

Environment Agency

Kent Fisheries Department

Medway Estuary Fisheries Survey 2001



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1 ABSTRACT

Fish fauna were surveyed at 5 locations on the tidal Medway as part of a Medway Estuary Project, funded by the Environment Agency's Water Resources function. The 2001 survey was a repeat of the 2000 survey, for comparisons to be drawn between years. Surveys were repeated in summer and autumn of 2001 for each site.

Species characteristic of estuarine conditions (e.g. flounder, goby, bass, smelt) were found to be present at all sites in both the summer and autumn. True freshwater species were present at the upper three estuary sites. There was no evidence of shad within the estuary from the surveys carried out as part of this report, although a trawl survey carried out by the Centre for Environment, Fisheries & Aquaculture Science (CEFAS) identified one individual twaite shad in the outer reaches of the estuary. No salmon or sea trout were taken by this survey.

An environmental impact assessment carried out in this year included prediction of relative species abundance around the Grain site, an analysis of 20 years of fish presence data up to 1993, compiled by the Fawley Aquatic Research Laboratory. A comparison of their findings to those found in this survey is also included.

Bass, herring, sprat and smelt have been identified as suitable indicator species for assessing water quality. This is due to their being relatively common, comparatively sensitive to changes in water quality and occur in the middle reaches of the estuary (defined within the tidal excursion range). It is in this zone that pollutants would concentrate as a consequence of the tidal regime.

Bass, sprat and smelt were found in the mid-estuary sites (and further down the estuary), and consequently the estuary has been awarded its environmental quality standard for fish. This was also achieved in the year 2000. Herring were found at one site, having not been recorded in the estuary since the autumn of 1998.

A study on smelt spawning recommended in the 2000 survey has been carried out to attempt to find evidence of smelt spawning in the historic smelt shoots between Snodland and Coxton. No smelt ova were recovered in this study, although the relatively large numbers of smelt in the estuary in the summer may indicate spawning.

2 INTRODUCTION

The following is a report on the fifth biannual Tidal Medway Survey, including a comparison with the previous surveys. The primary purpose of this report is to identify which fish species are present, and their distribution throughout the tidal region of the River Medway, and to attempt to establish any seasonal patterns.

The specific distribution of bass (*Dicentrarchus labrax*), herring (*Clupea harengus*), sprat (*Clupea sprattus*) and smelt (*Osmerus eperlanus*) is considered to be important due to the comparative sensitivities of these species to water conditions and the fact that they are commonly found within estuaries of the East coast.

The surveys also enable a check on protected species and those of conservation concern (migratory salmonids, smelt, allis and twaite shad).

Further information has been included as results of the trawl carried out by CEFAS, and a computer-generated analysis (using PISCES II) compiled for an environmental impact assessment. This included prediction of relative species abundance around the Grain site, an analysis of 20 years of fish presence data up to 1993, compiled by the Fawley Aquatic Research Laboratory.

3 METHOD

3.1 Seine netting

The method of seine netting followed that used in previous years. A 5mm micro-mesh seine net (35m x 2.5m) was deployed three times at each of the 5 sites. This was carried out at slack water, allowing the net to be worked easily and efficiently without resistance from tidal movement. The low slack period was used at all sites other than at Grain, where the high slack was used. The net was deployed from a dinghy with one end being held by two staff in dry suits who had waded out as far as safely possible. The net was fed out in the direction of any residual current. The dinghy completed an arc returning to the shore where the two staff in the dinghy landed and the net was then pulled in. Two members of staff worked on each of the lead and float lines at each end of the net to ensure the netting was as efficient as possible. A dinghy was not used at Allington because the water was shallow and permitted the deployment of the net on foot.



Using the seine net. Grain.

3.2 Fish processing

Fish caught were transferred to a bin until netting operations were complete. Nettings were carried out concurrently to minimise stress to the fish. The fish from the second and third nettings were transferred to the bin and no attempt was made to separate the catches, as population size was not calculated.

When the three sweeps of the net had been completed, the captured fish were identified and measured. All fish were returned alive to the estuary.

3.3 Species identification

Where possible, fish were identified in the field using identification keys. Small specimens and fry were taken back to the laboratory for more detailed analysis and accurate identification.



Smelt fry (enlarged)



Bass fry (enlarged)

3.4 Data processing

Information collected in the field was processed using Microsoft Excel version 5.0. A full analysis for each site and survey is to be found within the Appendix commencing from the head of the tide at Allington to the most seaward site at Grain Tower. Each analysis describes the site, the fish species found, the population composition and size distribution plus a length frequency histogram for each species caught. A temporal and physical density index has been included as in the 2000 survey, for comparison with this years', and future, results.

3.5 Sampling sites

To obtain a representative sample of fish from within the estuary, the 5 sites formerly used in previous surveys were again considered to provide suitable diversity and coverage of the tidal reach of the river. The use of the same sites enables a direct comparison between seasonal and annual patterns in fish populations and ensures continuity within the study. A map showing the sites can be seen in appendix 1.

Due to extensive fouling with submerged trees and other flood debris from the floods of 1999/2000 at Allington, a new site is being considered. A probable alternative is in the vicinity of Aylesford Bridge (TQ729588).

4 RESULTS

A total of 23 different species were encountered in this survey, in comparison to 16 in 2000, 17 in 1999, and 30 during the 1997-1998 surveys. Tabulated results are to be found in appendix 1, in the following site order.

4.1 *Allington*

This site represents the upper tidal limit of the tidal Medway.

4.1.1 Summer

During the summer survey a total of 8 fish species was recorded. Principally freshwater species, the survey found one exception (flounder), a euryhaline species characteristically found from the marine zone into freshwater. Stickleback and eel, also encountered, are comfortable in both estuary and freshwater conditions.

Bleak and roach dominated the catch, followed by perch; dace and rudd were present.

4.1.2 Autumn

A total of 5 species were recorded in the autumn survey at Allington, including one salmonid individual (brown trout). Although dominated by freshwater species (primarily dace) the sand goby was the second most abundant species. Perch and stickleback were also present.



Perch

4.2 *Wouldham*

The Wouldham site represents the middle zone of the tidal excursion. With salinity increasing with distance down the estuary, freshwater fish species make up a lesser proportion of the catch.

4.2.1 Summer

9 species were recorded in the summer survey at Wouldham, 3 of which (bleak, perch and roach) are truly freshwater species. These 3 species make up 25% of the population composition (calculated on frequency). Juvenile smelt made up the majority of the catch (39% of individuals), and their presence with juvenile bass (11% of individuals) ensured the site met its environmental quality standard, as it did in 2000. The size distribution histogram of the juvenile smelt indicates local recruitment, as the majority of individuals were in the size range 40-55mm. Bleak were the second most important species in numbers (16% of individuals).

4.2.2 Autumn

11 species were encountered, 3 of which were freshwater (bleak, dace and roach). Despite a similar species range, numbers of fish encountered were only 53% that of the summer survey. Juvenile sand goby dominated the catch, making up 50% of numbers, each of the remainder of the species spread making up 2-12%. One salmonid (brown trout) was encountered. All but 3 individual fish were in the 50-100mm range.

4.3 Borstal

This site also represents the middle of the tidal excursion zone.

4.3.1 Summer

During the summer survey, 9 species were found to be present. None were truly freshwater species, it being not unusual to encounter sticklebacks and eels in estuary conditions. Juvenile smelt made up 57% of the total catch (in frequency), and their presence alongside juvenile bass (16% of total numbers) and sprat (1%) ensured that the site met its environmental quality standard this year, as in 2000. The three most important species in terms of numbers were smelt, bass and sand goby (10%), making up 83% of the total catch.

4.3.2 Autumn

9 species were encountered in the autumn survey, including the three indicator species (sprat, smelt and bass). Small sand goby (in the 20-80mm size range) constituted 57% of the catch and were the most abundant species. Smelt and bass (the next most abundant species) represent 11% and 9% of total autumn numbers respectively. All but 2 individuals were in the 50-100mm size range.

4.4 Lower Upnor

4.4.1 Summer

Six species were present at the Upnor site in the summer survey, with sprat greatly dominating the catch, constituting 90% of the total numbers of fish encountered. Goby represented 7% and was the next most abundant species. The one bass was a mature specimen, 292mm in length.

4.4.2 Autumn

The autumn catch encountered 8 species, with sprat representing a much lower proportion of the total catch (4%) in contrast to the summer survey. Goby dominated the catch at 67% of total numbers, in the 25-130 mm size range. Bass and sand smelt were the next most abundant species at 16% and 10% total numbers respectively. The size distribution of the bass indicates one mature specimen, the majority being immature and probably locally recruited.

4.5 Grain

4.5.1 Summer

The summer survey was carried out at Cockleshell Tower, Grain. 9 species of fish were observed, the vast majority of which were sprats (92% of total numbers), largely within the 25-45mm length range. Garfish and smelt were the next most dominant species (each at 2%).

This area was also trawled by the Centre for Environment, Fisheries & Aquaculture Science (CEFAS) in a routine inshore fisheries survey, the results of which are included in Appendix 4 and summarised in section 6.2.

4.5.2 Autumn

The autumn catch included 7 species, also dominated by sprat (72%). Sand goby and sand smelt were the next most abundant species, each representing 10% of the catch. All fish except one individual smelt fell within the 50-100mm length range.



Deploying the seine net, Grain

4.6 Environmental status

The mid-reach sites determine the environmental status of the estuary as they represent the intertidal zone where fresh and saline water both exert strong influences, where juvenile fish of the indicator species should commonly be found. The surveys for the year 2001 identified bass, smelt and sprat at Borstal, and bass and smelt at Wouldham. Therefore the estuary met its environmental quality standard for this year, as it did for the year 2000.

Table A shows the distribution of these indicator species throughout all the survey sites. The Allington site was not suitable to their needs, being strongly influenced by freshwater and dominated by coarse fish species. Bass is both a marine and estuarine species, and as such is represented down the estuary from Wouldham. Juvenile bass that have spawned in the North Sea move inshore to estuary nursery areas from an early age, whereas smelt probably spawn in the upper estuary and the fry spread into the intertidal zone.

Table A. Measure of the status of water quality in the Medway Estuary using the main indicator species.

Site	Bass		Smelt		Herring		Sprat	
	Summer	Autumn	Summer	Autumn	Summer	Autumn	Summer	Autumn
Allington								
Wouldham								
Borstal								
Lower Upnor								
Isle of Grain								

Most of the fish taken in the micro-mesh seine net are juvenile fish, principally from fish hatched during the current year. This applies mostly to the species shown in Table A. 'Infant' mortality is naturally high but easily influenced by changes in water quality, and to a lesser extent by predation by other fish, crustaceans and birds, and juvenile fish are often more sensitive to environmental changes than adults.

5 DYNAMICS – BETWEEN SITES & BETWEEN YEARS

5.1 Comparisons between sites

The Allington site is directly influenced by freshwater discharges from the river, hence most fish caught are freshwater species. Only one marine fish (sand goby) was recorded at Allington.

At the other end of the estuary, the Grain site is exposed to the full strength of seawater, and for this reason, no freshwater fish were found here.

The middle reaches of the estuary show a steady transition of species from freshwater-dominated to marine-dominated, as would be expected.

5.2 Comparisons between years

The changes in fish populations throughout the years that the surveys have been carried out can be seen in table B.

No significant trends can be seen in comparisons of the temporal and physical fish density indices between the 2001 and 2000 surveys, although these

comparisons may reveal trends with further surveys in subsequent years (see appendix 2).

Juvenile herring were found at Upnor in the autumn survey of 2001, having been absent from the estuary since 1998. Future findings of herring may indicate recovery of the species in the estuary, although it is difficult to attribute this to specific environmental (or other) factors. It is possible, however, that the herring entries for the years 1997 and 1998 were wrongly identified sprat. The morphological differences between juvenile herring and sprat are slight, indicating a possibility of misidentification. However, there was a clear differentiation at the Lower Upnor site in the autumn survey. It is not known if the recovered herring was part of the local race that spawns off Whitstable.

In accordance with previous years, dace, bleak and roach have not been found downstream of Wouldham, to be expected due to increasing salinity towards the sea.

5 ADDITIONAL OBSERVATIONS

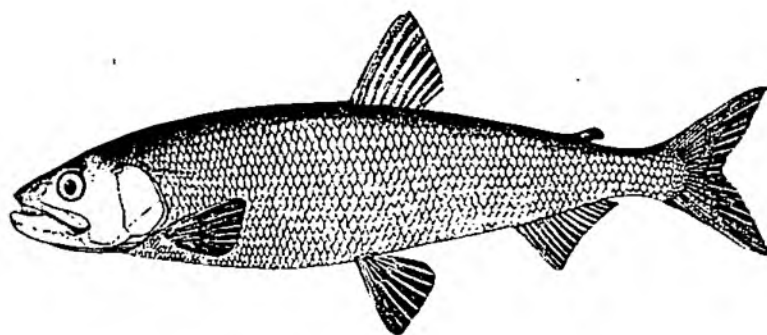
6.1 *Brown trout presence*

The presence of brown trout, even in the upper estuary, is unusual. These fish may have been displaced from upstream by floods. The nearest areas containing known populations of wild brown trout are the River Len, to the east of Maidstone, and the River Teise, upstream of Yalding – a considerable distance, making displacement by floods less likely. Some brown trout do occur in estuaries as a 'pseudo-sea trout', not fully migrating to sea, and may have come from these waters, but it is a possibility that these fish have come from the Leybourne or Ditton streams that enter the estuary at Snodland and Larkfield respectively.

6.2 *Smelt spawning survey*

Following the recommendations made in the survey report for the year 2000, smelt spawning was investigated in the estuary. Brush mats were placed in the historic smelt shoots between Snodland and Cuxton (see map in appendix 3) during the spring smelt spawning period, with the aim of collecting smelt ova to confirm spawning. No smelt ova were recovered from these areas, suggesting the smelt do not now spawn in the historic beds, which may have changed considering the fish require clean gravel upon which to spawn. However, there are plenty of other possibilities that could offer an explanation, such as long-term water temperature changes, water quality issues, riverbed changes, or behavioural changes.

All findings from this study are to be found in appendix 3.



Adult smelt (*Osmerus eperlanus*)

Table B: Distribution of certain fish species within the medway estuary

Site	1997		1998		1999		2000		2001	
	summer	autumn	summer	autumn	summer	autumn	summer	autumn	summer	autumn
Allington	bl, ro, da	ro, bl, go, da, ba	ro, bl, da	no sample	ro, da	ro, bl, ba, da, go	ro, da, bl	no sample	bl, ro, pe, fl	da, go, bt
Wouldham	bl, ba, sm, go	go, ba	he, ba, go, bl, sm	ba, go, sm	go, ba, sp, da	go, ba, da	bl, ba, sm, go, sp	go, sm, ba, ro, da	sm, bl, st, ba, fl, ro	sg, sb, bl, da, bt
Borstal	go, ba, sm, he	ba, go, sp	he, sm, go	go, ba	go, sp, ba	ba, go, sp	ba, go, sm, sp	go, ba, sm	sm, ba, sg, ssm,	sg, sm, ba, fl
Upnor	he, go, sm	he, ba, sm, go	he, ba, go	go, sp, ba	sp, go	sp, ba, go	sp, ba,	ba, sp, go, sm	sp, go, sm	go, ba, ssm, he, sp, bf
Grain	he, go, ds	ba, go	he, go, ba	go, ba, so	sp, sm	sp, ba, go	sp, ba, go	sp, go, ba	sp, ga, sm, ba	sp, sg, ssm, sm

key:

ba	bass
bl	bleak
bt	brown trout
da	dace
fl	flounder
go	common goby
he	herring
pe	perch
ro	roach
sb	stickleback (3-spined)
sg	sand goby
sm	smelt
sp	sprat
ssm	sand smelt

Emboldened symbols represent abundant/dominant species, normal type indicates presence

6.3 CEFAS trawl results

CEFAS regularly surveys inshore fisheries, and as part of this programme, trawled the Medway estuary at Kingsnorth Power Station Intake at the lower (seaward) part of the estuary. The surveys were carried out using a locally hired fishing vessel towing a pair of Bristol trawls each covering a ground track of approximately 12m in width. Generally, the density of fish caught in these trawls is less than that taken with the micro-mesh beach seine at the shore-based sites, however it does tend to take larger specimens.

10 fish species were found; smelt dominated the catch (44%). Dover sole and flounder were the next most abundant species, at 12% and 10% respectively. The presence of one individual twaite shad is noteworthy, as it has not been recorded in the beach-based surveys for this year and is a fish covered by the UK Biodiversity Action Plan Steering Group (BAPSG) list of priority species. A graphical representation of the results of this survey can be found in appendix 4.

6.4 Pisces II analysis

This analysis was carried out using 20 years of data (to 1993) compiled by the Fawley Aquatic Research Laboratory (FARL). All fish from these results have also been found in the intake screens of the Kingsnorth Power Station or in the discharge canal. Sprat have been found to be the most abundant species (53% abundance), followed by whiting, sand goby and herring (see table C). The relative importance of sprat is in accordance with the findings of the 2001 estuary survey, as is the presence of flounder and sand goby. The other 16 species recorded in the PISCES II data have not been recovered in the 2001 survey, which is probably due to two reasons:

- 1) The methods used to gather data by FARL were different, and surveyed a different section of the water than that covered by our beach-based surveys.
- 2) There has been some change in the estuary since 1993. The relative decline of herring (prior to this year not recorded since 1997 by the beach-based surveys), and the increase in the relative importance of bass, may support this hypothesis.

Table C. Relative abundance of the most frequently encountered fish species in the Upper Medway

Species	Common Name	% relative abundance
<i>Sprattus sprattus</i>	Sprat	53
<i>Merlangius merlangus</i>	Whiting	11
<i>Pomatoschistus minutus</i>	Sand goby	10
<i>Clupea harengus</i>	Herring	10
<i>Trisopterus luscus</i>	Pout	5
<i>Limanda limanda</i>	Dab	2
<i>Platichthys flesus</i>	Flounder	2
<i>Atherina boyeri</i>	Sand smelt	1.5
<i>Anguilla anguilla</i>	Silver eel	1.5
<i>Pleuronectes platessa</i>	Plaice	1
<i>Solea solea</i>	Sole	1
<i>Syngnathus acus</i>	Great pipefish	1
<i>Trisopterus minutus</i>	Poor cod	0.4
<i>Gobius niger</i>	Black goby	0.2
<i>Callionymus lyra</i>	Dragonet	0.2
<i>Liza ramada</i>	Thin-lipped mullet	<0.1
<i>Cillata mustella</i>	5-bearded rockling	<0.1
<i>Spinachia spinachia</i>	15-spined stickleback	<0.1
<i>Liparis liparis</i>	Sea snail	<0.1
<i>Dicentrarchus labrax</i>	Bass	<0.1

APPENDIX 1

List of fish species present in the 2001 Medway Estuary Survey and their scientific names

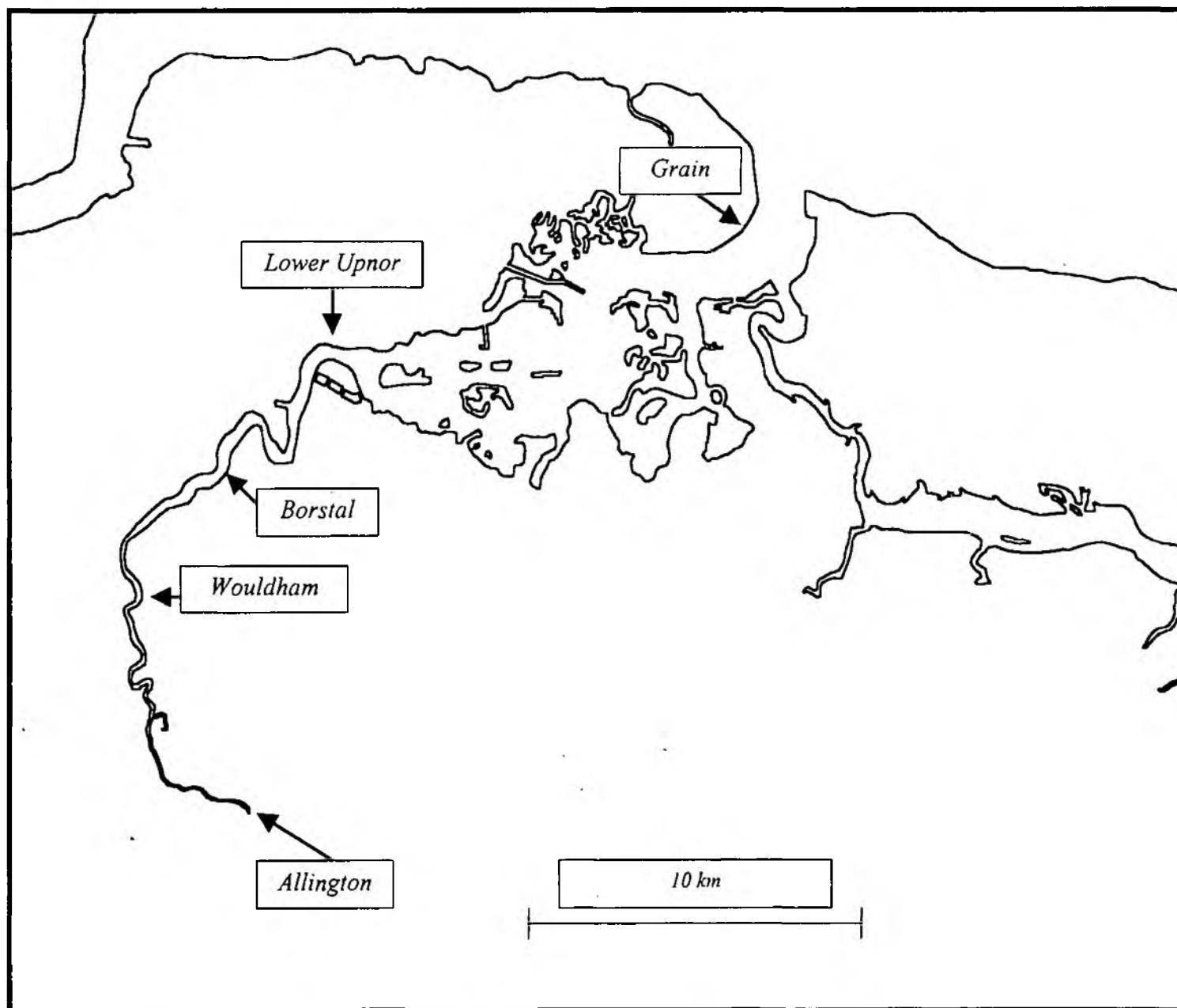
Map showing survey sites in the Medway Estuary

Survey results

*Allington
Wouldham
Borstal
Lower Upnor
Grain*

List of fish species present in the 2001 Medway Estuary Surveys

Common name	Scientific name
Bass	<i>Dicentrarchus labrax</i>
Bleak	<i>Alburnus alburnus</i>
Brown Trout	<i>Salmo trutta</i>
Butterfish	<i>Pholis gunnellus</i>
Common Goby	<i>Pomatoschistus microps</i>
Dace	<i>Leuciscus leuciscus</i>
Eel	<i>Anguilla anguilla</i>
Flounder	<i>Platichthys flesus</i>
Garfish	<i>Belone belone</i>
Herring	<i>Clupea harengus</i>
Mullet	<i>Crenimugil labrosus</i> & <i>Liza ramada</i>
Perch	<i>Perca fluviatilis</i>
Roach	<i>Rutilus rutilus</i>
Rudd	<i>Scardinius erythrophthalmus</i>
Sand Eel	<i>Ammodytes tobianus</i>
Sand Goby	<i>Pomatoschistus minutus</i>
Sand Smelt	<i>Atherina boyeri</i>
Smelt	<i>Osmerus eperlanus</i>
Sprat	<i>Sprattus sprattus</i>
Stickleback (3)	<i>Gasterosteus aculeatus</i>
Stickleback (9)	<i>Pungitius pungitius</i>



Map showing survey sites in the Medway Estuary

Allington results

RIVER	Medway
SITE NAME	Allington
SITE CODE	199
LOCATION	Immediately D/S of sluice
NGR	TQ 745 581
METHOD	35m x 2.5m micro mesh seine net
TIDAL STATE	Low
WIDTH AT LOW WATER (M)	Approximately 30m
DEPTH (M)	0.3 to 0.7m
SUBSTRATE	Gravel and some large stones/rocks with a heavy silt covering. Timbers and obstructions foul netting ops.
AQUATIC VEGETATION	None
BANKSIDE VEGETATION	None, flood defence wall. Despite this some vegetation growing on the wooden piling
ADJACENT LAND USE	Left bank Lock keepers house and private garden. Right bank Public footpath.



