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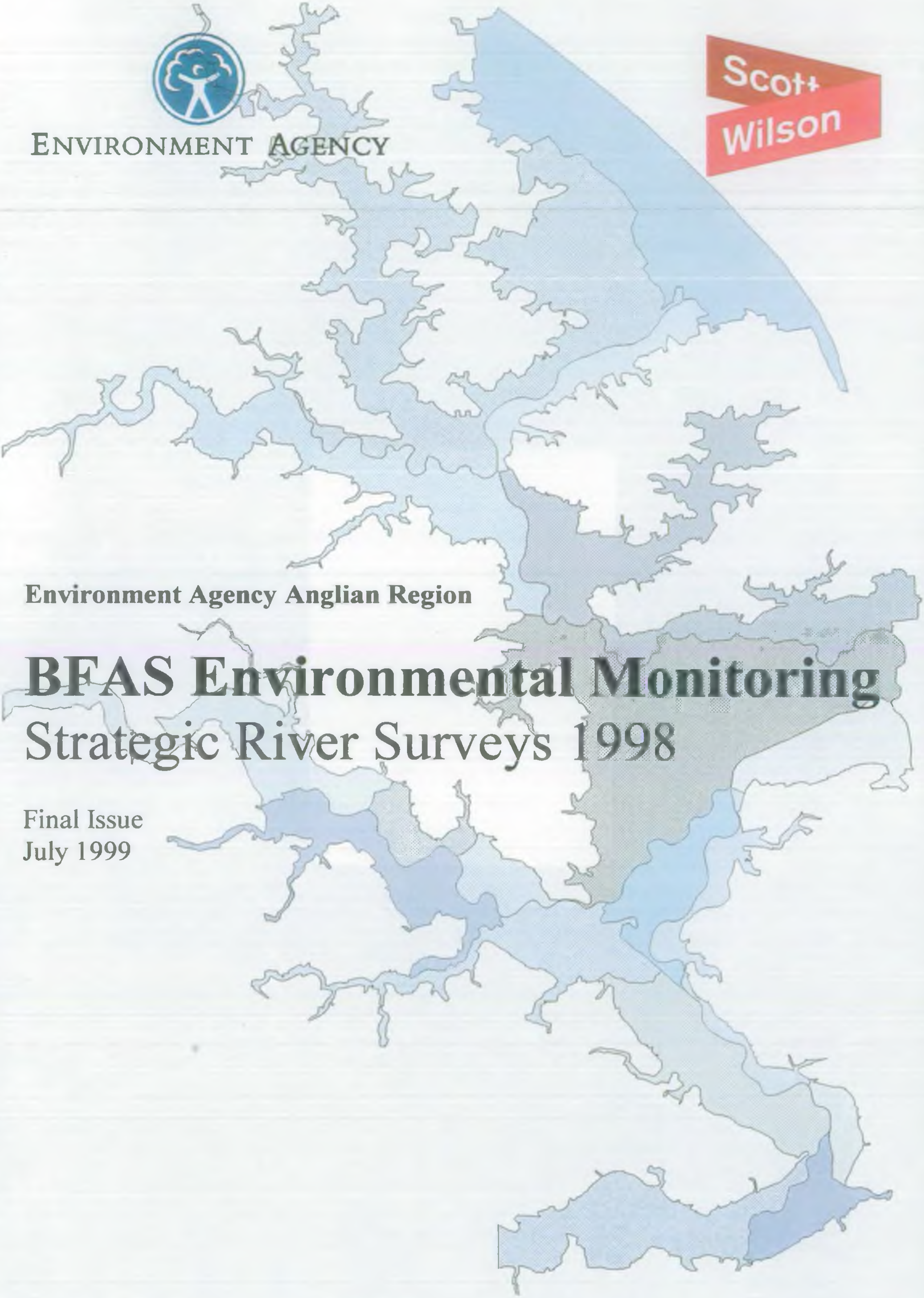
Scott Wilson



Environment Agency Anglian Region

BFAS Environmental Monitoring

Strategic River Surveys 1998

Final Issue
July 1999

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BROADLAND FLOOD ALLEVIATION STRATEGY
ENVIRONMENTAL MONITORING

STRATEGIC RIVER SURVEYS 1998

JULY 1999

Prepared for the
Environment Agency Anglian Region

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EAFEP	2	1	Final
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1. INTRODUCTION

1.1 Broadland Flood Alleviation Strategy - Aim and Objectives

The Broadland Flood Alleviation Strategy (BFAS) establishes and justifies the objective of sustaining the current standard of flood defence throughout Broadland. The Strategy proposes a ten-year programme of bank strengthening and erosion protection works followed by a rolling programme of works, at 15 year intervals, to maintain the defences and counter settlement and sea-level rise over the next 50 years. It is now expected that the works will be carried out by means of a 20-year Public Private Partnership Programme (PPPP) Contract. It is expected that a contract will be awarded during 2000.

The need for monitoring is identified in the BFAS Strategic Environmental Assessment (SEA). Monitoring is required both to provide baseline information on which Environmental Assessments can be based and also to assess impacts and changes resulting from flood defence works.

The SEA was carried out as part of the BFAS. The SEA set out in general terms criteria for the environmental acceptability of flood alleviation works and for environmental enhancement in Broadland. These criteria are listed in Appendix 1 in the Scoping Study Report (Scott Wilson, 1998d). The criteria relate to three different scales:

- Strategic: covering the whole of Broadland;
- Local: within individual flood compartments;
- Site-specific: individual flood defence works within a flood compartment.

The SEA emphasised the need to monitor to see if BFAS meets the environmental criteria as it develops, by carrying out baseline and subsequent environmental surveys.

Definition of environmental criteria in the SEA was followed by the development of a monitoring programme for these criteria: the Broadland Flood Alleviation Strategy Environmental Monitoring (BFASEM) programme. The objectives are as follows:

1. To determine if the BFAS has satisfied the environmental acceptability and enhancement criteria at a Broadland (strategic), flood compartment (local) and site specific level;

2. To provide a baseline of information against which future flood defence engineering induced changes in the Broadland environment can be assessed;

3. To review the effectiveness of all environmental mitigation and enhancement work associated with flood alleviation schemes;

4. To ensure that the BFAS has not adversely affected any sites of international conservation importance;

5. To establish an annual consultation, feedback and review exercise that will ensure that all future environmental engineering work is designed and implemented on the basis of lessons learned from past schemes.

6. The environmental acceptability and enhancement criteria given in the SEA can, in many cases, be seen as strategic goals for Broadland with much wider application than BFAS monitoring.

For monitoring to be funded by MAFF, as part of the BFAS, the minimum requirements to determine the potential impacts of the flood alleviation scheme are necessary. This means that the main focus of BFASEM is on any changes which are associated with the flood alleviation works, rather than those which are due to some other factors (e.g. natural changes). Nonetheless, the wider context is recognised and the aim is to make the BFAS monitoring as useful as possible to other Broadland monitoring and research. This will be done by adopting standard survey methods where available and suitable, and by development of an accessible data management system which will serve BFAS and other users. Similarly, relevant environmental data from other monitoring initiatives will be accessed for BFAS purposes.

1.2 Broadland Flood Alleviation Strategy - Development of Environmental Monitoring

This section summarises the development of an environmental monitoring programme in the period 1997-1999.

Following the production of the SEA, the Environment Agency commissioned an outline brief for environmental monitoring (Environment Agency, 1997). The Environment Agency subsequently appointed Scott Wilson as the monitoring co-ordinator in October 1997. The monitoring co-ordinator is responsible for developing and directing monitoring at a strategic level and advising and co-ordinating programmes at local and site specific levels.

Scott Wilson developed the proposals for BFASEM further, after a review of available environmental data and consultation with staff of the Environment Agency, English Nature and the Broads Authority. The development is recorded in the Interim Scoping Study Report (Scott Wilson, 1998b) and the Scoping Study Report (Scott Wilson, 1998d).

The Scoping Study Report grouped the environmental criteria into a series of topics. For each of the criteria given in the SEA, baseline monitoring was defined, together with proposed impact and change monitoring. Each topic included one or more monitoring protocols for BFASEM. The results from the surveys and analyses will provide the baseline and monitoring data required to check compliance with the environmental criteria of the SEA. The topics are:

- waterside landscape elements
- saltmarsh erosion/accretion
- saline intrusion in the main rivers
- saline intrusion in the marsh blocks
- vegetation monitoring
- rond erosion
- flood risk

These topics include monitoring at different scales, details of which were given in the Scoping Study Report. Broadly, strategic monitoring is undertaken by the monitoring co-ordinator and site-specific monitoring largely by consultants working on individual schemes, albeit to agreed methods. The local (flood compartment) monitoring will involve some work at compartment level, but will mainly be derived from interpretation of site-specific and strategic components of work, compiled by the monitoring co-ordinator. Following consultation, Scott Wilson issued notes on changes in the scope of work and priorities for 1998 (Scott Wilson, 1998e).

1.3 Strategic Monitoring in 1998

Delays in budget approval in 1998 meant that some components of BFASEM were deferred. The main programme of work under BFAS has not yet started, although some urgent works schemes were carried out, where there was considered to be a high risk of deterioration of particular flood defences. Work was carried out by the monitoring co-ordinator under the following strategic topics:

- waterside landscape elements
- saline intrusion in the main rivers
- vegetation monitoring

The work carried out in 1998 is presented in a series of monitoring reports:

1. Strategic Vegetation Surveys
2. Strategic River Surveys
3. Landscape Assessment and Monitoring
4. Data Management Strategy
5. BFAS Environmental Monitoring Annual Report

The Strategic Vegetation Surveys report covers all the strategic vegetation surveys of 1998, which includes:

- modified Phase 1 habitat surveys of river corridors
- pilot quadrat study
- main quadrat survey

The Strategic River Surveys report deals with water level and quality issues. It includes:

- analysis of historic salinity and water level data
- salinity surveys
- biological surveys for salinity using diatoms and macro-invertebrates

The Landscape Assessment reports the development of a unified approach to assessment of Broadland landscape condition, at a strategic, local and site specific level. It is based on consultation between the Environment Agency, it's consultants and the Broads Authority.

An important component of BFASEM is the development and operation of a data management system. This was outlined in the Data Management Strategy Report (Scott Wilson, 1998c). Developments in 1998/9 include work on an inventory of available environmental data for BFASEM, initial work on a BFASEM Geographical Information System (GIS) and on data standards, described in the BFASEM Data Handling Report (Scott Wilson, 1999). The material on the GIS will be made available in first issue on CD-ROM to the Environment Agency and to the other agencies in Broadland which have agreed to exchange data with BFASEM.

In addition, a short annual report summarises the environmental monitoring carried out in 1998 by the various consultants involved in BFAS.

1.4 Introduction to the Strategic River Surveys Report

Broadland consists of over 170 km of navigable and lock-free waterways, of which the three main rivers (Bure, Waveney and Yare) are under tidal influence for a considerable distance inland e.g. up to Norwich on the River Yare. Encouraged by the low lying landscape, saline intrusion occurs on a regular basis resulting in saline influenced habitats further upstream than on other British rivers of a similar size. Flood defence development has been ongoing, particularly over the last century to protect agricultural land, residential and business areas. The resulting riverside landscape is a product of these defence works and periodic river inundation (see Figure 1.1). These areas act as barriers, interceptors and storage areas for nutrients, pollutants and flood waters, and provide an important habitat for flora and fauna. These features may change over time through natural erosion or man-made bank strengthening which may affect the character and response to tidal influences of the Broadland rivers.

One of the roles of BFASEM is to monitor these changes to discover if there is an effect on the water quality and hydrometric conditions of the rivers. The aim of this report is to set a baseline for water quality and hydrometric monitoring in Broadland. This has been approached by using a combination of historical, physical and chemical water data analysis, salinity surveys and identification and quantification of aquatic bioindicators (i.e. aquatic invertebrates, molluscs and diatoms). The analysis of these at a strategic level is aimed towards meeting the following BFAS environmental-enhancement and acceptability criteria:

Strategic (acceptability)

- No increase in the saline limit upstream in rivers
- No damage (direct or indirect) to the ecological integrity of internationally important sites as a result of the scheme implementation

Strategic (enhancement) of the Broads

- Increase the protection afforded to 'unconnected' broads via bank strengthening and raising in key compartments
- Reduce saline intrusion ? incursion (rivers)

1.4.1 Report Structure

The following is a description of the report structure. Objectives for the surveys or data analyses are given within the relevant sections.

- Section two details the analysis of historic water quality and hydrometric data undertaken by Scott Wilson, using data obtained from the Environment Agency.

- Section three details the salinity surveys carried out in Broadland rivers by Scott Wilson.

- Section four is based on the identification and analyses of invertebrates by a sub-consultant (APEM) and further interpretation by Scott Wilson.

- Section five is based on the identification and analyses of diatoms by a sub-consultant (Fran Green) and further interpretation by Scott Wilson.

- Section six summarises the main findings from sections two to five along with recommendations for the use of information, the GIS interface and for future work.

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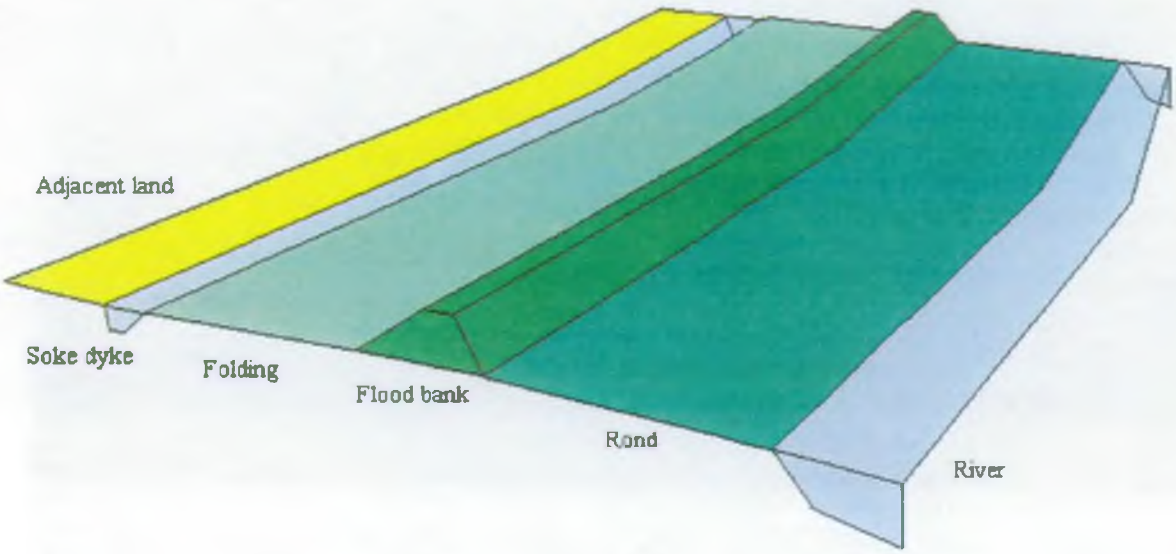
Figure 1.1 The typical riverside landscape in Broadland



2. ANALYSIS OF HISTORIC WATER QUALITY AND HYDROMETRIC DATA

2.1 Objectives

The objective of this study is to establish past and current, spatial and temporal trends in riverine salinity gradients, river flow, tidal cycles and their influence on river ecology in Broadland. To meet this objective data in the following categories has been analysed:

- fluvial flow
- tidal data
- water quality data
- records of fish kills linked to saline intrusion

2.2 Introduction

The River Yare and its tributaries drain to the sea through Great Yarmouth (see Figure 2.1). The low-lying land adjacent to the tidal reaches is prone to flooding. Flooding events can be fluvial, tidal or any combination of the two. The lower reaches are more influenced by tidal levels but the impact can be significant well upstream, especially during long duration tidal events. Saline water intrudes into the river system under some circumstances.

In addition to the normal monthly lunar cycle of tides, levels in the North Sea can be significantly influenced by climatic conditions. North Sea 'surges' typically occur when areas of low atmospheric pressure drift across the North Sea and northerly winds drive water into the 'funnel' formed by the UK and the Continent. This may happen at any state of the tide, but if it coincides with high water, significant increases can result. Even if a surge coincided with predicted low tide, the impact can be significant as it may prevent normal fluvial discharge.

2.3 Collection and Availability of Data

Automated recording of water quality, fluvial flow and tidal levels are carried out by the Environment Agency at sites throughout Broadland as shown on the location map (see Figure 2.2). Routine water quality spot sampling is carried out in the field at various sites (see Figure 2.3). Information on the cause, location and number of fish deaths are recorded when reported. For the purposes of this study data for the Rivers Bure, Thurne, Waveney and Yare were collated.. The data sources are summarised in Table 2.1.

Table 2.1 Data sources

Data Set	Source of Data	Type of Data	Sampling Period	Period of Data Analysed	Site of Data Collection
Water Quality	Environment Agency	Chloride, salinity and conductivity spot samples	sporadic sampling	1988 to 1998	8 sites on River Bure 3 sites on River Thurne 7 sites on River Waveney 7 sites on River Yare
		Hourly conductivity	remote, continuous	1997 to 1998	Acle, River Bure Burgh St Peter, River Waveney Cantley Red House, River Yare
Fluvial Flow	Environment Agency	Daily Average on Hydrolog	remote, continuous	1979 to 1998	Horstead, River Bure Needham Weir, River Waveney Colney, River Yare
Fish Kill Events	Fisheries Department, Environment Agency, Norwich	Reason for, number and species of fish deaths	sporadic: influenced by events	1990 to 1997	River Bure River Thurne River Waveney River Yare
Tidal Data	Environment Agency, Ipswich	Annual maxima (from paper charts)	annual	1973 to 1992 1978 to 1988 1970 to 1993 1974 to 1987 1969 to 1993 1969 to 1987 1953 to 1992	Acle Bridge, River Bure Hoveton, River Bure Beccles, River Waveney Burgh St Peter, River Waveney Carrow Bridge, River Yare Rockland, River Yare Great Yarmouth
		15 min. HYDROLOG water level readings	remote, continuos	12/1992 to 1998 10/1993 to 1998 10/1993 to 1998 10/1993 to 1998 12/1993 to 1998	Acle Bridge, River Bure Beccles, River Waveney Carrow Bridge, River Yare Cantley, River Yare Great Yarmouth
Precipitation	Environment Agency – Ipswich	Total daily precipitation	daily remote	1993 to 1998 1980 to 1998 1980 to 1998	Acle, River Bure Barsham, River Waveney Hemsby, nr River Bure

2.3.1 Fluvial Flow

River flow is recorded at three gauging stations upstream of the spot sampling sites at Horstead Mill on the River Bure, Needham Mill on the River Waveney and Colney on the River Yare by the Environment Agency (see Figure 2.2 and Table 2.2). Daily average flows are calculated from 15 minute readings and recorded on HYDROLOG. HYDROLOG is a computerised recording package, or database, recording large amounts of data which can filter data and calculate averages, maximum and minimum over a specified time, e.g. hourly, daily or annually.

Table 2.2 Flow gauge information

	River Bure	River Waveney	River Yare
Station name	Horstead Mill	Needham Mill	Colney
Grid reference	TG267194	TM229811	TG182082
Weir type	Compound crump	Compound crump	Crump and Broad crested
Catchment geology	Sand and Gravel	Boulder Clay	Boulder Clay/Chalk
Catchment area (km^2)	313.0	370.0	231.8

(*Source*: Institute of Hydrology & British Geological Survey, 1998)

The data is nearly complete from 1 October 1979 to the end of 1997 as shown in Table 2.3 (monitoring is ongoing) with only one or two fortnight long gaps and some complete months missing when probes have been temporarily out of service after becoming silted up or knocked by river traffic. Data gaps of less than one week can be averaged out using monthly average graphs, but month long gaps are still evident.

Table 2.3 Percentage of time flow gauges provide data

Year	% of data logged as correct readings		
	Horstead Mill, River Bure	Needham Mill, River Waveney	Colney, River Yare
1980	100	90.4	100
1981	100	98.4	83.6
1982	100	100	99.2
1983	100	100	85.2
1984	100	100	100
1985	100	100	90.4
1986	100	41.6	94.2
1987	100	92.3	89.0
1988	100	100	100
1989	99.2	96.2	88.0
1990	98.3	97.8	84.6
1991	100	99.0	99.5
1992	94.2	99.0	100
1993	81.1	97.4	94.5
1994	98.4	95.6	100
1995	91.5	94.8	100
1996	99.4	98.1	100
1997	80.8	100	97.0

2.3.2 Tidal Water Levels

Paper charts (held by the Environment Agency, Ipswich) have been used to record water levels in Broadland since 1970. Annual maximum water levels have been extracted from the charts available, some charts are missing. Tidal water levels are recorded as a height above the Ordinance Datum, known as mODN (metres above Ordinance Datum at Newlyn). Data have been recorded at four monitoring sites on HYDROLOG at 15 minute intervals. The available data since December 1992 at Acle Bridge on the River Bure and since October 1993 at Beccles Quay on the River Waveney, Cantley tide site and Carrow Bridge on the River Yare have been collated (Table 2.1). For comparison, daily maximum data were also collected from the tide gauge at Great Yarmouth.

The monitors are located in 'stilling well' to avoid adverse external influences of wind and boat washes. A number of problems with telecommunication lines have been experienced, so there is no data for periods when communication lines are down or the monitor is out of action. At the moment no backup exists at the monitoring sites. Problems most often occur during the winter. During high water level events the float may become tangled, catching at the top of the well. Maximum levels are not recorded and a good representation of the retreating water levels is not achieved.

The most complete annual data set is in 1993 at Acle Bridge. For a comparison of all the sites the most complete year is 1997: Great Yarmouth has 94%, Beccles and Carrow have 83%, Cantley has 57% and Acle Bridge only has 49%. The percentage of time per year that correct readings (i.e. not error readings) are being logged, are displayed in Table 2.4.

Table 2.4 Percentage of time tidal gauges provide data

Year	% of data logged as correct readings				
	Acle Bridge, River Bure	Beccles, River Waveney	Cantley, River Yare	Carrow, River Yare	Great Yarmouth
1993	98.4	16.9	16.9	16.9	8.7
1994	66.7	33.2	33.2	33.2	66.8
1995	16.6	7.7	7.7	7.7	16.1
1996	38.6	0	0	0	40.7
1997	49.5	83.9	57.0	83.6	94.0

2.3.3 Chemical Water Quality Spot Sampling Data

The Environment Agency is able to keep a check on the general water quality of the Broadland rivers through their spot sampling strategy. Broadland is a complex tidal system which results in variable conditions on an hourly basis. Spot samples have been taken at various intervals to assess water quality at sites on the tidal rivers of Broadland by the Environment Agency and its predecessors. A number of chemical parameters are measured, however for the purposes of this study only those relating to saline intrusion will be considered: salinity, chloride levels and conductivity. Data for the period 1988 to 1998 have been obtained for sites on the Rivers Bure, Thurne, Waveney and Yare (Figure 2.3). Sampling at the 24 stations was irregular in the period 1988 to 1993. Since 1993 at major sites (i.e. those with static water quality or hydrometric monitoring equipment or with easy access), sampling has occurred approximately monthly. Extra sampling is sometimes employed when a high tide is expected and consequently high inland water levels are expected, a fish kill event has been reported, or other impact has been noted. Some sites only have two or three samples a year whereas others are sampled more frequently as shown in Table 2.5.

The chloride level, conductivity and salinity of these samples are recorded, but the three are not necessarily recorded consistently. The most versatile parameter is conductivity as it can be monitored through sampling or with continuous monitors. It is also possible to measure conductivity both in the field and under controlled conditions in the laboratory to check the accuracy of on site monitors. Salinity is the most direct indicator of the chemical salt content of the water, but the salt precipitation test does not give an accurate reading below 1.8 g/l. As the majority of the sites have a salinity below 1.8 g/l most of the time this method is not accurate enough. Chloride concentration gives the next best indicator of the salinity of the water but is not easy to monitor continuously in the field and is therefore only recorded in the spot samples.

Table 2.5 **Water quality sampling frequency on main Broadland rivers**

River	Sampling site name	Sampling site reference	Sampling site distance upstream of Yare mouth (km)	Average number of samples per year		Length of data set (years)
				chloride	conductivity	
Bure	Upton	B175	25	2	3	5
	Acle Bridge	B180	22	11	2	11
	Stokesby	B181	19	2	3	5
	Stacey Arms	B183	17	2	11	6
	Runham	B1835	13	2	2	6
	Caister	B184	9	2	7	6
	Great Yarmouth	B188	6	2	2	7
	A47 Road Bridge	B190	5	10	2	11
Thurne	Martham Ferry	T065	34	21	10	10
	Thurne Mouth	T100	27	8	8	5
Waveney	Barnby	W155	34	2	2	5
	Burgh St Peter	W160	29	10	11	10
	Somerleyton	W163	23	2	2	6
	Haddiscoe	W167	20	2	16	5
	St. Olaves Bridge	W170	19	10	11	10
	Fritton	W172	15	2	6	6
	Burgh Castle	W179	11	2	2	5
Yare	Strumpshaw Common	Y227	31	2	2	5
	Buckenham Ferry	Y230	29	10	10	10
	Cantley Red House	Y240	25	10	10	10
	Limpenhoe	Y243	24	2	2	5
	Reedham Ferry	Y250	20	10	5	10
	Reedham Quay	Y260	18	2	2	5
	Berney Arms Mill	Y2625	11	2	2	5

2.3.4 Continuous Conductivity Monitoring

Continuous conductivity monitoring is also present to identify patterns of water quality within the tidal cycles. This aids the identification of a change in water quality as either a regular tidal change or a notable event. Three continuous conductivity monitors are located at Cantley Red House, on the River Yare, Burgh St. Peter, on the River Waveney and Acle, on the River Bure, recording conductivity hourly. However they are prone to losing calibration so are best used in conjunction with spot sample results, but are still useful as indicators of trends in water quality (*pers. comm.* Environment Agency). The data set for the period for 1997 has been analysed in conjunction with the other data collected. The monitors are out of service periodically, especially during the winter, for example all three monitors were out of service for at least a fortnight in November/December 1997.

2.3.5 Fish Kill Events

The Fisheries Department within the Environment Agency at Norwich have provided tabulated information of fish kill events (1990 to 1997) giving the date, location, number of deaths by species and possible cause of deaths.

The Environment Agency have two methods of estimating fish kills; reports from the public, e.g. by fishermen or field workers, and by using predictions, e.g. from hydrometric data, or repeated flood warnings.

The date recorded is not necessarily the date of the fish deaths as a record is only noted when dead fish are noticed floating on the water surface or washed up on the river banks which can be a number of days after the deaths. It is also difficult to accurately assess the number of deaths during a saline incursion as many fish will be washed out to sea on the ebbing tide.

2.4 Methods of Analysis

2.4.1 Fluvial Flow

Data sets of average daily flows for Horstead Mill on the River Bure, Needham Mill on the River Waveney and Colney on the River Yare were collected from the Environment Agency. These were then filtered to remove any error readings i.e. when no reading is recorded a -9999 is logged. Average daily flows have been calculated annually and broken down into winter and summer averages. Summer is taken to be 1 April to 30 September for these analyses. Winter and summer averages have been plotted against time for each river. Percentile calculations of annual and complete data sets for each river have been completed and presented as probability curves. Ten, 50 and 95 percentiles have been extracted for comparison with data from the Hydrometric Register of Statistics (1998).

2.4.2 Tidal Water Levels

Water level data from Acle Bridge on the River Bure, Beccles, River Waveney, Cantley and Carrow on the River Yare have been filtered to remove start up/shut down signals and error data, as classified on the HYDROLOG. Errors are also recognised when two consecutive (i.e. 15 minute interval) have greater difference than 0.5 m. Minimum and maximum water levels have been calculated on an annual and tidal basis. Tidal maxima are useful, as where large amounts of data are missing annual maxima are not very representative. Rank and percentile calculations have been represented on 'S'-curves (cumulative frequency curves) to allow the prediction of the percentage of time a specific water level is met or exceeded.

2.4.3 Chemical Water Quality Spot Sampling Data

Spot sampling data for the 24 sampling sites were collected and examined. For sites with a reasonable frequency of water quality spot samples (i.e. average number of samples per year greater than nine, see Table 2.5) the annual range and averages were plotted and examined for trends. Salinity has been calculated from conductivity readings and plotted against distance upstream.

2.4.4 Continuous Conductivity Monitoring

Continuous conductivity monitor data from 1997 for the Acle, Burgh St Peter and Cantley monitors were filtered to remove negative and zero values. The filtered data were plotted against time to identify average levels and peaks in conductivity. This information was plotted against tidal cycle water level maxima and average daily flow for each river. A comparison over time and between rivers was then conducted. Where peaks coincided on more than one river, a larger scale plot of 15 minute water level and flow readings against conductivity around significant events have been plotted.

2.4.5 Fish Kill Events

Fish kills reported to be due to saline intrusion have been extracted from the complete list of fish kills. Categories for the size of the fish kills were identified and the fish kill events then categorised. These have been compared with all the other data for at least the week prior to the reported fish kill event.

2.4.6 Flood Events

The 1997 data, (the only year with complete data) were analysed to find peaks in fluvial flow, tidal water levels and conductivity. Where more than one river has peaks within a few days these have been identified as flood events. Each flood event was then defined as fluvial, tidal or combined fluvial and tidal. These have then been compared with dates of fish kill events.

2.5 Results

2.5.1 Fluvial Flow

Fluvial flow in Broadland was generally lower than the hydrometric statistics (1998) long term average (see Figure 2.4), during the drier years of 1989 to 1992 (see Figure 2.5). Average flows were higher in both the summer and winter of 1993 to 1996, but fell again in 1997. The Rivers Waveney and Yare saw particularly high average flows in the winter of 1993. Generally higher flows were experienced from October to February than in the summer for all the years, except in 1997 the River Bure experienced lower average flows in the winter than in the summer (see Figure 2.4).

Figure 2.6 show that the Rivers Waveney and Yare react in a similar manner to a summer rainfall event around 29th June 1997. Flow increases gradually after the maximum rainfall with the peak up to three days later. Whereas the Bure has a characteristically flashy response reaching a peak in flow very quickly (the time lapse is less than that on the chart as the precipitation gauge is further downstream than the flow gauge). A significant trough is seen after this flashy response, and the flow does not return to normal conditions until eight days after the day of peak rainfall. Plots of a winter rainfall event (see Figure 2.7) show a higher base flow on all the rivers with less than a day's gap between the precipitation peak and flow peak. Similar to the summer event, the River Bure has a greater response to the precipitation on 4th to 5th November 1997 than the Rivers Waveney and Yare.

Cumulative percentage is the percentage of a period of time that a flow is not exceeded. Flows for cumulative percentages for the full data set (1980 to 1997) taken from cumulative probability curves for all three rivers are displayed below in Table 2.6 (also Figure 2.8). The highest 90 cumulative percent flow is seen on the River Waveney, because it has the largest catchment area of the three rivers considered (see Table 2.2). The River Bure has the highest 50 and 5 cumulative percent flow suggesting a generally higher flow rate.

Table 2.6 Table of Cumulative percentage for Broadland rivers for 1980 to 1997

River	Cumulative percentage		
	90 % flow (cumecs)	50 % flow (cumecs)	5 % flow (cumecs)
Bure	3.30	1.95	0.94
Waveney	3.59	0.72	0.27
Yare	2.84	0.82	0.27

2.5.2 Tidal Water Levels

Analysis of data is difficult, and statistical analysis inaccurate, due to the low percentage of continuous data available per year. Therefore any conclusions drawn from existing data are only provisional and can only be adopted where analysis of future data supports them. Comparison of annual S-curves for all the sites individually for 1993 to 1998 (for example the River Bure, Figure 2.9) suggests that during the period 1993 to 1998 minimum and maximum tidal water levels have decreased, but the same tidal range has been maintained. This is in line with lower flow rates in the rivers during this period as described in section 2.5.1, which results in a lower base water level before tidal influences are taken into account. With lower flow rates tidal influence will also reach further upstream especially under the influence of onshore winds. The gradient of curves on graphs comparing S-curves for each site show a trend of increasing gradient over time suggesting a decline in the frequency of high water events (see Figure 2.9 and Appendix 1).

The water level that is exceeded for 5% of each year or 95% cumulative percent falls between 1993 and 1994, peaks in 1995 and falls again towards 1997. 1997 recorded the lowest 95 cumulative percent water level for all the tidal gauges (see Table 2.7).

Table 2.7 Annual 95 cumulative percent water level for Broadland tide gauges

Year	5 percentile values at tide gauges			
	Great Yarmouth	**River Bure**	**River Waveney**	**River Yare**
1993	1.9	0.72	1.2	1.1
1994	1.4	0.67	0.93	0.89
1995	1.9	0.79	0.95	1.3
1996	1.5	0.69	no data	no data
1997	1.4	0.60	0.74	0.82

A plot of annual maximum water levels shows that maximum water levels at inland stations closely follow the pattern of annual maxima at the Great Yarmouth gauging station (see Figure 2.10). The maximum water level at Great Yarmouth for 1970 to 1998 (3.029 mODN) was in 1993, coinciding with maxima for the Rivers Waveney and Yare. The maximum water level for the River Bure in 1989 coincides with a gap in maximum data for Great Yarmouth and the River Yare. Two further peaks in water level at Great Yarmouth were recorded in 1976 and 1983, but did not coincide with significant maxima at the inland Broadland gauging stations. The lowest annual maxima were recorded in 1992 and 1997 on the River Bure.

The most significant flood event recorded by the Environment Agency in the last ten years was that of February 1993. The high maximum water level at Great Yarmouth was a result of a 'surge' tide in the North Sea. Local knowledge suggests that the event in February 1993 produced the highest water levels for a number of decades resulting in a long period of high tide throughout Broadland (Scott Wilson, 1998a). According to a resident near Oulton Broad the tidal flood event of 1993 left a higher 'tide mark' on a garage wall than the last major flood event of 1953 (Scott Wilson, 1998a). It was also suggested that daily maximum water levels are not as high as they used to be, but flood events are more extreme (but this has not yet been substantiated). Insufficient HYDROLOG data exists during the flood event of February 1993 to determine the character of the flood event further. Levels are difficult to measure during a flood event, as once a flood bank has been overtopped any further ingress of water will not increase the water level in the river, but will cause more extensive flooding. Above pre-set maximum levels the water level recorders malfunction because the measuring floats tangle up at the top of 'stilling wells'. After such an event water levels are also not recorded during the decline in flood water until the float has been released by hand.

2.5.3 Chemical Water Quality Spot Sampling

Due to the limited number of samples available any conclusions drawn from data analysis must be treated with care. Sampling does not necessarily occur at every high water event and therefore can not give an accurate analysis of the trend in saline intrusion.

For ease of comparison with the results of the Salinity Survey the following relationship between salinity and conductivity has been used:

Salinity (%) = 6.4 x 10^{-5} x Conductivity (μS) (Sutherland, 1998)

This equation becomes less reliable for fresh water where fewer Na and Cl ions exist, for more accurate conversion International Oceanographic tables should be used, but for this analysis the accuracy of this formula is sufficient to define a sample as fresh, saline or within the fresh/saline mixing zone, as set out in Table 2.8.

Table 2.8 Definition of saline and fresh water (Sutherland, 1998)

	fresh water	fresh/saline mixing zone	saline water
Salinity (%)	<0.1	>0.1 & <3.2	>3.2
Conductivity (µS)	<1560	>1560 & <50000	>50000

As would be expected salinity graphs show that percent salinity decreases with distance upstream from the mouth of the River Yare, except for the River Thurne which increases in salinity upstream (see Figure 2.11). The unusual rise in salinity upstream in the River
Thurne? Bure is due to the saline groundwater at the source resulting from the close proximity to the sea. The plots also show that the interface between the saline/fresh mixing zone and fresh water is usually found between sampling sites situated at 20 and 25 km upstream on the Rivers Yare and Waveney and sites only 15 to 20 km upstream in the River Bure. Sampling in the 0 to 10 km zone only occurs on the River Bure showing a higher salinity than is seen on any of the other rivers. Both sampling sites on the River Thurne remain within the fresh/saline mixing zone.

cf Section 14 survey maps

Plots of maximum, mean and minimum values for chloride for the Rivers Bure, Waveney and Yare show that annual minimum chloride levels have stayed relatively constant (see Figure 2.12). Maximum chloride levels have peaks in 1992 and 1997 for the River Waveney and River Yare. Average chloride levels at the A47 Road Bridge (B190) and Acle Bridge (B180) in the River Bure increased between 1988 and 1997, the minimum levels have remained relatively constant. The maximum at Acle Bridge still increased but this is not supported by the salinity/distance upstream graph (see Figure 2.11a), as it is due to a single outlier value. In the River Thurne average chloride concentrations have remained relatively constant for the last five years, but the minimum values appear to show an increase in salinity during the period 1992 to 1998.

2.5.4 Continuous Conductivity Monitoring

The continuous conductivity monitor on the River Bure is located at Acle Bridge about 22 km upstream from the River Yare mouth with the water level monitor. Spot samples show that this site is on the fresh water interface with the fresh/saline mixing zone. Figure 2.13 shows that for the majority of the year the conductivity is less than 1000 µS, at around 700 µS, with a series of high peaks in February (data only available for 1st February to 9th October 1997). The maximum conductivity was 4376 µS on 21st February which was preceded and succeeded by a number of smaller peaks. Figure 2.14 shows the period of 1st May to 31st September demonstrating that during the summer period smaller peaks of up to approximately 1600 µS are experienced. In comparison with flow data the 21st February peak was preceded by a peak in flow up to 3.2 cumecs, but a peak in flow of 4.871 cumecs on 27th June does not coincide with a conductivity peak. The maximum water level during the summer of 0.675 mODN (metres above Ordinance Datum) on 30th June, did not result in a peak in conductivity. Other water level peaks between May and September only had a small, if any, influence on conductivity (see Figure 2.14).

The continuous monitor at Burgh St Peter on the River Waveney is 29 km upstream of the River Yare mouth. As shown in Figure 2.15 the conductivity baseline is measured as approximately 9000 µS to 13000 µS. This is a significantly higher (order of ten) conductivity reading than the spot samples, which suggests that this monitor was out of calibration. It is relatively safe to assume however that similar trends would still be noted. The conductivity on the River Waveney shows a remarkably different plot to that on the River Bure and Yare in that there is a drop in the baseline conductivity from approximately 13000 µS to approximately 9000 µS on 6th May (see Figure 2.15). This is probably due to an attempt at recalibration. The monitor also only shows one major peak on 23rd June with a number of troughs between July and December. Peaks in water level correspond with peaks in conductivity on 6th May and 27th June, but the maximum water level (2nd October) has a trough in conductivity (see Figure 2.16). A scaled up plot of the period between 30th September and 4th October 1997 shows that as water level tidal maxima reach a peak, conductivity shows a similar pattern to the tidal cycle after a delay of approximately one hour (see Figure 2.17a). Figure 2.15 shows peaks in flow (19th February, 1st July and 3rd December) followed by troughs in conductivity approximately three days later. On 20th December, the date of maximum flow, conductivity was not recorded.

On the River Yare the continuous monitor at Cantley has a baseline reading of approximately 500 µS and therefore can be said to be within the fresh water zone (see Figure 2.18). Regular conductivity peaks occur once or twice a month coinciding with spring tides. Higher peaks were experienced in February (28796 µS), but the maximum occurred on 2nd October coinciding with a peak in water level of 1.17 mODN (see Figure 2.19). When the period around this date is scaled up it can be seen that the conductivity peaks occur approximately one hour after the water level peaks (see Figure 2.17b). This plot also shows that conductivity takes a number of tidal cycles to return to the baseline conductivity after a major peak. The other peaks in water levels show a direct relationship with peaks in conductivity and a slow return to the baseline of 700 µS, for example on 27th June and 16th September.

The plot of flow against conductivity shows a relatively constant flow of less than 1 cumecs with four peaks during the year (see Figure 2.18). December shows an unsettled period of high flow, but the annual maximum occurs on 1st July (5.357 cumecs), with no affect on conductivity. Most of the flow peaks are preceded by conductivity peaks.

On 2nd October 1997 the River Yare shows a maximum in conductivity coinciding with the annual maximum water level (see Figure 2.17b). In comparison the River Waveney shows a trough in conductivity on the 2nd October (see Figure 2.17a). The River Bure does not have a record of conductivity during the October peak. Maximum river flows in the Rivers Bure and Yare show very little influence on conductivity, but again conductivity was not recorded during the peak on the River Waveney. The peak in river flow occurs on the River Bure (27th June) three days before that on the Yare and Waveney (1st July). Conversely the tidal water level peak on the 27th June on the Rivers Yare and Waveney is not seen on the River Bure until the 30th June. The peaks in conductivity around this period occur on River Bure on the 19th June (see Figure 2.20a), but not until 24th June on the Rivers Waveney (see Figure 2.20b) and Yare (see Figure 2.20c). This shows that under both high flow and high tidal water level conditions the flashy River Bure has a shorter lag time of three to five days after the event than the Rivers Waveney and Yare.

2.5.5 Fish Kill Events

Fish kill data collected from the Environment Agency was divided into events linked with saline intrusion and others (e.g. spawning, pollution, unknown). All the events were given a size classification (as none previously existed) for convenient mapping, dependent on the number of fish deaths recorded as shown in Table 2.9. Figure 2.21 shows the location and size class of all the saline induced fish kills recorded.

All the saline incursion fish kill events noted by the Fisheries Department occurred in the winter period of September to February (see Table 2.9). The majority of these events were noted in the River Thurne: there were three separate incidents reported in 1990, three in 1991, none recorded in 1992 and two in 1993 of various sizes. Until 1993 all of the fish kills on the Thurne were recorded at or near Potter Heigham. In February 1993 saline intrusion only reached Womack Water near Ludham, but still resulted in a significantly large fish kill. No fish kills have been recorded in the River Thurne since 1993.

Table 2.9 Classification of fish kill events

Number of fish deaths recorded	Classification
1-30 (or unknown)	Small
31-300	Medium
301-3000	Large
3001+	Very Large

The Fisheries Department have operated a saline barrier at Potter Heigham to protect fish during saline incursion since the mid 1980s. The original barrier took up to three hours to install, by which time the highest tide may have passed and incursion could already be upstream of the barrier (Fisheries Department, Norwich *pers. comm.*). In 1993 this was replaced by a smaller, lighter version which is lifted quickly when conductivity reaches, or is expected to reach, 15000 µS. Since the introduction of the new barrier in the River Thurne no major fish kills were reported between 1993 and 1997.

Fish kills were recorded on the River Ant on two occasions, a large one in 1990 and a small one in 1991, both coinciding with events on the River Thurne. Only one large fish kill event was recorded on the River Chet in 1993. The River Bure has recorded fish kills in every year except 1991. The largest event in 1997 was the largest recorded on any river, with over 30,000 fish lost at Upton Dyke. This coincides with the high water levels and peak in conductivity recorded during the end of September and beginning of October 1997. As can be seen from Table 2.9 fish kills are not necessarily characterised by extreme high or low flows. Only two events in 1990 coincide with flows which occur less than 5% of the period 1980 to 1997. All the events in 1993 and 1996 were recorded after high recorded water levels. For the other events prior to 1993 tidal water levels have not been analysed for this project.

Under similar flooding conditions in the summer no fish kills are reported. This is because fish are more active during the summer months and can swim away from the saline water incursion, whereas in the winter fish tend to be sheltering in the calmer water of marinas. For example at Woods Boatyard fish can be are easily trapped by salt plugs. These are areas that are not flushed as regularly as the rivers by tidal action and retain saline conditions for a longer period resulting in a high number of fish deaths.

Table 2.10 Fish kills due to saline intrusion, minimum flow and maximum water level during preceding week on the River Bure

Date	Location	River	Size of fish loss		Minimum flow at Horstead Mill		Maximum water level at Acle Bridge (mOD)
			number	class	cumecs	Percentile	
20/09/90	Broadland Rivers	All	2500	Large	0.236	98.6	/
02/10/90	South Walsham Broad	Bure	300	Medium	0.404	98.4	/
02/10/90		Thurne	20	Small	0.404	98.4	/
13/12/90	How Hill	Ant	3000	Large	1.506	76.1	/
13/12/90	Potter Heigham	Thurne	200	Medium	1.506	76.1	/
19/10/91	How Hill	Ant	25	Small	1.175	90.7	/
19/10/91	Woods Boatyard	Thurne	1000	Large	1.175	90.7	/
06/11/91	Woods Boatyard	Thurne	10	Small	1.616	69.8	/
21/12/91	Woods Boatyard	Thurne	50	Medium	1.426	80.6	/
12/01/93	Woods Boatyard	Thurne	20	Small	2.033	46.0	0.807
22/02/93	Horning	Bure	500	Large	1.551	73.5	1.088
23/02/93	Womack Water	Thurne	1500	Large	1.551	73.5	1.088
25/02/93	Hardley Flood	Chet	350	Large	1.551	73.5	1.088
16/09/94	Acle	Bure	100	Medium	1.847	65.4	/
13/09/96	Acle - Upton Bridge	Bure	?	Small	1.239	88.9	0.763
02/10/97	Upton Dyke	Bure	30-40,000	Very Large	1.234	89.1	/

2.5.6 Flood Events

The following dates have been identified as possible flood events as two or three of the rivers show peaks in fluvial flow, tidal water level and/or conductivity. They have been defined as fluvial, tidal or combined by the nature of these peaks.

- 19th to 21st February 1997 — fluvial
- 5th to 9th May 1997 — combined
- 28th June to 1 July 1997 — combined
- 25th to 26th July 1997 — fluvial
- 16th to 18th September 1997 — tidal
- 2nd October 1997 — tidal
- 9th to 13th October 1997 — combined
- 12th December 1997 — tidal

This shows a total of eight possible flood events: three tidal, one fluvial and the rest combined. The 'tidal flood event' of 2nd October resulted in a very large fish kill.

During 1997 the Environment Agency issued only one amber flood warning and no red warnings (*pers. comm.* Environment Agency). The amber warning was for a fluvial flood event on 19th December 1997. None of the above identified events resulted in significant flooding in Broadland.

2.6 Conclusions

In all the river characteristics studied the Rivers Waveney and Yare show a similar reaction to both fluvial and tidal events. Since both have wide, relatively shallow channels on a clay/chalk catchment, they are less flashy than the River Bure. The River Bure has a faster response to rainfall and hence high flow events because of its narrow, meandering channel on a porous catchment basin. The similarity in conditions of the River Waveney and Yare is a useful comparison to make for future analyses of the effects of flood alleviation strategies being employed on the River Yare.

A decline in maximum water levels was noted during the period studied, but, since recorders have difficulty measuring extreme water level events, this may not be an actual trend. Also the low base flows measured combined with a relatively constant tidal range would produce lower maximum water levels.

Low base river flows during the period studied, resulting from low rainfall, have given ideal conditions for saline incursion further upstream, especially during high maximum tidal water level events. A general trend in this direction is noted from the water quality spot samples, but this is only a perceived trend, as yet it cannot be supported statistically, due to the nature of the sampling regime, therefore further analysis is required of future data to discern a trend.

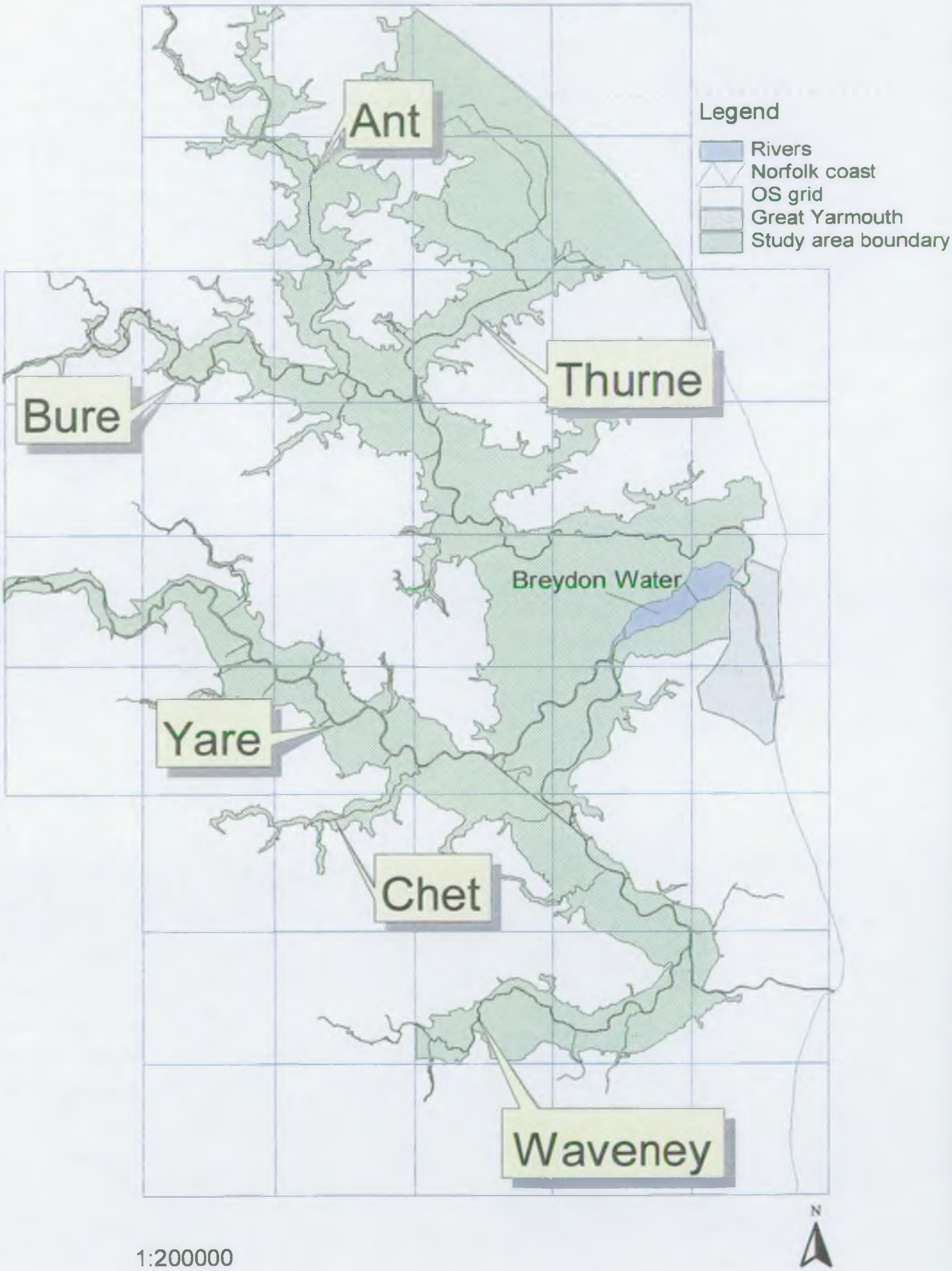
The conductivity monitors did not record significant long term saline incursion, but show that periodic tidal induced incursion is a regular occurrence on the Rivers Bure and Yare, with comparison to future data, significant trends can be noted. The unreliable monitor at Burgh St Peter on the River Waveney suggests that this monitor is not yet regularly affected by saline incursion, rather peaks in water levels produce a dilution effect reducing conductivity at the monitor.

The introduction of a lighter salinity barrier in the River Thurne has significantly reduced the number of fish deaths, but is unable to prevent fish deaths through saline incursion in the River Bure. The sudden very large event in 1997 supports the theory that saline incursion is reaching further upstream during extreme high water level events.

2.7 Recommendations

- Organise automatic transfer of data from Environment Agency to enable more up to date analyses.
- Increase frequency of water quality spot sampling to at least one sample month for all sites. For sites within the limit of the saline wedge more frequent sampling would allow frequency of maximum innundations to be assessed.
- Regular calibration of continuous conductivity probes to ensure accurate recording of saline intrusion.
- Extend period of analyses to 10 year data set , if possible, in all aspects to improve statistical results.

Figure 2.1 - Map showing the main rivers in Broadland



1:200000

Figure 2.2 - Location of continuous monitoring sites for conductivity, flow, precipitation, and water-levels.

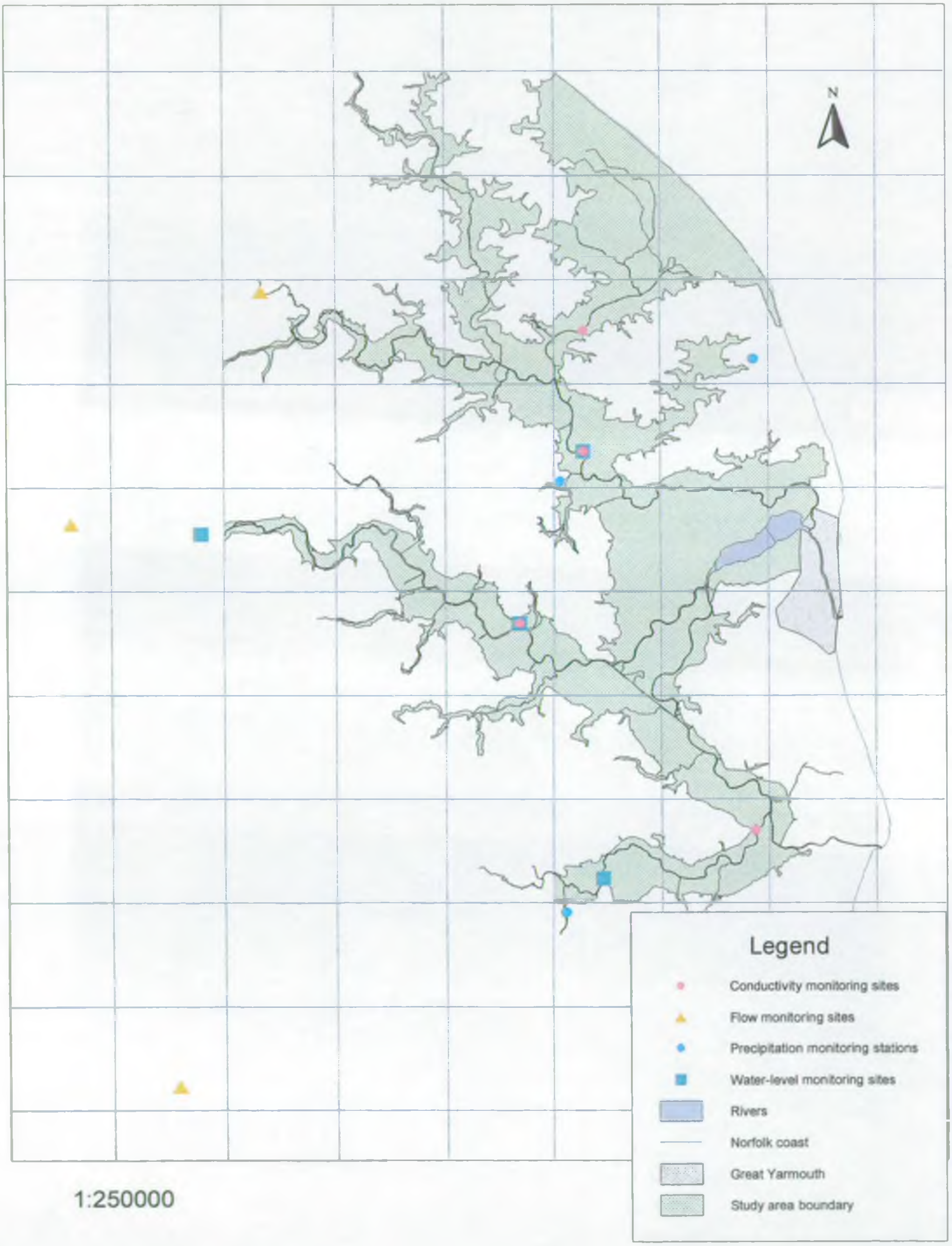


Figure 2.3 - Location of chemical water quality spot sampling sites.

