NATIONAL RIVERS AUTHORITY

THAMES REGION

UPPER THAMES AREA

SHILL BROOK

FISHERIES SURVEY

1989

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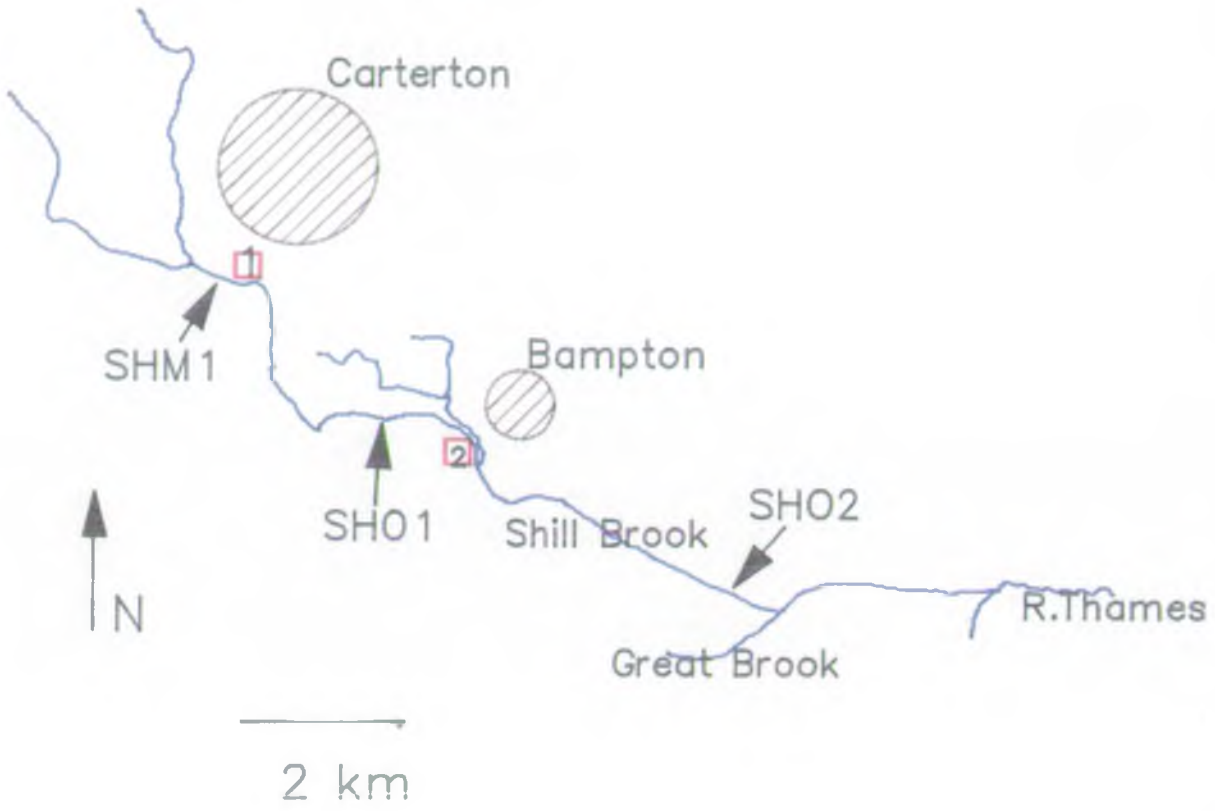
1. SUMMARY

In the upper reaches of the Shill brook (above Bampton) fish populations were found to be extremely low. There is evidence that this may have been caused by a number of pollution incidents.

In the lower reaches there is a good fish population, made up entirely of coarse fish. River engineering has reduced habitat quality whilst effluent from Carterton and Bampton sewage treatment works have reduced water quality. These factors may account for the absence of brown trout.

Fig 2.1 Map of Shill Brook



□ –Licensed Discharge (1)Carterton STW
(2)Bampton STW

→ –Fish Survey Sites

2 INTRODUCTION

2.1.DESCRIPTION OF WATERCOURSE

The source of the Shill Brook is near the tiny hamlet of Signet (SP244104), from where it flows south-easterly for 17km to its confluence with the Great Brook (SP347015). It has an average gradient of 1 in 425. The largest tributary,the Highmoor Brook, joins at Bampton.

2.2.GEOLOGY

The ephemeral source of the Shill Brook is fed by the Great Oolite limestone aquifer and water quality in the upper reaches is excellent.It then flows over bands of Forest Marble and Cornbrash onto the Oxford clay.

2.3.HYDROLOGY

The Shill Brook appears to rise quickly after heavy rain, but the level also falls rapidly afterwards. This may be due to surface runoff from roads and from the Brize Norton airfield. In general the water is of good clarity even after rain. Hydrological data for the Shill Brook is discontinuous and of limited value however they do show that mean summer flows at Bampton are approximately 0.1cumecs.

2.4.MAIN DISCHARGES

There are two significant sewage treatment works on the Shill Brook; Carterton STW (SP280049) discharging 2900cu.m/day and Bampton STW (SP323028) discharging an average of 420cu.m./day. Both works were failing to meet consent standards and were derogated on 25/9/90.

2.5.MORTALITIES

The Shill Brook has suffered from a number of pollution incidents causing fish mortalities during recent years (see Appendix VI). There have been several incidents in the vicinity of Bampton, the sources of which have never been traced. In addition there was a mortality above Black Bourton in May 1989 that represented a significant loss.

2.6.SUMMARY OF PREVIOUS FISHERY MANAGEMENT

Restocking by the Fisheries Department has been carried out on several occasions, to replace fish lost in the above incidents (Appendix VI).

2.7.LAND DRAINAGE

Historically the Shill Brook has been heavily modified downstream of Bampton. The channel is wider and straighter throughout most of this section compared to 50 years ago. Some heavy-handed maintenance dredging and over-zealous trimming during the last 4-5 years have also impoverished the habitat (both instream and bankside).

2.8.POLLUTION

In addition to the fish mortalities,there have been a number of incidents in the past where oil and glycol have entered the Highmoor Brook from Brize Norton airfield runoff. Recent pollution incidents are listed in Appendix VII.

3 AIMS AND OBJECTIVES

3.1 OVERALL AIMS OF SURVEYS

The National Rivers Authority (NRA) has a statutory obligation to maintain,improve and develop inland fisheries. To assist in meeting this obligation, NRA Thames Region fisheries staff have engaged upon a 5 year rolling programme of riverine fish population surveys to establish baseline data for each major watercourse in the Thames catchment.

3.2 RIVER CLASSIFICATION

River water quality is classified according to the National Water Council River Quality Objectives 1978 (RQO), (as amended by Thames Water Authority 1987).

Under the European Community Directive (78/659/EEC), some river zones are designated as capable of supporting either salmonid or cyprinid fish (Further details of the N.W.C. classification and the E.C. directive appear in the appendices).

The NRA Thames region have developed a site code classification system based upon the RQO and the E.C. directive (Appendix VII)

Fish biomass targets apply within the NRA Thames Region with respect to E.C.designated fisheries, viz:-

Cyprinid - 20g/sq.m
Salmonid - 15g/sq.m

3.3 SPECIFIC AIMS

This survey was particularly instigated to look at the effects of the two derogated sewage treatment works that discharge to the Shill Brook.