Fisheries Survey Results

River/Lake: Medway Estuary
 Site: d/s Allington Lock

Date: 29.06.01
 Surveyed length (m): 43
 Surveyed width (m): 35
 Area (m²): 1505

National Grid Ref: TQ 745 581 To

Start Time:
 Finish Time:
 Minutes: 36

note: 3 nettings

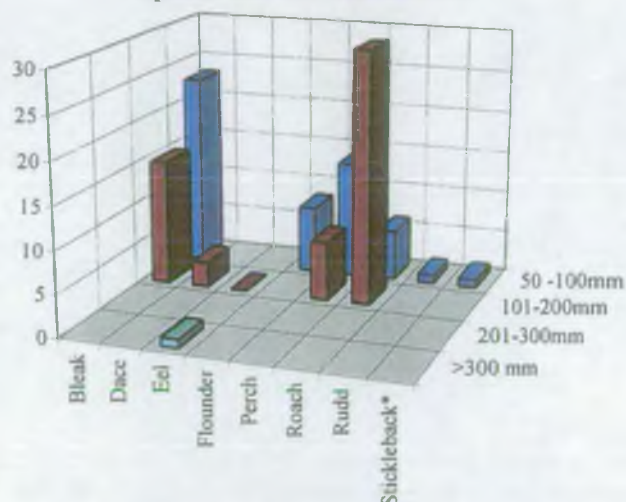
Total No. of fish observed: 109
 No. of species: 8
 Total Fish / m²: 0.07
 Total Fish / min: 3.03

(computer file:) mdw2906.199

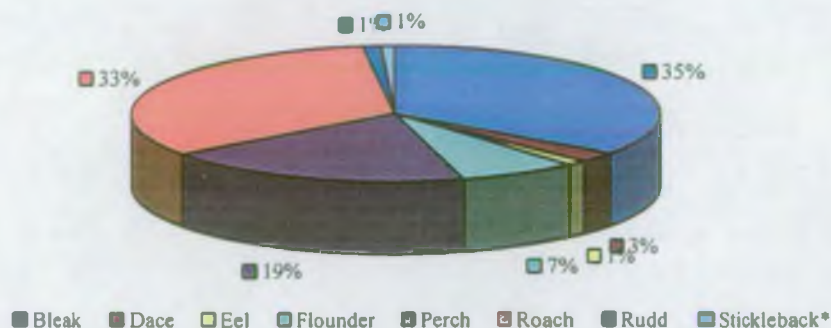
Raw Data

Species	50 -100mm	101-200mm	201-300mm	>300 mm	No. Caught	Fish / m ²	Fish / min.	% of Tot.
Bleak	23	15			38	0.03	1.06	35
Dace		3			3	0.00	0.08	3
Eel				1	1	0.00	0.03	1
Flounder	8				8	0.01	0.22	7
Perch	14	7			21	0.01	0.58	19
Roach	6	30			36	0.02	1.00	33
Rudd	1				1	0.00	0.03	1
Stickleback*	1				1	0.00	0.03	1

Species and Size Distribution

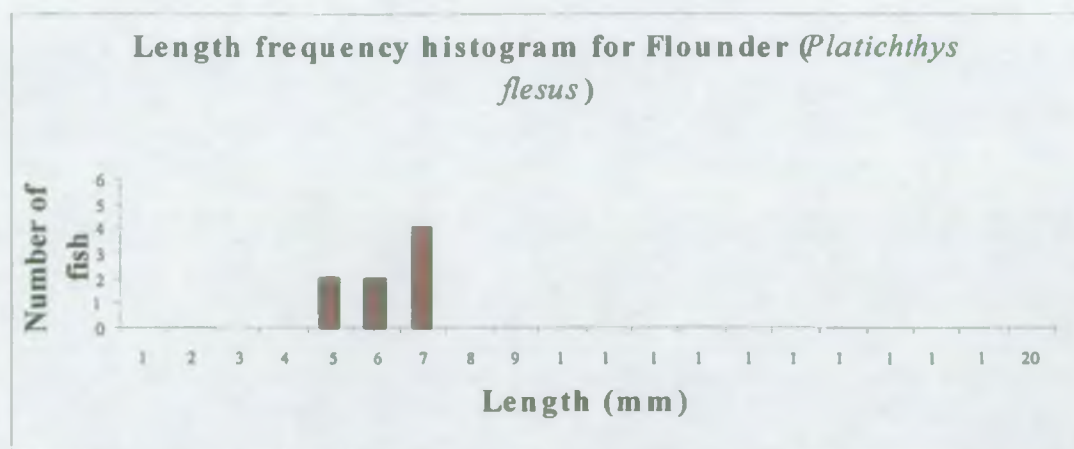
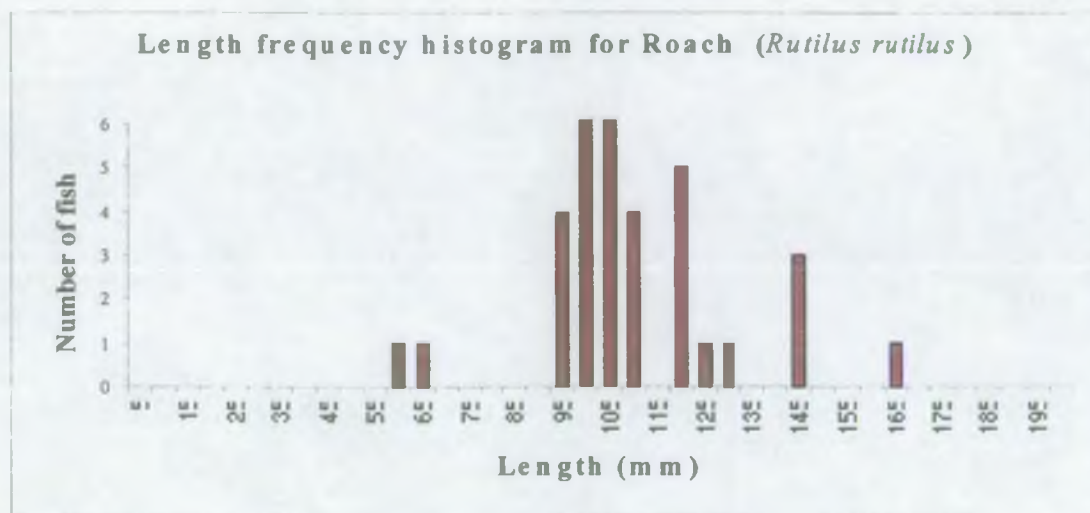
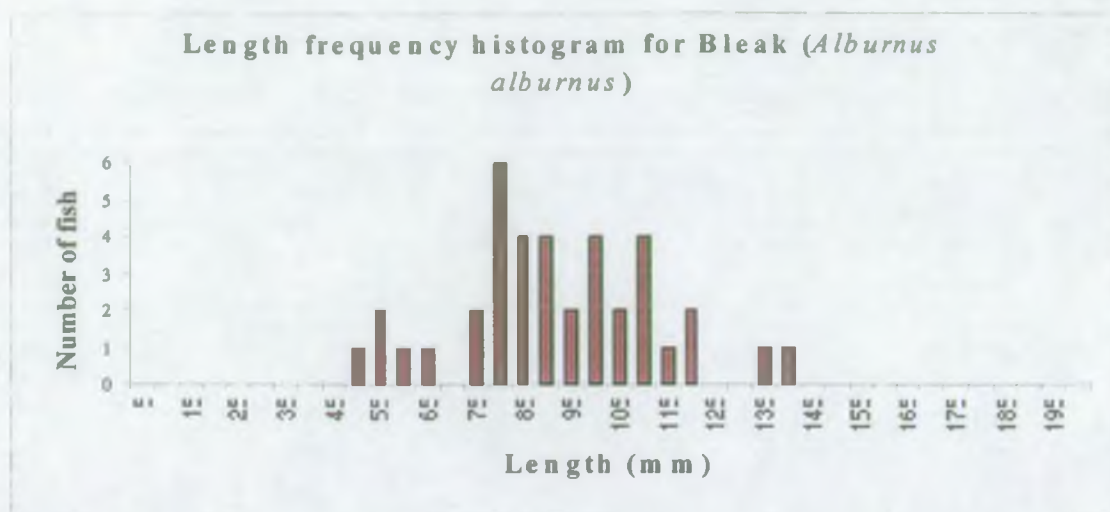


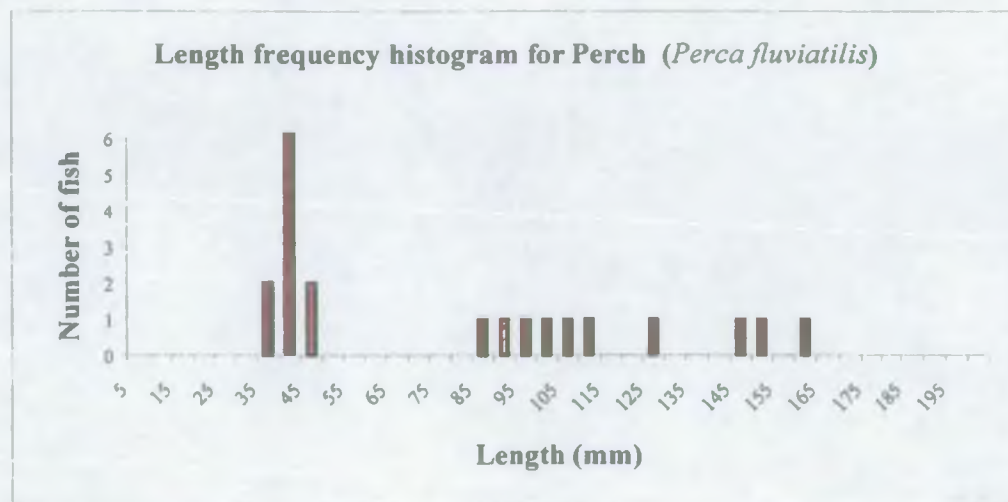
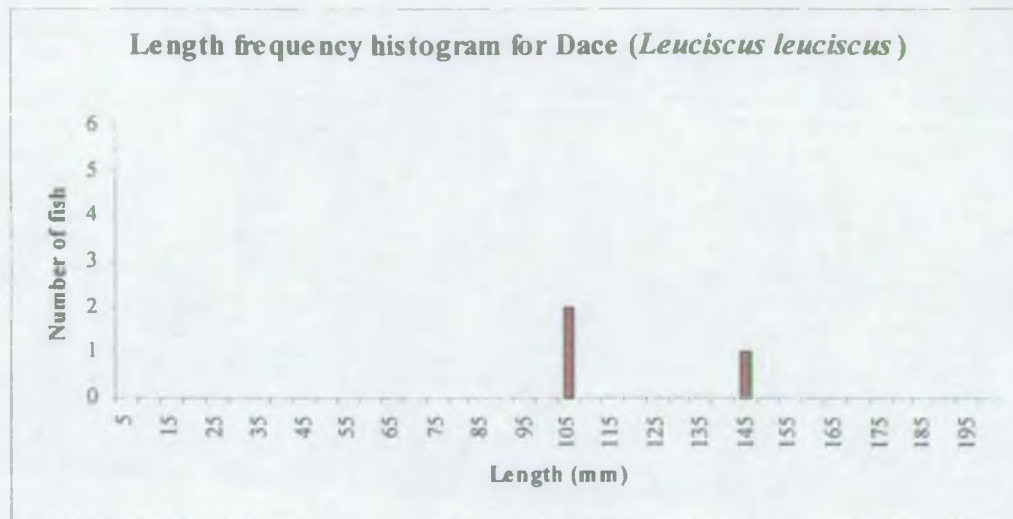
Population Composition (frequency)



Notes: * 9 spined

Length frequency histograms for Allington - summer survey





Rudd: one individual: 90mm
 Eel: one individual: 42mm

Fisheries Survey Results

River/Lake: Medway Estuary
 Site: d/s Allington Lock

Date: 26.09.01
 Surveyed length (m): 43
 Surveyed width (m): 35
 Area (m²): 1505

National Grid Ref: TQ745582 To

Start Time:
 Finish Time:
 Minutes: 30

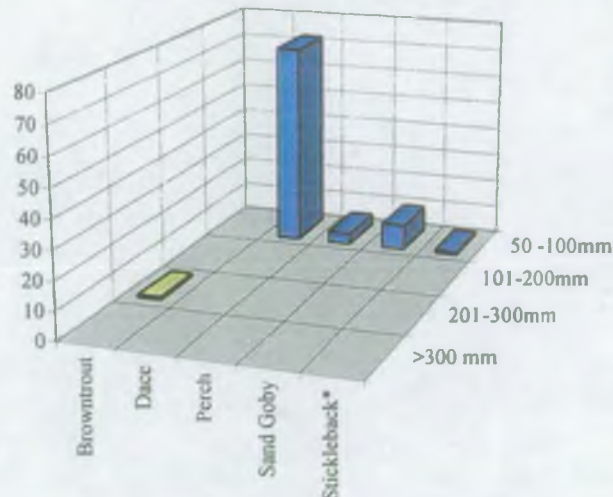
Total No. of fish observed: 87
 No. of species: 5
 Total Fish / m²: 0.06
 Total Fish / min: 2.90

(computer file:) mdw2609.xls

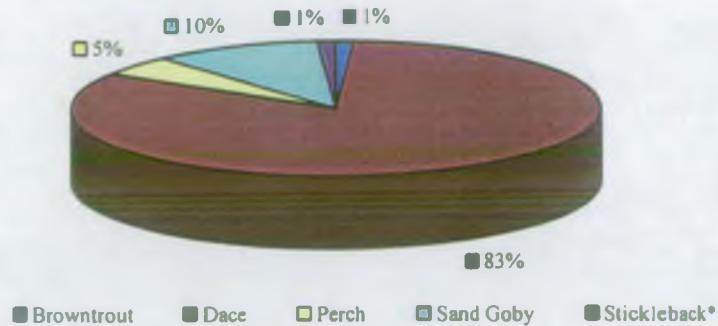
Raw Data

Species	50 -100mm	101-200mm	201-300mm	>300 mm	No. Caught	Fish / m ²	Fish / min.	% of Tot.
Browntrout			1		1	0.00	0.03	1
Dace	72				72	0.05	2.40	83
Perch	4				4	0.00	0.13	5
Sand Goby	9				9	0.01	0.30	10
Stickleback*	1				1	0.00	0.03	1

Species and Size Distribution

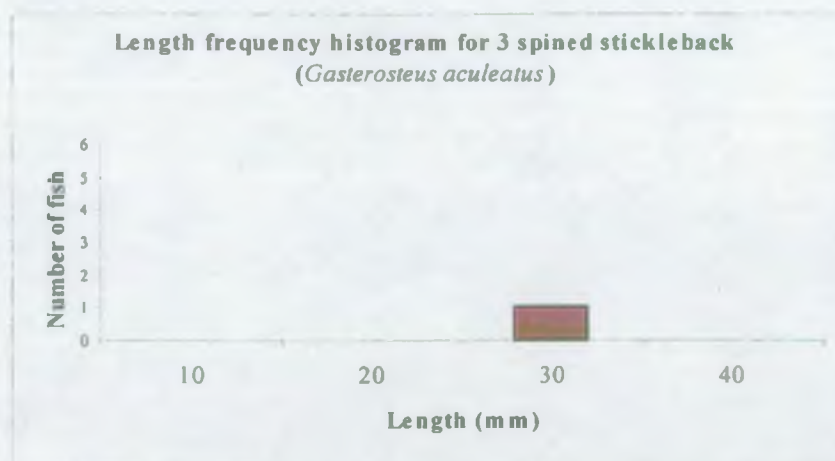
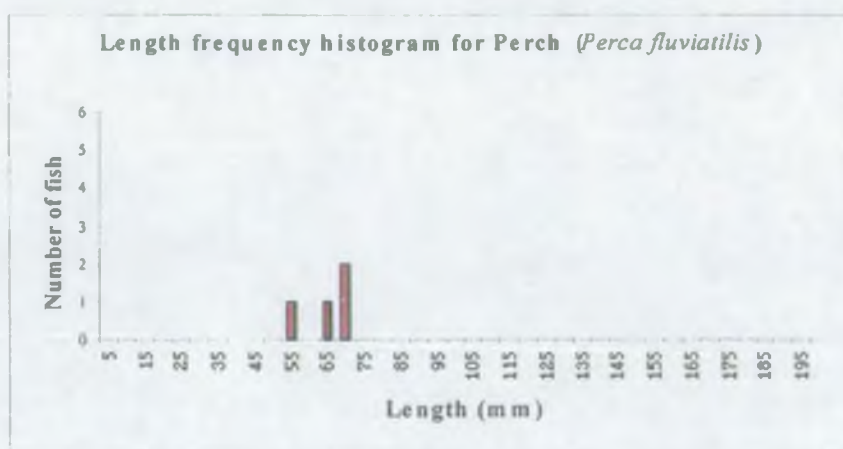
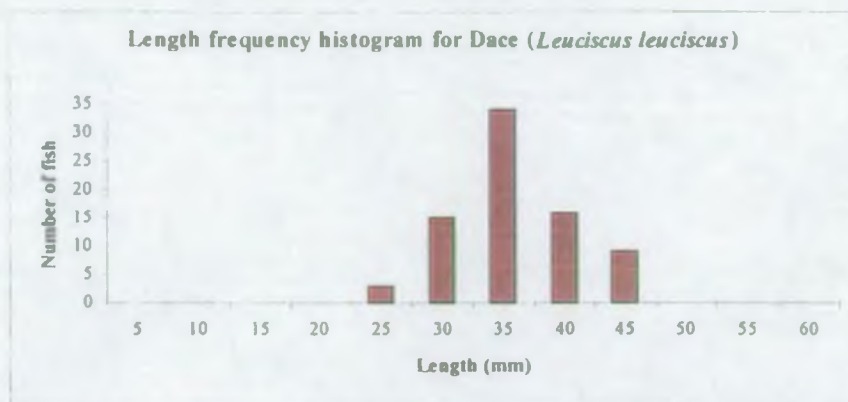


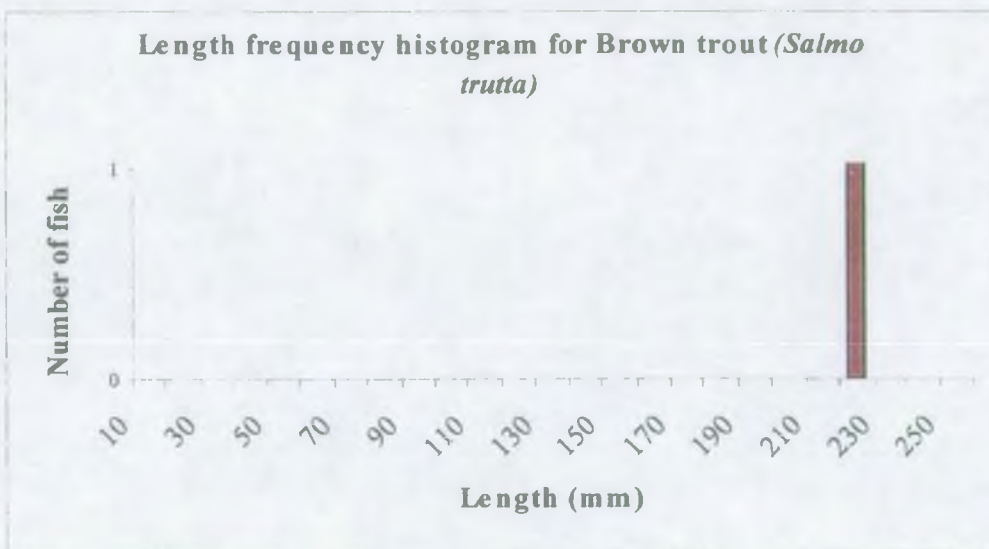
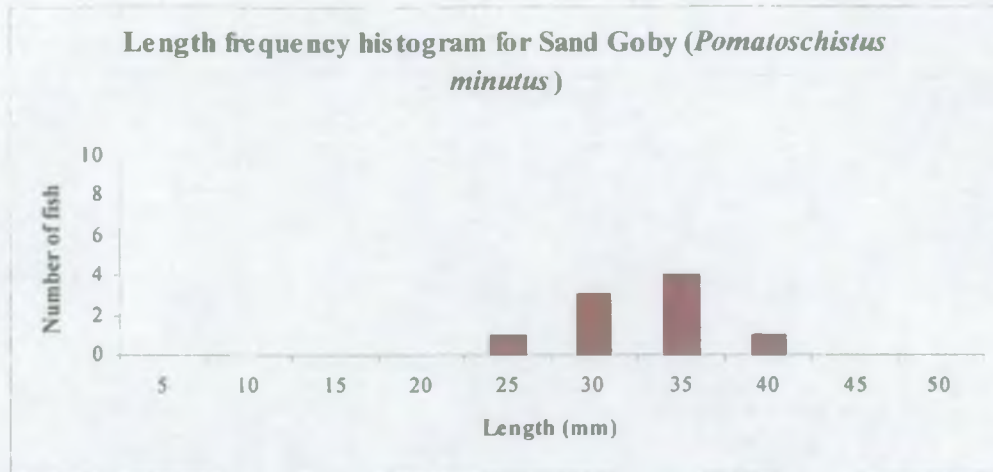
Population Composition (frequency)



