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BIOLOGY
WEST THURROCK FISH SURVEY 1990-91



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SUMMARY

1. Surveys of the fish living in the Thames Estuary were undertaken on a regular basis at West Thurrock Power Station during 1990 and 1991. Samples were collected by intercepting the washings from the cooling water intake screens over a four hour period.
2. A total of 50 and 42 fish species were recorded in 1990 and 1991 respectively. Both these figures are within the expected range of 42 to 56 species found annually since the improvement in water quality in the late 70's.
3. Two new species of fish were recorded in 1990. The Hake (*Merluccius merluccius*) and the Golden Mullet (*Liza auratus*) bring the total number of species recorded in this part of the Thames Estuary to 112 plus one hybrid.
4. The seasonal changes in species composition followed the expected trends during both 1990 and 1991 i.e. low species numbers during the summer and high species numbers in the autumn/winter.
5. A decline in the number of bass (*Dicentrarchus labrax*) was recorded in 1991, along with a continuing decline in the abundance of sand gobies (*Pomatoschistus minutus*). A general increase in gadoids (the cod family) has been recorded in recent years.
6. A high proportion of the fish species recorded during the surveys were represented by juveniles, reflecting the continuing importance of the Thames Estuary as a nursery ground for many species.

1. INTRODUCTION

Thames Water biologists first began monitoring the macrofauna in the Thames Estuary in 1974 primarily to monitor the recovery of the tideway biota after improvements to the major sewage treatment works at Beckton and Crossness. Much of this work was curtailed during the mid 1980s but was restarted during the transfer of the regulatory function of the Authority to the National Rivers Authority.

This report summarises the results of fish surveys undertaken at West Thurrock Power Station in 1990 and 1991, and can be read in conjunction with the two earlier reports of 1988 and 1989. The aim of the report is to present the results of the surveys and no inferences on water quality will be made. Use of the data to assess water quality will be the subject of other specifically targetted reports. This approach parallels that being taken with estuarine macroinvertebrates and meiofaunal data.

2. METHOD

The method of sample collection consisted of intercepting the washings from the cooling water intake screens at West Thurrock Power Station during a four hour period over low tide. A more detailed description of the method can be found in Section 3 of the Estuarine Fish Survey Report, 1989 (Thomas, 1990). The location of the power station is shown in Figure 1.

3. RESULTS

The sample results for both years are appended.

3.1 Number of Species - Annual Total

50 and 42 fish species were recorded in 1990 and 1991 respectively. Both these figures are within the expected range of 42 to 56 species found annually since the improvement in water quality in the late 70's (Figure 2).

Amongst the 50 species in 1990 were two species not previously recorded in samples at West Thurrock. A Golden Mullet (*Liza auratus*) was identified by

MAFF staff whilst assisting with a routine sample in October 1990. A Hake (*Merluccius merluccius*) was discovered by National Power staff in March 1990 and preserved until it could be confirmed by NRA biologists. No new species were recorded in 1991.

The total number of fish species found in this part of the Thames Estuary since 1964 now stands at 112 plus one hybrid. The general increase in species numbers since 1964 should be regarded as an indicator of the general improvements of fish stocks and not necessarily as a direct indicator of water quality.

3.2 Number of Species - Seasonal Pattern

The usual seasonal pattern of high species numbers in Autumn/Winter and low numbers in Summer was detected during both years (Figure 3). Species numbers during the critical period of mid-June to late August remained comparatively high in both years, with only the November 1990 samples showing species numbers to be slightly lower than might normally be expected.

3.3 Species Abundance - Totals/Trends

The total number of individuals recorded in 1990 was similar to that recorded in previous years. However, the total number recorded in 1991 was notably lower. This reduction was also reflected in the mean number of individuals recorded per sample. The number of samples taken in any one year and the time of year when these samples are taken will, of course, effect the number of individuals recorded. In 1991, however, a comparatively high number of samples were taken, suggesting that the overall reduction in fish numbers was unlikely to be due to the number of samples taken (Table 1).

Tables 2 and 3 present the species lists and abundances for 1990 and 1991 respectively. The high number of bass (*Dicentrarchus labrax*) recorded in 1989 was sustained during 1990. In 1991 however the numbers were considerably reduced, although still higher than pre 1989 levels. The general decline in the abundance of sand gobies, first detected in the late 1980's, continued with the lowest annual total for nearly ten years being recorded in 1991. As in previous years, due to the similarity between the sand goby (*Pomatoschistus minutus*) and the common goby (*P. microps*), and the shortage of time for identification during the survey, the two species have been recorded as one.

From previous surveys the common goby is thought to make up approximately 5% of the total goby catch.

Smelt (*Osmerus eperlanus*) achieved a four year high in 1990 after very limited numbers had been recorded in 1989.