4 METHODS

4.1 SITE SELECTION

Sites were selected to represent local environmental conditions within the defined water quality zones, taking into account bed topography, known water quality impacts and access considerations.

4.2 CAPTURE AND DATA ACQUISITION

Catch-depletion electrofishing techniques using pulsed DC equipment were employed at each site and operated within enclosed sections of approximately 100m in length. Two or more runs were fished at each site depending on the catch efficiency. All fish captured were enumerated by species and the fork length was measured to the nearest mm. A subsample of up to 40 fish of each species at each site was weighed to the nearest gram. Scale samples from the shoulder of up to 3 fish from each 1cm size class were taken for age estimation.

Minor species such as stoneloach (Neomacheilus barbatulus), minnow (Phoxinus phoxinus) and bullhead (Cottus gobio) were noted for relative abundance.

Other relevant site details were taken and appear in the site reports.

All data acquired in the field was entered into a Husky Hunter data logger. This was later down loaded to a desk top computer.

Single electrofishing runs were made immediately upstream of the site (where practicable), with the aim of assessing the validity of results obtained in the survey site.

4.3 DATA ANALYSIS

The data was processed on the computer using the Fisheries Information System (FINS) software package. Graphics were generated using Freelance Plus V.3.0.

Age analysis was carried out using the following convention; fish in year class 1 are between 1 and 2 years old, fish in year class 2 are between 2 and 3 years old, etc. The assumed birth date varies according to species.

4.4 HEALTH EXAMINATION

A representative sample of fish were examined by a fish biologist for parasitic fauna. Where appropriate, tissue samples were analysed for heavy metals and pesticides.

4.5 MACROINVERTEBRATES

NRA biological staff are engaged upon a biological monitoring programme of the main watercourses in the region. Macroinvertebrate data from this source is presented in this report.

Invertebrate samples tend to reflect the physico-chemical variations which occur in the river and this provides a means of monitoring the aquatic environment on a continuous basis. The results were evaluated using the Biological Monitoring Working Party (BMWP) scoring system. Results obtained were compared to scores predicted for the site if it were unpolluted.

4.6 WATER QUALITY

River Quality Objectives (RQO) are set according to present water quality conditions and the uses to which the river is subjected. Discharge consents are determined to ensure that the RQO is met. NRA pollution officers take routine samples, from consented discharges to monitor compliance with consent conditions, and from river points to assess that the RQO is being met. River and discharge samples are also taken following reports of pollution.

The samples are analysed for different parameters depending on the source of the sample. The 3 main parameters are Biological Oxygen Demand (BOD), Ammonia and suspended solids. Routine sample results are held on a register available for public inspection.

Derogated Sewage Treatment Works
To allow privatisation of the water industry it was necessary for all sewage treatment works (STWs) to comply with their consent standards. Those that had been failing the consent conditions were set a more relaxed (derogated) standard while improvement works took place. This relaxed standard was set for a fixed time period after which conditions would revert to those in force prior to derogation, or a tighter standard where applicable.

4.7 HYDROLOGY

Data was obtained from the Water Resources Department of the NRA. Flow rates were measured at gauging weirs with minimum, mean and maximum flows being recorded on a daily basis. Monthly and annual figures are also calculated.

SITE REPORT

WATERCOURSE: Shill Brook

SITE NAME: Alvescot SITE CODE: SHM1

LOCATION: Between Alvescot Mill and Carterton S.T.W.

N.G.R.: SP278048 DATE FISHED: 7/12/89

METHOD: Upstream electrofishing,wading,2 anodes,1 run

ROD: 1B EC TARGET BIOMASS: N/A

HABITAT FEATURES

LENGTH: 138m MEAN WIDTH (RANGE): 5.5m (5.0-6.5m)

AREA: 759sqm MEAN DEPTH (RANGE): 0.3m (0.2-0.5m)

WATER TEMPERATURE: 10°C

SUBSTRATE COMPOSITION (%)

BARE: 0; MUD & SILT: 20; GRAVEL: 80; STONE: 0; BOULDER: 0

VEGETATION (% COVER)

SUBMERGED: 10; FLOATING: 0; EMERGENT: 5; SHADE: 50

DOMINANT PLANT SPECIES(AQUATIC):Apium,Sparganium,Fontinalis

DOMINANT PLANT SPECIES(BANKSIDE): Juncus,Thistles,Nettles

WATER LEVEL: Normal WATER CLARITY: Clear

PHYSICAL STRUCTURE OF SITE: Meandering,pool-riffle regime. Good tree cover with some undercut banks. Some good gravels.

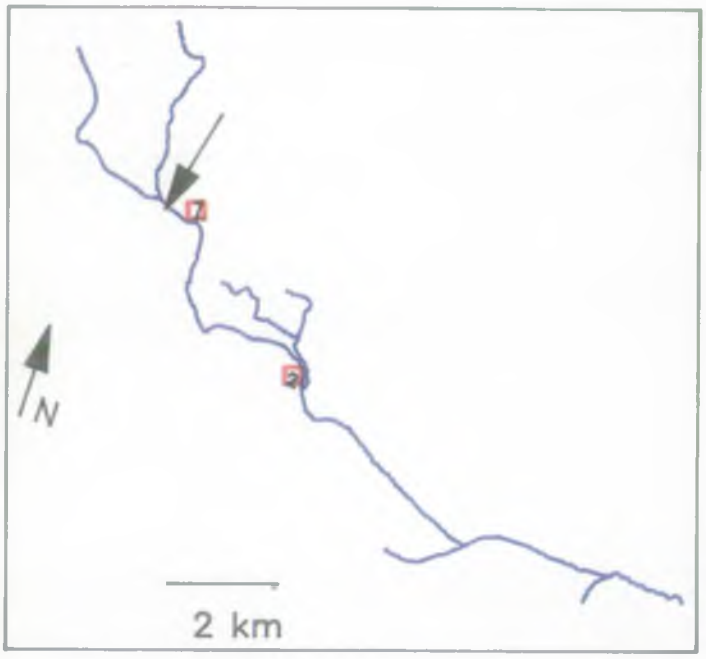
ADJACENT LAND USE: L.B. Permanent pasture
R.B.Permanent pasture

RIPARIAN OWNERS: L.B. Mr Jenkinson,Elmwood farms Ltd
R.B. Mr C.Edmonds,Alvescot

FISHING RIGHTS: L.B. Mr Jenkinson
R.B. Mr Edmonds

COMMENTS: An upstream run of 190m (mean width 4.4m) produced 1 stoneloach. No fish were observed in the survey section. This site was affected by an unknown pollutant on the 15th of May 1989 when 30 dead brown trout were counted. Survivors were observed at the time and there has been a restocking further downstream (Some of these stock fish may have been expected to migrate upstream). Abundant Gammarus and molluscs were observed but no caddis, stonefly or other insect larvae. Invertebrate sampling results have shown a steady decline at this site.A sample taken on the 16th of May gave a BMWP score of 68 (less than half the predicted score).

