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SALMON PARR SURVEYS 1992-93

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## SUMMARY

A total of twelve key sites on seven nursery tributaries were surveyed by electrofishing between October 1992 and March 1993.

The surveys were undertaken in order to assess the performance of salmon parr and fry stocked during spring 1992.

Parr survival varied significantly both within and between tributaries with survival densities ranging from 0 to  $0.082\text{m}^{-2}$ , and survival estimates of 0 to 11.1%.

The best parr performance was in the River Wey (South Branch) with a mean survival density of  $0.07\text{m}^{-2}$  (10% survival Appendix IV). This was approximately four times better than the next successful nursery stream (River Chess), and was attributed to consistently good habitat and water quality.

The survey results for the River Chess were disappointing in comparison with the previous year, especially at Mountwood Ford (survival 1.3%) which had shown the best performance in 1991 (25% survival). This was thought to be related to the poor condition of the parr (Lakeland) prior to stocking since river conditions had remained similar in both years.

The results of the River Enborne and River Loddon Surveys indicated parr performance to be poor, with no survival at the Enborne site.

The North Wey showed a moderate parr survival density ( $0.01\text{m}^{-2}$ ).

The three key sites in the River Lambourn produced variable results thought to be related to the different habitat type at each site. The below average parr survival at Moor Bridge Farm (LAAP) was probably the result of extensive weed cutting activities, shortly before the survey was undertaken.

The results for fry survival in the Pipestream were reasonable and indicated that fry growth is extremely fast in lowland Thames Tributaries with a proportion of fish becoming smolts after only one year.

A review of the long term survival densities of all the stocked nursery streams is due to be produced in 1993.

## INTRODUCTION

Each year, as part of the Thames Salmon Rehabilitation Scheme, up to 130,000 salmon parr are stocked into selected tributaries of the River Thames. The stocked areas are chosen according to their habitat, water quality and accessibility.

Following stocking, the parr intra- and intercompete in order to establish territories and to find food until the following spring when they become smolts and migrate to sea.

The performance of the parr in these tributaries is assessed each year by electrofishing key sites (ie; sites representative of the stocked sections of each river) during the winter months. Many factors will affect the growth and survival of the parr over this time including the condition of the fish at stocking, source of fish, flows, water quality, temperature, food availability and habitat quality.

Previous surveys have shown that stocking of these rivers is effective, and that the habitat quality in most of them has not deteriorated in spite of prolonged low flows up until last summer.

In spring 1992, 127,613 salmon parr originating from a number of sources were stocked into eight Thames tributaries. Sources included Thames Returnee progeny (produced by crossing Thames adult returnees with other genetic sources), and donations or purchases from Joseph Johnston, Lakeland smolt and Clearwell fish farms.

12,265 fed fry donated by Unilever Research were also stocked into two carrier streams of the River Kennet - the Pipestream and the Lambstream.

The parr were trickle-stocked throughout most sections in order that any suitable territories within a section could be occupied straight away.

Three spot stockings were performed in the upper end of the River Lambourn since it is not yet clear whether this stocking practice is effective.

Twelve electrofishing surveys were undertaken on seven of the stocked nursery streams between October 1992 and February 1993 at the key sites.

This report presents and discusses the results of these surveys.

## METHODS

A total of twelve electrofishing key sites were surveyed quantitatively on seven stocked nursery streams between October 1992 and February 1993.

Each site was a minimum of 100m in length and was enclosed with a stopnet at each end. Two or three runs were performed at each site to give a good catch depletion using pulsed DC equipment.

Details of each fish, including species, fork length and weight were recorded on the Husky Hunter data logger along with presence of minor species, physical measurements and habitat details.

All data was then downloaded and processed using the Fisheries Information System (FINS) and graphics were then produced using Freelance Plus.

Water quality and flow data was also obtained for each river.

Three key sites on the South Wey and Lambourn were also HABSCORED as part of a National R&D Project.

## RIVER LODDON

Survey Site	Site Code	NGR	Stocking Density m <sup>-2</sup>
1. Lodge Farm	LOCA	SU 673543	0.6
2. Lillymill Ford	LOE6	SU 676591	0.25

### Introduction

#### a) Stocking Details

The River Loddon was trickle stocked in February 1992 with 13000 Joseph Johnston parr at a mean weight of 6.5g and a mean density of 0.43m<sup>-2</sup>. Actual stocking densities varied slightly between the different sections.

#### b) Survey Details

Two key sites on the River Loddon were electrofished as part of the parr survey program. This included one site at Lodge Farm (LOCA) which was fished in November 1992, and a second at Lillymill Ford (LOE6) which was fished in January 1993.

Due to persistently high flows over winter the latter site was electrofished later than originally planned, and even then conditions were not ideal with flows still quite high and coloured.