Notes: * 3 spined

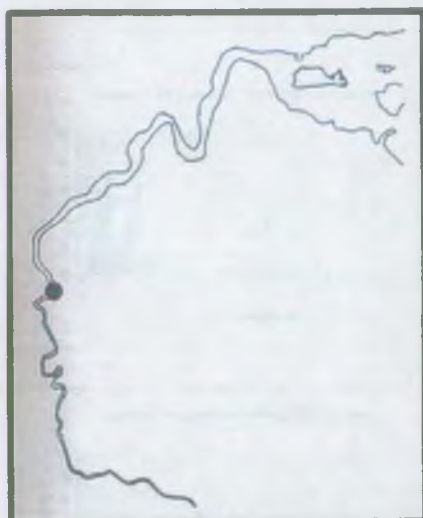
Length frequency histograms for Allington - autumn survey





Wouldham survey

RIVER	Medway	
SITE NAME	Wouldham	
SITE CODE	249	
LOCATION	Right bank next to church	
NGR	TQ 712 644	
METHOD	35m x 2.5m micro mesh seine net	
TIDAL STATE	Low	
WIDTH AT LOW WATER (M)	Approximately 6m	
DEPTH (M)	0.3 to 2m. Shallow drop off	
SUBSTRATE	Gravel sand and silt, some stones and rocks	
AQUATIC VEGETATION	None	
BANKSIDE VEGETATION	Left bank Right bank	Common club reed None
ADJACENT LAND USE	Left bank Right bank	Marshland Housing estate



Fisheries Survey Results

River/Lake: River Medway
 Site: Wouldham

Date: 9.8.01
 Surveyed length (m): 105
 Surveyed width (m): 24
 Area (m²): 2520

National Grid Ref: TQ712643 To

Start Time: 1125
 Finish Time: 1155
 Minutes: 30

Total No. of fish observed: 74
 No. of species: 9
 Total Fish / m²: 0.03
 Total Fish / min: 2.47

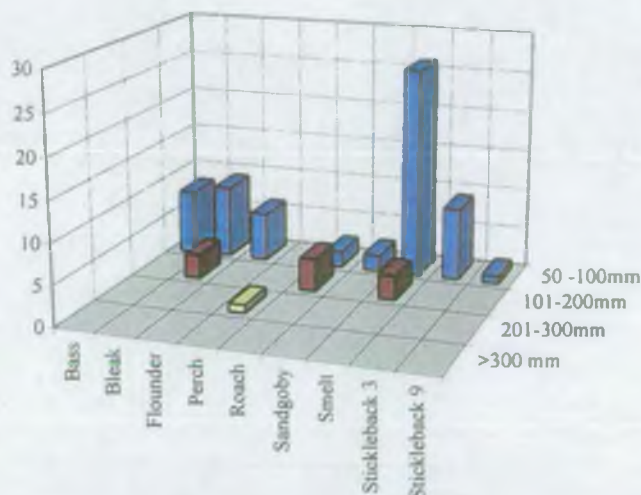
note: 3 nettings

(computer file:) mdw0908.249

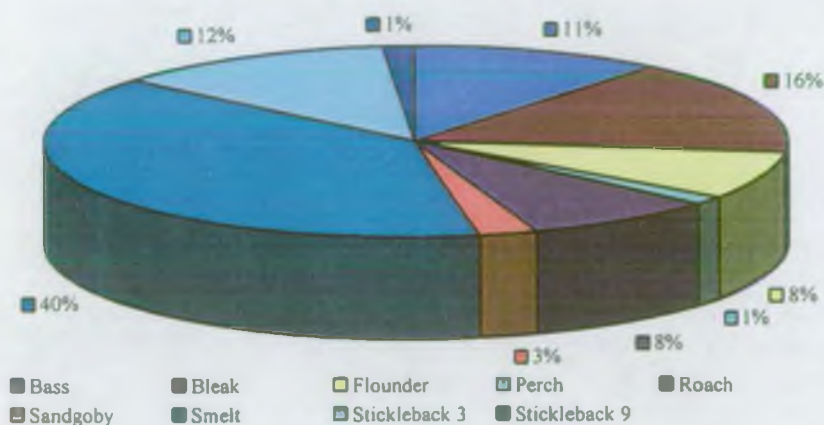
Raw Data

Species	50 -100mm	101-200mm	201-300mm	>300 mm	No. Caught	Fish / m ²	Fish / min.	% of Tot.
Bass	8				8	0.00	0.27	11
Bleak	9	3			12	0.00	0.40	16
Flounder	6				6	0.00	0.20	8
Perch			1		1	0.00	0.03	1
Roach	2	4			6	0.00	0.20	8
Sandgoby	2				2	0.00	0.07	3
Smelt	26	3			29	0.01	0.97	39
Stickleback 3	9				9	0.00	0.30	12
Stickleback 9	1				1	0.00	0.03	1

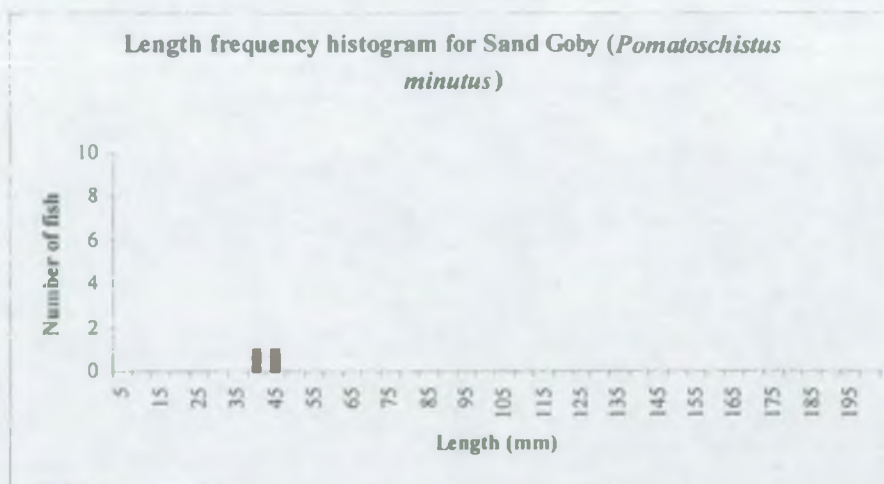
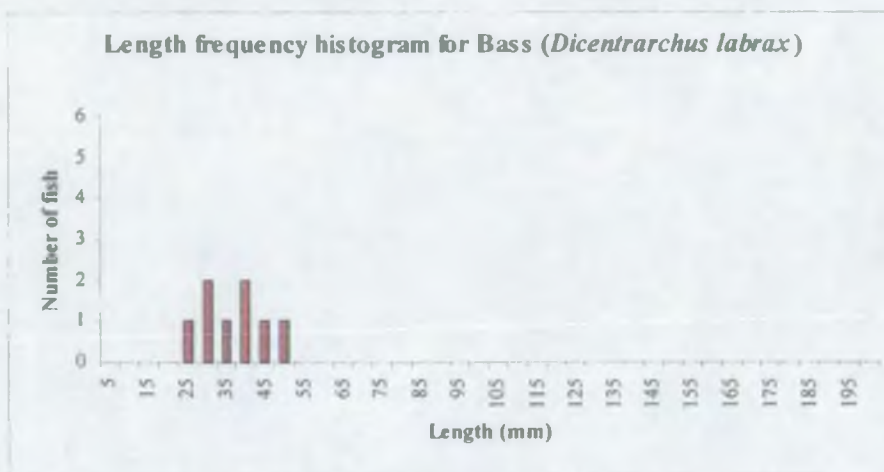
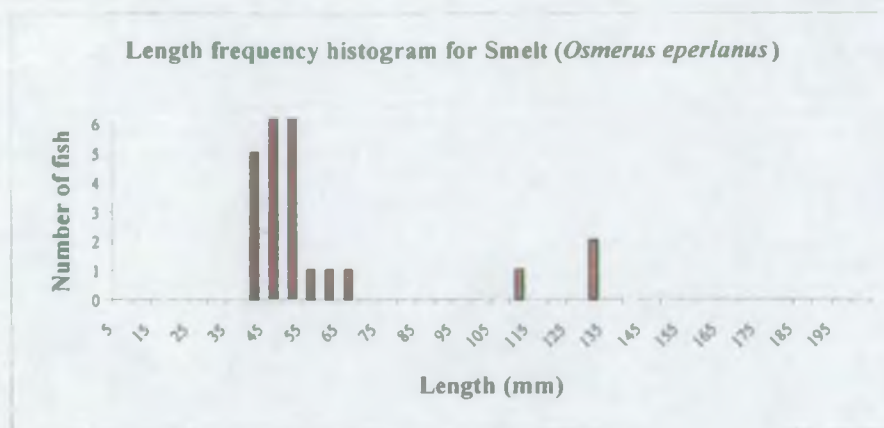
Species and Size Distribution

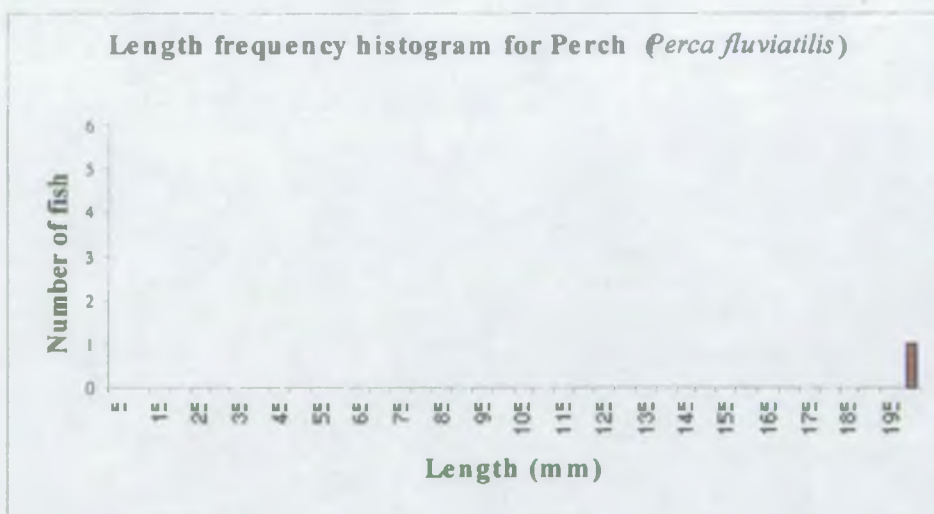
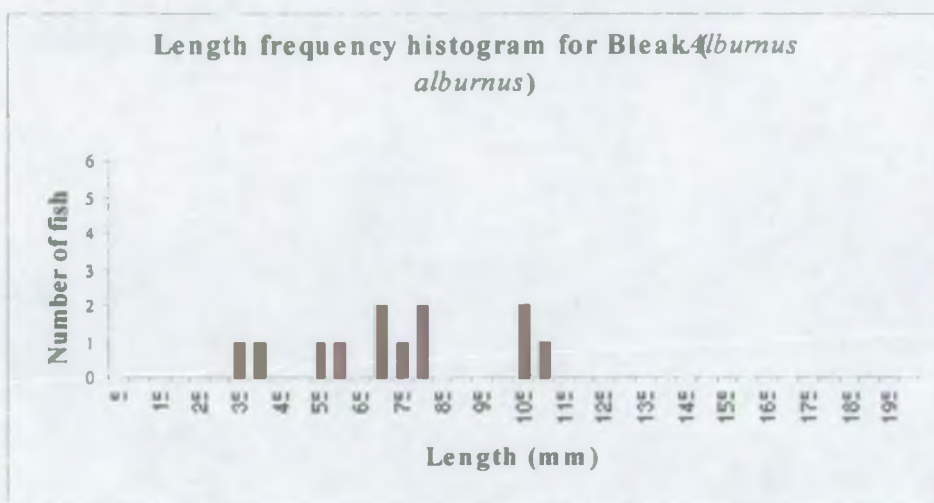
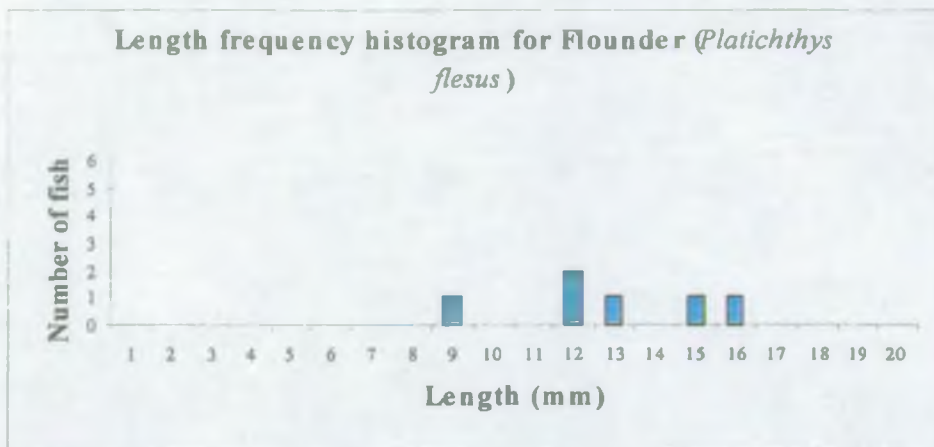


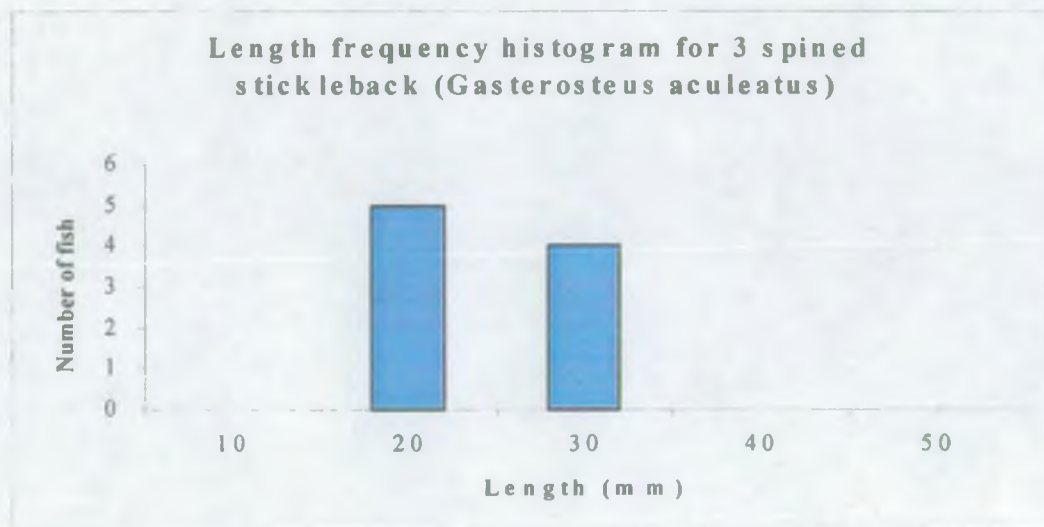
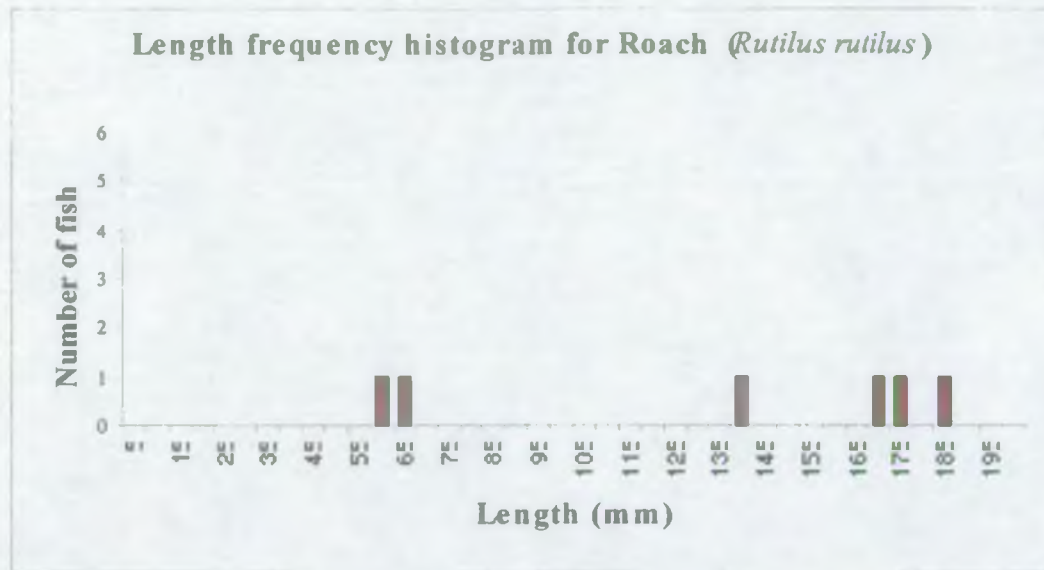
Population Composition (frequency)



Length frequency histograms for Wouldham – summer survey







9-spined stickleback: one individual: 33mm

Fisheries Survey Results

River/Lake: Medway Estuary
 Site: Wouldham

Date: 25.09.01
 Surveyed length (m): 105
 Surveyed width (m): 24
 Area (m²): 2520

National Grid Ref: TQ713644 To

Start Time: 1325
 Finish Time: 1350
 Minutes: 25

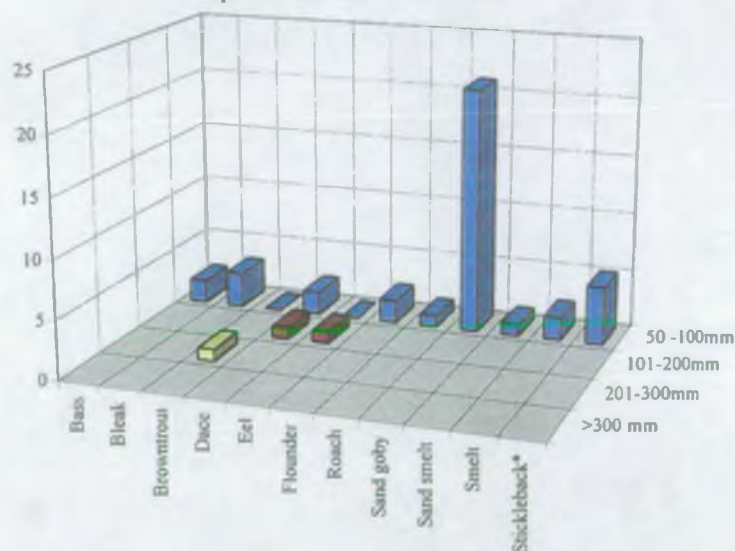
Total No. of fish observed: 42
 No. of species: 11
 Total Fish / m²: 0.01
 Total Fish / min: 1.36

(computer file:) mdw2509.xls

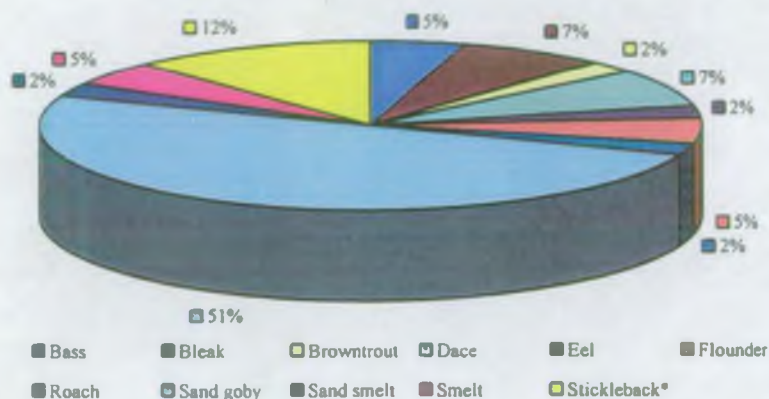
Raw Data

Species	50-100mm	101-200mm	201-300mm	>300 mm	No. Caught	Fish / m ²	Fish / min.	% of Tot.
Bass	2				2	0.00	0.08	5
Bleak	3				3	0.00	0.12	7
Browntrout			1		1	0.00	0.04	2
Dace	2	1			3	0.00	0.12	7
Eel		1			1	0.00	0.04	2
Flounder	2				2	0.00	0.08	5
Roach	1				1	0.00	0.04	2
Sand goby	21				21	0.01	0.84	50
Sand smelt	1				1	0.00	0.04	2
Smelt	2				2	0.00	0.08	5
Stickleback*	5				5	0.00	0.20	12

