Abundance shown in plant groups (see Appendix 1 for more detail)



Hudson's Bay

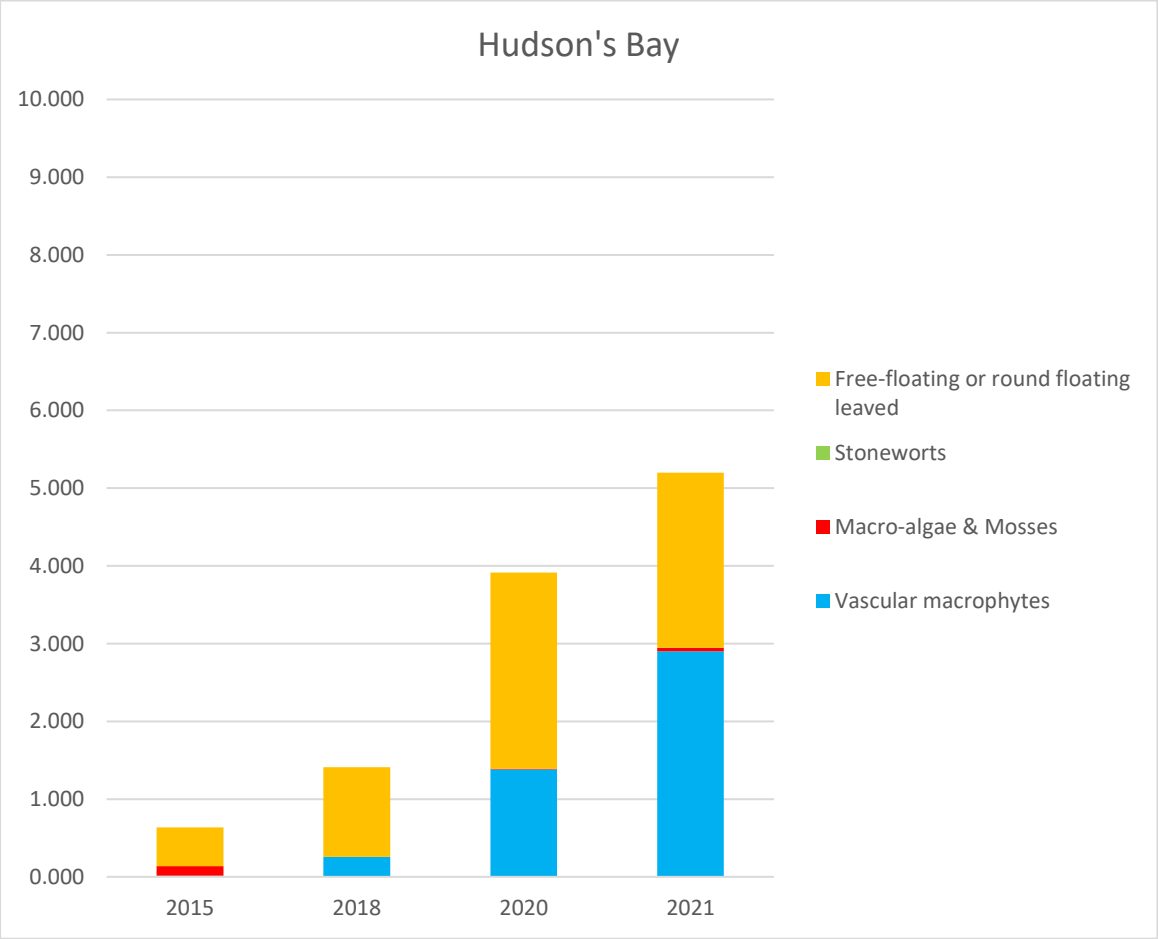
Table 15

Common Name	Scientific Name	Summary Abundance	Occurrences
Rigid hornwort	*Ceratophyllum demersum*	2.900	35
Yellow water lily	*Nuphar lutea*	2.050	19
White water lily	*Nymphaea alba*	0.200	3
Enteromorpha	*Enteromorpha*	0.025	1
Filamentous algae	*Zygnematales*	0.015	6
Jelly algae	*Nostoc*	0.005	2
Least duckweed	*Lemna minuta*	0.003	1
No plants	*No plants*	0.000	3
Total number of species recorded		7	Total samples taken:40

Hudsons Bay has recorded a marked difference in 2021 with an increase in summary abundance from below one in 2015 to just above five this year. Yellow water lily and rigid hornwort are the notable species for 2021. Rigid hornwort increased from 1.333 in summary abundance in 2020 to 2.900 this year, which makes up the majority of the marked increase in vascular macrophytes in 2021.

Graph 14

Abundance shown in plant groups (see Appendix 1 for more detail)



Ranworth

Table 16

Common Name	***Scientific Name***	**Summary Abundance**	**Occurrences**
Fennel-leaved pondweed	*Potamogeton pectinatus*	0.024	1
Total number of species recorded		**1**	**Total samples taken: 34**

Only one sample point recorded plants out of the 68 taken, with just Fennel-leaved pondweed present. The fish barriers now present in the broad were surveyed this year and are comparable to previous surveys as the points stayed the same. Unfortunately, plant growth has not taken hold inside the fish barriers yet compared to other sites.