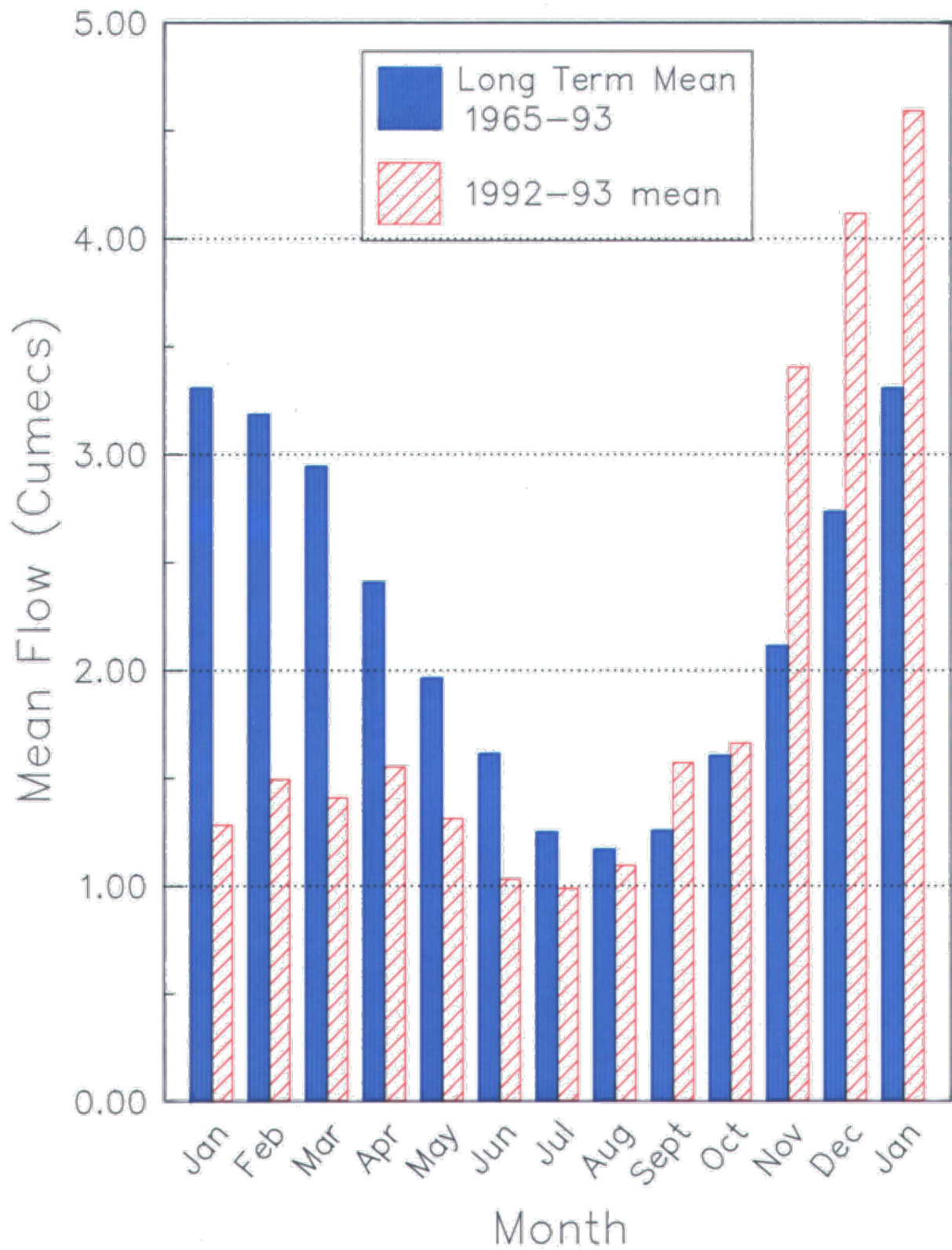
#### c) Flows (See fig 3a).

Monthly mean flows in the first half of 1992 continued to be significantly lower than the long-term mean flows, especially between January and March when they were about half of the normal flow of approximately 3 cumecs.

However, from September onwards the 1992 flows showed a steady increase to levels above the long term mean following a long spell of heavy rainfall.

Fig.3a

### River Loddon Flow Data Monthly Mean Flows At Sheepbridge



## SITE REPORT

WATERCOURSE : River Loddon  
SITE NAME : Lodge Farm  
SITE CODE : LOCA  
NGR : SU 673543  
DATE SAMPLED: 17.11.92

RQO : 1B  
EC DESIGNATED FISHERY: Salmonid

LAND OWNERSHIP : Mr Main  
ANGLING INTEREST: Dr A Gibberd

LENGTH: 100m                    MEAN WIDTH : 5m                    AREA: 500m<sup>2</sup>  
TEMP : -                            CONDUCTIVITY: -                    POPULATION METHOD: CR

### SUBSTRATE COMPOSITION (%)

BARE: 0    MUD & SILT: 25    GRAVEL: 70    STONES: 5    BOULDERS: 0

### WEED COVER (%)

EMERGENT: 0                    FLOATING: 0                    SUBMERGED: 40                    SHADE: 30

FLows AT TIME OF SURVEY: Low & Clear

### HABITAT QUALITY:

The habitat at this site was apparently well suited for juvenile salmonids with a good variety of riffles, glides and pools, plus a gravel substrate.

Both instream and bankside cover were also good and included stands of Ranunculus, plus tree roots and undercut banks.

### SURVEY RESULTS

During the first run it became apparent that the site was almost devoid of fish with only five brown trout (2 wild) and one loach being observed. Bullheads which are normally abundant were completely absent here.

Therefore no further runs within the site were performed and no data was recorded. Instead a single run was performed for several hundred metres upstream of the site where a ditch was found running from the farm into the river.

Downstream of the ditch only a few stocked trout and salmon parr were observed, however immediately upstream of the ditch there was a re-appearance of many small bullheads and a number of brown trout year classes plus other species.

An investigation into biological and chemical water quality data from routine samples failed to reveal any problems during the year.