Species and Size Distribution

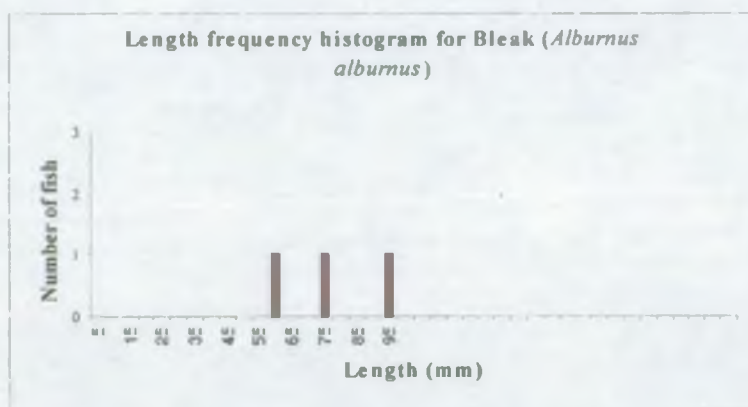
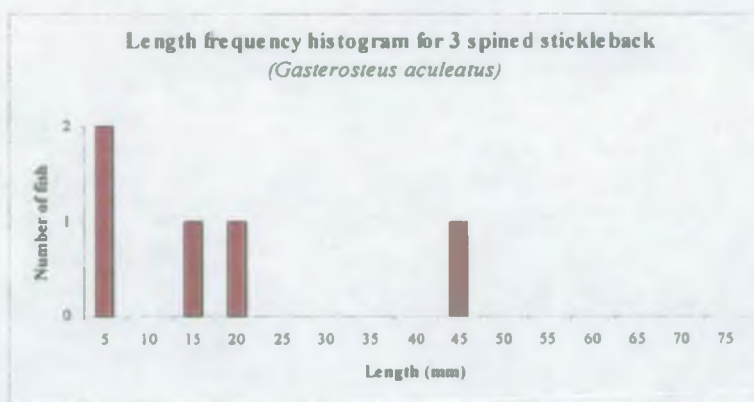
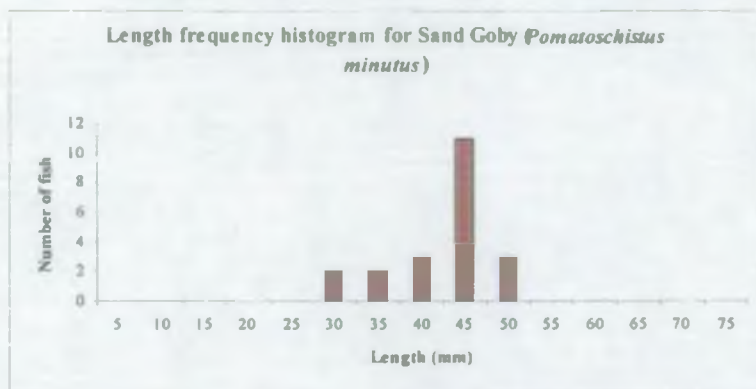


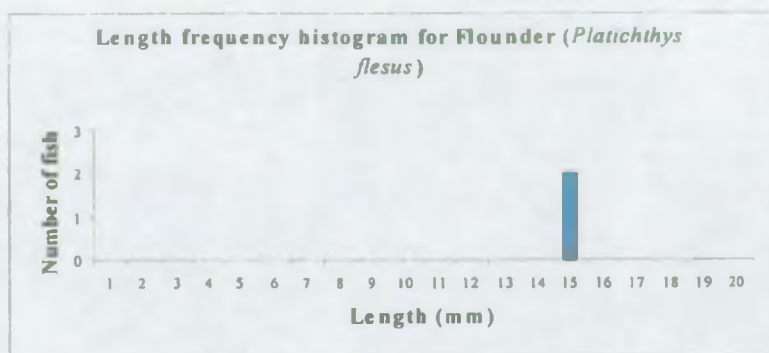
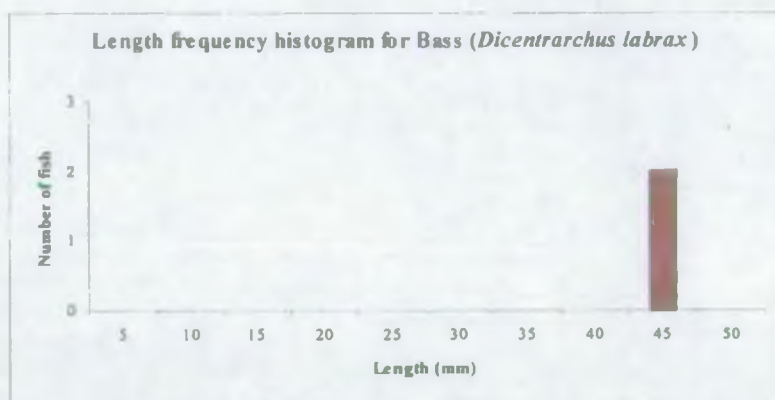
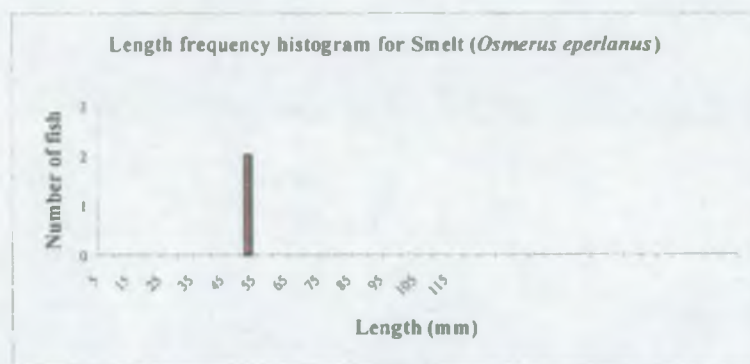
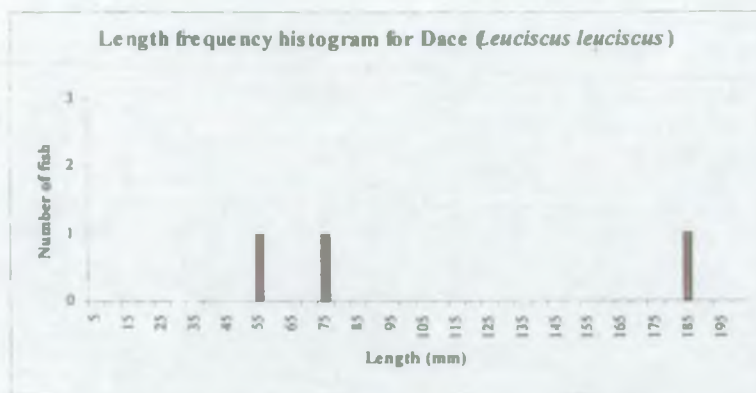
Population Composition (frequency)

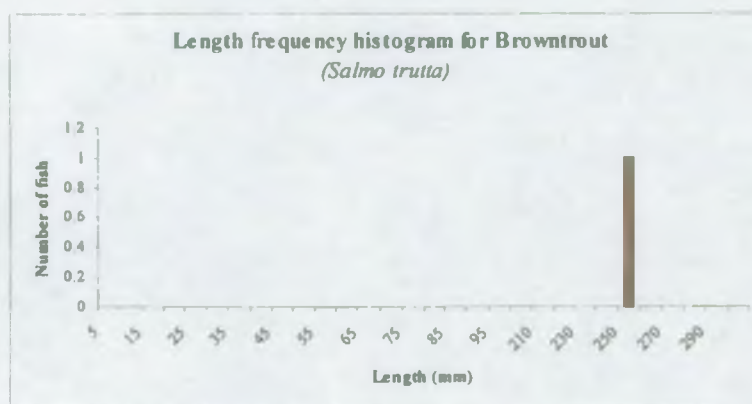
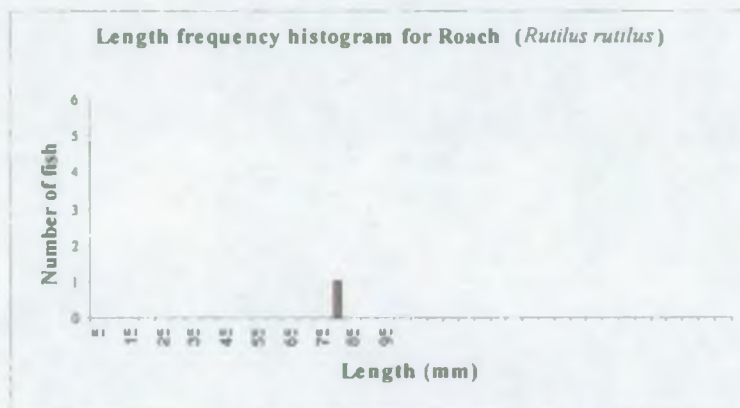
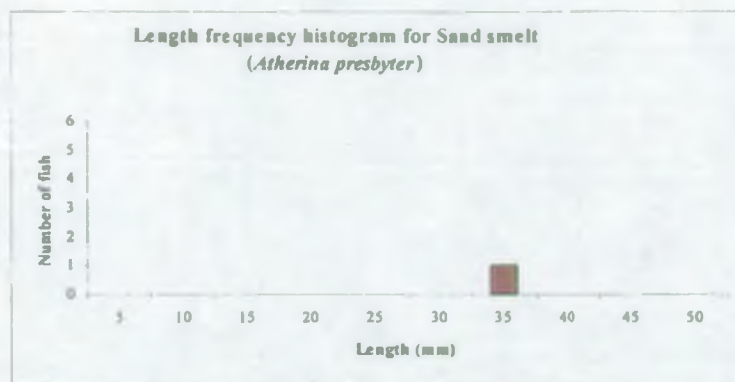


Note * 3 spined stickleback

Length frequency histograms for Wouldham – autumn survey

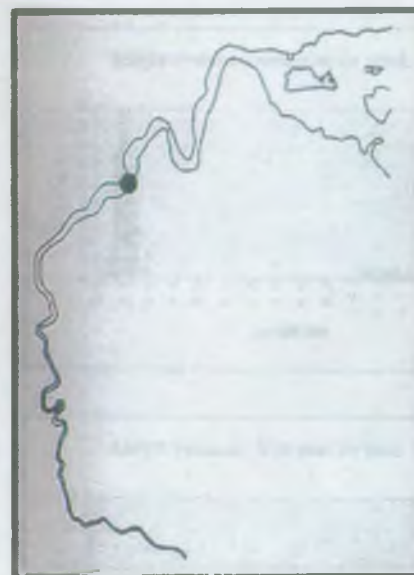






Borstal survey

RIVER	Medway	
SITE NAME	Borstal (M2 motorway Bridge)	
SITE CODE	371	
LOCATION	Shorts Road Slipway, D/S of Marina	
NGR	TQ 734 675	
METHOD	35m x 2.5m micro mesh seine net	
TIDAL STATE	Low	
WIDTH AT LOW WATER (M)	Approximately 300m	
DEPTH (M)	0 to 2m. Shallow drop off	
SUBSTRATE	Gravel sand and silt, some small stones/rocks	
AQUATIC VEGETATION	None	
BANKSIDE VEGETATION	Left bank	Common club reed
	Right bank	None. Slipway
ADJACENT LAND USE	Left bank	Marshland, Horse grazing
	Right bank	Public Road, heavy Industry



Fisheries Survey Results

River/Lake:
 Site:

Date:
 Surveyed length (m):
 Surveyed width (m):
 Area (m²):

National Grid Ref: To

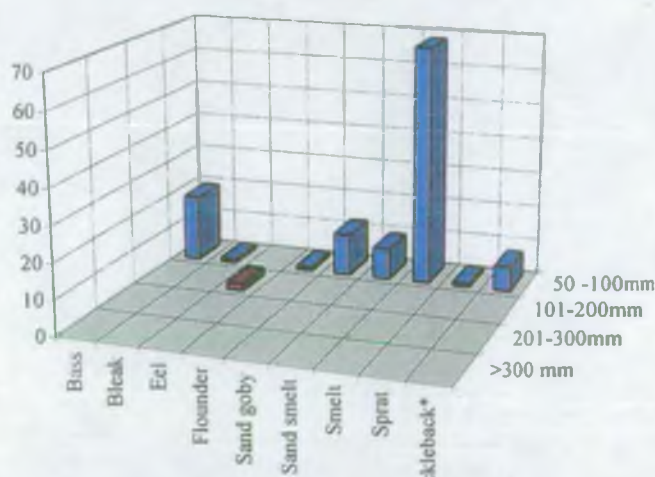
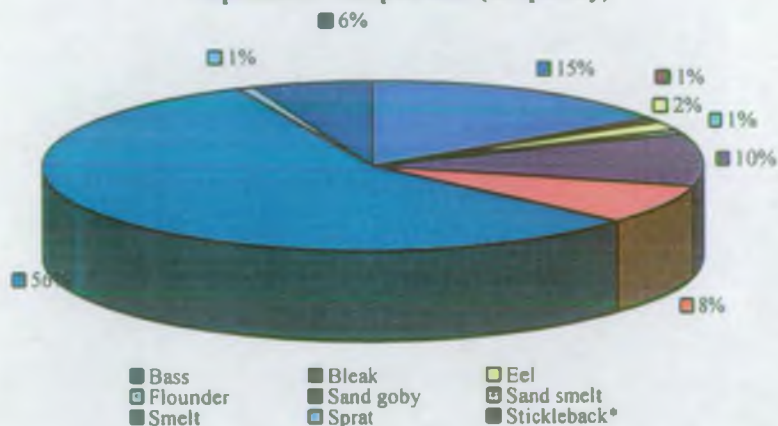
Start Time:
 Finish Time:
 Minutes:

Total No. of fish observed:
 No. of species:
 Total Fish / m²:
 Total Fish / min:

(computer file:) mdw0308.371

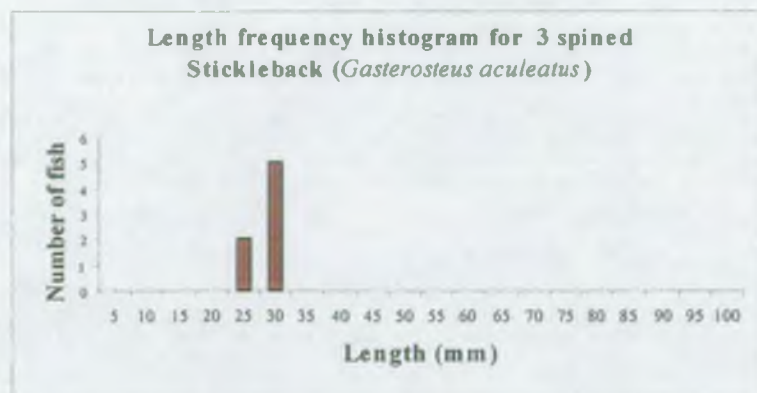
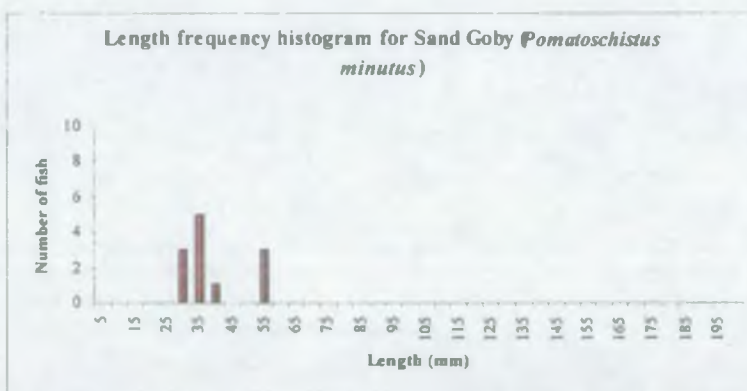
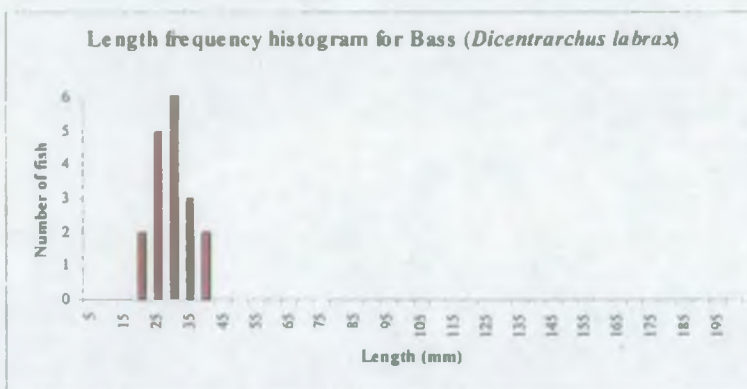
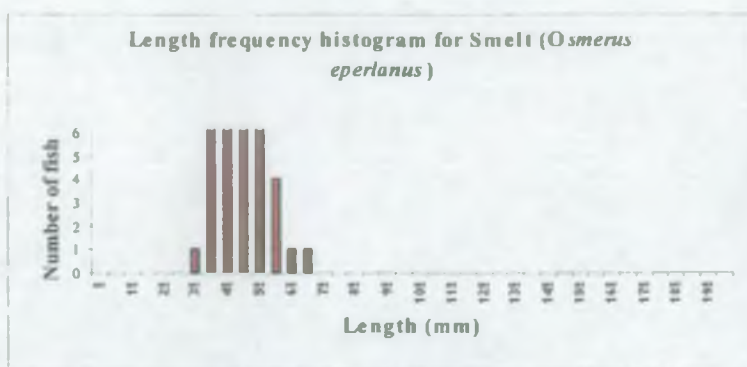
Raw Data

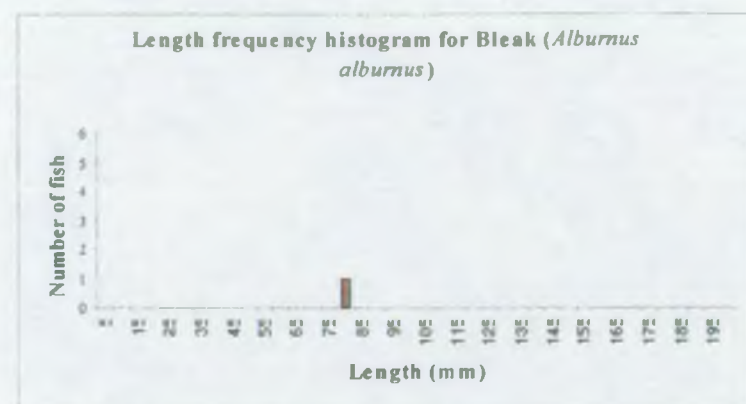
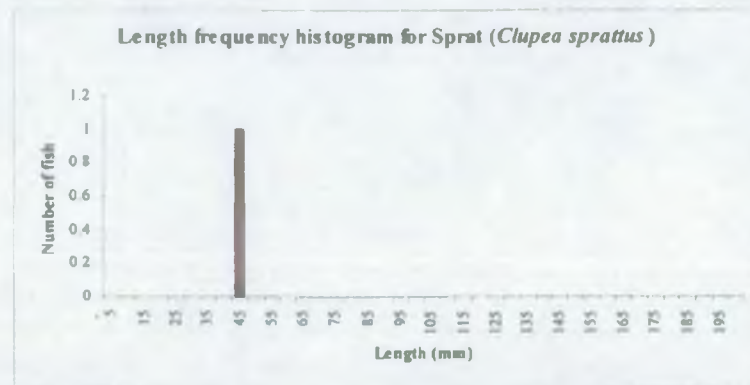
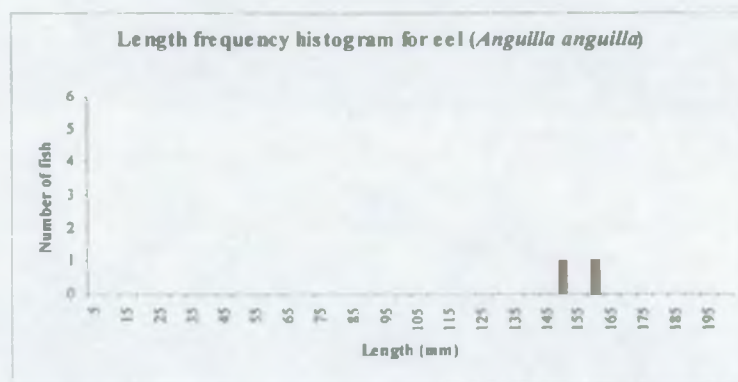
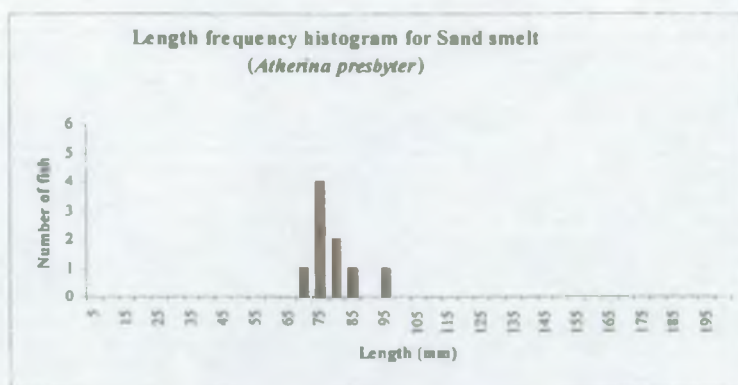
Species	50 -100mm	101-200mm	201-300mm	>300 mm	No. Caught	Fish / m ²	Fish / min.	% of Tot.
Bass	19				19	0.01	1.27	16
Bleak	1				1	0.00	0.07	1
Eel		2			2	0.00	0.13	2
Flounder	1				1	0.00	0.07	1
Sand goby	12				12	0.00	0.80	10
Sand smelt	9				9	0.00	0.60	8
Smelt	68				68	0.03	4.53	57
Sprat	1				1	0.00	0.07	1
Stickleback*	7				7	0.00	0.47	6

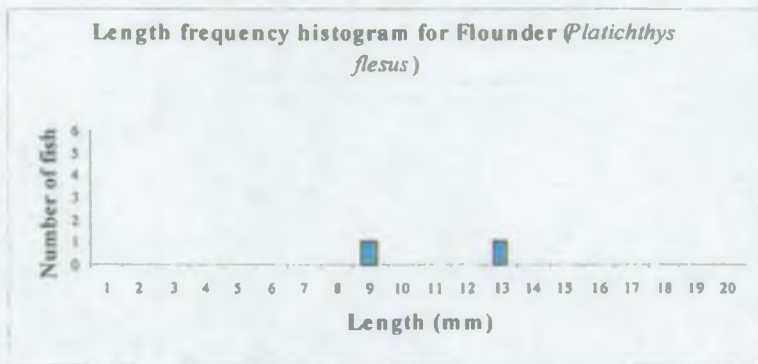
Species and Size Distribution**Population Composition (frequency)**

Notes: * 3 spined

Length frequency histograms for Borstal – summer survey







Fisheries Survey Results

River/Lake: Medway Estuary
 Site: Borstal

Date: 24.09.01
 Surveyed length (m): 105
 Surveyed width (m): 24
 Area (m²): 2520