Fig 5.1.1 Site SHM1 (Alvescot) Biomass and Density



	Biomass (gm-2)	Density (nm-2)
TOTAL	0.0	0.000

SITE REPORT

WATERCOURSE: Shill Brook

SITE NAME: Black Bourton SITE CODE: SHO1

LOCATION: Downstream of Mill Farm

N.G.R.: SP 295042 DATE FISHED: 20/2/90

METHOD: Upstream electrofishing,wading,2 anodes,2 runs

RQO: 2B EC TARGET BIOMASS: N/A

HABITAT FEATURES

LENGTH: 121m MEAN WIDTH (RANGE): 3.6 (3.0-4.0m)

AREA: 436sqm MEAN DEPTH (RANGE): 0.3 (0.2-0.5m)

WATER TEMPERATURE: 12°C

SUBSTRATE COMPOSITION (%)

BARE: 5; MUD & SILT: 30; GRAVEL: 65; STONE: 0; BOULDER: 0

VEGETATION (% COVER)

SUBMERGED: 5; FLOATING: 0; EMERGENT: 30; SHADE: 5

DOMINANT PLANT SPECIES(AQUATIC): Callitriche.Sparganium

WATER LEVEL: Slightly above normal,strong flow
WATER CLARITY: Clear

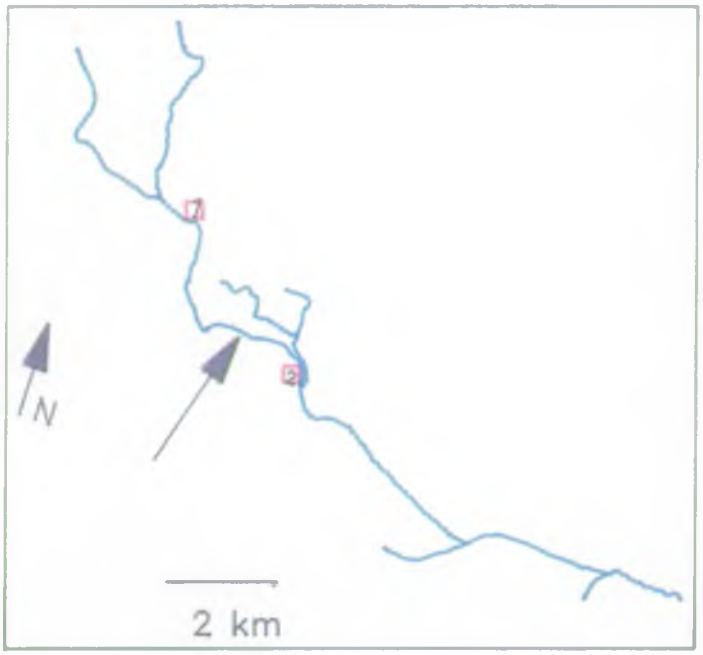
PHYSICAL STRUCTURE OF SITE: Meanders at upstream end of survey section and in the upstream run. Pool riffle regime with good gravels. Scouring currents have exposed bare clay in a few places. The upstream run had excellent tree cover, 2 bridges and a mill race.

ADJACENT LAND USE:L.B. Permanent pasture R.B. Arable

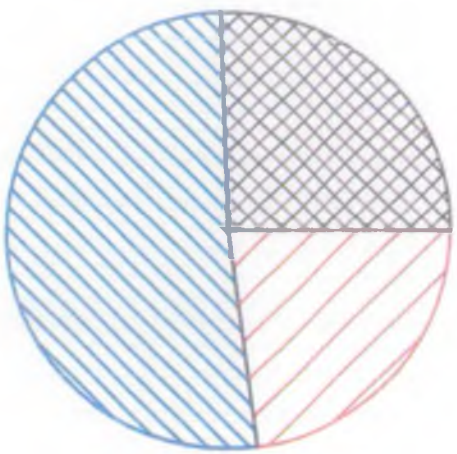
RIPARIAN OWNERS: L.B.& R.B. Mr Jenkinson
FISHING RIGHTS: L.B.& R.B. Mr Jenkinson

COMMENTS: Minnows,stoneloach and bullheads were abundant. Sticklebacks were common. The larger fish appeared healthy although the chub had an infestation of blackspot. Many of the minnows, stoneloach and bullheads were of specimen proportions, in addition many mature females were bloated with eggs. Despite the obvious success of these smaller species, only 7 fish (of larger species) were caught in the survey section, and 3 trout in an upstream run of 260m. The biomass of 2.7g/sqm falls well below the target of 15g/sqm (NRA:Thames region current levels of service)for salmonid waters. The paucity of fish does not appear to be caused by low oxygen levels, as the mill race provides excellent aeration. It seems likely that there is a connection with the problem at Alvescot where only 1 bullhead was caught and where a fish kill occured in May '89.

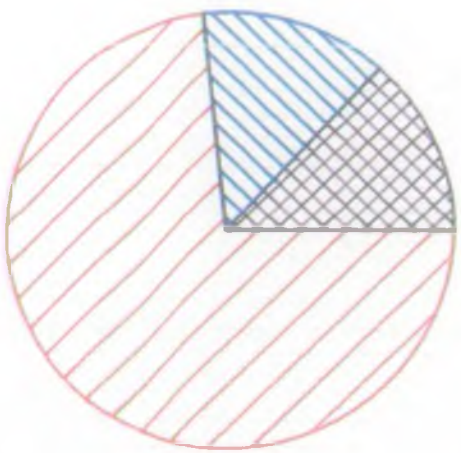
Fig 5.1.2a – Site SHO1 (Black Bourton) Biomass and Density



	Biomass (gm-2)	Density (nm-2)
Brown Trout	0.7	0.002
Chub	1.4	0.002
Dace	0.6	0.011
TOTAL	2.7	0.015



Biomass



Density

SITE REPORT

WATERCOURSE: Shill Brook

SITE NAME: Aston SITE CODE: SHO2

LOCATION: Farmers track out of Aston village

N.G.R.: SP343017 DATE FISHED: 7/12/89

METHOD: Upstream electrofishing,wading,2 anodes,2 runs

RQO: 2B EC TARGET BIOMASS: N/A

HABITAT FEATURES

LENGTH: 180m MEAN WIDTH (RANGE): 5.5m (5.3-5.7m)

AREA: 990sqm MEAN DEPTH (RANGE): 0.6m (0.4-0.7m)

WATER TEMPERATURE: 9°C

SUBSTRATE COMPOSITION (%)

BARE: 0; MUD & SILT: 35; GRAVEL: 60; STONE: 0; BOULDER: 5

VEGETATION (% COVER)

SUBMERGED: 30; FLOATING: 0; EMERGENT: 30; SHADE: 20

DOMINANT PLANT SPECIES(AQUATIC): Apium.Myriophyllum
(Sparganium.Callitriche present)

DOMINANT PLANT SPECIES(BANKSIDE): Rosebay willowherb,

WATER LEVEL: Low/normal WATER CLARITY: Clear

PHYSICAL STRUCTURE OF SITE: Man made channel (several decades ago). Straight, overwide, with fairly even depth and uniform sides. Natural processes have improved the habitat (banks of emergent vegetation deflecting and channelling the current). Gravel bed had thick silt deposition in places.