## SITE REPORT

WATERCOURSE : River Loddon  
SITE NAME : Lillymill Ford  
SITE CODE : LOE6  
NGR : SU 676591 RQO : 1B  
DATE SAMPLED: 19.01.93 EC DESIGNATED FISHERY: Salmonid

LAND OWNERSHIP : The Duke of Wellington  
ANGLING INTEREST: Mr S Penney

LENGTH: 146m MEAN WIDTH : 9.5m AREA: 1387m<sup>2</sup>  
TEMP : 9°C CONDUCTIVITY: 750us POPULATION METHOD: CR

### SUBSTRATE COMPOSITION (%)

BARE: 0 MUD & SILT: 30 GRAVEL: 60 STONES: 9 BOULDERS: 1

### WEED COVER (%)

EMERGENT: 0 FLOATING: 0 SUBMERGED: 10 SHADE: 35

FLOWS AT TIME SURVEY: Quite high and fairly coloured. Had recently overtopped the banks.

### HABITAT QUALITY:

The site was a fairly straight section with steep banks, and ran through fields. The right bank provided some good cover and shade from trees, and the left bank was open.

Stands of Ranunculus provided some instream cover but this was difficult to quantify due to the nature of the flows.

The substrate was fairly mixed with gravel in the faster flowing areas and silt along the margins. At the time of the survey there was almost a complete absence of riffles with the site being dominated by deeper runs and glides.

### SURVEY RESULTS (See figs 3b, 3c).

The site showed a fairly diverse fish population structure, dominated by dace at a density of 0.04m<sup>-2</sup> (biomass 7.4gm<sup>-2</sup>), with other coarse fish species including 12 chub and 4 roach.

The five salmon captured gave a survival density of 0.004m<sup>-2</sup> (biomass 0.164gm<sup>-2</sup> compared to the stocking density of 0.25m<sup>-2</sup> (1.6% survival). Six brown trout (both wild and stocked) were also caught giving a density of 0.004m<sup>-2</sup>, as well as one escapee rainbow trout. Bullheads were also present.

The overall fish biomass of 12.6gm<sup>-2</sup> was below the target biomass set for an EC designated salmonid fishery.

FP65

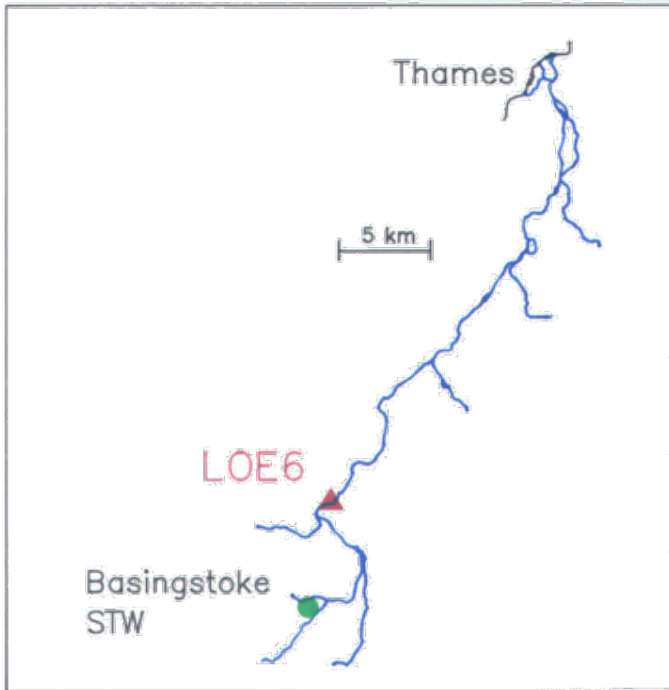
## Biomass, Density and Population for Species

14/06/92

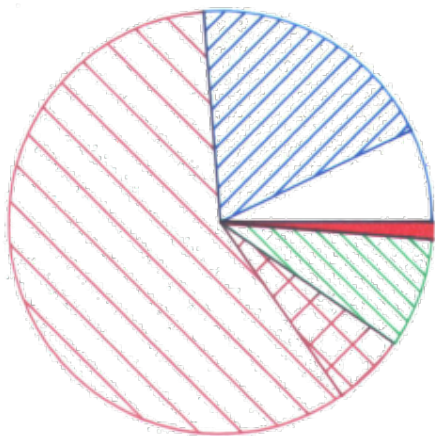
SITE LOE6 SURVEY: E0058 Salmon parr surveys DATE: 19/01/93

Species		Cutoff cm	Prob p	Biomass		D e n s i t y		Population		
				g/sqm	n/sqm	Upp	Low	Est	Upp	Low
=====										
BROWN TROUT										
Minimum Estimate	>	1.0	0.00	0.901	0.004	0.000	0.000	6	0	0
Minimum Estimate	<=	1.0		0.000	0.000			0		
CHUB										
Minimum Estimate	>	1.0	0.00	2.421	0.009	0.000	0.000	12	0	0
Minimum Estimate	<=	1.0		0.000	0.000			0		
DACE										
Carle&Strube	>	1.0	0.60	7.395	0.044	0.047	0.042	61	66	58
Minimum Estimate	<=	1.0		0.000	0.000			0		
ROACH										
Minimum Estimate	>	1.0	0.00	0.705	0.003	0.000	0.000	4	0	0
Minimum Estimate	<=	1.0		0.000	0.000			0		
RAINBOW TROUT										
Minimum Estimate	>	1.0	0.00	1.062	0.001	0.000	0.000	1	0	0
Minimum Estimate	<=	1.0		0.000	0.000			0		
SALMON										
Minimum Estimate	>	1.0	0.00	0.164	0.004	0.000	0.000	5	0	0
Minimum Estimate	<=	1.0		0.000	0.000			0		
Total biomass =				12.647 g/sqm		Total density =		0.065 n/sqm		