Table 4 shows the most common species recorded at West Thurrock, ranked by order of abundance for the period 1988 to 1991. A number of trends are apparent. 1990 was a particularly good year for the 5 bearded rockling (*Ciliata mustela*) with 1991 being good for scad (*Trachurus trachurus*). The abundance of both dab (*Limanda limanda*) and pogge (*Agonus cataphractus*) is currently declining while the gadoids of sub-family Gadinae (whiting, pouting, poor cod, cod) have all shown a gradual increase in relative abundance. Plaice (*Pleuronectes platessa*) was very low in numbers in 1990, but appeared to recover in 1991.

Table 4 also indicates the appearance of the thin-lipped mullet (*Liza ramada*) in 1990. Although there was a genuine increase in the numbers of mullet recorded in the samples, this species is likely to have been mis-identified as the thick-lipped mullet (*Crenimugil labrosus*) prior to 1990 and recorded as such in these earlier samples.

3.4 Species Abundance - Seasonal Pattern

Table 5 provides information on species abundance between 1989 and 1991 for selected species. The period of peak abundance for each species is similar to that found in other years, with a secondary or untypical peak only occurring when the abundance of the species in question is exceptionally high - bass 1989; smelt 1990; herring 1991; sprat 1991.

3.5 Length Frequency

The size ranges for various species are also shown in Table 5. The majority of species are largely represented by juveniles (0+ and 1+ fish), reflecting the value of the Thames Estuary as a nursery ground for many species.

3.6 Species Diversity Index (H'e)

The Species Diversity Index tended not to show any obvious trend during 1990. However, 1991 was more typical with low diversity during the summer and peaks in the spring and autumn (Figure 4).