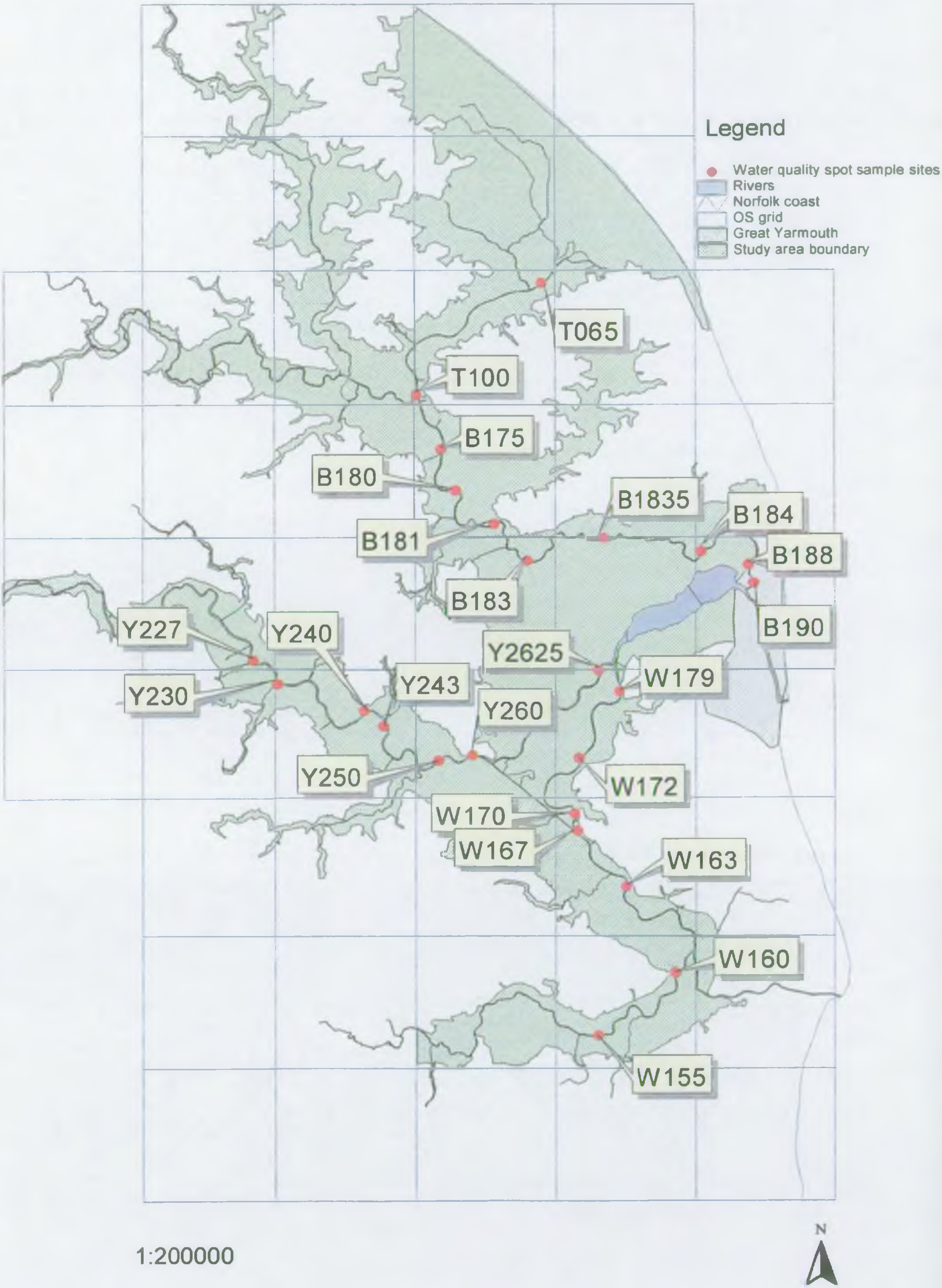
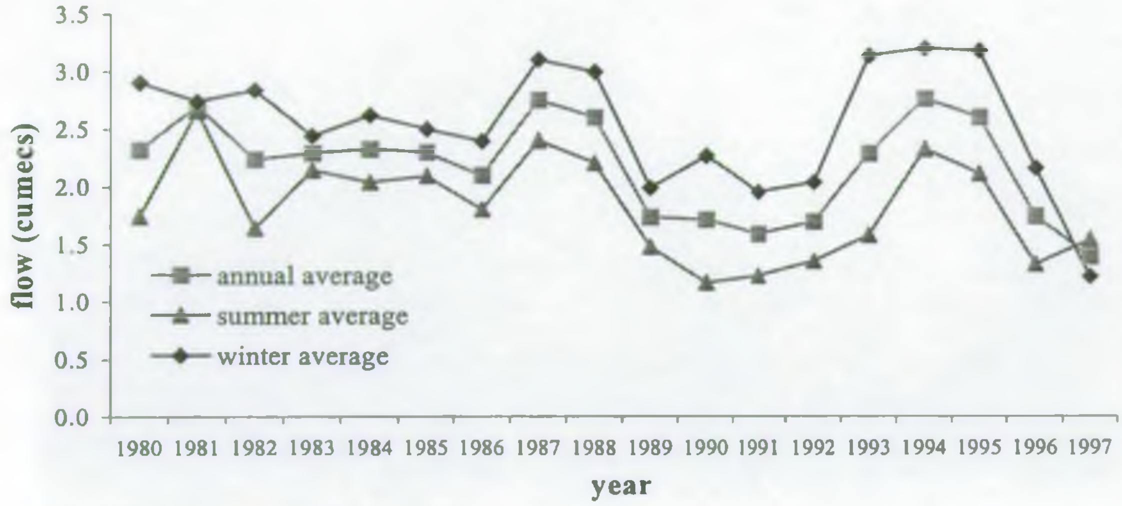
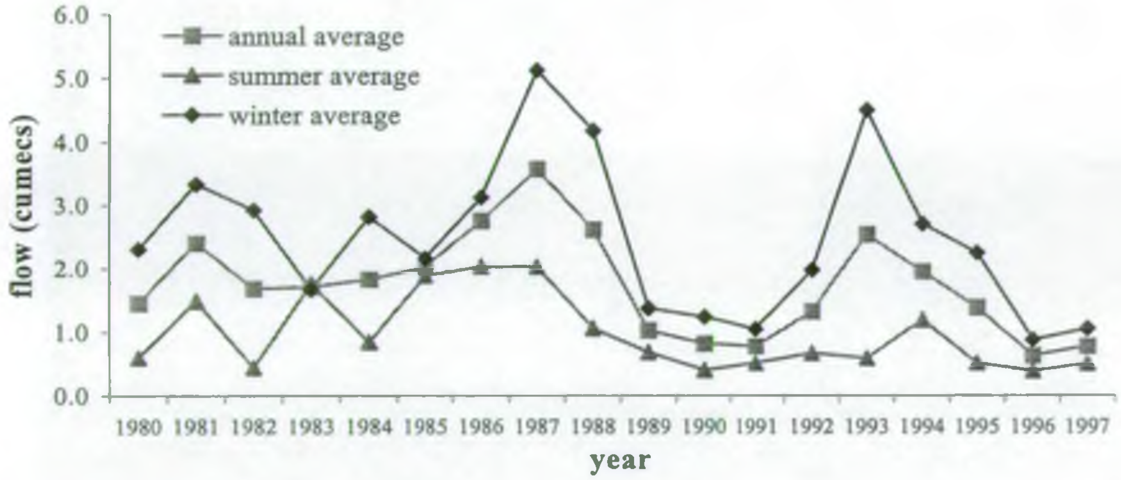


Figure 2.4 Annual, summer and winter average daily mean flow for the main Broadland rivers

a) Acle, River Bure



b) Needham Mill, River Waveney



c) Colney, River Yare

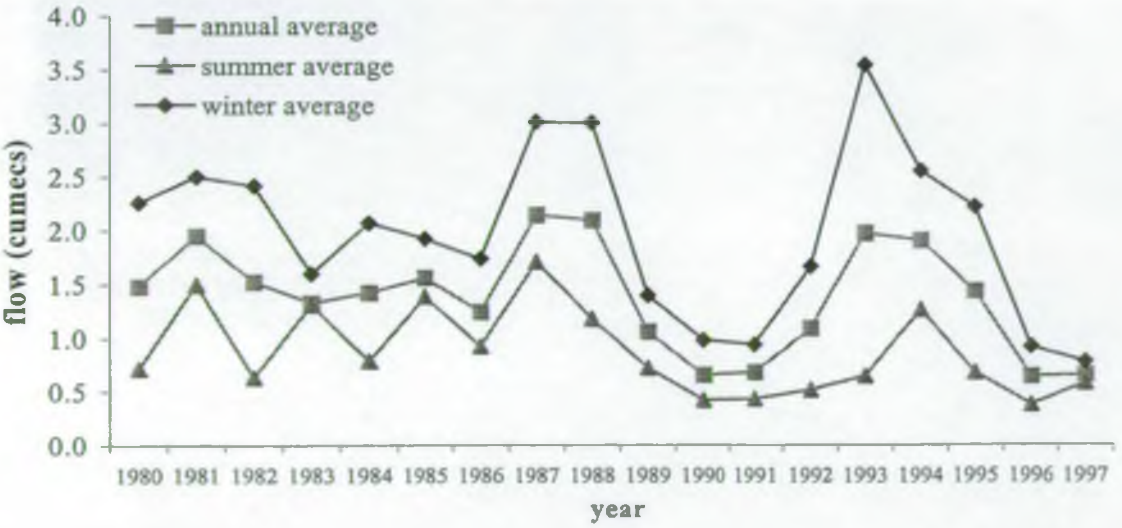


Figure 2.5 Annual precipitation at Hemsby 1980 to 1992, Acle 1993 to 1998 and Barsham Water works 1980 to 1992

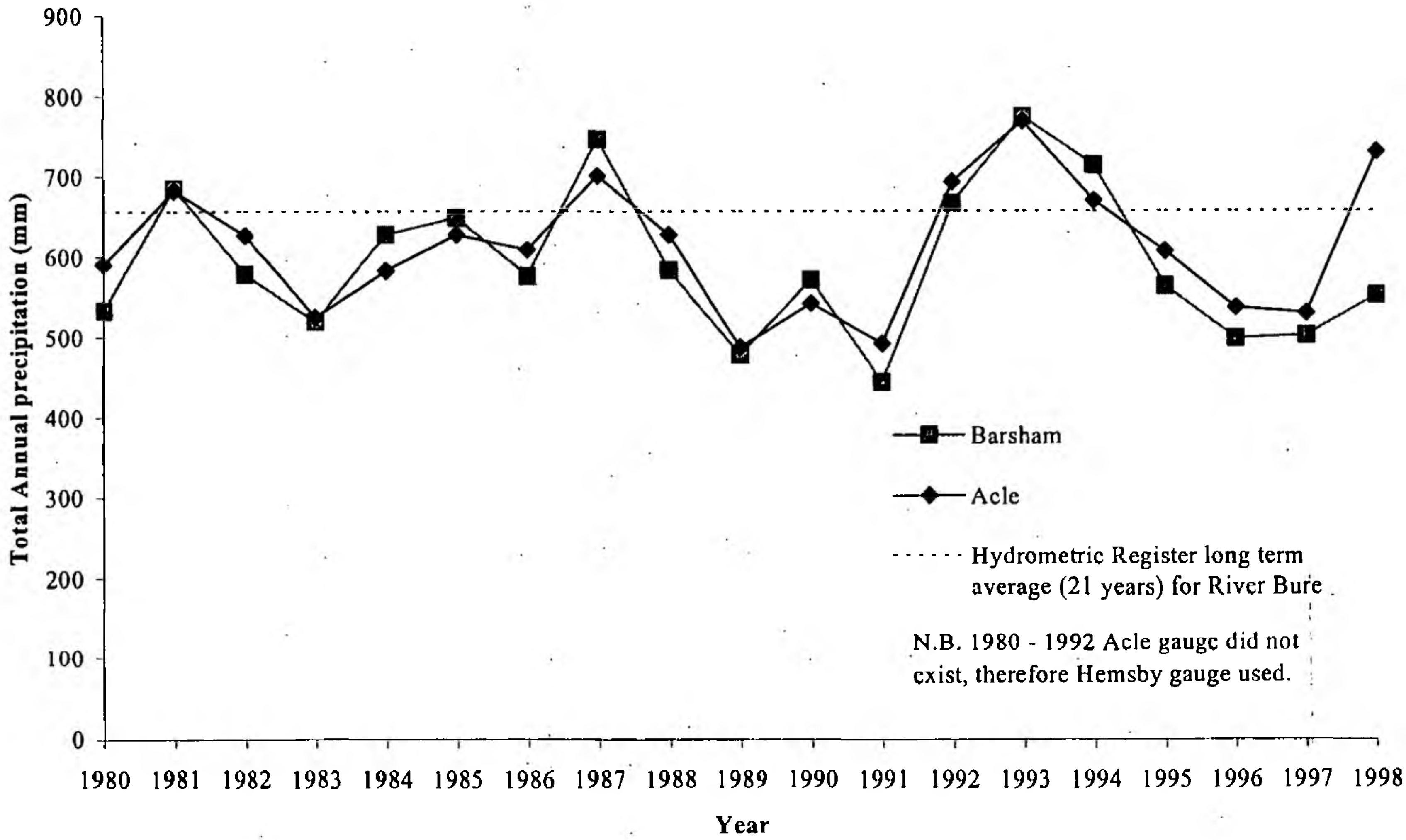
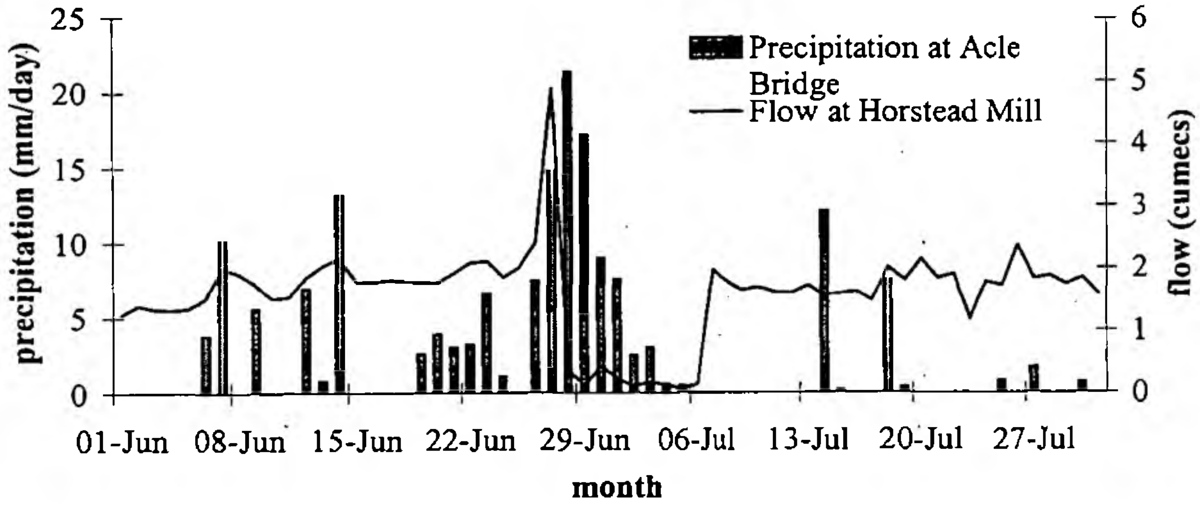
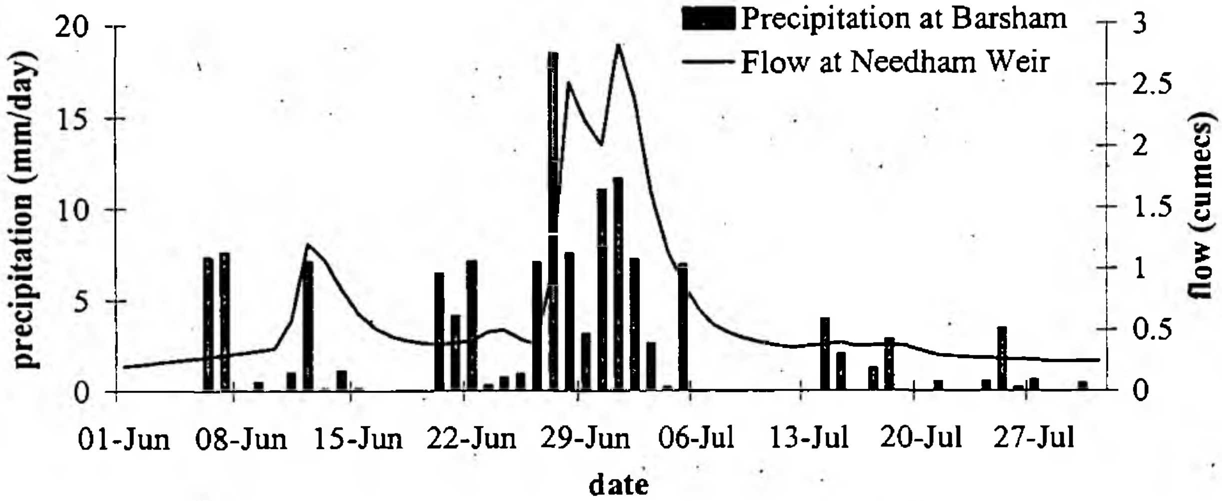


Figure 2.6 Flow and precipitation for main Broadland rivers for 1 June to 31 July 1997

a) River Bure



b) River Waveney



c) River Yare

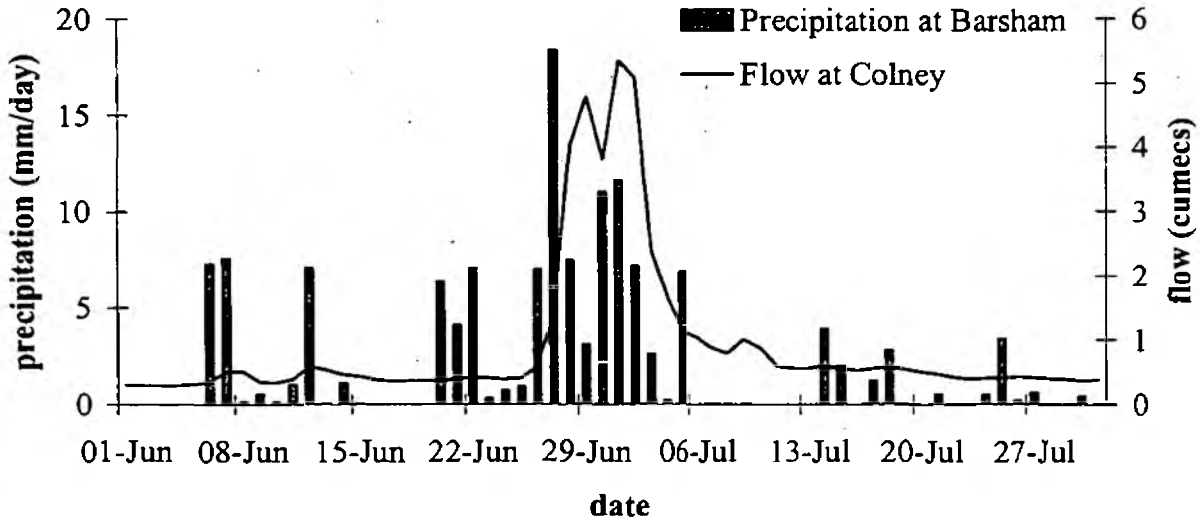
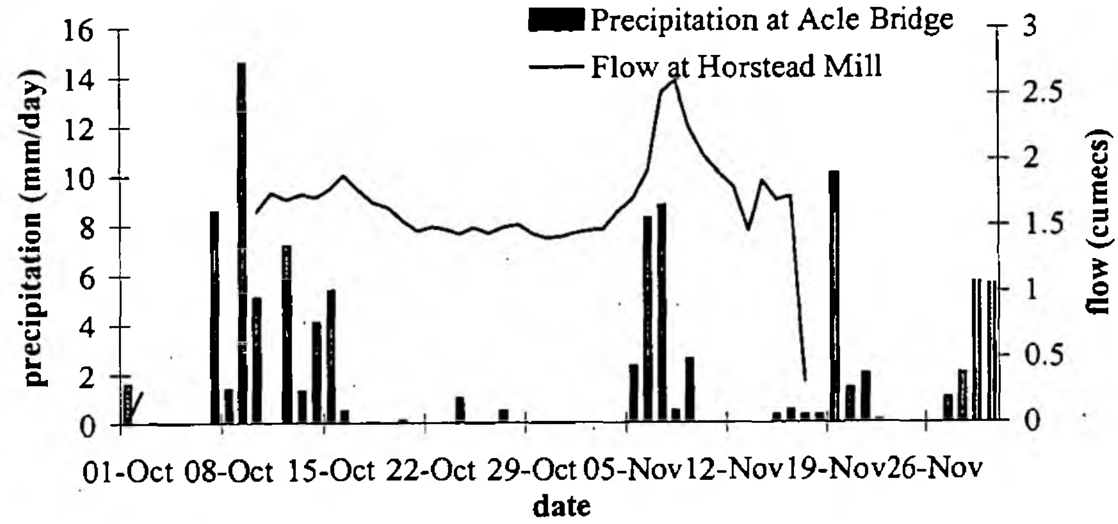
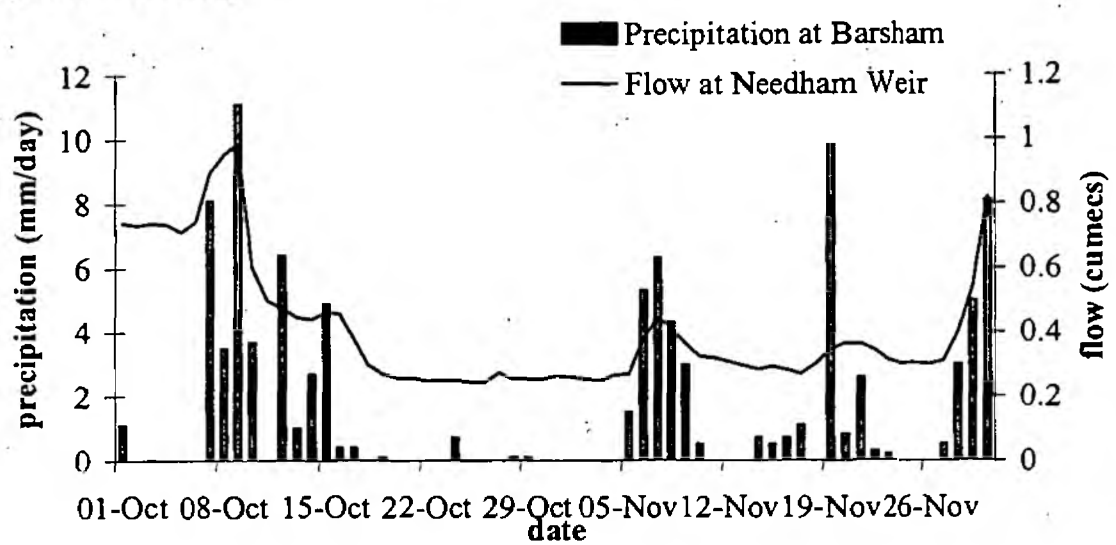


Figure 2.7 Flow and precipitation for main Broadland rivers for 1 October to 30 November 1997

a) River Bure



b) River Waveney



c) River Yare

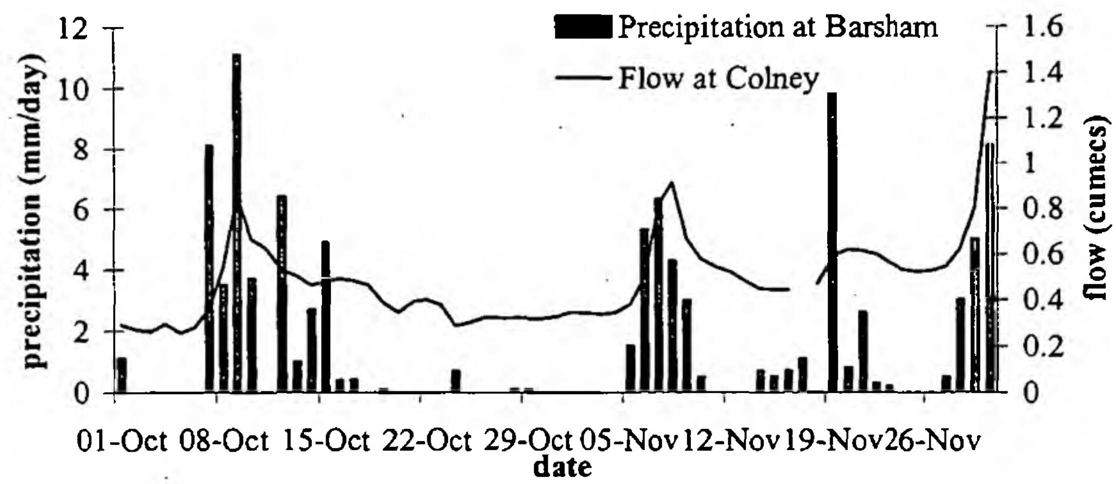
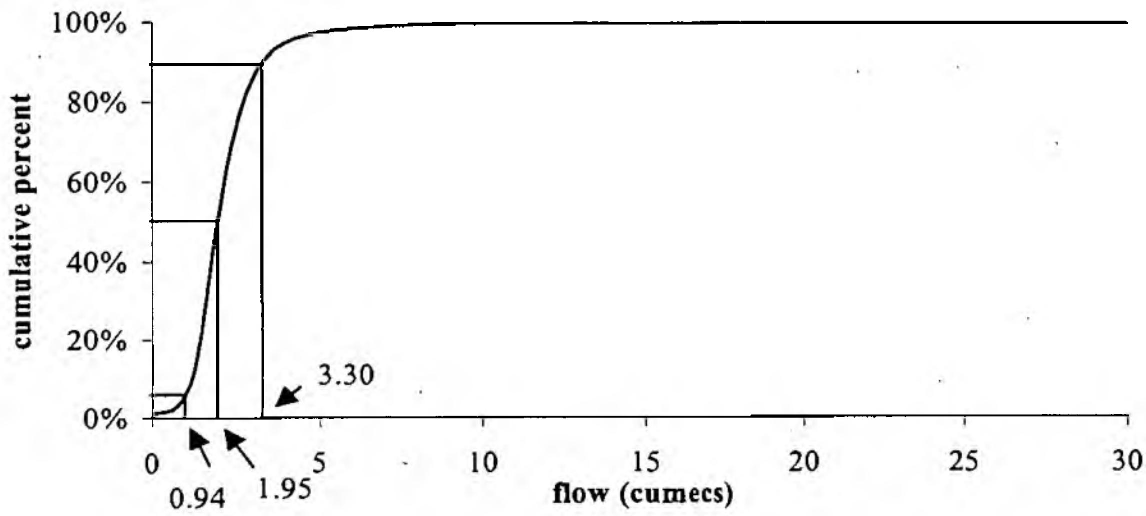
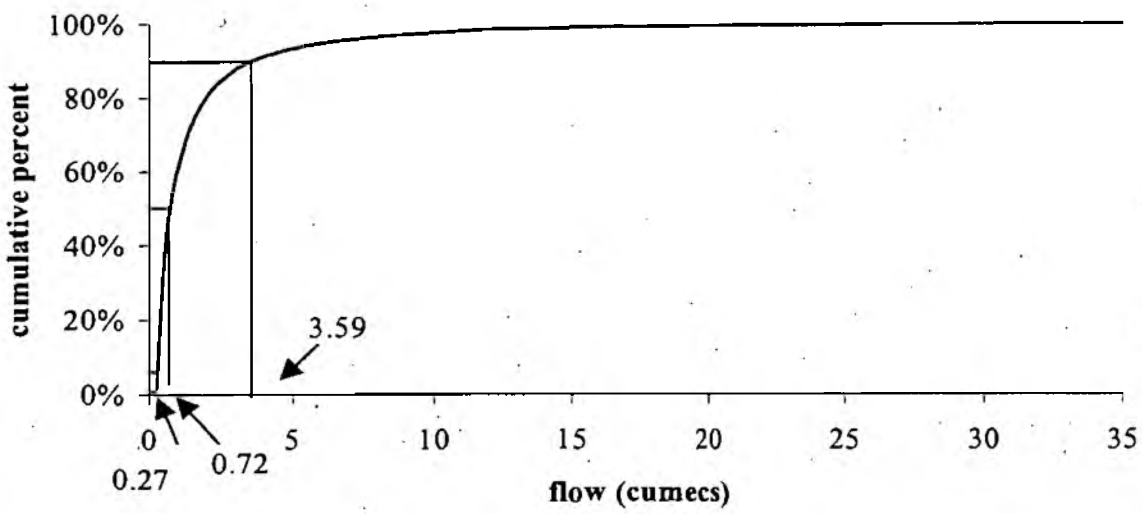


Figure 2.8 Cumulative probability curves for flow on Broadland rivers for 1980 to 1997

a) Horstead, River Bure



b) River Waveney



c) River Yare

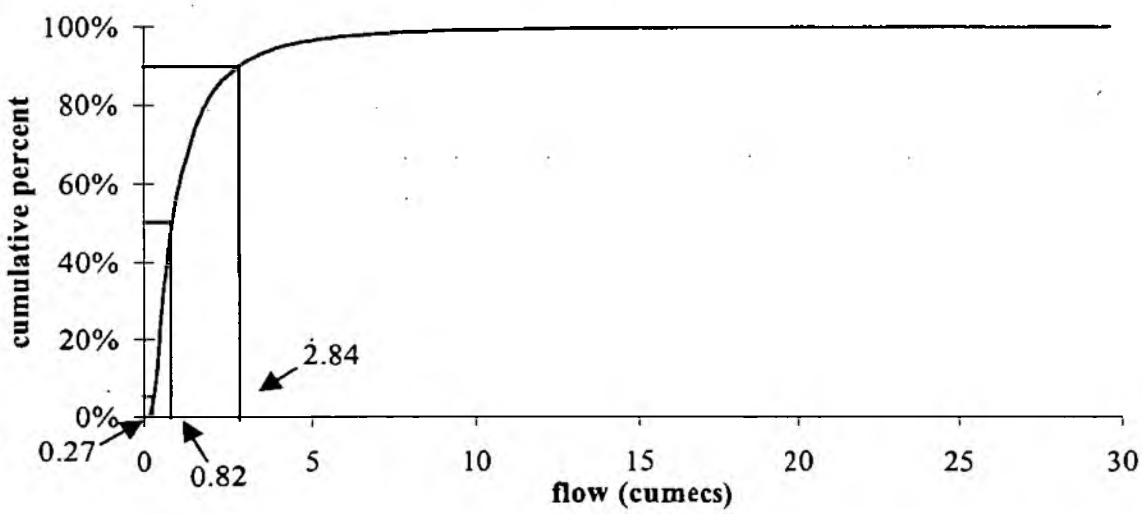


Figure 2.9 Cumulative probability curve comparison for Acle Bridge, River Bure

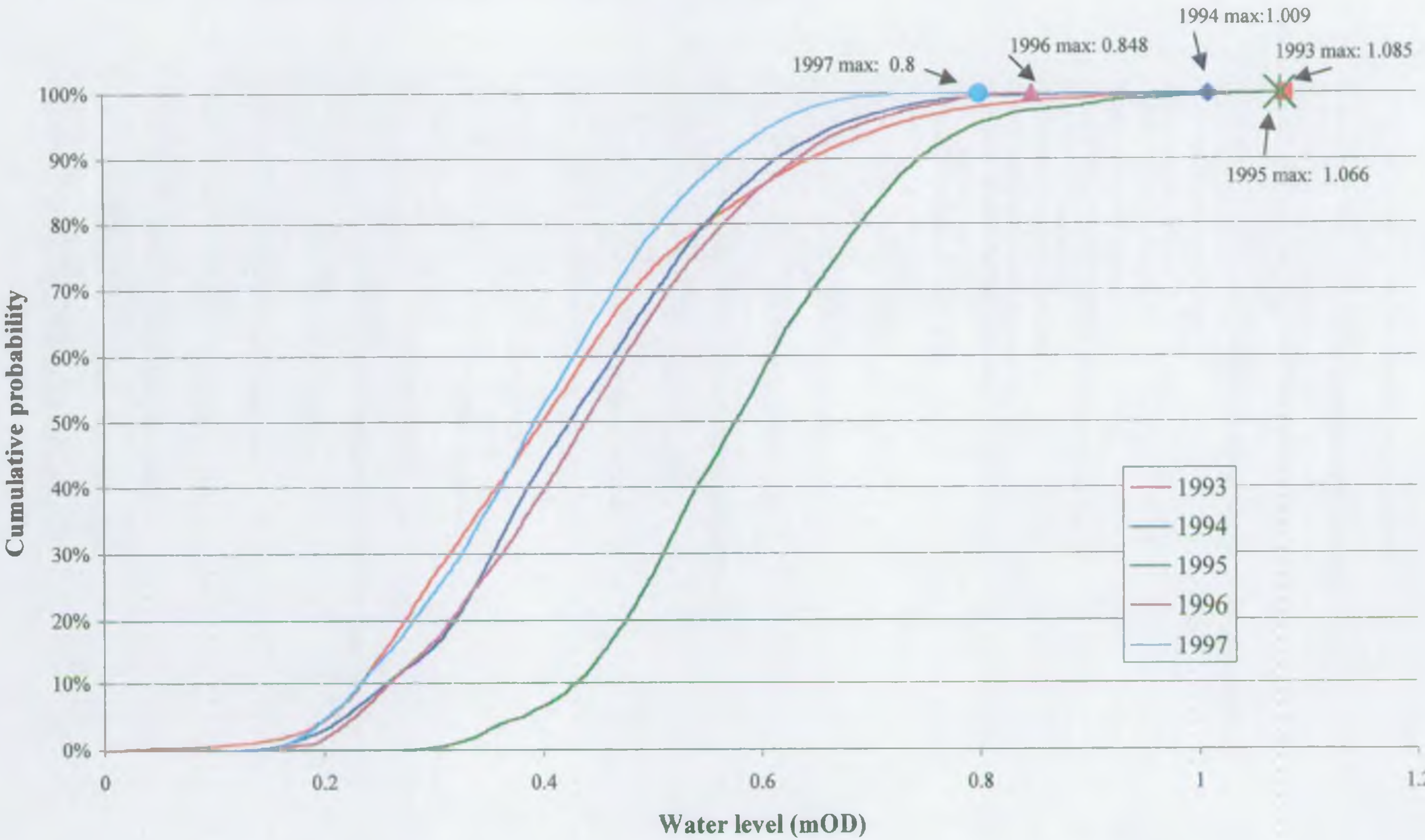


Figure 2.10 Annual maximum water levels at gauging stations in Broadland

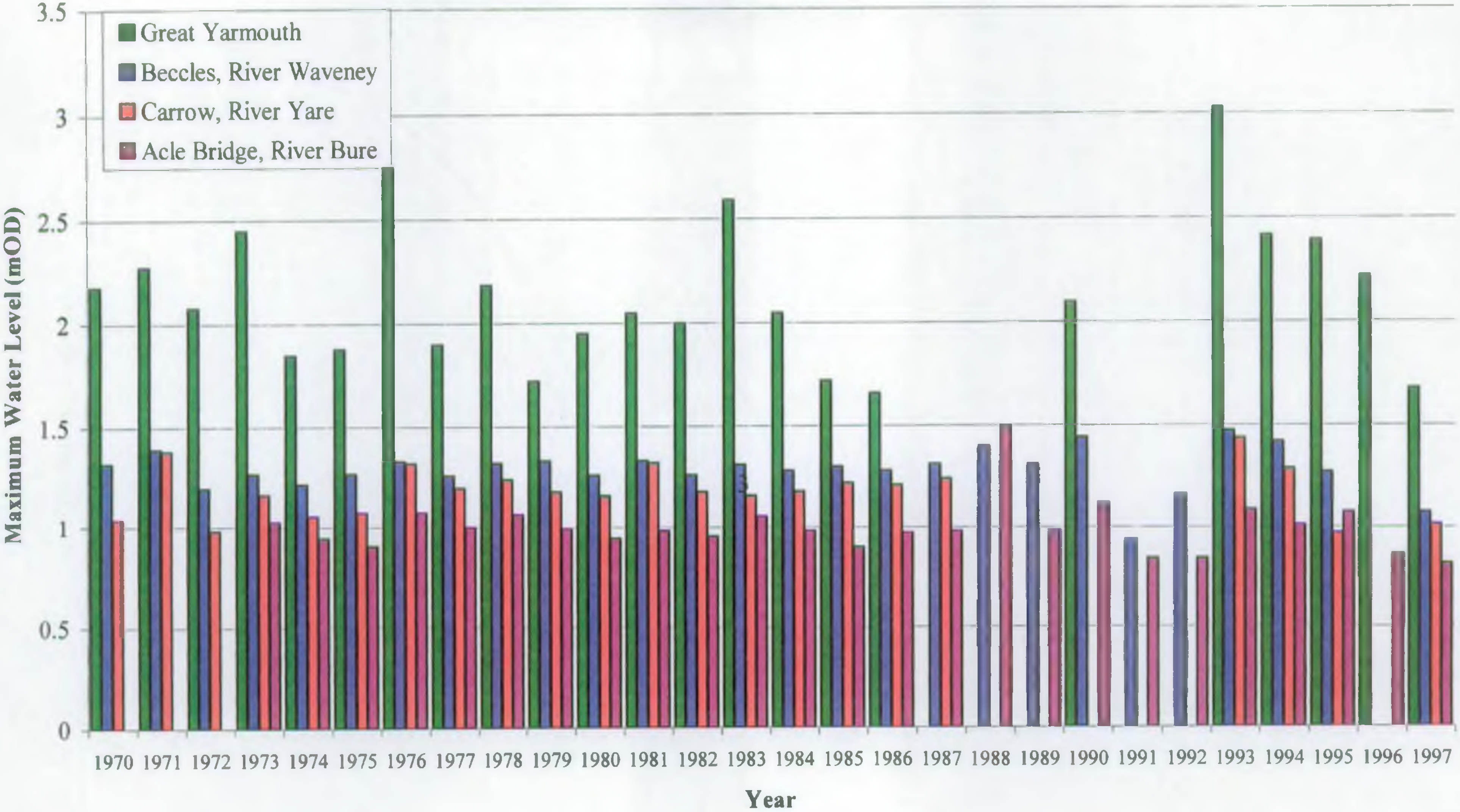
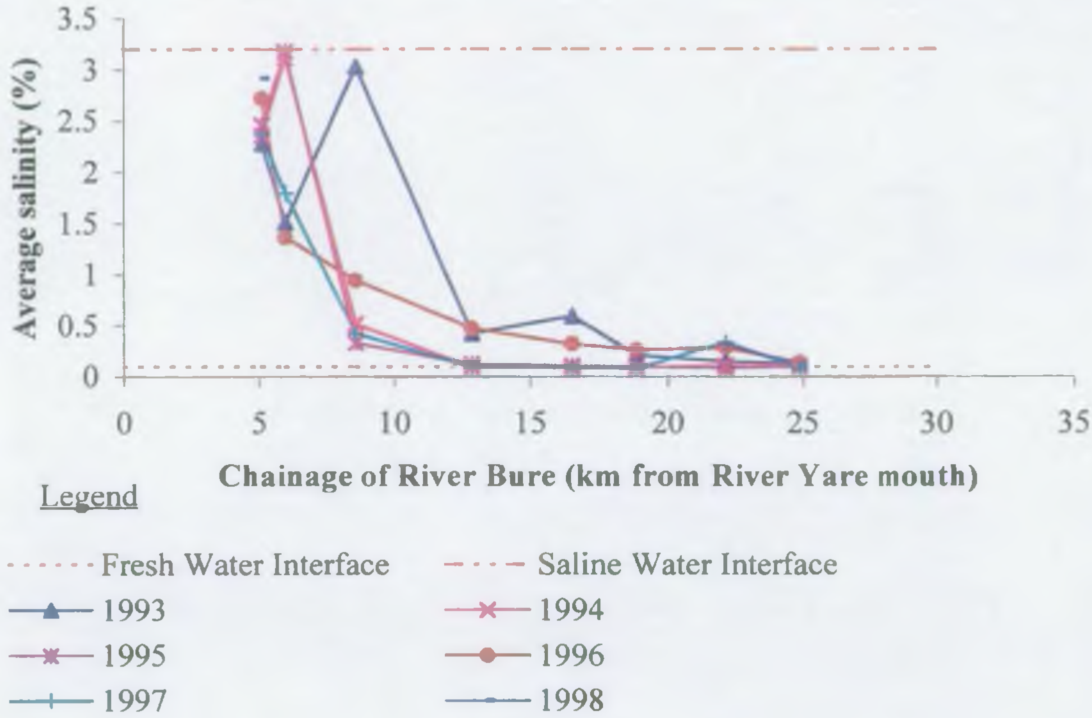


Figure 2.11 Average salinity of Broadland Rivers (based on average of water quality spot sample results)

a) River Bure



b) River Thurne

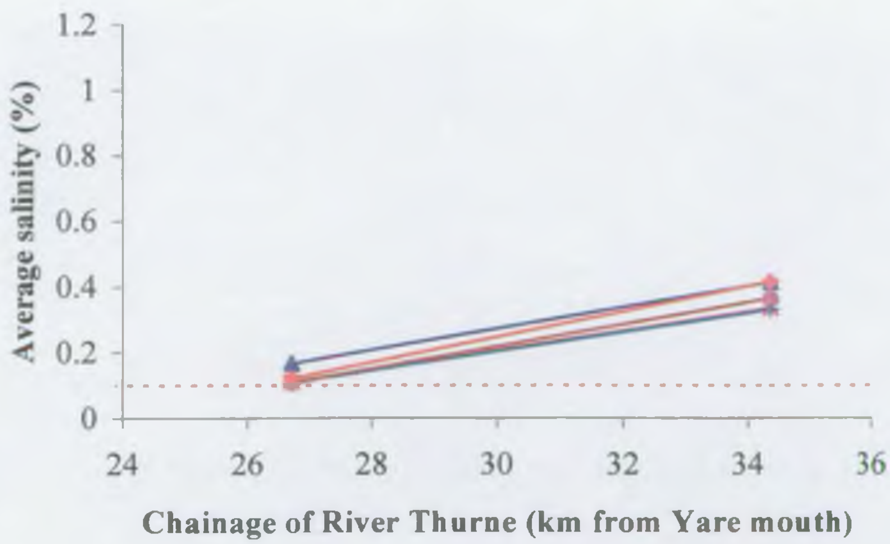
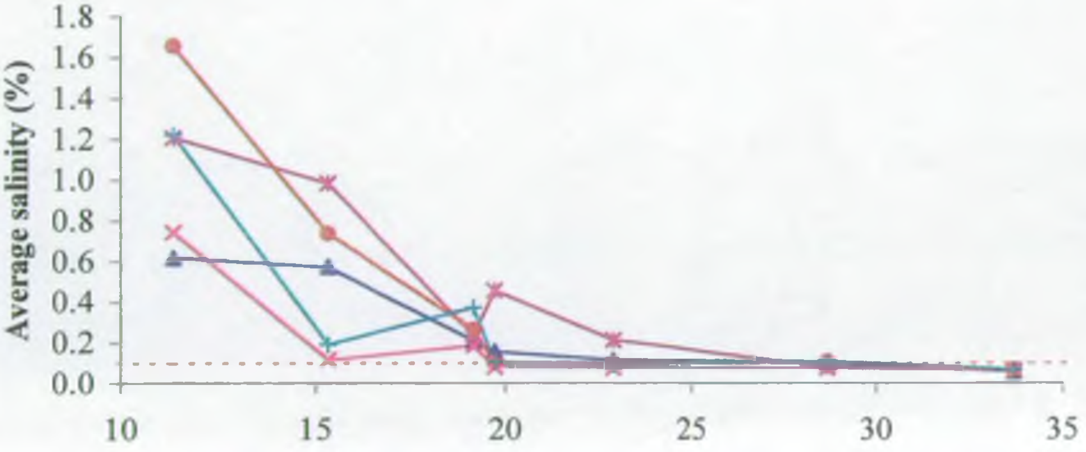


Figure 2.11 cont.

c) River Waveney



Legend

- - - - - Fresh Water Interface
—▲— 1993
—✕— 1994
—✱— 1995
—●— 1996
—+— 1997

d) River Yare

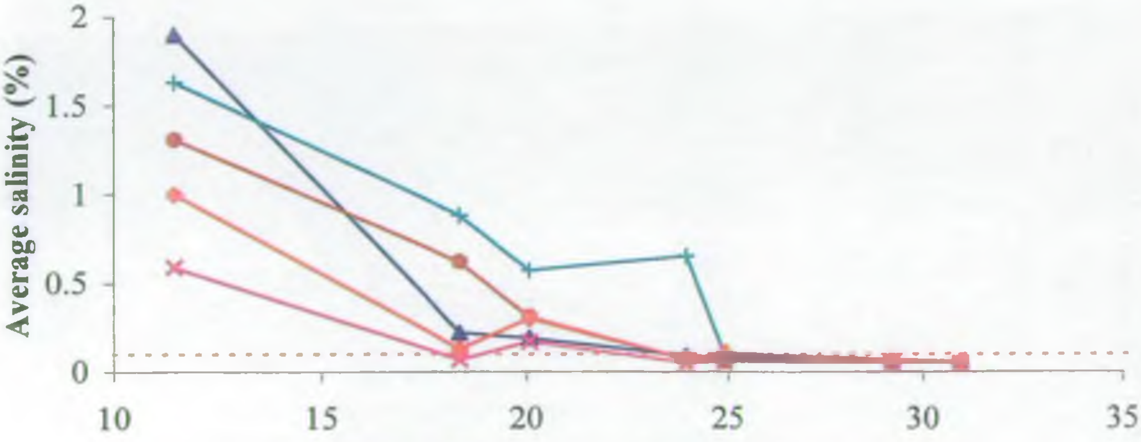
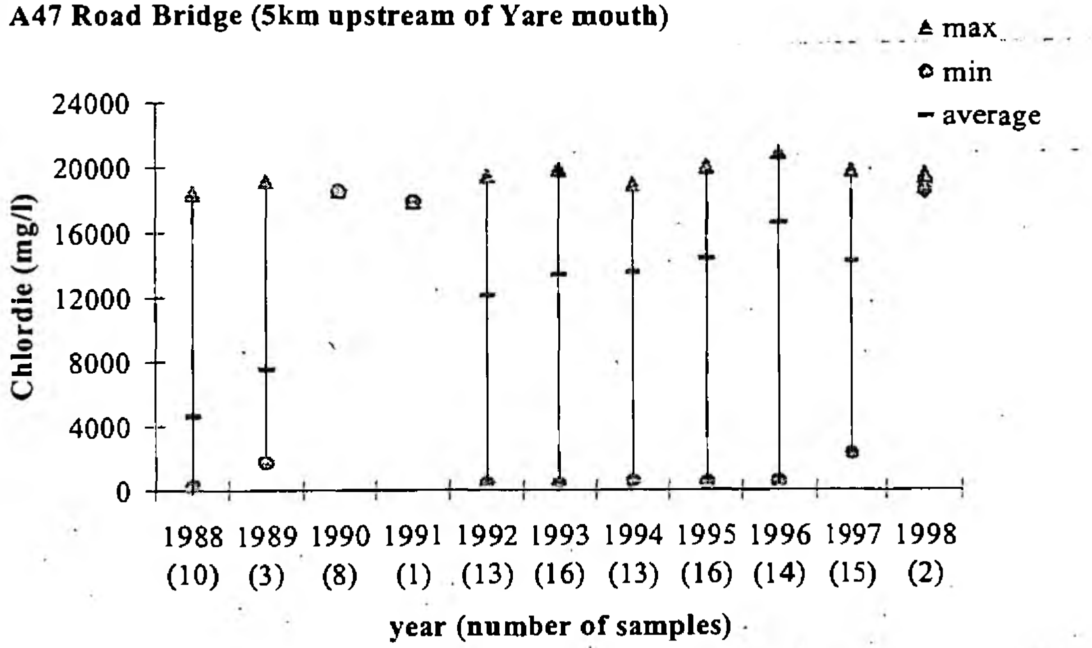


Figure 2.12 Chloride range of water quality spot samples taken from Broadland rivers

a) **River Bure**

1) A47 Road Bridge (5km upstream of Yare mouth)



2) Acle Bridge (22 km upstream of Yare mouth)

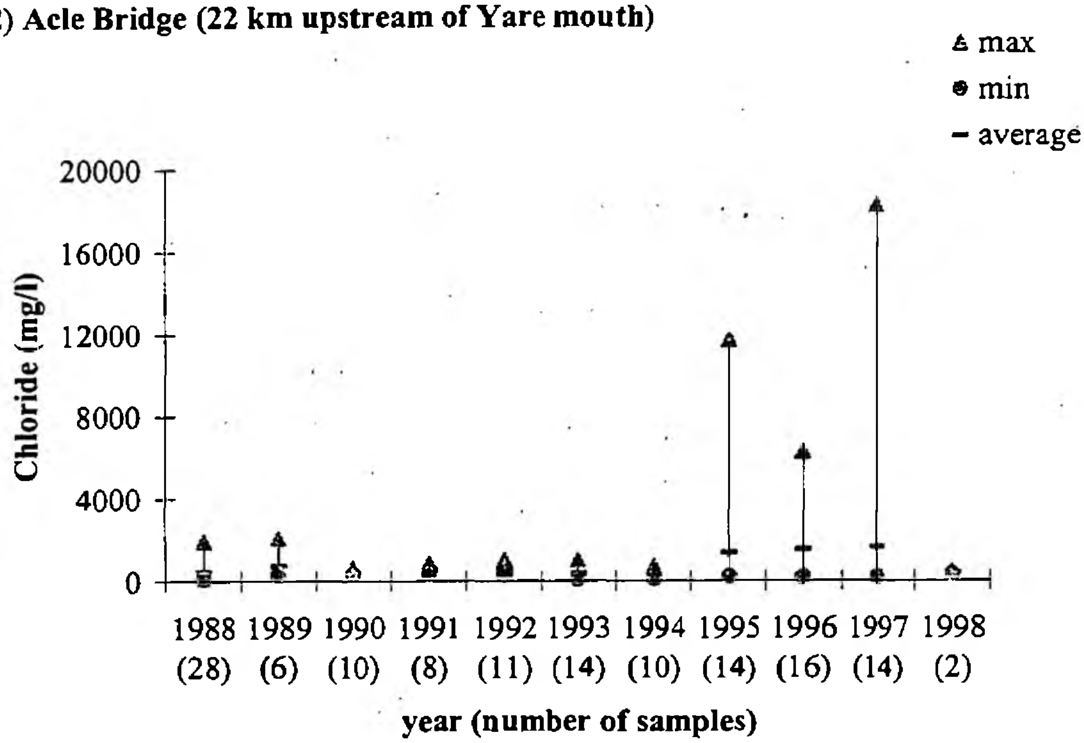
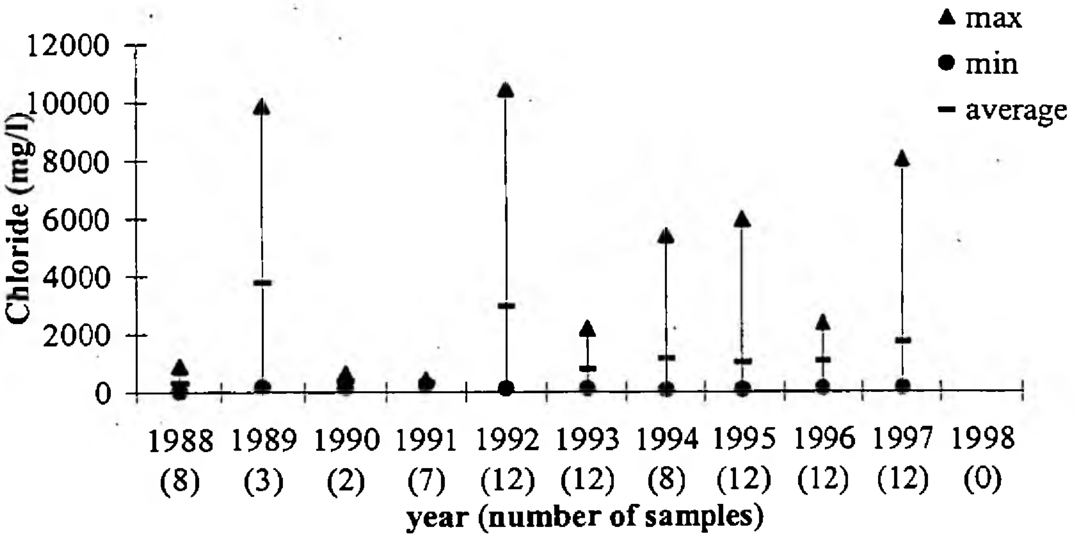
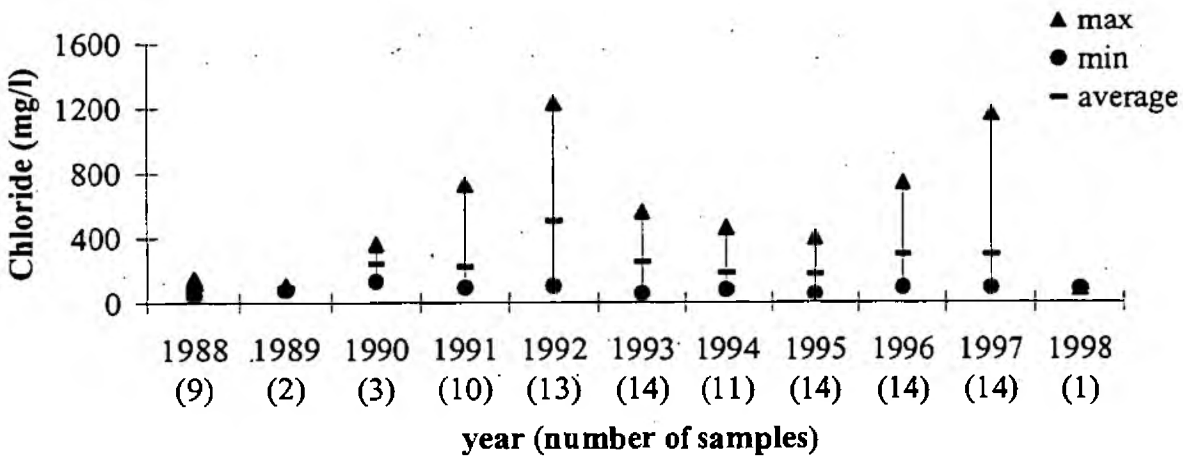


