

# Hydroacoustic Survey Report

## River Thurne 2008

This report was prepared in draft form by an Environment Agency employee at the time of the data collection. It has been reviewed and prepared for publication by the current Analysis and Reporting Team in 2021. The facts and conclusions are valid as far as can be determined.



# Contents

## River Thurne

1.0	Introduction	4
2.0	Methods	4
2.1	Hydroacoustics	
2.2	Validation	5
3.0	Results	5
3.1	Hydroacoustics	5
3.2	Validation	10
4.0	Discussion	13
4.1	Hydroacoustics	13
4.2	Validation	14
5.0	Conclusions	14

### List of figures

Figure 1. River Thurne fish density distribution (fish/1000m <sup>3</sup> ), Thurne confluence to Pleasure Boat end of Hickling Broad 2008.	7
Figure 2. Density of fish/1000m <sup>3</sup> vs river sample volume, Thurne confluence to Pleasure Boat end of Hickling Broad 2008.	9
Figure 3. Comparison of overall mean fish density between surveys, 2003- 2008	9
Figure 4. Echogram of shoaling fish, Thurne Mouth, 2008.	10
Figure 5. Species assemblage and proportional representation of individual Species within the sub-sample, Catfield Dyke.	11
Figure 6. Length frequency roach, Catfield Dyke, 2009	11
Figure 7. Length frequency bream, Catfield Dyke, 2009	12
Figure 8. Length frequency perch, Catfield Dyke, 2009	12
Figure 9. Length frequency pike, Catfield Dyke, 2009	12

## **1.0 Introduction**

The River Thurne, located in east Norfolk, is a tributary of the River Bure. It flows from its source (between Horsey and Somerton) south south-west to its confluence with the River Bure at Thurne. The River Thurne is tidally influenced although the effects are attenuated compared to the larger rivers. The river and interconnected broads are slightly brackish due to the penetration of sea water under the coastal dunes. Saline concentrations are highest at the upstream end (Horsey Mere, Hundred Stream) and decrease towards the River Bure confluence. Navigation continues up-stream as far as West Somerton though only for small craft. The river lies within the Broads Authority Executive area and forms part of the network of rivers and broads that are the Broads National Park. As such, it provides important recreational opportunities to visitors during the summer and for anglers throughout the year. The River Thurne is famous as a pike fishery (once holding the national pike record) and attracts pike anglers from all over the country. The largest rod caught river UK pike was recently caught in the Thurne system in February 2009, weighing 45lb 8oz. The capture of such a large fish will reinforce the area's reputation as a premier pike fishery.

Hydroacoustic surveys were started on this system in 2004 following successful trials in two large main rivers (Yare and Waveney) in 2003.

Surveys start and end at Thurne Mouth, confluence with the River Bure, and extend to down-stream of West Somerton, dependent upon the amount of macrophyte growth. The survey also extended into Hickling Broad but technical problems prevented these data from being included (see below, results section).

## **2.0 Methods**

### **2.1 Hydroacoustics**

An echosounder transmits short pulses of sound (known as 'pings') through a transducer beneath the boat. The transducer comprises housing containing ceramic plates that are clapped together in a controlled manner to provide the 'ping' under water. It is mounted forward of the craft to prevent background 'noise' interfering with the signal and the craft is piloted at approximately 3km/h, working along one side of the river and firing the transducer across the river width. The sound waves from these pulses reflect off objects with densities different to the surrounding water, such as fish swim-bladders. The transducer picks up these returning echoes and amplifies and records them onto a laptop.

Specialist software translates the survey data into a series of pictures called echograms that show the echo reflections from fish, as well as other material such as weed, silt and debris. An analyst must measure the size of the water column by drawing a line that cuts off weed and debris at the bottom of the river. This determines water volume and enables density to be calculated. Within this volume, the analyst looks for the strong echoes that denote fish, which are counted, and weak or untypical echoes, which seem not to be fish and are not counted. The minimum size of fish that can be reliably identified is approx. 5cm. Density of fish is reported for each surveyed section as fish per 1000m<sup>3</sup>.

The surveys are conducted at night, since fish are more evenly distributed throughout the water column during hours of darkness and can be more easily surveyed. The absence of other boat traffic also helps greatly. Each river is surveyed twice (once travelling upstream and once downstream) and the best quality data set is chosen for analysis and reporting.