Upton Great Broad

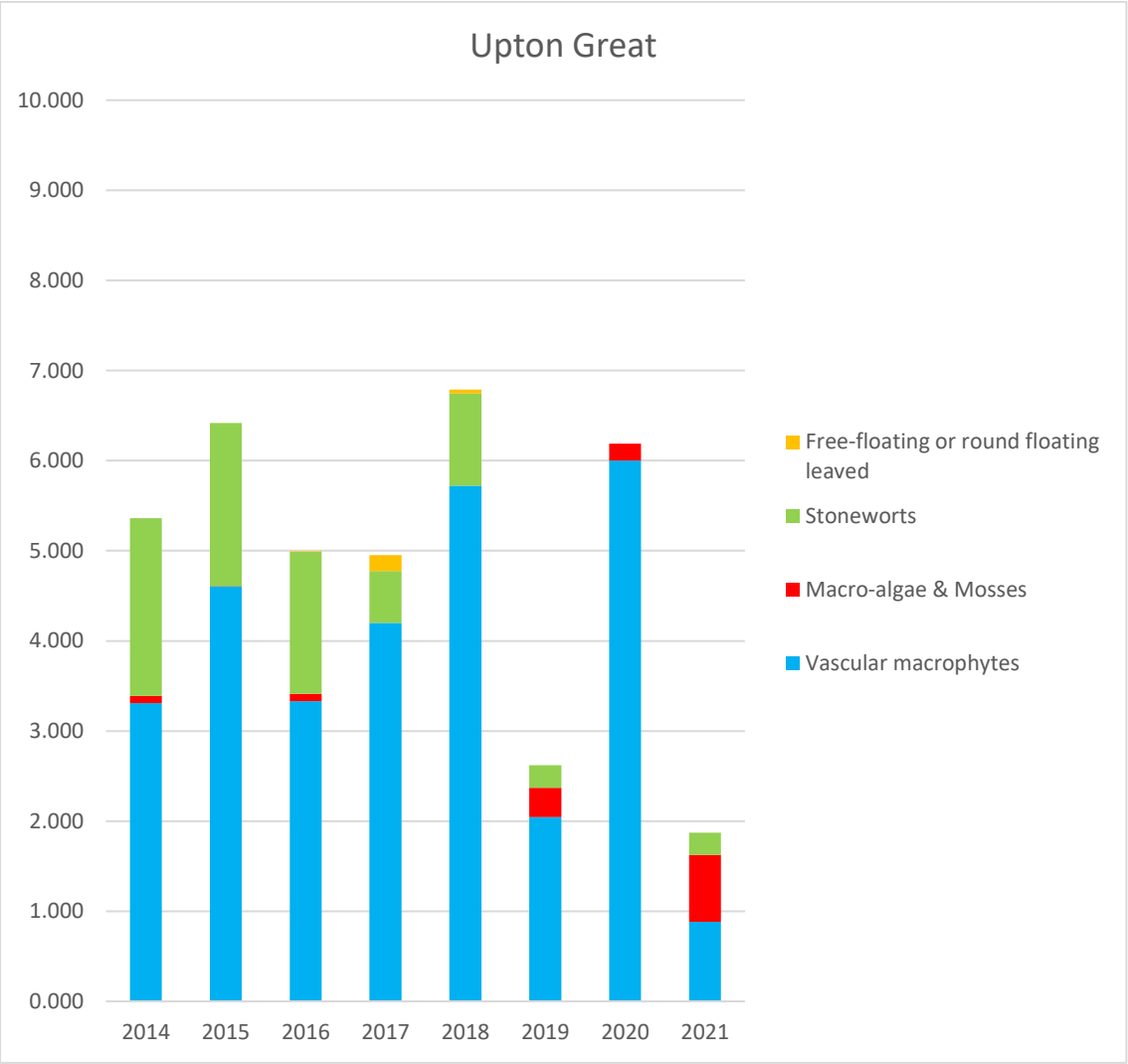
Table 17

Common Name	Scientific Name	Summary Abundance	Occurrences
Holly-leaved naiad	*Najas marina*	0.883	18
Filamentous algae	*Zygnematales*	0.740	30
Bristly stonewort	*C. hispida*	0.190	2
Rough stonewort	*C. aspera*	0.024	1
Common stonewort	*C. vulgaris*	0.024	1
Stonewort (Chara) species	*Chara sp.*	0.005	2
Fragile/convergent stonewort	*C. globularis/connivens*	0.005	2
Total number of species recorded		**7**	**Total samples taken: 48**

This year there was an increase from two species to seven, however there was a major crash in Holly-leaved naiad and the lowest summary abundance in the last seven years. Stoneworts were recorded this year compared with the absence seen in last year's fluctuation. Holly-leaved naiad has gone from an abundance of 6.002 to 0.883, whereas filamentous increased a little from 0.188 to 0.740.

Graph 15

Abundance shown in plant groups (see Appendix 1 for more detail)



Wroxham

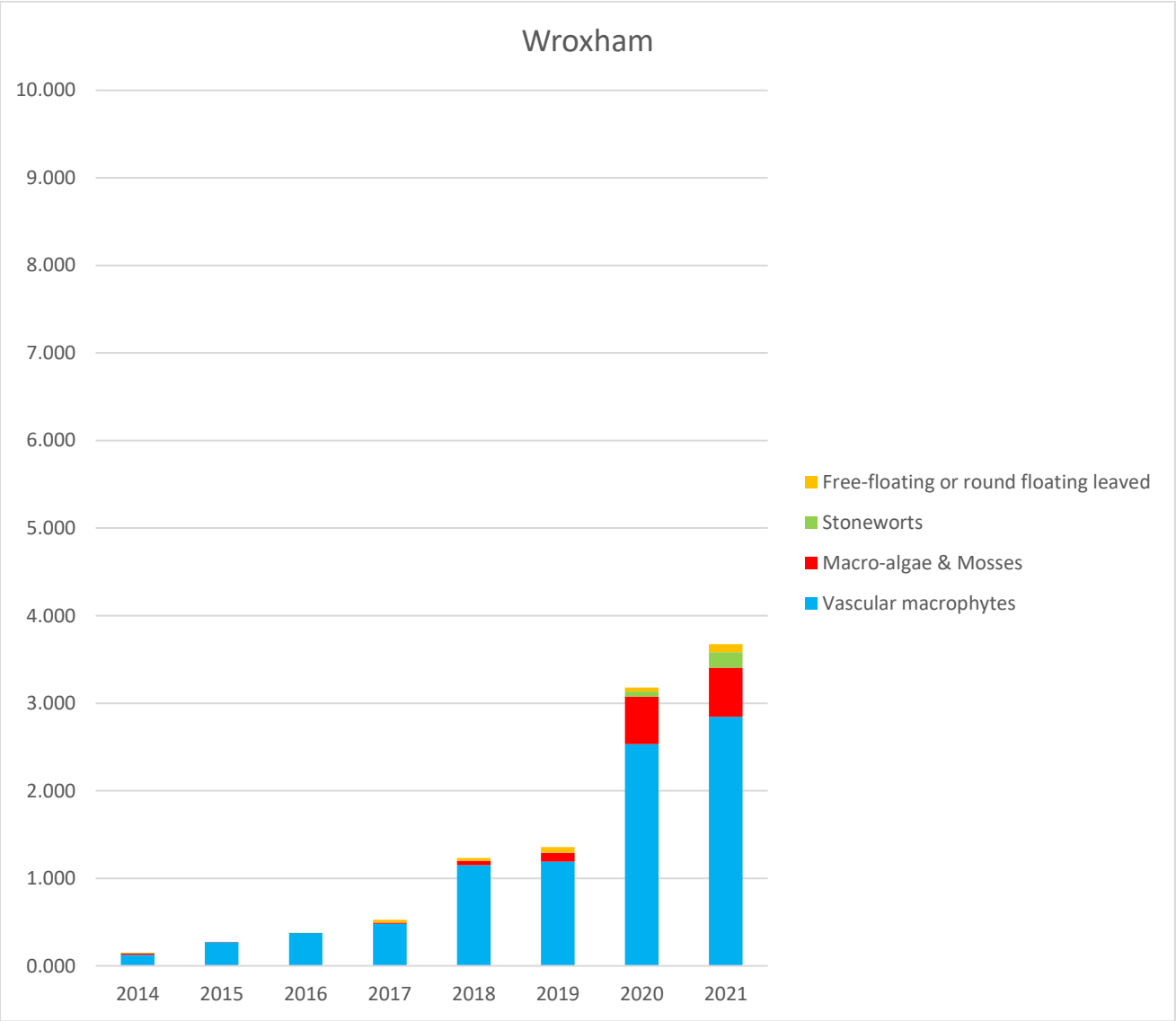
Table 18

Common Name	Scientific Name	Summary Abundance	Occurrences
Nuttall's waterweed	*Elodea nuttallii*	1.400	53
Rigid hornwort	*Ceratophyllum demersum*	0.737	47
Fennel-leaved pondweed	*P. pectinatus*	0.590	25
Filamentous algae	*Zygnematales*	0.501	33
Pointed stonewort	*Nitella mucronata*	0.178	9
Yellow water lily	*Nuphar lutea*	0.090	5
Spiked water milfoil	*Myriophyllum spicatum*	0.059	4
Enteromorpha	*Enteromorpha*	0.059	4
Starwort species	*Callitriche sp*	0.029	2
Unbranched bur-reed	*Sparganium emersum*	0.029	2
Long-stalked Pondweed	*Potamogeton praelongus*	0.015	1
Canadian waterweed	*Elodea canadensis*	0.001	1
Total number of species recorded		**12**	**Total samples taken:68**

Although this broad is very well used by boats, particularly between the months of June and August, the results are the best recorded for 8 years. Nuttall's water weed increased in abundance from 0.985 to 1.400 where most other species stayed at a similar level to last year. The number of points where no plants were recorded has decreased from 14 to 1. The water was clear around the south west edge which has a gravel substrate. Nuttall's waterweed has overtaken Rigid hornwort with the highest abundance for the second year in a row since the new survey method started.