National Grid Ref: TQ734675 To

Start Time: 1155
 Finish Time: 1215
 Minutes: 20

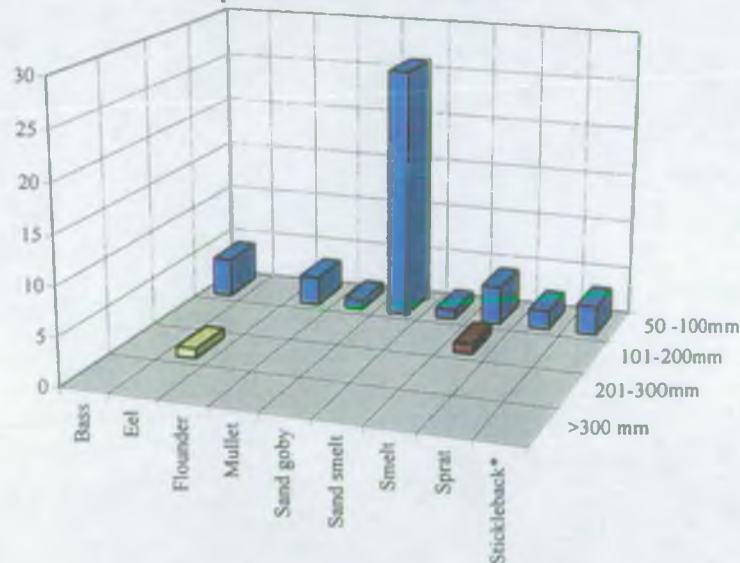
Total No. of fish observed: 46
 No. of species: 9
 Total Fish / m²: 0.02
 Total Fish / min: 2.30

(computer file:) mdw2409.xls

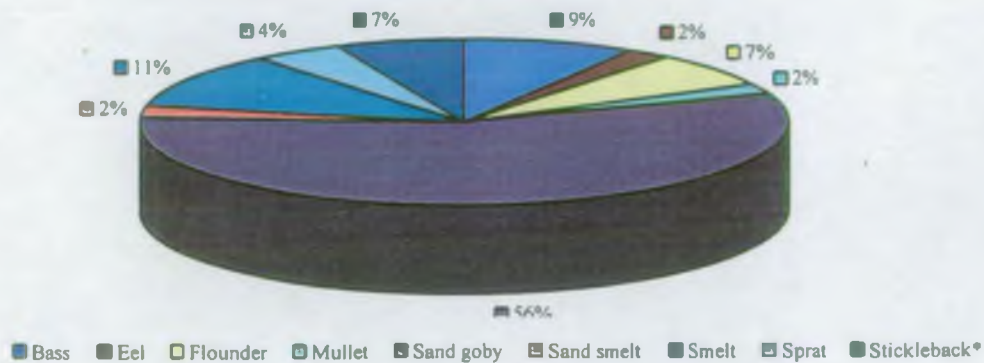
Raw Data

Species	50 -100mm	101-200mm	201-300mm	>300 mm	No. Caught	Fish / m ²	Fish / min.	% of Tot.
Bass	4				4	0.00	0.20	9
Eel			1		1	0.00	0.05	2
Flounder	3				3	0.00	0.15	7
Mullet	1				1	0.00	0.05	2
Sand goby	26				26	0.01	1.30	57
Sand smelt	1				1	0.00	0.05	2
Smelt	4	1			5	0.00	0.25	11
Sprat	2				2	0.00	0.10	4
Stickleback*	3				3	0.00	0.15	7

Species and Size Distribution



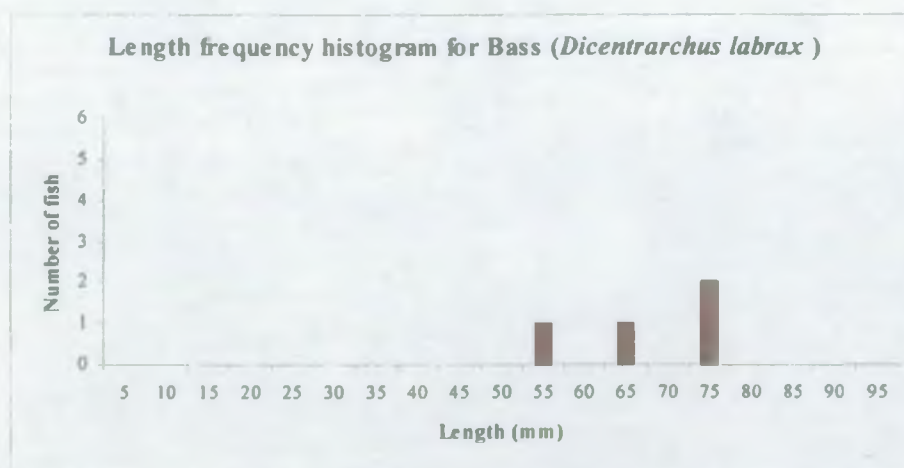
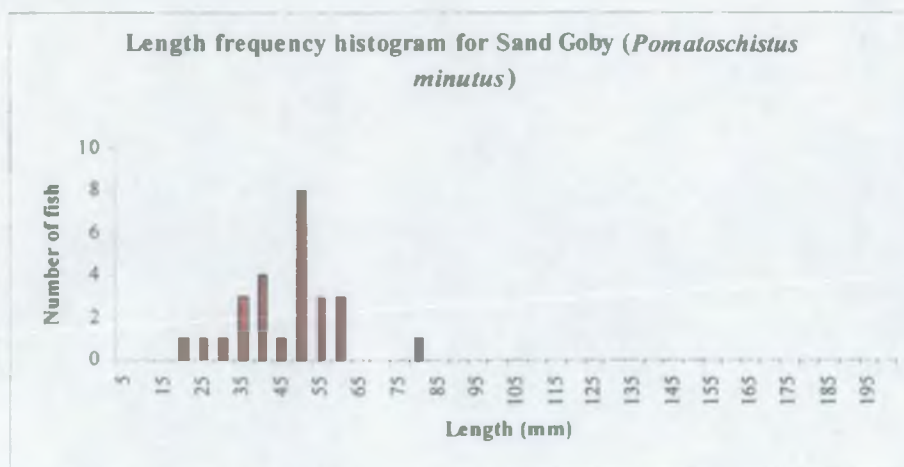
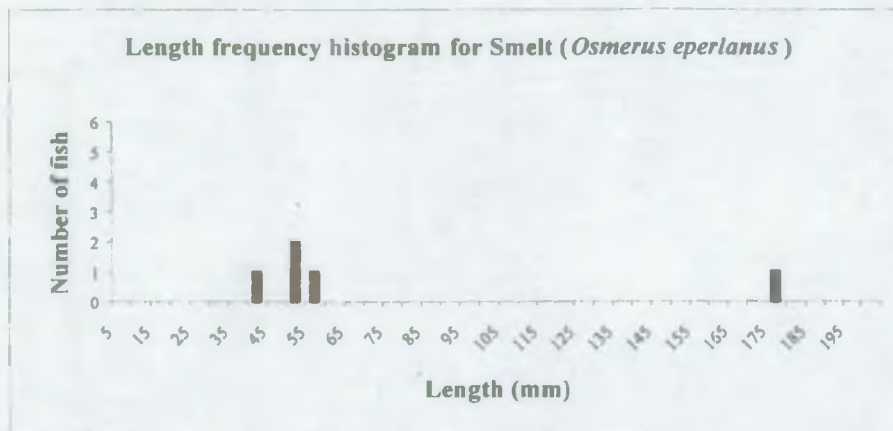
Population Composition (frequency)

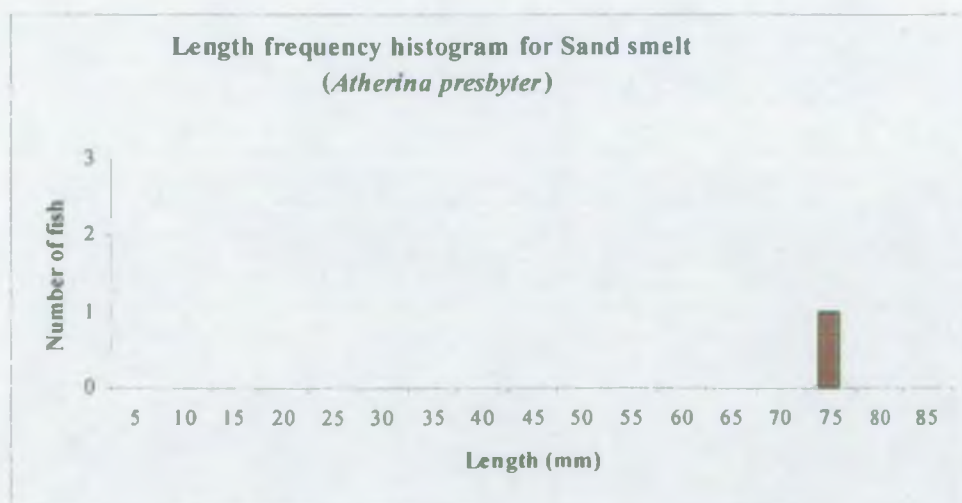
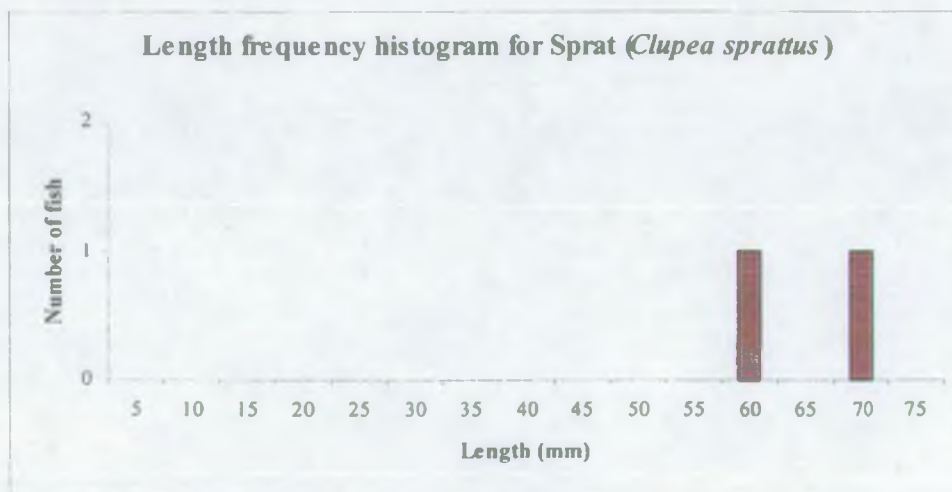
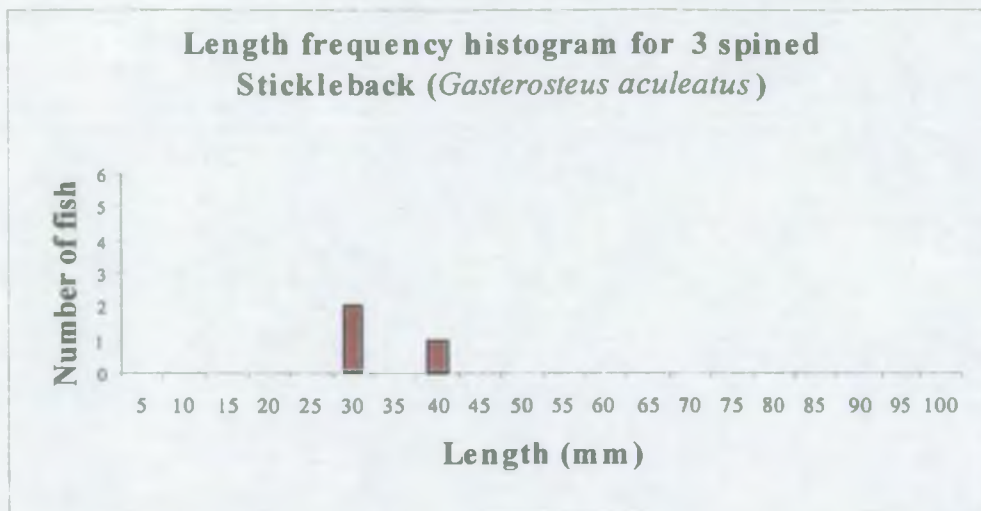


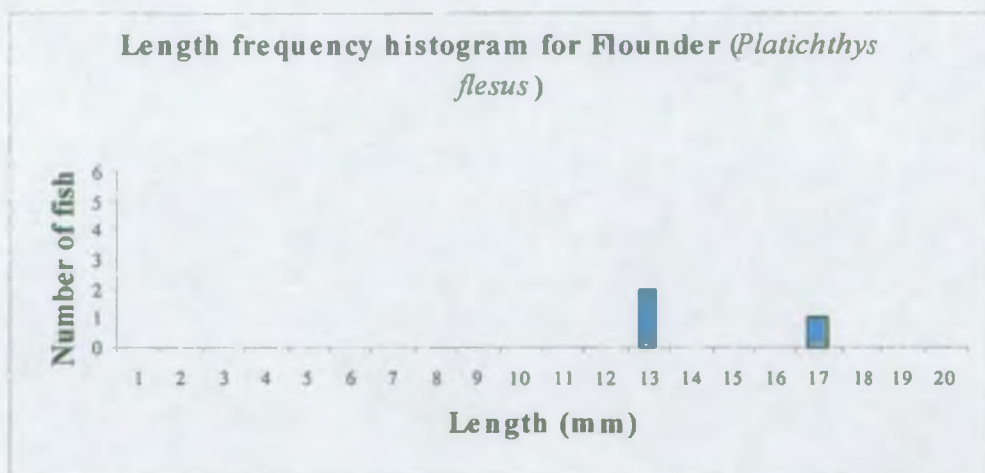
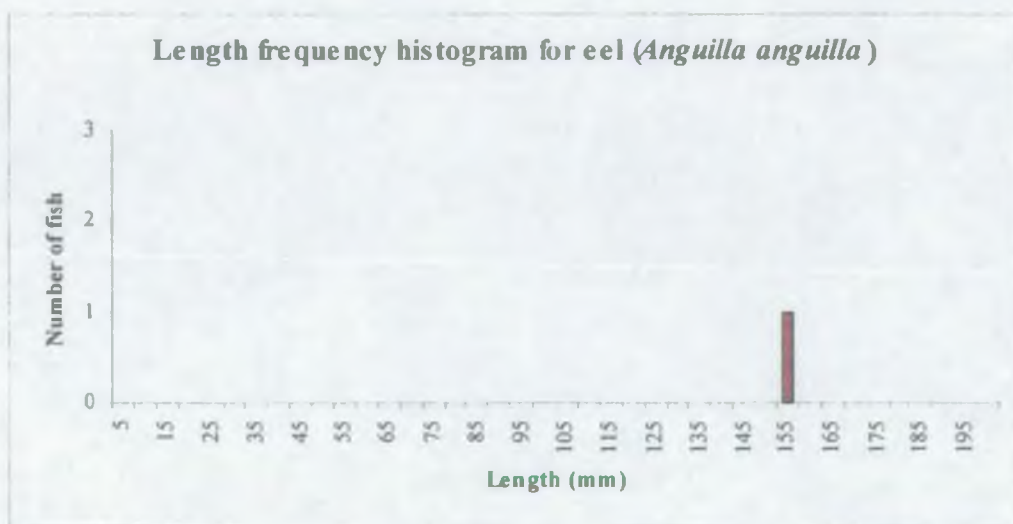
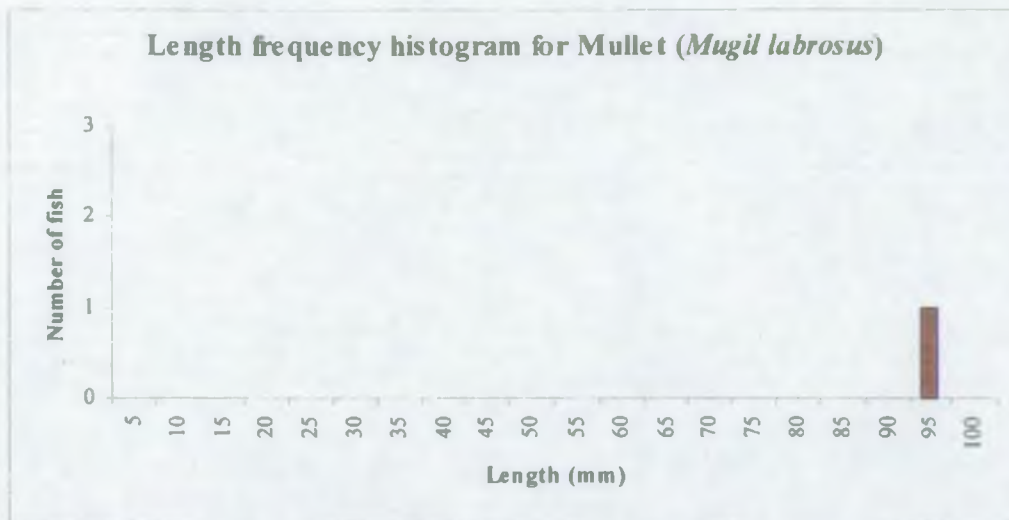
Notes:

* 3 spined stickleback

Length frequency histograms for Borstal – autumn survey







Lower Upnor survey

RIVER	Medway	
SITE NAME	Lower Upnor	
SITE CODE	256	
LOCATION	Left bank. 400m D/S of Marina	
NGR	TQ 770 712	
METHOD	35m x 2.5m micro mesh seine net	
TIDAL STATE	Low	
WIDTH AT LOW WATER (M)	Approximately 300m	
DEPTH (M)	0 to 2+m. Steep drop off	
SUBSTRATE	Pebbles and silt, some small stones/rocks	
AQUATIC VEGETATION	None	
BANKSIDE VEGETATION	Left bank	Common club reed
	Right bank	Beach and woodland, deciduous
ADJACENT LAND USE	Left bank	Public access boat moorings (not fixed)
	Right bank	Marshland, horse grazing



Fisheries Survey Results

River/Lake: Medway Estuary
 Site: Lower Upnor

Date: 27.07.01
 Surveyed length (m): 110
 Surveyed width (m): 50
 Area (m²): 5500

National Grid Ref: TQ 770 712 To

Start Time: 1209
 Finish Time: 1231
 Minutes: 15

Total No. of fish observed: 197
 No. of species: 6
 Total Fish / m²: 0.04
 Total Fish / min: 13.13

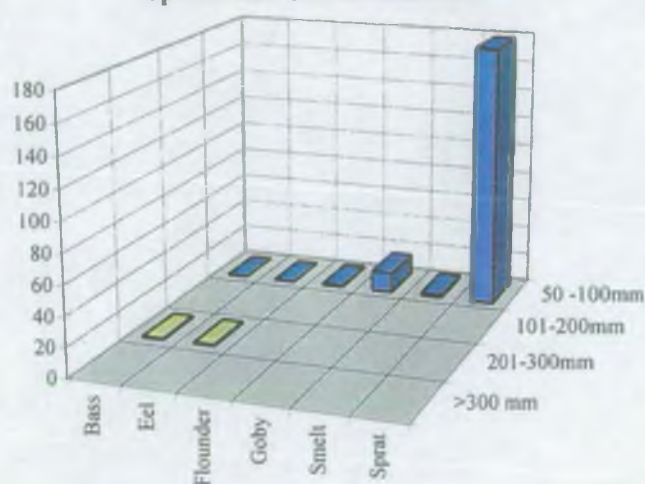
note: 3 nettings

(computer file:) mdw2707.256

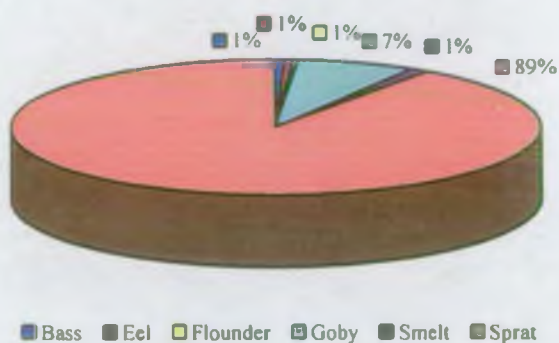
Raw Data

Species	50-100mm	101-200mm	201-300mm	>300 mm	No. Caught	Fish / m ²	Fish / min.	% of Tot.
Bass			1		1	0.00	0.07	1
Eel			1		1	0.00	0.07	1
Flounder	1				1	0.00	0.07	1
Goby	14				14	0.00	0.93	7
Smelt	2				2	0.00	0.13	1
Sprat	178				178	0.03	11.87	90

Species and Size Distribution

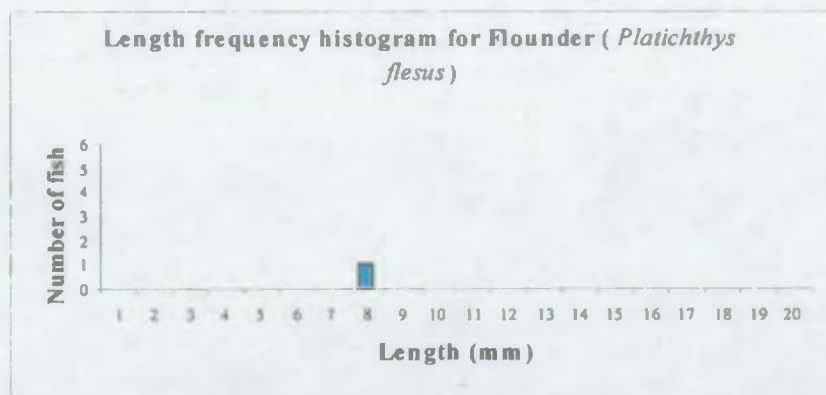
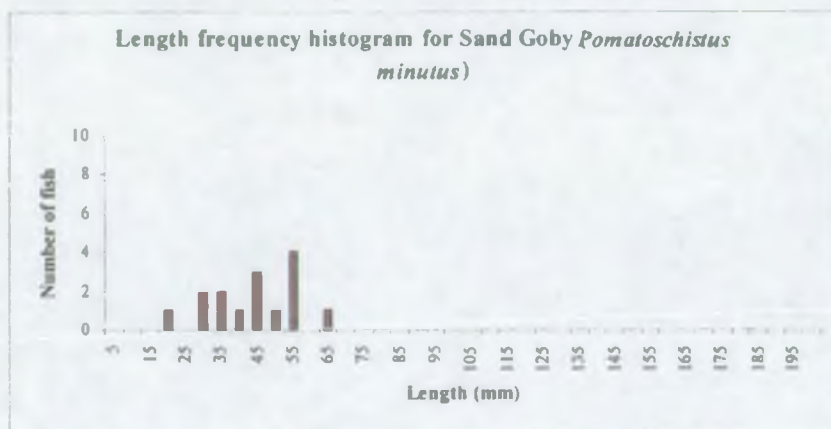
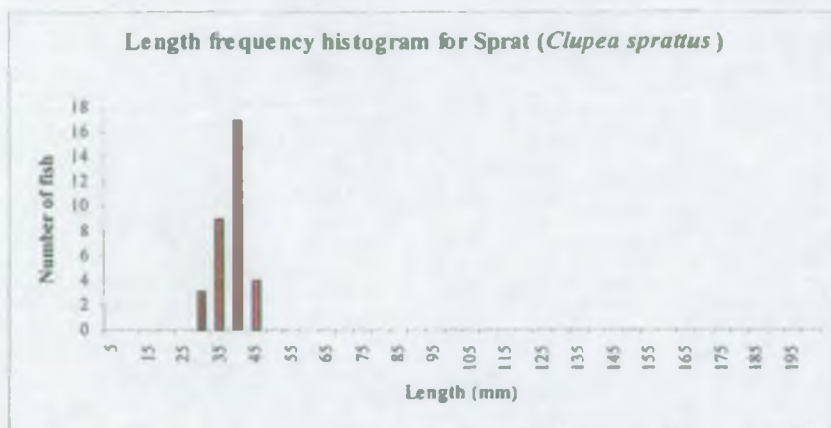