## **2.2 Validation**

Validation surveys were carried out at Catfield Dyke (Hickling) in February, 2009, where fish were present for over-wintering. Previous validation surveys have been in local boatyards (Potter Heigham) and dykes (Womack Water, Boundary Dyke (Thurne Lion)).

The fish were captured in the surveys by electro-fishing from a boat. The method involves the deployment of an electro-fishing box, powered by a 240v generator. Output is via hand held fibreglass rods, which hold anodes at the extreme end. The circuit is completed via a cathode trailed in the water adjacent to the boat. The resultant current induces galvanotaxis in fish within range, permitting their subsequent capture. Once captured the fish are identified, measured and scale samples taken for subsequent analysis (for age and growth rates).

The results give an indication of the composition and health of the fish community in the river as a whole, based on the assumption that the boatyard aggregations are representative of the wider population. Over-wintering in boatyards, backwaters and dykes has been described for various coarse fish species including cyprinids, percids and esocids (per obs.; E.A Boatyard Reports; Jordan & Wortley, 1985; Copp, 1997). The presence of various size classes of pike, and their relatively low numerical representation, would suggest that pike may follow/track the prey fish to such locations as opposed to displaying active over-wintering behaviour, since many pike are still caught by anglers on the main river during this time. Match catch data and personal observations also suggest that larger bream and roach generally stay in the river rather than entering boatyards and dykes. Therefore, the validation surveys are thought to under-represent pike and large bream and roach.

## **3.0 Results**

### **3.1 Hydroacoustics**

This survey report represents the 4<sup>th</sup> year of hydroacoustic surveys of the River Thurne, previously carried out in 2004, 2005, and 2006. There were no annual hydroacoustic surveys during 2007. The River Thurne was surveyed in the last week of September, 2008.

Fish density was high, typically 50-75 & 75-100 fish/1000m<sup>3</sup> in the sections below Potter Heigham (Fig. 1). The previously seen decrease in fish density above Potter Heigham and particularly Martham Ferry, typically 0-10 fish/1000m<sup>3</sup>, was not apparent during this year's survey where fish densities of >200 fish/1000m<sup>3</sup> were recorded (Fig. 1). Poor GPS coverage above Potter Heigham, created significant gaps in the data, preventing plotting densities in large parts of this section.

Issues with increasing Delta times on the echosounder interpretation software caused reliability problems with some of the data, which was subsequently excluded from further analysis and interpretation, hence no data are presented for Hickling Broad navigation channel and the other waterbodies between the river and Hickling Broad.

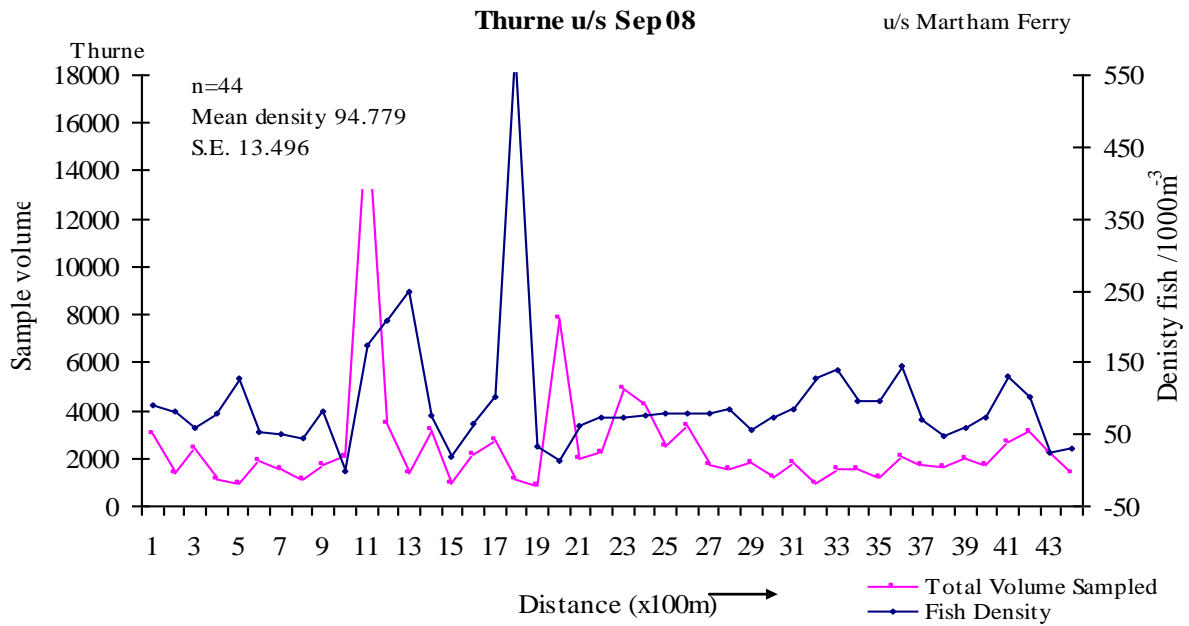
Overall mean fish density for sections of the Thurne system that could be analysed this year was 94.8 fish/1000m<sup>3</sup> ( $\pm$  S.E. 13.5) (Fig. 2), a marked increase from the previous year (2006) and the highest result seen since 2004 (Fig. 3). However, the coverage of this year's survey was much reduced and so direct comparison is not appropriate (see discussion section below).