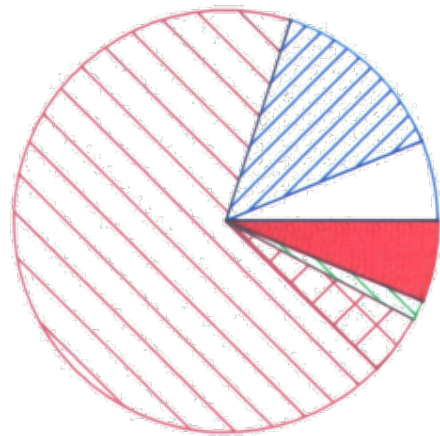
Fig.3b River Loddon 1992–1993  
 Site LOE6 Lillymill Ford  
 Biomass And Density



	Biomass (gm <sup>-2</sup> )	Density (nm <sup>-2</sup> )
Brown Trout	0.9	0.004
Chub	2.4	0.009
Dace	7.4	0.044
Roach	0.7	0.003
Rainbow Trout	1.1	0.001
Salmon	0.2	0.004
Total	12.6	0.065

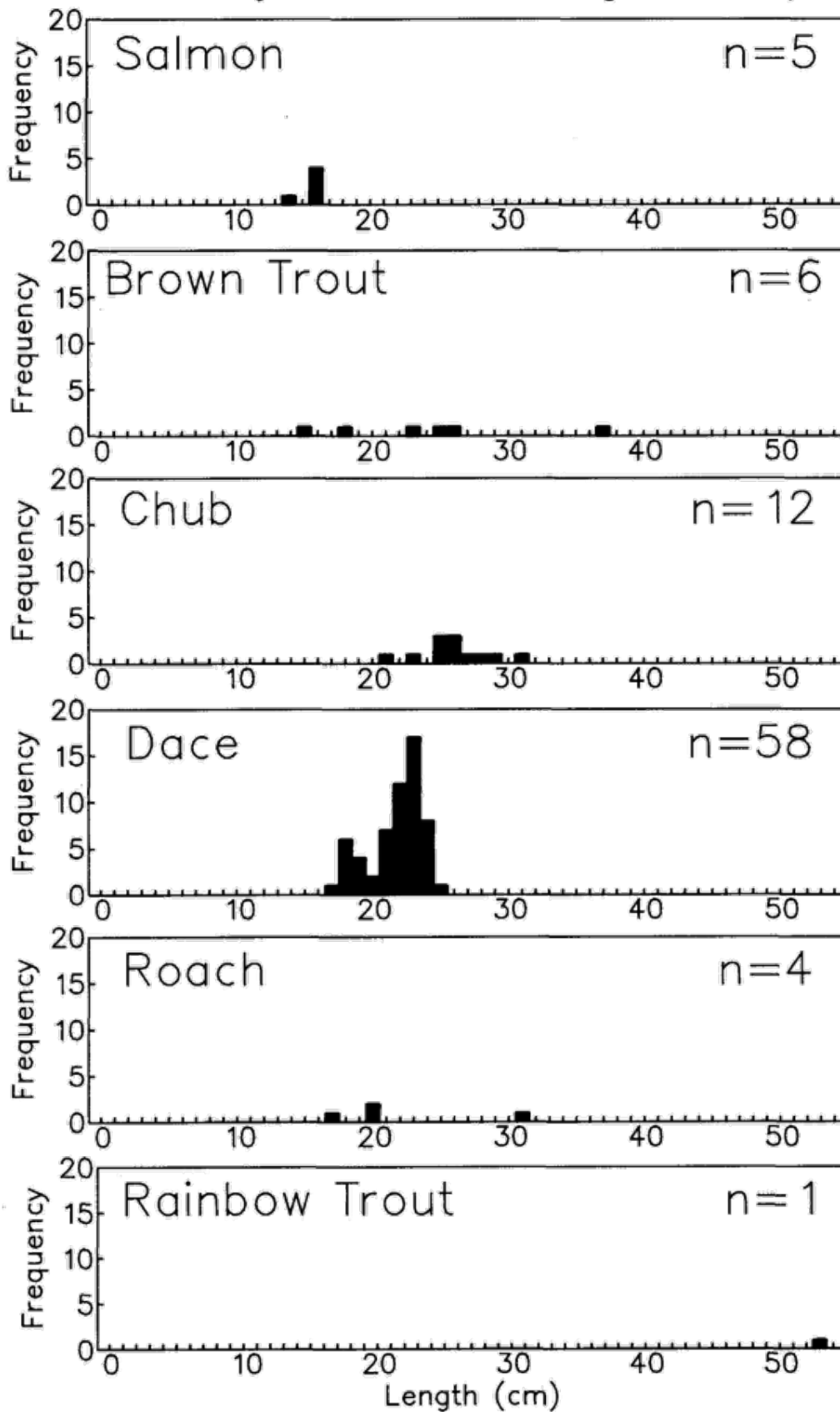


Biomass



Density

Fig.3c River Loddon 1992-1993  
Site LOE6 Lillymill Ford Length Frequency



## DISCUSSION - RIVER LODDON

The results showed that the salmon survival density ( $0.04\text{m}^{-2}$ ) at the Lillymill Ford site (LOE6) was poor in comparison with the stocking density of  $0.25\text{m}^{-2}$  (1.6% survival). However results from previous surveys indicated that survival had been consistently poor at this site, with densities no higher than  $0.017\text{m}^{-2}$  (in 1988). Wild brown trout recruitment was also poor here, with most trout consisting of large stocked fish, which may have predated on the salmon parr.

The poor juvenile salmonid survival was probably related to the unsuitable nature of the habitat, which was deep, slow moving, silty with impoundments throughout most of the stocked section. There were some discrete sections of riffle and good habitat, eg. at the survey site, however following heavy rainfall these areas became deep and fast flowing as river levels rose, possibly making it difficult for juvenile salmonids to maintain their position in the river during these conditions.