Figure 2.12 cont.
b) River Waveney

1) St. Olaves Bridge (19 km upstream of Yare mouth)



2) Burgh St. Peter (29km upstream of Yare mouth)



c) River Thurne

1) Martham Ferry (34 km upstream of Yare mouth)

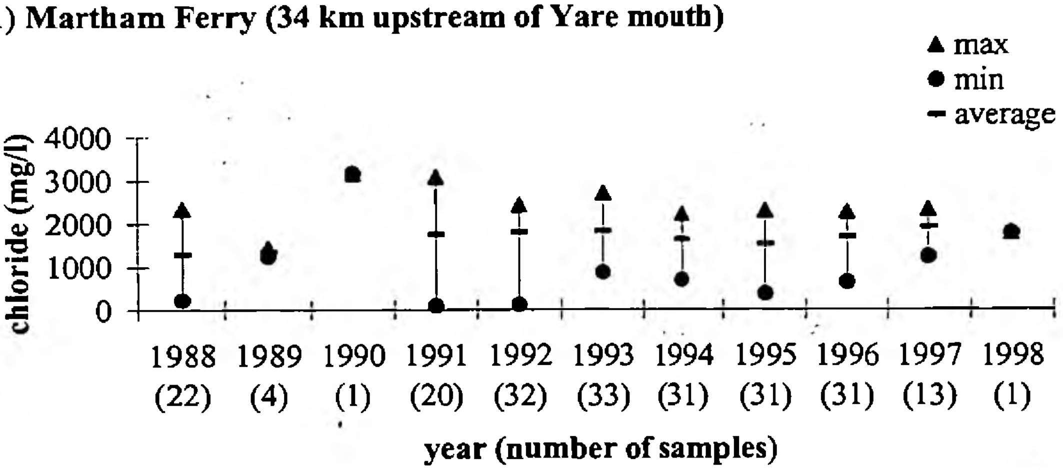
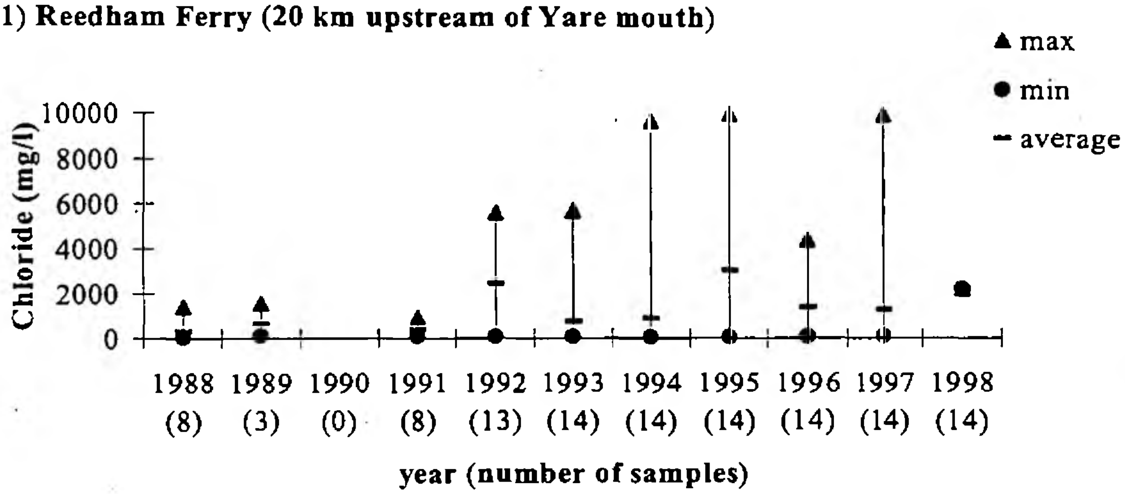
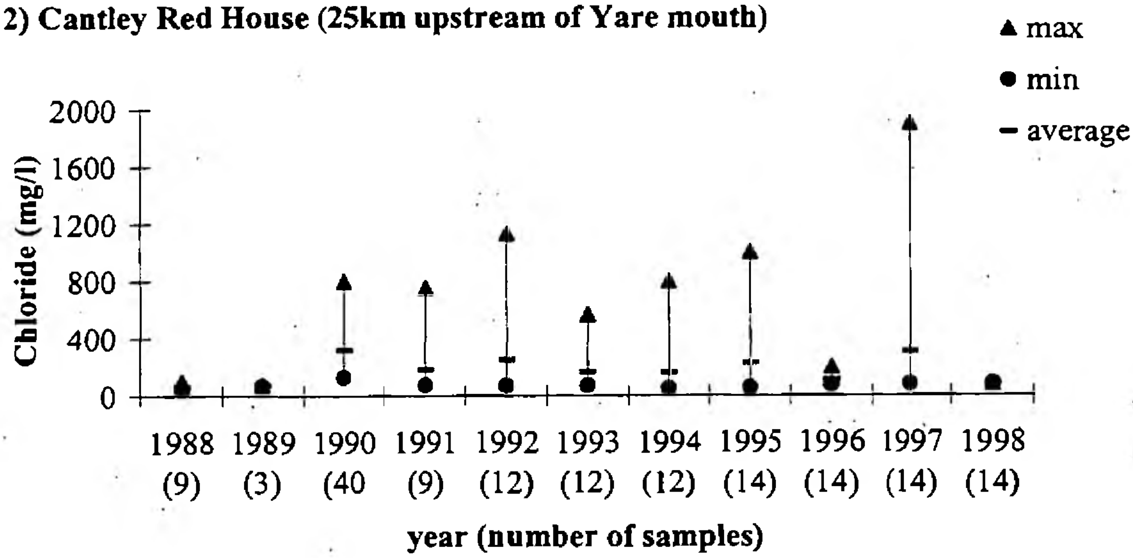


Figure 2.12 cont.
d) River Yare

1) Reedham Ferry (20 km upstream of Yare mouth)



2) Cantley Red House (25km upstream of Yare mouth)



3) Buckenham Ferry (20 km upstream of Yare mouth)

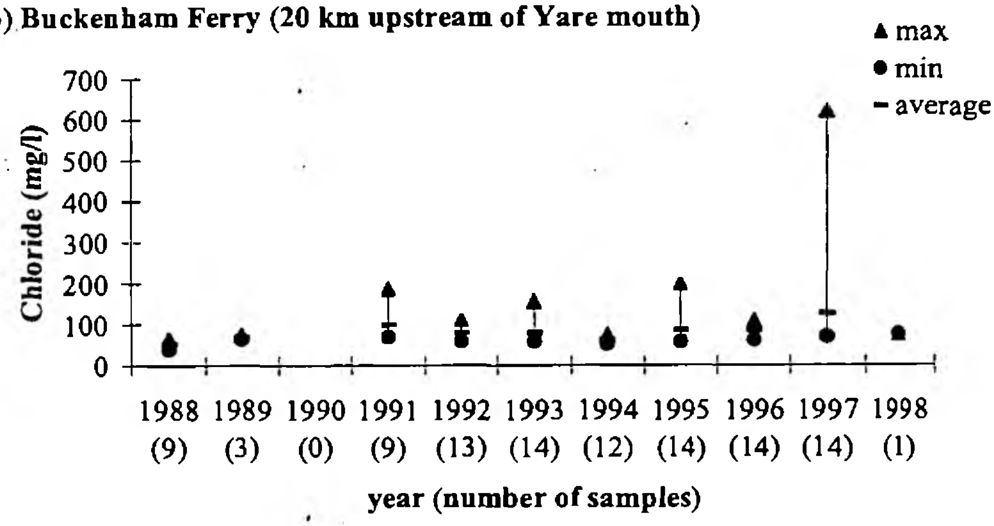


Figure 2.13 Hourly conductivity monitor readings at Acle and average daily flow at Horstead on the River Bure for 1997

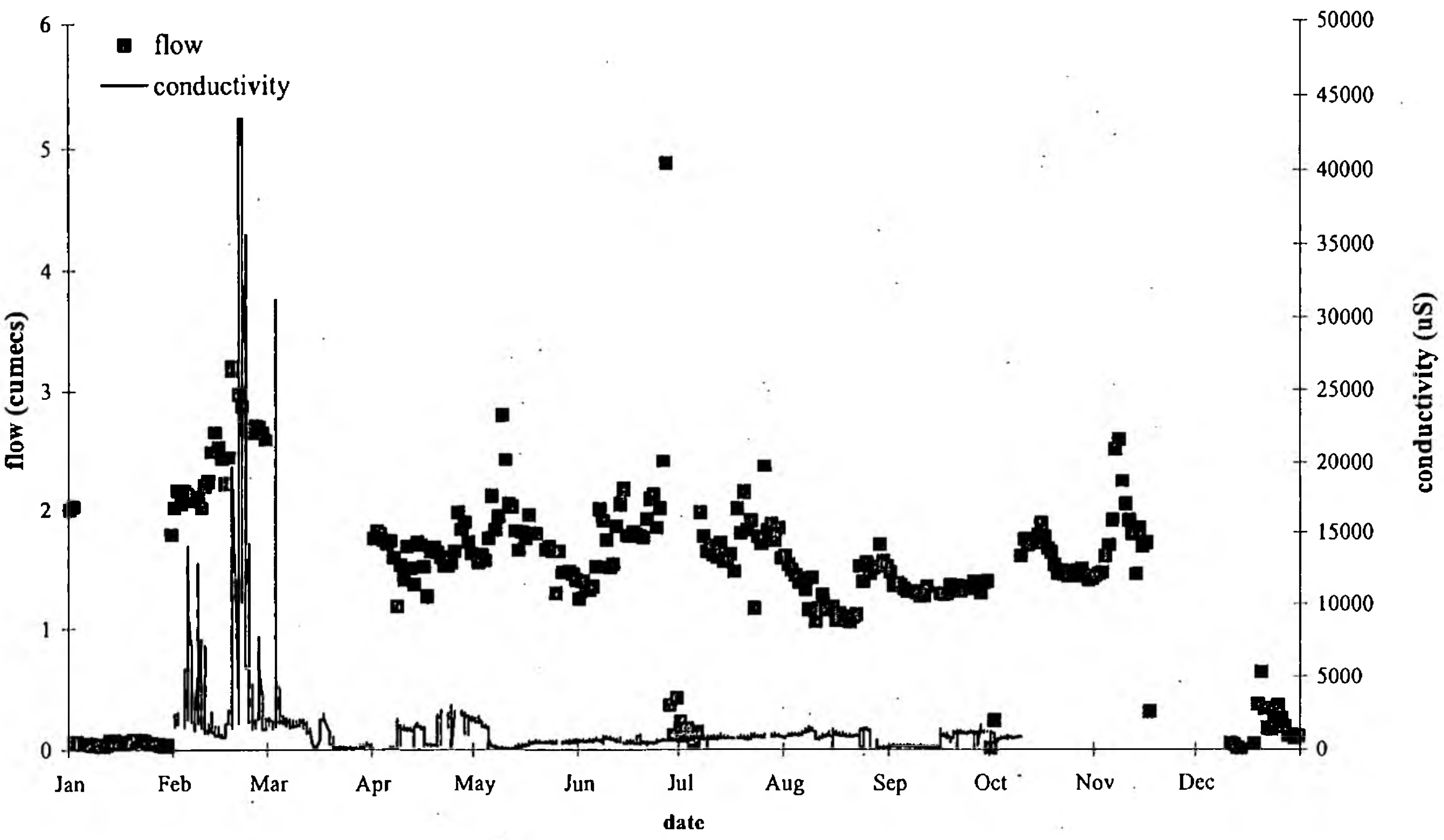


Figure 2.14 Continuous conductivity monitor readings and maximum water levels per tidal cycle at Acle Bridge, River Bure for 1997 (where coinciding data exists)

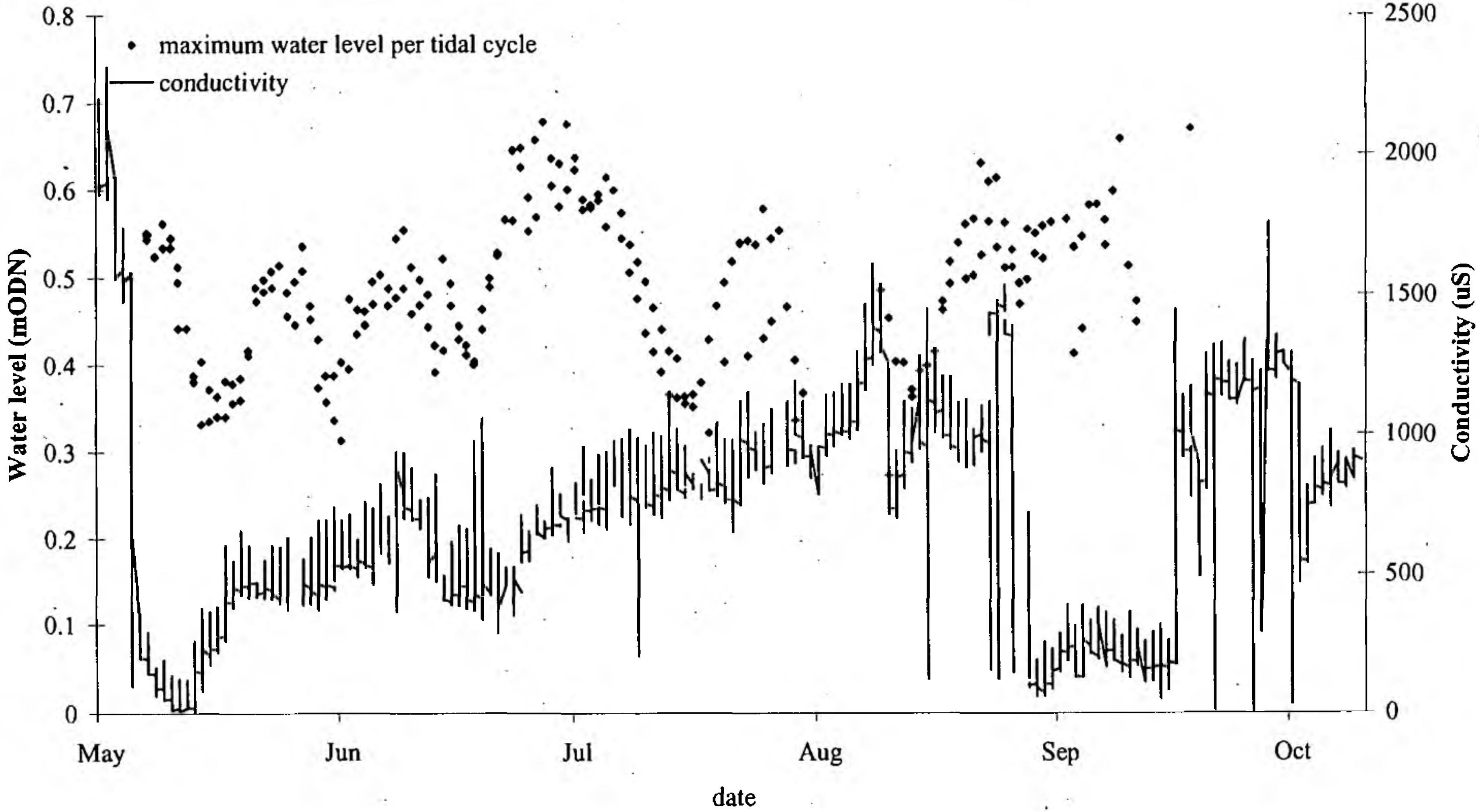


Figure 2.15 Continuous conductivity monitor daily maxima at Burgh St Peter and average daily flow at Needham Weir on the River Waveney in 1997

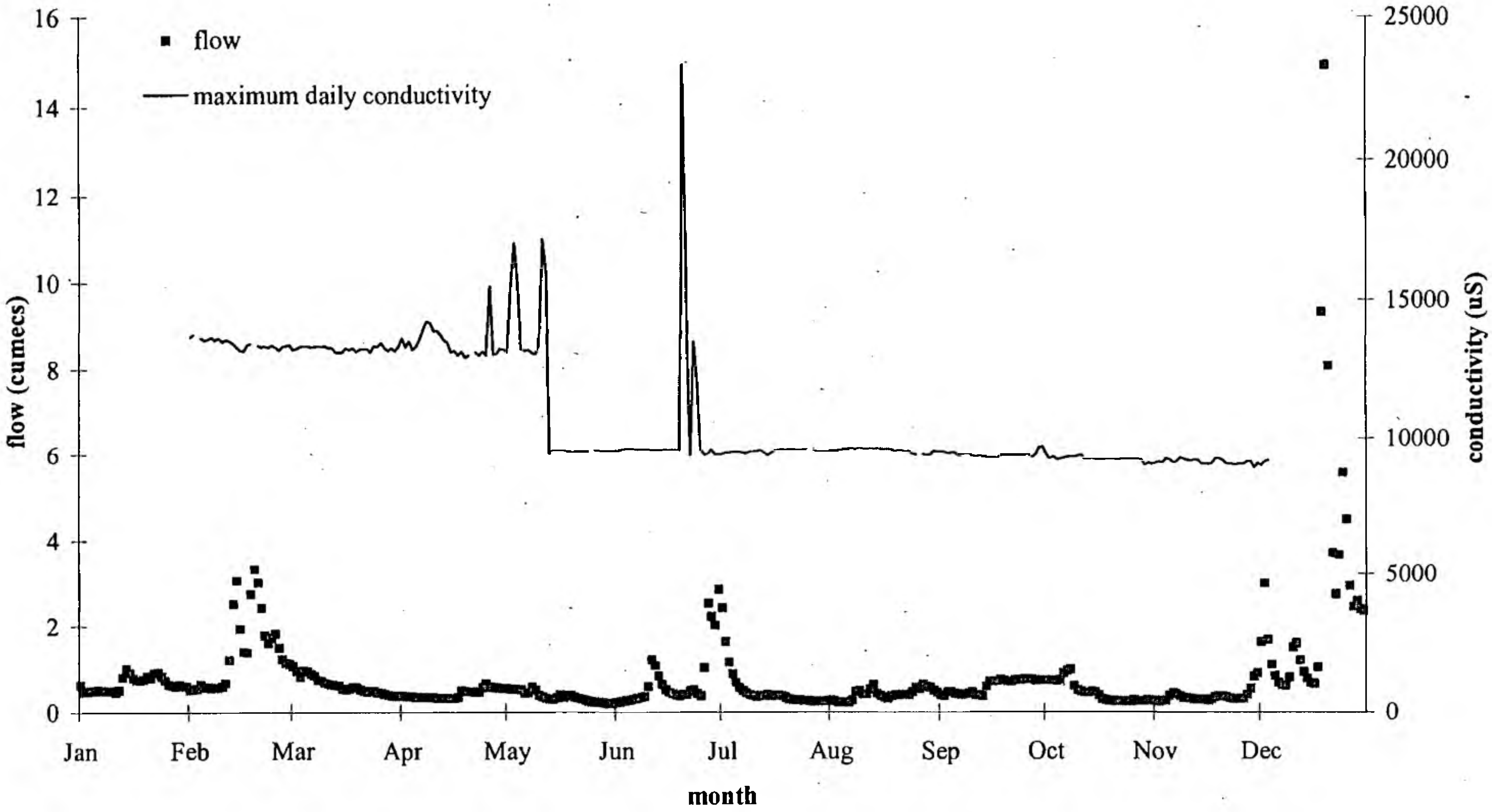


Figure 2.16 Continuous conductivity monitor hourly readings at Burgh St Peter and maximum water levels per tidal cycle at Beccles Quay on the River Waveney for 1997 (where coinciding data exists)

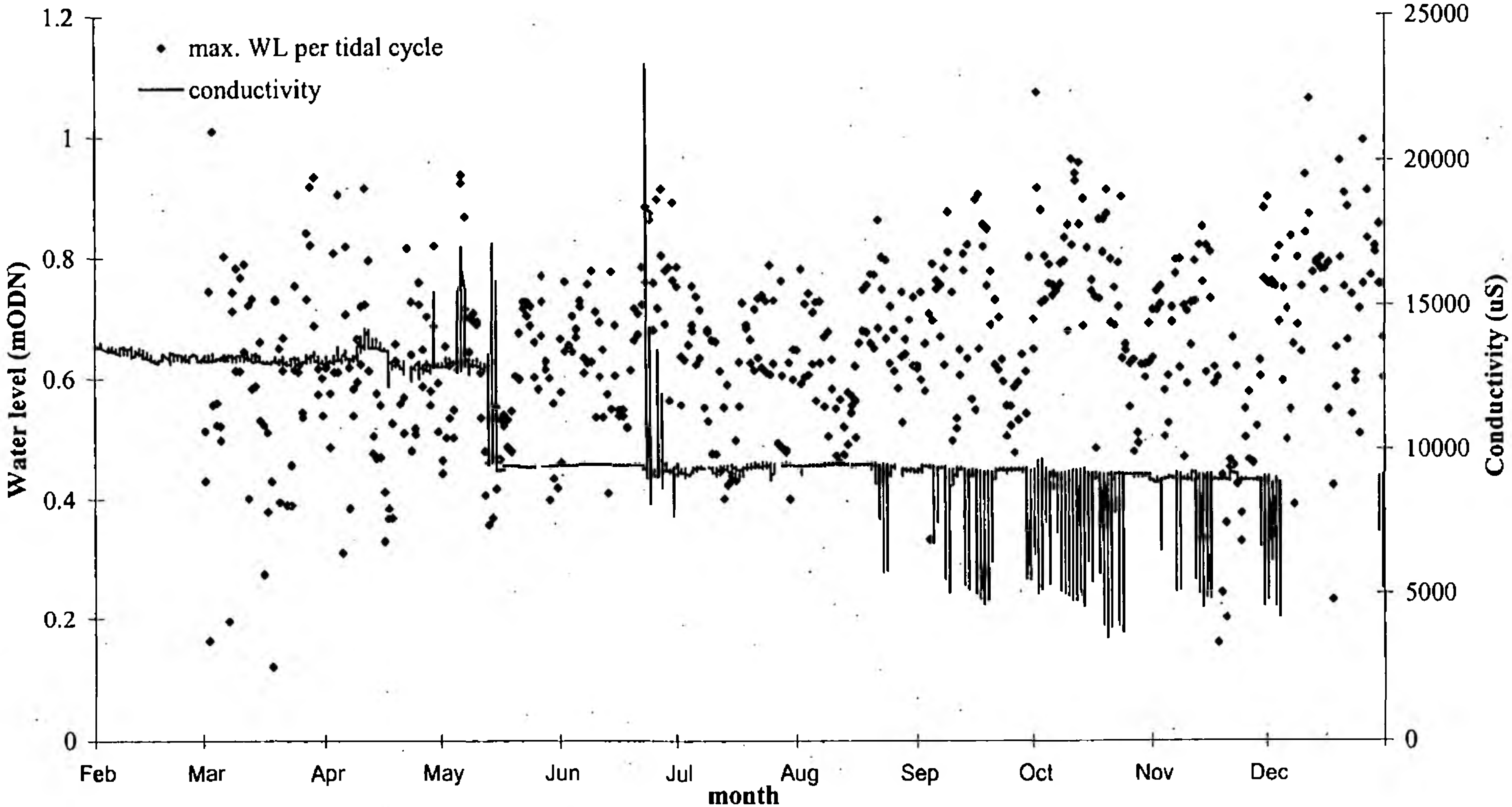
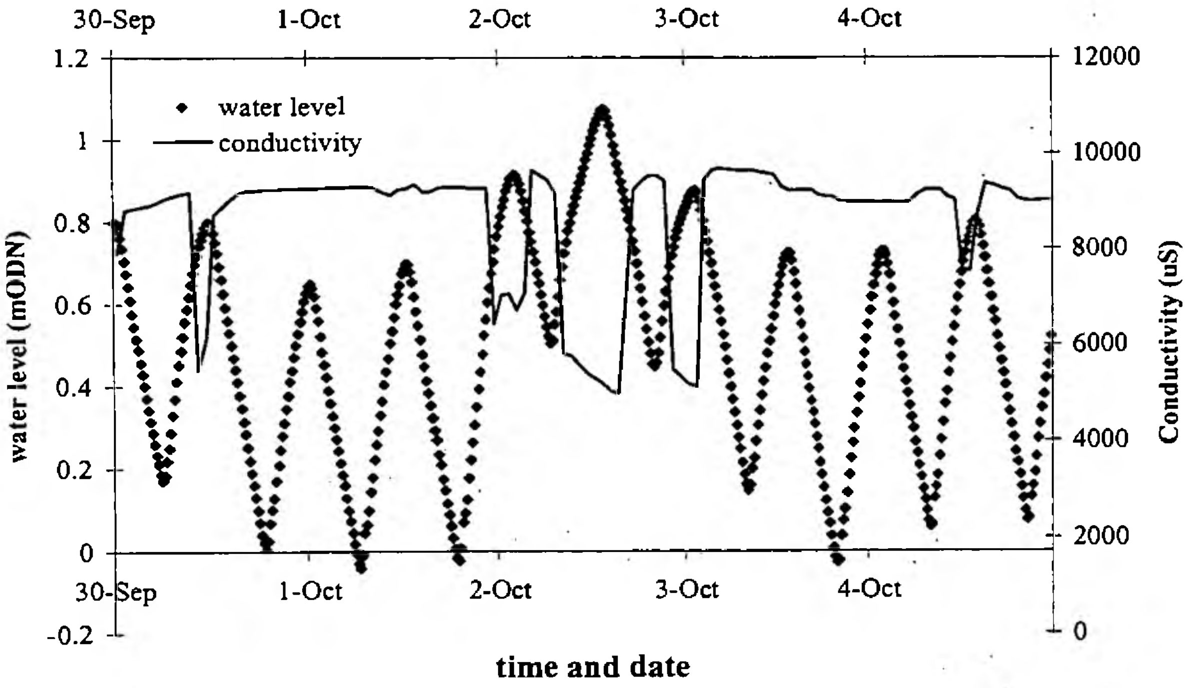


Figure 2.17 Continuous water level and hourly conductivity for 30 September to 4 October 1997

a) Water levels at Beccles and conductivity at Burgh St Peter on the River Waveney



b) Water level and conductivity at Cantley on the River Yare

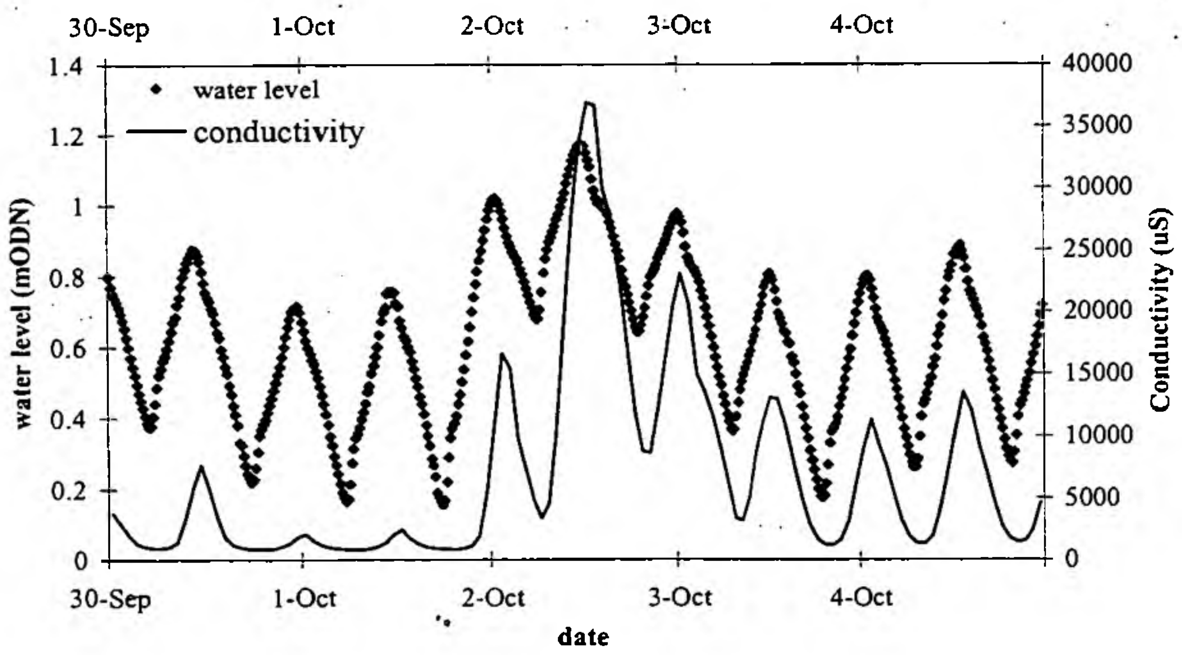


Figure 2.18 Daily maximum conductivity readings at Cantley and daily average flow at Colney on the River Yare for 1997

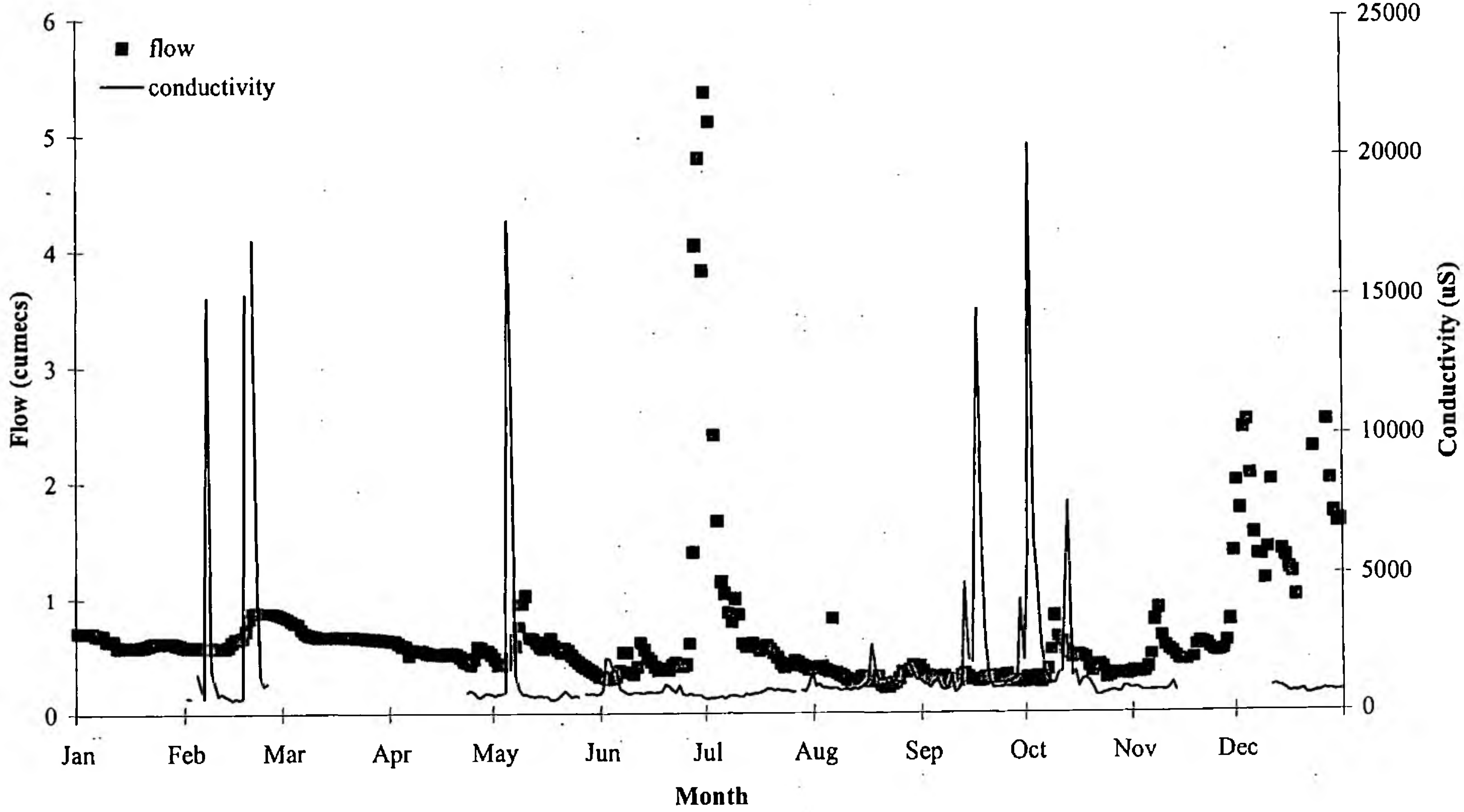


Figure 2.19 Hourly conductivitry readings and maximum water level per tidal cycle at Cantley on the River Yare for 1997

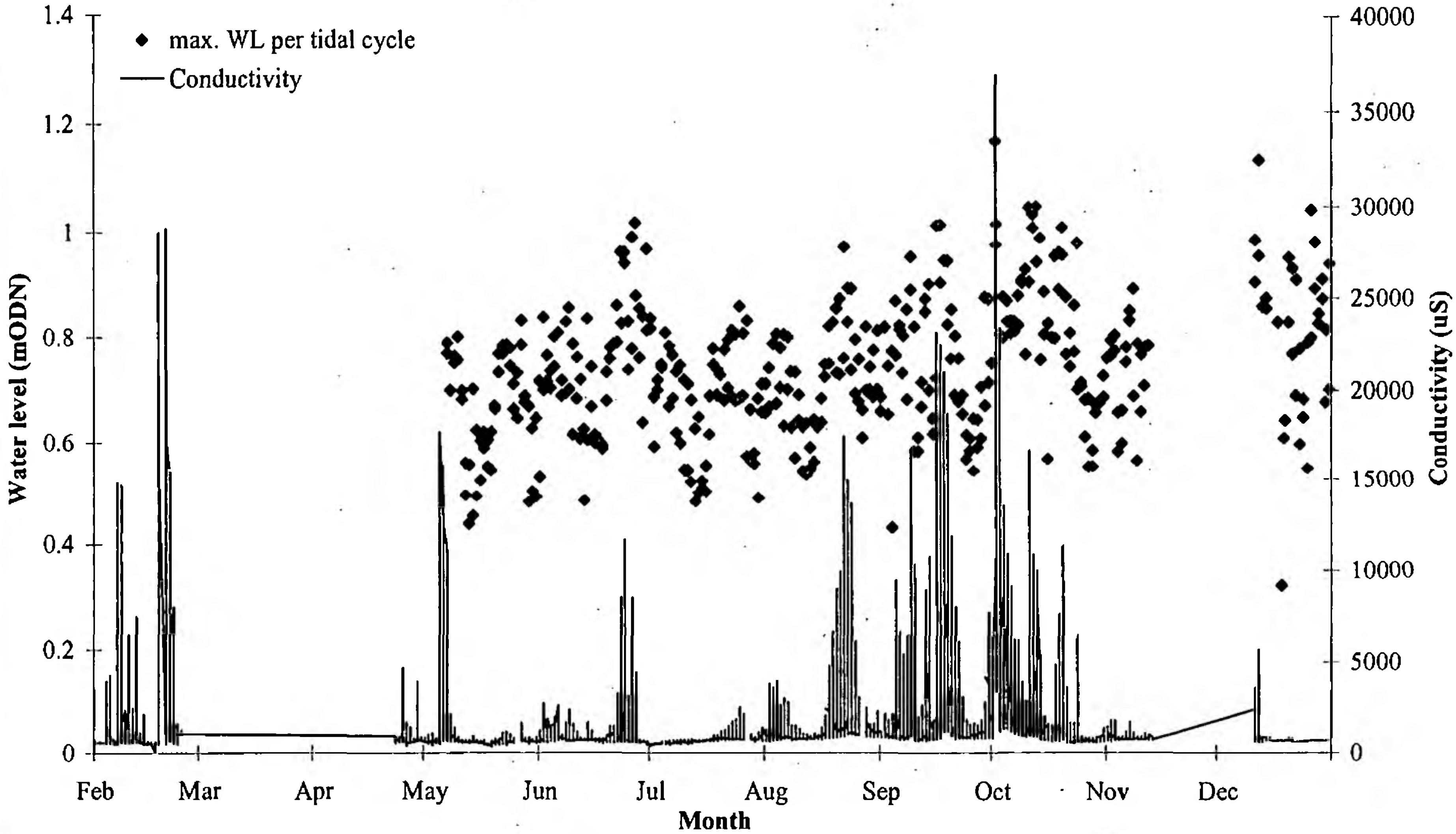
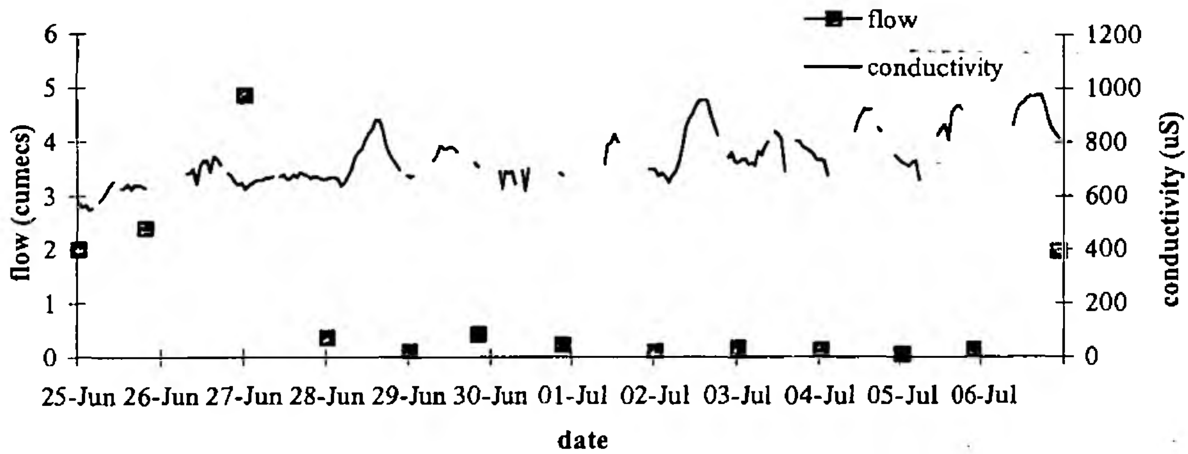
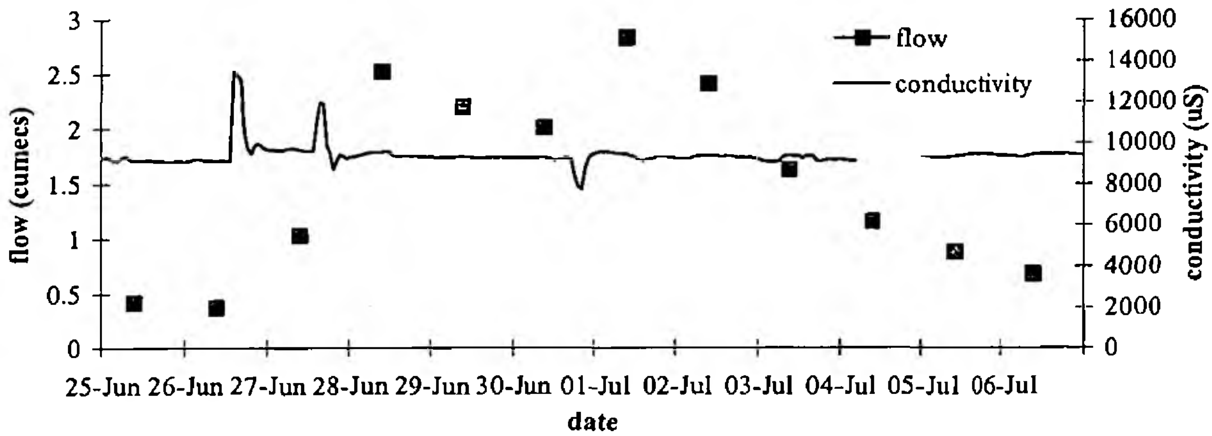


Figure 2.20 Continuous conductivity and daily average flow for 25 June to 6 July 1997

a) Conductivity at Acle and flow at Horstead on the River Bure



b) Conductivity at Burgh St Peter and flow at Needham Mill on the River Waveney



d) Continuous conductivity at Cantley and daily average flow at Colney on the River Yare for 25 June to 6 July 1997

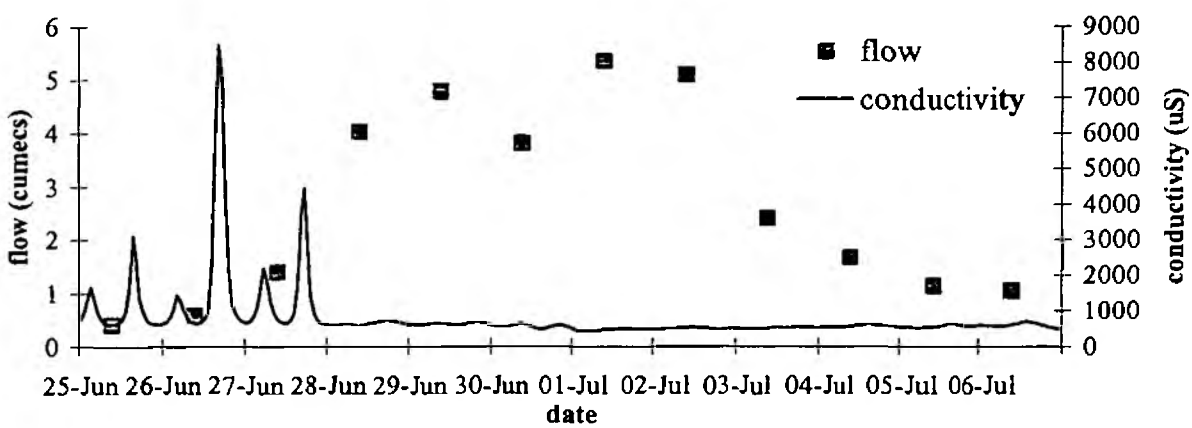
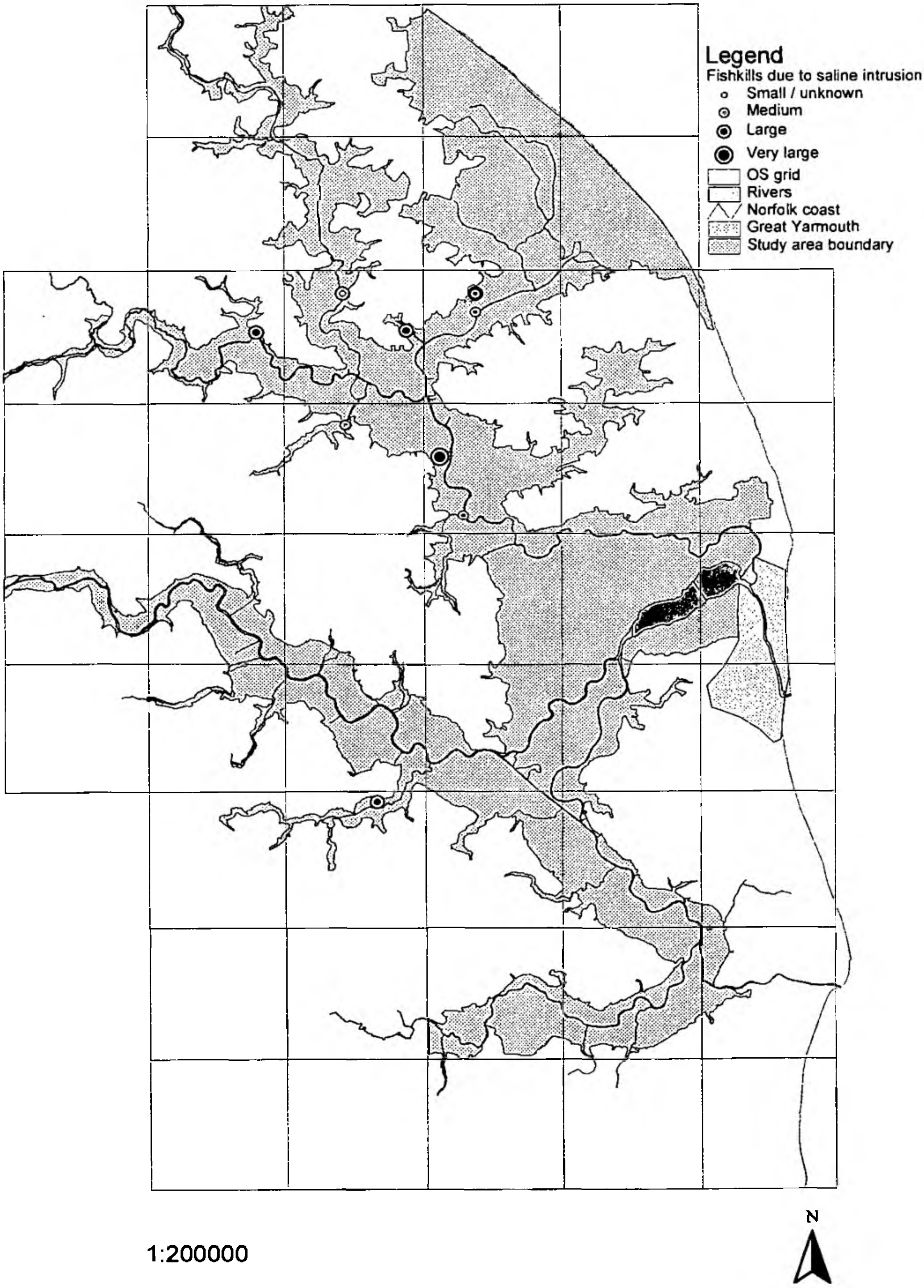


Figure 2.21 - Location map of fish kills due to saline intrusion



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3. SALINITY SURVEYS

3.1 Objectives

To determine baseline salinity values in Broadland rivers and particularly to characterise the saline/fresh water interface and mixing zone.

3.2 Introduction

The study area covered the three main rivers in Broadland: the Rivers Bure, Yare and Waveney and Breydon Water (see Figure 2.1).

The survey area extended as far as St. Olaves on the River Waveney. It did not extend as far as the seaward connection near Lowestoft via Oulton Dyke and Oulton Broad where there is a tidal lock.

3.3 Methods

A preliminary survey was carried out between 20-23 October 1998. One of the problems encountered during this survey was the occurrence of strong offshore winds, thus making it difficult to navigate the downstream waters to characterise the saline/fresh water interface during this period. A more detailed survey was carried out between 1-5 March 1999 under more favourable conditions. Most of this report refers to this later survey period.

A combination of reconnaissance and detailed surveys of water quality were undertaken. Reconnaissance surveys were carried out from river banks at accessible locations such as marinas and bridges. Detailed surveys were undertaken by boat.

A multi-parameter water quality probe (Horiba Instruments) was used to measure conductivity and temperature. Salinity was determined as a function of these two parameters. Turbidity, pH and dissolved oxygen were also recorded at some locations to provide additional background water quality data. The probe was attached to a weighted cable to minimise drifting, and was marked to enable depth measurement. At most sites measurements of all parameters were made close to the river bed (less than 0.3 m above bed level). Additional, salinity measurements were made at other depths to produce vertical profiles where possible.

Monitoring locations close to recognisable and mapped features were recorded on 1:2500 OS maps. Elsewhere, a Global Positioning System (GPS) (Trimble XRS) was used to determine the location of measurement sites.

3.3.1 Conditions at Time of Survey

River flows at gauging sites on the Rivers Bure and Yare are shown in Table 3.1 and Table 3.2. The gauging sites are located considerably upstream of Broadland, and the actual values are therefore not indicative of flows at the survey sites. However, the flows during the survey period may usefully be compared with monthly average flows and mean annual daily flows.

River flows were generally low at the time of the October 1998 survey, well below both October average flows and mean annual daily flows on the Bure, Yare and Waveney.

In general, river flows during March 1999 survey were relatively high. On the River Bure flows during the survey on 2 March 1999 were just below the March average, but considerably higher than (about double) the mean flow. On the River Yare, surveyed on 5 March 1999, flows were considerably higher than the March average (about 2.5 times greater) and about three times higher than the mean flow.

The October 1998 and March 1999 surveys were carried out during reasonably high spring tides. Table 3 shows predicted tide heights during the March 1999 survey. Predicted tide heights during the October 1998 survey were similar.

Offshore winds were prevalent during both surveys. These winds were strong during the October 1998 survey and relatively light to moderate during the March 1999 survey.

Table 3.1 River flow data, 20-23 October 1998

Date	River Bure at Ingworth (m^3/s)	River Yare at Colney (m^3/s)	River Waveney at Brampton (m^3/s)
20 Oct. 1998	0.792	0.582	0.429
21 Oct. 1998	0.788	0.515	0.394
22 Oct. 1998	0.760	0.486	0.377
23 Oct. 1998	0.952	0.514	0.376
October average flow	2.44	6.74	6.42
Mean daily flow	1.10	1.40	1.40

Table 3.2 River flow data, 1-5 March 1999

Date	River Bure at Ingworth (m^3/s)	River Yare at Colney (m^3/s)
1 March 1999	1.71	2.72
2 March 1999	2.31	6.13
3 March 1999	2.10	9.42
4 March 1999	1.80	6.70
5 March 1999	1.90	4.23
March average flow (1993 to 1998)	2.47	1.76
Mean daily flow	1.10	1.40

Table 3.3 Predicted tide heights (to Ordinance Datum at Newlyn 1999)

Date	Predicted tide heights at Great Yarmouth (m)			
	Low	High	Low	High
1 March 1999	-1.09	0.82	-0.77	0.99
2 March 1999	-1.20	0.85	-0.84	1.08
3 March 1999	-1.25	0.85	-0.88	1.11
4 March 1999	-1.23	0.81	-0.87	1.08
5 March 1999	-1.16	0.74	-0.83	1.00
Min. low/ max. high, Jan-Apr. 1999	-1.42	1.22	-1.42	1.22

3.4 Results and Discussion

Full results of surveys are included in Appendices 2a (20-23 October 1999) and 2b (March 1999). Unless stated, references in the discussion below refer to the March 1999 survey.

No significant lateral (cross-channel) variation in salinity was observed on the River Bure, Yare or Waveney in March 1999 and the survey therefore focused on measuring variations in salinity with distance, depth and time. Cross channel variation may be significant in Breydon Water, but this was not investigated during the surveys.

The observed salinity of fresh water not affected by mixing with saline water was generally below 0.1%. The salinity of sea water was about 3.2% (see Table 2.8).

3.4.1 The Salt Wedge

Figure 3.1 shows the approximate upstream extent of the saline wedge as measured during the March 1999 survey. The wedge reached approximately up to 8 km on the River Waveney, 9 km on the River Yare and 15 km on the River Bure. Figure 3.2 to Figure 3.4 show salinity contours on the rivers Bure, Yare and Waveney at close to high tide, interpreted from March 1999 survey results. A saline wedge (i.e. denser saline water extending upstream near the river bed) is noticeable on all three rivers. The upstream penetration of the wedge was over a similar distance on all three rivers. The 0.5% salinity contour at the river bed was estimated to lie between 14 and 17 km upstream of the estuary mouth at each site at high tide. The River Bure has a very different profile to that of the Waveney and Yare. Variation between rivers may be due in part to the time of measurement in relation to the tide, direction of travel while sampling, and varying tide conditions. However, there is some evidence from the greater upstream extent of the 2-3% contours on the Yare and Waveney that the volume of saline water flooding into the Yare and Waveney channels is greater perhaps owing to the greater width and depth of these dredged channels (although bed topography was not investigated during the survey). Figure 3.5 also shows vertical salinity profiles observed on the Bure, Yare and Waveney at around high tide.

ie. channel shape important as well as freshwater flow

3.4.2 Variations in Salinity with Distance from Sea

Figure 3.6 shows variation in observed salinity with distance from the estuary mouth at Gorleston-on-Sea for the Rivers Bure, Yare and Waveney. The survey attempted to monitor the likely maximum and minimum salinity along the rivers by, where possible, making observations at near low and high tide, and at different depths at each site. An envelope enclosing the observed points during the March 1999 survey is shown on each figure.

Salinity values generally showed less variation both upstream and downstream of a fairly well-defined saline/fresh water mixing zone. At low tide, discharging fresh water resulted in a considerable lowering of salinity at the estuary mouth and near to the beach in a northerly direction.

The greatest variations in salinity along the all three rivers were observed between 3 km and 17 km upstream of the estuary mouth in the March 1999 survey. This zone is referred to subsequently as the fresh water/saline mixing zone. In the fresh water/saline mixing zone, salinity declined rapidly during the ebb tide, and rose rapidly on the flood tide. This is illustrated in more detail for the monitoring site at White Swan, Great Yarmouth in Figure 3.7. The shape of the envelope enclosing the observed points is considerably different for the Rivers Yare and Waveney compared to the River Bure, owing to the effect of Breydon Water. A possible reason for the increased vertical stratification observed along the Rivers Yare and Bure is the much higher discharge of these rivers. At high tide, the results would imply that waters on the tidal flats in Breydon Water would be relatively fresh, since the water depth over much of this area is likely to be less than 1m.

Measurements during the March 1999 survey were made during reasonably high spring tides, generally offshore winds and high river flows. The location of the fresh water/saline mixing zone is dynamic and may be expected to move in response to tides, meteorological and hydrological conditions. On higher spring tides, when meteorological conditions create a storm surge in the North Sea pushing water towards the coast or during periods of lower river flows, this zone may be expected to move upstream. On neap tides, the zone may be expected to move further downstream. There is some evidence from the October 1998 survey that saline waters extended further upstream, perhaps by about 5-10 km, which may be due to the much lower river flows. However, the number of observed data points is too small to draw firm conclusions. Measurements made by the Environment Agency also suggest that at times saline waters intrude considerably further upstream. Temperature and wind effects are also likely to affect stratification, with higher temperatures promoting stratification in the mixing zone and high wind speeds resulting in increased shear stress and reduced stratification. High winds may have increased mixing at the time of the October 1998 survey.

3.4.3 Variation in pH, Temperature, Turbidity, Conductivity and Dissolved Oxygen

3.4.3.1 pH

Generally the pH of the samples was between 8.00 and 8.20 (see Figures 3.8). There was very little variation with distance upstream, although one sample on the River Bure at 25 km was pH 8.7.

p. 59 missing!

3.5 Conclusions

The saline wedge lies between 14 and 17 km on all the rivers, but the volume of saline water in the Rivers Waveney and Yare during the flooding tide is greater than that on the River Bure. This is likely to be due to the greater dredged channel width of the Rivers Waveney and Yare. The distance upstream that saline incursion will reach is dependent on both hydrometric and meteorological conditions, i.e. low fluvial flow and an onshore wind will push saline incursion further upstream.

The upstream extent of the saline wedge is not only characterised by salinity measurements. Turbidity, conductivity and levels of dissolved oxygen all decline to a minimum at the upstream edge of the saline wedge during low flows. It is possible that turbidity and dissolved oxygen levels will not decline so rapidly if the survey was conducted during high flows or when large volumes of boat traffic are present. Both high turbulent flows or disturbance caused by boat traffic are likely to increase both turbidity and dissolved oxygen.