FIGURES

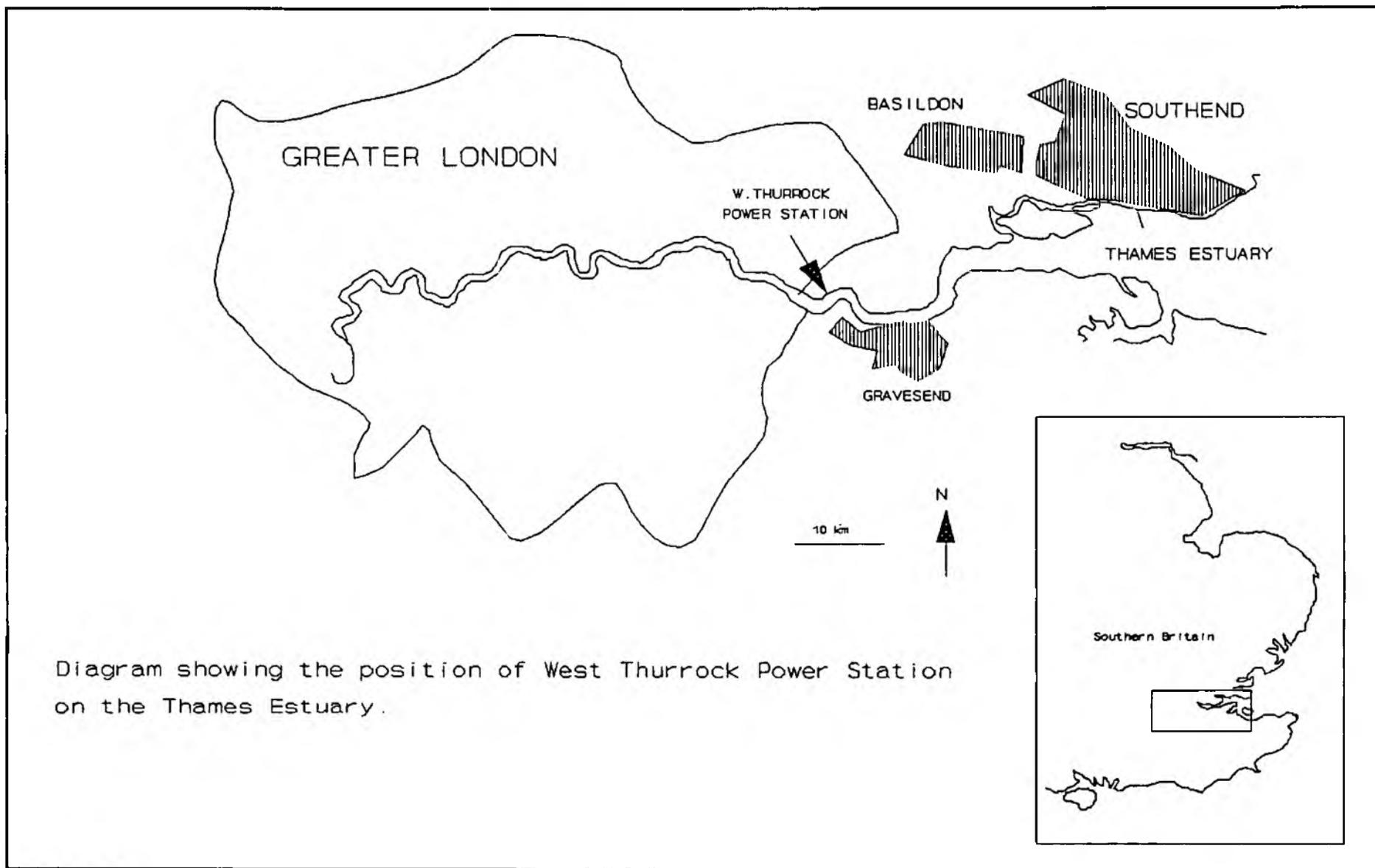
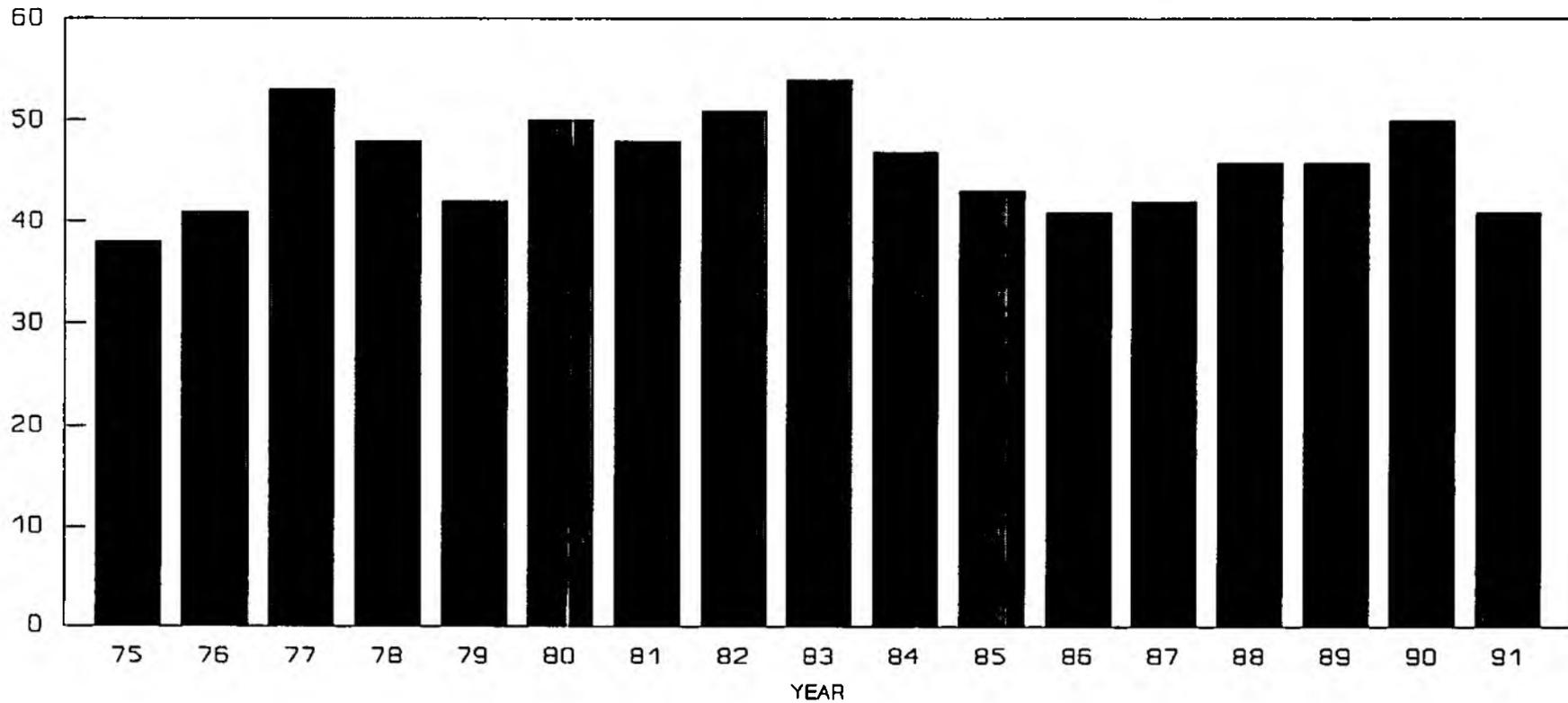


Diagram showing the position of West Thurrock Power Station on the Thames Estuary.