Another factor which may have suppressed juvenile salmonid survival was the questionable water quality of the Loddon. Although this reach passed its River Quality Objective class of 1B, (suitable for salmonids), it actually failed the EC fisheries directive for a designated salmonid fishery on ammonia and dissolved oxygen. This occurred because each system uses different criteria for assessing compliance. However, further investigation into the water quality is recommended, since there are potential problems from the Basingstoke STW and possibly from farms upstream of the section.

The results for the survey at Lodge Farm (LOCA) suggested that a short term acute water quality problem may have occurred at some time prior to the survey, wiping out the fish populations in this area without being detected in the routine water quality samples.

A further survey will probably be undertaken in 1993 if salmon are restocked into the section, which should give an indication of how the fish stocks have recovered over a year.

Based upon the parr survival at Lillymill Ford, an estimated population of 160 salmon remained out of the 10,000 fish originally stocked into this section of river. The results from the Lodge farm site will be disregarded here since they were not representative of the main stocked section of river.

## GENERAL DISCUSSION

The results for the 1992 parr surveys showed that, in general, survival was highly variable, both within and between tributaries and compared with previous years.

The highest parr survival was found at both key sites in the River Wey (South branch), with an increase over the previous years results in spite of continued low flows into the first half of 1992. This nursery stream has performed consistently well over the years with many sources of stocked salmon parr and also supports an excellent wild brown trout population. This is mainly due to the excellent salmonid habitat throughout much of the river, and consistently good water quality. Another reason for this success is possible because the South Wey is not heavily influenced by surface run off, and is therefore less subject to water quality problems and changes in the physical habitat caused by sudden increases in flow.

In contrast, the results for the River Chess Surveys in 1992 were disappointing compared with the previous year, when the site at Mountwood had shown the best survival rate. However, although salmon parr survival had decreased in 1992, the wild brown trout population was very encouraging, showing good recruitment of young fish, and therefore it was unlikely that the poor salmon survival was caused by river related problems.

It seemed most likely that the poor survival here was caused by the condition of the stocked parr (Lakeland) which had not adjusted well to the holding reservoir conditions prior to stocking.

The Rivers Enborne, North Wey and Lambourn which had also been stocked with this source of fish showed poor to moderate survival densities. However it cannot be assumed that this source of fish was the cause of the poor survival in all these rivers, since only a proportion of the cages holding Lakeland parr prior to stocking had suffered problems.

The River Enborne where no salmon parr were recaptured, and the North Wey where survival was moderate ( $0.01m^{-2}$ ) were comparable since they are both flashy rivers significantly affected by surface run off, and were both fished later than intended following a few months of very high flows during winter. It was also observed that numbers of coarse fish had decreased in both rivers compared with previous years even though the species diversity was still similar. Therefore it was possible that fish had emigrated out of the survey sites during flood conditions in search of more suitable habitats. It was also possible that these rivers were not suitable for salmonids since wild brown trout populations are historically poor, and predation from the dominant coarse fish populations may pose a significant threat to salmonid survival.

The three key sites in the River Lambourn showed a significant variation in parr survival which was largely attributed to the different nature of the habitat at each site. The survival at Moor Bridge Farm (LAAF) which was below average was almost certainly due to the extensive weed-cutting activities immediately prior to the survey.

The spot stocked site at Welford Park which has consistently shown poor survival was very wide and shallow, and the site at Dreweatt-Neate at the bottom of the stocked sections was immediately above a deep silty section containing many pike, although in the past it has performed well. This highlights the importance and difficulty in choosing representative site in the stocked nursery streams, especially those with only one key site.

Parr survival in the River Loddon was very poor for the third consecutive year at the Lillymill Ford site. Although this survey was also performed later than planned following a long period of high flows, the poor survival in 1992 may have been related to water quality problems since this section failed its EC directive and dissolved oxygen and ammonia although it still achieved its RQO of 1B. This was possible since each system uses slightly different criteria for assessing compliance with quality standards.

The key site at Lodge Farm was also thought to have suffered from an acute short term water quality problem resulting in the elimination of fish from this section of river earlier in the year. Unfortunately no evidence of this was found in routine water quality and biological samples and so it was not possible to reveal the cause of this. A further survey in 1993 will indicate how the recovery of the resident fish population has progressed over one year.

Unfortunately the key site at Hambridge (KTAX) in the River Kennet could not be sampled during these surveys, since the flows remained too high throughout the parr survey period. This was unfortunate since the parr stocked here were microtagged and adipose clipped Thames Progeny, and it was of special interest to obtain an indication of their performance since stocking.

A carrier stream of the River Kennet, the Pipestream which was stocked with salmon fry in June 1992 was surveyed in March and showed a moderate survival density ( $0.013\text{m}^{-2}$ ). The fish had grown exceedingly quickly from fry to large parr and pre-smolts by the time of the survey, and it was possible a number of fish had already migrated downstream prior to the survey, thus giving an underestimate of parr survival. There had also been observations made by the river keeper that some salmon had moved downstream during the summer months, which may also occur in other stocked streams, and could have major implications on parr survival estimates.

The relationship between stock densities and survival/recruitment has been subject to much research since it is not yet fully understood. It has been generally accepted that territorial behaviour by salmon parr places a finite limit on stream carrying capacity, ie; that survival density will remain at this limit above an optimum stocking density. However, research (Gee et al, 1978; Elson and Tuomi, 1975) suggests that recruitment may be depressed at high stocking densities resulting in a dome shaped recruitment curve, caused by the increased competition for territories, leading to a decrease in overall fitness.