Graph 16

Abundance shown in plant groups (see Appendix 1 for more detail)



Yare Valley

The majority of the broads within the Yare valley are isolated from the main river, with only Bargate, Rockland and Wheatfen having a direct hydrological connection. The Yare valley survey also includes two water bodies which are not a true ‘broad’ or ‘decoy’, a manmade lake created from flooded peat diggings or a lake created for wildfowl shooting respectively. Whitlingham Great and Little are created from gravel extraction and are quite young compared to other ‘broads’.

2021Summary

The three Broads surveyed this year recorded increases in abundance levels from previous years. In a year when some broads have seen major fluctuation the Yare Valley contingent have fared better.

Rockland Broad

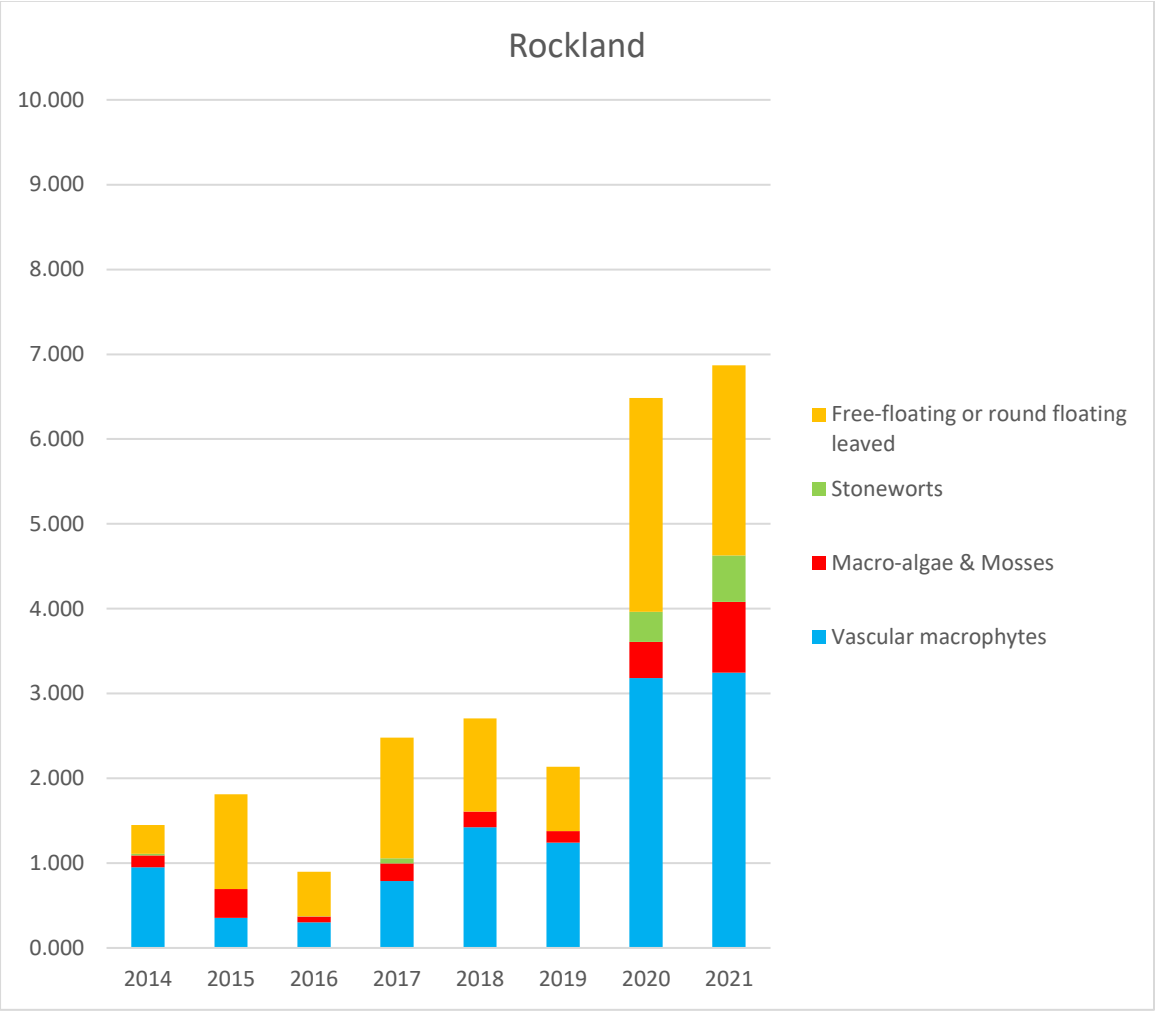
Table 19

Common Name	Scientific Name	Summary Abundance	Occurrences
Yellow water lily	Nuphar lutea	2.210	28
Nuttall's waterweed	Elodea nuttallii	1.113	52
Starwort species	Callitriche sp	0.726	41
Filamentous algae	Zygnematales	0.640	35
Unbranched bur-reed	Sparganium emersum	0.550	30
Pointed stonewort	Nitella mucronata	0.548	27
Rigid hornwort	Ceratophyllum demersum	0.500	29
Spiked water milfoil	Myriophyllum spicatum	0.276	15
Common water moss	Fontinalis antipyretica	0.145	9
Fresh water sponge	Spongillidae	0.032	2
Enteromorpha	Enteromorpha	0.032	2
Fennel-leaved pondweed	P. pectinatus	0.016	1
Water net	Hydrodictyon	0.016	1
Common duckweed	Lemna minor	0.016	1
Whorled water milfoil	Myriophyllum verticillatum	0.016	1
Jelly algae	Nostoc	0.016	1
Blunt-leaved pondweed	P. obtusifolius	0.016	1
Greater duckweed	Spirodela polyrhiza	0.016	1
Horned pondweed	Zannichellia palustris	0.016	1
Total number of species recorded		**19**	**Total samples taken: 62**

Nuttall's waterweed has been the one species to really increase this year from 0.452 to 1.113. Filamentous algae was also more prevalent this year going from 0.298 to 0.640. Access across the Broad was still difficult due to the amount of water plants across the area. Stoneworts are still present and a little more abundant this year compared to last, 0.335 to 0.548. Jelly algae was also recorded at one point.