Figure 1. River Thurne fish density distribution (fish/1000m<sup>3</sup>), Thurne confluence to u/s of Martham Ferry, 2008.

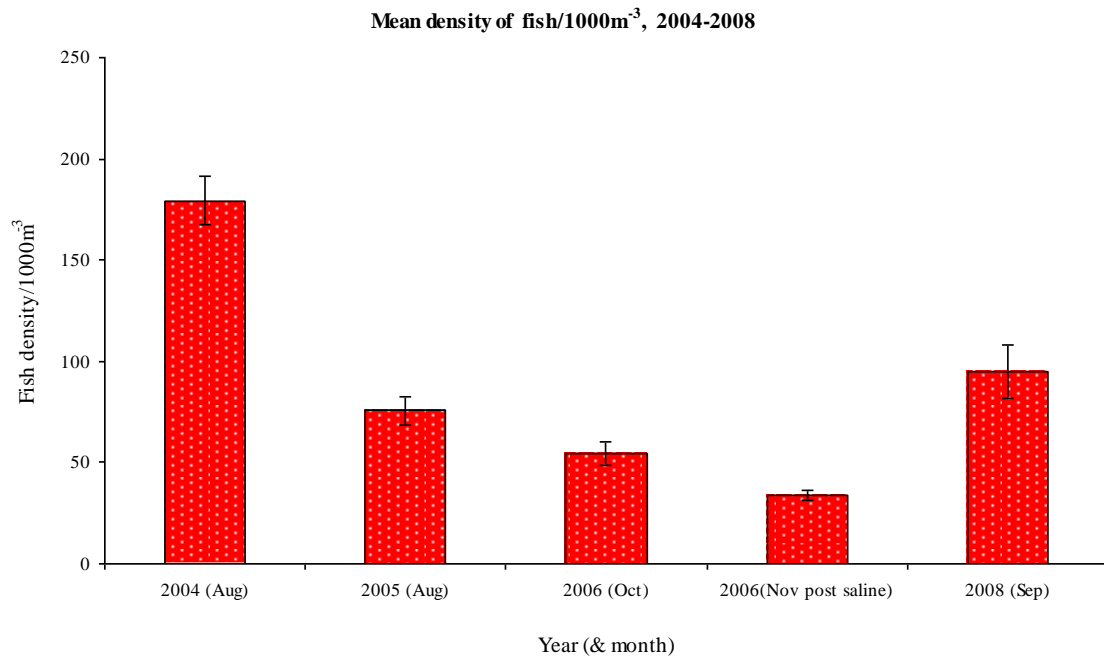




**Figure 2. Density of fish/1000m<sup>3</sup> vs river sample volume, Thurne confluence to u/s of Martham Ferry, 2008.**



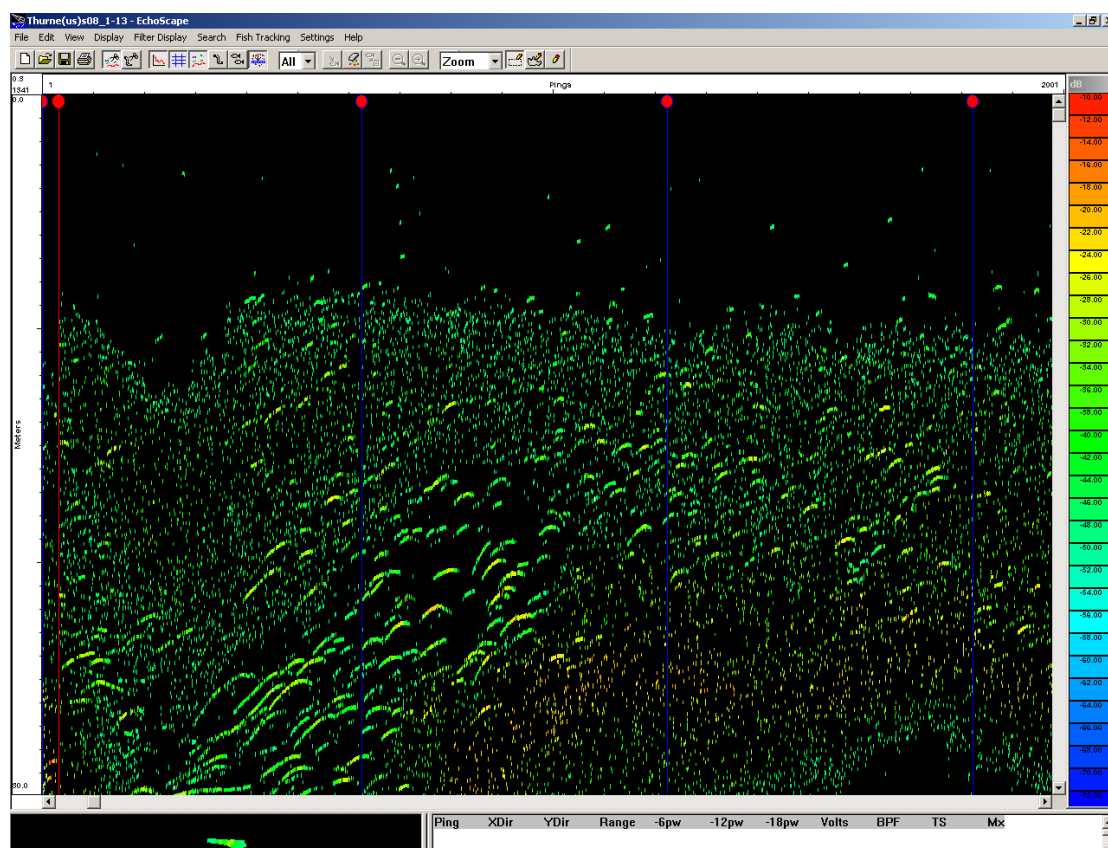
**Figure 3. Comparison of overall mean fish density between surveys, 2004 - 2008.