No significant relationship between the moderate range of stocking densities and parr survival in the Thames tributaries has been found yet, however data is quite limited at many sites. It is also known that many other variables, eg; flow, temperature, food availability influence the carrying capacity, and hence parr survival, however it is unknown how these all interact. Therefore suggestions for causes of changes in parr survival in different years may only be made when there is a significant change in one of these variables, eg; water quality, habitat, etc.

It is planned to produce a review of the long term performance of the stocked nursery streams in relation to these factors later in the year.

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APPENDIX 1

Salmon Parr Stocking Sites - 1992

<u>Date</u>	<u>River</u>	<u>Map Reference</u>	<u>Number</u>	<u>Density</u>	<u>Source</u>	<u>Batch Mark</u>
12-02-92	Loddon	SU672543-SU677548	3,000	0.60m <sup>-2</sup>	JJ/QEII	-
		SU682583-SU692608	10,000	0.25m <sup>-2</sup>		-
13-02-92	Pang	SU591721-SU593722	540	0.18m <sup>-2</sup>	JJ/QEII	-
		SU604727-SU634738	4,924	0.29m <sup>-2</sup>		-
		SU635745-SU635764	1,836	0.18m <sup>-2</sup>		-
05-03-92	Chess	SU987994-SU996987	4,165	0.96m <sup>-2</sup>	Lakeland/QEII	-
		SU999987-TQ008987	3,360	0.65m <sup>-2</sup>		-
		TQ015988-TQ028989	6,955	0.63m <sup>-2</sup>		-
11-03-92	Lambourn	SU409732	300	Spot	Lakeland/QEII	-
		SU411730	300	Spot		-
		SU415725	300	Spot		-
		SU419723-SU429707	16,763	0.51m <sup>-2</sup>		-
		SU466686-SU470683	3,174	0.80m <sup>-2</sup>		-
12-03-92	Wey(S)	SU859321-SU827338	13,799	0.62m <sup>-2</sup>	Thames/Fowey/ OB/QEII	AC
		SU823341-SU817348	5,115	0.93m <sup>-2</sup>		-
		SU812357-SU803358	5,115	1.02m <sup>-2</sup>		-
25-03-92	Wey(N)	SU865446-SU868444	7,500	0.58m <sup>-2</sup>	Lakeland/QEII	-
07-04-92	Kennet	SU491672-SU520655	23,100	0.44m <sup>-2</sup>	Thames/Fowey OB/QEII	AC&CWT
		SU555656-SU568665	10,000	0.38m <sup>-2</sup>		Lakeland/QEII
22-04-92	Enborne	SU570649-SU590661	4,600	0.25 <sup>-2</sup>	Lakeland/QEII	-
15-05-92	Kennet	SU555657	1,000	Spot	Clearwell	-
18-05-92	Odney Stream		500	Spot	Clearwell	-
TOTAL NUMBER STOCKED :			----- 127,613 -----			

APPENDIX II

Salmon Fry Stocking Sections - 1992

<u>Date</u>	<u>River</u>	<u>Map Reference</u>	<u>Number</u>	<u>Density</u>	<u>Source</u>	<u>Batch Mark</u>
01-07-92	Pipestream	SU392676	3,222	2.27m <sup>-2</sup>	Marine Harvest (Unilever)	-
01-07-92	Lambstream	SU400675-SU412674	9,043	1.74m <sup>-2</sup>	Marine Harvest (Unilever)	-

TOTAL NUMBER STOCKED:                   -----  
  12,265  
  =====

KEY: AC (Adipose Clip)  
          CWT (Coded Wire Tag)

APPENDIX III

Salmon Survey Sites 1992

<u>River</u>	<u>Date</u>	<u>Site Name</u>	<u>Map Reference</u>	<u>Site Code</u>
River Enborne	03-02-93	Wasing Farm	SU581659	ENAC
River Lambourn	06-10-92	Welford Park	SU409732	LAAC
	08-10-92	Moor Bridge Farm	SU429707	LAAF
	25-11-92	Dreweatt-Neate	SU466685	LAAH
River Loddon	17-11-92	Lodge Farm		LOCA
	19-01-93	Lillymill Ford	SU684595	LOE6
River Wey(South)	13-10-92	Heronwater	SU839328	WSHE
	14-10-92	Hatch Farm	SU817346	WSHG
River Wey(North)	20-01-93	Tilfordmill Bridge	SU869444	WNEC
River Chess	21-10-92	Latimer Island	TQ001987	CHNB
	21-10-92	Mountwood	TQ025989	CHEB
River Pipestream (Kennet Carrier)	05-03-93	Pipestream	SU392676	KTAZ