Graph 17

Abundance shown in plant groups (see Appendix 1 for more detail)



Wheatfen Broad and Channels

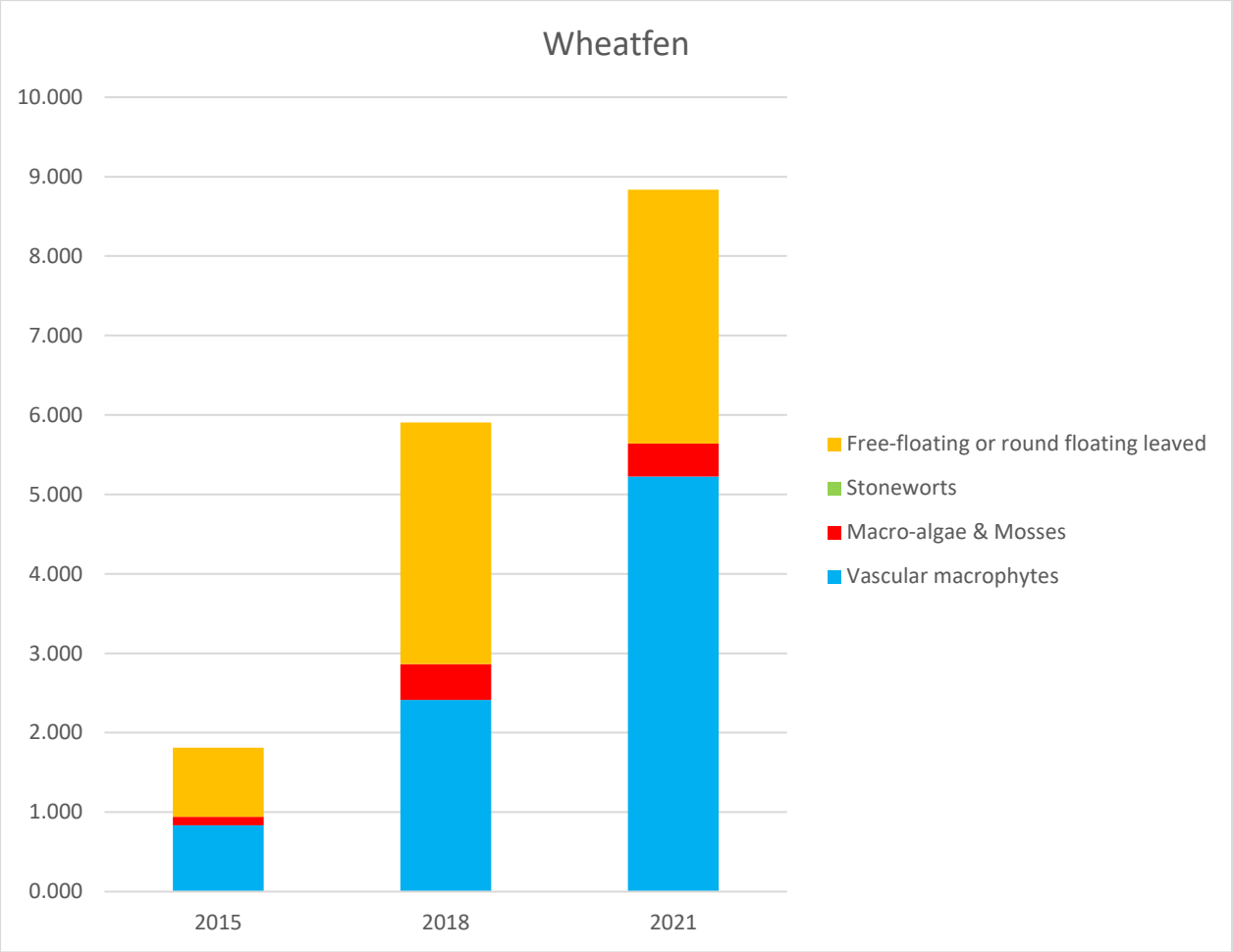
Table 20

Common Name	Scientific Name	Summary Abundance	Occurrences
Nuttall's waterweed	Elodea nuttallii	3.750	27
Yellow water lily	Nuphar lutea	1.222	14
Frogbit	Hydrocharis morsus-ranae	0.778	7
Unbranched bur-reed	Sparganium emersum	0.639	17
Common duckweed	Lemna minor	0.389	14
Starwort species	Callitriche sp	0.281	11
Filamentous algae	Zygnematales	0.278	9
Inflated duckweed	Lemna gibba	0.250	8
Whorled water milfoil	Myriophyllum verticillatum	0.250	4
Greater duckweed	Spirodela polyrhiza	0.222	8
Least duckweed	Lemna minuta	0.167	6
Ivy-leaved duckweed	Lemna trisulca	0.167	6
Arrowhead	Saggitaria sagittifolia	0.167	2
Rigid hornwort	Ceratophyllum demersum	0.139	5
Enteromorpha	Enteromorpha	0.139	5
Water forget-me-not	Myosotis scorpiodies	0.083	2
Fresh water sponge	Spongillidae	0.028	1
Total number of species recorded		**17**	**Total samples taken: 36**

This Broad and its surrounding channels has recorded good plant growth this year by increasing in total abundance from 5.907 in 2018 to 8.947 in 2021. The vascular macrophyte level has increased mainly due to Nuttall's waterweed increasing from 1.108 to 3.750. Water clarity was good and you could see to the bottom of the channel in most parts. Duckweeds were quite prominent in the edges and smaller channels where the survey took place whereas the more open sections were clear and Nuttall's waterweed and Unbranched bur-reed were visible from the surface.

Graph 18

Abundance shown in plant groups (see Appendix 1 for more detail)



Strumpshaw

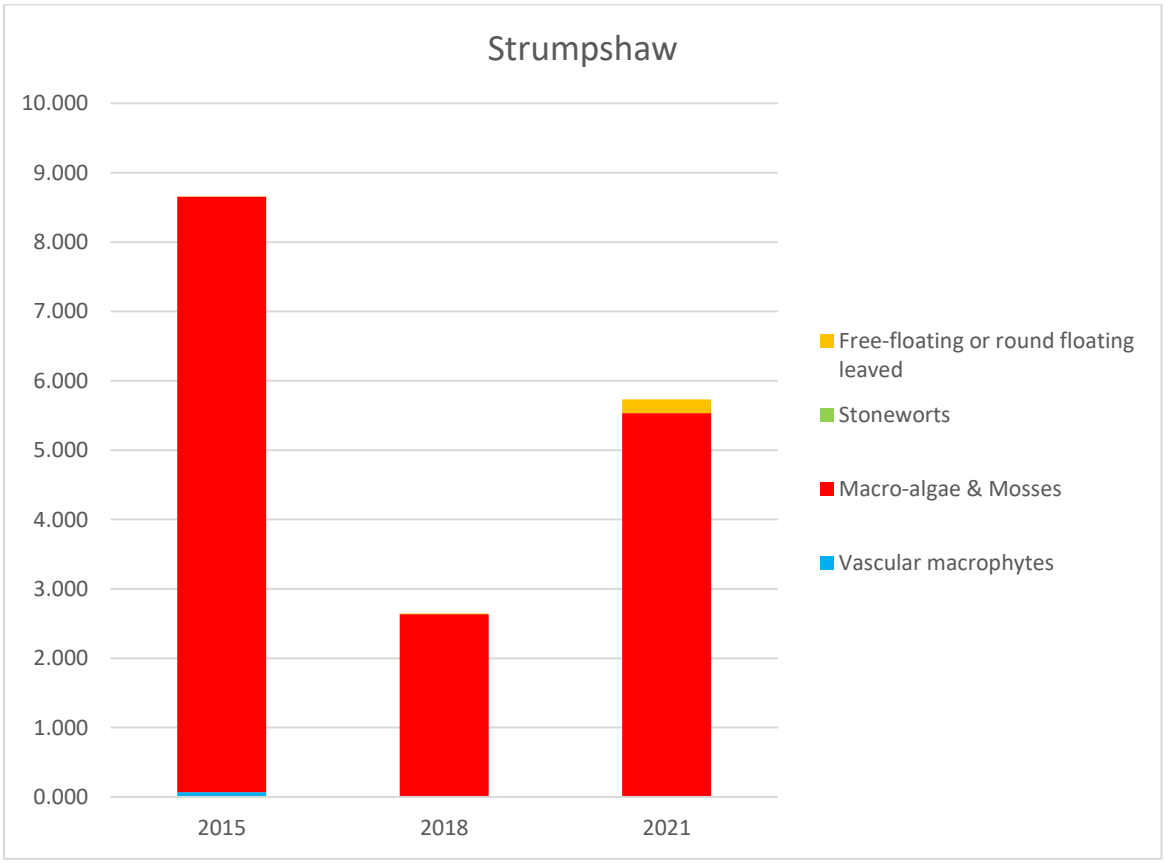
Table 21

Common Name	Scientific Name	Summary Abundance	Occurrences
Filamentous algae	Zygnematales	5.100	29
Enteromorpha	Enteromorpha	0.433	4
Least duckweed	Lemna minuta	0.133	4
Ivy-leaved duckweed	Lemna trisulca	0.067	2
Total number of species recorded		**4**	**Total samples taken: 30**