Figure 1

WEST THURROCK
ANNUAL FISH SPECIES NUMBERS
1975 - 1991

No. OF SPECIES



(Includes species found by CEGB/National Power)

Figure 2

WEST THURROCK SPECIES NUMBERS

NUMBERS

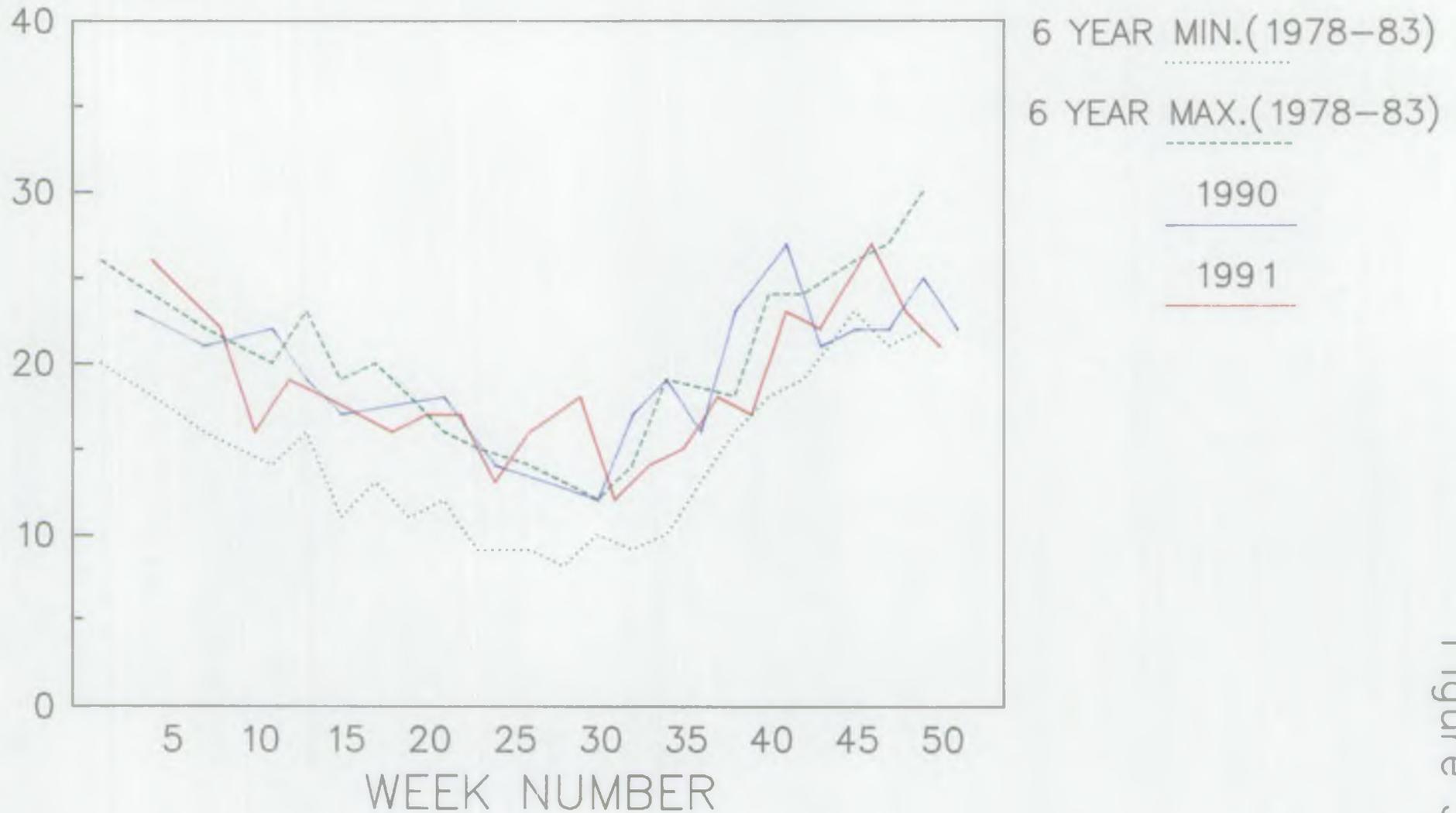


Figure 3

WEST THURROCK SPECIES DIVERSITY