Population Composition (frequency)



Notes: Also shore crabs, prawns, shrimps, comb jellies, mussels

Length frequency histograms for Lower Upnor - summer survey



Bass: one individual 292mm
 Flounder: one individual 44mm
 Eel: one individual 265mm
 Smelt

Fisheries Survey Results

River/Lake: Medway Estuary
 Site: Lower Upnor

Date: 21.09.01
 Surveyed length (m): 110
 Surveyed width (m): 50
 Area (m²): 5500

National Grid Ref: TQ765714 To

Start Time:
 Finish Time:
 Minutes: 36

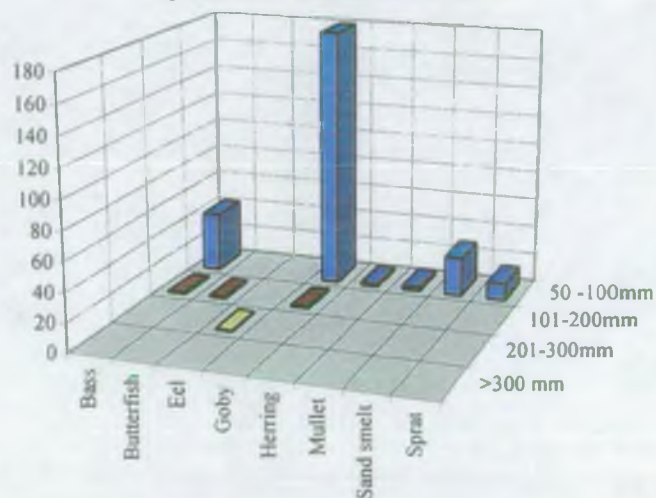
Total No. of fish observed: 268
 No. of species: 8
 Total Fish / m²: 0.05
 Total Fish / min: 7.44

(computer file:) mdw2109.xls

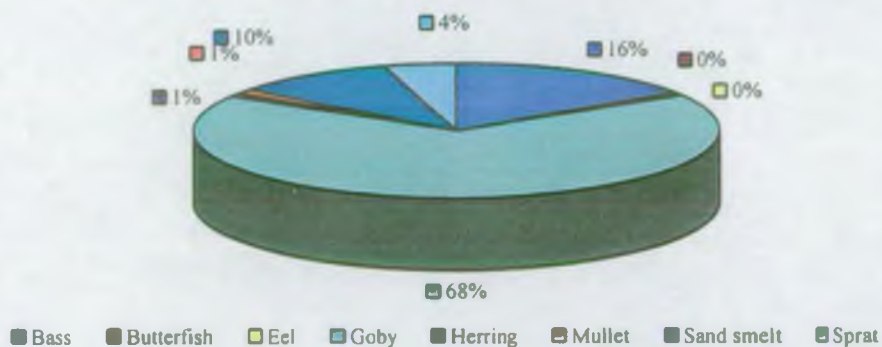
Raw Data

Species	50 -100mm	101-200mm	201-300mm	>300 mm	No. Caught	Fish / m ²	Fish / min.	% of Tot.
Bass	41	1			42	0.01	1.17	16
Butterfish		1			1	0.00	0.03	0
Eel			1		1	0.00	0.03	0
Goby	179	1			180	0.03	5.00	67
Herring	2				2	0.00	0.06	1
Mullet	3				3	0.00	0.08	1
Sand smelt	27				27	0.00	0.75	10
Sprat	12				12	0.00	0.33	4

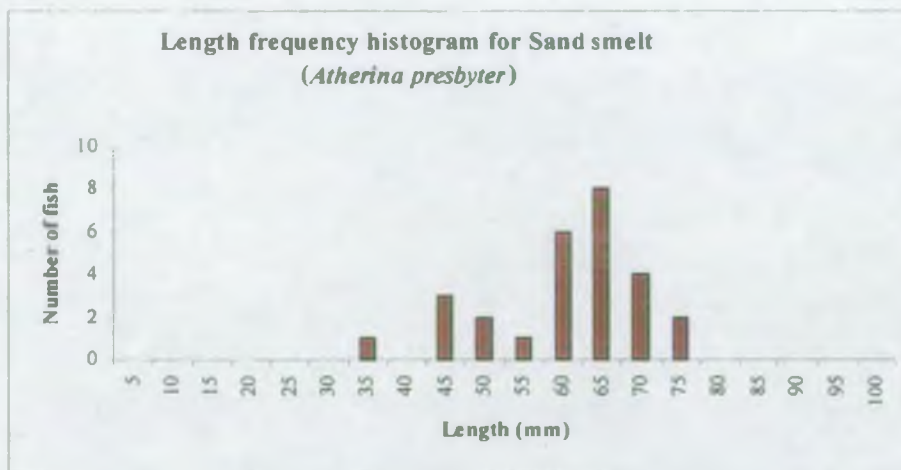
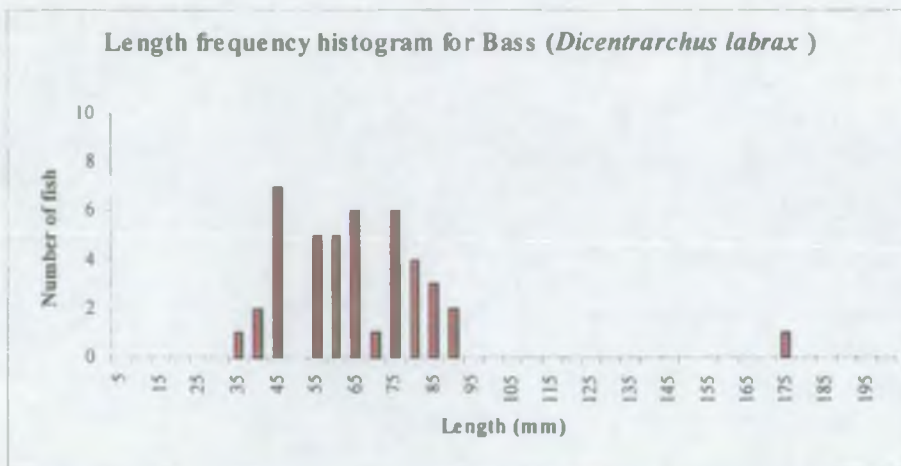
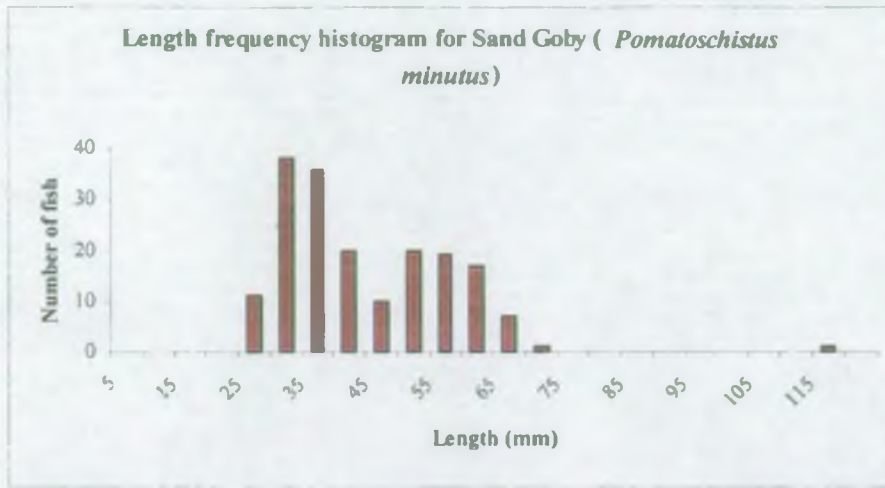
Species and Size Distribution

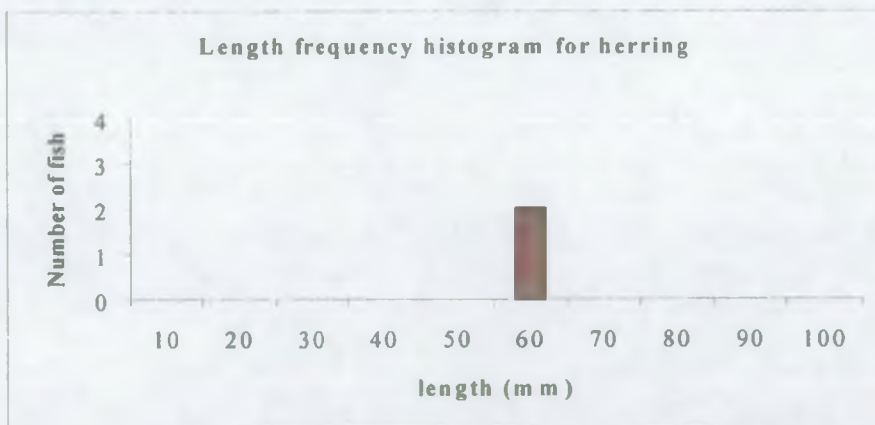
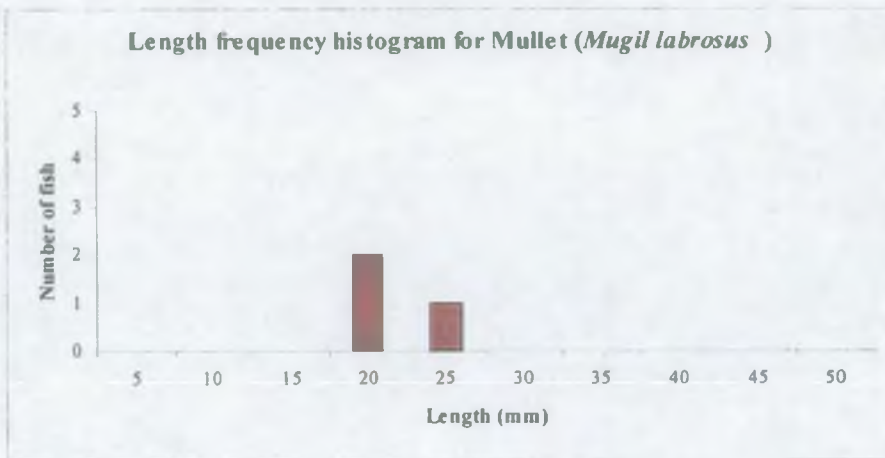
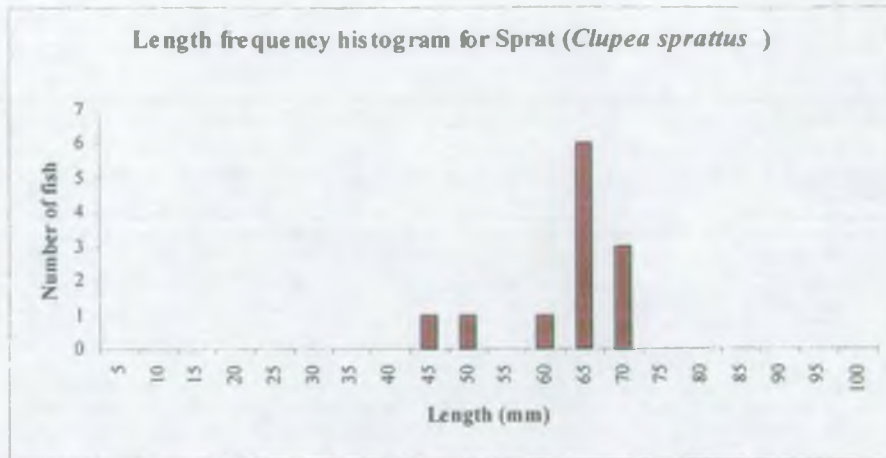


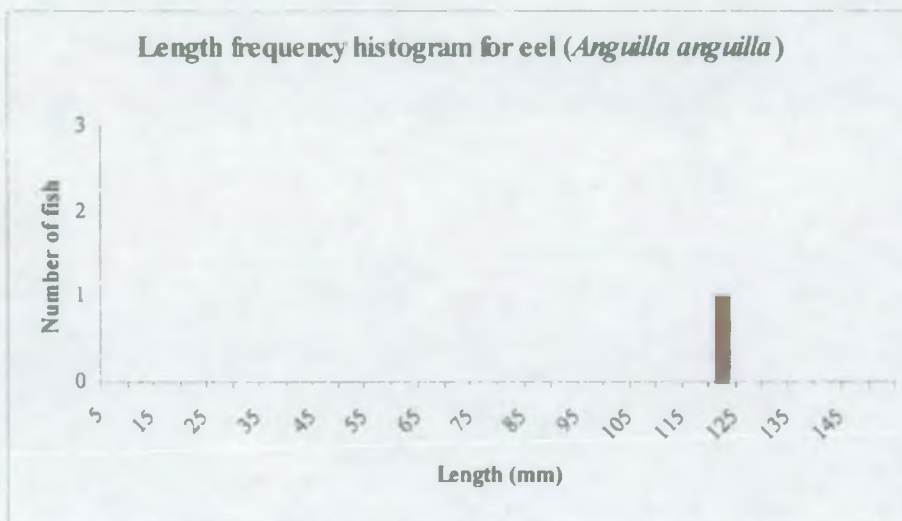
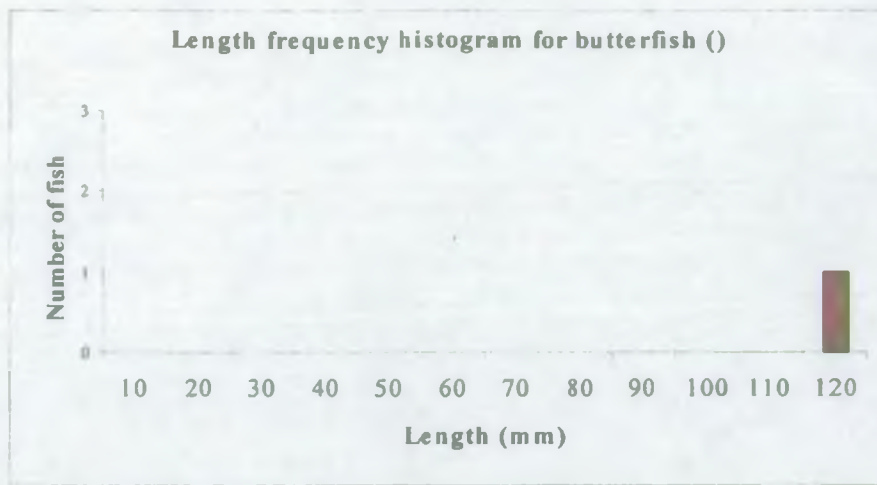
Population Composition (frequency)



Length frequency histograms for Lower Upnor – autumn survey







Grain survey

RIVER	Medway	
SITE NAME	Grain Tower	
SITE CODE	372	
LOCATION	Left bank, next to power station inlet/outlet channel	
NGR	TQ 888 744	
METHOD	35m x 2.5m micro mesh seine net	
TIDAL STATE	High water	
WIDTH AT LOW WATER (M)	500 – 1000m	
DEPTH (M)	Not ascertainable, but gentle slope	
SUBSTRATE	Mud and silt at low tide. Sand and single further upshore	
AQUATIC VEGETATION	None	
BANKSIDE VEGETATION	Left bank	None
	Right bank	None
ADJACENT LAND USE	Left bank	Sandy, shingle shore and flood defence embankments
	Right bank	N/A



Fisheries Survey Results

River/Lake: Medway estuary
 Site: Cockleshell tower, Grain

Date: 05/07/01
 Surveyed length (m): 110
 Surveyed width (m): 50
 Area (m²): 5500

National Grid Ref: TQ813713 To

Start Time:
 Finish Time:
 Minutes: 35

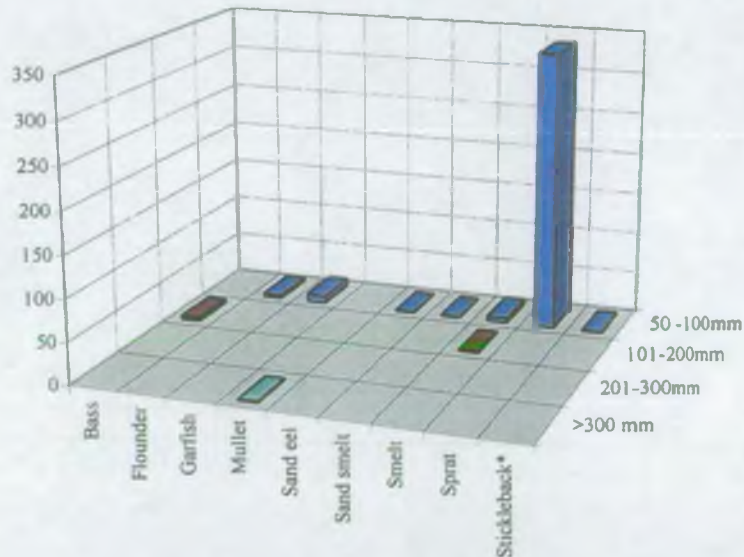
Total No. of fish observed: 363
 No. of species: 9
 Total Fish / m²: 0.07
 Total Fish / min: 10.37

(computer file:) mdwl405.033

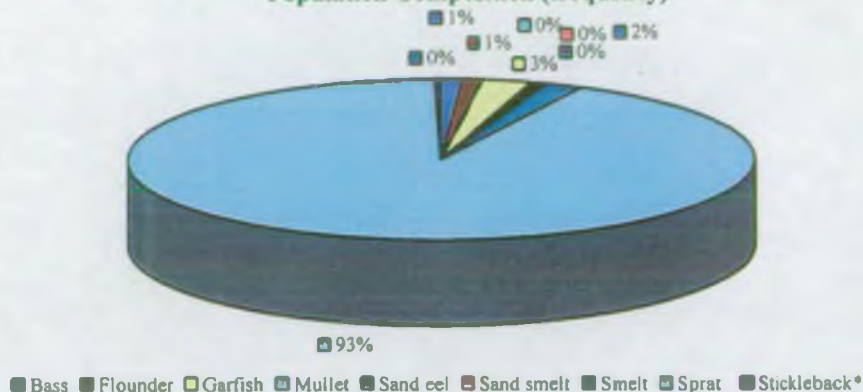
Raw Data

Species	50 -100mm	101-200mm	201-300mm	>300 mm	No. Caught	Fish / m²	Fish / min.	% of Tot.
Bass		4			4	0.00	0.11	1
Flounder	4				4	0.00	0.11	1
Garfish	9				9	0.00	0.26	2
Mullet				1	1	0.00	0.03	0
Sand eel	1				1	0.00	0.03	0
Sand smelt	1				1	0.00	0.03	0
Smelt	6	1			7	0.00	0.20	2
Sprat	335				335	0.06	9.57	92
Stickleback*	1				1	0.00	0.03	0

Species and Size Distribution



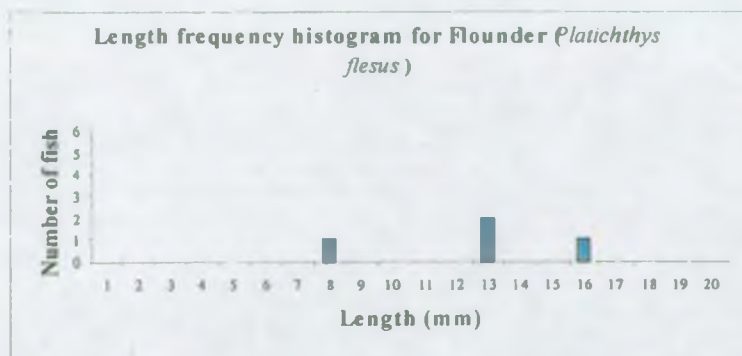
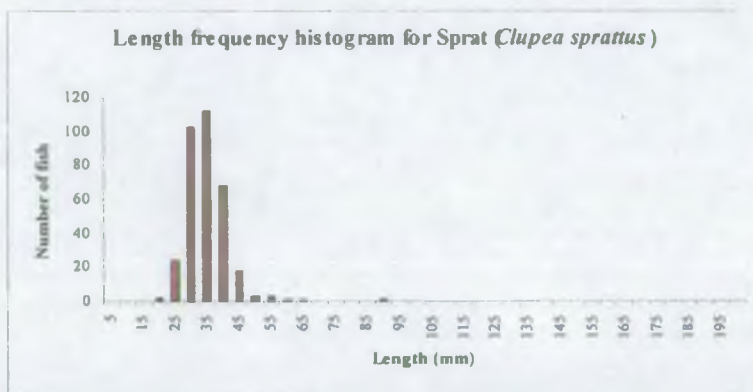
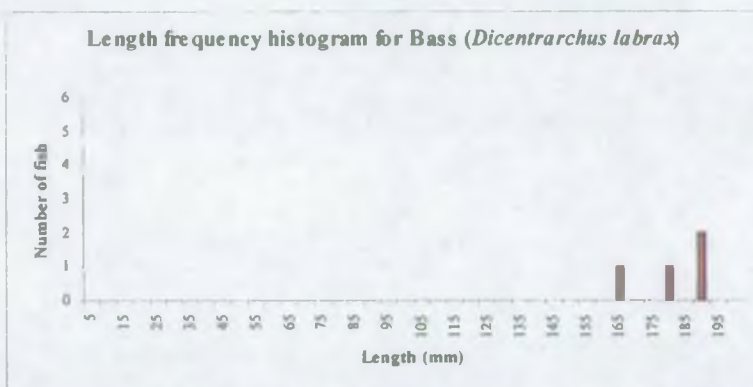
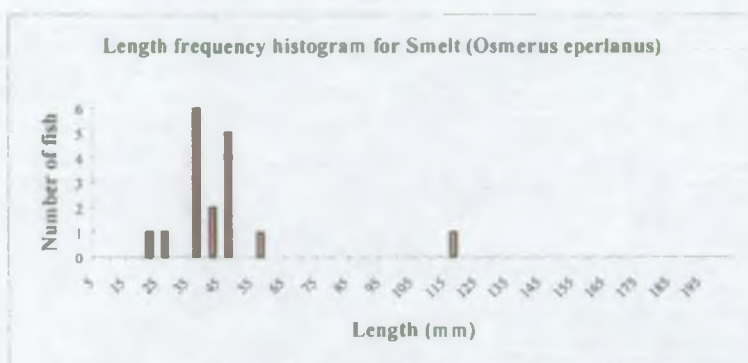
Population Composition (frequency)