**





Suspended organic matter prevents quantification of fish densities on occasion, despite evidence of the fish being present (Fig. 4).

**Figure 4. Echogram of shoaling fish, Thurne Mouth, 2008.**

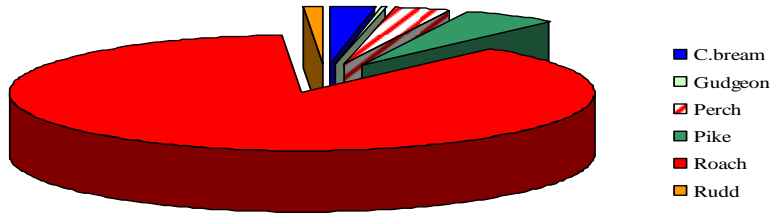


### 3.2 Validation

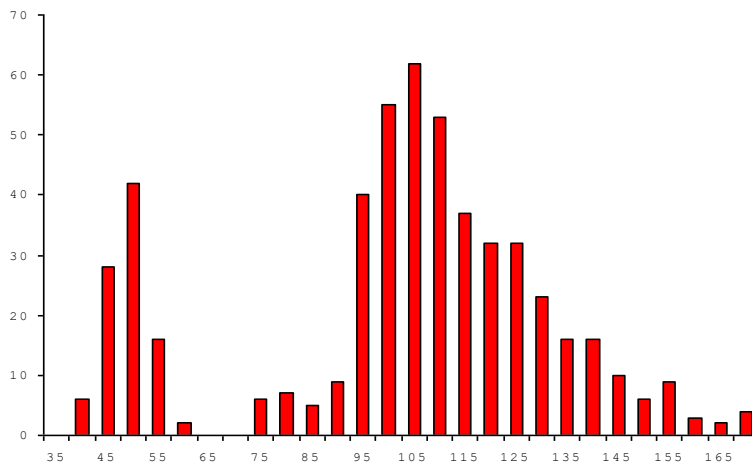
The validation survey departs from previous approaches and concentrates on the most significant over wintering site known on the Thurne system - Catfield Dyke.