Filamentous algae was not at levels seen back in 2015 however it had increased from 2018. Free-floating or round leaved species were more abundant in 2021 than the last two surveys. Sections of the Broad were quite clear of the filamentous algae and the clarity of the water was very good being able to see down to the bottom in some cases.

Graph 19

Abundance shown in plant groups (see Appendix 1 for more detail)



River Plant Survey Methodology

Point sample survey technique

The new survey design develops upon groundwork laid by earlier surveys of the Broads' river systems. Stretches where routine water plant cutting takes place annually were identified and the surveys have focused exclusively on these reaches (see Appendix 1).

Survey points were placed in a diamond formation along the reach to be surveyed, to account for differing plant communities at the margins compared to the centre of the channel (see figure 3). A sampling point was taken in the middle of the channel and then 100m downstream two sampling points were taken at the true left and true right banks. The maps and sample point co-ordinates were loaded onto a Samsung tablet for the survey teams to use.

Along each reach to be surveyed, the survey team used the maps and grid references, loaded onto the Samsung tablet, and GPS to navigate by boat to each sample point. Once within 5m of the plotted grid reference, mud weights were deployed to keep the boat in the correct location. At the sample point a double headed survey rake is thrown at a distance of 5m from the edge of the boat. In contrast to the broads' water plant survey, only one downstream throw is made at each point to mitigate against downstream drift of plant material. The rake is left for 10 seconds to allow it to sink to the bottom, after which it is pulled steadily back towards the boat.

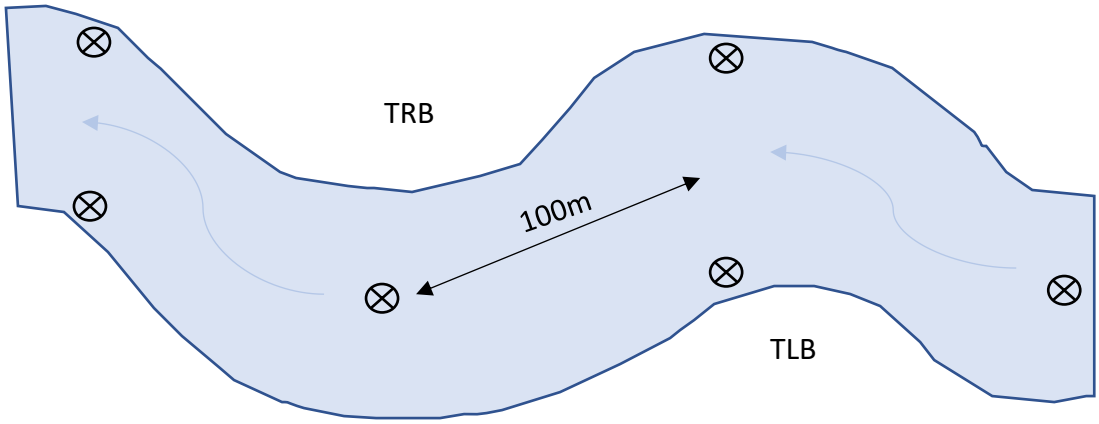


Figure 3: Diagram illustrating river survey methodology

The plants accumulated on the rake head are collected in a white survey tray and washed to remove any excess sediment, as required. All live plant material is identified to species level wherever possible. However, some particularly difficult groups, such as the non-flowering starworts *Callitriche sp.*, can only be identified to genus level. Specimens that remain unidentified in the field, or where identification was uncertain, are collected in labelled plastic bags and taken for closer inspection under a microscope or sent for expert identification. Specimens of interest are pressed and dried using standard herbarium techniques.

A level of abundance for each species is assigned based on the total volume of live water plant material, accounting for maximum trap-ability on the rake. Scores give each species present a range from 10% (low abundance) to 100% (the maximum trappable) in increments of 10%, with scores of 1% given to trace, or very small amounts, of identifiable plant material. A score of 100% represents the maximum amount trappable on the rake, to control for the 'trap-ability' of a given species. For instance, fine leaved species such as unbranched bur-reed, *Sparganium emersum,* are not as trappable with the rake as more structured species such as spiked water milfoil, *Myriophyllum spicatum.* This has the potential to result in under-recording of high abundances of less readily trapped species. Consequently, surveyor experience and judgement are important for scoring these less trappable species, such as duckweeds, *Lemna sp.* and water lilies. Scoring should consider the likelihood of a given species being retrieved on the rake and other visual indications of abundance.

The maximum total of all species abundance scores on an individual rake sample cannot really be more than 100%, although ± 10% is considered acceptable to account for the varying trap-ability of different species.

Due to the constraints introduced by the coronavirus pandemic in 2020, the river survey was confined to the River Thurne. In 2021, lifting restrictions allowed the survey to be extended to the other Broads river systems, along the reaches indicated in Appendix 1. However, in 2021 the River Ant was excluded from the survey programme due to an infestation of floating pennywort which is currently under management. A preliminary survey is undertaken in April/May time, before the water plant cutter is mobilised, and where prioritised, a secondary survey is undertaken later in the season, in June or July.

River Plant Survey Results

The data collected from each river transect is presented as abundance (the amounts of each species recorded) based on the Braun-Blanquet Scale. The results tables illustrate the number of points at which each species was recorded to indicate frequency of occurrence. Historical records from past surveys are not presented here, different survey methodologies were used and therefore the results are not directly comparable.