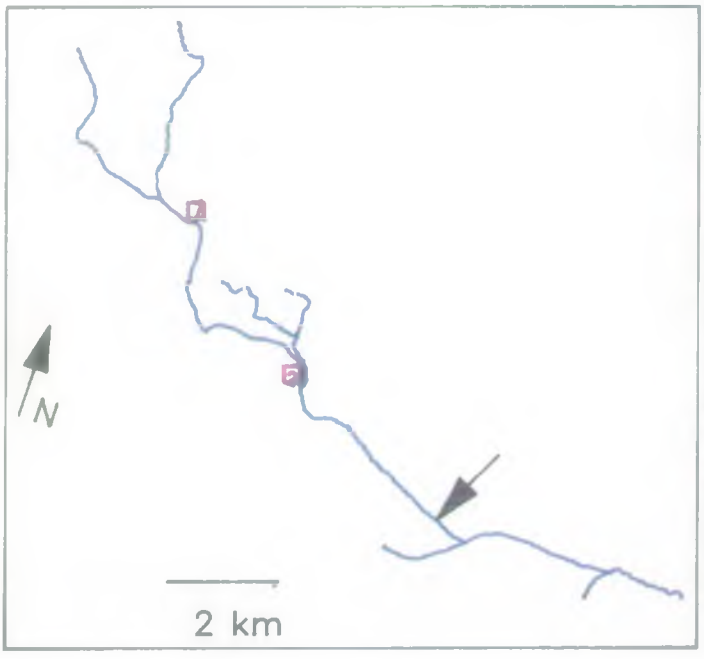
ADJACENT LAND USE: L.B. Arable
R.B. Arable

RIPARIAN OWNERS: L.B. Mr E.Baughan,Kingsway Farms,Aston
R.B. Mr Hughes,Refuge Farms,Buckland

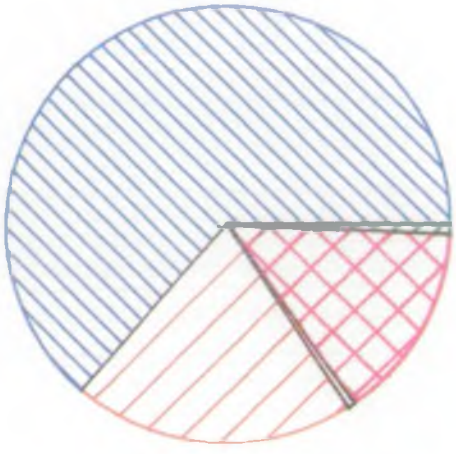
FISHING RIGHTS: L.B. Mr Baughan
R.B. Mr Hughes

COMMENTS: An upstream run of 137m produced 15kg of fish (a biomass of 19.9g/sqm). This was very similar to the biomass of 20g/sqm obtained in the survey section. The site achieves the target biomass (NRA Thames Region current levels of service) for a cyprinid site of 20g/sqm. Bullheads were abundant, stoneloach common and minnows were present. A number of cyprinid fry were also observed. 1 chub had a heavy infestation of blackspot.

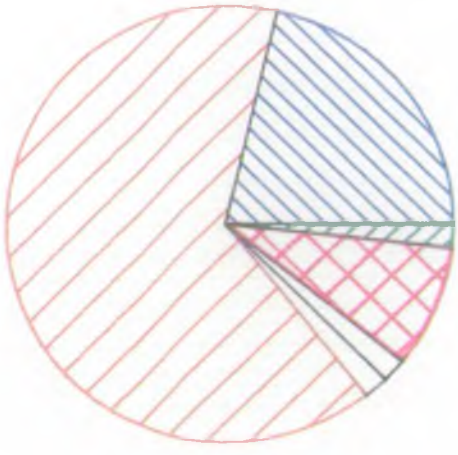
Fig 5.1.3a Site SH02 (Aston) Biomass and Density



	Biomass (gm-2)	Density (nm-2)
Chub	12.7	0.024
Dace	4.1	0.072
Gudgeon	0.1	0.002
Perch	0.1	0.002
Pike	2.9	0.010
Roach	0.2	0.002
TOTAL	20.0	0.112