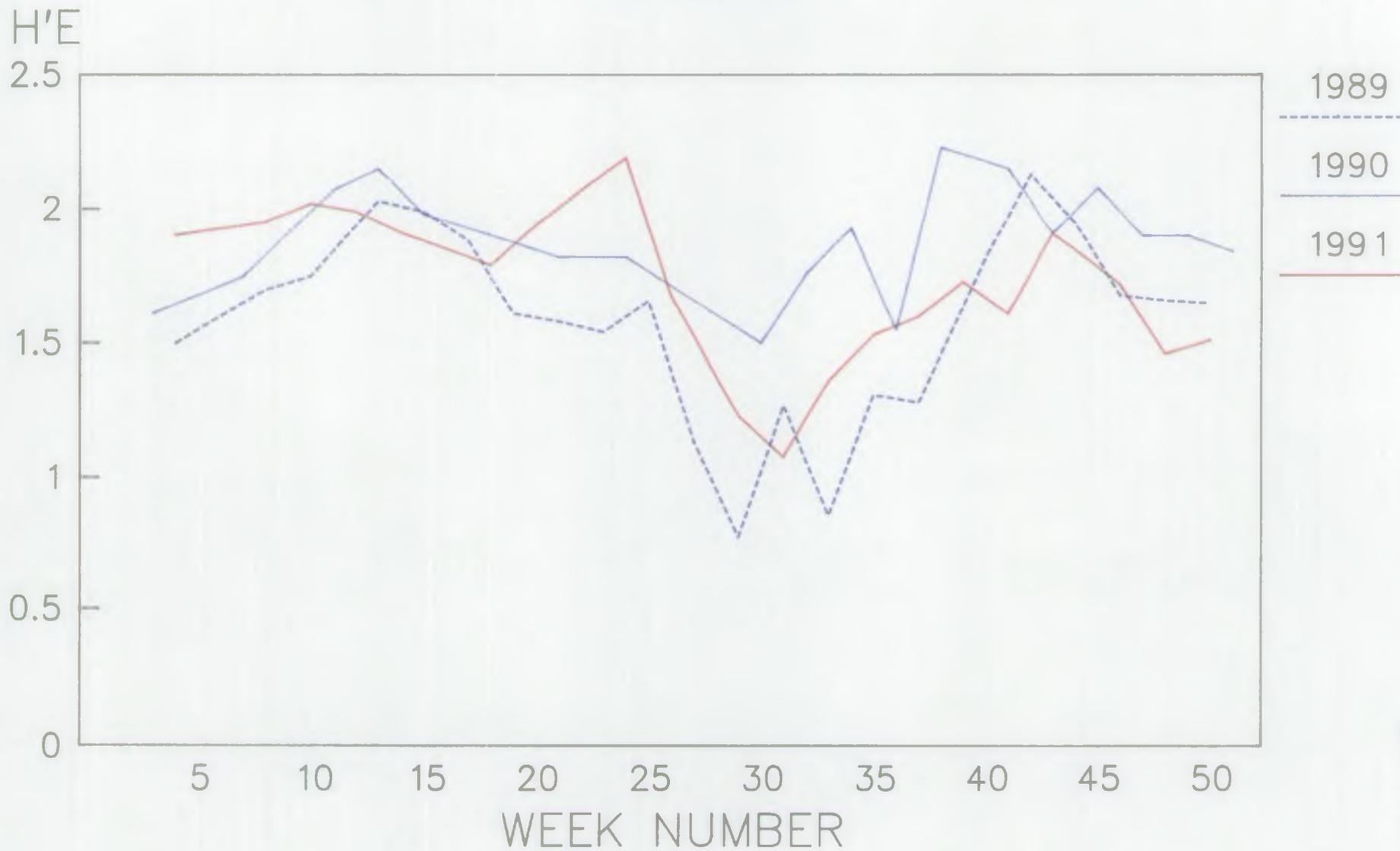


Figure 4

TABLES

Table 1

SUMMARY TABLE OF TOTAL NUMBER OF FISH RECORDED
DURING WEST THURROCK SURVEYS

	1988	1989	1990	1991
TOTAL No OF FISH RECORDED	30,258	30,540	28,179	24,392
No OF SAMPLES	18	22	17	21
MEAN No OF FISH PER SAMPLE	1,681	1,388	1,658	1,162