APPENDIX IV

Parr Survival Summary 1992

STOCKING DETAILS

SURVEY DETAILS

<u>River</u>	<u>Date Stocked</u>	<u>Number Stocked</u>	<u>Stocking Density</u>	<u>Source</u>	<u>Survey Site</u>	<u>Date Fished</u>	<u>Site Survival Density</u>	<u>% Survival at site</u>	<u>Mean Density in River</u>	<u>Mean % Survival in River</u>
Enborne	22-04-92	4,600	0.25m <sup>-2</sup>	Lakeland/QEII	ENAC	03-02-92	0m <sup>-2</sup>	0	0m <sup>-2</sup>	0
Lambourn	11-03-92	20,837	0.56m <sup>-2</sup>	Lakeland/QEII	LAAC	06-10-92	(0.002m <sup>-2</sup> )	(1)	-	-
			(0.43m <sup>-2</sup> )		LAAF	08-10-92	0.011m <sup>-2</sup>	2.6	0.013m <sup>-2</sup>	2.2
			(0.8m <sup>-2</sup> )		LAAH	25-11-92	0.014m <sup>-2</sup>	1.75		
Loddon	12-02-92	13,000	0.43m <sup>-2</sup>	Joseph Johnston /QEII	LOCA	-	-	-	-	-
			(0.6m <sup>-2</sup> )		LOE6	19-01-92	0.004m <sup>-2</sup>	1.6	0.004m <sup>-2</sup>	1.6
Wey(S)	12-03-92	13,799	0.60m <sup>-2</sup>	Thames/Fowey/	WSHE	13-10-92	0.061m <sup>-2</sup>	11.1	0.07m <sup>-2</sup>	10.0
		10,230	(0.55m <sup>-2</sup> )	OB/QEII	WSHG	14-10-92	0.082m <sup>-2</sup>	8.8	-	-
			(0.98m <sup>-2</sup> )	Thames/Fowey/OB						
			(0.93m <sup>-2</sup> )							
Wey(N)	25-03-92	7,500	0.58m <sup>-2</sup>	Lakeland/QEII	WNEC	20-01-93	0.01m <sup>-2</sup>	1.9	0.01m <sup>-2</sup>	1.9
Chess	05-03-92	15,747	0.75m <sup>-2</sup>	Lakeland/QEII	CHNB	21-10-92	0.024m <sup>-2</sup>	3.7	0.018m <sup>-2</sup>	2.5
			(0.65m <sup>-2</sup> )		CHEB	21-10-92	0.012m <sup>-2</sup>	1.3	-	-
			(0.63m <sup>-2</sup> )							

STOCKING DETAILS

<u>River</u>	<u>Date Stocked</u>	<u>Number Stocked</u>	<u>Stocking Density</u>	<u>Source</u>
Kennet	06-04-92	23100	0.44m <sup>-2</sup>	Thames/Fowey/ OB/QEII
	07-04-92	10000	0.38m <sup>-2</sup>	Lakeland/QEII
	15-05-92	1000	-	Clearwell
Odney Stream	18-05-92	500	-	Clearwell
Pang	13-02-92	7300	0.24m <sup>-2</sup>	Joseph Johnston /QEII
<u>Fry</u>				
Pipestream	01-07-92	3222	2.27m <sup>-2</sup>	Marine Harvest/ (Unilever)
Lambstream	01-07-92	9043	1.74m <sup>-2</sup>	Marine Harvest/ (Unilever)

SURVEY DETAILS

<u>Survey Site</u>	<u>Date Fished</u>	<u>Site Survival Density</u>	<u>% Survival at site</u>	<u>Mean Density in River</u>	<u>Mean % Survival in River</u>
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
KTAZ	05-03-92	0.013m <sup>-2</sup>	0.6	0.013m <sup>-2</sup>	0.6m <sup>-2</sup>
-	-	-	-	-	-

APPENDIX I N.W.C. CLASSIFICATION OF RIVER QUALITY

River Class	Quality criteria	Remarks	Current potential uses
<b>1A Good Quality</b>	<p>Class limiting criteria (95 percentile)</p> <ul style="list-style-type: none"> <li>(i) Dissolved oxygen saturation greater than 80%</li> <li>(ii) Biochemical oxygen demand not greater than 3 mg/l</li> <li>(iii) Ammonia not greater than 0.4 mg/l</li> <li>(iv) Where the water is abstracted for drinking water, it complies with requirements for A2* water</li> <li>(v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)</li> </ul>	<ul style="list-style-type: none"> <li>(i) Average BOD probably not greater than 1.5 mg/l</li> <li>(ii) Visible evidence of pollution should be absent</li> </ul>	<ul style="list-style-type: none"> <li>(i) Water of high quality suitable for potable supply abstraction and for all other abstractions</li> <li>(ii) Game or other high class fisheries</li> <li>(iii) High amenity value</li> </ul>
<b>1B Good Quality</b>	<ul style="list-style-type: none"> <li>(i) DO greater than 60% saturation</li> <li>(ii) BOD not greater than 5 mg/l</li> <li>(iii) Ammonia not greater than 0.9 mg/l</li> <li>(iv) Where water is abstracted for drinking water, it complies with the requirements for A2* water</li> <li>(v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)</li> </ul>	<ul style="list-style-type: none"> <li>(i) Average BOD probably not greater than 2 mg/l</li> <li>(ii) Average ammonia probably not greater than 0.5 mg/l</li> <li>(iii) Visible evidence of pollution should be absent</li> <li>(iv) Waters of high quality which cannot be placed in Class 1A because of the high proportion of high quality effluent present or because of the effect of physical factors such as canalisation, low gradient or eutrophication</li> <li>(v) Class 1A and Class 1B together are essentially the Class 1 of the River Pollution Survey (RPS)</li> </ul>	Water of less high quality than Class 1A but usable for substantially the same purposes
<b>2 Fair Quality</b>	<ul style="list-style-type: none"> <li>(i) DO greater than 40% saturation</li> <li>(ii) BOD not greater than 9 mg/l</li> <li>(iii) Where water is abstracted for drinking water it complies with the requirements for A3* water</li> <li>(iv) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)</li> </ul>	<ul style="list-style-type: none"> <li>(i) Average BOD probably not greater than 5 mg/l</li> <li>(ii) Similar to Class 2 of RPS</li> <li>(iii) Water not showing physical signs of pollution other than humic colouration and a little foaming below weirs</li> </ul>	<ul style="list-style-type: none"> <li>(i) Waters suitable for potable supply after advanced treatment</li> <li>(ii) Supporting reasonably good coarse fisheries</li> <li>(iii) Moderate amenity value</li> </ul>
<b>3 Poor Quality</b>	<ul style="list-style-type: none"> <li>(i) DO greater than 10% saturation</li> <li>(ii) Not likely to be anaerobic</li> <li>(iii) BOD not greater than 17 mg/l. This may not apply if there is a high degree of re-aeration</li> </ul>	Similar to Class 3 of RPS	Waters which are polluted to an extent that fish are absent or only sporadically present. May be used for low grade industrial abstraction purposes. Considerable potential for further use if cleaned up
<b>4 Bad Quality</b>	Waters which are inferior to Class 3 in terms of dissolved oxygen and likely to be anaerobic at times	Similar to Class 4 of RPS	Waters which are grossly polluted and are likely to cause nuisance
<b>X</b>	DO greater than 10% saturation		Insignificant watercourses and ditches not usable, where the objective is simply to prevent nuisance developing
<b>Notes</b>	<ul style="list-style-type: none"> <li>(a) Under extreme weather conditions (eg flood, drought, freeze-up), or when dominated by plant growth, or by aquatic plant decay, rivers usually in Class 1, 2 and 3 may have BODs and dissolved oxygen levels, or ammonia content outside the stated levels for those Classes. When this occurs the cause should be stated along with analytical results</li> <li>(b) The BOD determinations refer to 5 day carbonaceous BOD (ATU). Ammonia figures are expressed as NH<sub>4</sub>.</li> <li>(c) In most instances the chemical classification given above will be suitable. However, the basis of the classification is restricted to a finite number of chemical determinands and there may be a few cases where the presence of a chemical substance other than those used in the classification markedly reduces the quality of the water. In such cases, the quality classification of the water should be down-graded on the basis of biota actually present, and the reasons stated.</li> <li>(d) EIFAC (European Inland Fisheries Advisory Commission) limits should be expressed as 95 percentile limits.</li> </ul>		
	* EEC category A2 and A3 requirements are those specified in the EEC Council Directive of 16 June 1975 concerning the Quality of Surface Water Intended for Abstraction of Drinking Water in the Member State.		