Biomass



Density

Fig 5.1.3b – Site SH02 (Aston)
Length Frequency

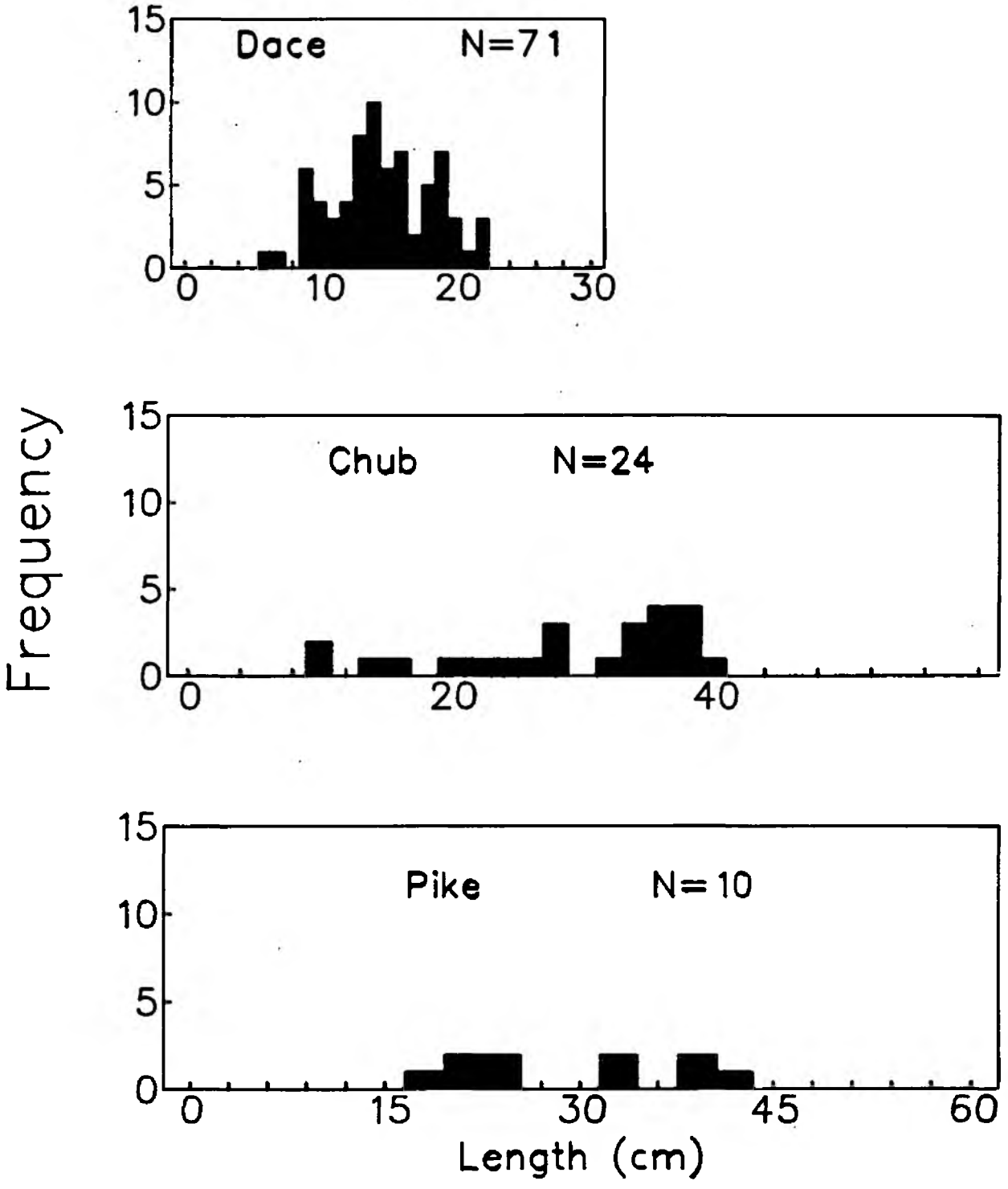


Fig 5.2.2.a Growth Curve for Dace

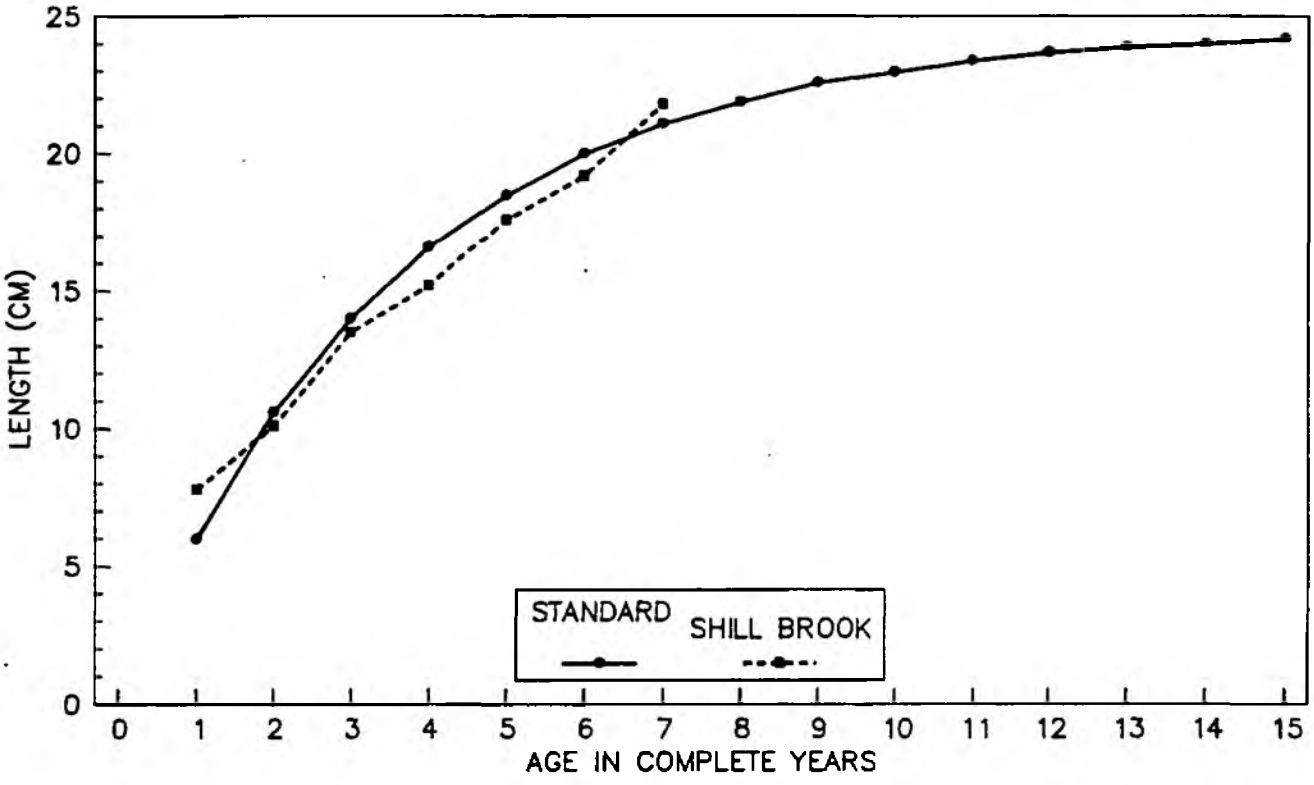
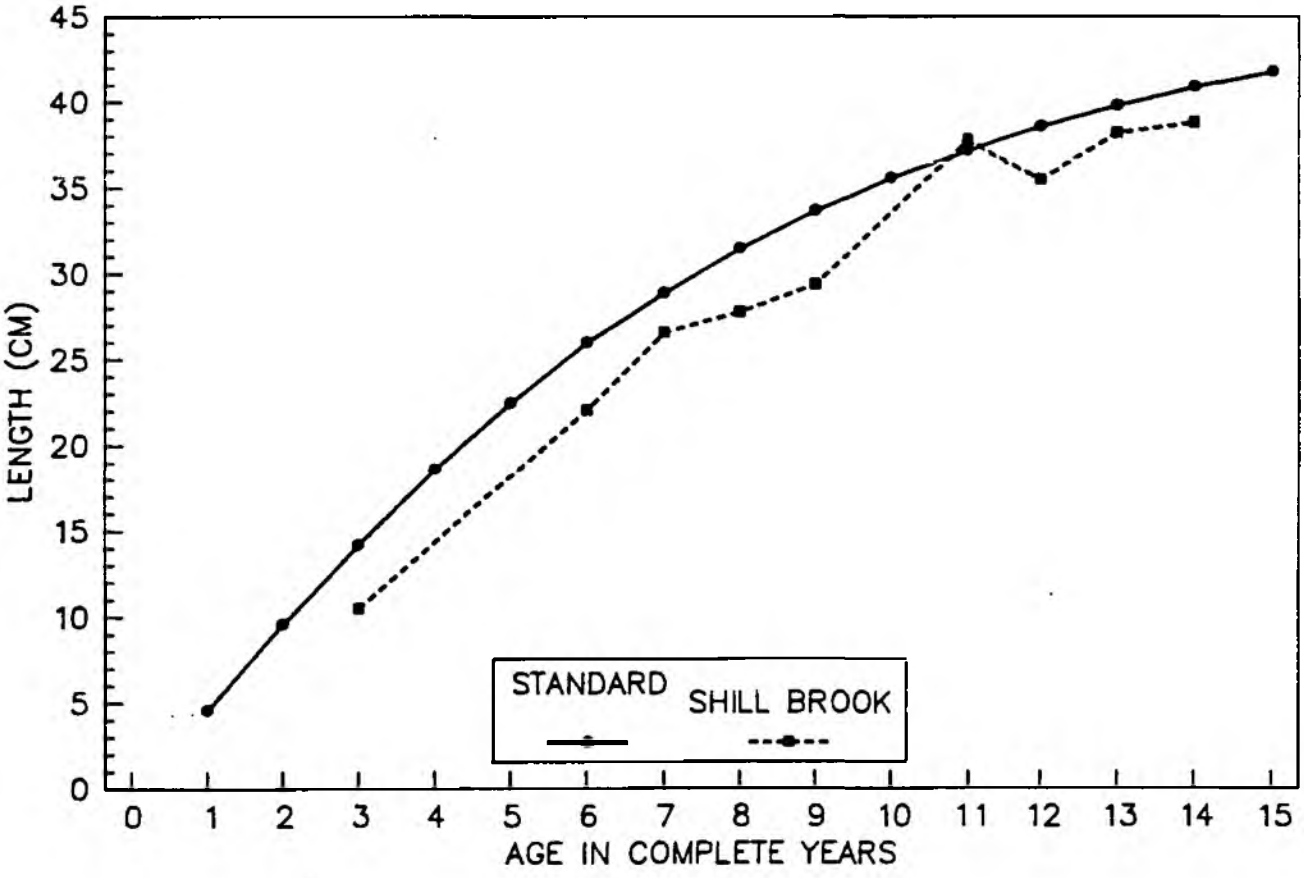


Fig 5.2.2.b Growth Curve for Chub



5.3. FISH HEALTH

A sample of 6 chub, 2 dace, 7 pike and 1 roach were examined by a fish biologist. No significant parasite loadings were observed, although there was a high prevalence of Triaenophorus nodulus in the pike. Liver and gonad tissues were analysed for pesticide residues. No interpretation of these results has been attempted.