3.6 Recommendations

To determine whether the saline/fresh water interface is located significantly further upstream at times, the survey could be repeated during a period of low river flows and high spring tides (i.e. in the summer). Also, during the summer it is possible that vertical stratification may be less significant, owing to the impact of boat traffic.

Figure 3.1 - Map showing the extent of the saline wedge or mixing zone (shown in red), and upstream saline limit (shown in yellow) during the March 1999 survey.

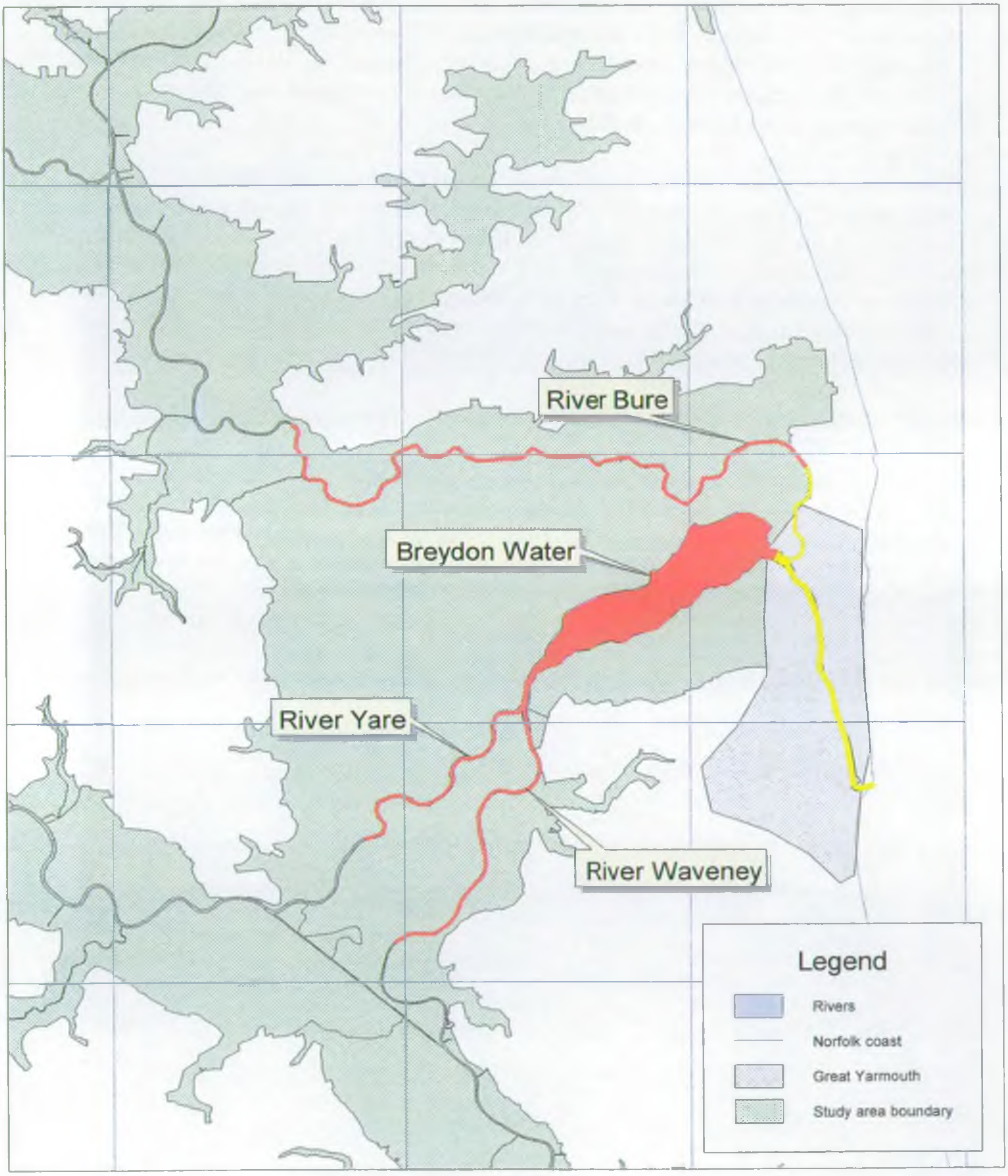

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Figure 3.2 River Bure: Salinity profiles at high tide (between 1001 & 1200 on 2 March 1999)

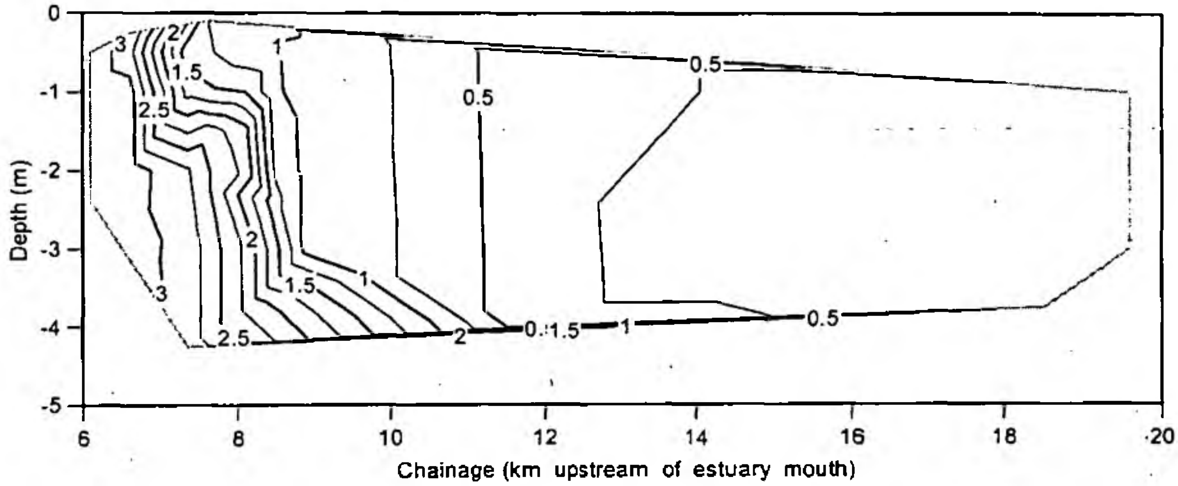


Figure 3.3 River Yare: Salinity profiles at high tide (between 1325 & 1445 on 5 March 1999)

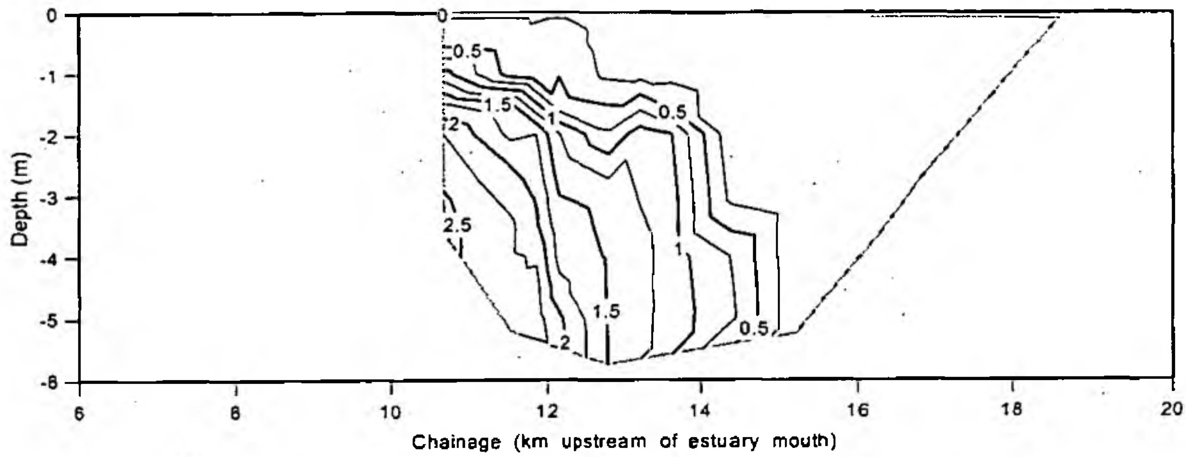


Figure 3.4 River Waveney: Salinity profiles at high tide (between 1158 & 1335 on 4 March 1999)

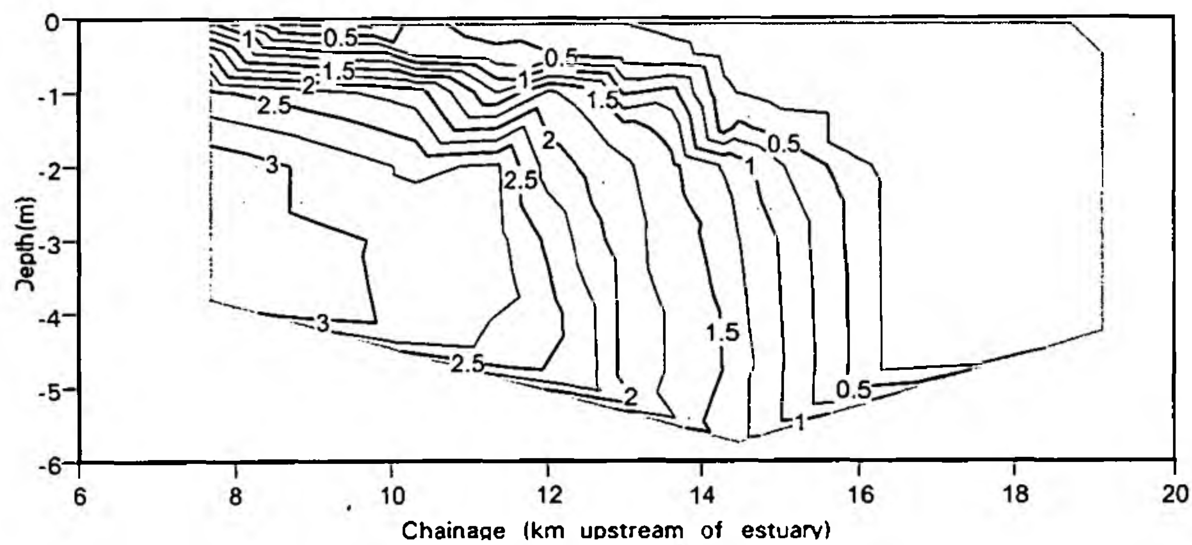
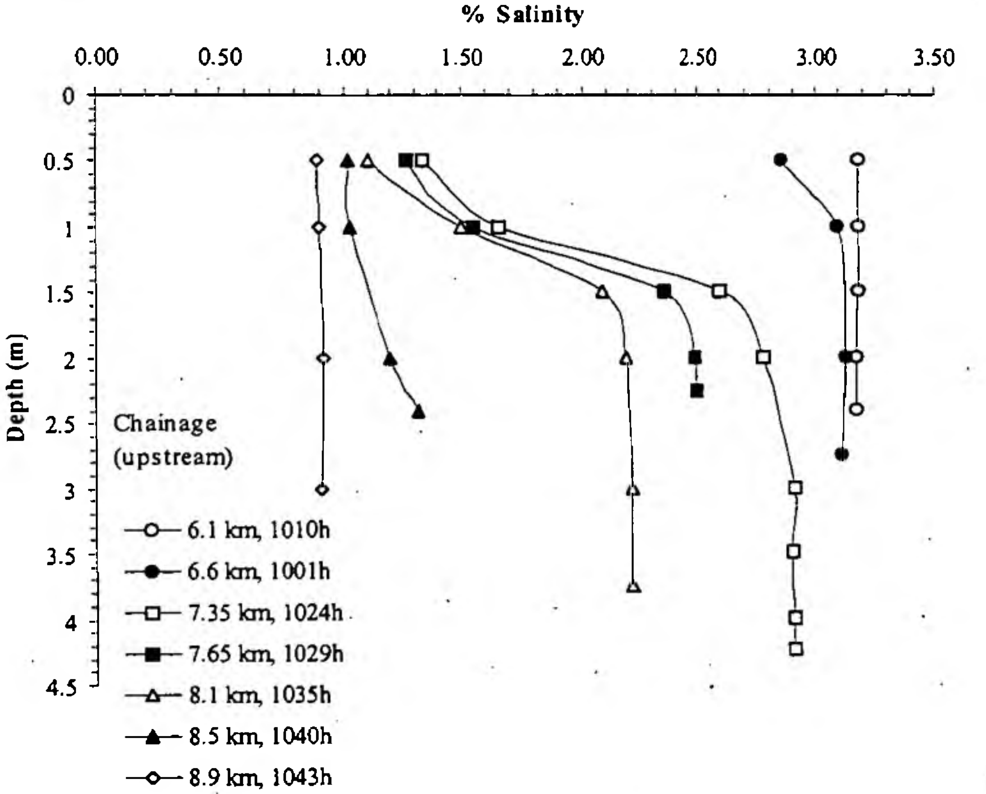


Figure 3.5 Vertical salinity profiles at high tide, and possible shape of saline wedge

a) River Bure (high tide between 1001 &1200 on 2 March 1999)



b) River Yare (high tide between 1325 & 1445 on 5 March 1999)

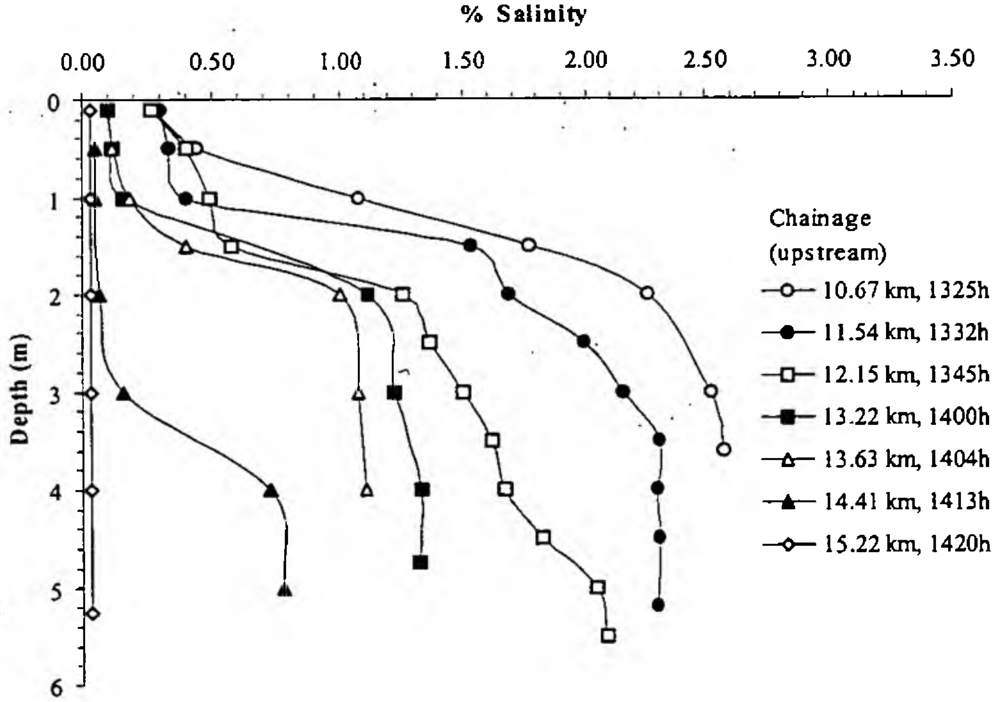


Figure 3.5 cont.
c) River Waveney (high tide between 1158 & 1335)

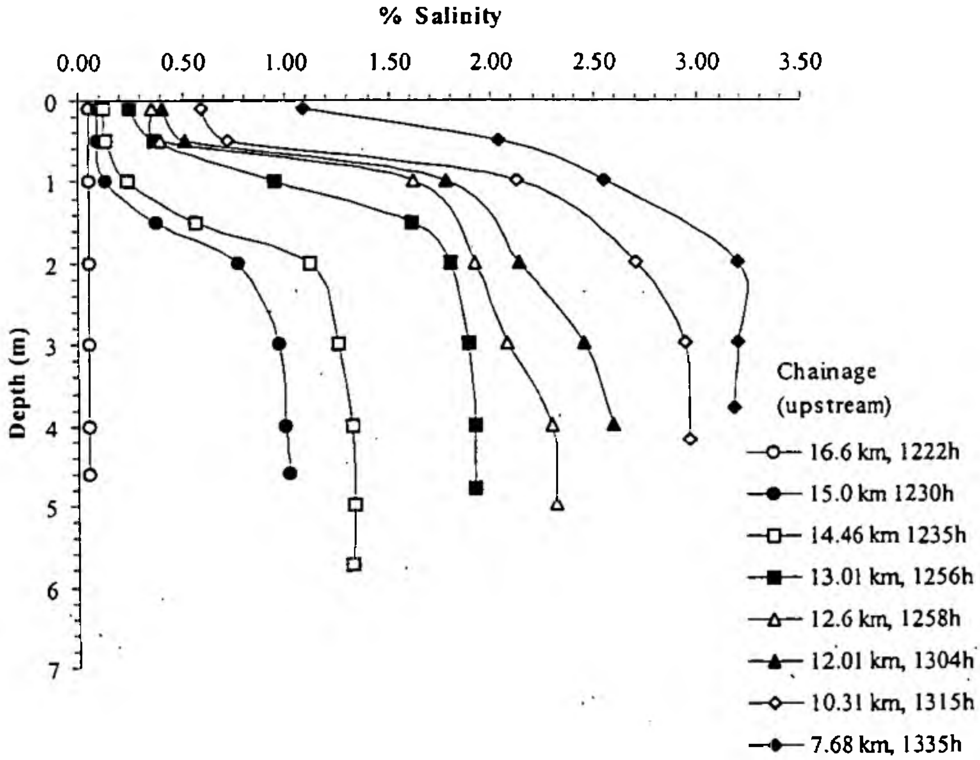
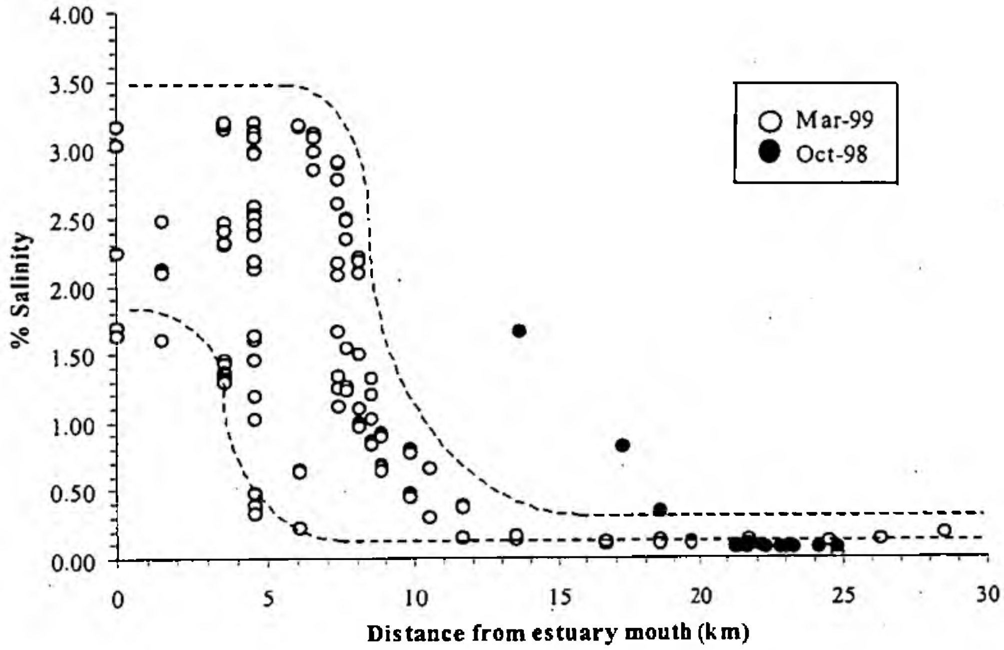


Figure 3.6 Variation in salinity with distance upstream from the river estuary

a) River Bure



b) River Yare

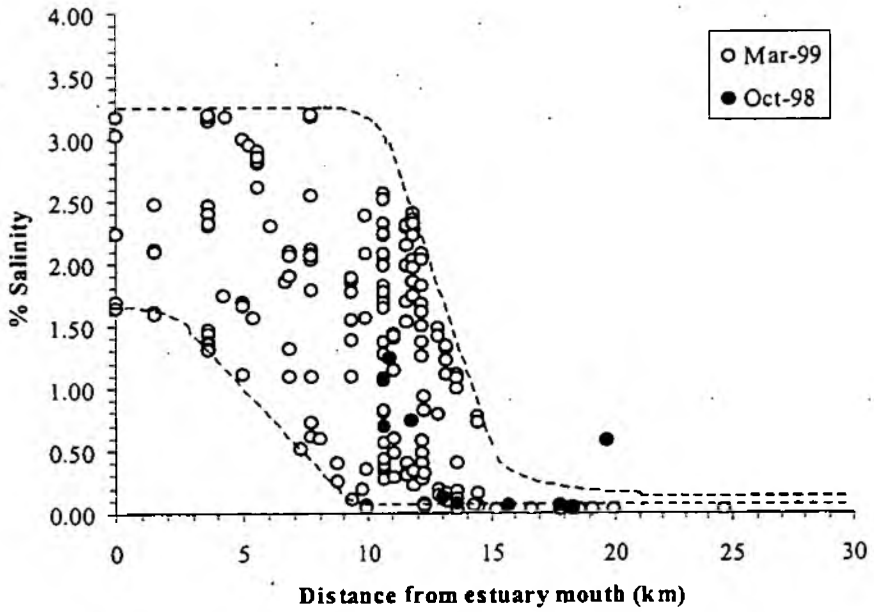


Figure 3.6 cont.

c) River Waveney

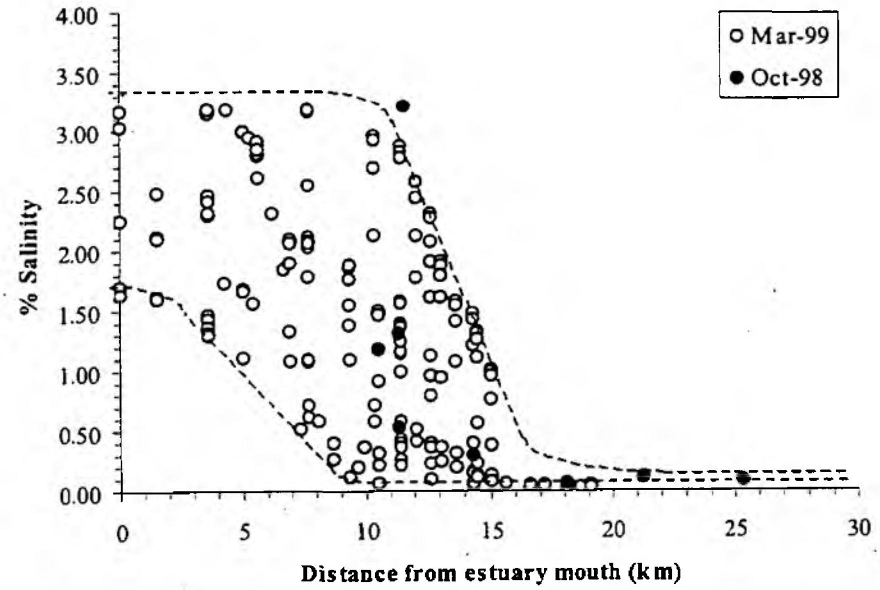
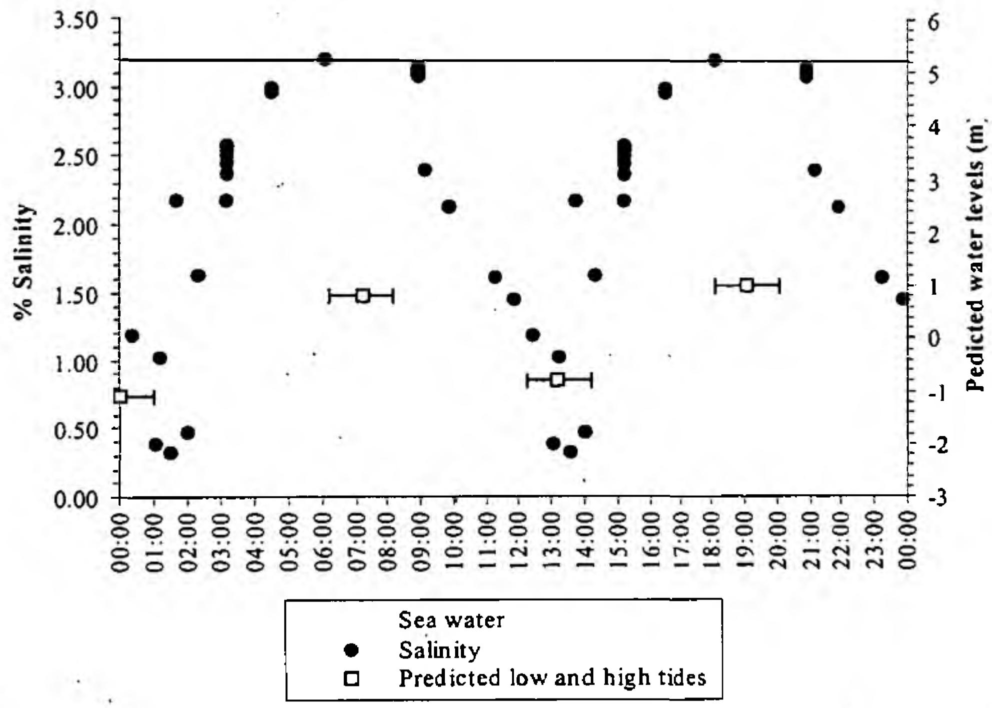
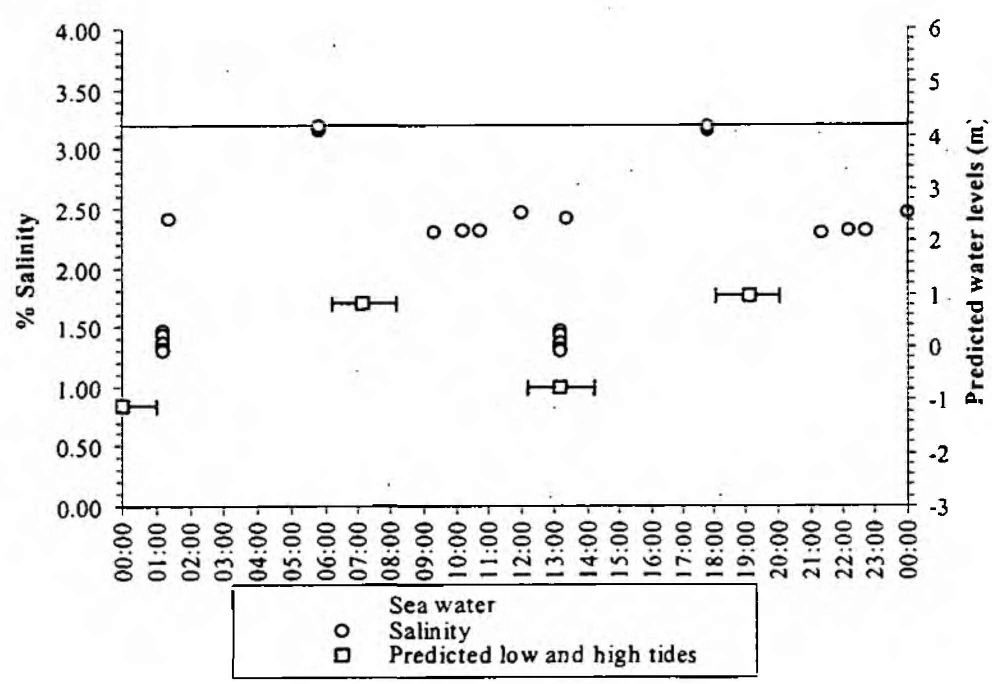


Figure 3.7 Salinity time series at Great Yarmouth
a) White Swan, River Bure



Note: Measurements made during three tidal cycles, and are shown duplicated on chart. Duplicate measurements at a given point show variation with depth

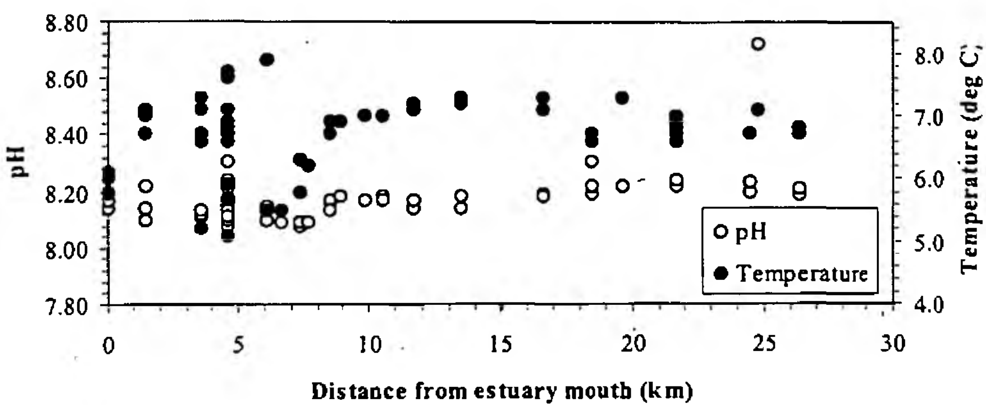
b) Haven Bridge, River Yare



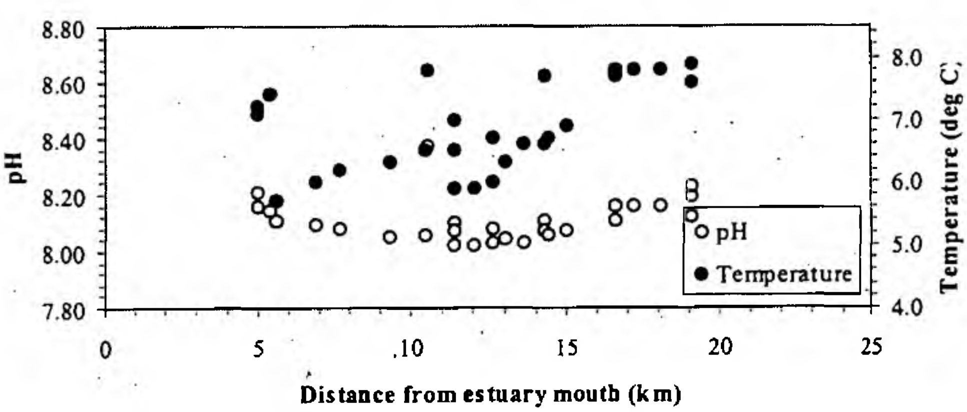
Note: Measurements made during three tidal cycles. Multiple measurements at a given point show variation with depth

Figure 3.8 Variation in pH and temperature upstream

a) River Bure



b) River Waveney



c) River Yare

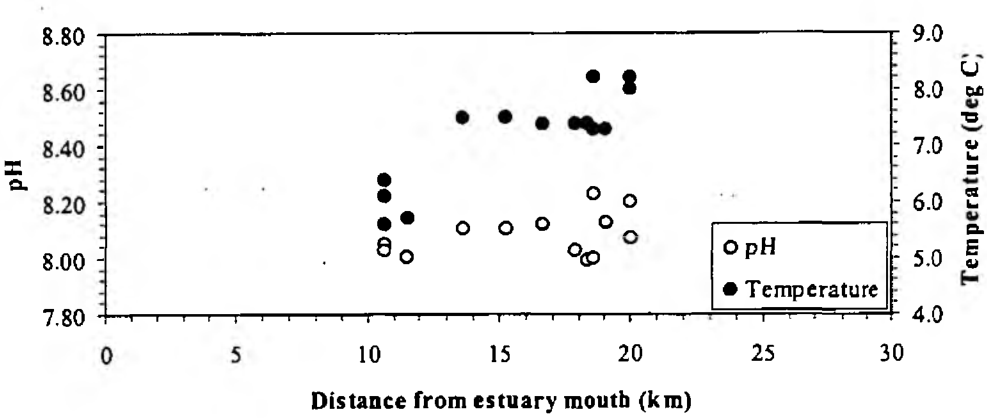
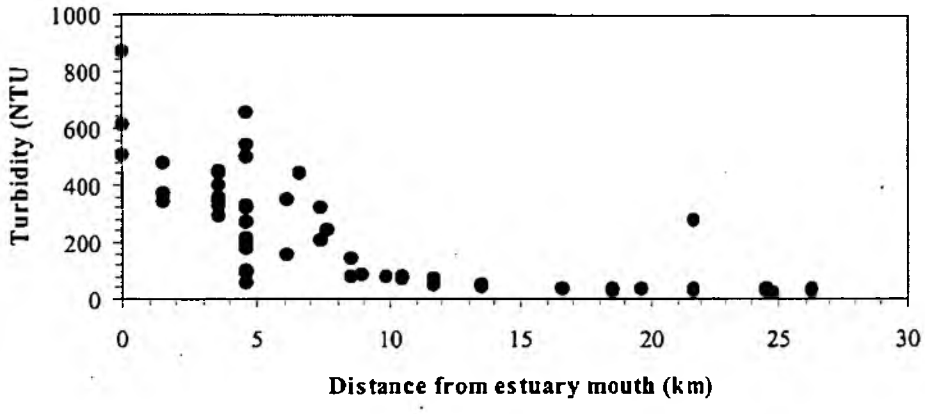
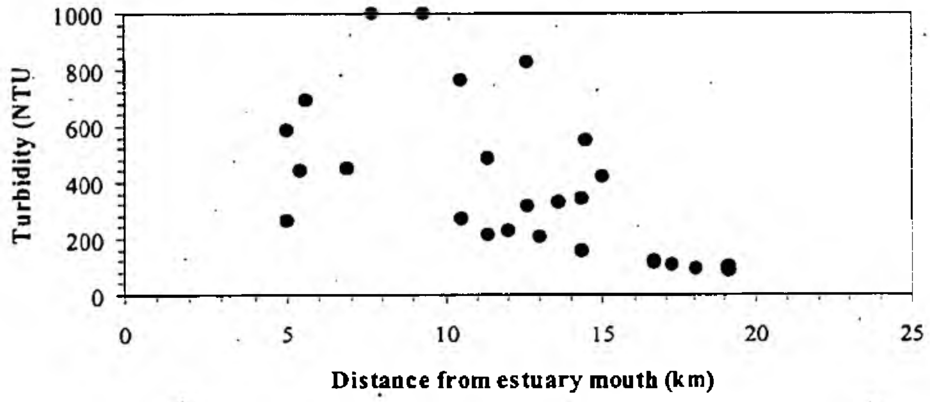


Figure 3.9 Variation in turbidity upstream

a) River Bure



b) River Waveney



c) River Yare

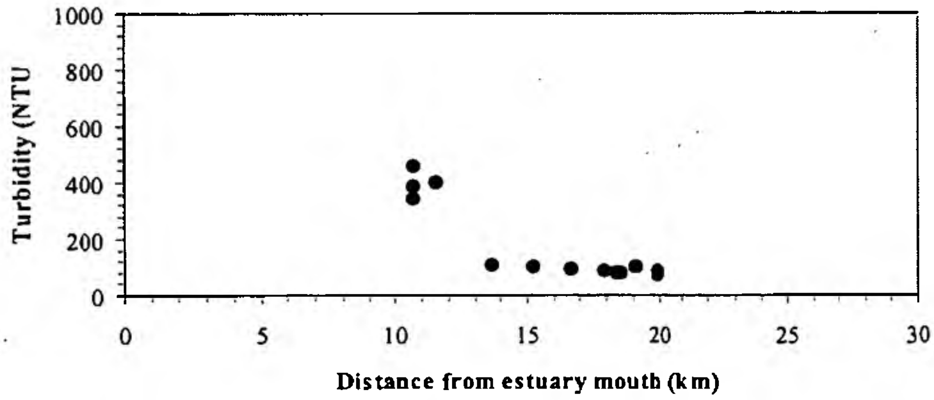
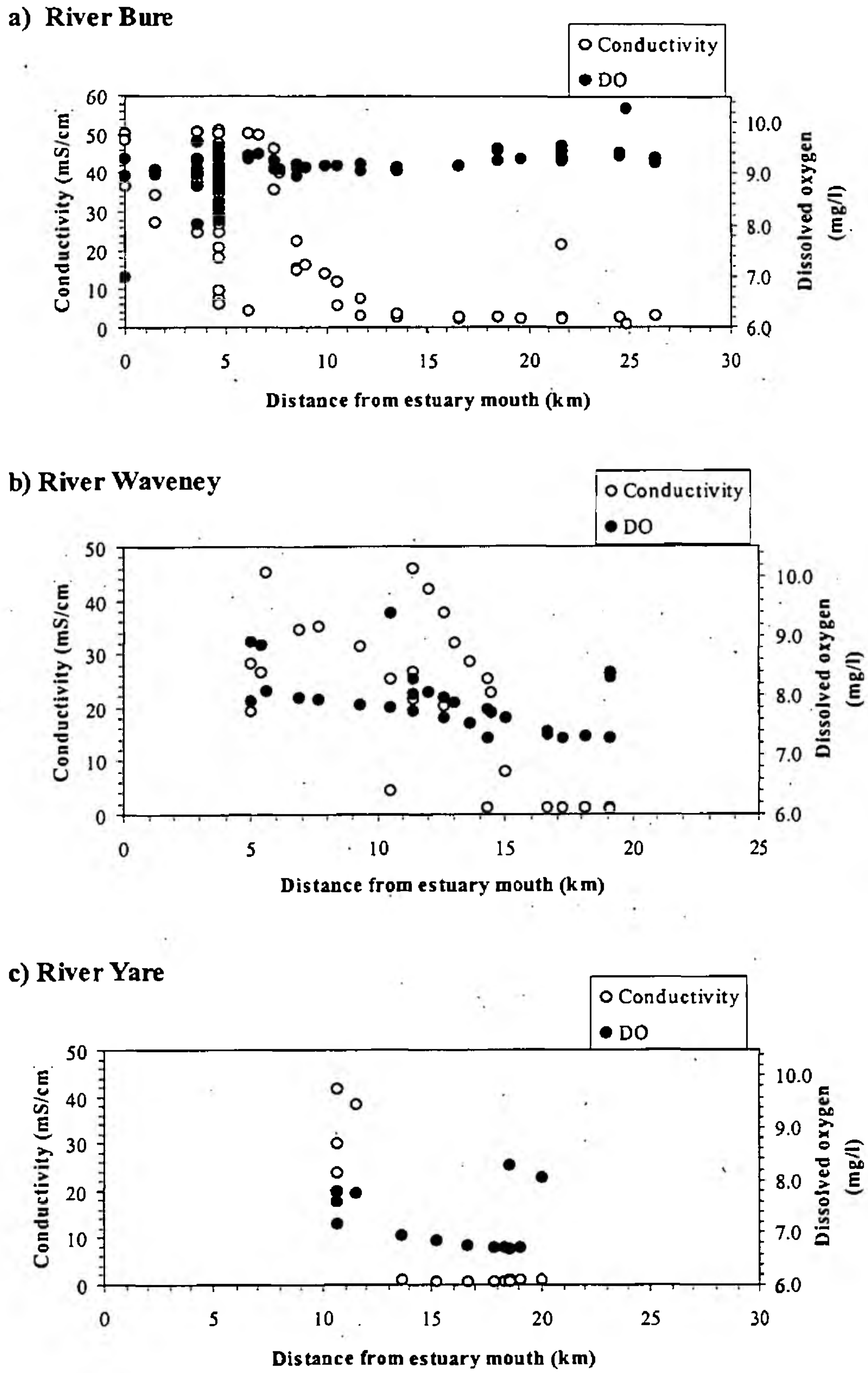


Figure 3.10 Variation in conductivity and dissolved oxygen upstream



4. INVERTEBRATE MONITORING

4.1 Objectives

To characterise the invertebrate fauna in the Rivers Ant, Bure, Thurne, Waveney and Yare in Broadland in relation to species salinity tolerance.

4.2 Introduction

Invertebrate samples were collected during late October 1998, from artificial colonisation material at sample sites in the Rivers Ant, Bure, Thurne, Waveney and Yare by Scott Wilson (see Figure 4.1). APEM were commissioned by Scott Wilson to analyse these invertebrate samples. Scott Wilson then carried out further analysis and interpretation of the results.

4.3 Methods

4.3.1 Sampling Method

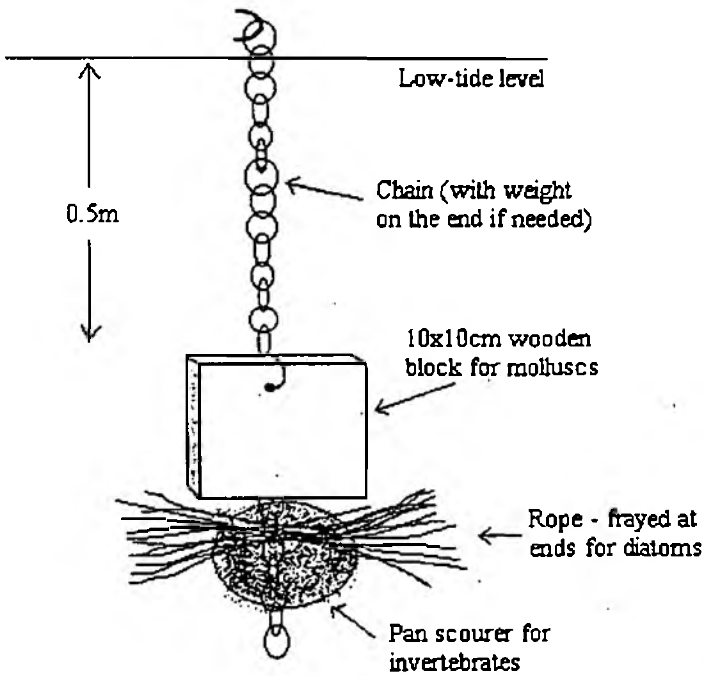
The location of the sample sites are shown in Figure 4.1. Thirty two samples sites were randomly spaced to span the anticipated saline limit of the river. In addition, three marine control sites each with two sample sites (A and B) spaced 50 m apart, were situated towards the lower end of the River Bure, Yare and Waveney.

At each sample site and control site artificial colonisation material was suspended at 0.5m and 1 m below the low tide level and 0.5 m above the river bed, where possible (some sites were in water less than 1.5 m deep). Information was recorded for each sample or control site on site recording sheets (see e.g. in Appendix 7).

The artificial colonisation material consisted of a chain welded to steel piling with a pan scourer (for aquatic invertebrates), a nylon rope with frayed ends (for diatoms) and a 10 x 10 cm block of wood (for molluscs) attached (see Figure 4.2). The colonisation material was put into the rivers in early September and then collected approximately six weeks later in late October.

The pan scourer was carefully removed from the water with a plastic bag covering it, so as not to lose the invertebrates and replaced with a new pan scourer. The invertebrate samples were then preserved in 70% methanol and sent to the APEM laboratory for analysis. The percentage cover of molluscs (i.e. barnacles) were estimated on the 10 x 10 cm block. These were then scraped off the wooden block with a potato peeler, bagged up, and stored in a refrigerator for later identification.

Figure 4.2. Artificial colonisation material



4.3.2 Invertebrate Analysis

Invertebrate samples were sorted and identified to species level in the APEM laboratory following 'NAMAS' procedures for macro-invertebrate analysis. This allows no more than two taxa per sample to be missed or mis-identified. In addition, 5% of all samples sorted in the APEM laboratory were sent out for external verification by recognised authorities e.g. The Institute of Freshwater Ecology.

In addition to the APEM analysis, further interpretation of the results was carried out. This looked at the salinity tolerances of the species found, and whether the method and/or the taxa may be used in future to identify changes in the overall salinity levels of these rivers. Taxa occurring less than six times in the full dataset were discounted as being too infrequent to have substantial indicator value (i.e. in less than 6 out of 58 samples). The invertebrate samples at each site were inspected for obvious relationships with distance upstream and annual average salinity.

Two statistical analyses were carried out, with unsuccessful results. A PRIMA analysis (Department of Marine Biology, Plymouth) was carried out to determine the degree of similarity between species. A DECORANA (Hill, 1979) analysis was carried out to see if there were any clustering of species and to determine if any environmental factors were influencing this.

4.4 Results

The results from the invertebrate analysis for each of the rivers are shown in Appendix 3.

Generally, invertebrate communities in the all the Rivers Bure (including Ant and Thurne), Waveney and Yare were similar in character, and were dominated by the brackish water amphipod *Gammarus zaddachi*. Many of the species recorded are included in the species lists produced by Driscoll (1995) and Driscoll and Waterford (1992) in their examination of invertebrate fauna of the lower reaches of the Rivers Bure and Yare respectively. However, their work involved the use of hand net techniques in various habitats, including piling and marginal vegetation. The species lists collected from these different sampling techniques tend to be more varied in comparison to this study, as the technique covers a broader range of habitats.

4.4.1 River Bure

The results of the analysis of invertebrates in the River Bure are displayed in Appendix 3a. The invertebrate fauna of the River Bure and associated rivers contained three brackish water species, all crustaceans, namely *Gammarus zaddachi*, *Corophium multisetosum* and *Sphaeroma rugicauda*. These species are included in the brackish invertebrate fauna reported by Driscoll (1995) which examined records on the lower reaches of the River Bure from 1977 to 1982. However, Driscoll (1995) also recorded 16 additional brackish water species, often collected from piling, which were not recorded in this survey.

A total of 20 fresh water taxa were recorded in the River Bure and associated rivers. In general, the number of fresh water species increased with distance upstream as the influence of saline water is diminished. However, the River Thurne was characterised by low numbers of fresh water fauna and the presence of brackish water species.

4.4.1.1 Brackish water species in the River Bure

The brackish water amphipod *Gammarus zaddachi* was recorded at all sites and often in the River Bure in large numbers e.g. 357 were found 0.5 m from the river bottom at SP5. Driscoll (1995) reported that *Gammarus zaddachi* was widely distributed between the mouth of the River Ant and Great Yarmouth in 1977 and 1982 and was often found in great numbers.

Gammarus zaddachi is more tolerant of fresh water than any of the other brackish or marine species of *Gammarus*. However, it is rarely found in fresh water far from the tidal influence of the sea and usually in regions effected by high spring tide level.

Immature specimens of *Gammarus* which could not be confidently identified to species were recorded as *Gammarus spp*. It is possible that some of these individuals could be immature specimens of *Gammarus* other than *Gammarus zaddachi*.

Corophium multisetosum was recorded from eight sites in the River Bure. These include SP1, SP2-A, SP3, SP5 and SP6 on the River Bure and SP11, SP12 and SP14 on the River Thurne. It is interesting to note that sites SP5 and SP6 on the River Bure and all the sites on the River Thurne are greater than 30 km from the mouth of the River Yare. Driscoll (1995) reported several recordings of the species (mainly on pilings) near Acle Bridge and near Three Mile House on the River Bure in 1982.

Corophiids (suborder Gammaridea, order Amphipoda) are mainly marine and brackish water tube-building crustaceans. However, *Corophium multisetosum* can tolerate fresh water and is found in the lower reaches of rivers in Norfolk and Suffolk. The species is more tolerant to low salinity conditions than the more brackish species *Corophium lacustre*.

The isopod *Sphaeroma rugicauda* was recorded at three sites in the survey: SP2-B on the River Bure and SP13 and SP14 on the River Thurne. Driscoll (1995) reported a few recordings of specimens on the River Bure near Thurne Mouth and near Upton in 1977 and near Maultby Marsh Farm, near Scaregap Farm and near Three Mile House in 1982.

Sphaeroma rugicauda is a brackish water species which can tolerate low salinity water and extreme fluctuations in temperature and salinity but prolonged exposure to fresh water conditions will be unfavourable to the organism.

4.4.1.2 Fresh water species in the River Bure

The majority of fresh water species were recorded in the upper sites in the River Bure (SP5, SP6 and SP7) and the River Ant (SP8, SP9 and SP10). Samples taken 1 m below the water surface and 0.5 m from the bottom tended to contain more taxa than samples 0.5 m below the water surface.

Five species of mollusc were recorded in the survey but only *Potamopygrus jenkinsi* was found throughout the system with a maximum of 1220 recorded 1m below the water surface at SP 8. Driscoll (1995) found that the species was recorded at several sites in the lower reaches of the River Bure in 1977 and 1982 surveys.

Various species of worms, flatworms and leeches were recorded from sites in the upper section of the River Bure and the River Ant but none were recorded in the River Thurne. The distribution of the two species of water hog-louse *Asellus aquaticus* and *Asellus meridianus* followed a similar pattern.

Insects recorded included the mayfly *Caenis horaria*, damselfly *Erythromma najas* and caseless caddis flies *Ecnomus tenellus* and *Cyrnus flavidus*. These species are characteristic of still or very slow flowing fresh water which is of moderate to good quality. None of these species were recorded in the lower reaches of the River Bure or the River Thurne.

Chironomids were recorded at 12 of the 17 sites sampled with the highest numbers recorded in the upper sites of the River Bure (SP6 and SP7).

4.4.2 River Yare

The results of the analysis of the River Yare are shown in Appendix 3b. The invertebrate fauna of the River Yare contained the same 3 brackish water species recorded in the River Bure, namely *Gammarus zaddachi*, *Corophium multisetosum* and *Sphaeroma rugicauda*. Driscoll and Waterford (1992) examining records on the lower reaches of the River Yare from 1976 to 1990 indicated many more brackish water species downstream of Buckenham with the salinity gradient along the river reflected in the distributions of these species.

A total of 10 fresh water taxa were recorded in the River Yare. Generally, the number of fresh water species increased with distance upstream but far less fresh water invertebrate species were recorded in this study compared to those recorded by Driscoll and Waterford (1992) who examined records from samples of various habitats including piling, reedswamp, eroded margin and open water.

4.4.2.1 Brackish water species in the River Yare

Gammarus zaddachi was recorded at all sites often in large numbers e.g. 135 were found 0.5 m from the bottom of site SP15. Driscoll and Waterford (1992) indicated that the species was widely distributed between Langley and Berney Arms in 1977 and between Buckenham and Berney Arms on piling in 1982 and 1990.

Corophium multisetosum was recorded at five sites on the River Yare from SP15 at the lower end of the river to the furthest upstream site SP23. Driscoll and Waterford (1992) indicated that the species has been recorded from several sites between Brundall and Reedham in 1977, between Limpenhoe and Berney Arms in 1982 and between Buckenham and the mouth of the River Chet in 1990. Nearly all previous records were from piling.

Sphaeroma rugicauda was recorded from SP16 and SP18. These sites are not far from Reedham towards the lower part of the River Yare. Driscoll and Waterford (1992) noted that a few specimens were swept from reeds near Reedham in 1977 and 1982 and recorded on piling at Seven Mile House in 1989. The species appears much more limited in distribution than *Gammurus zaddachi* and *Corophium multisetosum*.

4.4.2.2 Fresh water species in the River Yare

Fresh water taxa increased with distance upstream. *Potamopygrus jenkinsi* and chironomids were found at several sites in the River Yare. The fresh water shrimp *Gammarus pulex* was found at one site 0.5 m from the bottom of site SP21. The riffle beetle *Oulimnius sp.* and the caseless caddis fly *Polycentropus flavomaculatus* were found at SP23. This was the furthest site from the mouth of the River Yare and contained seven different fresh water taxa.

4.4.3 River Waveney

The results of the analysis for the River Waveney are shown in Appendix 3c. The invertebrate fauna of the River Waveney contained the same three brackish water species recorded in the River Bure and River Yare, namely *Gammarus zaddachi*, *Corophium multisetosum* and *Sphaeroma rugicauda*. However, *Gammarus zaddachi* was not found at every site and *Corophium multisetosum* and *Sphaeroma rugicauda* were found at fewer sites than in the River Bure and River Yare systems.

A total of seven fresh water taxa were recorded in the River Waveney. This was a lower number than found in both the River Bure and River Yare. Fresh water species diversity increased with distance upstream.

At two sites SP24 (at 0.5 m from the top and bottom) and SP28 (at 0.5 m from the bottom) no invertebrates were found in the samples.

4.4.3.1 Brackish water species in the River Waveney

Gammarus zaddachi was recorded at nine of the 11 sites with a maximum of 160 at 0.5 m from the bottom of SP25. *Corophium multisetosum* was recorded at two sites SP25 and SP27 while *Sphaeroma rugicauda* was only found 0.5 m from the bottom of SP25.

4.4.3.2 Fresh water species in the River Waveney

The limited fresh water taxa included the molluscs *Potamopygrus jenkinsi*, *Bithynia leachi* and *Theodoxus fluviatilis*. In addition, *Glossiphonia complanata*, *Piscicola geometra*, *Ecnomus tenellus* and Chironomidae were recorded in low numbers.

4.4.4 Salinity indicator species

The distribution of the commoner taxa against the approximate distance and salinity for each sample and control sites are given in Tables 4.1 and 4.2 below. Salinity is based on the mean annual salinity at the nearest water quality spot sample point.

Stylaria, Sphaeroma, Asellus, Corophium and *Potamopygus* species were all absent at the seaward extremes, 5000 + mg/l (Chloride). There was a broad relationship between number of taxa and distance upstream, in that higher numbers were not found at the downstream extremities, whereas almost the full range of numbers were found upstream.

Table 4.1 Distribution of the commoner taxa against chainage upstream

Chainage upstream in km	*Potamopyrgus jenkinsi*	*Gammarus zaddachi*	Chironomidae	*Stylaria lacustris*	*Sphaeroma*	*Asellus aquaticus*	*Corophium*
5		•	•				
10		•					
12		•					
15		•					•
15							
18	•	•					•
18		•		•	•		
19	•	•	•		•		•
20	•	•					
22	•	•	•		•		•
23	•	•	•		•		•
23	•	•	•				•
23		•					
25	•	•	•				•
25	•	•					•
25	•	•					•
26							
27	•	•	•				
27	•	•					•
27		•	•				
29		•	•			•	•
29	•	•	•			•	
29	•	•					•
29		•	•	•			•
29	•	•					
30	•	•	•	•		•	•
30		•	•	•		•	
30	•	•	•		•		
31	•	•					
32		•	•	•			
33		•	•				
34		•	•	•			
34		•	•		•		•
34		•					

Note: Repeated chainage values represent samples taken from different rivers.

Table 4.2 Distribution of the commoner taxa against salinity

Salinity, annual average (Cl mg/l)	*Potamopyrgus jenkinsi*	*Gammarus zaddachi*	Chironomidae	*Stylaria lacustris*	*Sphaeroma*	*Asellus aquaticus*	*Corophium*
100	•	•	•				•
100	•	•	•				
100		•	•			•	•
100	•	•	•			•	
100		•	•	•			•
100	•	•	•	•		•	•
100		•	•	•		•	
100		•	•	•			
100		•	•				
100		•	•	•			
100		•					
150	•	•					•
200	•	•	•		•		•
200	•	•	•				•
200		•					
200	•						•
200		•					
200		•	•				
200	•	•					
200	•	•					
400	•	•	•				•
400	•	•					•
400	•	•					•
400	•	•	•		•		
500		•					•
500		•		•	•		
600							
1000	•	•					
2000	•	•	•		•		•
2000	•	•	•		•		•
2000		•	•		•		•
5000		•					
6500		•					
14000		•	•				

Note: Salinity readings are based on nearest, available water quality measurements to the sample points

4.4.5 Barnacle Sample Results

All records obtained were for the barnacle *Balanus improvisus* and these all fell within the control sites (the sites furthest downstream) (Table 4.3). Records were found on nine out of the 12 sample blocks at a coverage between <5% and a maximum of 10 - 15%. No barnacles were recorded on any of the blocks out of the control sites.