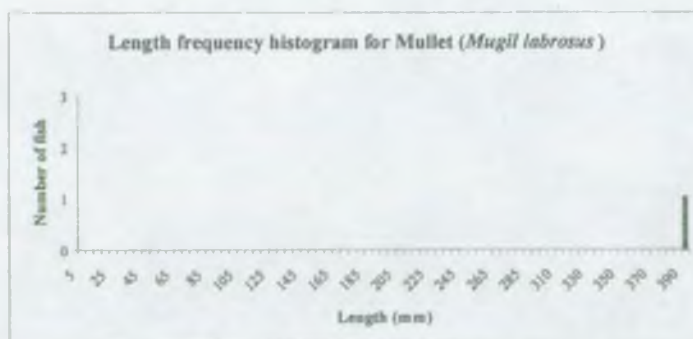
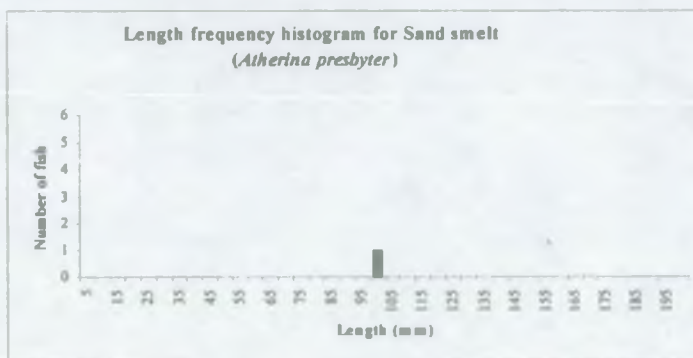
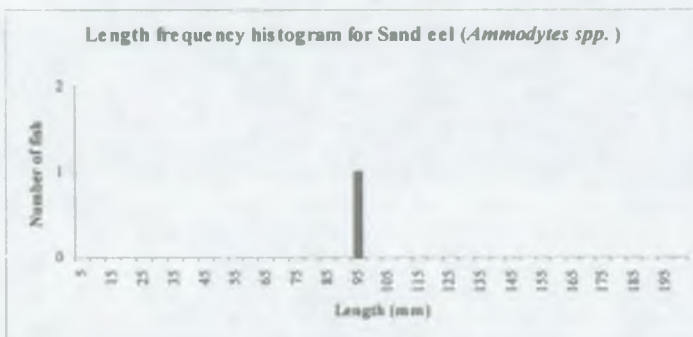
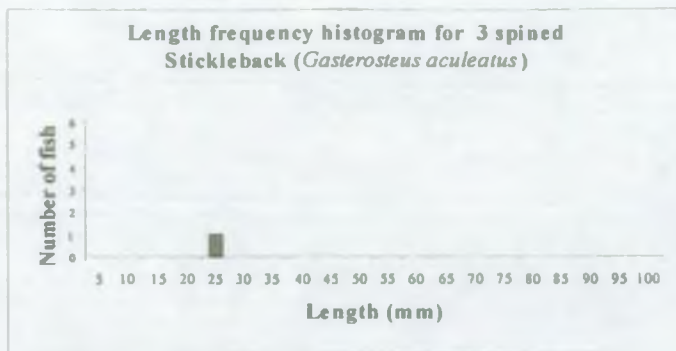


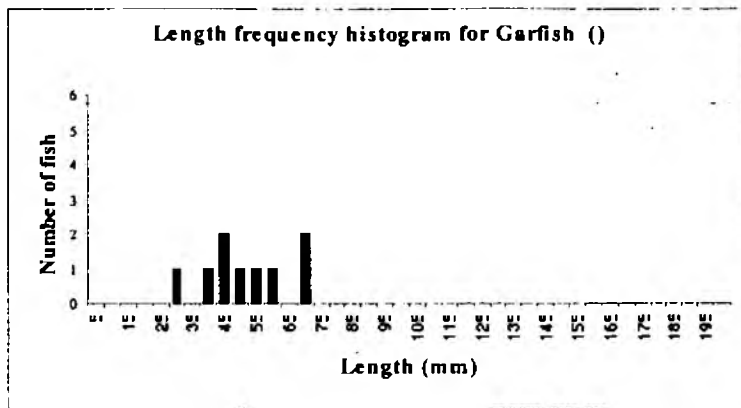
Notes:

* 3 spined stickleback

Length frequency histogram for Grain – summer survey







Fisheries Survey Results

River/Lake: Medway Estuary
 Site: Grain Tower

Date: 2.10.01
 Surveyed length (m): 110
 Surveyed width (m): 50
 Area (m²): 5500

National Grid Ref: TQ888744 To

Start Time:
 Finish Time:
 Minutes: 25

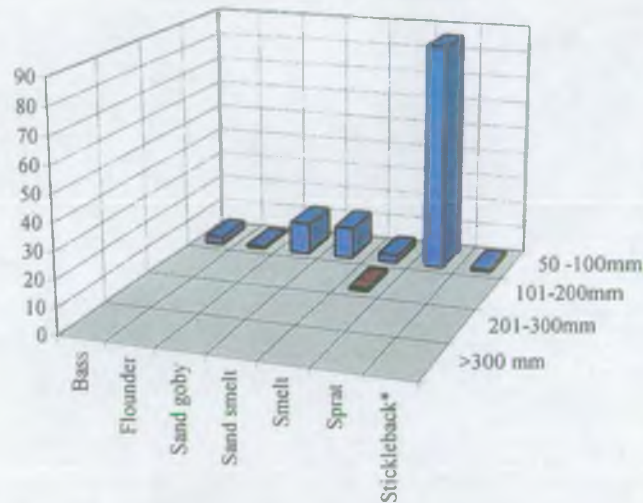
Total No. of fish observed: 119
 No. of species: 7
 Total Fish / m²: 0.02
 Total Fish / min: 4.76

(computer file:) mdw0210.xls

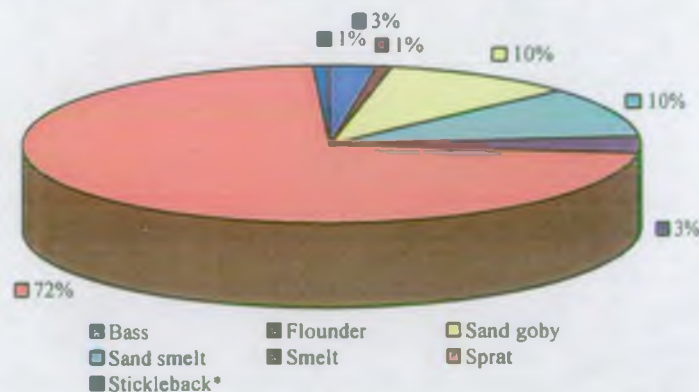
Raw Data

Species	50 -100mm	101-200mm	201-300mm	>300 mm	No. Caught	Fish / m ²	Fish / min.	% of Tot.
Bass	3				3	0.00	0.12	3
Flounder	1				1	0.00	0.04	1
Sand goby	12				12	0.00	0.48	10
Sand smelt	12				12	0.00	0.48	10
Smelt	3	1			4	0.00	0.16	3
Sprat	86				86	0.02	3.44	72
Stickleback*	1				1	0.00	0.04	1

Species and Size Distribution

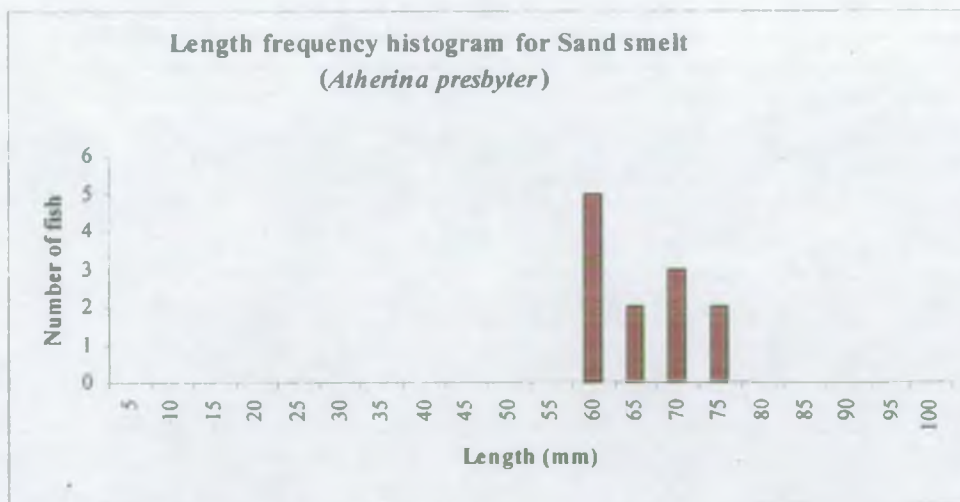
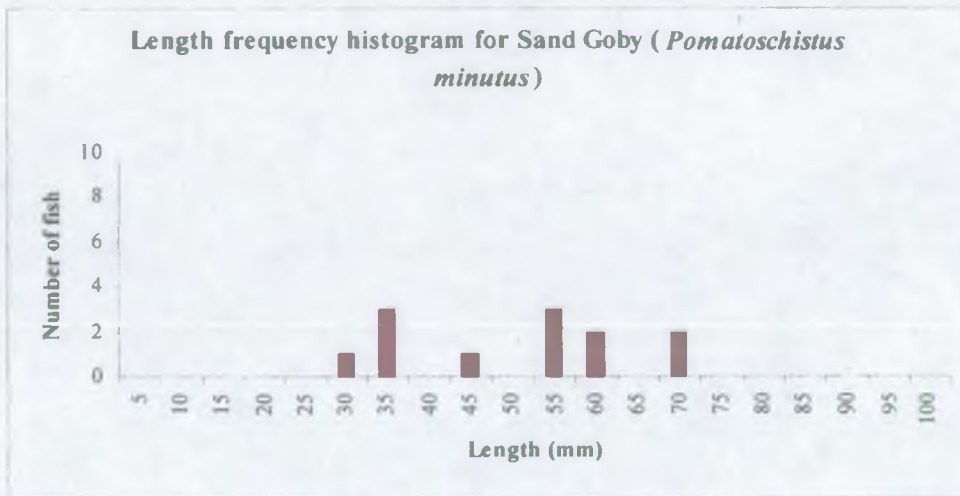
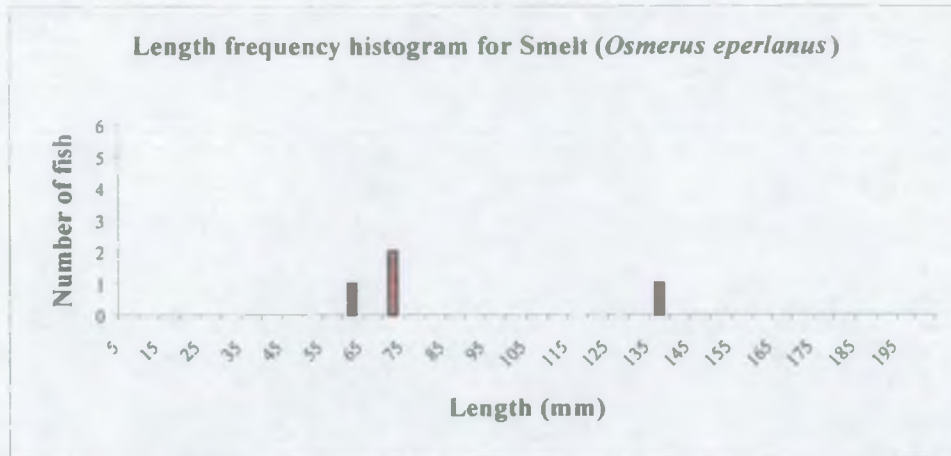


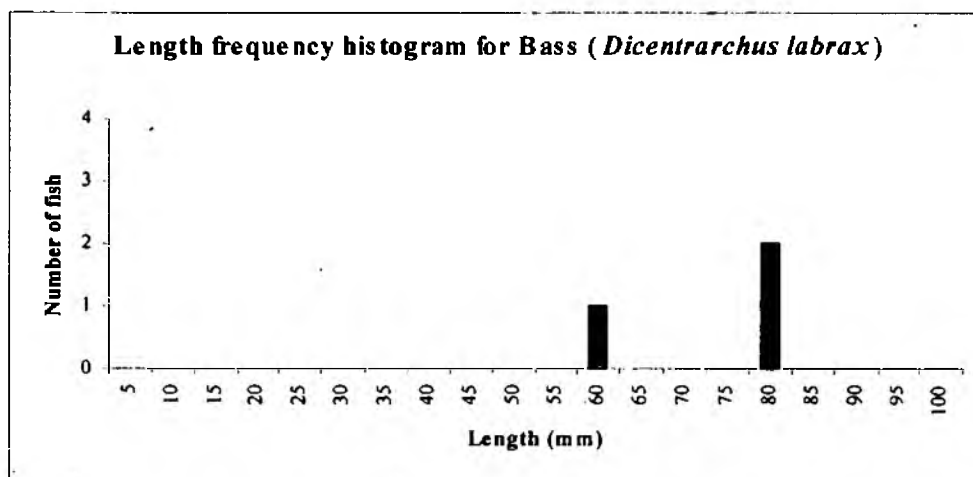
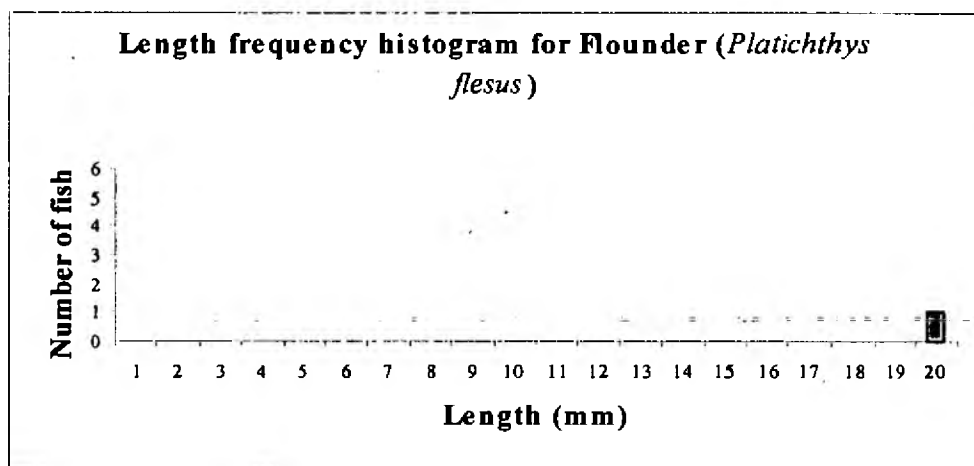
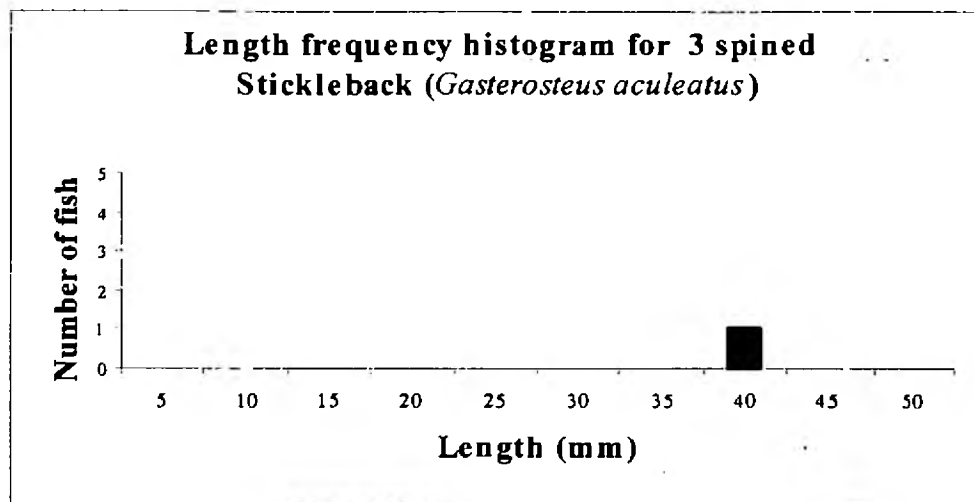
Population Composition (frequency)

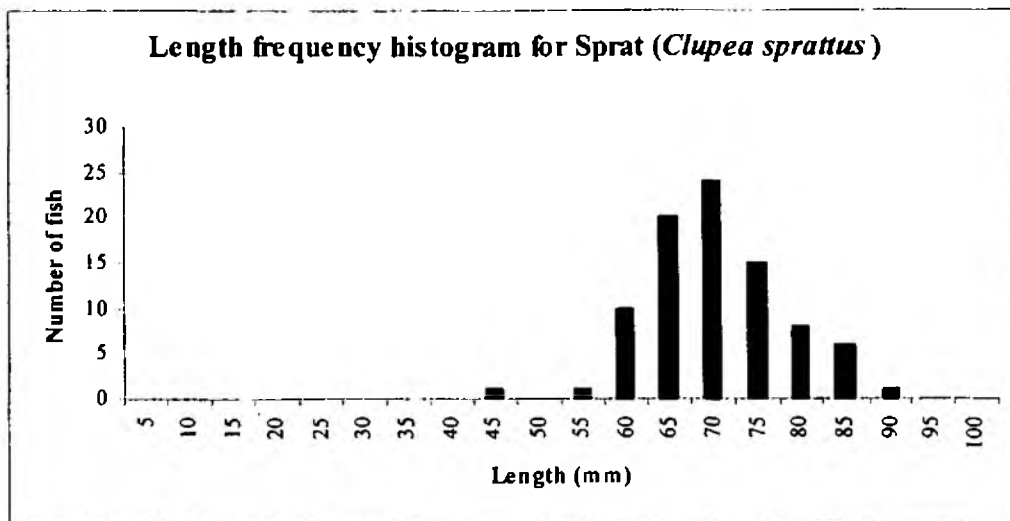


Notes: * 3 spined stickleback

Length frequency histograms for Grain - autumn survey







APPENDIX 2

Comparison of fish density indices between 2000 and 2001:

Summer surveys - fish/m²

fish/min

Autumn surveys - fish/min

fish/m²

Comparison of fish density indices between autumn and summer sampling:

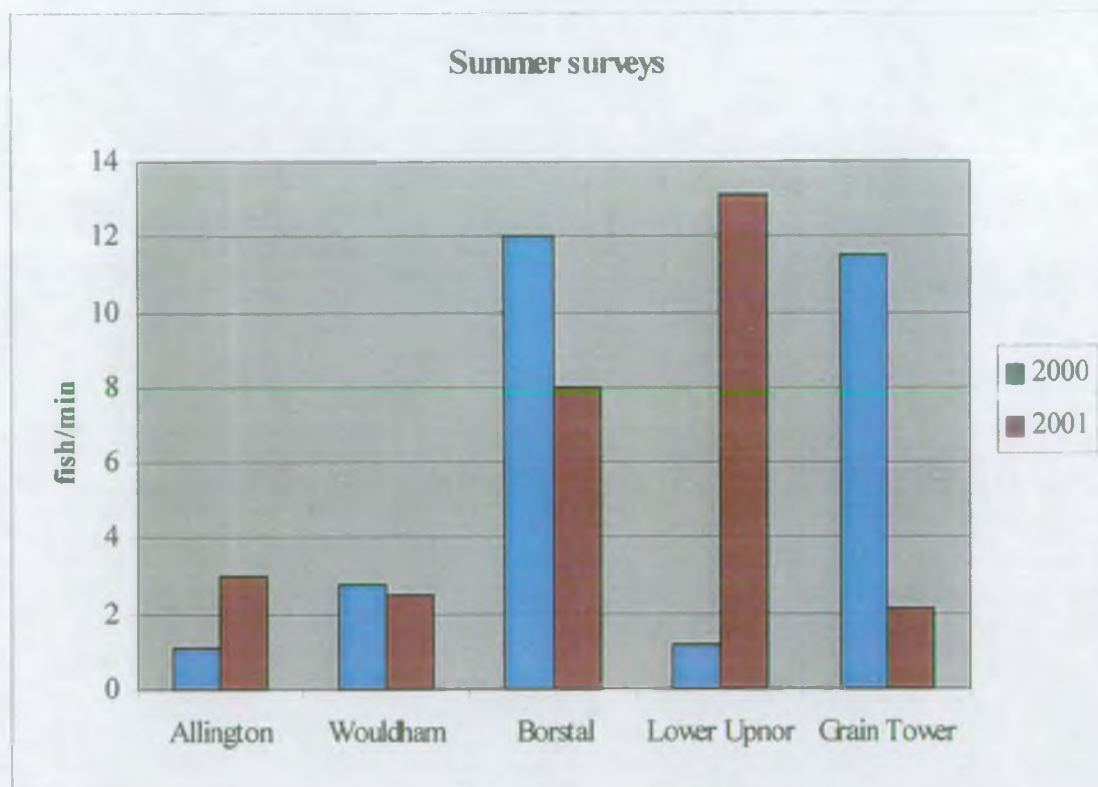
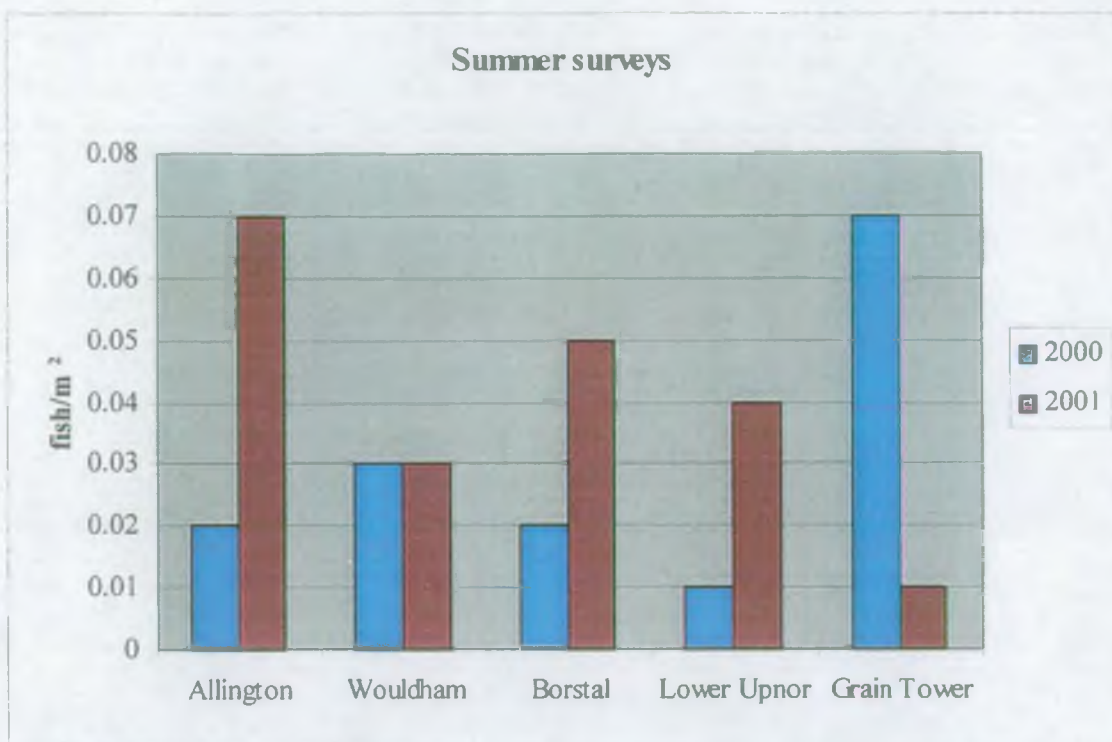
Year 2000 - fish/m²