Table 2

WEST THURROCK 1990 SURVEY
SPECIES LIST

<u>COMMON NAME</u>	<u>SPECIES</u>	<u>TOTAL</u>
SAND/COMMON GOBY	<i>Pomatoschistus minutus/microps</i>	6,415
BASS	<i>Dicentrarchus labrax</i>	5,683
SMELT	<i>Osmerus eperlanus</i>	4,361
HERRING	<i>Clupea harengus</i>	2,926
WHITING	<i>Merlangius merlangus</i>	2,504
FLOUNDER	<i>Platichthys flesus</i>	1,303
DOVER SOLE	<i>Solea vulgaris</i>	1,145
SPRAT	<i>Sprattus sprattus</i>	965
5-BEARDED ROCKLING	<i>Ciliata mustela</i>	786
POUTING	<i>Trisopterus luscus</i>	742
NILSSONS PIPEFISH	<i>Syngnathus rostellatus</i>	361
EEL	<i>Anguilla anguilla</i>	225
THIN LIPPED MULLET	<i>Liza ramada</i>	140
3-SPINED STICKLEBACK	<i>Gasterosteus aculeatus</i>	119
POOR COD	<i>Trisopterus minutus</i>	115
POGGE	<i>Agonus cataphractus</i>	95
TUB GURNARD	<i>Trigla lucerna</i>	76
DAB	<i>Limanda limanda</i>	31
PERCH	<i>Perca fluviatilis</i>	31
TRANSPARENT GOBY	<i>Aphia minuta</i>	24
GREAT PIPEFISH	<i>Syngnathus acus</i>	22
DRAGONET	<i>Callionymus lyra</i>	16
RED GURNARD	<i>Aspitrigla cuculus</i>	16
BLACK GOBY	<i>Gobius niger</i>	14
COD	<i>Gadus morhua</i>	14
SCAD	<i>Trachurus trachurus</i>	12
PLAICE	<i>Pleuronectes platessa</i>	9
BULL ROUT	<i>Myoxocephalus scorpius</i>	2
COMMON SEA SNAIL	<i>Liparis liparis</i>	4
GREATER SAND EEL	<i>Hyperlopus immaculatus</i>	3
LESSER WEEVER	<i>Trachinus vipera</i>	3
PILCHARD	<i>Sardina pilchardus</i>	2
SEA SCORPION	<i>Taurulus bubalis</i>	2
BALLAN WRASSE	<i>Labrus bergylta</i>	1
BLACK SEA BREAM	<i>Spondylisoma cantharus</i>	1
BREAM	<i>Abramis brama</i>	1
BRILL	<i>Scopthalmus rhombus</i>	1
CARP	<i>Cyprinus carpio</i>	1
DACE	<i>Leuciscus leuciscus</i>	1
GOLDEN MULLET	<i>Liza auratus</i>	1
GREY GURNARD	<i>Eutrigla gurnardus</i>	1
HADDOCK	<i>Melanogrammus aeglefinus</i>	1
RAITT'S SAND EEL	<i>Ammodytes marinus</i>	1
RED MULLET	<i>Mullus surmuletus</i>	1
TADPOLE FISH	<i>Raniceps raninus</i>	1
TWAITE SHAD	<i>Alosa fallax</i>	1
CONGER EEL	<i>Conger conger</i>	1*
HAKE	<i>Merluccius merluccius</i>	1*
RIVER LAMPREY	<i>Lampetra fluviatilis</i>	1*
ROACH	<i>Rutilus rutilus</i>	1*

* Found by National Power staff

Table 3

WEST THURROCK 1991 SURVEY
SPECIES LIST

<u>COMMON NAME</u>	<u>SPECIES</u>	<u>TOTAL</u>
HERRING	<i>Clupea harengus</i>	4,504
SAND/COMMON GOBY	<i>Pomatoschistus minutus/microps</i>	4,343
WHITING	<i>Merlangius merlangus</i>	3,508
FLOUNDER	<i>Platichthys flesus</i>	2,962
SMELT	<i>Osmerus eperlanus</i>	2,481
BASS	<i>Dicentrarchus labrax</i>	1,903
DOVER SOLE	<i>Solea vulgaris</i>	1,356
SPRAT	<i>Sprattus sprattus</i>	1,269
NILSSONS PIPEFISH	<i>Syngnathus rostellatus</i>	518
POUTING	<i>Trisopterus luscus</i>	435
POOR COD	<i>Trisopterus minutus</i>	306
EEL	<i>Anguilla anguilla</i>	220
3-SPINED STICKLEBACK	<i>Gasterosteus aculeatus</i>	82
THIN LIPPED MULLET	<i>Liza ramada</i>	72
PLAICE	<i>Pleuronectes platessa</i>	64
SCAD	<i>Trachurus trachurus</i>	62
TUB GURNARD	<i>Trigla lucerna</i>	59
COD	<i>Gadus morhua</i>	48
POGGE	<i>Agonus cataphractus</i>	32
5-BEARDED ROCKLING	<i>Ciliata mustela</i>	26
DAB	<i>Limanda limanda</i>	25
TRANSPARENT GOBY	<i>Aphia minuta</i>	22
GREAT PIPEFISH	<i>Syngnathus acus</i>	21
RED GURNARD	<i>Aspitrigla cuculus</i>	14
BULL ROUT	<i>Myoxocephalus scorpius</i>	12
LESSER SAND EEL	<i>Ammodytes tobianus</i>	11
BLACK GOBY	<i>Gobius niger</i>	9
DRAGONET	<i>Callionymus lyra</i>	8
GREATER SAND EEL	<i>Hyperlopus immaculatus</i>	4
RED MULLET	<i>Mullus surmuletus</i>	3
LESSER WEEVER	<i>Trachinus vipera</i>	2
RIVER LAMPREY	<i>Lampetra fluviatilis</i>	2
4-BEARDED ROCKLING	<i>Rhinonemus cimbricus</i>	1
ANCHOVY	<i>Engraulis encrasicolus</i>	1
ATLANTIC MACKEREL	<i>Scomber scombrus</i>	1
BREAM	<i>Abramis brama</i>	1
COMMON SEA SNAIL	<i>Liparis liparis</i>	1
GREY GURNARD	<i>Eutrigla gurnardus</i>	1
LEMON SOLE	<i>Microstomus kitt</i>	1
ROACH	<i>Rutilus rutilus</i>	1
SALMON	<i>Salmo salar</i>	1
THICK LIPPED MULLET	<i>Chelon labrosus</i>	1