5.4. WATER QUALITY

Both Carterton and Bampton STW discharges were, on occasion failing to comply with their consent standards, hence Thames Water applied for these works to be derogated (see 4.6.). A comparison between 1979 and 1989 shows that the quality of the discharge effluent has deteriorated. Bampton STW shows this particularly dramatically for ammoniacal nitrogen concentrations. (No standards are set for this parameter at Bampton STW).

The water quality of the Shill Brook normally complies with its RQO.

Above Carterton STW it had one failure on BOD (out of 103 samples).

At Black Bourton below Carterton STW, the Shill Brook complied with its RQO in every sample.

At Bampton the BOD failed to meet the RQO standard on 3 out of 61 occasions. The Ammoniacal Nitrogen at this site reached 3.1mg/l on one occasion. This was the only time that it exceeded 1mg/l. However, it should be noted that the Shill Brook below Carterton STW is classed as a 2b watercourse and that 2b watercourses do not have an ammonia standard in their RQO.

2a watercourses have to comply with the requirements of the EIFAC directive for cyprinid waters (see Appendices I, II and III), Class 2b watercourses do not.

There is no sampling point on the Shill Brook below Bampton STW.

5.5. MACROINVERTEBRATES MONITORING

The results of macroinvertebrate monitoring by NRA biologists are presented in Figure 5.5.

In addition an investigation was carried out on 16th May 1989 following a fish kill, see Appendix VI (5/5/89). To summarise their findings:- above Brize Norton Airfield the score was 133, which was higher than predicted. Just above Carterton STW the score was 68, less than half that predicted for the site. A qualitative sample downstream of the stormwater discharge from the airfield produced no dead animals, but there was indication of some organic enrichment. Sites on the Kencot Brook (a tributary of the Shill Brook) and further upstream on the Shill Brook appeared to have normal invertebrate populations.

Table 5.4

WATER QUALITY RESULTS (1979-1989)

(1) Shill Brook just above Carterton STW

	Suspended Solids	BOD (ATU)	Dissolved Oxygen % Sat.	Ammoniacal Nitrogen	Unionised Ammonia
Maximum	15.5	7.1	130	0.36	0.004
Minimum	0.5	0.1	71	0.01	0.000
Mean	4.9	1.1	93	0.04	0.001
No. of Determinations	41	103	103	103	104
No. of determinations failing RQO (1b)	-	1	0	0	0

(2) Shill Brook at Roadbridge, Black Bourton

	Suspended Solids	BOD (ATU)	Dissolved Oxygen % Sat.	Ammoniacal Nitrogen	Unionised Ammonia
Maximum	87.3	8.6	132	1.30	0.012
Minimum	1.6	0.7	51	0.01	0.000
Mean	11.7	2.2	84	0.13	0.002
No. of Determinations	43	105	105	106	106
No. of Determinations failing RQO (2b)	-	0	0	* -	* -

(3) Shill Brook at Fisher's Bridge, Bampton

	Suspended Solids	BOD (ATU)	Dissolved Oxygen % Sat.	Ammoniacal Nitrogen	Unionised Ammonia
Maximum	77.6	14.9	146	3.10	0.024
Minimum	0.4	1.0	62	0.01	0.000
Mean	17.9	2.3	99	0.22	0.002
No. of Determinations	13	61	61	76	63
No. of Determinations failing RQO (2b)	-	3	0	* -	* -

* No standard set for these parameters, for an RQO of 2B

Fig 5.4.1. CARTERTON STW EFFLUENT QUALITY (1979 & 1989)

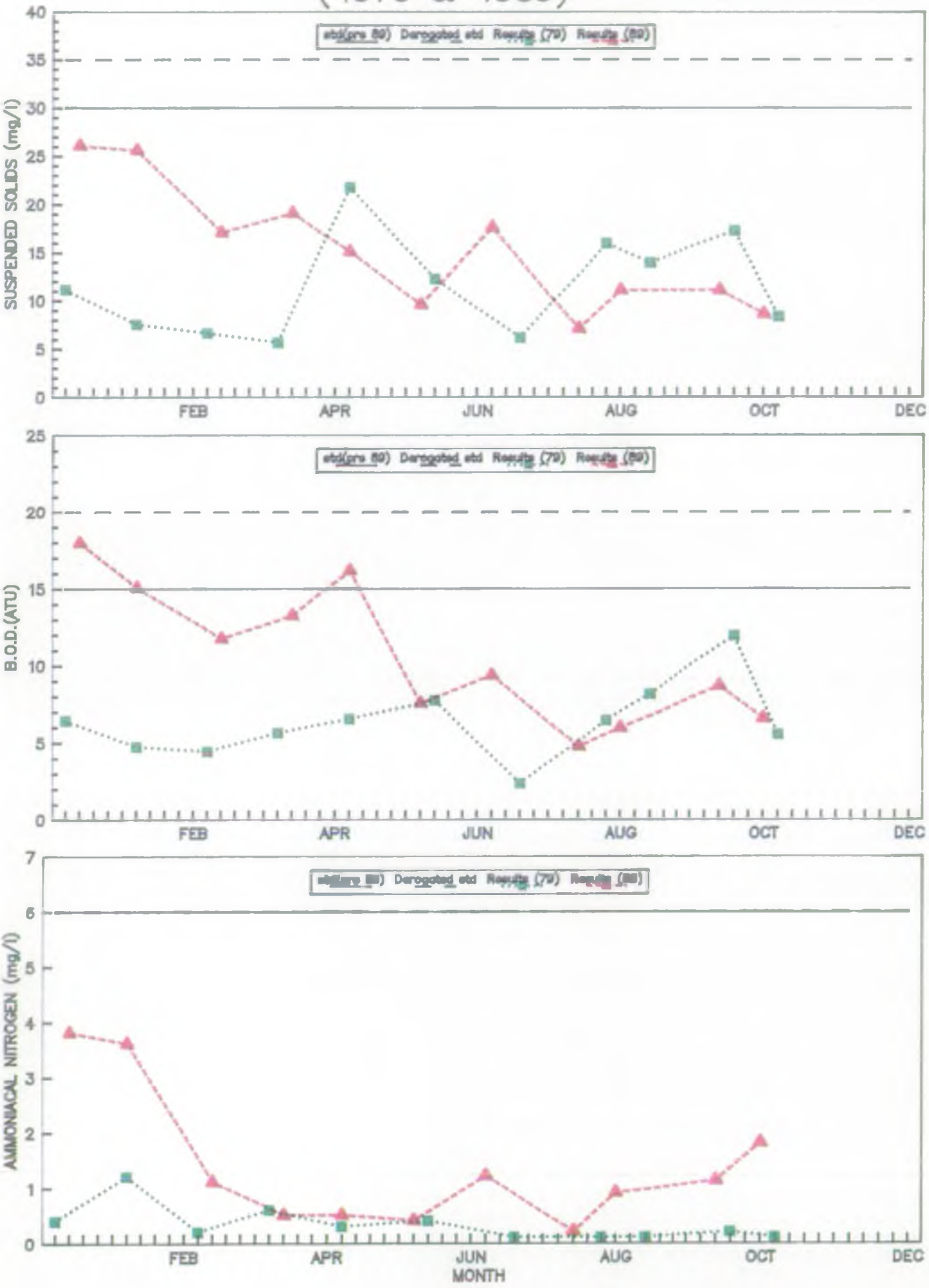


Fig 5.4.2. BAMPTON STW EFFLUENT QUALITY (1979 & 1989)