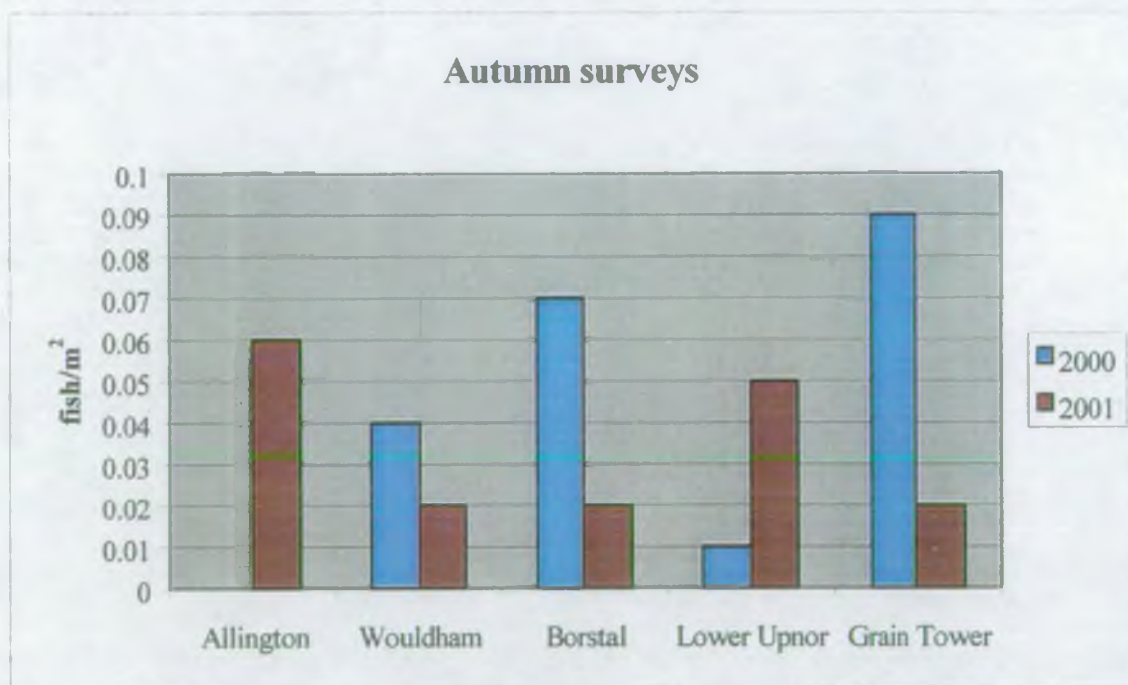
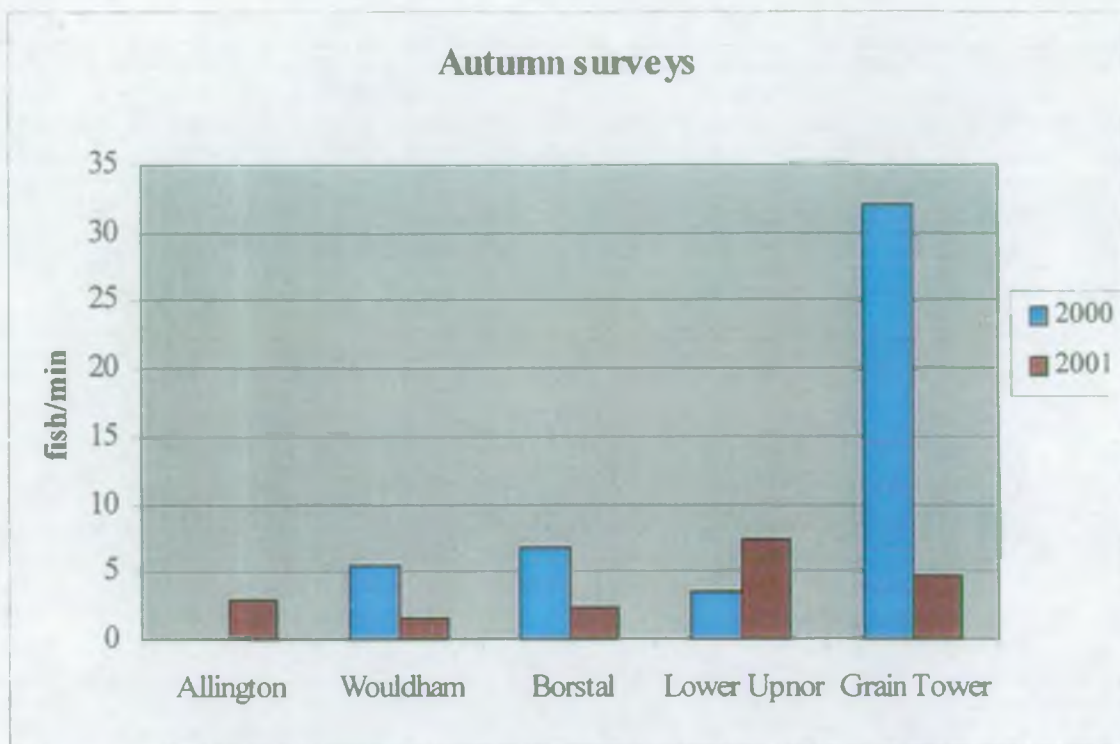
fish/min

Year 2001 - fish/m²

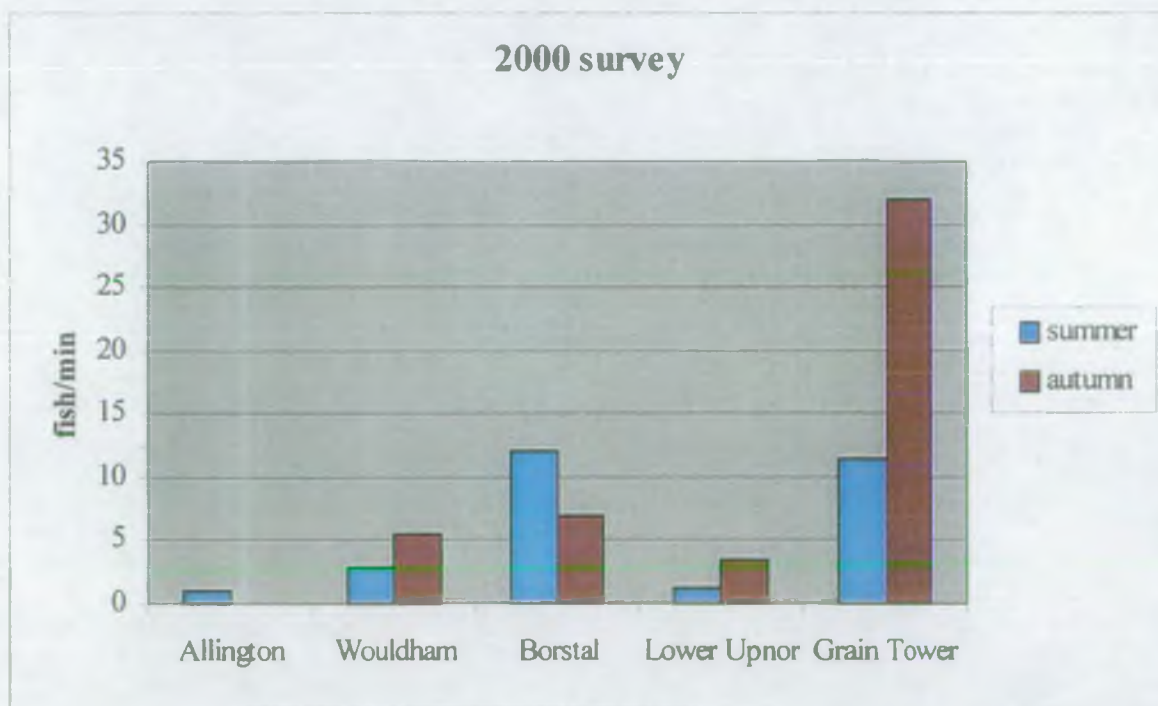
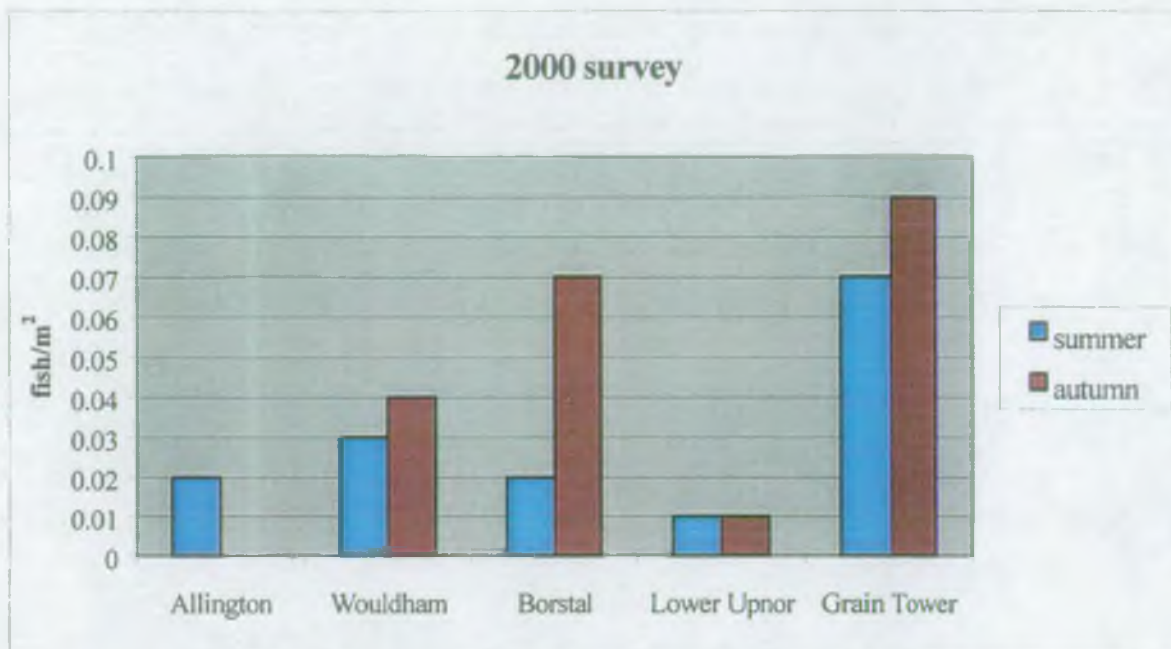
fish/min

Comparison of fish density indices between 2000 and 2001:

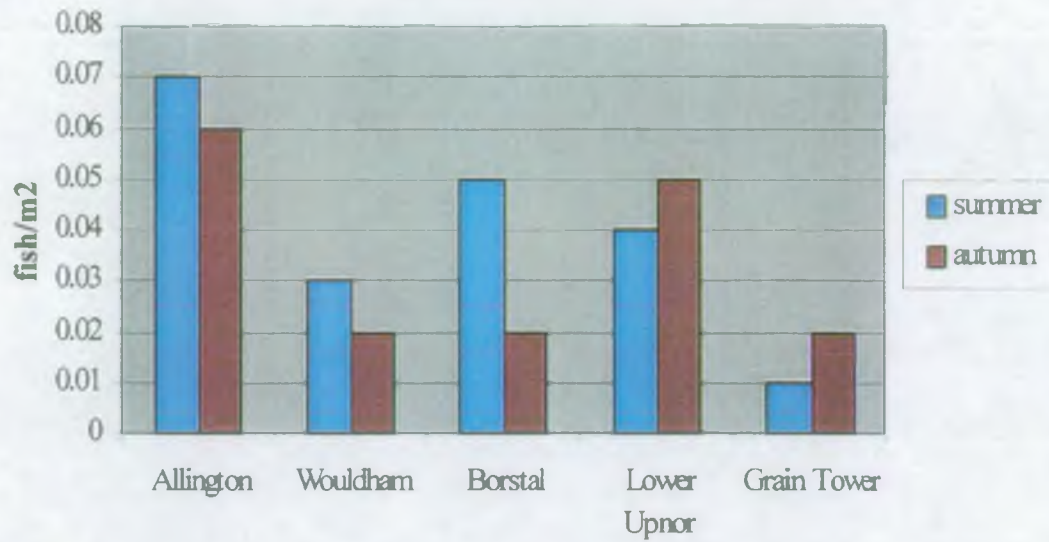




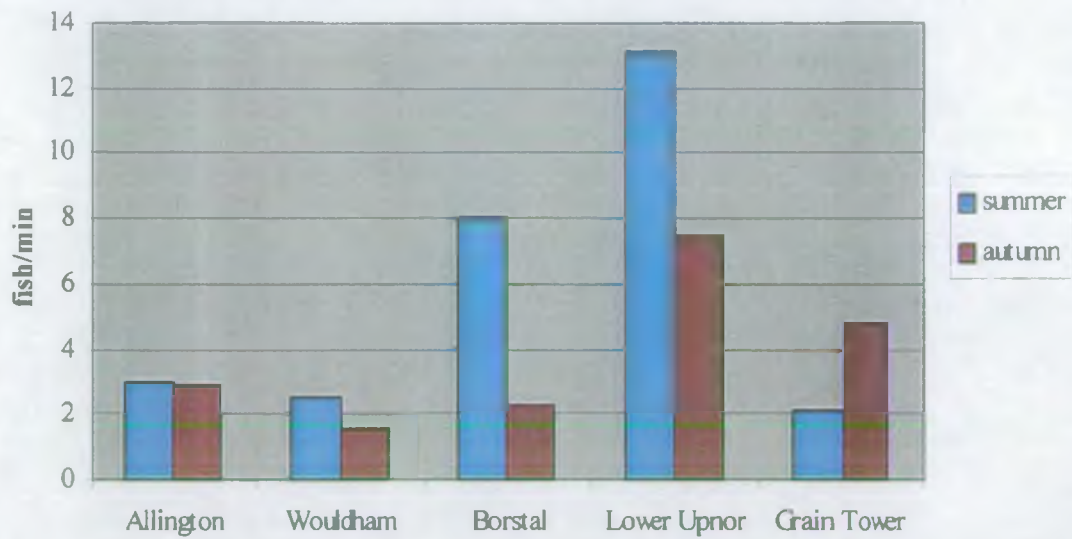
Comparison of fish density indices between autumn and summer sampling:



2001 survey



2001 survey



APPENDIX 3

Map showing smelt ova sampling sites

Description of smelt ova sampling stations

Smelt ova sampling survey actions and results



Map showing smelt ova sampling sites

Medway Estuary

Description of Smelt Ova Sampling Stations

No.	NGR	Station	Access	Bank
1	TQ 710660	opposite Cuxton	via lane below Ringshill Place	right
2	TQ 707652	North Halling	via lane below Ringshill Place	right
3	TQ 710647	d/s Wouldham Church	via lane N of Wouldham Church	right
4	TQ 707640	d/s Halling Church - opposite Wouldham Ferry	via locked gate to riverside	left
5	TQ 712629	d/s Mill Bay, ladder to beach where wharf is black - under buses	via gated lane	right
6	TQ 710624	U/s Mill Bay	down fold to beach	right
7	TQ 710617	opposite Townsend Hook	down bank next to Aylesford Battle Stones	right
8	TQ 708638	opposite Halling	by boat	right

Notes: (1) all sites accessible if small boat launched Burham Church Lane end & recovered Blaw Knox

(2) key for access lane gate (TQ 713652) Sites 1 & 2 from James Gore, Rings Hill Farm

(3) no key available for barrier by Wouldham Church (N side) - foot access only to site (3)

(4) no key available for footpath (TQ 714350) - foot access to sites (5) & (6)

(5) landrover access via Burham Church Lane end along embankment to sites (7),(6) & (5)

(1a) launch Smurfit Townsend Hook - Alan Card 01634240205; recover Rugby Cement

Ben Cook 01634245421/ 07968644056

Medway Estuary
Smelt Ova Sampling 2001

Date	Station	Action	Time NGR	Position	Ban	Water t.degC
23/02/01	6	Place 1 substrate	905 TQ70838627827	54 paces into river from mud/gravel interface in freshwater sluice ru	left	7
23/02/01	5	Place 1 substrate	915 TQ7120763056	13 paces into river from paint splash at revettment top;c. 50m. U/s l	right	7
Notes: LW Sheerness 0800 commencing upstream run at Station 6						
26/02/01	6	Recovered 1 substrate Installed replacement	854 TQ70838627827		left	5.8
26/02/01	5	Substrate exposed Reset substrate	905 TQ7120363053	17 paces into river from paint splash at revettment top;c. 50m. U/s l	right	
26/02/01	8	Place 1 substrate	914 TQ7081063796	Opp. Embankment/ 3 tyres in line; d/s lb inlet; 30m. off rb- v.g. gra	right	
26/02/01	4	Place 1 substrate	931 TQ7066964424	27 paces to rb mud line, opp. D/s end housing revettment - v. clean	right	
26/02/01	3	Place 1 substrate	950 TQ7098665034	42 paces to rb mud line, c. 50m. u/s lb sign - clean gravel backwater	right	
26/02/01	2	Place 1 substrate	1010 TQ7049665726	51 paces to beach top; barnacled stones; d/s power cables- tide risin	left	
Notes: LW Sheerness 833 (0.52m) rising at site 2						
1630 in the lab: Station 6 recovery substrate hosed & sieved 4mm, 1mm, 0.5mm						
No smelt ova. No. of Gammarus zaddachi, snails, tubificids						
05/03/01	6	Recovered 1 substrate	1255	Stake retrievals - 1 only		4.8
05/03/01	5	Recovered 1 substrate	1305	3 only		
05/03/01	8	Recovered 1 substrate	1337	All		
05/03/01	4	Recovered 1 substrate	1350	2 only		
05/03/01	3	Not recovered				
05/03/01	2	Not recovered				
Notes: LW Sheerness 1359 (Tide not as low as when mats were set leading to recovery problems.						
No smelt ova recovered. Sites 5 & 6. Recovered G.zaddachi, tubificids. Site 6 recovered Corophium						
considered to have been displaced downstream by high flows						
12/03/01		Placed substrates				
13/03/01		Recovered substrate				
02/04/01		Placed substrates				
03/04/01	1	Recovered substrate				
03/04/01	2	Recovered substrate				
03/04/01	3	Recovered substrate				
03/04/01	4	Recovered substrate				
03/04/01	5	Recovered substrate				
No smelt ova recovered. Recovered G.zaddachi, snails and 1 stickleback (site 5)						
10/04/01	1	Set substrate				
10/04/01	2	Set substrate				
10/04/01	3	Set substrate				
10/04/01	4	Set substrate				
10/04/01	5	Set substrate				
2 pulls of 80m seine net at Halling Cement Works produced 2 x roach <150mm,						
13 x bream <100mm, 3 x flounder <100mm						
12/04/01	1	Recovered substrate				
12/04/01	2	Recovered substrate				
12/04/01	3	Recovered substrate				
12/04/01	4	Recovered substrate				
12/04/01	5	Recovered substrate				
12/04/01	6	Recovered substrate				
No smelt ova recovered. Recovered a small no. of glass and coloured elvers						

c:\data\sveys\med_est\2001\smelt ova sampling

APPENDIX 4

CEFAS trawl results

Fisheries Survey Results

(CEFAS survey)

River/Lake: Medway estuary
Site: Kingsnorth Power Station Intake

Date: 14.05.01

National Grid Ref: TQ813713 To

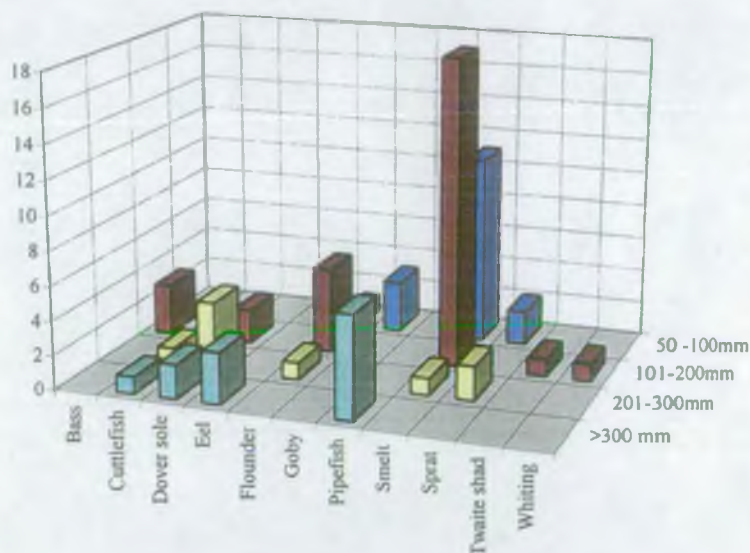
Total No. of fish observed: 68
No. of species: 11

(computer file:) mdw1405.033

Raw Data

Species	50 - 100mm	101 - 200mm	201 - 300mm	>300 mm	No. Caught	% of Tot.
Bass		3			3	4
Cuttlefish			1	1	2	3
Dover sole		2	4	2	8	12
Eel				3	3	4
Flounder	1	5	1		7	10
Goby	3				3	4
Pipefish				6	6	9
Smelt	11	18	1		30	44
Sprat	2		2		4	6
Twaite shad		1			1	1
Whiting		1			1	1

Species and Size Distribution



Population Composition (frequency)