Table 4

**MOST COMMON SPECIES RECORDED AT WEST THURROCK
RANKED BY ORDER OF ABUNDANCE FOR EACH YEAR**

SPECIES	1988	1989	1990	1991
HERRING	2	3	4	1
SPRAT	10	9	8	8
WHITING	6	5	5	3
POUTING	15	15	10	10
POOR COD	17	18	15	11
COD	22	32	25	18
SOLE	5	7	7	7
FLOUNDER	3	4	6	4
PLAICE	13	19	27	15
DAB	11	13	18	21
SAND GOBY	1	1	1	2
EEL	12	11	12	12
3SP. STICKLEBACK	14	12	14	13
THIN LIP MULLET	-	-	13	14
SMELT	4	6	3	5
SCAD	30	29	26	16
TUB GURNARD	20	22	17	17
BASS	8	2	2	6
POGGE	9	10	16	19
5-BR. ROCKLING	24	26	9	20
N. PIPEFISH	7	8	11	9

Table 5

SUMMARY OF SELECTED SPECIES ABUNDANCE DATA 1989-91

SPECIES		PERIOD OF PEAK ABUNDANCE	SIZE RANGE DURING PEAK	MODAL SIZE DURING PEAK	ANNUAL SIZE RANGE
DOVER SOLE	89	Mid-April	6-17 cms	8 cms	5-42 cms
	90	March	6-13 cms	8 cms	3-37 cms
	91	May	7-32 cms	10 cms	4-32 cms
FLOUNDER	89	May-August	3-29 cms	4 cms	3-34 cms
	90	June-July	3-17 cms	4 cms	3-38 cms
	91	June-August	3-23 cms	5 cms	3-31 cms
HERRING	89	Jan-Feb	5-24 cms	10 cms	3-24 cms
	90	January	5-15 cms	11 cms	3-24 cms
	91	Jan-Feb & Nov	4-19 cms	8 cms (Jan) 10 cms (Nov)	4-26 cms
SPRAT	89	January	4-14 cms	9 cms	2-14 cms
	90	January	5-13 cms	9 cms	3-13 cms
	91	January & March	4-17 cms	5 cms (Jan) 6 cms (Mar)	4-12 cms
BASS	89	September	4-10 cms	6 cms	4-22 cms
	90	Jan & Dec	5-23 cms	7 & 9 cms	3-23 cms
	91	Jan-Feb	5-25 cms	8 cms	5-28 cms
SMELT	89	Jan-March	7-27 cms	10 cms	4-27 cms
	90	October	7-19 cms	9 cms	6-23 cms
	91	Jan-May	7-21 cms	10 cms	7-23 cms
WHITING	89	November	7-24 cms	13 cms	6-25 cms
	90	October	7-18 cms	9 cms	5-29 cms
	91	Nov-Dec	7-26 cms	13 cms	4-26 cms

APPENDIX

WEST THURROCK SAMPLE SUMMARY 1990

	15/1	12/2	28/3	12/4	25/5	11/6	23/7	8/8	22/8	6/9	20/9	8/10	22/10	6/11	21/11	5/12	20/12
POGGE	5	1	13	30	2									4	5	16	19
GT SAND EEL		1		2													
RAITT'S SAND EEL							1										
EEL	45	22	10		10	4	8	21	7	6	27	23	11	11	11	2	7
BRILL													1				
DRAGONET		2	2					2				1			1		8
SCAD					1							3	2	1	2	1	1
HERRING	713	401	40	18	8	1	33	63	15	19	67	266	199	179	176	281	447
PILCHARD												1					1
TWAITE SHAD											1						
SPRAT	288	124	32	8	11	3	3	1	8	10	21	63	34	72	49	110	128
BULL ROUT	1															1	
SEA SCORPION														1	1		
BREAM	1																
CARP		1															
DACE	1																
COD												7	6				1
HADDOCK																	1
POOR COD	7	9	10	15	5			3	2	1	12	5		1		11	34
POUTING	1	2	2	2	1	2	1	1	3	1	79	123	137	169	89	76	53
WHITING	2		23	72	1				3	5	164	609	694	457	193	194	87
5 BD ROCKLING	1	2	2					1	4	16	172	221	189	75	75	18	10
TADPOLE FISH			1														
3 SP STICKLEBACK	13	14	4	2	20	4	16	9	6	2	2	6	5	3	4	4	5
BLACK GOBY								3	2		2	5			1	1	
SAND GOBY	1126	42	80	320	1	1	74	355	91	608	208	298	281	466	787	936	741
TRANSPARENT GOBY			2	20	2												
BALLAN WRASSE											1						
SEA SNAIL											1	1					2
THIN LIP MULLET	85	33				1						1		5		6	9
GOLDEN MULLET													1				
RED MULLET												1					
SMELT	33	213	32	22	5	6	111	216	173	278	364	663	788	423	447	421	166
PERCH	20	11															
DAB	3	2		2					1		2	2	2	4	3	5	5
FLOUNDER	45	25	46	18	180	63	372	163	100	39	92	67	36	30	12	10	5
PLAICE						1						2	5				1
BASS	1386	509	147	150	71	10	29	36	194	234	212	299	101	496	266	614	929
SOLE	28	5	239	240	94	34	38	89	90	69	47	57	28	25	20	19	23
BLACK SEA BREAM												A					
GT PIPEFISH			6			2		A	1	1		1	1	7	1	2	
NILSSONS PIPEFISH	10	2	46	138	31	30	2	5	14	16	2	2	10	7	7	21	18
LESSER WEAVER			2						1								
GREY GURNARD	1																
RED GURNARD								1	1	2	3	6	1	1	1		
TUB GURNARD	3			2	2	3					2	7	3	15	6	10	23
No. of Species	23	21	19	17	18	14	12	17	19	16	23	27	21	22	22	25	22
Diversity (H'e)	1.61	1.75	2.15	1.98	1.82	1.82	1.50	1.75	1.93	1.55	2.23	2.15	1.91	2.08	1.90	1.90	1.84