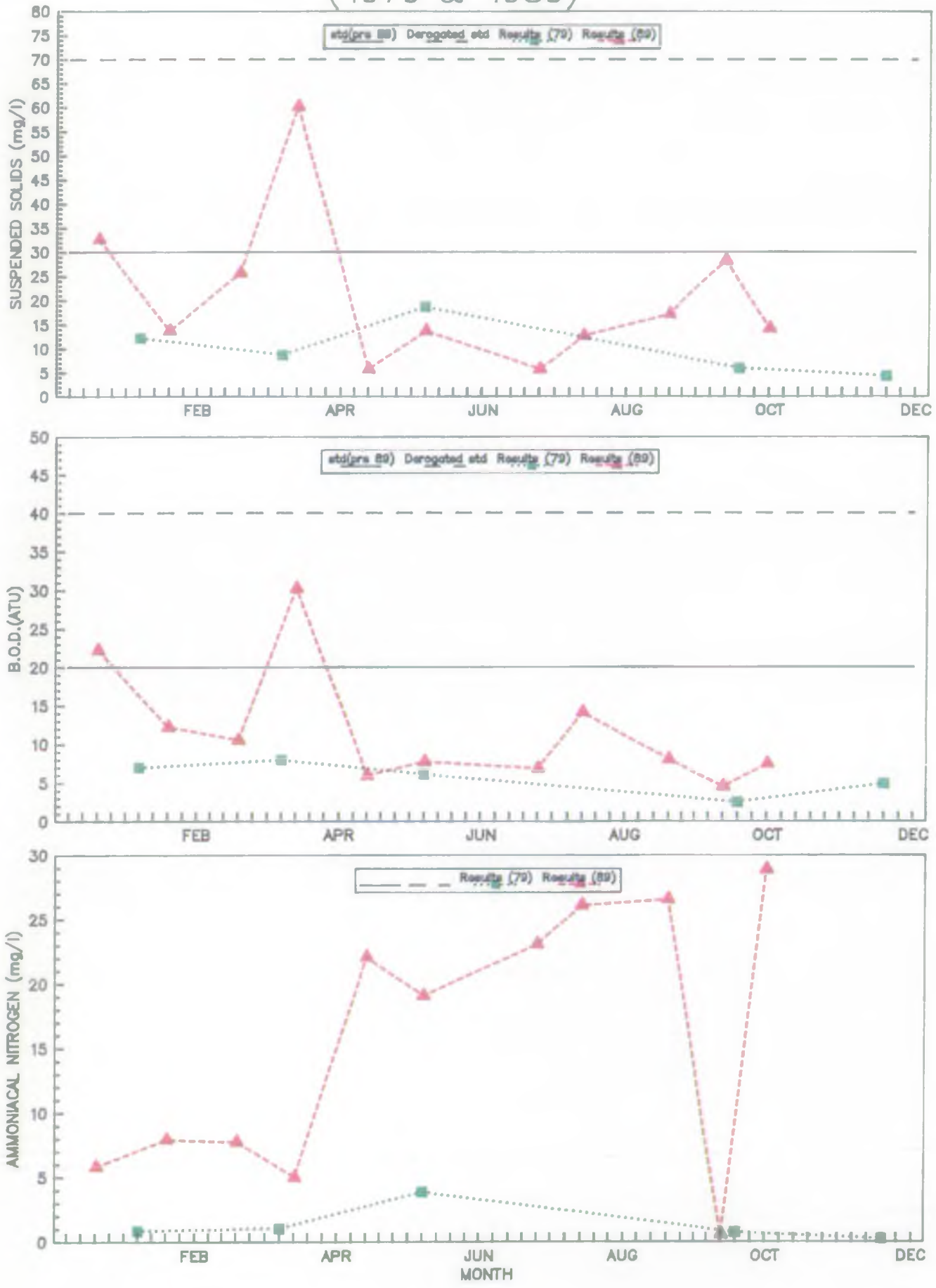
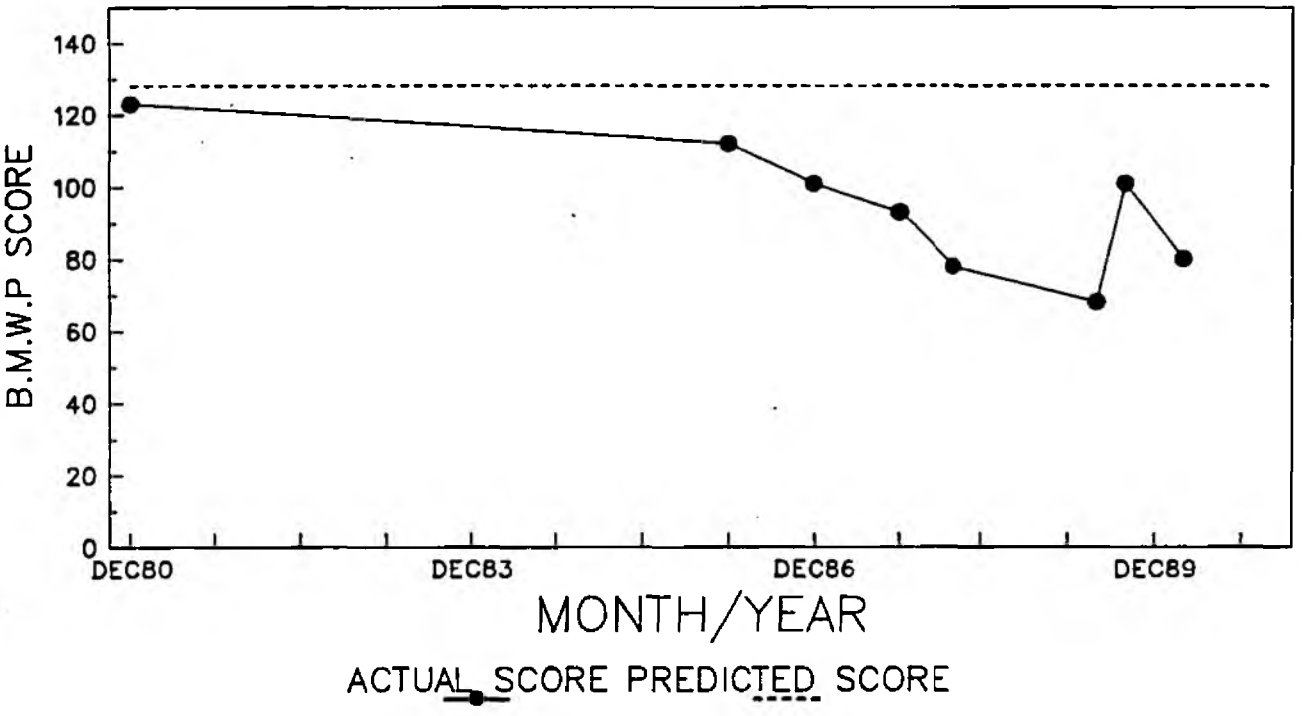
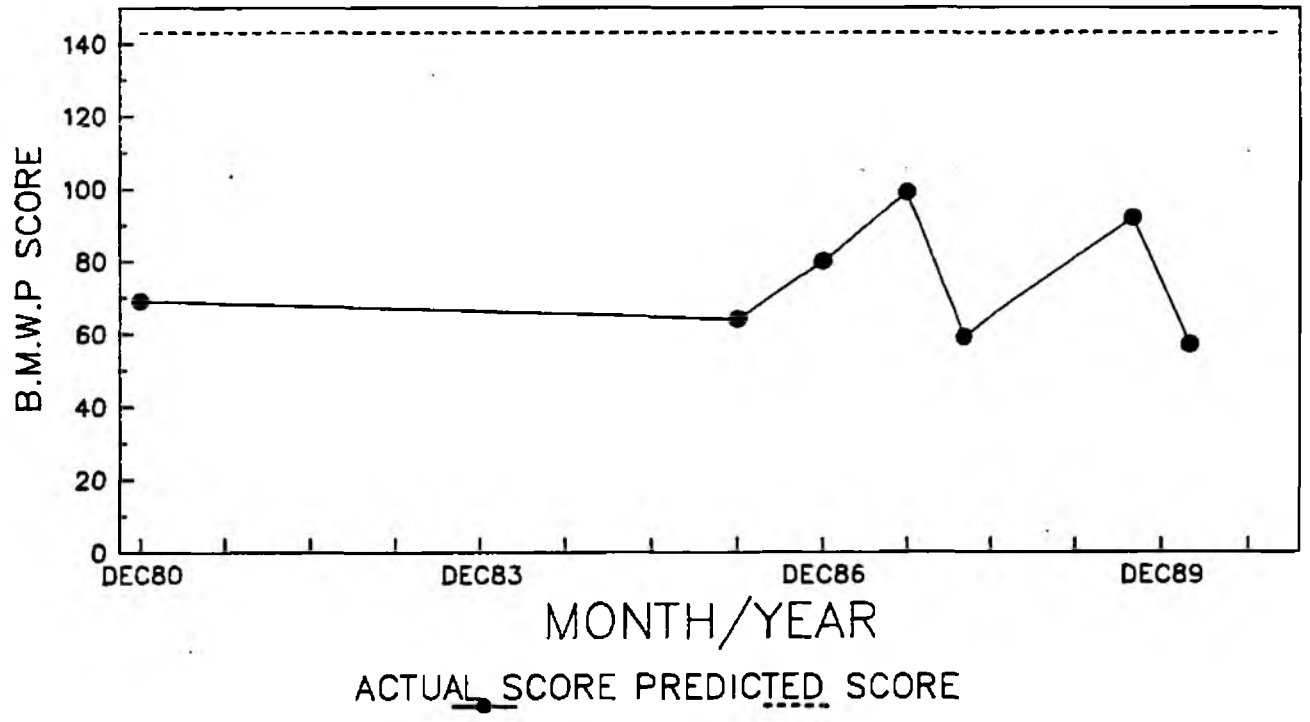