Summary

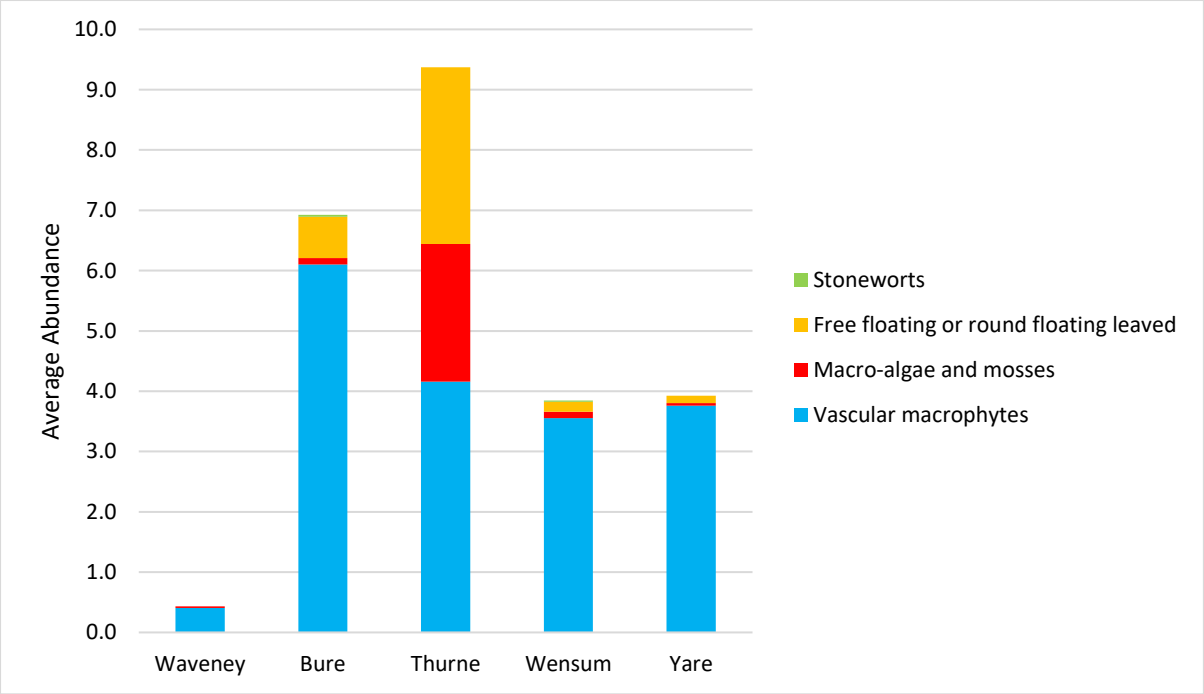
Vascular plants were the most common group of plants recorded on all the river systems, followed by floating plants. Pointed stonewort, *Nitella mucronata,* was recorded on two points across the Bure and the Wensum but otherwise stoneworts are not well represented in the river systems. The Bure and the Thurne were the most species rich river systems and carried the greatest abundance of plants, with the Thurne ultimately having the greatest

species richness and abundance. Greater levels of macro-algae and mosses were recorded on the Thurne compared to the other river systems. Holly-leaved naiad, *Najas marina,* which is a section 41 priority species, was only recorded on the Thurne.

The Waveney had the lowest species richness and abundance. The dominant species was unbranched bur-reed, *Sparganium emersum,* across both of the stretches, Beccles and Geldeston, surveyed on the Waveney. The Wensum and the Yare showed similarly moderate abundance and species richness.

Graph 20

Abundance shown in plant groups (see Appendix 1 for more detail)



Thurne

Table 22

Common Name	Scientific Name	Abundance	Occurrences
Starwort species	*Callitriche sp*	0.2	8
Rigid hornwort	*Ceratophyllum demersum*	0.025	1
Canadian waterweed	*Elodea canadensis*	0.3775	15.1
Nuttall's waterweed	*Elodea nuttallii*	0.625	25

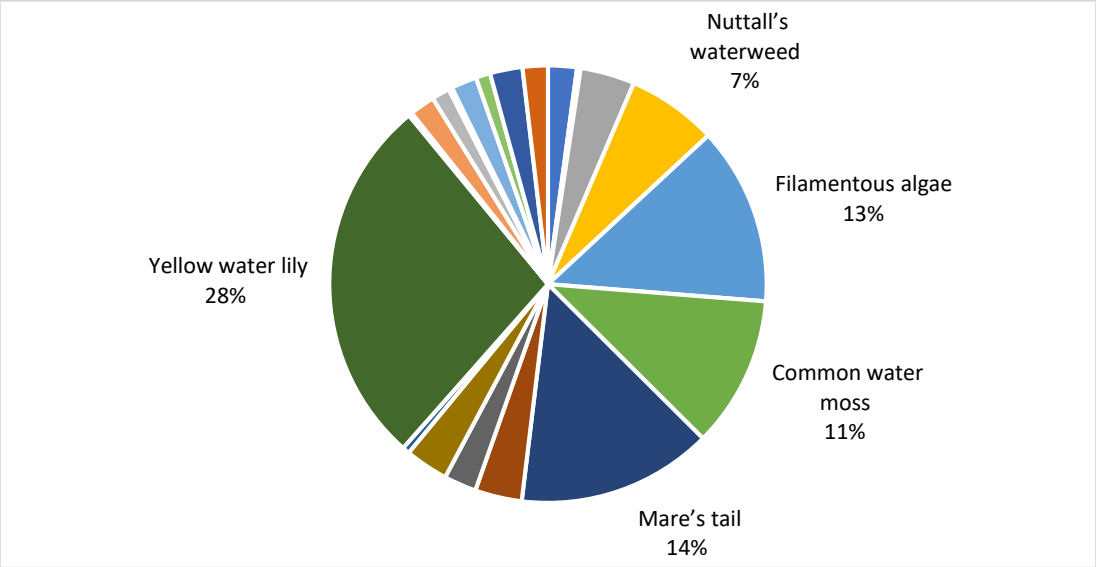
Zygnematales	*Filamentous algae*	1.2325	49.3
Common water moss	*Fontinalis antipyretica*	1.05	42
Mare's tail	*Hippuris vulgaris*	1.355	54.2
Ivy leaved duckweed	*Lemna trisulca*	0.325	13
Spiked water milfoil	*Myriophyllum spicatum*	0.225	9
Whorled water milfoil	*Myriophyllum verticillatum*	0.3	12
Holly leaved naiad	*Najas marina*	0.05	2
Yellow water lily	*Nuphar lutea*	2.5775	103.1
White water lily	*Nymphaea alba*	0.025	1
Curled pondweed	*P. crispus*	0.175	7
Fennel-leaved pondweed	*P. pectinatus*	0.125	5
Lesser pondweed	*P. pusillus*	0.025	1
Willow-leaved pondweed	*P. x salicifolius*	0.1775	7.1
Long-stalked pondweed	*Potamogeton praelongus*	0.1	4
Arrowhead	*Saggitaria sagittifolia*	0.225	9
Unbranched bur-reed	*Sparganium emersum*	0.175	7
Total number of species recorded		**20**	**Total samples taken: 40**

Yellow water lily, *Nuphar lutea,* was the most dominant species on the Thurne system followed by mare's tail, *Hippuris vulgaris.* Filamentous algae, *Zygnematales,* was abundant on the Thurne compared to the other river systems.

Although in low abundance, there was greater species richness recorded on the Thurne than on any of the other surveyed river systems.