Table 4.3 Coverage of barnacles recorded on wooden sample blocks

Site	Depth of sample (in metres)	Species	% Cover	Comments
S1 - 32	0.5 & 1.0	0	0	
CP1A	0.5	0	0	Silty
	1.0	0	0	Silty
CP1B	0.5	0	0	Silty
	1.0	*Balanus improvisus*	<5	Silty
CP2A	0.5	*Balanus improvisus*	5 - 10	
	1.0	*Balanus improvisus*	5 - 10	
CP2B	0.5	*Balanus improvisus*	5 - 10	Silty
	1.0	*Balanus improvisus*	5 - 10	Silty
CP3A	0.5	*Balanus improvisus*	10 - 15	
	1.0	*Balanus improvisus*	10 - 15	
CP3B	0.5	*Balanus improvisus*	5 - 10	
	1.0	*Balanus improvisus*	5 - 10	

4.5 Discussion

Apart from at the highest salinities, all taxa were found at all salinities. It is likely that the differences observed between samples sites and rivers were more likely a combination of local habitat conditions and the sampling method used, rather than salinity. The method samples mobile taxa, which can be displaced from time to time.

Because the commonest or best sampled taxa were virtually ubiquitous, their actual value in relation to salinity is low. A possible explanation for this is that most invertebrates are simply recorded for broad bands of habitat type and are not studied in depth regarding salinity tolerance. However, a number of potentially useful indicators of salinity were found. The absence of any *Stylaria, Sphaeoma, Asellus, Corophium* and *Potamopyrgus* species indicates salinity above 5000 mg/l chloride, in most cases. The absence of *Gammarus zaddachi* is often associated with non-tidal fresh water. As all the samples contained this species, this would suggest that the non-tidal zone was probably not sampled. For example *Gammarus zaddachi* is replaced by *Gammarus pulex* in non-tidal fresh water in two Yorkshire rivers.

There are several species of Oligochaeta and Chironomidae which are reasonably sessile with restricted salinity tolerances, that may provide a better indication of salinity tolerances. This would require a benthic sampling method (e.g. using a grab to obtain mud samples from the base of the river), and a specialist to identify the species.

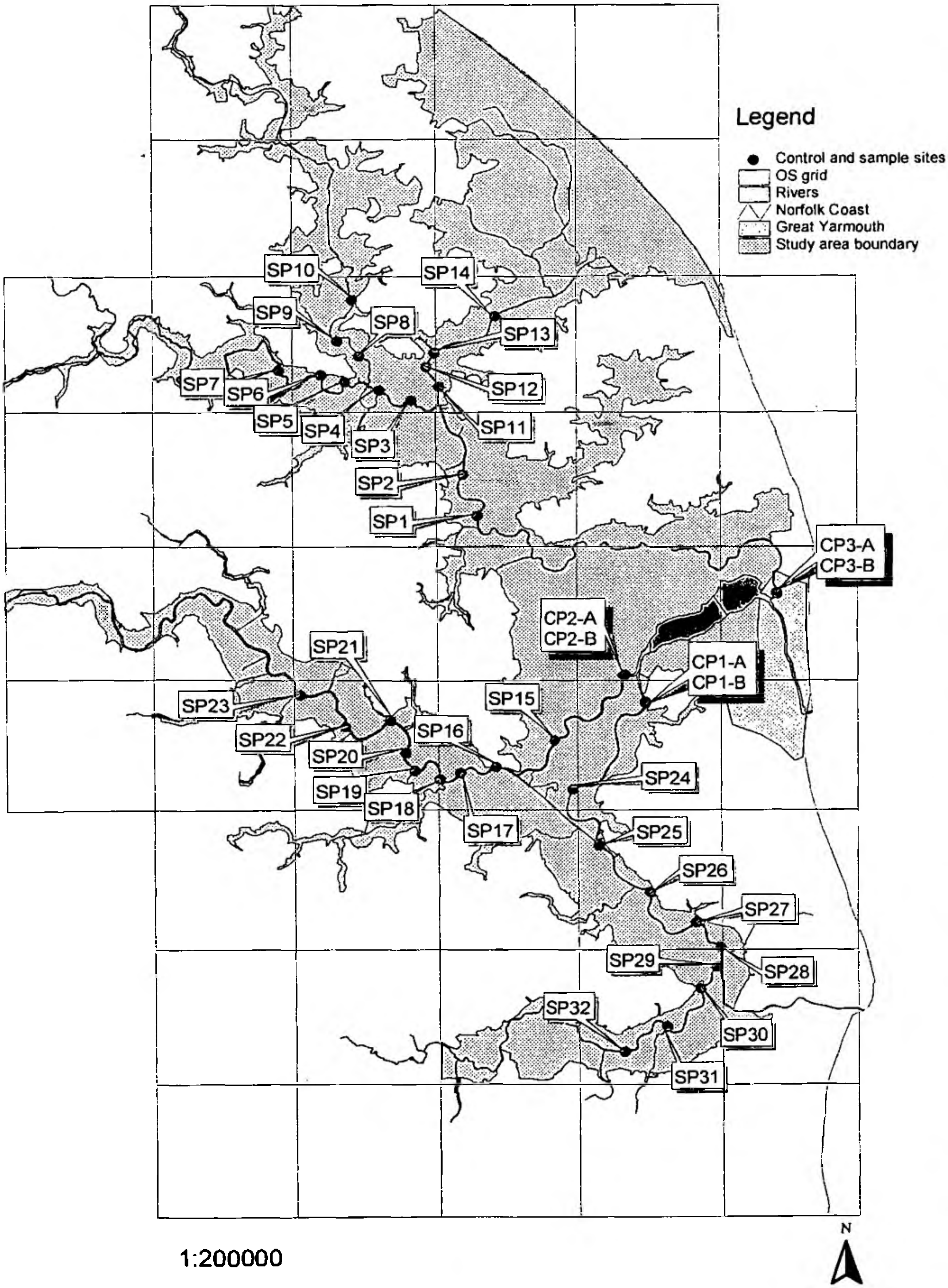
The barnacle *Balanus improvisus* was the only mollusc found at the control sites (the sites nearest the sea), and their use as an indicator of salinity throughout the rivers is unclear at present. With the recent discovery of the Asiatic clam *Corbicula fluminea* in the River Chet (Baker et al., 1999) the existing sample and control sites will be useful to monitor the possible spread of this species. It's spread across continents has proved to be rapid and has the potential to cause disruption by blocking water abstraction pipes. Within Broadland there are sites at risk owned by the water companies, the Cantley sugar beet processing plant and spray irrigation systems used by agriculture.

4.6 Conclusions and Recommendations

Using the invertebrates found to indicate precise salinity levels is difficult as most of the taxa were found at all salinity levels. *Gammarus zaddachi* and *G. pulex* are useful to indicate the extent of the tidal limit of the river, and would need further sampling to determine the use of these as indicator species.

Piloting a grab survey to pick up Oligochaeta and Chironomidae is a possibility, but could prove costly. The current data would benefit from additional surveys before a baseline can be set, or it is decided the method is not appropriate for monitoring salinity levels. The existing sample sites could be monitored to pick up the spread of the Asiatic clam *Corbicula fluminea*. If this species spreads it may have serious financial implications for industry.

Figure 4.1 Location of invertebrate/diatom control and sample sites



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5. DIATOM MONITORING

5.1 Objectives

To characterise the diatoms in the Rivers Ant, Bure, Thurne, Waveney and Yare in Broadland in relation to species salinity tolerance.

5.2 Introduction

An independent diatom specialist was commissioned by Scott Wilson to identify and analyse the diatom samples. These were collected during late October 1998, from artificial colonisation material at sample sites in the Rivers Ant, Bure, Thurne, Waveney and Yare (see Figure 4.1). Further interpretation was carried out by Scott Wilson.

5.3 Methods

5.3.1 Sampling

The sampling method is the same as for the invertebrates, (see section 4.3.1) the only difference is that nylon rope with frayed ends was used as colonisation material for the diatoms (see Figure 4.2).

The diatoms were collected in the field as periphytic samples. A few strands of the rope were carefully removed in the water and put into a bag. After collection the rope sections were preserved in Lugol's iodine, prior to diatom preparation.

5.3.2 Diatom Preparation

Diatom samples were prepared by boiling the sample material on the nylon rope in 10% hydrogen peroxide until all the organic material disappeared. The samples were mounted using Naphrax. Routine counting under x1000 magnification with the use of immersion oil attained a minimum count of over 200 diatom frustules for all samples.

Diatom nomenclature follows Hartley (1986) with identification assisted by reference to Van der Werf and Huls (1957-74), Hendey (1964), Cleve-Euler (1951-55) and Hartley (1996). Diagrams were constructed as a percentage of all diatom frustules counted (%TDV) and drawn up using only species which occurred as more than 1% of the total diatoms counted. The diagrams have been produced to indicate the salinity tolerance of each species, with a summary curve for each sampling station.

The salinity coding used in this report is based on several sources, principally De Wolf, 1993, Denys, 1990 and Van de Werf and Huls, 1957-1974. Any classification is however a simplification and many diatom species are tolerant of intermediate stages of this classification and across a broad spectrum of classes. The salinity data is drawn up according to the salinity classification by Hustedt (1957) where:

Polyhalobian:	marine (>3% salinity)
Mesohalobian:	brackish (0.2% - 3% salinity)
Oligohalobian-halophile:	requires some low salinity
Oligohalobian-indifferent:	can tolerate low salinity
Halophobes:	fresh water only.

Other classifications used are shown in Appendix 4.

5.3.3 DECORANA

DECORANA (Detrended Correspondence Analysis) (Hill, 1979) was used to help interpret the findings. The aim of this was to see if; a) it was possible to identify clustering of species distribution in relation to an environmental gradient (e.g. identifying species that indicate a high salinity levels), and; b) to identify clustering of samples in relation to an environmental gradient, which could be used to indicate particular salinity levels.

5.4 Results and Analysis

Diatoms were abundant in all samples and more diverse than expected. There was a high level of silt in almost all samples which suggests that some of the algal material was allocthonious. This would account for the high diversity of species identified. The need to clean the diatom frustules and remove the chloroplasts (hydrogen peroxide digestion) to enable accurate identification unfortunately also means that the allocthonous material could not be distinguished from the living material.

In all rivers the most fresh water species, those which are intolerant of exposure to saline conditions (halophobes) are almost totally absent. This reflects the regular tidal influence that most of the rivers are subject to and the affect of saline groundwater such as in the River Thurne. The data will be described for each individual river. All diagrams have been constructed with the most upstream sample at the top. Some sample points have several samples from different depths in the water column.

5.4.1 River Bure

Samples were taken between slightly upstream of Cockshoot Broad to almost the mouth of the Bure, and the results are shown in Figure 5.1. A strong salinity gradient is noted between the mouth of the River Bure and the sample SP1 at Ludham bridge. This is largely due to the increase in two marine (Polyhalobous) species: *Raphoneis amphiceros* and *R. minutissima*. Brackish (Mesohalobous) species start to become more important downstream of SP4 near Ranworth marsh. Although a benthic brackish species, *Gyrosigma balticum* is present at low levels in almost all samples.

The summary salinity curves (Figure 5.1) show the major trend of increased tidal influence down stream but variation in the oligohalobous-halophile and Oligohalobous-indifferent species show more subtle variation in salinity. The most upstream samples SP7, 6 and 5 are dominated by the planktonic *Cyclostephanos dubius* and *Stephanodiscus hantzschii* and *Aulacosira* species some of which may be derived from the adjacent broads. Downstream fresh water species still dominate but the planktonic species are replaced by benthic species such as *Navicula tripunctata* and *Diatoma tenue*. This change may simply be an affect of the presence of large bodies of open water upstream and an absence of large broads down stream. Alternatively, such a variation may be related to salinity tolerance varying between these species.

Several sites have samples from different levels in the water column. The difference between such samples from downstream sites is negligible but those from upstream show a variation in species but not overall salinity trend. Benthic *Navicula tripuntata* is more abundant from higher up in the water column whereas planktonic *Aulacosira* species are relatively more abundant lower in the water column. This may be related to a variation in sunlight requirements for these species.

5.4.2 River Ant

As shown in Figure 5.2 almost no marine influence is reflected in the diatom assemblages of this river (with the exception of low frequencies of *Actinophychus serians* in the downstream sample). However brackish species are present in almost all samples. Planktonic fresh water species, in particular *Aulacosira ambigua* and *A. granulata*. dominate the diatom assemblages in the two upstream samples, with a different although still fresh water assemblage in the downstream sample. This variation may be related to the presence of Barton Broad upstream and some species washing out. There is a similar variation in species in samples from different depths as there are in the samples from the River Bure.

5.4.3 River Thurne

The River Thurne (Figure 5.3) is anomalous to other rivers in that the highest frequency of marine species is found in the most upstream samples. This is due to the influence of saline groundwater and the intrusion of saline waters from ditches in the coastal zone in the area of Sea Palling. Downstream marine species are less important but a low but constant level of brackish species are encountered.

The fresh water diatoms all have a tolerance for low salinity levels. The assemblage differs from the previous two rivers in that benthic species are more frequent than planktonic forms. This may be accounted for by the lack of a large area of standing water. Of particular note are the high frequencies of *Navicula tripunctata* in almost all samples, together with *Diatoma tenue*.

The overall salinity tendency of the samples from different heights in the water column is the same but again there is a variation in species with more planktonic species in the samples nearer the bottom.

5.4.4 River Yare

The dominant species (Figure 5.4) in almost every sample is *Navicula tripunctata* but trends in salinity are apparent. Marine species are found in all samples with a fluctuating but increasing frequency downstream. Assemblages from upstream contain marine brackish and fresh water species. Some of the brackish and fresh water species in these upstream samples are epiphytic and attach themselves generally to larger plants e.g. *Synedra pulchella* and *Cocconeis placentula*. Downstream *Melosira monofiliformis* is a marine species which behaves in a similar way. This river has a more diverse and less planktonic diatom spectra compared with the north Norfolk rivers and is more similar to the River Waveney, with a higher frequency of benthic and epiphytic species. This is probably related to the strong influence of the broads on the north Norfolk rivers.

Paralia sulcata is a species of particular interest since it is a benthic/planktonic species thought to be suspended during storms and high tides, therefore it may be an indicator species for strong tidal influences.

5.4.5 River Waveney

There are many similarities in the River Waveney (Figure 5.5) with the diatom assemblages of the River Yare. High *Navicula tripunctata* frequencies in almost all samples, low frequencies of planktonic species and abundant benthic and epiphytic species. Upstream, near Beccles, marine species are relatively unimportant and occur as infrequent elements. Further downstream the marine species increase in frequency and diversity, in particular the *Melosira monofilformis*, *Raphoneis amphiceros* and *Raphoneis minutissima*. Extraordinary peaks of *Navicula mutica, N. cari var cincta* are noted in several samples and result in some distortion of the oligohalobous-halophile and Oligohalobous-indifferent peaks. These peaks reflect the growth of blooms of these species on the nylon rope and have a distorting affect on the data.

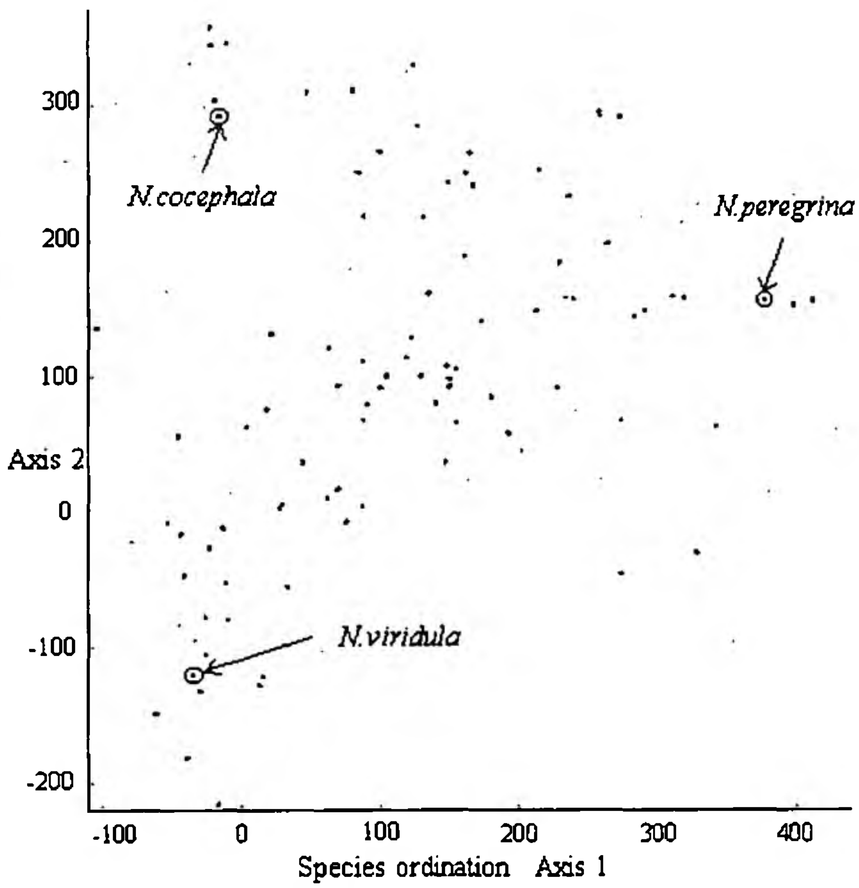
Paralia sulcata is noted at low levels but increasing steadily downstream, reflecting the increased affect of tidal influence on the river.

5.4.6 DECORANA Results

The plots from the DECORANA analysis are shown in Appendix 6. Axis 1 of the species ordination showed a general gradient from Halophobes/Oligohalobian-indifferent species (lowest values) to Polyhalobian species (highest values). This gradient showed up better for some species than others. This gradient was observed in *Navicula* and examples of *Navicula* species are highlighted in Figure 5.6. For example *N. peregrina* is a marine species usually present around North Sea coasts, whereas *N. cocephala* and *N. viridula* are fresh water species that are often found in brackish conditions. Axis 2 & 3 of the species ordination showed no recognisable pattern (see Appendix 6).

The distribution of samples (i.e. mixtures of species) showed no recognisable pattern along any axis. This suggests that there are spatially no distinct assemblages of species in relation to an environmental gradient (e.g. salinity) from the samples taken.
Reasons for the lack of a clear distribution of samples and some species could be due to sudden blooms in growth of short lived species and the inclusion of allocthonous material being washed in from elsewhere (e.g. the broads, or the sea).

Figure 5.6 Axis 1 plot of the species ordination



5.5 Conclusions and Recommendations

The potential of this method for monitoring salinity is high since many diatom species are specific in their salinity tolerances. The data collected shows that saline influences can be identified at low levels in almost all reaches of the rivers in this study area (indicating only the tidal areas were sampled). The DECORANA analysis is inconclusive at this stage for defining the salinity tolerances of assemblages of species (i.e. samples), although there are patterns of distribution for some individual species in relation to salinity. Lack of clarity is possibly due to the influx of allocthonous material and the short lived blooms of particular species.

To try and prevent distortion of the data by short lived blooms the sample strings could be left in-situ for an extended period. Lugol's iodine proved to be unsuitable as a preservative when hydrogen peroxide is used to digest organic material, since it is too strong an oxidising agent and results in the hydrogen peroxide being broken down before it can digest any of the organic material. It is suggested that the samples are kept cool and processed soon after collection and no preservative is used. Although more labour intensive this should ensure only live material is identified.

An additional data set to include in the DECORANA analysis (or similar analyses) would be beneficial to attempt to get a better idea of the individual species and assemblages most sensitive to salinity variation. This could then provide markers for comparison against future monitoring.

Figure 5.1 **Diagram of salinity classifications based on diatom assemblages from the River Bure, 1998**

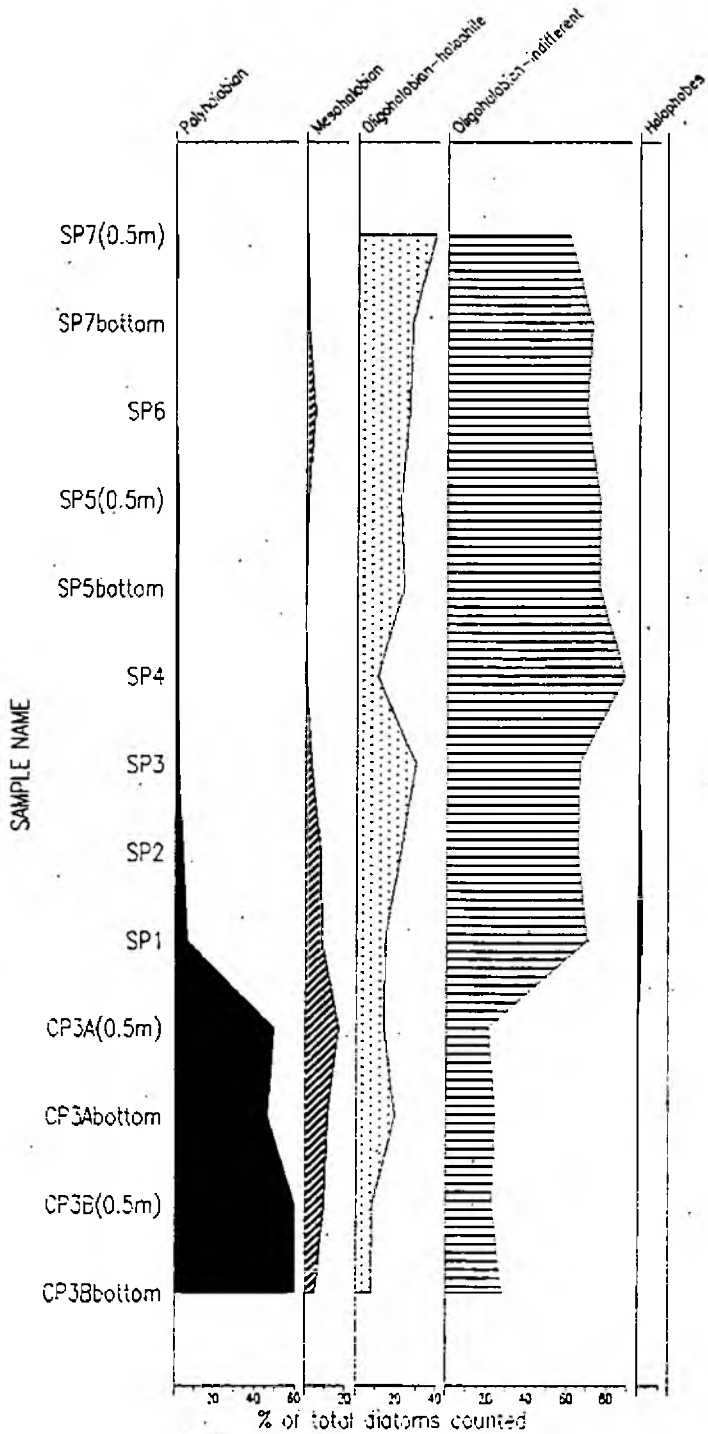


Figure 5.2 **Diagram of salinity classifications based on diatom assemblages from the River Ant, 1998**

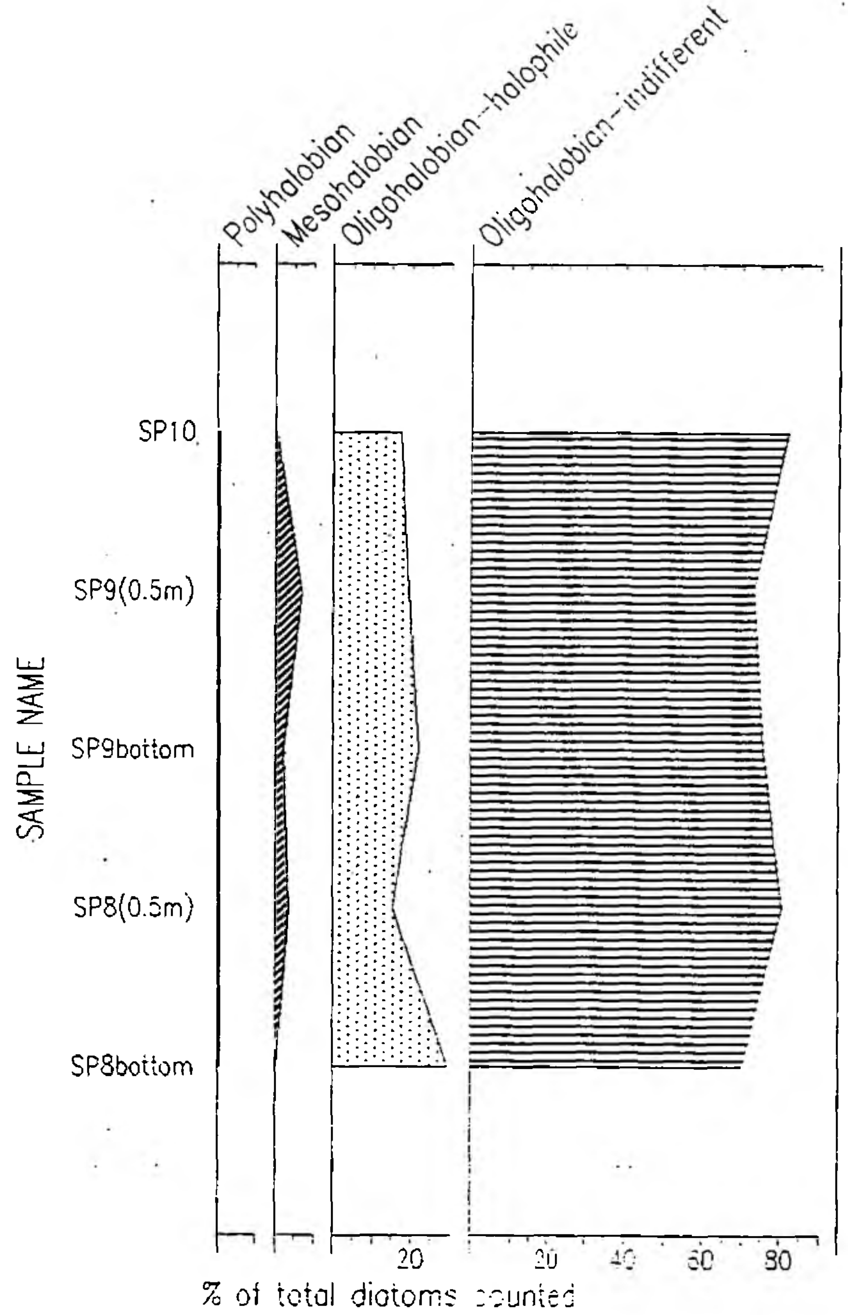


Figure 5.3 Diagram of salinity classifications based on diatom assemblages from the River Thurne, 1998

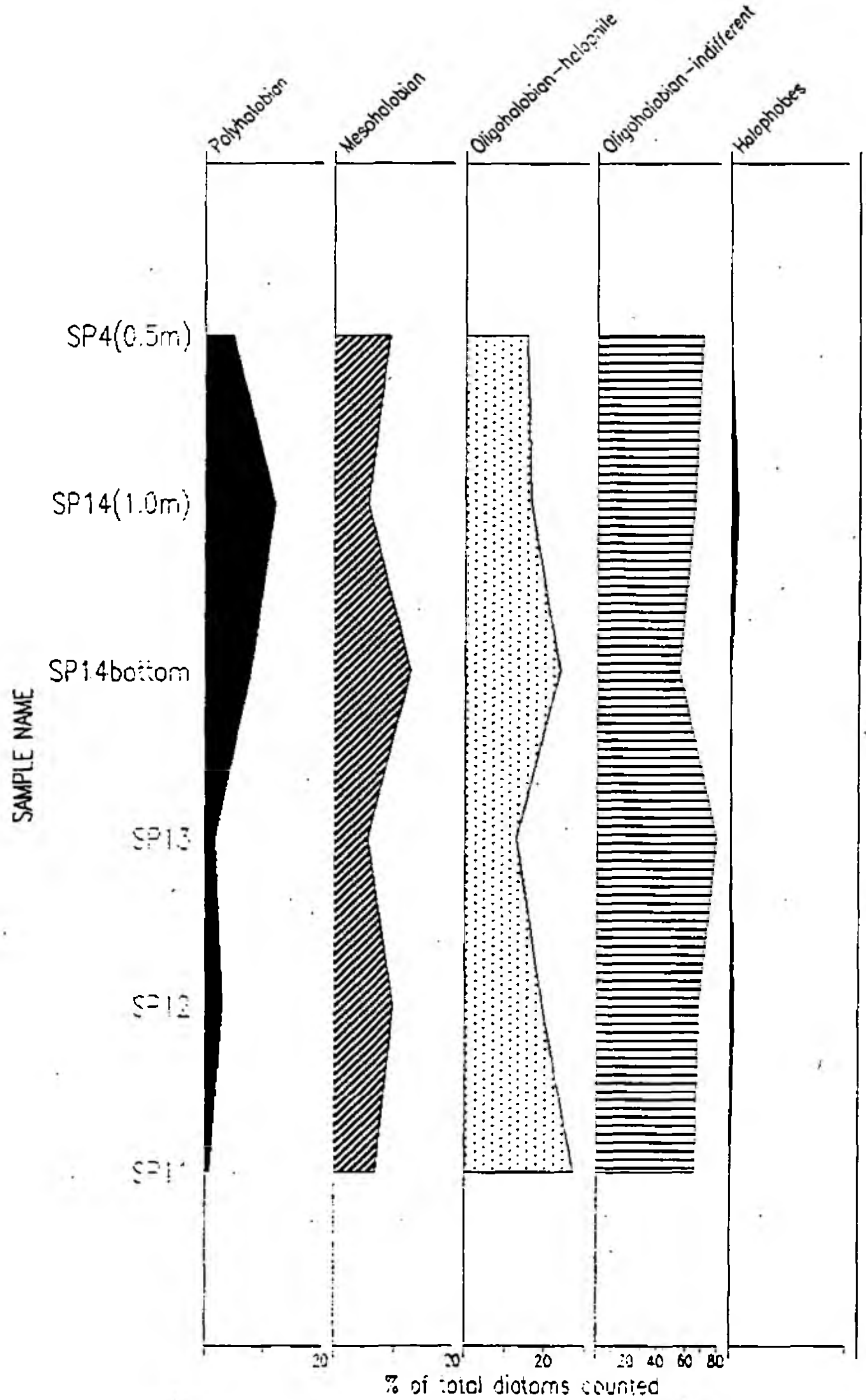


Figure 5.4 Diagram of salinity classifications based on diatom assemblages from the River Yare, 1998

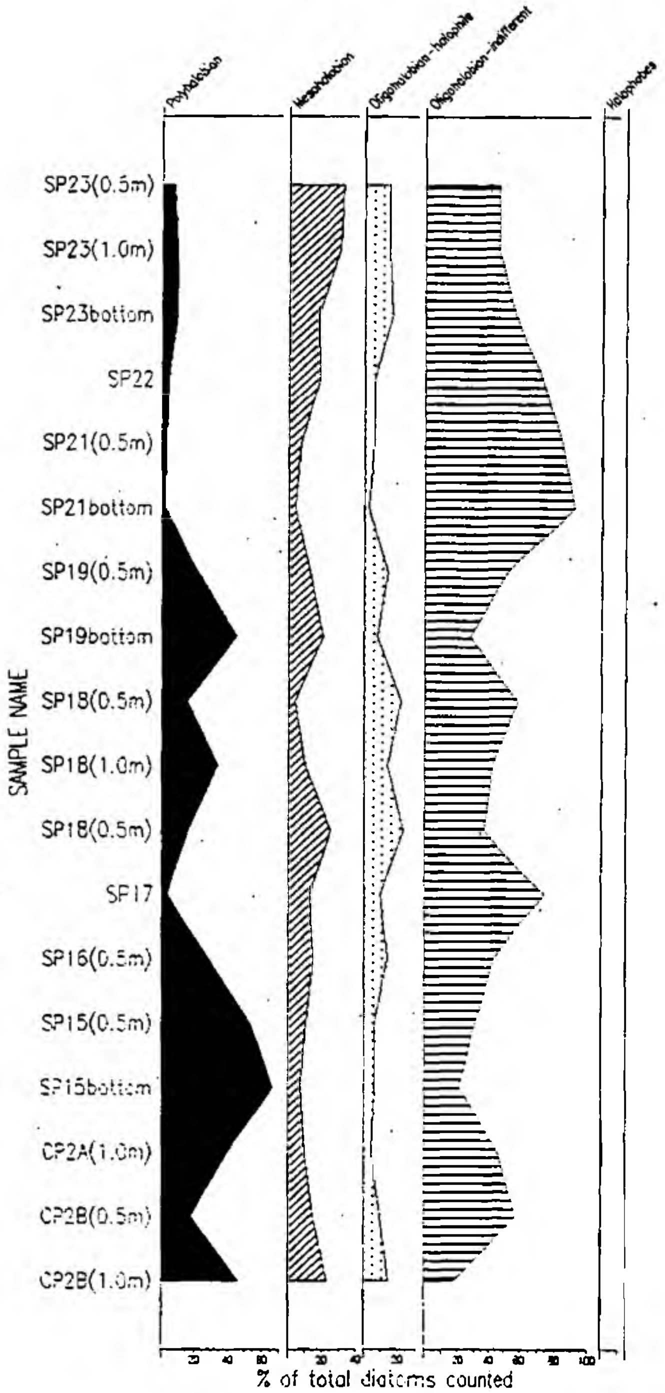
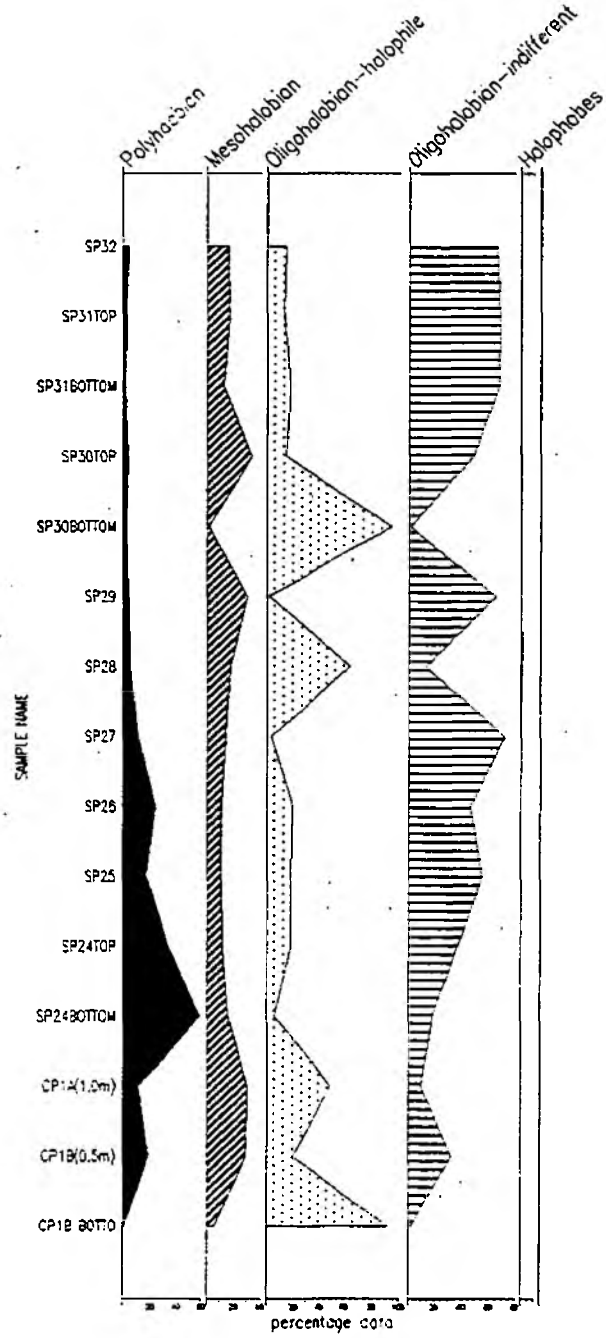


Figure 5.5 **Diagram of salinity classifications based on diatom assemblages from the River Waveney, 1998**



6. MAIN CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary of Main Findings

6.1.1 Historic Water Quality and Hydrometric Data

- The Rivers Waveney and Yare have similar characteristics. These are different from the River Bure which has 'flashy' characteristics.
- There is periodic saline incursion at two (of the three) conductivity monitors during regular tidal highs, at Cantley on the River Yare and Acle on the River Bure.
- The introduction of the new saline barrier (in 1993) in the River Thurne has reduced the frequency of fish kills.

6.1.2 Salinity Surveys

- The upstream limit of the saline wedge is between 14 and 17 km upstream on the Rivers Bure, Waveney and Yare during March survey conditions.
- Conductivity, turbidity and dissolved oxygen levels are linked to the position of the saline wedge during March survey conditions.

6.1.3 Invertebrate monitoring

- Most of the taxa sampled are present at all levels of salinity. Therefore using invertebrates to indicate precise levels of salinity is not possible with the current data.
- The sampling method was successfully used to sample molluscs and the existing sites could be useful to monitor for the possible spread of the Asiatic clam (*Corbicula fluminea*).

6.1.4 Diatom Monitoring

- Diatoms are specific in their salinity tolerances and initial results show that they could be useful to provide a baseline for monitoring salinity throughout Broadland rivers. Better resolution is expected if further data is collected.

6.2 The Geographical Information System (GIS) and Recommendations for Future Work.

6.2.1 Introduction

The GIS has been used to display graphically the information from the BFASEM Strategic Surveys carried out by Scott Wilson. How the information from this report is currently displayed on the Broadland GIS is shown below together with recommendations for future input of information onto the GIS.

Suggestions for future surveys and data analyses are given which will complement the existing data to monitor water quality and hydrometric conditions in relation to the relevant BFAS environmental enhancement and acceptability criteria:

Strategic (acceptability)

- No increase in the saline limit upstream in rivers
- No damage (direct or indirect) to the ecological integrity of internationally important sites as a result of the scheme implementation

Strategic (enhancement) of the broads

- Increase the protection afforded to 'unconnected' broads via bank strengthening and raising in key compartments
- Reduce saline intrusion

6.2.2 Historic Water Quality and Hydrometric Data

Sample sites for hydrometric and water quality data collection have been digitised onto the GIS. These have been used to assess their distance upstream and positions relative to each other.

Fluvial flow and tidal water level cumulative frequency graphs have been linked to the sample sites allowing easy access to summary hydrometric information. Gaps in water level data, especially during maximum water level events, mean that the accuracy of these plots are reduced. To improve the statistical accuracy the data set could be extended up to a 10 year period. In addition the processing and auditing of HYDROLOG data could be carried out more frequently to identify problems with monitors earlier and therefore reduce frequency and size of data gaps. For regular updating of summarised hydrometric data on the GIS regular transfer of data from the Environment Agency could be organised. Once the new topographic survey is completed, and the bank heights are known an estimation of flood risk should be possible with a more complete set of water level data.

Annual precipitation data from the three sites used have been plotted and linked to the sites on the GIS. Future studies could be expanded to the assessment of other meteorological conditions during flood events, which could also be linked to the GIS.

Water quality data has been displayed by linking both continuous conductivity data and spot sampling results. Continuous conductivity temporal plots for 1997 have been linked with the appropriate points on the GIS. One of the monitors at Burgh St Peter is known to have been out of calibration for much of the year (*pers. comm.* Environment Agency), hence more regular checks for calibration accuracy against water quality spot sample results should be carried out.

Water quality spot sampling chloride results are displayed for each spot sampling site as annual range graphs. The graphs also include the number of samples taken at each site during the year, since many have only two or three samples per year. Sites of particular interest, (e.g. Berney Arms on the River Yare) that are within the saline wedge, would benefit from a greater frequency of sampling during the flooding tide to map the movement of the wedge. In addition regular spot sampling should be carried out at internationally important sites for nature conservation, before and after flood alleviation scheme implementation.

Fish kill data on the GIS has been classified into events caused by saline incursion or other reasons (e.g. pollution, spawning, unknown), for the period 1990 to 1997. Graduated symbols have been used to show the magnitude of the fish kill (see Table 2.9) which are linked to tabulated information. Future fish kill data should be categorised using the same method for input onto the GIS. The data will help to identify areas of extreme or frequent fish kill events that can be targeted for remediation measures.

6.2.3 Salinity Surveys

The current salinity survey has located the position of the saline wedge during March (Spring) conditions. Further surveys will provide information on the position of the saline wedge under different conditions enabling baseline predictions to be set for a variety of conditions. Initially a summer survey is recommended in conditions under low fluvial flow and high spring tides. The larger volume of boats in the summer may cause mixing of vertical stratification.

The other parameters measured (e.g. turbidity, temperature, pH, and dissolved oxygen) should be repeated to assess the conditions during the survey and to compare with the previous survey. Measuring these are also important to assess the conditions for aquatic/marginal fauna and flora. It would also be advantageous to note the bed depth and wind strength and direction for assessment of the movement of the saline wedge.

6.2.4 Invertebrates and Diatoms

On the GIS at each sample and control sites there are links to the site recording sheets, giving detailed information on the number of samples collected (at different depths), substrate description, access points, and a photo of the sample point (see example in Appendix 7). A link to the results show actual numbers of invertebrates and diatoms for each sample/control site at different depths (where recorded).

Further studies should enable a better understanding of the salinity tolerances of individuals and assemblages of diatoms and/or invertebrates. On the GIS selected indicator species or assemblages of species could be highlighted based on their levels of salinity tolerances. It is envisaged that this information will then be used as a baseline to monitor saline incursion and to see if the saline limits for each main river change over time.

Monitoring the possible spread of the Asiatic clam *Corbicula fluminea* should be carried out at the existing sample sites by, in the first place, Scott Wilson. A separate layer on the GIS could be set up to receive data from this sampling, and incorporate data from local and site specific surveys.

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Glossary of Terms

Accretion: gradual increase in size by the gradual addition or inclusion of external material, for example fluvial deposition on sand banks.

Allocthonous: material generated outside the system (e.g. dead organisms washed downstream).

Aquatic bioindicator: an organism that is present in the water indicating an environmental parameter e.g. salinity.

Average daily flow: calculated average of daily measured flows, it is commonly monthly or annual.

Benthic: the organisms living on the bottom of the river.

Chloroplast: a part of a plant responsible for photosynthesis.

Colonisation material: Man made material supplied for invertebrates and diatoms to inhabit.

Conductivity: measure of the ability of a material to conduct an electrical charge e.g. saline water will conduct electricity more readily than fresh water as it contains chloride ions.

DECORANA: a statistical computer program for Detrended Correspondence Analysis and Reciprocal Averaging, devised by Hill (1979).

Diatom: minute unicellular or colonial algae of the class Bacillariophycae.

Dissolved oxygen: oxygen found in suspension in water.

Ebb tide: falling tide after rising flood tide.

Epiphytic: ecological classification of aquatic lifeforms which attach to plants, rocks, sand or any substrate.

Flashy river: flow and/or water levels increase and decline rapidly after a period of rainfall.

Float: used to determine water level, it is an object which will remain on the surface of the water (unless it becomes tangled) and is easier to identify than the water surface.

Flood bank: man-made embankment adjacent to the river designed to prevent flooding of adjacent land.

Flood compartment: an administrative division of Broadland into 40 independent compartments.

Flood defence or alleviation: the measure taken to protect land adjacent to the river from inundation of water during high river flow or high tide events.

Flood events: situations when high river flow or high tides cause overtopping of, or seepage through flood banks. The result may be standing water on adjacent land.

Flood risk: probability of certain flood events occurring.

Flood tide: Rising tide.

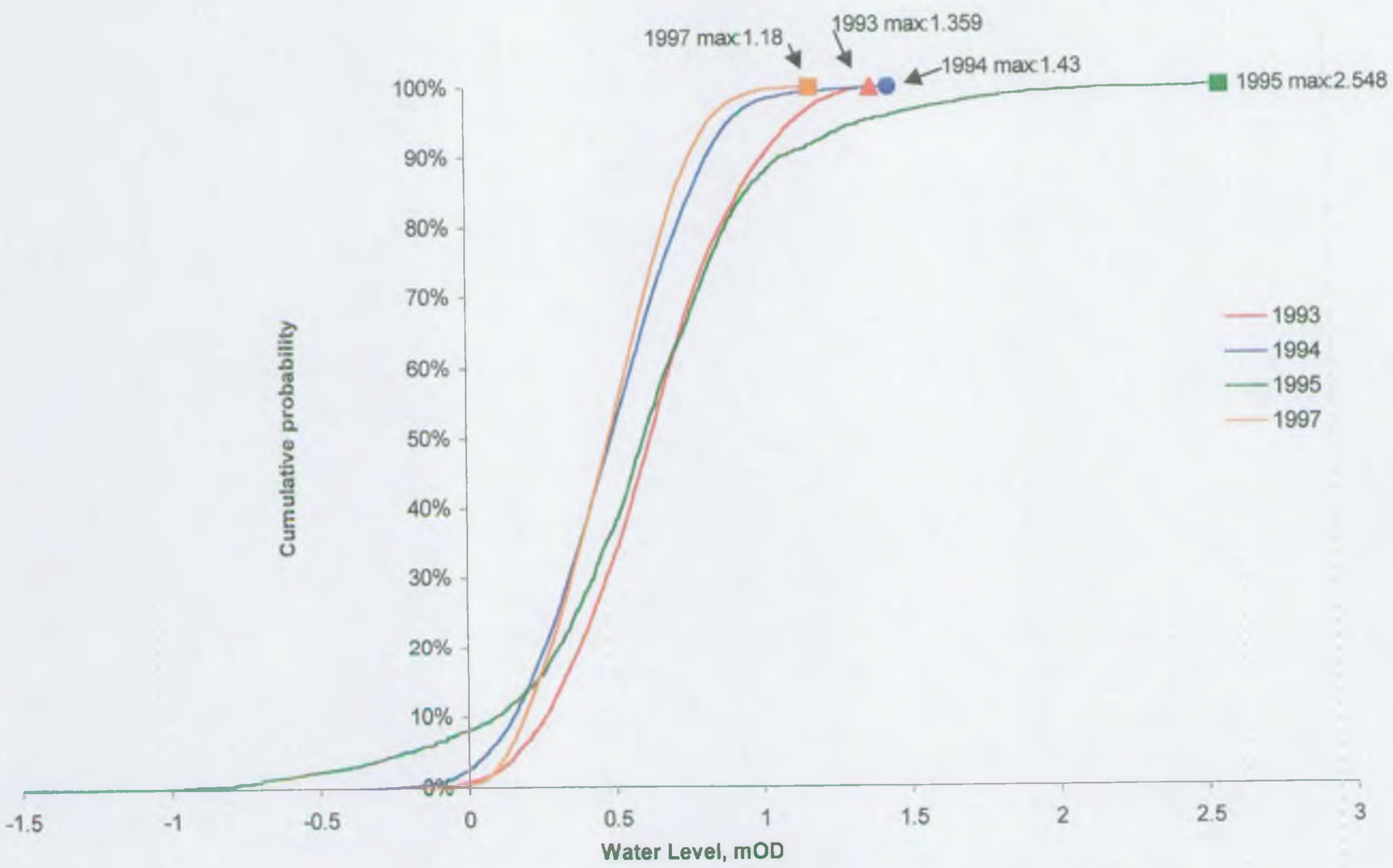
Flood warnings: issued by the Environment Agency when predictions suggest that tidal or meteorological conditions are likely to produce a risk of flooding. These warnings are categorised into red, amber and yellow warnings depending on the severity of the expected flood event.

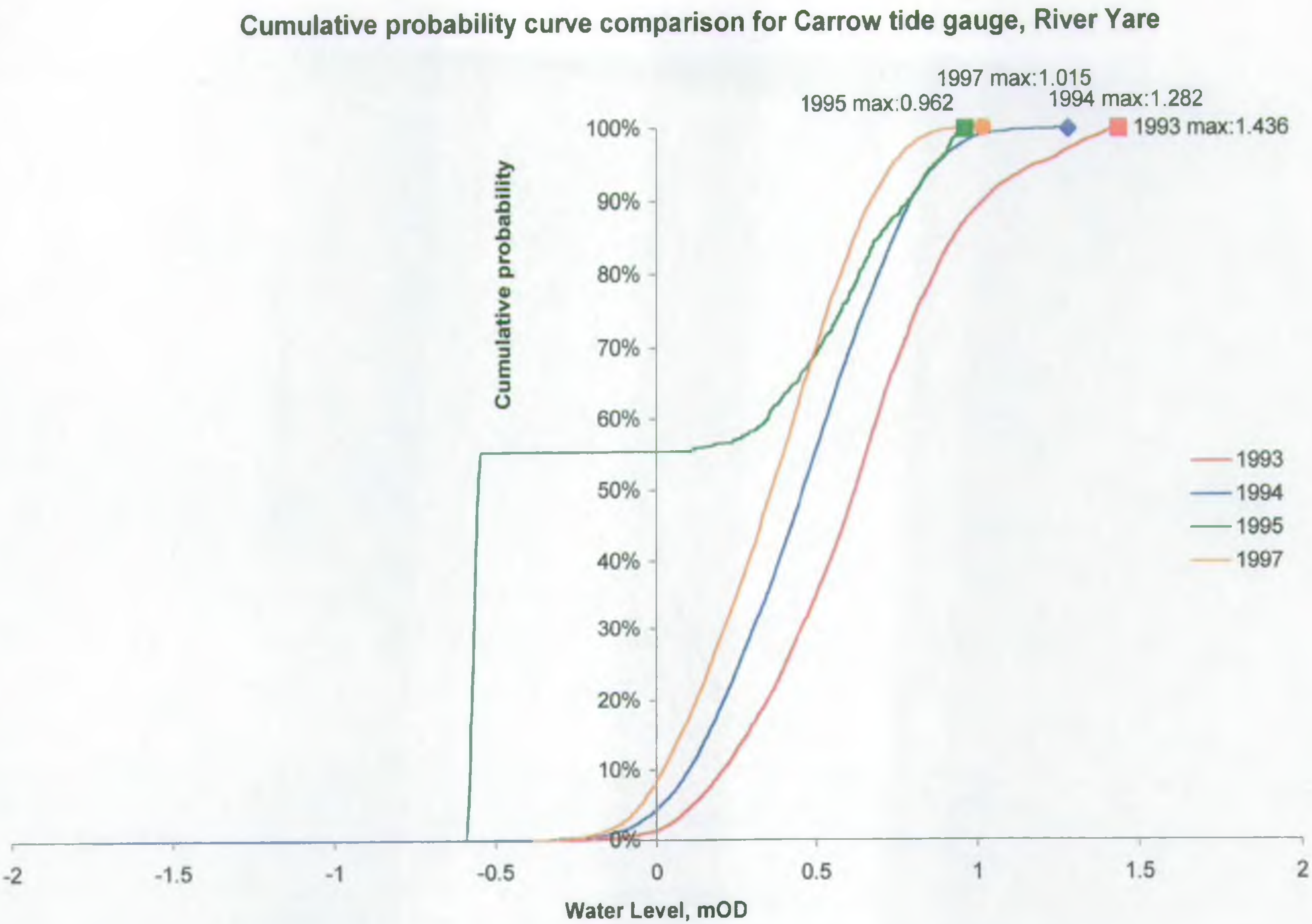
Fluvial flow: river flow or movement of water downstream by gravity.

Folding: area of low lying land adjacent to the river between the flood bank and soke dyke.

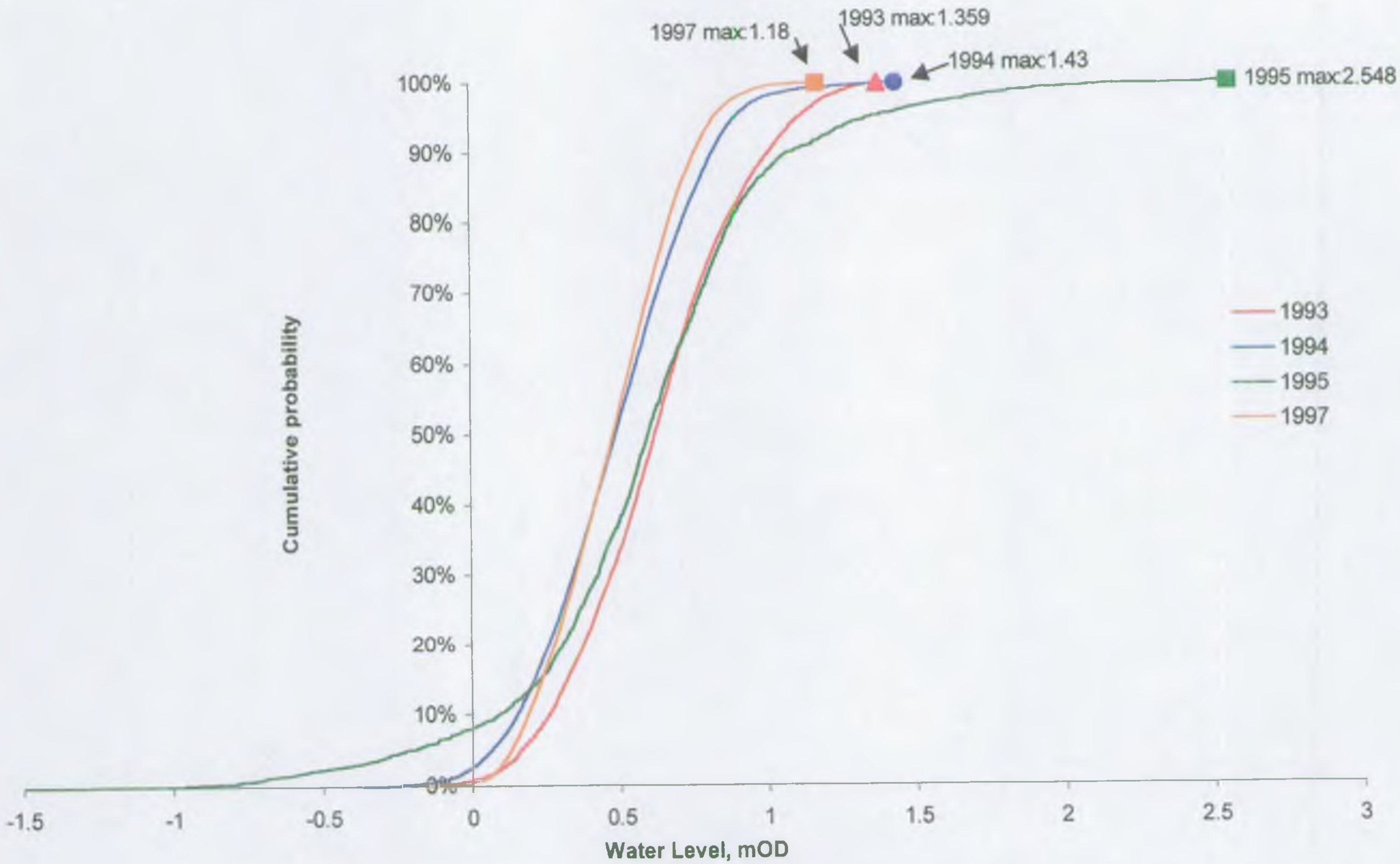
Frustule: hard silicate shell of a diatom.