Roach dominate the fish community (89%) (Fig. 5), a fairly typical proportion (other main rivers, ~77-91%, 2009). Bream were present, though only contributing 2.6% to the total number of fish caught. Rudd were present (1%) as were perch and pike, the latter contributing 5.5% to the total number of fish surveyed.

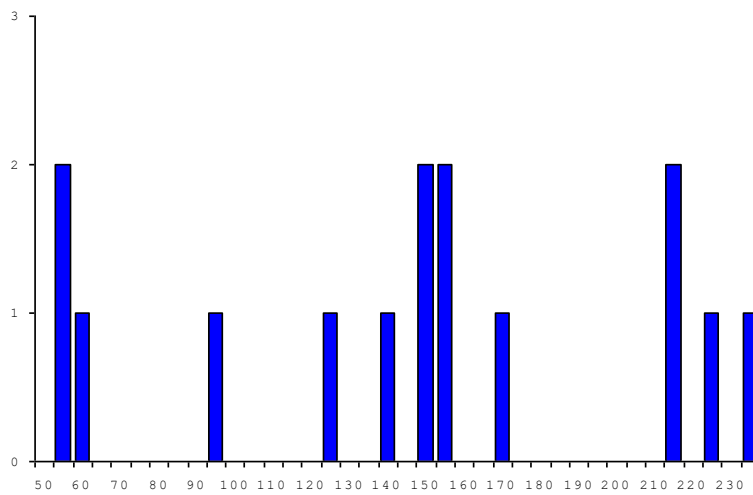
**Figure 5. Species assemblage and proportional representation of individual species within the sub-sample, Catfield Dyke, 2009.**



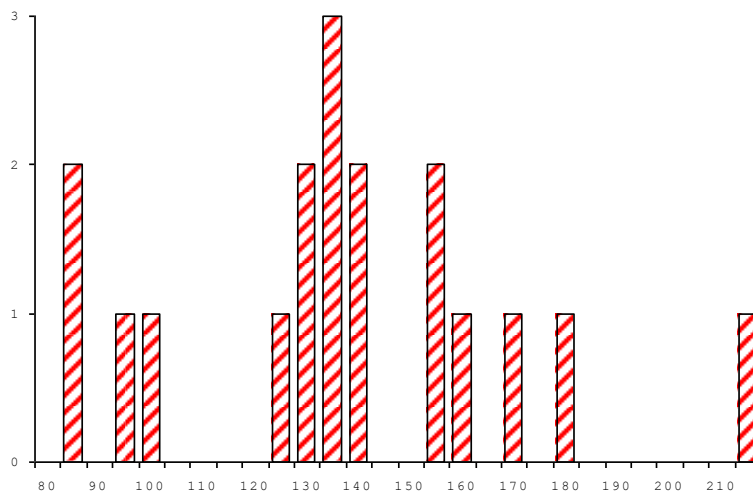
**Figure 6. Length frequency roach, Catfield Dyke, 2009**



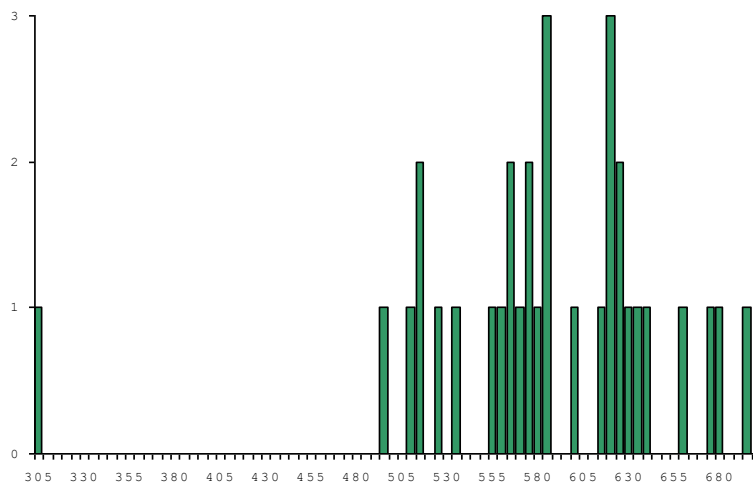
**Figure 7. Length frequency bream, Catfield Dyke, 2009**