Graph 21

Abundance shown in plant groups (see Appendix 1 for more detail)



Waveney

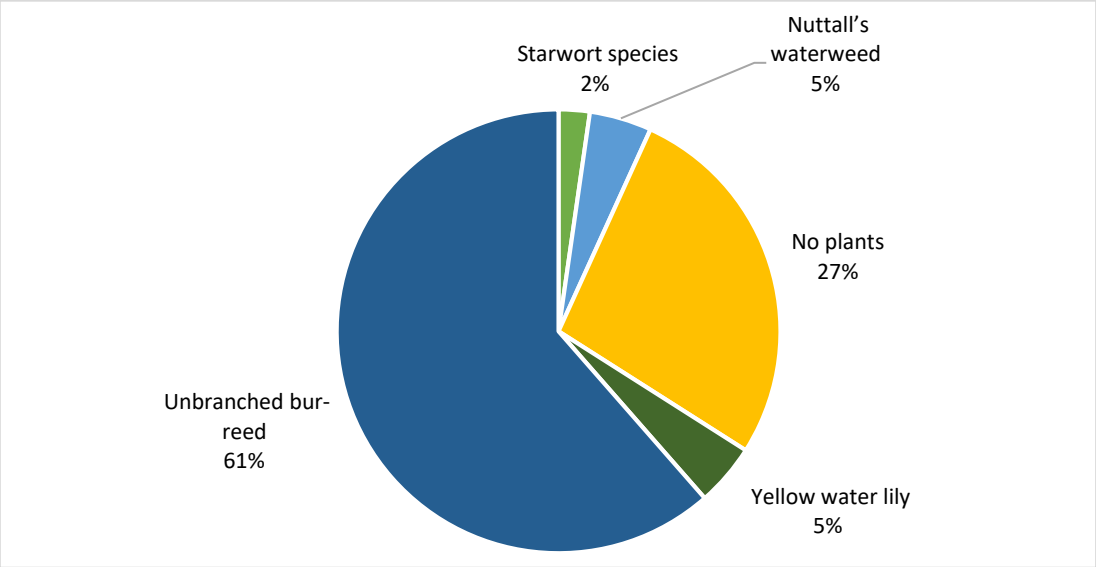
Table 23

Common name	Scientific name	Abundance	Occurrences
Starwort species	*Callitriche sp*	0.014	1
Nuttall's waterweed	*Elodea nuttallii*	0.027	2
Yellow water lily	*Nuphar lutea*	0.027	2
Unbranched bur-reed	*Sparganium emersum*	0.366	27.1
Total number of species recorded		**4**	**Total samples taken: 74**

The Waveney had the lowest diversity and abundance of any of the river systems. The plant community was dominated by unbranched bur-reed, *Sparganium emersum.*

Graph 22

Abundance shown in plant groups (see Appendix 1 for more detail)



Bure

Table 24

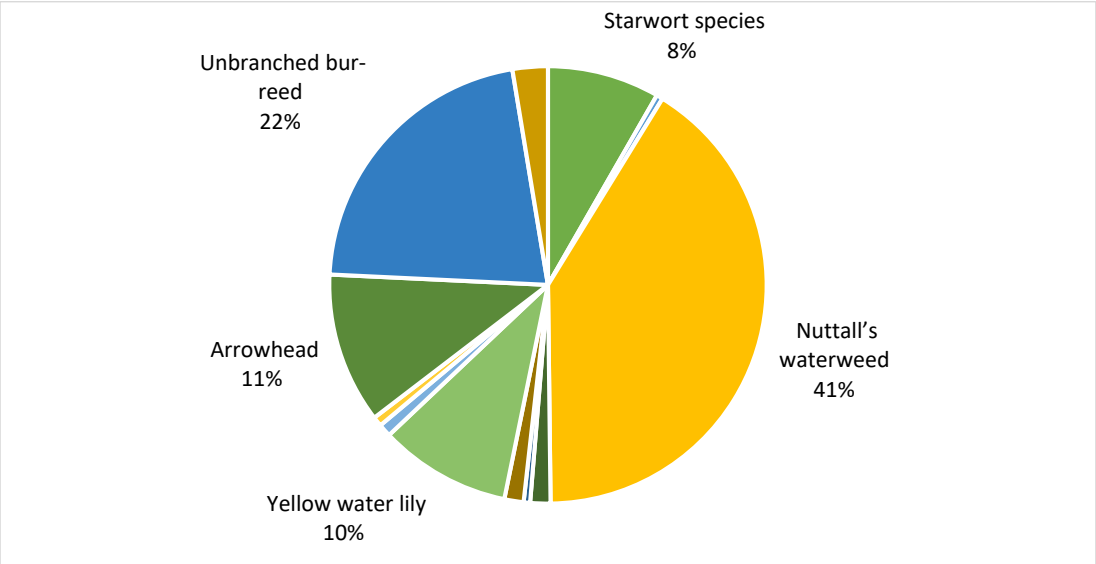
Common name	Scientific name	Abundance	Occurrence
Starwort species	Callitriche sp	0.583	35
Rigid hornwort	Ceratophyllum demersum	0.033	2
Nuttall's waterweed	Elodea nuttallii	2.883	173
Zygnematales	Filamentous algae	0.105	6.3
Pointed stonewort	Nitella mucronata	0.033	2
Yellow water lily	Nuphar lutea	0.685	41.1
Long stalked pondweed	Potamogeton praelongus	0.067	4

Water cress	Rorippa nasturtium-aquaticum	0.050	3
Arrowhead	Saggitaria sagittifolia	0.783	47
Unbranched bur-reed	Sparganium emersum	1.520	91.2
Fool's watercress	Apium nodifolium	0.183	11
Total number of species recorded		**11**	**Total samples taken: 60**

The Bure had the second highest species diversity of all the rivers. The most dominant species was Nuttall's waterweed, *Elodea nuttallii,* followed by unbranched bur-reed, *Sparganium emersum.* Although the species recorded had good abundance, there was lower diversity recorded on the Bure compared to the Thurne.

Graph 23

Abundance shown in plant groups (see Appendix 1 for more detail)



Yare

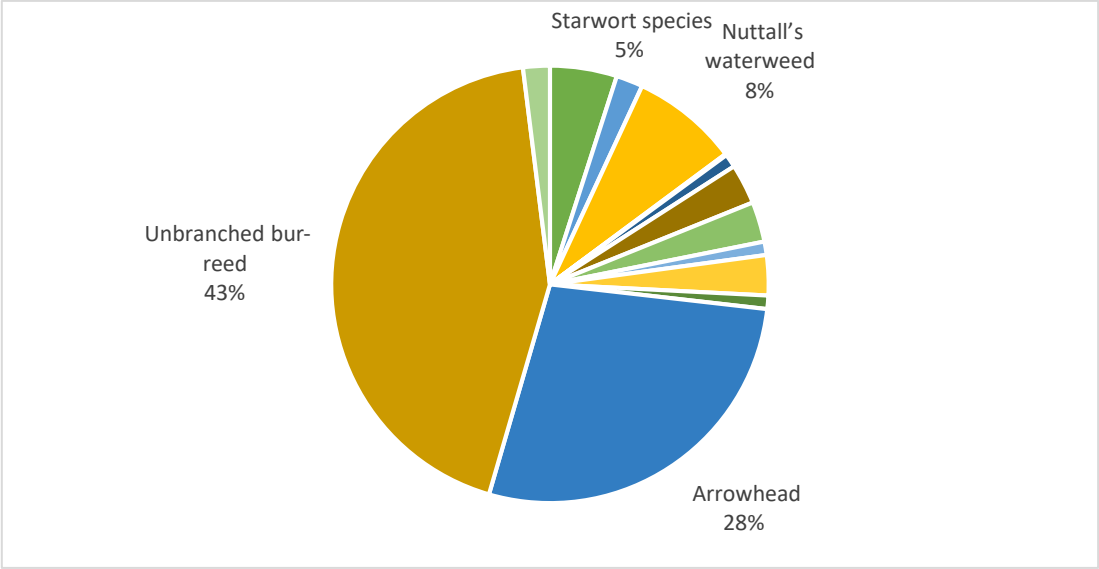
Table 25

Common name	Scientific name	Abundance	Quantity
Starwort species	*Callitriche sp*	0.200	5
Rigid hornwort	*Ceratophyllum demersum*	0.080	2
Nuttall's waterweed	*Elodea nuttallii*	0.320	8
Zygnematales	*Filamentous algae*	0.004	0.1
Common water moss	*Fontinalis antipyretica*	0.040	1
Yellow water lily	*Nuphar lutea*	0.120	3
Blunt leaved pondweed	*P. obtusifolius*	0.040	1
Fennel leaved pondweed	*P. pectinatus*	0.120	3
Water cress	*Rorippa nasturtium-aquaticum*	0.040	1
Arrowhead	*Saggitaria sagittifolia*	1.120	28
Unbranched bur-reed	*Sparganium emersum*	1.760	44
Horned pondweed	*Zannichellia palustris*	0.080	2
Total number of species recorded		**12**	**Total samples taken: 25**

Unbranched bur-reed, *Sparganium emersum,* was the most dominant species on the section of the Yare surveyed, followed by arrowhead, *Saggitaria sagittifolia.* There was a good diversity of species in the stretch surveyed, with a total of 12 separate species recorded.