Cumulative probability curve comparison for Cantley tide gauge, River Yare
(NB data incomplete)

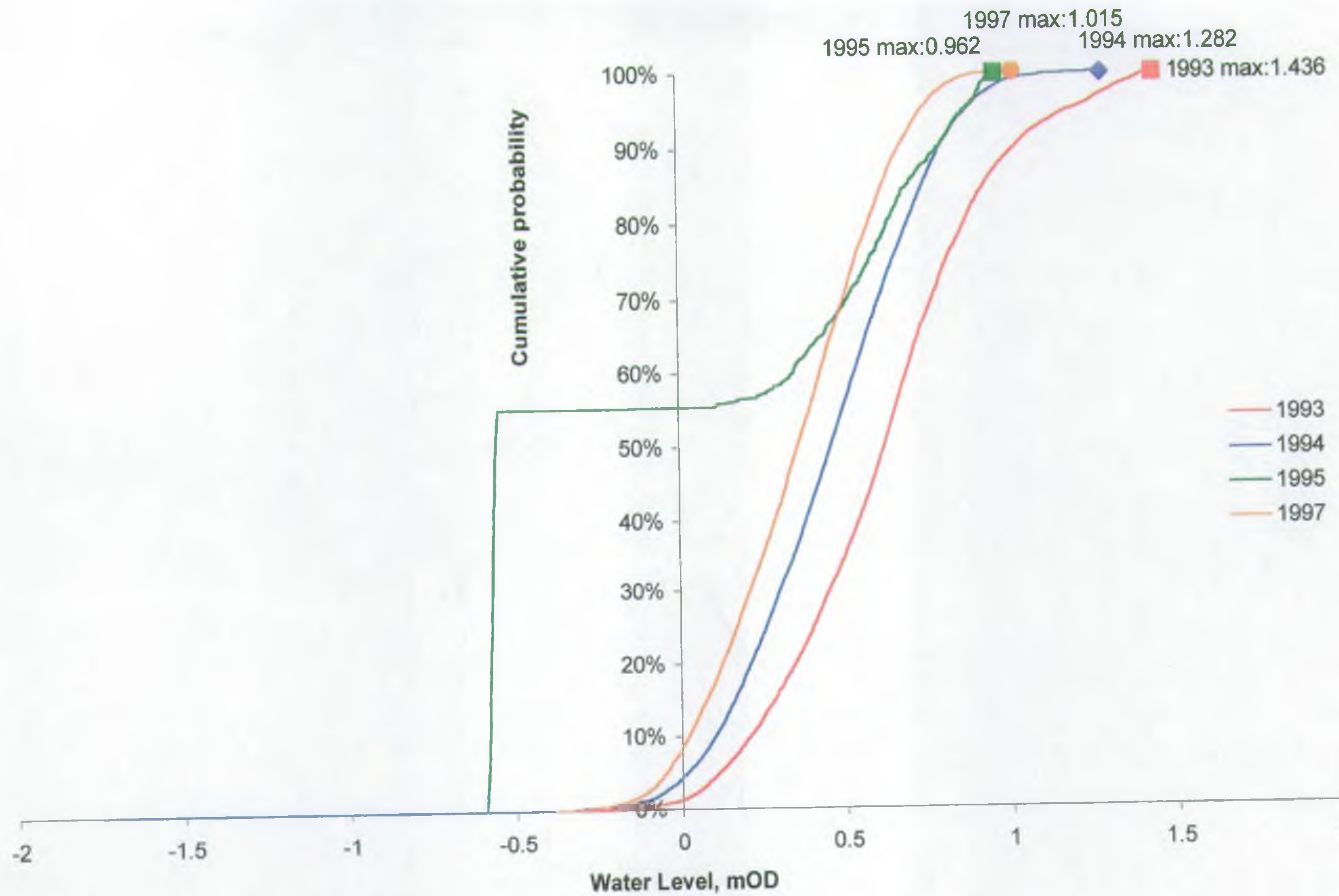



Cumulative probability curve comparison for Carrow tide gauge, River Yare
1997 max:1.015
1995 max:0.962
1994 max:1.282
1993 max:1.436
Cumulative probability
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Water Level, mOD
1993
1994
1995
1997

Cumulative probability curve comparison for Cantley tide gauge, River Yare
(NB data incomplete)



Cumulative probability curve comparison for Carrow tide gauge, River Yare



Appendix 2a: Salinity survey results for October 1998

River Bure: October 1998 survey results

Site	Easting	Northing	Chainage	Date	Time	High tide	Before or After High Tide	Depth	Salinity
			(km)		(hh:mm)	(hh:mm)		(m)	(%)
?	640688	314079	24.8	20/10/98	11:45	12:38	-	1.5	0.07
?	640688	314079	24.8	20/10/98				1.0	0.07
?	640688	314079	24.8	20/10/98				0.5	0.07
?	1°33'37.7"	52°40'12.1"	24.1	20/10/98	11:55	12:32	-	1.5	0.07
?	1°33'37.7"	52°40'12.1"	24.1	20/10/98				1.0	0.07
?	1°33'37.7"	52°40'12.1"	24.1	20/10/98				0.5	0.07
?	640828	312541	23.3	20/10/98	12:05	12:24	-	2.0	0.08
?	640828	312541	23.3	20/10/98				1.5	0.08
?	640828	312541	23.3	20/10/98				1.0	0.08
?	640828	312541	23.3	20/10/98				0.5	0.08
?	640672	312258	23.0	20/10/98	12:18	12:22	-	2.0	0.08
?	640672	312258	23.0	20/10/98				1.5	0.08
?	640672	312258	23.0	20/10/98				1.0	0.08
?	640672	312258	23.0	20/10/98				0.5	0.08
?	640679	312029	22.8	20/10/98	12:25	12:20	+	2.0	0.08
?	640679	312029	22.8	20/10/98				1.5	0.08
?	640679	312029	22.8	20/10/98				1.0	0.08
?	640679	312029	22.8	20/10/98				0.5	0.08
?	640782	311803	22.3	20/10/98	12:32	12:15	+	2.0	0.08
?	641076	311716	22.1	20/10/98	12:38	12:14	+	2.0	0.09
?	641380	311694	21.7	20/10/98	12:44	12:10	+	2.0	0.10
10m downstream of Acle Bridge	641390	311694	21.6	22/10/98	12:00	13:20	+	0.1	0.08
10m downstream of Acle Bridge	641390	311694	21.6	22/10/98				4.0	0.09
?	1°33'59.0"	52°38'25.5"	21.3	22/10/98	12:10			0.1	0.08
?	1°33'59.0"	52°38'25.5"	21.3	22/10/98	?			4.0	0.07
?	1°34'22.9"	52°38'16.9"	21.7	22/10/98	12:17			0.1	0.09
Ferry Inn, Stokesby	643113	310475	18.5	20/10/98	13:41	11:41	+	4.0	0.34
Old Hall Mill	643600	309450	17.2	20/10/98	13:54	11:29	+	5.0	0.82
Opp. Six Mile House	646038	310000	13.7	20/10/98	14:16	10:58	+	4.0	1.67

River Waveney: October 1998 survey results

Site	E	N	Chainage	Date	Sample Time	High tide	Before or After High Tide ?	Depth	Salinity
Opposite Burgh Castle	647225	304575	10.47	21/10/98	11:17	10:09	+	6.0	1.18
Goodchild Marine mooring	647370	304030	11.51	22/10/98	10:35	10:44	-	0.1	3.22
Near Black Drainage Mill	1°38'17.3"	52°34'30.0"	11.31	23/10/98	09:35			0.1	0.54
Near Black Drainage Mill	1°38'17.3"	52°34'30.0"	11.31	23/10/98				bottom	1.31
Opposite Caldecott Drainage Mill	1°37'56.9"	52°33'40.8"	14.30	23/10/98	09:47	12:22	-	0.1	0.30
Fritton Marsh Drainage Mill	1°36'43.7"	52°32'24.7"	18.10	23/10/98	10:21	12:47	-	0.1	0.07
Herring Fleet Drainage Mill	1°37'56.8"	52°31'11.6"	21.30	23/10/98	10:45	13:08	-	0.1	0.12
Herring Fleet Drainage Mill	1°37'56.8"	52°31'11.6"	21.30	23/10/98				bottom	0.12
SP27	649195	295920	25.37	23/10/98	11:24	13:35		0.1	0.09
SP27	649195	295920	25.37	23/10/98				bottom	0.09

River Yare: October 1998 survey results

Site	Easting	Northing	Chainage	Date	Time	High tide	Before or After High Tide	Depth	Salinity
			(km)		(hh:mm)	(hh:mm)		(m)	(%)
?	1°35'40.0"	52°33'31.4"	19.7	22/10/98	?	11:56		0.0	0.58
50m downstream of Reedham swing bridge	642300	301638	18.4	21/10/98	10:15	11:40	-	2.0	0.05
Near confluence of Cut & Yare	642628	301464	17.9	22/10/98	?	11:35		0.1	0.07
10m downstream of SP15	644132	302699	15.7	21/10/98	10:35	11:23	-	4.0	0.07
Reedham Marshes drainage pump (disused)	645300	303446	13.6	21/10/98	10:47	11:07	-	4.0	0.08
?	645800	303500	13.0	21/10/98	10:56	11:03	-	4.0	0.13
Raven Hall	646525	304575	11.8	21/10/98	11:02	10:55	+	6.0	0.75
20m upstream of Berny Drainage Mill	646505	304575	10.9	21/10/98	11:07	10:49	+	6.0	1.25
Berny Arms Pub	646738	305163	10.7	21/10/98	11:12	10:48	+	6.0	1.07
Berny Arms Pub	646738	305163	10.7	22/10/98	?	10:30		0.1	0.70

Appendix 2b: Salinity survey results for March 1999

River Bure: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	(m)
Gorleston-on-Sea beach			0.0	03/03/99	16:40		0.1	3.17	8.20	50.4	869	7.00	6.1	
Beach on GY side			0.0	03/03/99	15:30		0.1	2.25	8.14	36.8	612	9.28	6.0	
Breakwater on GY side, beach side			0.0	03/03/99	15:40		3.0	3.03	8.17	48.5	504	8.94	5.8	
Breakwater on GY side, beach side			0.0	03/03/99	15:40		2.5	3.03						
Breakwater on GY side, beach side			0.0	03/03/99	15:40		2.0	3.03						
Breakwater on GY side, beach side			0.0	03/03/99	15:40		1.5	3.03						
Breakwater on GY side, beach side			0.0	03/03/99	15:40		1.0	3.04						
Breakwater on GY side, beach side			0.0	03/03/99	15:40		0.5	3.04						
Breakwater on GY side, channel side			0.0	03/03/99	15:45		2.0	1.70						
Breakwater on GY side, channel side			0.0	03/03/99	15:45		1.0	1.64						
Great Yarmouth P.A. viewing point			1.5	01/03/99	15:45	2.3	2.0	2.48	8.14	40.3	342	9.08	6.7	2
Great Yarmouth P.A. viewing point			1.5	01/03/99	15:45	2.3	1.5	2.48						1.5
Great Yarmouth P.A. viewing point			1.5	01/03/99	15:45	2.3	1.0	2.48						1
Great Yarmouth P.A. viewing point			1.5	01/03/99	15:45	2.3	0.5	2.48						0.5
Great Yarmouth P.A. viewing point			1.5	02/03/99	17:35	2.6	2.3	2.12	8.10	34.6	369	8.98	7.0	2.25
Great Yarmouth P.A. viewing point			1.5	02/03/99	17:35	2.6	2.0	2.12						2
Great Yarmouth P.A. viewing point			1.5	02/03/99	17:35	2.6	1.0	2.11						1
Great Yarmouth P.A. viewing point			1.5	02/03/99	17:35	2.6	0.5	2.10						0.5
Great Yarmouth P.A. viewing point			1.5	03/03/99	16:15	1.7	1.4	1.61	8.22	27.2	476	9.00	7.1	
Great Yarmouth P.A. viewing point			1.5	03/03/99	16:15	1.7	1.0	1.60						
Great Yarmouth P.A. viewing point			1.5	03/03/99	16:15	1.7	0.5	1.60						
Great Yarmouth P.A. viewing point			1.5	03/03/99	16:15	1.7	0.1	1.60						
u/s Haven Bridge at Yarmouth			3.6	01/03/99	09:15	7.3	2.0	3.16		50.7	441	9.60	5.2	2
u/s Haven Bridge at Yarmouth			3.6	01/03/99	09:15	7.3	3.0	3.17						3
u/s Haven Bridge at Yarmouth			3.6	01/03/99	09:15	7.3	4.0	3.15						4
u/s Haven Bridge at Yarmouth			3.6	01/03/99	09:15	7.3	5.0	3.18						5
u/s Haven Bridge at Yarmouth			3.6	01/03/99	09:15	7.3	6.0	3.18						6
u/s Haven Bridge at Yarmouth			3.6	01/03/99	09:15	7.3	7.0	3.19						7
u/s Haven Bridge at Yarmouth			3.6	01/03/99	15:25	5.3	5.0	2.47	8.11	40.2	356	9.23	6.7	5
u/s Haven Bridge at Yarmouth			3.6	01/03/99	15:25	5.3	4.0	2.47	8.12	40.2	353	9.09	6.6	4
u/s Haven Bridge at Yarmouth			3.6	01/03/99	15:25	5.3	3.0	2.47	8.13	40.1	344	9.09	6.6	3
u/s Haven Bridge at Yarmouth			3.6	01/03/99	15:25	5.3	2.0	2.47	8.13	40.1	327	8.98	6.6	2

River Bure: March 1999 survey results

Site	Northing	Easting	Chainage (km)	Date	Time (hh:mm)	Max. Depth (m)	Depth (m)	Salinity (%)	pH	EC (mS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. (deg. C)	Depth (m)
u/s Haven Bridge at Yarmouth			3.6	01/03/99	15:25	5.3	1.0	2.47	8.13	40.1	294	8.75	6.6	1
u/s Haven Bridge at Yarmouth			3.6	01/03/99	17:00	2.8	2.5	2.41	8.12	39.2	332	9.27	6.7	2.5
u/s Haven Bridge at Yarmouth			3.6	01/03/99	17:00	2.8	0.5	2.41						0.5
u/s Haven Bridge at Yarmouth			3.6	02/03/99	13:25	4.9	4.6	2.30	8.13	37.4	450	8.98	7.1	4.6
u/s Haven Bridge at Yarmouth			3.6	02/03/99	14:20		1.0	2.31						1
u/s Haven Bridge at Yarmouth			3.6	02/03/99	14:50		1.0	2.32						1
u/s Haven Bridge at Yarmouth			3.6	02/03/99	17:25	3.8	3.5	1.46	8.13	24.8	401	8.02	7.3	3.5
u/s Haven Bridge at Yarmouth			3.6	02/03/99	17:25	3.8	3.0	1.43						3
u/s Haven Bridge at Yarmouth			3.6	02/03/99	17:25	3.8	2.5	1.37						2.5
u/s Haven Bridge at Yarmouth			3.6	02/03/99	17:25	3.8	2.0	1.36						2
u/s Haven Bridge at Yarmouth			3.6	02/03/99	17:25	3.8	1.5	1.32						1.5
u/s Haven Bridge at Yarmouth			3.6	02/03/99	17:25	3.8	1.0	1.30						1
u/s Haven Bridge at Yarmouth			3.6	02/03/99	17:25	3.8	0.5	1.31						0.5
u/s Haven Bridge at Yarmouth			3.6	02/03/99	17:25	3.8	0.1	1.30						0.1
50 m upstream from Yare confl.				04/03/99	13:55		0.1	3.16						
Acle Road Bridge at White Swan			4.6	01/03/99	09:30	2.3	2.0	3.20		51.2	501	9.50	5.1	2
Acle Road Bridge at White Swan			4.6	01/03/99	14:40	0.8	0.5	1.61	8.15	27	324	9.15	6.9	0.5
Acle Road Bridge at White Swan			4.6	01/03/99	15:15	0.8	0.5	1.45	8.17	24.6	217	9.09	6.8	0.45
Acle Road Bridge at White Swan			4.6	01/03/99	16:00	0.8	0.5	1.19	8.22	20.7	97	9.37	6.7	0.5
Acle Road Bridge at White Swan			4.6	01/03/99	16:50	1.3	1.0	1.02	8.21	18	59	9.28	6.8	1
Acle Road Bridge at White Swan			4.6	01/03/99	16:50	1.3	0.5	1.02						0.5
Acle Road Bridge at White Swan			4.6	01/03/99	17:20	1.5	1.2	2.18	8.12	36.4	180	8.84	6.6	1.2
Acle Road Bridge at White Swan			4.6	02/03/99	13:15	0.9	0.6	2.40	8.12	39.1	269	9.30	6.8	0.6
Acle Road Bridge at White Swan			4.6	02/03/99	14:00	0.7	0.4	2.13	8.13	35	328	9.15	6.9	0.4
Acle Road Bridge at White Swan			4.6	02/03/99	17:17	0.8	0.5	0.39	8.24	7.58	175	8.97	7.7	0.5
Acle Road Bridge at White Swan			4.6	02/03/99	17:47	0.9	0.6	0.32	8.30	6.27	91	8.83	7.6	0.6
Acle Road Bridge at White Swan			4.6	02/03/99	18:14	1.2	0.9	0.48	8.21	9.8	91	8.44	7.6	0.9
Acle Road Bridge at White Swan			4.6	02/03/99	18:33	1.3	1.0	1.63	8.11	27	201	8.67	7.1	1
Acle Road Bridge at White Swan			4.6	04/03/99	08:34	3.4	3.1	2.56	8.08	41.9	545	8.09	5.9	
Acle Road Bridge at White Swan			4.6	04/03/99	08:34	3.4	2.5	2.58						
Acle Road Bridge at White Swan			4.6	04/03/99	08:34	3.4	2.0	2.53						
Acle Road Bridge at White Swan			4.6	04/03/99	08:34	3.4	1.5	2.51						

River Bure: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	(m)
Acle Road Bridge at White Swan			4.6	04/03/99	08:34	3.4	1.0	2.45						
Acle Road Bridge at White Swan			4.6	04/03/99	08:34	3.4	0.5	2.38						
Acle Road Bridge at White Swan			4.6	04/03/99	08:34	3.4	0.1	2.18						
Acle Road Bridge at White Swan			4.6	04/03/99	09:51	2.6	2.3	2.97	8.10	47.8	655	8.20	5.7	
Acle Road Bridge at White Swan			4.6	04/03/99	09:51	2.6	2.0	2.99						
Acle Road Bridge at White Swan			4.6	04/03/99	09:51	2.6	1.5	2.99						
Acle Road Bridge at White Swan			4.6	04/03/99	09:51	2.6	1.0	2.98						
Acle Road Bridge at White Swan			4.6	04/03/99	09:51	2.6	0.5	2.98						
Acle Road Bridge at White Swan			4.6	04/03/99	09:51	2.6	0.1	2.98						
Acle Road Bridge at White Swan			4.6	04/03/99	14:18	2.5	2.2	3.14	8.11	50.2	318	8.33	5.7	
Acle Road Bridge at White Swan			4.6	04/03/99	14:18	2.5	2.0	3.12						
Acle Road Bridge at White Swan			4.6	04/03/99	14:18	2.5	1.5	3.13						
Acle Road Bridge at White Swan			4.6	04/03/99	14:18	2.5	1.0	3.13						
Acle Road Bridge at White Swan			4.6	04/03/99	14:18	2.5	0.5	3.10						
Acle Road Bridge at White Swan			4.6	04/03/99	14:18	2.5	0.1	3.09						
?	308775	652045		04/03/99	08:26	2.7	2.4	1.67	8.08	28.3	288	7.90	6.3	
?	308775	652045		04/03/99	08:26	2.7	2.0	1.66						
?	308775	652045		04/03/99	08:26	2.7	1.5	1.62						
?	308775	652045		04/03/99	08:26	2.7	1.0	1.46						
?	308775	652045		04/03/99	08:26	2.7	0.5	0.95						
?	308775	652045		04/03/99	08:26	2.7	0.1	0.91						
?	308540	652033		04/03/99	08:30		0.1	0.99						
150 m downstream of snack bar			6.1	02/03/99	10:10	2.7	2.4	3.17	8.10	50.5	352	9.35	5.5	2.4
151 m downstream of snack bar			6.1	02/03/99	10:10	2.7	2.0	3.17						2
152 m downstream of snack bar			6.1	02/03/99	10:10	2.7	1.5	3.18						1.5
153 m downstream of snack bar			6.1	02/03/99	10:10	2.7	1.0	3.18						1
154 m downstream of snack bar			6.1	02/03/99	10:10	2.7	0.5	3.18						0.5
155 m downstream of snack bar			6.1	02/03/99	17:07		0.5	0.23	8.15	4.63	156	9.26	7.9	0.5
156 m downstream of snack bar			6.1	04/03/99	08:15	1.5	1.2	0.65						
157 m downstream of snack bar			6.1	04/03/99	08:15	1.5	0.5	0.64						
u/s end of Port of Yarmouth moorings			6.6	02/03/99	10:01	3.1	2.8	3.11	8.09	49.9	444	9.38	5.5	2.75
u/s end of Port of Yarmouth moorings			6.6	02/03/99	10:01	3.1	2.0	3.13					5.5	2

River Bure: March 1999 survey results

Site	Northing	Easting	Chainage (km)	Date	Time (hh:mm)	Max. Depth (m)	Depth (m)	Salinity (%)	pH	EC (mS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. (deg. C)	Depth (m)
u/s end of Port of Yarmouth moorings			6.6	02/03/99	10:01	3.1	1.0	3.10						1
u/s end of Port of Yarmouth moorings			6.6	02/03/99	10:01	3.1	0.5	2.85						0.5
u/s end of Port of Yarmouth moorings			6.6	02/03/99	10:01	3.1	0.3	2.99						0.25
?			7.4	02/03/99	09:54	4.1	3.8	2.17	8.08	35.7	204	9.09	6.3	3.75
?			7.4	02/03/99	09:54	4.1	3.0	2.17						3
?			7.4	02/03/99	09:54	4.1	2.0	2.08						2
?			7.4	02/03/99	09:54	4.1	1.0	1.25						1
?			7.4	02/03/99	09:54	4.1	0.5	1.12						0.5
?			7.4	02/03/99	10:24	4.6	4.3	2.91	8.09	46.5	322	9.25	5.8	4.25
?			7.4	02/03/99	10:24	4.6	4.0	2.91						4
?			7.4	02/03/99	10:24	4.6	3.5	2.90						3.5
?			7.4	02/03/99	10:24	4.6	3.0	2.91						3
?			7.4	02/03/99	10:24	4.6	2.0	2.78						2
?			7.4				1.5	2.60						1.5
?			7.4	02/03/99	10:24	4.6	1.0	1.66						1
?			7.4	02/03/99	10:24	4.6	0.5	1.34						0.5
?			7.7	02/03/99	10:29	2.6	2.3	2.50	8.09	40.3	243	9.07	6.2	2.25
?			7.7	02/03/99	10:29	2.6	2.0	2.49						2
?			7.7	02/03/99	10:29	2.6	1.5	2.35						1.5
?			7.7	02/03/99	10:29	2.6	1.0	1.55						1
?			7.7	02/03/99	10:29	2.6	0.5	1.27						0.5
?			7.7	02/03/99	10:29	2.6	0.1	1.24						0.1
Ashtree Farm Drainage Mill			8.1	02/03/99	09:47	4.8	4.5	0.99						4.5
Ashtree Farm Drainage Mill			8.1	02/03/99	09:47	4.8	4.0	0.99						4
Ashtree Farm Drainage Mill			8.1	02/03/99	09:47	4.8	3.0	0.98						3
Ashtree Farm Drainage Mill			8.1	02/03/99	09:47	4.8	2.0	0.98						2
Ashtree Farm Drainage Mill			8.1	02/03/99	09:47	4.8	1.0	0.97						1
Ashtree Farm Drainage Mill			8.1	02/03/99	09:47	4.8	0.5	0.96						0.5
Ashtree Farm Drainage Mill			8.1	02/03/99	10:35	4.1	3.8	2.21						3.75
Ashtree Farm Drainage Mill			8.1	02/03/99	10:35	4.1	3.0	2.21						3
Ashtree Farm Drainage Mill			8.1	02/03/99	10:35	4.1	2.0	2.19						2
Ashtree Farm Drainage Mill			8.1	02/03/99	10:35	4.1	1.5	2.09						1.5

River Bure: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	(m)
Ashtree Farm Drainage Mill			8.1	02/03/99	10:35	4.1	1.0	1.50						1
Ashtree Farm Drainage Mill			8.1	02/03/99	10:35	4.1	0.5	1.10						0.5
Ashtree Farm			8.5	02/03/99	09:42	3.6	3.3	0.86	8.16	15.4	81	9.16	6.9	3.25
Ashtree Farm			8.5	02/03/99	09:42	3.6	2.5	0.86						2.5
Ashtree Farm			8.5	02/03/99	09:42	3.6	2.0	0.86						2
Ashtree Farm			8.5	02/03/99	09:42	3.6	1.5	0.85						1.5
Ashtree Farm			8.5	02/03/99	09:42	3.6	1.0	0.84						1
Ashtree Farm			8.5	02/03/99	09:42	3.6	0.5	0.84	8.17	15.2	79	8.94	6.9	0.5
Ashtree Farm			8.5	02/03/99	10:40	2.7	2.4	1.32	8.13	22.5	140	9.10	6.7	2.4
Ashtree Farm			8.5	02/03/99	10:40	2.7	2.0	1.20						2
Ashtree Farm			8.5	02/03/99	10:40	2.7	1.0	1.03						1
Ashtree Farm			8.5	02/03/99	10:40	2.7	0.5	1.02						0.5
Near Scare Gap			8.9	02/03/99	09:36	3.6	3.3	0.68						3.25
Near Scare Gap			8.9	02/03/99	09:36	3.6	3.0	0.68						3
Near Scare Gap			8.9	02/03/99	09:36	3.6	2.0	0.67						2
Near Scare Gap			8.9	02/03/99	09:36	3.6	1.0	0.64						1
Near Scare Gap			8.9	02/03/99	10:43	3.3	3.0	0.91	8.18	16.3	89	9.12	6.9	3
Near Scare Gap			8.9	02/03/99	10:43	3.3	2.0	0.92						2
Near Scare Gap			8.9	02/03/99	10:43	3.3	1.0	0.90						1
Near Scare Gap			8.9	02/03/99	10:43	3.3	0.5	0.89						0.5
?	309695	649664	9.9	02/03/99	09:32	2.6	2.3	0.48						2.25
?	309695	649664	9.9	02/03/99	09:32	2.6	2.0	0.48						2
?	309695	649664	9.9	02/03/99	09:32	2.6	1.5	0.46						1.5
?	309695	649664	9.9	02/03/99	09:32	2.6	1.0	0.45						1
?	309695	649664	9.9	02/03/99	09:32	2.6	0.5	0.45						0.5
?	309756	649571	9.9	02/03/99	10:51	3.6	3.3	0.80	8.17	14.3	78	9.15	7.0	3.25
?	309756	649571	9.9	02/03/99	10:51	3.6	3.0	0.80						3
?	309756	649571	9.9	02/03/99	10:51	3.6	2.0	0.79						2
?	309756	649571	9.9	02/03/99	10:51	3.6	1.0	0.79						1
?	309756	649571	9.9	02/03/99	10:51	3.6	0.5	0.78						0.5
Mautby Marsh Drainage Mill			10.5	02/03/99	09:28	4.1	3.8	0.29	8.18	5.73	82	9.15	7.0	3.8
Mautby Marsh Drainage Mill			10.5	02/03/99	09:28	4.1	3.0	0.29						3

River Bure: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	(m)
Mautby Marsh Drainage Mill			10.5	02/03/99	09:28	4.1	2.0	0.29						2
Mautby Marsh Drainage Mill			10.5	02/03/99	09:28	4.1	1.0	0.29						1
Mautby Marsh Drainage Mill			10.5	02/03/99	09:28	4.1	0.5	0.29						0.5
Mautby Marsh Drainage Mill			10.5	02/03/99	10:55	3.6	3.3	0.66	8.17	12	70	9.13	7.0	3.25
Mautby Marsh Drainage Mill			10.5	02/03/99	10:55	3.6	3.0	0.66						3
Mautby Marsh Drainage Mill			10.5	02/03/99	10:55	3.6	2.0	0.66						2
Mautby Marsh Drainage Mill			10.5	02/03/99	10:55	3.6	1.0	0.65						1
Mautby Marsh Drainage Mill			10.5	02/03/99	10:55	3.6	0.5	0.65						0.5
Five Mile House Drainage Mill			11.7	02/03/99	09:13	4.1	3.8	0.15	8.14	3.17	52	9.05	7.2	3.75
Five Mile House Drainage Mill			11.7	02/03/99	09:13	4.1	0.5	0.15						0.5
Five Mile House Drainage Mill			11.7	02/03/99	11:06	4.3	4.0	0.39	8.17	7.45	68	9.18	7.1	4
Five Mile House Drainage Mill			11.7	02/03/99	11:06	4.3	3.0	0.39						3
Five Mile House Drainage Mill			11.7	02/03/99	11:06	4.3	2.0	0.38						2
Five Mile House Drainage Mill			11.7	02/03/99	11:06	4.3	1.0	0.37						1
Five Mile House Drainage Mill			11.7	02/03/99	11:06	4.3	0.5	0.37						0.5
Six Mile House Drainage Mill			13.5	02/03/99	09:00	3.8	3.5	0.13	8.14	2.73	47	9.05	7.2	3.5
Six Mile House Drainage Mill			13.5	02/03/99	09:00	3.8	0.5	0.13						0.5
Six Mile House Drainage Mill			13.5	02/03/99	11:15	3.8	3.5	0.16	8.18	3.47	42	9.12	7.3	3.5
Six Mile House Drainage Mill			13.5	02/03/99	11:15	3.8	3.5	0.16						3.5
Six Mile House Drainage Mill			13.5	02/03/99	11:15	3.8	3.5	0.16						3.5
Six Mile House Drainage Mill			13.5	02/03/99	11:15	3.8	3.5	0.16						3.5
Vegetation site code B005L	309734	644837		02/03/99	11:30	4.3	4.0	0.13						4
Vegetation site code B005L	309734	644837		02/03/99	11:30	4.3	3.0	0.13						3
Vegetation site code B005L	309734	644837		02/03/99	11:30	4.3	2.0	0.13						2
Vegetation site code B005L	309734	644837		02/03/99	11:30	4.3	1.0	0.13						1
Stracey Arms			16.6	02/03/99	08:38	4.1	3.8	0.10	8.19	2.23	36	9.13	7.1	3.75
Stracey Arms			16.6	02/03/99	08:38	4.1	0.5	0.10						0.5
Stracey Arms			16.6	02/03/99	11:39	3.7	3.4	0.12	8.18	2.6	35	9.13	7.3	3.4
Stracey Arms			16.6	02/03/99	11:39	3.7	3.0	0.12						3
Stracey Arms			16.6	02/03/99	11:39	3.7	2.0	0.12						2
Stracey Arms			16.6	02/03/99	11:39	3.7	1.0	0.12						1
Ferry Inn at Stokesby			18.5	01/03/99	09:55	1.6	1.3	0.11	8.30	2.43	35	9.46	6.6	1.25

River Bure: March 1999 survey results

Site	Northing	Easting	Chainage (km)	Date	Time (hh:mm)	Max. Depth (m)	Depth (m)	Salinity (%)	pH	EC (mS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. (deg. C)	Depth (m)
Ferry Inn at Stokesby			18.5	01/03/99	12:00	4.1	3.8	0.13	8.19	2.75	32	9.45	6.7	3.75
Ferry Inn at Stokesby			18.5	01/03/99	12:00	4.1	2.0	0.13	8.22	2.76	34	9.24	6.7	2
Ferry Inn at Stokesby			18.5	02/03/99	08:25	4.6	4.3	0.11						4.25
Ferry Inn at Stokesby			18.5	02/03/99	08:25	4.6	0.5	0.11						0.5
Ferry Inn at Stokesby			18.5	02/03/99	11:51	4.1	3.8	0.10						3.75
Ferry Inn at Stokesby			18.5	02/03/99	11:51	4.1	3.0	0.10						3
Ferry Inn at Stokesby			18.5	02/03/99	11:51	4.1	2.0	0.10						2
Ferry Inn at Stokesby			18.5	02/03/99	11:51	4.1	1.0	0.10						1
Vegetation site code B006L	310523	642773		02/03/99	11:55	4.1	3.8	0.10						3.75
Vegetation site code B006L	310523	642773		02/03/99	11:55	4.1	3.0	0.10						3
Vegetation site code B006L	310523	642773		02/03/99	11:55	4.1	2.0	0.10						2
Vegetation site code B006L	310523	642773		02/03/99	11:55	4.1	1.0	0.10						1
Confluence with Muck Fleet			19.6	02/03/99	08:15		0.5	0.12						0.5
Confluence with Muck Fleet			19.6	02/03/99	12:00	3.3	3.0	0.10	8.22	2.23	34	9.27	7.3	3
Confluence with Muck Fleet			19.6	02/03/99	12:00	3.3	2.0	0.10						2
Confluence with Muck Fleet			19.6	02/03/99	12:00	3.3	1.0	0.10						1
Vegetation site code B007R	311395	641718		02/03/99	12:10	4.1	3.8	0.11						3.8
Vegetation site code B007R	311395	641718		02/03/99	12:10	4.1	3.0	0.11						3
Vegetation site code B007R	311395	641718		02/03/99	12:10	4.1	2.0	0.11						2
Vegetation site code B007R	311395	641718		02/03/99	12:10	4.1	1.0	0.11						1
Acle Bridge			21.7	01/03/99	08:25	1.8	1.5	0.11		2.46	278	9.55	7.0	1.5
Acle Bridge			21.7	01/03/99	08:31	?	1.5	0.12		2.57	32	9.31	6.7	1.5
Acle Bridge			21.7	01/03/99	08:31	?	3.0	0.12		2.57	31	9.24	6.6	3
Acle Bridge			21.7	01/03/99	08:31	?	4.0	0.12		2.58				4
Acle Bridge			21.7	01/03/99	11:40	3.1	2.8	0.09	8.22	2.14	33	9.49	6.7	2.75
Acle Bridge			21.7	01/03/99	11:40	3.1	1.0	0.09	8.23	21.4	37	9.43	6.7	1
Acle Bridge			21.7	01/03/99	12:45	3.3	3.0	0.09	8.22	2.14	33	9.53	6.9	3
Acle Bridge			21.7	01/03/99	12:45	3.3	2.0	0.09	8.24	2.15	32	9.50	6.8	2
Acle Bridge			21.7	01/03/99	12:45	3.3	1.0	0.09	8.24	2.15	29	9.42	6.8	1
Acle Bridge			21.7	02/03/99	08:00		0.5	0.14						0.5
Oby Drainage Mill			24.5	01/03/99	11:25	4.3	4.0	0.12	8.20	2.61	34	9.40	6.7	4
Oby Drainage Mill			24.5	01/03/99	11:25	4.3	2.0	0.12	8.23	2.61	32	9.33	6.7	2

River Bure: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	(m)
Thurne Mouth			26.3	01/03/99	11:10	3.3	3.0	0.13	8.19	2.88	38	9.31	6.8	3
Thurne Mouth			26.3	01/03/99	11:10	3.3	2.0	0.13	8.21	2.88	37	9.26	6.8	2
Thurne Mouth			26.3	01/03/99	11:10	3.3	1.0	0.13	8.21	2.88	32	9.22	6.7	1
Confluence with Womack Water			28.5	01/03/99	10:50	2.1	1.8	0.18						1.75
Confluence with Womack Water			28.5	01/03/99	10:50	2.1	1.5	0.18						1.5
Confluence with Womack Water			28.5	01/03/99	10:50	2.1	1.0	0.18						1
Confluence with Womack Water			28.5	01/03/99	10:50	2.1	0.5	0.18						0.5
Filby Bridge			24.8	01/03/99	14:20	0.6	0.3	0.03	8.72	0.767	22	10.26	7.1	0.25
Sea water					00:00			3.20						
					12:00			3.20						
					23:59			3.20						

River Waveney: March 1999 survey results

Site	Northing	Easting	Chainage (km)	Date	Time (hh:mm)	Max. Depth (m)	Depth (m)	Salinity (%)	pH	EC (mS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. (deg. C)	Depth
R. Bure confluence			4.2	04/03/99	13:54		0.1	1.74						0.1
Downstream end of Breydon Water	307930	651857	4.3	04/03/99	09:00		0.1	3.18						0.1
Jetty nr Recreation Ground			5.0	03/03/99	14:19	2.5	2.2	1.69	8.16	28.2	587	8.91	7.2	2.2
Jetty nr Recreation Ground			5.0	03/03/99	14:19	2.5	1.5	1.67						1.5
Jetty nr Recreation Ground			5.0	03/03/99	14:19	2.5	1.0	1.67						1
Jetty nr Recreation Ground			5.0	03/03/99	14:19	2.5	0.5	1.67						0.5
Jetty nr Recreation Ground			5.0	03/03/99	14:19	2.5	0.1	1.66						0.1
Jetty nr Recreation Ground			5.0	04/03/99	09:04		0.1	3.00						0.1
Jetty nr Recreation Ground			5.0	04/03/99	17:00	2.1	1.8	1.12	8.21	19.3	266	7.90	7.1	1.8
Jetty nr Recreation Ground			5.0	04/03/99	17:00	2.1	1.5	1.11						1.5
Jetty nr Recreation Ground			5.0	04/03/99	17:00	2.1	1.0	1.11						1
Jetty nr Recreation Ground			5.0	04/03/99	17:00	2.1	0.5	1.11						0.5
Jetty nr Recreation Ground			5.0	04/03/99	17:00	2.1	0.1	1.11						0.1
400 m upstream of jetty			5.4	03/03/99	14:11		0.1	1.57	8.14	26.5	445	8.86	7.4	0.1
?	307745	651043	5.2	04/03/99	09:06		0.1	2.95						0.1
?	307613	650631	5.6	04/03/99	09:09		0.1	2.61						0.1
	307613	650631	5.6	04/03/99	09:09	7.8	7.5	2.80	8.11	45.3	696	8.07	5.7	7.5
	307613	650631	5.6	04/03/99	09:09	7.8	6.5	2.82						6.5
	307613	650631	5.6	04/03/99	09:09	7.8	5.5	2.89						5.5
	307613	650631	5.6	04/03/99	09:09	7.8	4.5	2.91						4.5
	307613	650631	5.6	04/03/99	09:09	7.8	3.5	2.91						3.5
	307613	650631	5.6	04/03/99	09:09	7.8	2.5	2.91						2.5
	307613	650631	5.6	04/03/99	09:09	7.8	1.5	2.91						1.5
	307613	650631	5.6	04/03/99	09:09	7.8	0.5	2.85						0.5
?	307387	650095	6.1	04/03/99	09:15		0.1	2.31						0.1
?	307092	649609	6.7	04/03/99	09:19		0.1	1.85						0.1
?	306991	649400	6.9	04/03/99	09:20	4.8	4.5	2.08	8.09	34.5	449	7.96	6.0	4.5
			6.9	04/03/99	09:20	4.8	4.0	2.10						4
			6.9	04/03/99	09:20	4.8	3.0	2.10						3
			6.9	04/03/99	09:20	4.8	2.0	2.07						2
			6.9	04/03/99	09:20	4.8	1.0	1.90						1
			6.9	04/03/99	09:20	4.8	0.5	1.33						0.5

River Waveney: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	
			6.9	04/03/99	09:20	4.8	0.1	1.09						0.1
?	306793	649001	7.3	04/03/99	09:26		0.1	0.51						0.1
Downstream of Lockgate Drainage Mill	306660	648653	7.7	04/03/99	13:35	4.1	3.8	3.17						3.8
Downstream of Lockgate Drainage Mill	306660	648653	7.7	04/03/99	13:35	4.1	3.0	3.19						3
Downstream of Lockgate Drainage Mill	306660	648653	7.7	04/03/99	13:35	4.1	2.0	3.19						2
Downstream of Lockgate Drainage Mill	306660	648653	7.7	04/03/99	13:35	4.1	1.0	2.55						1
Downstream of Lockgate Drainage Mill	306660	648653	7.7	04/03/99	13:35	4.1	0.5	2.04						0.5
Downstream of Lockgate Drainage Mill	306660	648653	7.7	04/03/99	13:35	4.1	0.1	1.09						0.1
?	306658	648683	7.7	04/03/99	09:29	4.3	4.0	2.12	8.08	35	999	7.94	6.2	4
?	306658	648683	7.7	04/03/99	09:29	4.3	3.0	2.08						3
?	306658	648683	7.7	04/03/99	09:29	4.3	2.0	2.06						2
?	306658	648683	7.7	04/03/99	09:29	4.3	1.5	1.10						1.5
?	306658	648683	7.7	04/03/99	09:29	4.3	1.0	1.79						1
?	306658	648683	7.7	04/03/99	09:29	4.3	0.5	0.72						0.5
?	306658	648683	7.7	04/03/99	09:29	4.3	0.1	0.61						0.1
?	306545	648288	8.1	04/03/99	09:35		0.1	0.59						0.1
?	306295	647765	8.7	04/03/99	13:30		0.1	0.26						0.1
?	306266	647753	8.7	04/03/99	09:39		0.1	0.40						0.1
?	305892	647275	9.3	04/03/99	09:45	4.3	4.0	1.86	8.05	31.2	999	7.84	6.3	4
?	305892	647275	9.3	04/03/99	09:45	4.3	3.0	1.88						3
?	305892	647275	9.3	04/03/99	09:45	4.3	2.5	1.77						2.5
?	305892	647275	9.3	04/03/99	09:45	4.3	2.0	1.55						2
?	305892	647275	9.3	04/03/99	09:45	4.3	1.5	1.38						1.5
?	305892	647275	9.3	04/03/99	09:45	4.3	1.0	1.10						1
?	305892	647275	9.3	04/03/99	09:45	4.3	0.5	0.11						0.5
?	305529	647158	9.7	04/03/99	13:24		0.1	0.20						0.1
Entrance to R. Waveney	305196	647121	9.9	04/03/99	09:51		0.1	0.36						0.1
?	304592	647219	10.5	04/03/99	09:55	4.6	4.3	1.49	8.06	25.4	761	7.80	6.5	4.25
?	304592	647219	10.5	04/03/99	09:55	4.6	3.5	1.50						3.5
?	304592	647219	10.5	04/03/99	09:55	4.6	3.0	1.50						3
?	304592	647219	10.5	04/03/99	09:55	4.6	2.0	1.46						2
?	304592	647219	10.5	04/03/99	09:55	4.6	1.0	0.91						1

River Waveney: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	
?	304592	647219	10.5	04/03/99	09:55	4.6	0.5	0.22						0.5
?	304592	647219	10.5	04/03/99	09:55	4.6	0.1	0.06						0.1
Nr. Burgh Castle	304922	647142	10.3	04/03/99	13:15	4.5	4.2	2.96						4.2
Nr. Burgh Castle	304922	647142	10.3	04/03/99	13:15	4.5	3.0	2.94						3
Nr. Burgh Castle	304922	647142	10.3	04/03/99	13:15	4.5	2.0	2.70						2
Nr. Burgh Castle	304922	647142	10.3	04/03/99	13:15	4.5	1.0	2.13						1
Nr. Burgh Castle	304922	647142	10.3	04/03/99	13:15	4.5	0.5	0.72						0.5
Nr. Burgh Castle	304922	647142	10.3	04/03/99	13:15	4.5	0.1	0.59						0.1
Church Farm PH			10.5	03/03/99	11:40		0.1	0.32	8.37	4.45	270	9.38	7.8	0.1
Fisherman's Bar - Burgh Castle			11.4	03/03/99	11:20	1.4	1.1	1.15	8.10	21.5	211	8.27	7.0	1.1
Fisherman's Bar - Burgh Castle			11.4	03/03/99	11:20	1.4	0.5	0.43						0.5
Fisherman's Bar - Burgh Castle			11.4	03/03/99	11:20	1.4	0.1	0.40						0.1
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:10	2.5	2.2	1.40						2.2
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:10	2.5	1.5	1.39						1.5
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:10	2.5	1.0	1.37						1
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:10	2.5	0.8	1.17						0.75
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:10	2.5	0.5	0.26						0.5
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:10	2.5	0.1	0.21						0.1
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:31	2.9	2.6	1.59	8.07	26.7	485	7.75	6.5	2.6
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:31	2.9	2.0	1.59						2
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:31	2.9	1.5	1.59						1.5
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:31	2.9	1.0	1.56						1
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:31	2.9	0.5	1.00						0.5
Fisherman's Bar - Burgh Castle			11.4	04/03/99	10:31	2.9	0.0	0.59						0
Fisherman's Bar - Burgh Castle	304188	647373	11.4	04/03/99	13:10	3.9	3.6	2.88	8.02	46	214	8.03	5.9	3.6
Fisherman's Bar - Burgh Castle	304188	647373	11.4	04/03/99	13:10	3.9	3.0	2.83						3
Fisherman's Bar - Burgh Castle	304188	647373	11.4	04/03/99	13:10	3.9	2.0	2.79						2
Fisherman's Bar - Burgh Castle	304188	647373	11.4	04/03/99	13:10	3.9	1.0	1.25						1
Fisherman's Bar - Burgh Castle	304188	647373	11.4	04/03/99	13:10	3.9	0.5	0.58						0.5
Fisherman's Bar - Burgh Castle	304188	647373	11.4	04/03/99	13:10	3.9	0.1	0.36						0.1
Between Black Drainage Mill & Marina	303707	647133	12.0	04/03/99	13:04	4.3	4.0	2.59	8.02	42.1	227	8.04	5.9	4
Between Black Drainage Mill & Marina	303707	647133	12.0	04/03/99	13:04	4.3	3.0	2.45						3

River Waveney: March 1999 survey results

Site	Northing	Easting	Chainage (km)	Date	Time (hh:mm)	Max. Depth (m)	Depth (m)	Salinity (%)	pH	EC (mS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. (deg. C)	Depth
Between Black Drainage Mill & Marina	303707	647133	12.0	04/03/99	13:04	4.3	2.0	2.14						2
Between Black Drainage Mill & Marina	303707	647133	12.0	04/03/99	13:04	4.3	1.0	1.78						1
Between Black Drainage Mill & Marina	303707	647133	12.0	04/03/99	13:04	4.3	0.5	0.51						0.5
Between Black Drainage Mill & Marina	303707	647133	12.0	04/03/99	13:04	4.3	0.1	0.41						0.1
Black Drainage Mill			12.6	04/03/99	10:45	2.8	2.5	1.13	8.08	20.1	828	7.62	6.7	2.5
Black Drainage Mill			12.6	04/03/99	10:45	2.8	2.0	0.97						2
Black Drainage Mill			12.6	04/03/99	10:45	2.8	1.5	0.80						1.5
Black Drainage Mill			12.6	04/03/99	10:45	2.8	1.0	0.23						1
Black Drainage Mill			12.6	04/03/99	10:45	2.8	0.5	0.10						0.5
Black Drainage Mill			12.6	04/03/99	10:45	2.8	0.1	0.10						0.1
Black Drainage Mill	303668	646560	12.6	04/03/99	12:58	5.3	5.0	2.31	8.03	37.7	316	7.97	6.0	5
Black Drainage Mill	303668	646560	12.6	04/03/99	12:58	5.3	4.0	2.29						4
Black Drainage Mill	303668	646560	12.6	04/03/99	12:58	5.3	3.0	2.08						3
Black Drainage Mill	303668	646560	12.6	04/03/99	12:58	5.3	2.0	1.92						2
Black Drainage Mill	303668	646560	12.6	04/03/99	12:58	5.3	1.0	1.62						1
Black Drainage Mill	303668	646560	12.6	04/03/99	12:58	5.3	0.5	0.40						0.5
Black Drainage Mill	303668	646560	12.6	04/03/99	12:58	5.3	0.1	0.36						0.1
Nr. Six Mile House Drainage Mill	303286	646301	13.0	04/03/99	12:56	5.1	4.8	1.92	8.04	31.9	206	7.89	6.3	4.8
Nr. Six Mile House Drainage Mill	303286	646301	13.0	04/03/99	12:56	5.1	4.0	1.92						4
Nr. Six Mile House Drainage Mill	303286	646301	13.0	04/03/99	12:56	5.1	3.0	1.89						3
Nr. Six Mile House Drainage Mill	303286	646301	13.0	04/03/99	12:56	5.1	2.0	1.80						2
Nr. Six Mile House Drainage Mill	303286	646301	13.0	04/03/99	12:56	5.1	1.5	1.61						1.5
Nr. Six Mile House Drainage Mill	303286	646301	13.0	04/03/99	12:56	5.1	1.0	0.95						1
Nr. Six Mile House Drainage Mill	303286	646301	13.0	04/03/99	12:56	5.1	0.5	0.37						0.5
Nr. Six Mile House Drainage Mill	303286	646301	13.0	04/03/99	12:56	5.1	0.1	0.25						0.1
Nr. Belton Marshes	302675	646377	13.6	04/03/99	12:46	3.1	2.8	1.58	8.03	28.5	331	7.53	6.6	2.8
Nr. Belton Marshes	302675	646377	13.6	04/03/99	12:46	3.1	2.5	1.59						2.5
Nr. Belton Marshes	302675	646377	13.6	04/03/99	12:46	3.1	2.0	1.55						2
Nr. Belton Marshes	302675	646377	13.6	04/03/99	12:46	3.1	1.5	1.41						1.5
Nr. Belton Marshes	302675	646377	13.6	04/03/99	12:46	3.1	1.0	1.08						1
Nr. Belton Marshes	302675	646377	13.6	04/03/99	12:46	3.1	0.5	0.31						0.5
Nr. Belton Marshes	302675	646377	13.6	04/03/99	12:46	3.1	0.1	0.20						0.1

River Waveney: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	
Caldecott Drainage Mill			14.3	04/03/99	10:57	5.3	5.0	0.05	8.11	1.33	156	7.29	7.7	5
Caldecott Drainage Mill			14.3	04/03/99	10:57	5.3	4.0	0.05						4
Caldecott Drainage Mill			14.3	04/03/99	10:57	5.3	3.0	0.05						3
Caldecott Drainage Mill			14.3	04/03/99	10:57	5.3	2.0	0.06						2
Caldecott Drainage Mill			14.3	04/03/99	10:57	5.3	1.0	0.06						1
Caldecott Drainage Mill			14.3	04/03/99	10:57	5.3	0.1	0.06						0.1
Caldecott Drainage Mill			14.3	04/03/99	12:42	5.1	4.8	1.49	8.07	25.3	344	7.78	6.6	4.8
Caldecott Drainage Mill			14.3	04/03/99	12:42	5.1	4.0	1.48						4
Caldecott Drainage Mill			14.3	04/03/99	12:42	5.1	3.0	1.43						3
Caldecott Drainage Mill			14.3	04/03/99	12:42	5.1	2.0	1.22						2
Caldecott Drainage Mill			14.3	04/03/99	12:42	5.1	1.5	0.40						1.5
Caldecott Drainage Mill			14.3	04/03/99	12:42	5.1	1.0	0.30						1
Caldecott Drainage Mill			14.3	04/03/99	12:42	5.1	0.5	0.17						0.5
Caldecott Drainage Mill			14.3	04/03/99	12:42	5.1	0.1	0.15						0.1
No Water-Skiing' sign	301845	646152	14.5	04/03/99	12:35	6.1	5.8	1.32	8.06	22.7	553	7.70	6.7	5.75
No Water-Skiing' sign	301845	646152	14.5	04/03/99	12:35	6.1	5.0	1.33						5
No Water-Skiing' sign	301845	646152	14.5	04/03/99	12:35	6.1	4.0	1.32						4
No Water-Skiing' sign	301845	646152	14.5	04/03/99	12:35	6.1	3.0	1.26						3
No Water-Skiing' sign	301845	646152	14.5	04/03/99	12:35	6.1	2.0	1.12						2
No Water-Skiing' sign	301845	646152	14.5	04/03/99	12:35	6.1	1.5	0.56						1.5
No Water-Skiing' sign	301845	646152	14.5	04/03/99	12:35	6.1	1.0	0.24						1
No Water-Skiing' sign	301845	646152	14.5	04/03/99	12:35	6.1	0.5	0.13						0.5
No Water-Skiing' sign	301845	646152	14.5	04/03/99	12:35	6.1	0.1	0.12						0.1
Pettingell's Drainage Mill			15.0	04/03/99	12:30	4.9	4.6	1.02	8.07	7.9	422	7.63	6.9	4.6
Pettingell's Drainage Mill			15.0	04/03/99	12:30	4.9	4.0	1.00						4
Pettingell's Drainage Mill			15.0	04/03/99	12:30	4.9	3.0	0.97						3
Pettingell's Drainage Mill			15.0	04/03/99	12:30	4.9	2.0	0.77						2
Pettingell's Drainage Mill			15.0	04/03/99	12:30	4.9	1.5	0.38						1.5
Pettingell's Drainage Mill			15.0	04/03/99	12:30	4.9	1.0	0.13						1
Pettingell's Drainage Mill			15.0	04/03/99	12:30	4.9	0.5	0.09						0.5
Pettingell's Drainage Mill			15.0	04/03/99	12:30	4.9	0.1	0.09						0.1
?	301105	645624	15.6	04/03/99	12:29		0.1	0.06						0.1