**Figure 8. Length frequency perch, Catfield Dyke, 2009**



**Figure 9. Length frequency pike, Catfield Dyke, 2009**



## 4.0 Discussion

### 4.1 Hydroacoustics

The first hydroacoustic fish survey of the River Thurne was conducted in mid-late summer (August). However, the large amount of weed growth at this time of year leads to problems conducting the survey (e.g. weed entrapment on the transducer, lack clarity of the echograms). This meant it was not possible to survey beyond Martham Ferry, although the rest of the system was successfully surveyed. Therefore, to avoid these problems, surveys have been conducted slightly later in subsequent years. The reduced presence of macrophytes enabled surveys to be conducted up stream of Martham Ferry. However, in 2005 when the survey was extended to within a several hundred meters of West Somerton, problems were found with data validity associated with the small size of the channel further up-stream. Therefore, this year the survey was stopped a few hundred meters upstream of Martham Ferry, where the channel narrows.

The reduced macrophyte growth present during this year's survey enabled more rigorous data collection and analysis showing the highest density values of the survey (585 fish/1000m<sup>3</sup>), confirming the supposition that weed growth can lead to underestimates of fish densities. Indeed, this was the second highest single density estimate since the surveys began in 2004. The highest recorded estimate was 797 fish/1000m<sup>3</sup> at the entrance to Candle Dyke, 2004.

Good survey coverage was achieved in the section between the River Bure and Potter Heigham. Densities were mostly in the range 50-100 fish/1000m<sup>3</sup> with a few sections with higher and lower densities. This represents an increase compared to the 25-75 fish/1000m<sup>3</sup> densities seen in 2006 but is very similar to the 2005 results. In 2004 most densities in this reach were >100 fish/1000m<sup>3</sup>. This pattern is consistent with a season pattern of reduced fish presence in the river channel moving from summer through to autumn. In this section of the survey, highest results were recorded in August, lowest in October and November with September in between.

Survey coverage of the river upstream of Potter Heigham old bridge was very limited due to various technical problems and so limited conclusions can be drawn. However, it is worth noting that many of the recorded densities were high (>200 fish/1000m<sup>3</sup>). This contrasts to previous years when densities of <10 fish/1000m<sup>3</sup> were common in this section of the river.

The limited coverage of the upper river and the stretch up and into Hickling Broad means limited conclusions can be drawn from the few results. The overall density of the survey was 94.8 fish/1000m<sup>3</sup> ( $\pm$  S.E. 13.5), an increase of 73% from Oct 2006. However, this survey is not really comparable to previous years due to very different survey extents reported. Nevertheless, the high densities seen in the river below Potter Heigham indicates no lasting effect of the saline surge fish kill seen in 2006.

Survey estimates are to be considered representative of the river rather than definitive, since no method is able to portray the fish population 100%. The survey indicates overall fish density of fish >75mm. Fish within the littoral margin or within extensive macrophyte beds (i.e. Hickling, off main channel) may also be excluded due to background noise preventing post processing analysis and/or reflecting echoes from entrained air, suspended organic matter (Fig. 4), weed and mudbanks.

## 4.2 Validation

The over wintering site selected for validation survey was Catfield Dyke, off Hickling Broad. Whilst this site is unlikely to relate to the majority of fish found on the main river, it is a significant over wintering site for those fish that reside on Hickling Broad, which is surveyed as part of the River Thurne survey, and under normal circumstances would directly relate to the data presented elsewhere in this report. This site is the most significant over wintering site as yet identified on the Thurne system.

The composition of the fish community seen in 2008 was very much in line with previous validation surveys on the Thurne system (Potter Heigham boatyard, Boundary Dyke, Womack Water) and other validation surveys in the Broads.

## 5.0 Conclusions

- River Thurne is suitable for hydroacoustic surveys
- Mean density 94.8 fish/1000m<sup>3</sup>
- Surveying the Hickling Broad sections are worthwhile, revealing good fish populations (macrophyte growth and timing dependent), though this could not be verified this year
- Fish density 'hot-spots' are not so apparent within the river, but elevated densities previously apparent within Hickling Broad are also featuring on the main river
- Unlike 2006, when large numbers of fish were observed but not surveyed up-stream of Martham Ferry due to macrophyte growth, this year it was possible to survey a short way up stream and some high fish densities were seen
- The fish population appears to show signs of good recovery when compared to the post saline event survey, November 2006
- There is evidence of consistent discreet high fish densities on the main river (i.e. High's Mill)