Graph 24

Abundance shown in plant groups (see Appendix 1 for more detail)



Wensum

Table 26

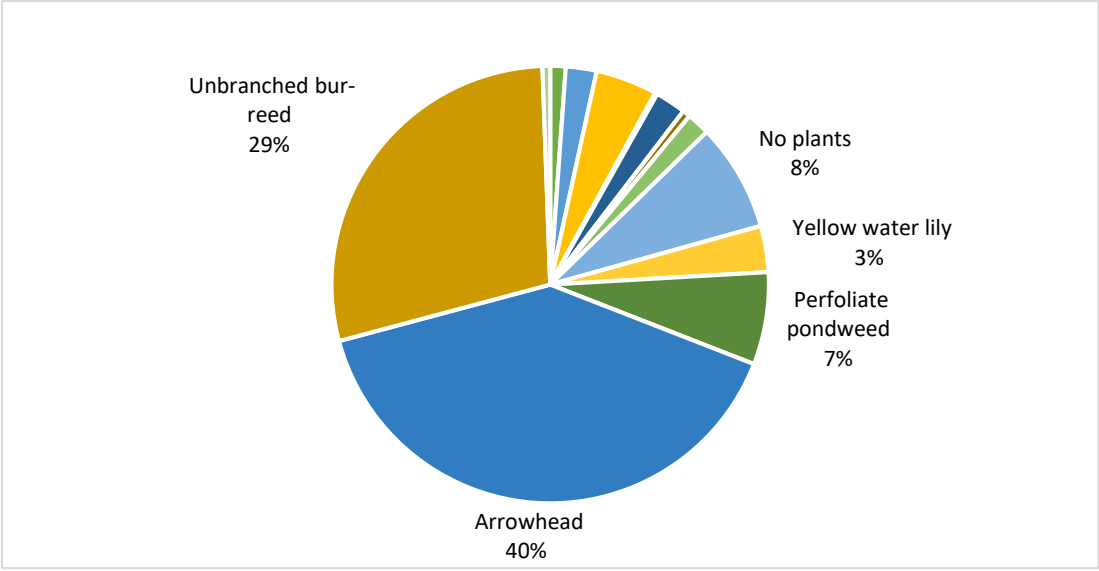
Common name	Scientific name	Abundance	Occurrence
Starwort species	*Callitriche sp*	0.048	2
Rigid hornwort	*Ceratophyllum demersum*	0.095	4
Nuttall's waterweed	*Elodea nuttallii*	0.190	8
Zygnematales	*Filamentous algae*	0.007	0.3
Common water moss	*Fontinalis antipyretica*	0.095	4
Ivy leaved duckweed	*Lemna trisulca*	0.024	1
Spiked water milfoil	*Myriophyllum spicatum*	0.071	3
Yellow water lily	*Nuphar lutea*	0.143	6
Perfoliate pondweed	*P. perfoliatus*	0.286	12
Arrowhead	*Saggitaria sagittifolia*	1.669	70.1

Unbranched bur-reed	*Sparganium emersum*	1.195	50.2
Pointed stonewort	*Nitella mucronata*	0.024	1
Total number of species recorded		**12**	**Total samples taken: 42**

Arrowhead, *Saggitaria sagittifolia,* and unbranched bur-reed, *Sparganium emersum,* were the most dominant species on the Wensum. The species diversity and abundance was similar to that recorded on the Yare.

Graph 25

Abundance shown in plant groups (see Appendix 1 for more detail)



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Appendix I: Common water plants in the Broads

Table 27

Details of Broads water plants

Group	Scientific name	Common name	Section 41
Stoneworts	*Chara aspera*	Rough stonewort	
	C. baltica	Baltic stonewort	Y
	C. connivens	Convergent stonewort	Y
	C. contraria	Opposite stonewort	
	C. curta	Lesser bearded stonewort	
	C. globularis	Fragile stonewort	
	C. hispida	Bristly stonewort	
	C. intermedia	Intermediate stonewort	Y
	C. pedunculata	Hedgehog stonewort	
	C. virgata	Delicate stonewort	
	C. vulgaris	Common stonewort	
	Nitella flexilis	Starry stonewort	Y

	N. mucronata	Pointed stonewort	
	N. translucens	Translucent stonewort	
Vascular macrophytes	*Acorus calamus*	Sweet flag	
	Crassula helmsii	Australian swamp stonecrop	
	Callitriche sp.	Starwort sp.	
	Ceratophyllum demersum	Rigid hornwort	
	Elodea canadensis	Canadian waterweed	
	E. nuttallii	Nuttall's waterweed	
	Eleogiton fluitans	Floating club-rush	
	Glyceria maxima	Reed sweet grass	
	Hippuris vulgaris	Mare's tail	
	Myriophyllum spicatum	Spiked water milfoil	
	M. verticillatum	Whorled water milfoil	
	Najas marina	Holly-leaved naiad	Y
	Persicaria amphibia	Amphibious bistort	
	Potamogeton acutifolius	Sharp-leaved pondweed	
	P. berchtoldii	Small pondweed	
	P. crispus	Curled pondweed	
	P. friesii	Flat-stalked pondweed	
	P. lucens	Shining Pondweed	
	P. natans	Broad –leaved pondweed	
	P. obtusifolius	Blunt-leaved pondweed	
	P. pectinatus	Fennel-leaved pondweed	
	P. perfoliatus	Perfoliate pondweed	
	P. pusillus	Lesser pondweed	
	P. trichoides	Hair like pondweed	
	Potamogeton x Salicifolius	Willow-leaved pondweed	
	Ranunculus circinatus	Fan-leaved water crowfoot	
	Rorippa nasturtium-aquaticum	Water cress	
	Saggitaria sagittifolia	Arrowhead	
	Sparganium erectum	Branched bur-reed	
	S. emersum	Unbranched bur-reed	
	Stratiotes aloides	Water-soldier	
	Utricularia vulgaris	Greater bladderwort	
	Zannichellia palustris	Horned pondweed	
Free-floating or Round floating leaved macrophytes	*Hydrocharis morsus-ranae*	Frogbit	
	Lemna gibba	Inflated duckweed	
	L. minor	Common duckweed	
	L. minuta	Least duckweed	
	L. trisulca	Ivy-leaved duckweed	
	Nuphar lutea	Yellow water lily	
	Nymphaea alba	White water lily	
	Spirodela polyrhiza	Greater duckweed	
Macro-algae & Mosses	*Enteromorpha*		
	Fontinalis antipyretica	Common water moss	
	Hydrodictyon	Water net	
	Leptodictyum riparium	Stringy moss	
	Zygnematales	Filamentous algae	