River Waveney: March 1999 survey results

Site	Northing	Easting	Chainage (km)	Date	Time (hh:mm)	Max. Depth (m)	Depth (m)	Salinity (%)	pH	EC (mS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. (deg. C)	Depth
Toft Monks Drainage Mill			16.6	04/03/99	11:12	5.5	5.2	0.04	8.11	1.14	115	7.39	7.7	5.2
Toft Monks Drainage Mill			16.6	04/03/99	11:12	5.5	4.0	0.05						4
Toft Monks Drainage Mill			16.6	04/03/99	11:12	5.5	3.0	0.05						3
Toft Monks Drainage Mill			16.6	04/03/99	11:12	5.5	2.0	0.05						2
Toft Monks Drainage Mill			16.6	04/03/99	11:12	5.5	1.0	0.05						1
Toft Monks Drainage Mill			16.6	04/03/99	12:22	4.9	4.6	0.05	8.16	1.17	124	7.33	7.8	4.6
Toft Monks Drainage Mill			16.6	04/03/99	12:22	4.9	4.0	0.05						4
Toft Monks Drainage Mill			16.6	04/03/99	12:22	4.9	3.0	0.05						3
Toft Monks Drainage Mill			16.6	04/03/99	12:22	4.9	2.0	0.05						2
Toft Monks Drainage Mill			16.6	04/03/99	12:22	4.9	1.0	0.05						1
Toft Monks Drainage Mill			16.6	04/03/99	12:22	4.9	0.1	0.05						0.1
Nr. Fritton Marsh Drainage Mill	300288	644583	17.2	04/03/99	12:14	5.3	5.0	0.05	8.16	1.17	108	7.28	7.8	5
Nr. Fritton Marsh Drainage Mill	300288	644583	17.2	04/03/99	12:14	5.3	4.0	0.05						4
Nr. Fritton Marsh Drainage Mill	300288	644583	17.2	04/03/99	12:14	5.3	3.0	0.05						3
Nr. Fritton Marsh Drainage Mill	300288	644583	17.2	04/03/99	12:14	5.3	2.0	0.05						2
Nr. Fritton Marsh Drainage Mill	300288	644583	17.2	04/03/99	12:14	5.3	1.0	0.05						1
Nr. Fritton Marsh Drainage Mill	300288	644583	17.2	04/03/99	12:14	5.3	0.1	0.05						0.1
Fritton Marsh Drainage Mill			18.1	04/03/99	11:24		0.1	0.05						0.1
Fritton Marsh Drainage Mill			18.1	04/03/99	12:06	4.8	4.5	0.04	8.16	1.11	95	7.30	7.8	4.5
Fritton Marsh Drainage Mill			18.1	04/03/99	12:06	4.8	4.0	0.04						4
Fritton Marsh Drainage Mill			18.1	04/03/99	12:06	4.8	3.0	0.04						3
Fritton Marsh Drainage Mill			18.1	04/03/99	12:06	4.8	2.0	0.04						2
Fritton Marsh Drainage Mill			18.1	04/03/99	12:06	4.8	1.0	0.04						1
Fritton Marsh Drainage Mill			18.1	04/03/99	12:06	4.8	0.0	0.04						0
W003 R	299770	645665	18.7	04/03/99	11:29		0.0	0.04						0
St. Olaves Bridge			19.1	03/03/99	10:41	4.5	4.2	0.05	8.19	1.25	90	8.32	7.6	4.2
St. Olaves Bridge			19.1	03/03/99	10:41	4.5	3.0	0.05						3
St. Olaves Bridge			19.1	03/03/99	10:41	4.5	2.0	0.05						2
St. Olaves Bridge			19.1	03/03/99	10:41	4.5	1.0	0.05						1
St. Olaves Bridge			19.1	03/03/99	12:00	4.6	4.3	0.05	8.23	1.23	85	8.39	7.6	4.25
St. Olaves Bridge			19.1	03/03/99	12:00	4.6	3.0	0.05						3
St. Olaves Bridge			19.1	03/03/99	12:00	4.6	2.0	0.05						2

River Waveney: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	
St. Olaves Bridge			19.1	03/03/99	12:00	4.6	1.0	0.05						1
St. Olaves Bridge			19.1	04/03/99	11:58	2.6	2.3	0.04	8.12	1.08	100	7.28	7.9	2.25
St. Olaves Bridge			19.1	04/03/99	11:58	2.6	1.5	0.04						1.5
St. Olaves Bridge			19.1	04/03/99	11:58	2.6	0.5	0.04						0.5

River Yare: March 1999 survey results

Site	Northing	Easting	Chainage (km)	Date	Time (hh:mm)	Max. Depth (m)	Depth (m)	Salinity (%)	pH	EC (mS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. (deg. C)	Depth
Near Burgh Castle	305518	647190	9.9	05/03/99	12:37	2.8	2.5	2.38						2.5
Near Burgh Castle	305518	647190	9.9	05/03/99	12:37	2.8	2.0	2.08						2
Near Burgh Castle	305518	647190	9.9	05/03/99	12:37	2.8	1.0	1.56						1
Near Burgh Castle	305518	647190	9.9	05/03/99	12:37	2.8	0.5	0.06						0.5
Near Burgh Castle	305518	647190	9.9	05/03/99	12:37	2.8	0.1	0.05						0.1
Berney Arms PH	305163	646738	10.7	05/03/99	11:55	2.9	2.6	1.37	8.05	23.8	345	7.19	6.4	2.6
Berney Arms PH	305163	646738	10.7	05/03/99	11:55	2.9	2.0	1.37						2
Berney Arms PH	305163	646738	10.7	05/03/99	11:55	2.9	1.5	1.28						1.5
Berney Arms PH	305163	646738	10.7	05/03/99	11:55	2.9	1.0	0.56						1
Berney Arms PH	305163	646738	10.7	05/03/99	11:55	2.9	0.5	0.40						0.5
Berney Arms PH	305163	646738	10.7	05/03/99	11:55	2.9	0.1	0.34						0.1
Berney Arms PH	305163	646738	10.7	05/03/99	12:30	2.8	2.5	1.75	8.03	29.9	456	7.59	6.1	2.5
Berney Arms PH	305163	646738	10.7	05/03/99	12:30	2.8	2.0	1.77						2
Berney Arms PH	305163	646738	10.7	05/03/99	12:30	2.8	1.5	1.72						1.5
Berney Arms PH	305163	646738	10.7	05/03/99	12:30	2.8	1.0	1.69						1
Berney Arms PH	305163	646738	10.7	05/03/99	12:30	2.8	0.5	0.81						0.5
Berney Arms PH	305163	646738	10.7	05/03/99	12:30	2.8	0.1	0.36						0.1
Berney Arms PH	305163	646738	10.7	05/03/99	12:46	4.1	3.8	2.32						3.8
Berney Arms PH	305163	646738	10.7	05/03/99	12:46	4.1	3.0	2.22						3
Berney Arms PH	305163	646738	10.7	05/03/99	12:46	4.1	2.0	2.05						2
Berney Arms PH	305163	646738	10.7	05/03/99	12:46	4.1	1.5	1.77						1.5
Berney Arms PH	305163	646738	10.7	05/03/99	12:46	4.1	1.0	1.69						1
Berney Arms PH	305163	646738	10.7	05/03/99	12:46	4.1	0.5	1.64						0.5
Berney Arms PH	305163	646738	10.7	05/03/99	12:46	4.1	0.1	0.41						0.1
Berney Arms PH	305163	646738	10.7	05/03/99	13:07	4.1	3.8	2.56						3.8
Berney Arms PH	305163	646738	10.7	05/03/99	13:07	4.1	3.0	2.56						3
Berney Arms PH	305163	646738	10.7	05/03/99	13:07	4.1	2.0	2.08						2
Berney Arms PH	305163	646738	10.7	05/03/99	13:07	4.1	1.5	1.98						1.5
Berney Arms PH	305163	646738	10.7	05/03/99	13:07	4.1	1.0	1.83						1
Berney Arms PH	305163	646738	10.7	05/03/99	13:07	4.1	0.5	0.83						0.5
Berney Arms PH	305163	646738	10.7	05/03/99	13:07	4.1	0.1	0.39						0.1
Berney Arms PH	305163	646738	10.7	05/03/99	13:25	3.9	3.6	2.57	8.03	41.7	387	7.79	5.6	3.6

River Yare: March 1999 survey results

Site	Northing	Easting	Chainage (km)	Date	Time (hh:mm)	Max. Depth (m)	Depth (m)	Salinity (%)	pH	EC (mS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. (deg. C)	Depth
Berney Arms PH	305163	646738	10.7	05/03/99	13:25	3.9	3.0	2.52						3
Berney Arms PH	305163	646738	10.7	05/03/99	13:25	3.9	2.0	2.25						2
Berney Arms PH	305163	646738	10.7	05/03/99	13:25	3.9	1.5	1.77						1.5
Berney Arms PH	305163	646738	10.7	05/03/99	13:25	3.9	1.0	1.08						1
Berney Arms PH	305163	646738	10.7	05/03/99	13:25	3.9	0.5	0.44						0.5
Berney Arms PH	305163	646738	10.7	05/03/99	13:25	3.9	0.1	0.28						0.1
Berney Arms PH	305163	646738	10.7	05/03/99	13:25	3.9								0
Berney Arms Drainage Mill	304850	646570	11.1	05/03/99	11:45	5.7	5.4	1.40						5.4
Berney Arms Drainage Mill	304850	646570	11.1	05/03/99	11:45	5.7	5.0	1.40						5
Berney Arms Drainage Mill	304850	646570	11.1	05/03/99	11:45	5.7	4.0	1.43						4
Berney Arms Drainage Mill	304850	646570	11.1	05/03/99	11:45	5.7	3.0	1.42						3
Berney Arms Drainage Mill	304850	646570	11.1	05/03/99	11:45	5.7	2.0	1.15						2
Berney Arms Drainage Mill	304850	646570	11.1	05/03/99	11:45	5.7	1.0	0.60						1
Berney Arms Drainage Mill	304850	646570	11.1	05/03/99	11:45	5.7	0.5	0.49						0.5
Berney Arms Drainage Mill	304850	646570	11.1	05/03/99	11:45	5.7	0.1	0.29						0.1
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	5.2	2.29	8.01	38.4	402	7.75	5.7	5.2
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	4.5	2.30						4.5
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	4.0	2.29						4
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	3.5	2.30						3.5
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	3.0	2.15						3
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	2.5	1.99						2.5
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	2.0	1.69						2
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	1.5	1.54						1.5
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	1.0	0.40						1
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	0.5	0.33						0.5
Ashtree Farm	304775	646555	11.5	05/03/99	13:32	5.5	0.1	0.30						0.1
Langley Detached Drainage Mill	304480	646463	11.9	05/03/99	13:37	5.6	5.3	2.40						5.3
Langley Detached Drainage Mill	304480	646463	11.9	05/03/99	13:37	5.6	5.0	2.35						5
Langley Detached Drainage Mill	304480	646463	11.9	05/03/99	13:37	5.6	4.5	2.32						4.5
Langley Detached Drainage Mill	304480	646463	11.9	05/03/99	13:37	5.6	4.0	2.22						4
Langley Detached Drainage Mill	304480	646463	11.9	05/03/99	13:37	5.6	3.5	2.04						3.5
Langley Detached Drainage Mill	304480	646463	11.9	05/03/99	13:37	5.6	3.0	1.97						3

River Yare: March 1999 survey results

Site	Northing	Easting	Chainage (km)	Date	Time (hh:mm)	Max. Depth (m)	Depth (m)	Salinity (%)	pH	EC (mS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. (deg. C)	Depth
Langley Detached Drainage Mill	304480	646463	11.9	05/03/99	13:37	5.6	2.5	1.85						2.5
Langley Detached Drainage Mill	304480	646463	11.9	05/03/99	13:37	5.6	2.0	1.75						2
Langley Detached Drainage Mill	304480	646463	11.9	05/03/99	13:37	5.6	1.0	0.34						1
Langley Detached Drainage Mill	304480	646463	11.9	05/03/99	13:37	5.6	0.1	0.23						0.1
?	304300	646253	12.2	05/03/99	13:45	5.8	5.5	2.08						5.5
?	304300	646253	12.2	05/03/99	13:45	5.8	5.0	2.04						5
?	304300	646253	12.2	05/03/99	13:45	5.8	4.5	1.82						4.5
?	304300	646253	12.2	05/03/99	13:45	5.8	4.0	1.67						4
?	304300	646253	12.2	05/03/99	13:45	5.8	3.5	1.62						3.5
?	304300	646253	12.2	05/03/99	13:45	5.8	3.0	1.50						3
?	304300	646253	12.2	05/03/99	13:45	5.8	2.5	1.37						2.5
?	304300	646253	12.2	05/03/99	13:45	5.8	2.0	1.26						2
?	304300	646253	12.2	05/03/99	13:45	5.8	1.5	0.58						1.5
?	304300	646253	12.2	05/03/99	13:45	5.8	1.0	0.49						1
?	304300	646253	12.2	05/03/99	13:45	5.8	0.5	0.40						0.5
?	304300	646253	12.2	05/03/99	13:45	5.8	0.1	0.27						0.1
?	304303	646159	12.3	05/03/99	11:37	4.3	4.0	0.93						4
?	304303	646159	12.3	05/03/99	11:37	4.3	3.0	0.82						3
?	304303	646159	12.3	05/03/99	11:37	4.3	2.0	0.32						2
?	304303	646159	12.3	05/03/99	11:37	4.3	1.0	0.08						1
?	304303	646159	12.3	05/03/99	11:37	4.3	0.5	0.07						0.5
?	304303	646159	12.3	05/03/99	11:37	4.3	0.1	0.07						0.1
?	303988	645825	12.8	05/03/99	13:54	6.1	5.8	1.49						5.75
?	303988	645825	12.8	05/03/99	13:54	6.1	5.0	1.49						5
?	303988	645825	12.8	05/03/99	13:54	6.1	4.0	1.48						4
?	303988	645825	12.8	05/03/99	13:54	6.1	3.0	1.42						3
?	303988	645825	12.8	05/03/99	13:54	6.1	2.0	0.79						2
?	303988	645825	12.8	05/03/99	13:54	6.1	1.0	0.19						1
?	303988	645825	12.8	05/03/99	13:54	6.1	0.5	0.15						0.5
?	303988	645825	12.8	05/03/99	13:54	6.1	0.1	0.14						0.1
?	303611	645701	13.2	05/03/99	14:00	5.1	4.8	1.33						4.75
?	303611	645701	13.2	05/03/99	14:00	5.1	4.0	1.34						4

River Yare: March 1999 survey results

Site	Northing	Easting	Chainage (km)	Date	Time (hh:mm)	Max. Depth (m)	Depth (m)	Salinity (%)	pH	EC (mS/cm)	Turbidity (NTU)	DO (mg/l)	Temp. (deg. C)	Depth
?	303611	645701	13.2	05/03/99	14:00	5.1	3.0	1.23						3
?	303611	645701	13.2	05/03/99	14:00	5.1	2.0	1.12						2
?	303611	645701	13.2	05/03/99	14:00	5.1	1.0	0.16						1
?	303611	645701	13.2	05/03/99	14:00	5.1	0.5	0.12						0.5
?	303611	645701	13.2	05/03/99	14:00	5.1	0.1	0.10						0.1
Draining Pump (disused)	303446	645300	13.6	05/03/99	11:36	4.8	4.5	0.04	8.11	0.99	105	6.95	7.5	4.5
Draining Pump (disused)	303446	645300	13.6	05/03/99	11:36	4.8	4.0	0.04						4
Draining Pump (disused)	303446	645300	13.6	05/03/99	11:36	4.8	3.0	0.04						3
Draining Pump (disused)	303446	645300	13.6	05/03/99	11:36	4.8	2.0	0.04						2
Draining Pump (disused)	303446	645300	13.6	05/03/99	11:36	4.8	1.0	0.04						1
Draining Pump (disused)	303446	645300	13.6	05/03/99	11:36	4.8	0.1	0.04						0.1
Draining Pump (disused)	303446	645300	13.6	05/03/99	14:04	4.3	4.0	1.11						4
Draining Pump (disused)	303446	645300	13.6	05/03/99	14:04	4.3	3.0	1.08						3
Draining Pump (disused)	303446	645300	13.6	05/03/99	14:04	4.3	2.0	1.00						2
Draining Pump (disused)	303446	645300	13.6	05/03/99	14:04	4.3	1.5	0.40						1.5
Draining Pump (disused)	303446	645300	13.6	05/03/99	14:04	4.3	1.0	0.18						1
Draining Pump (disused)	303446	645300	13.6	05/03/99	14:04	4.3	0.5	0.12						0.5
Cadge's Drainage Mill	303500	644600	14.4	05/03/99	14:13	5.3	5.0	0.78						5
Cadge's Drainage Mill	303500	644600	14.4	05/03/99	14:13	5.3	4.0	0.73						4
Cadge's Drainage Mill	303500	644600	14.4	05/03/99	14:13	5.3	3.0	0.16						3
Cadge's Drainage Mill	303500	644600	14.4	05/03/99	14:13	5.3	2.0	0.07						2
Cadge's Drainage Mill	303500	644600	14.4	05/03/99	14:13	5.3	1.0	0.05						1
Cadge's Drainage Mill	303500	644600	14.4	05/03/99	14:13	5.3	0.5	0.05						0.5
?	303595	644742	14.2	05/03/99	11:35		0.1	0.07						0.1
Upper Severn Mile House	302844	644431	15.2	05/03/99	11:15	5.0	4.7	0.03	8.11	0.897	102	6.85	7.5	4.7
Upper Severn Mile House	302844	644431	15.2	05/03/99	11:15	5.0	4.0	0.03						4
Upper Severn Mile House	302844	644431	15.2	05/03/99	11:15	5.0	3.0	0.03						3
Upper Severn Mile House	302844	644431	15.2	05/03/99	11:15	5.0	2.0	0.03						2
Upper Severn Mile House	302844	644431	15.2	05/03/99	11:15	5.0	1.0	0.03						1
Upper Severn Mile House	302844	644431	15.2	05/03/99	11:15	5.0	0.1	0.03						0.1
Upper Severn Mile House	302844	644431	15.2	05/03/99	14:20	5.6	5.3	0.03						5.25
Upper Severn Mile House	302844	644431	15.2	05/03/99	14:20	5.6	4.0	0.03						4

River Yare: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	
Upper Severn Mile House	302844	644431	15.2	05/03/99	14:20	5.6	3.0	0.03						3
Upper Severn Mile House	302844	644431	15.2.	05/03/99	14:20	5.6	2.0	0.03						2
Upper Severn Mile House	302844	644431	15.2	05/03/99	14:20	5.6	1.0	0.03						1
Upper Severn Mile House	302844	644431	15.2	05/03/99	14:20	5.6	0.1	0.03						0.1
?	301691	643619	16.7	05/03/99	11:05	5.1	4.8	0.03	8.12	0.878	93	6.76	7.4	4.8
?	301691	643619	16.7	05/03/99	11:05	5.1	4.5	0.03						4.5
?	301691	643619	16.7	05/03/99	11:05	5.1	4.0	0.03						4
?	301691	643619	16.7	05/03/99	11:05	5.1	3.0	0.03						3
?	301691	643619	16.7	05/03/99	11:05	5.1	2.0	0.03						2
?	301691	643619	16.7	05/03/99	11:05	5.1	1.0	0.03						1
?	301691	643619	16.7	05/03/99	11:05	5.1	0.1	0.03						0.1
New Cut	300654	643569	19.1	05/03/99	10:44	2.7	2.4	0.03	8.13	0.906	100	6.72	7.3	2.4
New Cut	300654	643569	19.1	05/03/99	10:44	2.7	2.0	0.03						2
New Cut	300654	643569	19.1	05/03/99	10:44	2.7	1.5	0.03						1.5
New Cut	300654	643569	19.1	05/03/99	10:44	2.7	1.0	0.03						1
New Cut	300654	643569	19.1	05/03/99	10:44	2.7	0.5	0.03						0.5
New Cut	300654	643569	19.1	05/03/99	10:44	2.7	0.1	0.03						0.1
New Cut	301120	643003	18.4	05/03/99	10:35	2.3	2.0	0.03	7.99	0.862	80	6.71	7.4	2
New Cut	301120	643003	18.4	05/03/99	10:35	2.3	1.5	0.03						1.5
New Cut	301120	643003	18.4	05/03/99	10:35	2.3	1.0	0.03						1
New Cut	301120	643003	18.4	05/03/99	10:35	2.3	0.5	0.03						0.5
New Cut	301120	643003	18.4	05/03/99	10:35	2.3	0.1	0.03						0.1
New Cut Confl	301464	642628	17.9	05/03/99	10:24	5.8	5.5	0.03	8.03	0.834	85	6.72	7.4	5.5
New Cut Confl	301464	642628	17.9	05/03/99	10:24	5.8	5.0	0.03						5
New Cut Confl	301464	642628	17.9	05/03/99	10:24	5.8	4.0	0.03						4
New Cut Confl	301464	642628	17.9	05/03/99	10:24	5.8	3.0	0.03						3
New Cut Confl	301464	642628	17.9	05/03/99	10:24	5.8	2.0	0.03						2
New Cut Confl	301464	642628	17.9	05/03/99	10:24	5.8	1.0	0.03						1
Lord Nelson PH, Reedham	301675	642000	18.6	03/03/99	13:10	1.9	1.6	0.04	8.23	1.07	82	8.29	8.2	1.6
Lord Nelson PH, Reedham	301675	642000	18.6	03/03/99	13:10	1.9	1.0	0.04						1
Lord Nelson PH, Reedham	301675	642000	18.6	03/03/99	13:10	1.9	0.5	0.04						0.5
Lord Nelson PH, Reedham	301675	642000	18.6	05/03/99	10:05	2.4	2.1	0.03	8.00	0.813	77	6.70	7.3	2.1

River Yare: March 1999 survey results

Site	Northing	Easting	Chainage	Date	Time	Max. Depth	Depth	Salinity	pH	EC	Turbidity	DO	Temp.	Depth
			(km)		(hh:mm)	(m)	(m)	(%)		(mS/cm)	(NTU)	(mg/l)	(deg. C)	
Lord Nelson PH, Reedham	301675	642000	18.6	05/03/99	10:05	2.4	1.5	0.03						1.5
Lord Nelson PH, Reedham	301675	642000	18.6	05/03/99	10:05	2.4	1.0	0.03						1
Lord Nelson PH, Reedham	301675	642000	18.6	05/03/99	10:05	2.4	0.5	0.03						0.5
Lord Nelson PH, Reedham	301675	642000	18.6	05/03/99	10:05	2.4	0.1	0.03						0.1
Lord Nelson PH, Reedham	301675	642000	18.6	05/03/99	14:45	2.4	0.1	0.04						0.1
Reedham Ferry	301470	640755	20.0	03/03/99	12:29	1.0	0.7	0.04	8.20	1.02	85	8.06	8.2	0.7
Reedham Ferry	301470	640755	20.0	03/03/99	10:05	1.9	1.6	0.04	8.07	1	68	8.05	8.0	1.6
Reedham Ferry	301470	640755	20.0	03/03/99	10:05	1.9	1.0	0.04						1
Reedham Ferry	301470	640755	20.0	03/03/99	10:05	1.9	0.5	0.04						0.5
Red House PH, Cantley	638225	303370	24.7	05/03/99	15:30		0.1	0.03						0.1

Appendix 3: Invertebrate results

Table 1 River Bure (including Rivers Ant and Thurne) Invertebrate List

	Sites	CP3-A	CP3-A	CP3-B	CP3-B	SP1	SP2-A	SP2-B	SP2-B	SP3
	Depth (m)	0.5	Bottom	0.5	Bottom	0.5	0.5	0.5	1	0.5
Taxa	Date	8-Sep-98	8-Sep-98	8-Sep-98	8-Sep-98	2-Sep-98	2-Sep-98	2-Sep-98	2-Sep-98	3-Sep-98
TRICLADIA										
Planariidae										
MOLLUSCA										
Hydrobiidae	*Potamopygrus jenkinsi*					2	105			11
Bithyniidae	*Bithynia leachi*									
Planorbidae	*Planorbis crista*									1
Sphaeriidae	*Pisidium* spp.									
Succineidae	*Succinea putris*									
OLIGIOCHAETA										
Naididae	*Nais* spp.									
	Ophidonais serpentina									
	Stylaria lacustris									
Tubificidae	*Limnodrilus* spp.									
	Tubifex spp.									
HIRUDINEA										
Glossiphoniidae	*Helobdella stagnalis*									
Erpobdellidae	*Erpobdella octoculata*									
CRUSTACEA										
Asellidae	*Asellus aquaticus*									
	Asellus meridianus									
Sphaeromatidae	*Sphaeroma rugicauda*								1	
Gammaridae	*Gammarus zaddachi*	22	12	3	27	113	90	44	31	135
	Gammarus spp.	2	6	1	4	49	46	18	8	9
Corophiidae	*Corophium multisetosum*					10	10			2
	Corophium spp.					3				
EPHEMEROPTERA										
Caenidae	*Caenis horaria*									
ODONATA										
Coenagriidae	*Erythromma najas*									
TRICHOPTERA										
Economidae	*Ecnomus tenellus*									
Polycentropodidae	*Cyrnus flavidus*									
DIPTERA										
Chironomidae				1			2			6

River Bure (including Rivers Ant and Thurne) Invertebrate List

	Sites	SP4	SP5	SP5	SP6	SP7	SP7	SP8	SP8	SP9
	Depth (m)	0.5	0.5	Bottom	0.5	0.5	Bottom	0.5	1	0.5
Taxa	Date	3-Sep-98	3-Sep-98	3-Sep-98	3-Sep-98	3-Sep-98	3-Sep-98	1-Sep-98	1-Sep-98	1-Sep-98
TRICLADIA										
Planariidae						1			1	
MOLLUSCA										
Hydrobiidae	*Potamopygrus jenkinsi*	24			8			40	1220	
Bithyniidae	*Bithynia leachi*								6	
Planorbidae	*Planorbis crista*									
Sphaeriidae	*Pisidium* spp.						1		1	
Succineidae	*Succinea putris*									
OLIGIOCHAETA										
Naididae	*Nais* spp.						1			
	Ophidonais serpentina						1			
	Stylaria lacustris				25	1				2
Tubificidae	*Limnodrilus* spp.								7	
	Tubifex spp.								1	
HIRUDINEA										
Glossiphoniidae	*Helobdella stagnalis*								9	
Erpobdellidae	*Erpobdella octoculata*									
CRUSTACEA										
Asellidae	*Asellus aquaticus*			1	1			2	35	2
	Asellus meridianus								6	
Sphaeromatidae	*Sphaeroma rugicauda*									
Gammaridae	*Gammarus zaddachi*	218	255	357	121	95	155	61	79	75
	Gammarus spp.	1		2			1			
Corophiidae	*Corophium multisetosum*			4	4					
	Corophium spp.									
EPHEMEROPTERA										
Caenidae	*Caenis horaria*						1			1
ODONATA										
Coenagriidae	*Erythromma najas*						1			
TRICHOPTERA										
Economidae	*Ecnomus tenellus*	1			5	1	2			
Polycentropodidae	*Cyrnus flavidus*					1				
DIPTERA										
Chironomidae		9	14	43	96	113	70	1	26	4

River Bure (including Rivers Ant and Thurne) Invertebrate List

	Sites	SP9	SP10	SP11	SP12	SP13	SP14	SP14	SP14
	Depth (m)	Bottom	0.5	0.5	0.5	0.5	0.5	1	Bottom
Taxa	Date	1-Sep-98	2-Sep-98	2-Sep-98	2-Sep-98	2-Sep-98	2-Sep-98	2-Sep-98	2-Sep-98
TRICLADIA									
Planariidae									
MOLLUSCA									
Hydrobiidae	*Potamopygrus jenkinsi*			1	97	7			
Bithyniidae	*Bithynia leachi*								
Planorbidae	*Planorbis crista*								
Sphaeriidae	*Pisidium* spp.								
Succineidae	*Succinea putris*	1							
OLIGIOCHAETA									
Naididae	*Nais* spp.	1							
	Ophidonais serpentina								
	Stylaria lacustris	2	32						
Tubificidae	*Limnodrilus* spp.								
	Tubifex spp.								
HIRUDINEA									
Glossiphoniidae	*Helobdella stagnalis*								
Erpobdellidae	*Erpobdella octoculata*		3						
CRUSTACEA									
Asellidae	*Asellus aquaticus*	1							
	Asellus meridianus	1	1						
Sphaeromatidae	*Sphaeroma rugicauda*					4		1	3
Gammaridae	*Gammarus zaddachi*	39	18	95	95	126	69	87	33
	Gammarus spp.			11	10	23	7	11	4
Corophiidae	*Corophium multisetosum*			3	6		1	2	7
	Corophium spp.								
EPHEMEROPTERA									
Caenidae	*Caenis horaria*	1							
ODONATA									
Coenagriidae	*Erythromma najas*								
TRICHOPTERA									
Economidae	*Ecnomus tenellus*		3						
Polycentropodidae	*Cyrnus flavidus*								
DIPTERA									
Chironomidae		4	91			2		3	3

Table 3 River Waveney Invertebrate List

	Sites	CP1-A	CP1-A	CP1-B	SP24	SP24	SP25	SP26	SP27	SP28
	Depth (m)	0.5	1	0.5	0.5	Bottom	Bottom	Bottom	0.5	Bottom
Taxa	Date	8-Sep-98	8-Sep-98	8-Sep-98	7-Sep-98	7-Sep-98	5-Sep-98	5-Sep-98	5-Sep-98	7-Sep-98
MOLLUSCA										
Hydrobiidae	*Potamopygrus jenkinsi*						1		12	
Bithyniidae	*Bithynia leachi*									
Neritidae	*Theodoxus fluviatilis*									
HIRUDINEA										
Glossiphoniidae	*Glossiphonia complanata*									
Erpobdellidae	*Erpobdella octoculata*									
Piscolidae	*Piscicola geometra*									
CRUSTACEA										
Sphaeromatidae	*Sphaeroma rugicauda*						2			
Gammaridae	*Gammarus zaddachi*	1	10	2			160	1	24	
	Gammarus spp.		4				2		10	
Corophiidae	*Corophium multisetosum*						32		8	
TRICHOPTERA										
Economidae	*Ecnomus tenellus*									
DIPTERA										
Chironomidae							2			

Table 3 River Waveney Invertebrate List

	Sites	SP29	SP30	SP30	SP31	SP31	SP32
	Depth (m)	Bottom	0.5	Bottom	0.5	Bottom	Bottom
Taxa	Date	7-Sep-98	5-Sep-98	5-Sep-98	7-Sep-98	7-Sep-98	7-Sep-98
MOLLUSCA							
Hydrobiidae	*Potamopygrus jenkinsi*	6	1				
Bithyniidae	*Bithynia leachi*	1					
Neritidae	*Theodoxus fluviatilis*	2					
HIRUDINEA							
Glossiphoniidae	*Glossiphonia complanata*	1					
Erpobdellidae	*Erpobdella octoculata*						
Piscolidae	*Piscicola geometra*					1	
CRUSTACEA							
Sphaeromatidae	*Sphaeroma rugicauda*						
Gammaridae	*Gammarus zaddachi*	47	14	9	4	43	2
	Gammarus spp.	2	2	3	1	10	
Corophiidae	*Corophium multisetosum*						
TRICHOPTERA							
Economidae	*Ecnomus tenellus*			1			
DIPTERA							
Chironomidae						2	

Table 2

River Yare Invertebrate List

	Sites	CP2	CP2	SP15	SP15	SP16	SP17	SP18	SP18	SP18
	Depth (m)	0.5	1	0.5	Bottom	0.5	0.5	0.5	1	Bottom
Taxa	Date	8-Sep-98	8-Sep-98	4-Sep-98	4-Sep-98	4-Sep-98	4-Sep-98	4-Sep-98	4-Sep-98	4-Sep-98
TRICLADIA										
Planariidae										
MOLLUSCA										
Hydrobiidae	*Potamopygrus jenkinsi*						2	4	13	30
Sphaeriidae	*Pisidium* sp.									
OLIGIOCHAETA										
Naididae	*Nais* spp.							1		
	Ophidonais serpentina									
	Stylaria lacustris					1				
CRUSTACEA										
Asellidae	*Asellus aquaticus*									
	Asellus meridianus									
Sphaeromatidae	*Sphaeroma rugicauda*					1		1		
Gammaridae	*Gammarus zaddachi*	31	88	42	135	15	28	78	55	66
	Gammarus pulex									
	Gammarus spp.	2	80	16	5	26	10	7	3	4
Corophiidae	*Corophium multisetosum*				3				13	17
	Corophium spp.							1		
COELOPTERA										
Elmidae	*Oulimnius* sp.									
TRICHOPTERA										
Polycentropodidae	*Polycentropus flavomaculatus*									
DIPTERA										
Chironomidae								1	1	

Table 2 River Yare Invertebrate List

	Sites	SP19	SP19	SP21	SP21	SP22	SP23	SP23	SP23
	Depth (m)	0.5	Bottom	0.5	Bottom	0.5	0.5	1	Bottom
Taxa	Date	4-Sep-98	4-Sep-98	4-Sep-98	4-Sep-98	3-Sep-98	3-Sep-98	3-Sep-98	3-Sep-98
TRICLADIA									
Planariidae							3	1	1
MOLLUSCA									
Hydrobiidae	*Potamopygrus jenkinsi*	11	41	2	3				1
Sphaeriidae	*Pisidium* sp.		1						
OLIGIOCHAETA									
Naididae	*Nais* spp.								3
	Ophidonais serpentina						1		1
	Stylaria lacustris								3
CRUSTACEA									
Asellidae	*Asellus aquaticus*								
	Asellus meridianus								
Sphaeromatidae	*Sphaeroma rugicauda*								
Gammaridae	*Gammarus zaddachi*	54	40	130	80	13	101	73	55
	Gammarus pulex				7				
	Gammarus spp.	7	11	9	12	10	7	20	22
Corophiidae	*Corophium multisetosum*	1	3	2	1				1
	Corophium spp.								
COELOPTERA									
Elmidae	*Oulimnius* sp.							1	
TRICHOPTERA									
Polycentropodidae	*Polycentropus flavomaculatus*								2
DIPTERA									
Chironomidae		1		2	2	1			2

Appendix 4: Diatom classification

The ecological coding used in this report is based on several sources, principally De Wolf, 1993, Denys, 1990 and Van de Werff and Huls, 1957-1974. All classifications are a simplification and many diatom species are tolerant of intermediate stages of any classification and across a broad spectrum of classes.

Salinity

The salinity data is drawn up according to the salinity classification by Hustedt (1957) where:

Polyhalobian =	marine (> 3% salinity)
Mesohalobian =	brakish (0.2 to 3% salinity)
Oligohalobian-halophile =	requires some low salinity
Oligohalobian-indifferent =	can tolerate low salinity
Halophobes =	freshwater only

Lifeform

Lifeform is the simplest form of ecological classification and follows De Wolf 1993

Planktic =	Aquatic: Lives in the water column
Benthic =	Aquatic: Lives on or in the sediments
Epiphytic =	Aquatic: Is attached to plants, rocks, sand or any substrate
Aerophil =	Aquatic but can withstand occasional exposure to air
Eu-terrestrial =	Mainly terrestrial

Trophic conditions

Trophic conditions follow the classification of Naumann, 1932, and are referred to in Denys, 1990.

Unknown	
Irrelevant =	Marine species
Eutrophic =	high supplies of nutrients and high rates of primary productivity
Eutrophic-mesotrophic =	slightly less nutrient rich with less primary productivity than above
Mesotrophic =	slightly less nutrient rich with less primary productivity than above
Mesotrophic to oligotrophic =	slightly less nutrient rich with less primary productivity than above
Oligotrophic =	low levels and supplies of at lest one major nutrient, low primary productivity
Oligotrophic to Dystrophic =	Low productivity, tending to higher levels of brown humic acids lessening light penetration resulting in even lower productivity.
Eutrophic to oligotrophic =	

Eutrophic to dystrophic =	higher productivity in acidic bog lakes due to eutrophic bog lake with peat filled margins.

Currents

Watercurrents indicates of the diatoms require the presence of flowing or still water and follows the classification in DE Wolf, 1993.

Rheophil =	requires running water
Indifferent =	indifferent
Limnophil =	requires still water

Appendix 5: Diatom results

[1]DIATOM COUNTS FROM RIVER ANT 1998.

Sample	SP10	SP9 (0.5m)	SP9 (Bottom)	SP8 (0.5m)	SP8 (Bottom)
Achnanthes delicatula	0.0	0.0	0.0	4.0	0.0
Achnanthes hungarica	0.0	1.0	0.0	0.0	0.0
Achnanthes lanceolata	0.0	2.0	1.0	2.0	0.0
Achnanthes minutissima	0.0	0.0	1.0	4.0	0.0
Actinoptychus senarius	0.0	0.0	0.0	0.0	1.0
Amphora ovalis var. affinis	0.0	1.0	3.0	3.0	0.0
Aulacosira ambigua	85.0	80.0	85.0	20.0	30.0
Aulacosira granulata	53.0	20.0	45.0	33.0	45.0
Aulacosira granulata var. curvata	0.0	5.0	0.0	0.0	7.0
Aulacosira granulata var. angustissima	10.0	0.0	23.0	27.0	4.0
Asterionella formosa	25.0	18.0	9.0	4.0	6.0
Caloneis permagna	1.0	0.0	0.0	0.0	0.0
Cocconeis placentula	0.0	0.0	1.0	12.0	0.0
Cyclostephanos dubius	13.0	3.0	23.0	0.0	73.0
Cylcotella atomus	0.0	2.0	2.0	1.0	0.0
Cyclotella comta	15.0	4.0	5.0	1.0	20.0
Cyclotella meneghiniana	2.0	2.0	8.0	0.0	7.0
Cymbella inaequalis	0.0	0.0	1.0	0.0	0.0
Cymbella tumida	0.0	1.0	0.0	3.0	0.0
Diatoma tenue	40.0	42.0	40.0	43.0	25.0
Fragilaria construens	20.0	7.0	15.0	8.0	6.0
Fragilaria pinnata	0.0	0.0	1.0	0.0	0.0
Gomphoneis olivaceum	0.0	1.0	0.0	25.0	0.0
Gomphonema gracile	0.0	0.0	0.0	4.0	0.0
Gyrosigma acuminatum	0.0	0.0	0.0	2.0	0.0
Gyrosigma balticum	0.0	3.0	2.0	8.0	2.0
Melosira varians	2.0	0.0	0.0	0.0	0.0
Navicula bacillum	0.0	0.0	0.0	0.0	1.0
Navicula capitata	0.0	0.0	0.0	1.0	0.0
Navicula cari var cincta	0.0	2.0	1.0	18.0	0.0
Navicula cryptocephala	0.0	5.0	0.0	0.0	0.0
Navicula gregaria	0.0	15.0	1.0	0.0	0.0
Navicula hungarica	0.0	0.0	1.0	0.0	0.0
Navicula phyllepta	2.0	0.0	0.0	0.0	0.0
Navicula radiosa	0.0	0.0	1.0	2.0	1.0
Navicula rhyncocephala	0.0	0.0	2.0	0.0	0.0
Navicula tripunctata	5.0	22.0	7.0	70.0	5.0
Neidium dubium	0.0	0.0	1.0	0.0	0.0
Nitzschia amphibia	0.0	0.0	0.0	1.0	0.0
Nitzschia apiculata	0.0	0.0	1.0	1.0	0.0
Nitzschia brevissima	0.0	1.0	0.0	0.0	0.0
Nitzschia dissipata	0.0	1.0	2.0	10.0	0.0
Nitzschia fonticola	0.0	2.0	0.0	1.0	0.0
Nitzschia palea	5.0	8.0	8.0	30.0	0.0
Nitzschia punctata	0.0	0.0	0.0	1.0	0.0
Nitzschia sigma	0.0	1.0	2.0	1.0	0.0
Nitzschia tryblionella	0.0	0.0	1.0	0.0	0.0
Opephora martyi	0.0	0.0	0.0	1.0	0.0
Pinnularia abaujensis	1.0	0.0	0.0	0.0	0.0
Pleurosigma formosum	0.0	0.0	1.0	0.0	1.0
Pleurosigma strigosum	0.0	0.0	0.0	1.0	0.0
Rhaphoneis amphiceros	0.0	0.0	0.0	1.0	0.0
Rhaphoneis minutissima	0.0	0.0	0.0	1.0	0.0
Rhoicosphenia curvata	0.0	0.0	0.0	20.0	0.0
Skeletonema subsalsum	2.0	10.0	2.0	6.0	0.0
Stephanodiscus hantzschii	37.0	35.0	37.0	34.0	120.0
Stephanodiscus minutulus	5.0	0.0	10.0	1.0	8.0
Synedra acus	3.0	0.0	1.0	4.0	0.0
Synedra fasciculata	1.0	0.0	0.0	0.0	0.0
Synedra pulchella	0.0	2.0	0.0	0.0	0.0
Thalassiosira bramaputrae	0.0	0.0	1.0	0.0	0.0
Thalassiosira eccentrica	0.0	2.0	1.0	0.0	0.0

DIATOM COUNTS FROM THE RIVER BURE, 1998.

Sample	SP7 (0.5m)	SP7 bottom	SP6	SP5 (0.5m)	SP5 bottom	SP4	SP3	SP2	SP1	CP3A (0.5m)	CP3A bottom
Achnanthes brevipes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	1.0	1.0
Achnanthes clevei	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Achnanthes delicatula	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0
Achnanthes exigua	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
Achnanthes hungarica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0
Achnanthes lanceolata	3.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Achnanthes minutissima	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Actinoptychus senarius	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	3.0	5.0
Amphora ovalis var. affinis	3.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	1.0	1.0	2.0
Asterionella formosa	1.0	3.0	8.0	0.0	0.0	5.0	15.0	16.0	1.0	0.0	3.0
Aulacosira ambigua	30.0	50.0	15.0	10.0	30.0	75.0	12.0	52.0	15.0	25.0	2.0
Aulacosira granulata	30.0	60.0	70.0	60.0	125.0	25.0	52.0	15.0	11.0	5.0	3.0
Aulacosira granulata var. angustissima	0.0	5.0	6.0	0.0	0.0	0.0	2.0	5.0	0.0	0.0	0.0
Aulacosira granulata var. curvata	8.0	24.0	29.0	4.0	10.0	2.0	0.0	5.0	13.0	0.0	15.0
Bacillaria paradoxa	0.0	0.0	1.0	0.0	0.0	0.0	2.0	0.0	9.0	0.0	0.0
Biddulphia alternans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caloneis bacillum	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Caloneis westii	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Campylosira cymbelliformis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	7.0
Cocconeis placentula	2.0	0.0	6.0	1.0	0.0	1.0	1.0	5.0	1.0	1.0	4.0
Cocconeis scutellum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0
Cyclostephanos dubius	95.0	75.0	75.0	50.0	70.0	8.0	47.0	24.0	20.0	4.0	3.0
Cyclotella comta	1.0	1.0	3.0	28.0	5.0	60.0	2.0	7.0	1.0	1.0	1.0
Cyclotella meneghiniana	3.0	12.0	5.0	2.0	5.0	10.0	0.0	7.0	6.0	0.0	3.0
Cyclotella striata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cylcotella atomus	0.0	0.0	1.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0
Cymatopleura elliptica var. hibernica	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymatosira belgica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0
Cymbella microcephala	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymbella prostrata	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Delphineis surirella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Diatoma tenue	11.0	11.0	28.0	12.0	10.0	20.0	43.0	26.0	20.0	5.0	30.0
Diploneis bombus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Diploneis didyma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diploneis interrupta	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diploneis ovalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0
Diploneis smithii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epithemia adnata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epithemia sorex	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0
Fragilaria construens	2.0	7.0	20.0	8.0	28.0	24.0	5.0	3.0	0.0	1.0	10.0
Fragilaria lapponica	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Fragilaria leptostauron	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0
Fragilaria pinnata	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
Grammatophora oceanica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0

RIVER BURE cont...

Sample	SP7 (0.5m)	SP7 bottom	SP6	SP5 (0.5m)	SP5 bottom	SP4	SP3	SP2	SP1	CP3A (0.5m)	CP3A bottom
Gyrosigma acuminatum	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	7.0	1.0	0.0
Gyrosigma balticum	2.0	2.0	6.0	2.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Gyrosigma eximium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mastogloia smithii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Melosira moniliformis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	18.0	29.0
Melosira nummuloides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
Melosira varians	5.0	2.0	8.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Navicula cari var cincta	7.0	0.0	5.0	4.0	0.0	1.0	5.0	5.0	1.0	2.0	5.0
Navicula cryptocephala	0.0	0.0	0.0	0.0	0.0	0.0	2.0	24.0	0.0	1.0	0.0
Navicula digitoradiata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Navicula flanatica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Navicula gregaria	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	5.0	8.0	6.0
Navicula halophila	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula lanceolata	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula mutica	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0	23.0	17.0
Navicula palpebralis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula peregrina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Navicula phyllepta	0.0	0.0	0.0	1.0	4.0	3.0	5.0	2.0	0.0	1.0	0.0
Navicula pupula	0.0	0.0	2.0	1.0	3.0	0.0	0.0	0.0	1.0	0.0	0.0
Navicula radiosa	0.0	0.0	0.0	0.0	0.0	3.0	0.0	5.0	3.0	0.0	0.0
Navicula rhyncocephala	0.0	0.0	5.0	0.0	0.0	0.0	3.0	0.0	1.0	0.0	1.0
Navicula slesvicensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Navicula tripunctata	25.0	1.0	21.0	36.0	17.0	66.0	27.0	52.0	145.0	12.0	19.0
Nitzchia intermedia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia amphibia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Nitzschia apiculata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	15.0	0.0
Nitzschia brevissima	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Nitzschia constricta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Nitzschia dissipata	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0
Nitzschia dubia	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	5.0
Nitzschia fonticola	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0
Nitzschia frustulum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0	2.0	0.0
Nitzschia gracilis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0
Nitzschia hungarica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia navicularis	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia palea	0.0	0.0	1.0	7.0	0.0	3.0	28.0	13.0	0.0	3.0	1.0
Nitzschia punctata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Nitzschia recta	1.0	3.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Nitzschia sigma	0.0	1.0	2.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	2.0
Nitzschia tryblionella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0
Odontella aurita	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	6.0	6.0
Opephora martyi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
Paralia sulcata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	7.0	10.0
Pinnularia abaujensis	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pleurosigma formosum	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.0	0.0	0.0
Pleurosigma strigosum	0.0	0.0	0.0	3.0	0.0	1.0	0.0	6.0	0.0	0.0	3.0

RIVER BURE cont...

Sample	SP7 (0.5m)	SP7 bottom	SP6	SP5 (0.5m)	SP5 bottom	SP4	SP3	SP2	SP1	CP3A (0.5m)	CP3A bottom
Rhabdonema minutum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhaphoneis amphiceros	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	45.0	33.0
Rhaphoneis minutissima	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.0	40.0
Rhizosolenia imbricata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0
Rhoicosphenia curvata	0.0	0.0	0.0	0.0	0.0	1.0	2.0	2.0	1.0	2.0	1.0
Stephanodiscus hantzschii	65.0	90.0	85.0	70.0	45.0	40.0	67.0	57.0	45.0	2.0	8.0
Stephanodiscus minutulus	0.0	0.0	2.0	1.0	1.0	15.0	10.0	8.0	9.0	0.0	0.0
Surirella biserata	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surirella ovalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	1.0
Synedra acus	0.0	0.0	7.0	0.0	0.0	0.0	2.0	7.0	0.0	0.0	0.0
Synedra fasciculata	0.0	0.0	1.0	0.0	0.0	0.0	5.0	12.0	10.0	20.0	12.0
Synedra pulchella	0.0	0.0	2.0	0.0	0.0	0.0	2.0	15.0	0.0	0.0	0.0
Synedra ulna	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Thalassiosira bramaputrae	0.0	0.0	3.0	2.0	0.0	2.0	0.0	0.0	2.0	1.0	0.0
Thalassiosira eccentrica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	6.0	4.0
Trachyneis aspera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Triceratium reticulum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0

Sample	CP3B (0.5m)	CP3B bottom
Achnanthes brevipes	0.0	0.0
Achnanthes clevei	0.0	0.0
Achnanthes delicatula	1.0	0.0
Achnanthes exigua	0.0	0.0
Achnanthes hungarica	0.0	0.0
Achnanthes lanceolata	0.0	0.0
Achnanthes minutissima	1.0	0.0
Actinoptychus senarius	0.0	4.0
Amphora ovalis var. affinis	2.0	0.0
Asterionella formosa	0.0	0.0
Aulacosira ambigua	10.0	13.0
Aulacosira granulata	5.0	4.0
Aulacosira granulata var. angustissima	0.0	0.0
Aulacosira granulata var. curvata	0.0	0.0
Bacillaria paradoxa	0.0	0.0
Biddulphia alternans	0.0	1.0
Caloneis bacillum	0.0	0.0
Caloneis westii	0.0	0.0
Campylosira cymbelliformis	7.0	0.0
Cocconeis placentula	5.0	0.0
Cocconeis scutellum	7.0	7.0
Cyclostephanos dubius	8.0	2.0
Cyclotella comta	2.0	4.0
Cyclotella meneghiniana	0.0	3.0

Sample	CP3B (0.5m)	CP3B bottom
Cyclotella striata	0.0	1.0
Cylcotella atomus	1.0	0.0
Cymatopleura elliptica var. hibernica	0.0	0.0
Cymatosira belgica	10.0	3.0
Cymbella microcephala	0.0	0.0

RIVER BURE cont...

Sample	CP3B (0.5m)	CP3B bottom
Cymbella prostrata	0.0	0.0
Delphineis surirella	10.0	5.0
Diatoma tenue	2.0	7.0
Diploneis bombus	0.0	0.0
Diploneis didyma	1.0	1.0
Diploneis interrupta	1.0	0.0
Diploneis ovalis	1.0	0.0
Diploneis smithii	0.0	1.0
Epithemia adnata	2.0	0.0
Epithemia sorex	1.0	0.0
Fragilaria construens	5.0	40.0
Fragilaria lapponica	0.0	1.0
Fragilaria leptostauron	0.0	0.0
Fragilaria pinnata	0.0	0.0
Grammatophora oceanica	0.0	0.0
Gyrosigma acuminatum	0.0	0.0
Gyrosigma balticum	2.0	0.0
Gyrosigma eximium	0.0	1.0
Mastogloia smithii	1.0	0.0
Melosira moniliformis	20.0	10.0
Melosira nummuloides	0.0	0.0
Melosira varians	0.0	0.0
Navicula cari var cincta	2.0	0.0
Navicula cryptocephala	7.0	1.0
Navicula digitoradiata	0.0	1.0
Navicula flanatica	0.0	0.0
Navicula gregaria	3.0	0.0
Navicula halophila	0.0	1.0
Navicula lanceolata	0.0	0.0
Navicula mutica	3.0	5.0
Navicula palpebralis	0.0	1.0
Navicula peregrina	0.0	0.0
Navicula phyllepta	0.0	1.0
Navicula pupula	0.0	0.0
Navicula radiosa	0.0	0.0
Navicula rhyncocephala	0.0	0.0
Navicula slesvicensis	0.0	0.0
Navicula tripunctata	20.0	18.0
Nitzchia intermedia	0.0	1.0
Nitzschia amphibia	0.0	0.0
Nitzschia apiculata	1.0	0.0
Nitzschia brevissima	1.0	0.0
Nitzschia constricta	1.0	1.0
Nitzschia dissipata	2.0	2.0
Nitzschia dubia	0.0	0.0
Nitzschia fonticola	1.0	3.0
Nitzschia frustulum	0.0	0.0
Nitzschia gracilis	0.0	0.0
Nitzschia hungarica	0.0	6.0
Nitzschia navicularis	0.0	1.0
Nitzschia palea	0.0	1.0
Nitzschia punctata	1.0	0.0
Nitzschia recta	0.0	0.0
Nitzschia sigma	0.0	2.0
Nitzschia tryblionella	0.0	0.0
Odontella aurita	0.0	4.0
Opephora martyi	0.0	0.0
Paralia sulcata	6.0	7.0
Pinnularia abaujensis	0.0	0.0
Pleurosigma formosum	0.0	0.0
Pleurosigma strigosum	3.0	0.0
Rhabdonema minutum	0.0	1.0
Rhaphoneis amphiceros	34.0	34.0
Rhaphoneis minutissima	60.0	95.0
Rhizosolenia imbricata	3.0	0.0
Rhoicosphenia curvata	1.0	0.0
Stephanodiscus hantzschii	3.0	0.0
Stephanodiscus minutulus	0.0	0.0
Surirella biserata	0.0	0.0
Surirella ovalis	1.0	0.0
Synedra acus	0.0	0.0
Synedra fasciculata	16.0	7.0
Synedra pulchella	0.0	0.0

RIVER BURE cont...

Sample	CP3B (0.5m)	CP3B bottom
Synedra ulna	0.0	0.0
Thalassiosira bramaputrae	0.0	0.0
Thalassiosira eccentrica	5.0	10.0
Trachyneis aspera	1.0	1.0
Triceratium reticulum	0.0	0.0

DIATOM COUNTS FROM RIVER THURNE 1998

Sample	SP14 (0.5m)	SP14 (1.0m)	SP14 Bottom	SP13	SP12	SP11
Achnanthes delicatula	0.0	0.0	0.0	0.0	0.0	1.0
Achnanthes hungarica	0.0	0.0	7.0	0.0	0.0	0.0
Achnanthes lanceolata	3.0	1.0	1.0	2.0	1.0	0.0
Achnanthes minutissima	1.0	0.0	0.0	0.0	0.0	0.0
Actinocyclus normanii	0.0	0.0	0.0	0.0	1.0	0.0
Amphora ovalis	7.0	0.0	0.0	0.0	2.0	0.0
Amphora ovalis var. affinis	0.0	5.0	3.0	0.0	0.0	5.0
Amphora veneta	20.0	0.0	0.0	3.0	0.0	0.0
Anomoeoneis exilis	2.0	0.0	0.0	0.0	0.0	0.0
Anorthoneis excentrica	2.0	0.0	0.0	0.0	0.0	0.0
Asterionella formosa	0.0	6.0	4.0	0.0	2.0	4.0
Aulacosira ambigua	0.0	11.0	20.0	43.0	51.0	40.0
Aulacosira granulata	15.0	25.0	22.0	8.0	16.0	10.0
Aulacosira granulata var. angustissima	0.0	5.0	2.0	7.0	2.0	1.0
Aulacosira granulata var. curvata	0.0	0.0	4.0	3.0	0.0	6.0
Bacillaria paradoxa	5.0	3.0	1.0	0.0	1.0	0.0
Cocconeis pediculus	0.0	0.0	0.0	0.0	1.0	0.0
Cocconeis placentula	23.0	4.0	2.0	2.0	3.0	1.0
Cocconeis scutellum	2.0	0.0	0.0	0.0	0.0	0.0
Cyclostephanos dubius	3.0	27.0	25.0	3.0	15.0	13.0
Cyclotella comta	6.0	3.0	20.0	7.0	20.0	15.0
Cyclotella meneghiniana	3.0	2.0	11.0	8.0	17.0	7.0
Cyclotella pseudostelligera	0.0	0.0	0.0	0.0	1.0	0.0
Cyclotella stelligera	0.0	0.0	0.0	0.0	1.0	0.0
Cylcotella atomus	0.0	3.0	6.0	1.0	0.0	0.0
Cymbella helvetica	0.0	0.0	0.0	1.0	0.0	0.0
Delphineis surirella	0.0	0.0	0.0	0.0	0.0	1.0
Diatoma tenue	12.0	15.0	29.0	24.0	24.0	40.0
Diploneis didyma	0.0	0.0	0.0	1.0	0.0	0.0
Diploneis ovalis	48.0	4.0	2.0	0.0	0.0	2.0
Diploneis smithii	2.0	0.0	1.0	0.0	0.0	0.0
Epithemia adnata	0.0	0.0	0.0	1.0	0.0	0.0
Epithemia sorex	0.0	0.0	0.0	0.0	0.0	1.0
Eunotia monodon	0.0	0.0	0.0	0.0	1.0	0.0
Fragilaria construens	4.0	2.0	4.0	1.0	1.0	1.0
Fragilaria pinnata	0.0	1.0	0.0	0.0	0.0	0.0
Fragillaria vaucheriae	0.0	0.0	0.0	0.0	0.0	3.0
Gomphoneis olivaceum	0.0	0.0	0.0	1.0	3.0	0.0
Gomphonema parvulum	0.0	0.0	0.0	1.0	0.0	0.0
Gyrosigma acuminatum	8.0	2.0	0.0	0.0	0.0	1.0
Gyrosigma balticum	3.0	6.0	1.0	0.0	1.0	3.0
Melosira moniliformis	0.0	28.0	12.0	0.0	0.0	0.0
Melosira nummuloides	0.0	0.0	14.0	0.0	2.0	0.0
Melosira varians	10.0	0.0	0.0	0.0	0.0	0.0
Navicula capitata	0.0	0.0	0.0	1.0	0.0	0.0
Navicula cari var cincta	2.0	0.0	0.0	1.0	1.0	1.0
Navicula digitoradiata	0.0	0.0	0.0	0.0	1.0	0.0
Navicula flanatica	1.0	0.0	0.0	0.0	0.0	0.0
Navicula gregaria	1.0	7.0	1.0	7.0	0.0	2.0
Navicula halophila	2.0	0.0	0.0	0.0	0.0	0.0
Navicula mutica	0.0	2.0	0.0	0.0	1.0	4.0
Navicula peregrina	0.0	0.0	0.0	0.0	1.0	0.0
Navicula perminuta	0.0	0.0	0.0	0.0	0.0	4.0
Navicula radiosa	0.0	0.0	0.0	4.0	6.0	0.0
Navicula rhyncocephala	2.0	0.0	1.0	3.0	1.0	1.0
Navicula tripunctata	48.0	81.0	14.0	127.0	55.0	45.0
Nitzchia intermedia	15.0	0.0	1.0	1.0	3.0	0.0
Nitzschia amphibia	4.0	0.0	0.0	0.0	0.0	2.0
Nitzschia apiculata	2.0	0.0	0.0	0.0	4.0	1.0
Nitzschia brevissima	0.0	0.0	0.0	0.0	1.0	1.0

River Thurne cont.