(A=Additional Species)

WEST THURROCK SAMPLE SUMMARY 1991

	21/1	18/2	4/3	18/3	2/4	29/4	16/5	30/5	14/6	28/6	15/7	29/7	12/8	28/8	10/9	25/9	9/10	25/10	11/11	25/11	10/12	
POGGE	22	3	1	A	1			1									1		2		1	
GT SAND EEL		1		1			1	1														
LESSER SAND EEL	2	1	1	5	2																	
EEL	7	5	3	11	12	10	21	11	12	2	6	6	14	15	5		9	41	13	8	9	
DRAGONET	2	A			1										2	2				1		
SCAD								1									1	50	6	3	1	
ANCHOVY																	1					
SPRAT	224	209	82	266	1	35	119	65	30	40	4	24	8	2	13	45	40	35	12	9	6	
HERRING	539	561	290	220	26	10	40	20	10	72	50	35	8	17	33	22	122	150	431	1394	454	
BULL ROU															5	5		1	1			
BREAM	1																					
ROACH																					1	
COD																	1	5	8	19	15	
POOR COD	65	51	35	5		9	7	6	2	3	1					2	1	6	6	8		
POUTING	80	86	47	16	14	36	64	17	33	17	2	1	1	2			1	3	3	3	9	
WHITING	39	3	1	7	5	3				247	51	22				7	118	490	440	484	716	872
4 BD ROCKLING	1																					
5 BD ROCKLING	4	1	2	2											2		4	1	4	2	4	
3 SP STICKLEBACK	6	17	11	11	4	1	2			2	2		1	5	2		1	5	4	4	4	
BLACK GOBY	2			3							1									1		
SAND GOBY	1015	198	75	20	119	17	2		2	2	21	31	71	283	350	430	551	136	373	375	272	
TRANSPARENT GOBY						2	12	3	3	2												
SEA SNAIL		1																				
THIN LIP MULLET	13	26	10	2	1								1	A				3	1	15		
THICK LIP MULLET															A							
RED MULLET																		1	2			
SMELT	328	289	147	174	159	332	347	66	37	83	104	73	79	32	50	22	24	19	47	40	29	
LAMPERN																		1	1			
LEMON SOLE	1																					
DAB	4	5											1	2	2	5	3		2		1	
FLOUNDER	15	12	10	15	12	26	22	28	20	398	806	661	402	161	170	60	64	45	26	11	8	
PLAICE							3	12	13	3	4	1	1	3	5	12	4	3				
MACKEREL																				1		
SALMON						1																
BASS	386	445	173	149	162	33	36	27	5	2	14	6	8	10	8	48	47	54	42	168	80	
SOLE	40	30	58	165	74	55	232	90	65	60	128	36	89	71	65	45	23	10	7	7	6	
NILSSONS PIPEFISH	4	1		12	9	80	107	160	32	13	1		1	2	5	5	4	4	13	29	36	
GT PIPEFISH	1				5	6	1	1			1		1			2		1	1	1	1	
LESSER WEAVER											1									1		
GREY GURNARD	1																					
RED GURNARD											A					2	1	2	6	2	1	
TUB GURNARD	3	A			1		3	2		3		1			A		1	5	11	20	9	
No. of Species	26	22	16	19	18	16	17	17	13	16	18	12	14	15	18	17	23	22	27	23	21	
Diversity (H'e)	1.90	1.95	2.02	1.99	1.91	1.79	1.94	2.07	2.19	1.68	1.23	1.08	1.36	1.53	1.6	1.73	1.61	1.91	1.72	1.46	1.51	

(A=Additional Species)