APPENDIX II N.R.A. - THAMES REGION. RIVER QUALITY OBJECTIVE PARAMETERS

Class 1A - High quality waters

1. Suitable for potable supply at defined abstraction points, and
2. Suitable for all other abstractions, and
3. Suitable for game or any other high class fisheries, (complying with the requirements of Directive 78/659/EEC for salmonid waters), and
4. Of high amenity value.

Class 1B - High quality waters

1. Used for the transport of high proportions of sewage effluent, trade effluent or urban run-off, and
2. Suitable for potable supply at defined abstraction points, and
3. Suitable for all other abstractions, and
4. Suitable for game or any other high class fisheries, (complying with the requirements of Directive 78/659/EEC for salmonid waters), and
5. Of high amenity value.

Class 2A - Fair quality waters

1. Suitable for potable supply after advanced treatment at defined abstraction points, and
2. Suitable for agricultural uses, and
3. Capable of supporting good coarse fisheries, (complying with the requirements of Directive 78/659/EEC for cyprinid waters), and
4. Of moderate amenity value.

Class 2B - Fair quality waters

1. Suitable for potable supply after advanced treatment at defined abstraction points, and
2. Suitable for agricultural uses, and
3. Capable of supporting reasonably good coarse fisheries, and
4. Of moderate amenity value.

Class 3 - Poor quality waters

1. Suitable for low grade industrial use, and
2. Not anaerobic or likely to cause a nuisance, and

3. Capable of supporting a restricted aquatic flora and fauna.

N.B. Not required to be capable of supporting a viable fishery.

Class 4 - Bad quality waters

1. Likely to cause a nuisance.

2. Flora and fauna absent or restricted to pollution tolerant organisms.

Class X - Insignificant watercourses

1. Watercourses, not usable, and not placed in Classes 1A to 4 above.

2. Capable of supporting a restricted flora and fauna, and

3. Not likely to cause a nuisance.

APPENDIX III E.C. WATER QUALITY CRITERIA FOR FISHERIES

LIST OF DETERMINANDS

Determinand	Salmonid Waters		Cyprinid Waters	
	G	I	G	I
(a) Temperature (max) (b) Temperature rise		$\leq 21.5^{\circ}\text{C}$ $\geq 1.5^{\circ}\text{C}$		$\leq 28^{\circ}\text{C}$ $\geq 3^{\circ}\text{C}$
Dissolved oxygen (mg/l O <sub>2</sub> )	50% $\geq 9$ 100% $\geq 7$	50% $\geq 9$	50% $\geq 8$ 100% $\geq 5$	50% $\geq 7$
pH		6-9		6-9
Suspended solids (mg/l)	$\leq 25$		$\leq 25$	
B.O.D. (A.T.U.) (mg/l)	$\leq 5^*$		$\leq 8^*$	
Nitrites (mg/l)	$\leq 0.2^*$		$\leq 0.5^*$	
Non-ionized ammonia (mg/l)	$\leq 0.005$	$\leq 0.025$	$\leq 0.005$	$\leq 0.025$
Total ammonium (mg/l NH <sub>4</sub> )	$\leq 0.04$	$\leq 1$	$\leq 0.2$	$\leq 1$
Total residual chlorine (mg/l HClO)		$\leq 0.005$		$\leq 0.005$
Zinc (mg/l)		$\leq 0.3$		$\leq 1$
Copper (mg/l)	$\leq 0.04$		$\leq 0.04$	

\* The revised G-values that have been set by the U.K. government