Sample	SP14 (0.5m)	SP14 (1.0m)	SP14 Bottom	SP13	SP12	SP11
Nitzschia dissipata	35.0	4.0	5.0	2.0	0.0	0.0
Nitzschia dubia	0.0	0.0	1.0	0.0	0.0	0.0
Nitzschia fonticola	10.0	0.0	0.0	5.0	1.0	3.0
Nitzschia frustulum	4.0	5.0	1.0	4.0	1.0	5.0
Nitzschia gracilis	0.0	2.0	0.0	0.0	0.0	0.0
Nitzschia linearis	1.0	0.0	0.0	0.0	0.0	0.0
Nitzschia palea	3.0	15.0	5.0	12.0	17.0	12.0
Nitzschia pseudofonticola	0.0	0.0	0.0	0.0	1.0	0.0
Nitzschia recta	0.0	0.0	0.0	2.0	0.0	0.0
Nitzschia sigma	1.0	0.0	2.0	1.0	13.0	2.0
Nitzschia sigmoidea	0.0	2.0	0.0	1.0	0.0	0.0
Nitzschia tryblionella	0.0	0.0	0.0	0.0	0.0	1.0
Opephora martyi	0.0	3.0	0.0	0.0	0.0	0.0
Paralia sulcata	0.0	0.0	1.0	0.0	1.0	0.0
Pleurosigma strigosum	11.0	10.0	7.0	5.0	9.0	0.0
Rhaphoneis amphiceros	0.0	0.0	2.0	1.0	0.0	0.0
Rhaphoneis minutissima	0.0	0.0	1.0	0.0	0.0	0.0
Rhoicosphenia curvata	20.0	5.0	2.0	0.0	2.0	1.0
Skeletonema subsalsum	0.0	4.0	0.0	0.0	0.0	0.0
Stephanodiscus hantzschii	11.0	17.0	43.0	35.0	30.0	22.0
Stephanodiscus minutulus	1.0	7.0	10.0	5.0	11.0	5.0
Surirella ovalis	0.0	0.0	2.0	1.0	0.0	0.0
Synedra acus	0.0	2.0	1.0	1.0	0.0	2.0
Synedra fasciculata	15.0	2.0	15.0	8.0	2.0	9.0
Synedra parasitica	2.0	0.0	0.0	1.0	0.0	0.0
Synedra pulchella	5.0	0.0	3.0	0.0	4.0	1.0
Thalassiosira bramaputrae	1.0	0.0	1.0	1.0	3.0	0.0
Thalassiosira eccentrica	0.0	0.0	0.0	0.0	0.0	1.0

DIATOM COUNTS FROM THE RIVER WAVENEY, 1998.

Sample	SP32	SP31 (0.5)	SP31 (bottom)	SP30	SP30 (bottom)	SP29	SP28	SP27	SP26	SP25	SP24
Achnanthes brevipes	2.0	0.0	3.0	2.0	0.0	0.0	7.0	7.0	0.0	0.0	0.0
Achnanthes delicatula	7.0	6.0	9.0	15.0	0.0	7.0	0.0	0.0	1.0	1.0	1.0
Achnanthes exigua	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	1.0	0.0	0.0
Achnanthes hungarica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Achnanthes lanceolata	15.0	16.0	15.0	3.0	0.0	15.0	3.0	0.0	2.0	0.0	0.0
Achnanthes longipes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Achnanthes minutissima	2.0	1.0	0.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0
Actinocyclus normanii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Actinoptychus senarius	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0
Amphora ovalis	0.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amphora ovalis var. affinis	2.0	0.0	2.0	5.0	0.0	5.0	2.0	0.0	2.0	1.0	10.0
Amphora veneta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Aulacosira ambigua	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
Aulacosira granulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	15.0
Aulacosira granulata var. angustissima	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
Aulacosira granulata var. curvata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
Bacillaria paradoxa	3.0	23.0	20.0	75.0	0.0	11.0	5.0	3.0	10.0	3.0	1.0
Biddulphia alternans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biddulphia biddulphiana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Caloneis bacillum	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Campylosira cymbelliformis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Cocconeis disculus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cocconeis placentula	26.0	28.0	85.0	5.0	0.0	90.0	5.0	11.0	3.0	1.0	1.0
Cocconeis scutellum	0.0	1.0	1.0	0.0	0.0	1.0	0.0	1.0	1.0	0.0	2.0
Coscinodiscus nodulifer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyclostephanos dubius	3.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	9.0
Cyclotella comta	1.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	3.0
Cyclotella meneghiniana	3.0	6.0	0.0	6.0	0.0	1.0	0.0	2.0	2.0	6.0	7.0
Cyclotella pseudostelligera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Cylcotella atomus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Cymatosira belgica	1.0	0.0	0.0	1.0	1.0	0.0	3.0	0.0	3.0	6.0	4.0
Delphineis surirella	0.0	1.0	0.0	2.0	0.0	0.0	0.0	0.0	8.0	0.0	6.0
Diatoma tenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	3.0
Diploneis didyma	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Diploneis interrupta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Diploneis oculata	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diploneis ovalis	0.0	0.0	1.0	0.0	1.0	0.0	0.0	1.0	2.0	1.0	1.0
Epithemia adnata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Epithemia sorex	0.0	0.0	0.0	1.0	0.0	1.0	1.0	1.0	2.0	0.0	1.0
Frustulia rhomboides	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Gomphoneis olivaceum	0.0	1.0	2.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	3.0
Gomphonema acuminatum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	3.0	0.0	0.0
Gomphonema gracile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gomphonema parvulum	7.0	1.0	4.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0

DIATOM COUNTS FROM THE RIVER WAVENEY, 1998. Cont……

Sample	SP32	SP31 (0.5)	SP31 (bottom)	SP30	SP30 (bottom)	SP29	SP28	SP27	SP26	SP25	SP24
Grammatophora oceanica	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Gyrosigma acuminatum	0.0	1.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Gyrosigma balticum	1.0	11.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
Gyrosigma fasciola	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Melosira moniliformis	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	9.0	3.0	10.0
Melosira nummuloides	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Meridion circulare	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Navicula bacillum	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula cari var cincta	30.0	29.0	52.0	22.0	0.0	2.0	200.0	0.0	1.0	10.0	10.0
Navicula cryptocephala	0.0	0.0	0.0	2.0	0.0	0.0	10.0	0.0	3.0	1.0	0.0
Navicula digitoradiata	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Navicula flanatica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula gregaria	10.0	5.0	0.0	4.0	3.0	82.0	35.0	13.0	3.0	1.0	5.0
Navicula halophila	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula hungarica	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Navicula menisculus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
Navicula mutica	2.0	0.0	0.0	7.0	265.0	4.0	5.0	3.0	35.0	4.0	10.0
Navicula peregrina	0.0	0.0	0.0	0.0	1.0	1.0	0.0	1.0	3.0	0.0	1.0
Navicula perminuta	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	10.0	8.0	1.0
Navicula phyllepta	3.0	3.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	3.0
Navicula pygmaea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula radiosa	0.0	0.0	1.0	4.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0
Navicula rhyncocephala	0.0	0.0	0.0	1.0	0.0	5.0	0.0	2.0	0.0	0.0	0.0
Navicula slesvicensis	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Navicula tripunctata	74.0	153.0	89.0	75.0	0.0	88.0	1.0	56.0	99.0	170.0	49.0
Navicula viridula	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia acuminata	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia amphibia	0.0	0.0	0.0	1.0	0.0	1.0	5.0	0.0	3.0	1.0	0.0
Nitzschia apiculata	3.0	2.0	1.0	1.0	1.0	0.0	0.0	4.0	4.0	1.0	13.0
Nitzschia brevissima	1.0	1.0	5.0	8.0	0.0	0.0	4.0	2.0	3.0	2.0	0.0
Nitzschia constricta	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Nitzschia dissipata	39.0	20.0	21.0	30.0	0.0	10.0	18.0	1.0	0.0	0.0	2.0
Nitzschia dubia	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	1.0	2.0	0.0
Nitzschia epithemiodes	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia fonticola	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0
Nitzschia frustulum	0.0	5.0	3.0	2.0	2.0	0.0	2.0	1.0	0.0	25.0	10.0
Nitzschia lanceolata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia linearis	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia microcephala	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia navicularis	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0
Nitzschia palea	8.0	2.0	0.0	0.0	0.0	8.0	4.0	1.0	0.0	0.0	1.0
Nitzschia panduriformis	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia punctata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	1.0
Nitzschia recta	4.0	6.0	0.0	17.0	0.0	0.0	2.0	0.0	0.0	2.0	2.0
Nitzschia scalaris	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia sigma	9.0	5.0	2.0	5.0	0.0	4.0	11.0	4.0	0.0	1.0	3.0

DIATOM COUNTS FROM THE RIVER WAVENEY, 1998. Cont......

Sample	SP32	SP31 (0.5)	SP31 (bottom)	SP30	SP30 (bottom)	SP29	SP28	SP27	SP26	SP25	SP24
Nitzschia sigmoidea	2.0	3.0	0.0	4.0	0.0	4.0	0.0	0.0	0.0	0.0	7.0
Nitzschia tryblionella	1.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia tryblionella var levidensis	0.0	3.0	3.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Odontella aurita	0.0	0.0	0.0	1.0	0.0	0.0	0.0	5.0	2.0	1.0	1.0
Odontella obtusa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Odontella rhombus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Opephora martyi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Paralia sulcata	0.0	0.0	0.0	2.0	1.0	3.0	1.0	8.0	6.0	5.0	16.0
Pleurosigma formosum	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pleurosigma strigosum	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pleurosira laevis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
Psammodiscus nitidus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Pseudopodosira westii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhaphoneis amphiceros	1.0	2.0	0.0	5.0	1.0	1.0	7.0	3.0	9.0	10.0	13.0
Rhaphoneis minutissima	1.0	0.0	0.0	0.0	2.0	8.0	3.0	10.0	27.0	22.0	35.0
Rhizosolenia hebetata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Rhizosolenia imbricata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Rhizosolenia setigera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Rhoicosphenia curvata	5.0	1.0	7.0	2.0	0.0	0.0	1.0	137.0	7.0	0.0	0.0
Stauroneis biundulata	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stephanodiscus hantzschii	3.0	3.0	0.0	0.0	0.0	0.0	1.0	2.0	9.0	2.0	2.0
Stephanodiscus minutulus	0.0	1.0	3.0	3.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0
Surirella gemma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surirella ovalis	1.0	1.0	5.0	1.0	0.0	1.0	0.0	0.0	4.0	4.0	0.0
Synedra acus	0.0	1.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Synedra capitata	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Synedra fasciculata	2.0	0.0	3.0	0.0	0.0	1.0	0.0	5.0	3.0	12.0	7.0
Synedra parasitica	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Synedra pulchella	6.0	6.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	1.0	0.0
Thalassiosira bramaputrae	0.0	0.0	0.0	0.0	0.0	1.0	0.0	5.0	0.0	0.0	0.0
Thalassiosira eccentrica	4.0	0.0	4.0	1.0	0.0	1.0	1.0	3.0	5.0	2.0	4.0
Triceratium reticulum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DIATOM COUNTS FROM THE RIVER WAVENEY, 1998.cont......

Sample	SP24 (bottom)	CP1A (1.0m)	CP1B (0.5m)	CP1B (bottom)
Achnanthes brevipes	5.0	0.0	0.0	0.0
Achnanthes delicatula	1.0	0.0	3.0	0.0
Achnanthes exigua	1.0	0.0	0.0	0.0
Achnanthes hungarica	0.0	0.0	0.0	0.0
Achnanthes lanceolata	0.0	0.0	0.0	0.0
Achnanthes longipes	0.0	0.0	0.0	0.0
Achnanthes minutissima	0.0	0.0	0.0	0.0
Actinocyclus normanii	0.0	0.0	0.0	0.0
Actinoptychus senarius	11.0	0.0	1.0	1.0
Amphora ovalis	0.0	0.0	0.0	0.0
Amphora ovalis var. affinis	4.0	0.0	0.0	0.0
Amphora veneta	0.0	0.0	0.0	0.0
Aulacosira ambigua	0.0	0.0	0.0	0.0
Aulacosira granulata	3.0	0.0	0.0	0.0
Aulacosira granulata var. angustissima	0.0	0.0	0.0	0.0
Aulacosira granulata var. curvata	0.0	0.0	0.0	0.0
Bacillaria paradoxa	3.0	0.0	0.0	0.0
Biddulphia alternans	2.0	0.0	0.0	0.0
Biddulphia biddulphiana	0.0	0.0	0.0	0.0
Caloneis bacillum	0.0	0.0	0.0	0.0
Campylosira cymbelliformis	0.0	0.0	0.0	0.0
Cocconeis disculus	0.0	0.0	0.0	4.0
Cocconeis placentula	4.0	0.0	0.0	0.0
Cocconeis scutellum	7.0	3.0	1.0	0.0
Coscinodiscus nodulifer	3.0	0.0	0.0	0.0
Cyclostephanos dubius	0.0	2.0	0.0	0.0
Cyclotella comta	2.0	0.0	0.0	0.0
Cyclotella meneghiniana	0.0	0.0	0.0	0.0
Cyclotella pseudostelligera	0.0	0.0	0.0	0.0
Cylcotella atomus	0.0	0.0	0.0	0.0
Cymatosira belgica	12.0	0.0	0.0	0.0
Delphineis surirella	9.0	0.0	0.0	0.0
Diatoma tenue	2.0	3.0	0.0	0.0
Diploneis didyma	0.0	0.0	0.0	0.0
Diploneis interrupta	0.0	0.0	0.0	0.0
Diploneis oculata	0.0	0.0	0.0	0.0
Diploneis ovalis	0.0	0.0	0.0	0.0
Epithemia adnata	0.0	0.0	0.0	0.0
Epithemia sorex	0.0	0.0	0.0	0.0
Frustulia rhomboides	0.0	0.0	0.0	0.0
Gomphoneis olivaceum	1.0	0.0	2.0	0.0
Gomphonema acuminatum	0.0	0.0	0.0	0.0
Gomphonema gracile	0.0	0.0	1.0	0.0
Gomphonema parvulum	0.0	0.0	0.0	0.0
Grammatophora oceanica	1.0	0.0	0.0	0.0
Gyrosigma acuminatum	3.0	0.0	0.0	0.0
Gyrosigma balticum	0.0	0.0	0.0	0.0
Gyrosigma fasciola	0.0	0.0	0.0	1.0
Melosira moniliformis	63.0	10.0	0.0	0.0
Melosira nummuloides	9.0	0.0	3.0	0.0
Meridion circulare	0.0	0.0	0.0	0.0
Navicula bacillum	0.0	0.0	0.0	0.0
Navicula cari var cincta	10.0	0.0	0.0	0.0
Navicula cryptocephala	2.0	28.0	10.0	0.0
Navicula digitoradiata	2.0	1.0	0.0	0.0
Navicula flanatica	0.0	2.0	25.0	0.0
Navicula gregaria	10.0	35.0	10.0	0.0
Navicula halophila	0.0	0.0	12.0	2.0
Navicula hungarica	0.0	0.0	2.0	0.0
Navicula menisculus	0.0	0.0	0.0	0.0
Navicula mutica	3.0	28.0	15.0	309.0
Navicula peregrina	0.0	0.0	0.0	3.0
Navicula perminuta	0.0	75.0	25.0	0.0
Navicula phyllepta	1.0	10.0	2.0	0.0
Navicula pygmaea	1.0	0.0	0.0	0.0
Navicula radiosa	1.0	0.0	0.0	0.0
Navicula rhyncocephala	0.0	0.0	0.0	0.0
Navicula slesvicensis	0.0	0.0	0.0	0.0
Navicula tripunctata	47.0	30.0	70.0	0.0
Navicula viridula	0.0	0.0	0.0	0.0
Nitzschia acuminata	0.0	0.0	5.0	0.0

DIATOM COUNTS FROM THE RIVER WAVENEY, 1998.cont......

Sample	SP24 (bottom)	CP1A (1.0m)	CP1B (0.5m)	CP1B (bottom)
Nitzschia amphibia	0.0	0.0	0.0	0.0
Nitzschia apiculata	1.0	40.0	40.0	5.0
Nitzschia brevissima	0.0	0.0	0.0	0.0
Nitzschia constricta	4.0	0.0	0.0	0.0
Nitzschia dissipata	0.0	0.0	2.0	0.0
Nitzschia dubia	4.0	2.0	20.0	0.0
Nitzschia epithemiodes	0.0	1.0	0.0	0.0
Nitzschia fonticola	1.0	0.0	15.0	0.0
Nitzschia frustulum	2.0	5.0	0.0	0.0
Nitzschia lanceolata	0.0	0.0	6.0	0.0
Nitzschia linearis	0.0	0.0	0.0	0.0
Nitzschia microcephala	0.0	0.0	0.0	0.0
Nitzschia navicularis	0.0	0.0	0.0	1.0
Nitzschia palea	0.0	0.0	22.0	2.0
Nitzschia panduriformis	0.0	0.0	0.0	0.0
Nitzschia punctata	5.0	0.0	0.0	2.0
Nitzschia recta	0.0	0.0	3.0	0.0
Nitzschia scalaris	0.0	0.0	0.0	1.0
Nitzschia sigma	15.0	6.0	10.0	3.0
Nitzschia sigmoidea	0.0	0.0	0.0	0.0
Nitzschia tryblionella	0.0	0.0	0.0	1.0
Nitzschia tryblionella var levidensis	0.0	0.0	0.0	0.0
Odontella aurita	8.0	0.0	0.0	0.0
Odontella obtusa	0.0	0.0	0.0	0.0
Odontella rhombus	1.0	0.0	0.0	0.0
Opephora martyi	0.0	0.0	0.0	0.0
Paralia sulcata	22.0	0.0	0.0	0.0
Pleurosigma formosum	0.0	0.0	0.0	0.0
Pleurosigma strigosum	1.0	0.0	0.0	0.0
Pleurosira laevis	0.0	0.0	0.0	0.0
Psammodiscus nitidus	0.0	0.0	0.0	0.0
Pseudopodosira westii	1.0	0.0	0.0	0.0
Rhaphoneis amphiceros	27.0	4.0	2.0	0.0
Rhaphoneis minutissima	37.0	2.0	20.0	0.0
Rhizosolenia hebetata	0.0	0.0	0.0	0.0
Rhizosolenia imbricata	0.0	0.0	0.0	0.0
Rhizosolenia setigera	0.0	0.0	0.0	0.0
Rhoicosphenia curvata	1.0	0.0	0.0	0.0
Stauroneis biundulata	0.0	0.0	0.0	0.0
Stephanodiscus hantzschii	0.0	0.0	0.0	0.0
Stephanodiscus minutulus	0.0	0.0	0.0	0.0
Surirella gemma	0.0	2.0	0.0	0.0
Surirella ovalis	1.0	0.0	0.0	1.0
Synedra acus	0.0	0.0	0.0	0.0
Synedra capitata	0.0	0.0	0.0	0.0
Synedra fasciculata	5.0	4.0	20.0	0.0
Synedra parasitica	0.0	0.0	0.0	0.0
Synedra pulchella	0.0	0.0	0.0	0.0
Thalassiosira bramaputrae	0.0	0.0	0.0	0.0
Thalassiosira eccentrica	5.0	0.0	10.0	1.0
Triceratium reticulum	4.0	0.0	0.0	0.0

DIATOM COUNTS FROM RIVER YARE, 1998.

Sample	SP23 (0.5m)	SP23 (1.0m)	SP23 bottom	SP22	SP21 (0.5m)	SP21 bottom	SP19 (0.5m)	SP19 bottom	SP18 (0.5m)	SP18 (1.0m)	SP18 (bottom)
Achnanthes brevipes	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	4.0
Achnanthes delicatula	0.0	1.0	1.0	7.0	0.0	0.0	11.0	10.0	1.0	3.0	1.0
Achnanthes exigua	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Achnanthes hungarica	1.0	5.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Achnanthes lanceolata	1.0	2.0	0.0	0.0	2.0	0.0	3.0	0.0	0.0	0.0	0.0
Achnanthes minutissima	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Actinocyclus normanii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	5.0
Actinoptychus senarius	0.0	1.0	0.0	1.0	0.0	0.0	3.0	6.0	10.0	1.0	2.0
Amphora ovalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Amphora ovalis var. affinis	1.0	6.0	5.0	5.0	0.0	0.0	2.0	0.0	0.0	0.0	8.0
Anorthoneis excentrica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aulacosira ambigua	2.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aulacosira granulata	0.0	0.0	4.0	0.0	1.0	0.0	0.0	12.0	0.0	0.0	0.0
Aulacosira granulata var. curvata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aulacosira granulata var. angustissima	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Asterionella formosa	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Bacillaria paradoxa	0.0	6.0	10.0	29.0	4.0	0.0	8.0	0.0	0.0	4.0	30.0
Biddulphia alternans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caloneis subsalina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Campylosira cymbelliformis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Cocconeis disculus	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0
Cocconeis pediculus	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cocconeis peltoides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cocconeis placentula	29.0	29.0	55.0	55.0	5.0	2.0	3.0	3.0	3.0	6.0	17.0
Cocconeis placentula var euglypta	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cocconeis scutellum	0.0	1.0	2.0	2.0	0.0	0.0	7.0	12.0	3.0	0.0	0.0
Coscinodiscus nodulifer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyclostephanos dubius	5.0	1.0	2.0	0.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0
Cyclotella comta	10.0	13.0	23.0	5.0	2.0	0.0	7.0	0.0	0.0	4.0	0.0
Cyclotella meneghiniana	4.0	18.0	22.0	0.0	3.0	0.0	5.0	1.0	1.0	3.0	20.0
Cyclotella pseudostelligera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0
Cyclotella radiosa	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0
Cyclotella stelligera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymatosira belgica	1.0	1.0	3.0	0.0	0.0	0.0	0.0	4.0	1.0	4.0	19.0
Cymbella hebridica	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymbella helvetica	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymbella prostrata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
Delphineis surirella	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Diatoma tenue	0.0	2.0	2.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	2.0
Diatoma vulgare	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Diploneis bombus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Diploneis didyma	0.0	0.0	0.0	0.0	1.0	0.0	2.0	1.0	0.0	0.0	0.0
Diploneis ovalis	0.0	1.0	2.0	0.0	3.0	0.0	0.0	1.0	0.0	0.0	0.0
Diploneis papula	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DIATOM COUNTS FROM RIVER YARE, 1998.cont....

Sample	SP23 (0.5m)	SP23 (1.0m)	SP23 bottom	SP22	SP21 (0.5m)	SP21 bottom	SP19 (0.5m)	SP19 bottom	SP18 (0.5m)	SP18 (1.0m)	SP18 (bottom)
Diploneis smithii	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epithemia argus	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epithemia sorex	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Eunotia monodon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fragilaria construens	0.0	1.0	0.0	0.0	1.0	0.0	15.0	0.0	0.0	10.0	0.0
Fragilaria lapponica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gomphoneis olivaceum	1.0	1.0	5.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0
Gomphonema acuminatum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gomphonema angustatum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gomphonema parvulum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Gyrosigma acuminatum	1.0	2.0	0.0	0.0	2.0	0.0	7.0	3.0	2.0	3.0	6.0
Gyrosigma balticum	4.0	23.0	13.0	0.0	2.0	1.0	5.0	5.0	1.0	0.0	3.0
Gyrosigma fasciola	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Melosira moniliformis	2.0	0.0	0.0	0.0	1.0	3.0	6.0	8.0	10.0	0.0	0.0
Melosira nummuloides	3.0	1.0	0.0	2.0	0.0	0.0	1.0	5.0	5.0	0.0	0.0
Melosira varians	0.0	2.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula bacciliformis	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula cari var cincta	20.0	17.0	10.0	1.0	7.0	0.0	0.0	0.0	0.0	1.0	9.0
Navicula cryptocephala	0.0	0.0	2.0	0.0	3.0	0.0	5.0	0.0	0.0	0.0	2.0
Navicula digitoradiata	0.0	0.0	0.0	0.0	1.0	0.0	1.0	1.0	0.0	0.0	0.0
Navicula flanatica	0.0	1.0	0.0	8.0	0.0	0.0	0.0	2.0	0.0	3.0	0.0
Navicula graciloides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula gregaria	4.0	4.0	2.0	13.0	5.0	4.0	0.0	0.0	0.0	10.0	8.0
Navicula halophila	0.0	0.0	0.0	0.0	0.0	0.0	8.0	4.0	1.0	0.0	0.0
Navicula hungarica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula menisculus	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula mutica	2.0	1.0	4.0	3.0	0.0	3.0	22.0	4.0	68.0	4.0	5.0
Navicula peregrina	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Navicula perminuta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0
Navicula phyllepta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	2.0	0.0
Navicula pupula	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Navicula radiosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula rhyncocephala	0.0	2.0	0.0	0.0	3.0	0.0	0.0	0.0	1.0	3.0	1.0
Navicula slesvicensis	2.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula tripunctata	46.0	62.0	28.0	152.0	200.0	207.0	110.0	56.0	205.0	107.0	55.0
Neidium binodis	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia acuminata	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	1.0	0.0	0.0
Nitzschia amphibia	0.0	2.0	2.0	2.0	0.0	0.0	1.0	3.0	1.0	0.0	4.0
Nitzschia apiculata	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0
Nitzschia brevissima	1.0	0.0	0.0	0.0	3.0	0.0	12.0	15.0	4.0	5.0	13.0
Nitzschia commutata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia constricta	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Nitzschia dissipata	10.0	6.0	2.0	5.0	9.0	7.0	2.0	0.0	0.0	1.0	0.0
Nitzschia dubia	1.0	2.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0
Nitzschia epithemiodes	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DIATOM COUNTS FROM RIVER YARE, 1998. Cont......

Sample	SP23 (0.5m)	SP23 (1.0m)	SP23 bottom	SP22	SP21 (0.5m)	SP21 bottom	SP19 (0.5m)	SP19 bottom	SP18 (0.5m)	SP18 (1.0m)	SP18 (bottom)
Nitzschia fonticola	5.0	2.0	0.0	0.0	4.0	2.0	8.0	0.0	0.0	3.0	0.0
Nitzschia frustulum	7.0	5.0	1.0	7.0	0.0	0.0	0.0	0.0	0.0	20.0	18.0
Nitzschia granulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Nitzschia hungarica	0.0	0.0	0.0	1.0	0.0	0.0	0.0	3.0	1.0	0.0	0.0
Nitzchia intermedia	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	10.0	0.0	0.0
Nitzschia microcephala	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia navicularis	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Nitzschia obtusa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Nitzschia palea	1.0	3.0	0.0	35.0	15.0	11.0	0.0	2.0	3.0	1.0	1.0
Nitzschia panduriformis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0
Nitzschia punctata	0.0	0.0	1.0	0.0	0.0	0.0	0.0	3.0	0.0	1.0	2.0
Nitzschia recta	2.0	6.0	0.0	1.0	2.0	0.0	1.0	0.0	8.0	0.0	4.0
Nitzschia sigma	10.0	8.0	1.0	3.0	0.0	5.0	1.0	20.0	5.0	4.0	16.0
Nitzschia sigmoidea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Nitzschia spectabilis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Nitzschia tryblionella	0.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Odontella aurita	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	3.0	0.0
Opephora martyi	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paralia sulcata	0.0	6.0	7.0	2.0	1.0	0.0	0.0	60.0	10.0	2.0	6.0
Pinnularia abaujensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pleurosigma formosum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pleurosigma strigosum	3.0	6.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Podosira stelliger	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Psammodiscus nitidus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Rhaphoneis amphiceros	3.0	7.0	8.0	0.0	3.0	1.0	15.0	23.0	6.0	27.0	0.0
Rhaphoneis minutissima	10.0	5.0	3.0	0.0	2.0	0.0	35.0	11.0	10.0	68.0	18.0
Rhoicosphenia abbreviata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhoicosphenia curvata	5.0	2.0	5.0	1.0	5.0	0.0	1.0	0.0	5.0	2.0	2.0
Skeletonema subsalsum	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stephanodiscus hantzschii	10.0	10.0	15.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	4.0
Stephanodiscus minutulus	3.0	1.0	1.0	0.0	3.0	0.0	1.0	0.0	0.0	0.0	1.0
Surirella gemma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surirella ovalis	6.0	2.0	5.0	1.0	0.0	1.0	1.0	3.0	1.0	0.0	3.0
Synedra acus	2.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0
Synedra capitata	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Synedra fasciculata	11.0	18.0	9.0	2.0	1.0	0.0	2.0	1.0	4.0	3.0	2.0
Synedra parasitica	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
Synedra pulchella	50.0	29.0	5.0	5.0	10.0	0.0	1.0	2.0	0.0	1.0	1.0
Synedra ulna	0.0	0.0	1.0	3.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0
Thalassionema nitzschioides	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thalassiosira angstii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Thalassiosira bramaputrae	5.0	5.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Thalassiosira eccentrica	1.0	1.0	2.0	0.0	1.0	0.0	3.0	2.0	1.0	2.0	3.0
Trachyneis aspera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Triceratium reticulum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0

River Yare cont….

Sample	SP17	SP16	SP15 (0.5m)	SP15 (1.0m)	CP2A (1.0m)	CP2B (0.5m)	CP2B (1.0m)
Achnanthes brevipes	1.0	0.0	0.0	1.0	1.0	1.0	1.0
Achnanthes delicatula	0.0	1.0	0.0	1.0	0.0	0.0	34.0
Achnanthes exigua	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Achnanthes hungarica	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Achnanthes lanceolata	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Achnanthes minutissima	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Actinocyclus normanii	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Actinoptychus senarius	1.0	1.0	3.0	1.0	7.0	3.0	4.0
Amphora ovalis	0.0	2.0	0.0	0.0	0.0	0.0	0.0
Amphora ovalis var. affinis	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Anorthoneis excentrica	0.0	2.0	0.0	0.0	0.0	0.0	0.0
Aulacosira ambigua	0.0	0.0	0.0	0.0	6.0	0.0	0.0
Aulacosira granulata	0.0	5.0	0.0	0.0	0.0	0.0	0.0
Aulacosira granulata var. curvata	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aulacosira granulata var. angustissima	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Asterionella formosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bacillaria paradoxa	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Biddulphia alternans	0.0	0.0	0.0	0.0	2.0	0.0	1.0
Caloneis subsalina	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Campylosira cymbelliformis	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cocconeis disculus	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cocconeis pediculus	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cocconeis peltoides	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Cocconeis placentula	0.0	3.0	0.0	0.0	0.0	0.0	3.0
Cocconeis placentula var euglypta	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cocconeis scutellum	4.0	5.0	0.0	3.0	6.0	4.0	3.0
Coscinodiscus nodulifer	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Cyclostephanos dubius	0.0	2.0	1.0	0.0	1.0	0.0	2.0
Cyclotella comta	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Cyclotella meneghiniana	3.0	2.0	0.0	0.0	1.0	0.0	0.0
Cyclotella pseudostelligera	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyclotella radiosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyclotella stelligera	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Cymatosira belgica	0.0	0.0	0.0	1.0	1.0	0.0	1.0
Cymbella hebridica	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymbella helvetica	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymbella prostrata	0.0	0.0	0.0	0.0	4.0	0.0	0.0
Delphineis surirella	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Diatoma tenue	0.0	0.0	0.0	1.0	0.0	1.0	1.0
Diatoma vulgare	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diploneis bombus	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Diploneis didyma	2.0	0.0	0.0	0.0	4.0	0.0	0.0
Diploneis ovalis	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Diploneis papula	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Diploneis smithii	0.0	0.0	1.0	0.0	0.0	0.0	1.0

River Yare cont.....

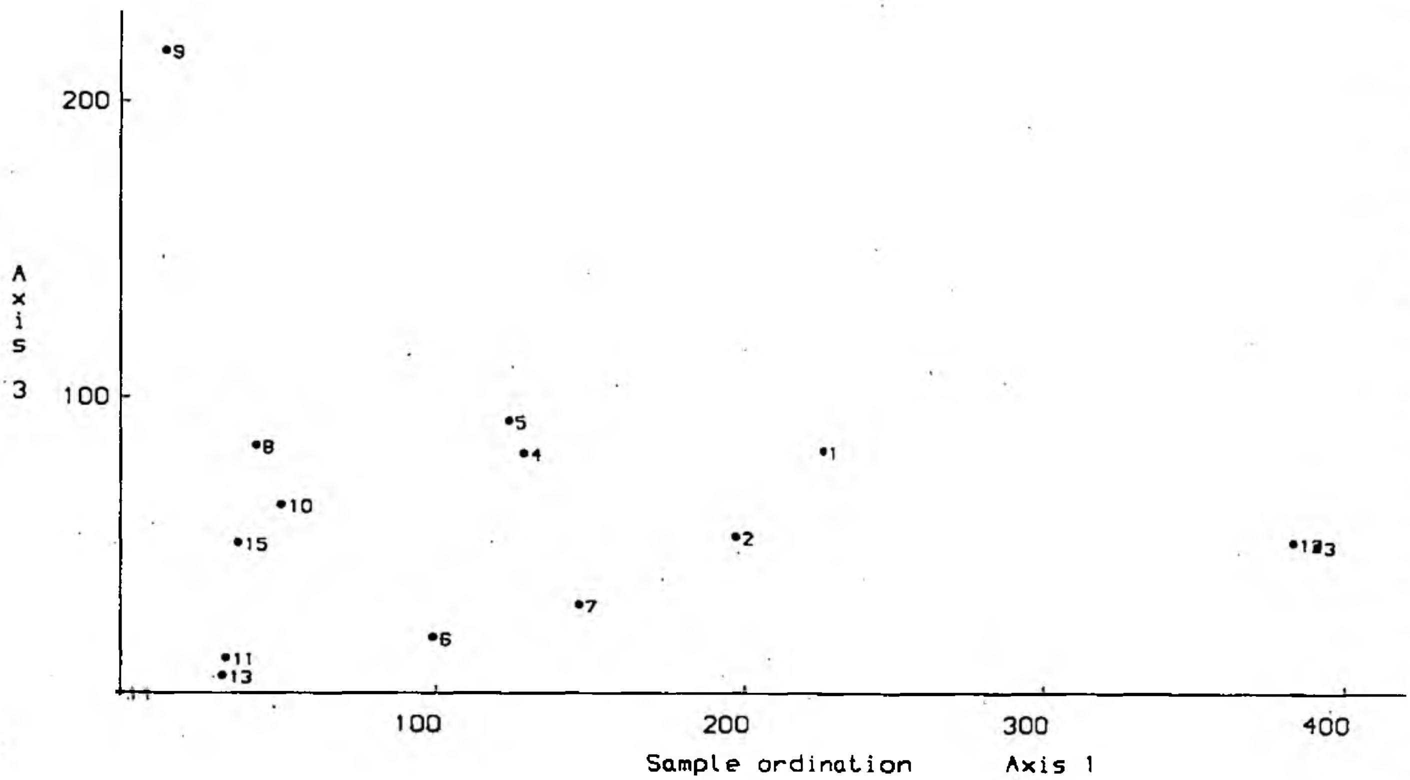
Sample	SP17	SP16	SP15 (0.5m)	SP15 (1.0m)	CP2A (1.0m)	CP2B (0.5m)	CP2B (1.0m)
Epithemia argus	0.0	4.0	0.0	0.0	0.0	0.0	0.0
Epithemia sorex	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Eunotia monodon	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Fragilaria construens	0.0	0.0	6.0	0.0	35.0	0.0	0.0
Fragilaria lapponica	0.0	0.0	0.0	1.0	5.0	0.0	0.0
Gomphoneis olivaceum	0.0	1.0	0.0	0.0	0.0	1.0	0.0
Gomphonema acuminatum	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Gomphonema angustatum	0.0	12.0	0.0	0.0	0.0	0.0	0.0
Gomphonema parvulum	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyrosigma acuminatum	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyrosigma balticum	2.0	0.0	0.0	0.0	1.0	0.0	0.0
Gyrosigma fasciola	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Melosira moniliformis	0.0	8.0	137.0	164.0	13.0	13.0	16.0
Melosira nummuloides	0.0	2.0	2.0	8.0	3.0	8.0	3.0
Melosira varians	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula bacciliformis	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula cari var cincta	0.0	7.0	0.0	0.0	0.0	0.0	0.0
Navicula cryptocephala	0.0	0.0	0.0	1.0	1.0	0.0	0.0
Navicula digitoradiata	0.0	2.0	0.0	0.0	0.0	0.0	1.0
Navicula flanatica	0.0	0.0	0.0	0.0	5.0	1.0	0.0
Navicula graciloides	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Navicula gregaria	3.0	10.0	15.0	0.0	0.0	0.0	0.0
Navicula halophila	3.0	10.0	0.0	5.0	3.0	10.0	2.0
Navicula hungarica	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula menisculus	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula mutica	15.0	10.0	5.0	10.0	10.0	8.0	23.0
Navicula peregrina	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula perminuta	0.0	5.0	5.0	0.0	0.0	0.0	0.0
Navicula phyllepta	3.0	0.0	0.0	2.0	3.0	0.0	0.0
Navicula pupula	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula radiosa	0.0	10.0	0.0	0.0	0.0	0.0	0.0
Navicula rhyncocephala	0.0	3.0	0.0	0.0	0.0	0.0	0.0
Navicula slesvicensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Navicula tripunctata	233.0	90.0	71.0	57.0	96.0	165.0	37.0
Neidium binodis	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia acuminata	1.0	0.0	0.0	0.0	0.0	3.0	0.0
Nitzschia amphibia	1.0	0.0	0.0	1.0	0.0	0.0	0.0
Nitzschia apiculata	5.0	12.0	0.0	0.0	0.0	0.0	0.0
Nitzschia brevissima	10.0	10.0	0.0	1.0	2.0	8.0	0.0
Nitzschia commutata	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Nitzschia constricta	0.0	0.0	0.0	1.0	6.0	3.0	2.0
Nitzschia dissipata	1.0	8.0	0.0	1.0	0.0	0.0	0.0
Nitzschia dubia	0.0	8.0	0.0	0.0	0.0	0.0	4.0
Nitzschia epithemiodes	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia fonticola	0.0	0.0	3.0	0.0	0.0	0.0	0.0
Nitzschia frustulum	0.0	5.0	6.0	0.0	0.0	0.0	0.0

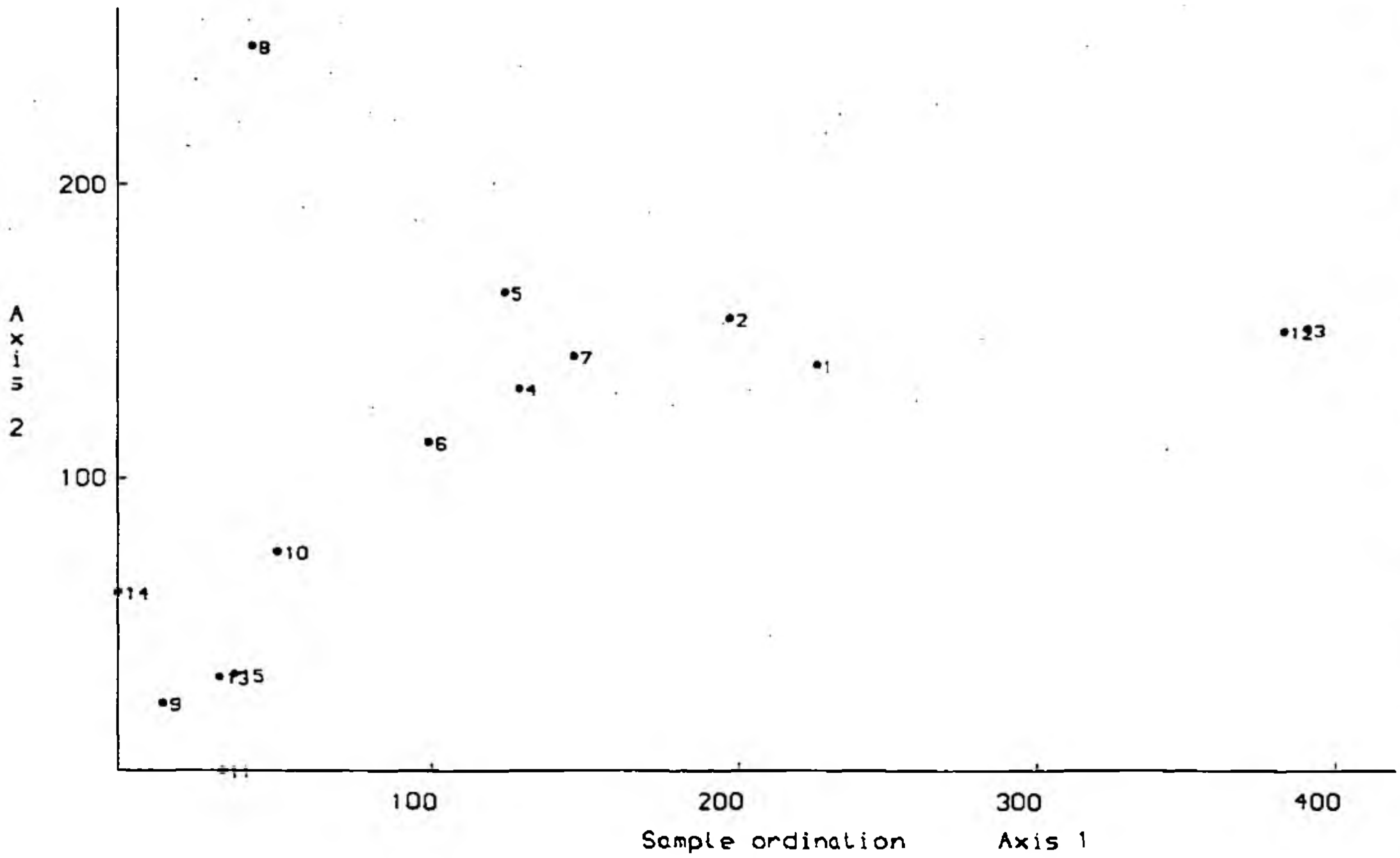
River Yare cont.....[2]

Sample	SP17	SP16	SP15 (0.5m)	SP15 (1.0m)	CP2A (1.0m)	CP2B (0.5m)	CP2B (1.0m)
Nitzschia granulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia hungarica	3.0	0.0	0.0	2.0	0.0	10.0	5.0
Nitzchia intermedia	1.0	0.0	0.0	2.0	0.0	0.0	0.0
Nitzschia microcephala	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia navicularis	0.0	0.0	0.0	0.0	3.0	0.0	0.0
Nitzschia obtusa	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia palea	1.0	2.0	0.0	0.0	0.0	0.0	0.0
Nitzschia panduriformis	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia punctata	0.0	2.0	2.0	0.0	0.0	0.0	0.0
Nitzschia recta	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia sigma	22.0	2.0	9.0	0.0	1.0	4.0	5.0
Nitzschia sigmoidea	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia spectabilis	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nitzschia tryblionella	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Odontella aurita	0.0	0.0	0.0	1.0	0.0	0.0	2.0
Opephora martyi	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paralia sulcata	1.0	10.0	0.0	8.0	10.0	7.0	14.0
Pinnularia abaujensis	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Pleurosigma formosum	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pleurosigma strigosum	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Podosira stelliger	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psammodiscus nitidus	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhaphoneis amphiceros	0.0	30.0	3.0	4.0	25.0	3.0	12.0
Rhaphoneis minutissima	0.0	40.0	5.0	14.0	45.0	11.0	55.0
Rhoicosphenia abbreviata	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Rhoicosphenia curvata	2.0	3.0	1.0	2.0	0.0	0.0	0.0
Skeletonema subsalsum	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stephanodiscus hantzschii	0.0	5.0	2.0	0.0	1.0	0.0	0.0
Stephanodiscus minutulus	0.0	0.0	2.0	0.0	1.0	0.0	0.0
Surirella gemma	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Surirella ovalis	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Synedra acus	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Synedra capitata	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Synedra fasciculata	0.0	10.0	2.0	7.0	14.0	20.0	11.0
Synedra parasitica	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Synedra pulchella	2.0	1.0	0.0	0.0	3.0	0.0	0.0
Synedra ulna	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thalassionema nitzschioides	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thalassiosira angstii	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thalassiosira bramaputrae	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thalassiosira eccentrica	0.0	3.0	0.0	1.0	4.0	2.0	3.0
Trachyneis aspera	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Triceratium reticulum	0.0	0.0	0.0	0.0	0.0	0.0	0.0

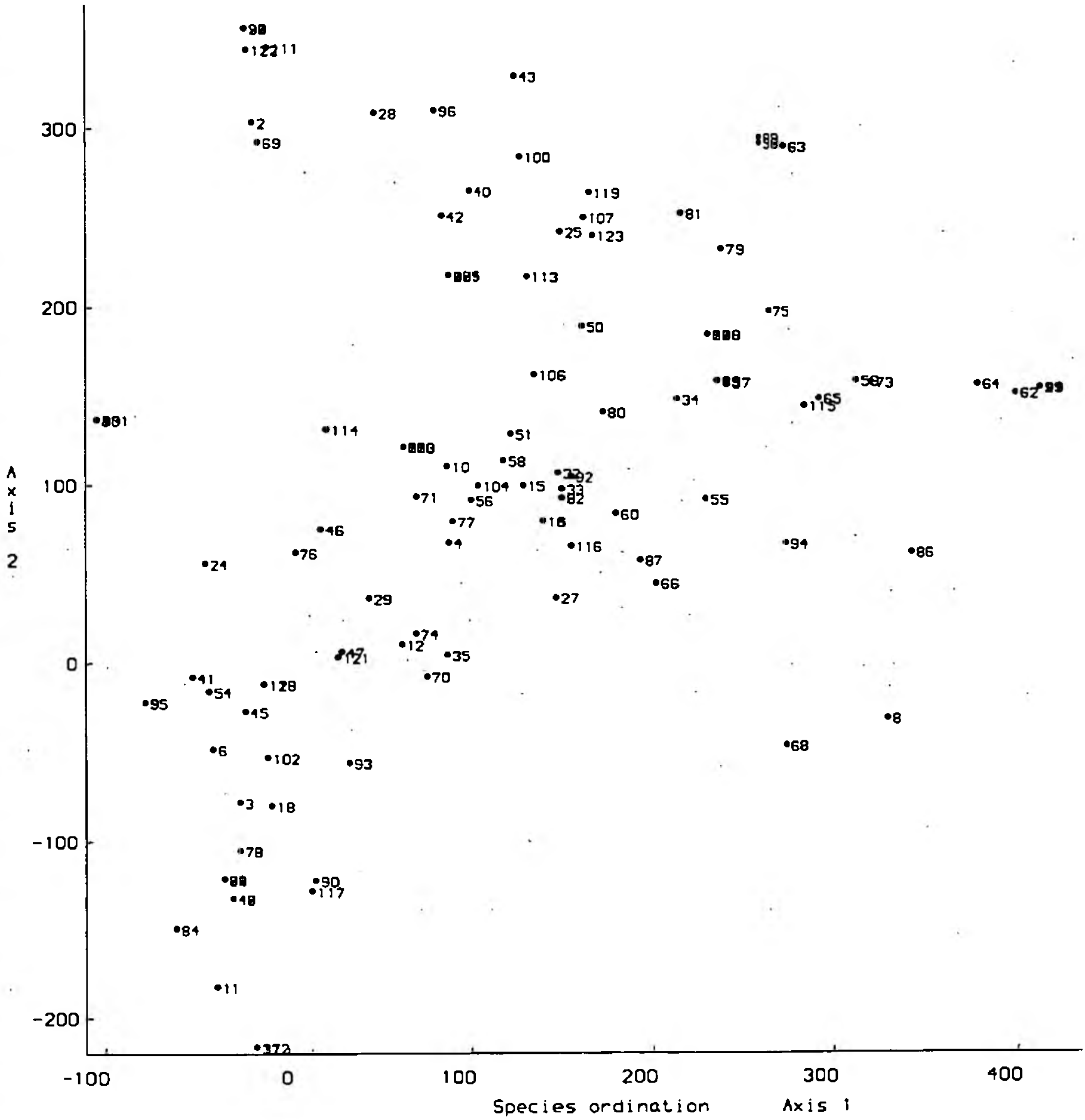
2

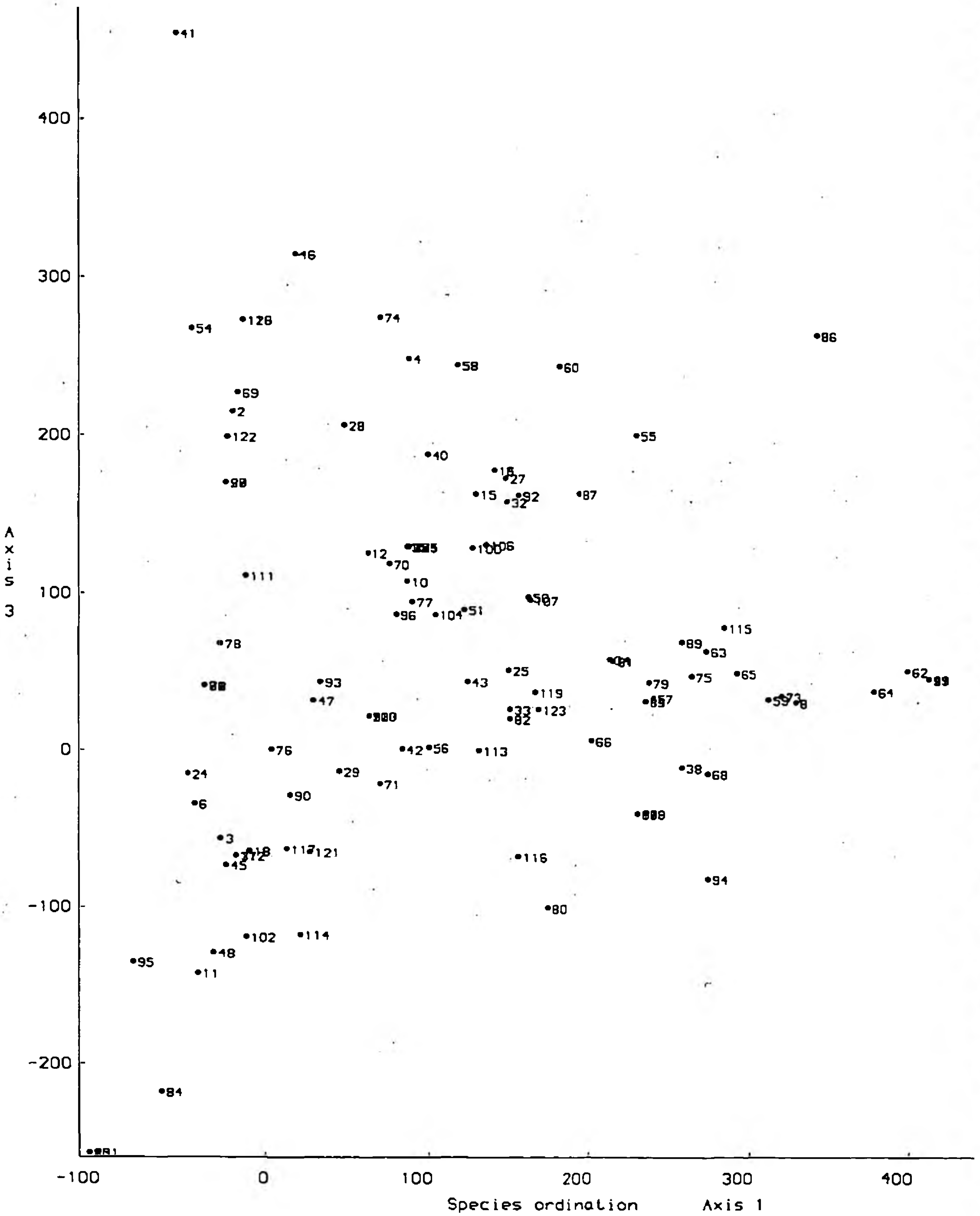
Appendix 6a: DECORANA plots - Sample ordination





Appendix 6b: DECORANA plots - Species ordination




Axis 3
Species ordination Axis 1

Appendix 7 - Invertebrate/diatom site recording sheet and location photograph of SP15

SITE RECORDING SHEET FOR INSTALLATION OF INVERTEBRATE SITE MONITORING PLATES IN BROADLAND BFAS

RECORDER S. OAKLEY

RIVER....YARE........... SAMPLE NO SP.15. 6 FIG NGR....440.027

DATE 4/9/98.. RIVER DEPTH LW 1:45M PHOTO ....No.7,..FILM 2.

NO OF SAMPLES AT SITE 2 (0.5m) 1m (0.5m) from bottom

ANCHOR SUBSTRATE DESCRIPTION (steel piling etc)

Galvanised sheet steel piling (with steel bar across top).

Tidal range: 65cm

SITE DESCRIPTION This should include a diagram of the sample location detailing any useful site relocating features, exact measurements from bridge, large tree or other feature. Your diagram should also show the tidal range which you worked on in your depth assessment.

Access point: Difficult! Use GPS!

Either - Walk upstream from Seven Mile House along the river until crossed right no. dykes

Or - Walk along the track connecting Seven Mile House + Church Farm, + cut across to the river following dykes.

By boat - First piling downstream of Reedham; 2m downstream of start of piling.

GPS Reading: N 52° 34' 02.2"
E 001° 36' 02.1"