Fig 5.5.1 BIOLOGICAL MONITORING RESULTS 1980–90

a) Above Carterton STW (PUTR.0081)



b) Roadbridge,Black Bourton (PUTR.0080)



6. DISCUSSION

When the Shill Brook survey was instigated it was thought that the dominant factors on fish populations would be the effluent from the two sewage treatment works at Bampton and Carterton. Evidence suggests that these effluents cause a deterioration of water quality as indicated by the BMWP scores for macroinvertebrates.

The fish population may have been affected by mortalities associated with a series of unattributed pollutions incidents. The most recent of which occurred in May '89, and it is possible that further pollution has occurred after that date.

Above Carterton STW, where the water quality objective is 1B, the river has complied with this standard over a ten year period (fig. 5.4). There was previously a thriving brown trout population, but in December 1989 only one bullhead was caught in 330m of brook. (After the pollution on the 5th May 1989 there were still live fish in this section. Furthermore post mortality restocking with more than 400 brown trout at Black Bourton in July 1989 would have been expected to have incrased populations in this section.

The next site downstream, at Black Bourton, in an area of good physical habitat, there was a biomass of 2.7g/sqm which was also very poor. It would seem that this site may be affected by the same problem as the Alvescot site. Interestingly the smaller species of fish were thriving here, compared to the lone bullhead at Alvescot. This may indicate some recovery.

The invertebrate data also suggests a long term pollution problem in the brook. The site above Carterton STW has shown a gradual decline in the BMWP score since 1980. The present score is half that predicted for the site if it were unpolluted.

The lowest site on the Shill Brook at Aston had an apparently healthy fish population and just achieved the target biomass for a cyprinid site (NRA Thames Region - current levels of service) of 20g/sqm. The macro-invertebrate populations are also improved from upstream, although still much lower than predicted for an unpolluted site.

The Shill Brook, in its natural state, would be a trout stream throughout its length. However the poorer water quality caused by the STWs, and the poor habitat caused by land drainage/engineering operations have resulted in a shift from salmonid to coarse fish. Not one trout was caught in the site at Aston.

Since the completion of the survey field work in February 1990, implementation of the STW improvements has proceeded, but nothing has come to light to identify the sources of other water quality problems identified at the top two sites.

7. RECOMMENDATIONS

(1) The Shill Brook above Bampton normally holds a good population of brown trout.

   (a) The cause of the depleted fish and invertebrate populations should be investigated.

   (b) Water quality standards should aim to protect the status as a trout fishery.

(2) Downstream of Bampton the Shill Brook is a good coarse fishery.

   (a) Water quality standards should aim to protect or improve the fishery.

   (b) Habitat improvement would be beneficial. Instream groynes or deflectors would create flow diversification and could create improved conditions for gravel spawning fish. Tree planting on featureless sections of bank would improve bankside habitat, and create shading and cover.

(3) Consideration should be given to the creation of a river sampling point on the Shill Brook downstream of Bampton STW. This would show whether the RQO is being achieved, and whether the consent conditions for Bampton STW are appropriate to meet the RQO.

8. REFERENCES

1. Hickley P. and Dexter K.F., 1979. A comparative index for quantifying growth in length of fish. Fishery Management 10(4) 147-151.

2. Council of the European Communities 1978. Directive on the quality of freshwaters needing protection or improvement in order to support fish life. 78/659/EEC. Official Journal of the European Communities L222/1.

APPENDIX I

River quality classification

River Class	Quality criteria	Remarks	Current potential uses
	Class limiting criteria (95 percentile)		
1A Good Quality	(i) Dissolved oxygen saturation greater than 80% (ii) Biochemical oxygen demand not greater than 3 mg/l (iii) Ammonia not greater than 0.4 mg/l (iv) Where the water is abstracted for drinking water, it complies with requirements for A2* water (v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)	(i) Average BOD probably not greater than 1.5 mg/l (ii) Visible evidence of pollution should be absent	(i) Water of high quality suitable for potable supply abstractions and for all other abstractions (ii) Game or other high class fisheries (iii) High amenity value
1B Good Quality	(i) DO greater than 60% saturation (ii) BOD not greater than 5 mg/l (iii) Ammonia not greater than 0.9 mg/l (iv) Where water is abstracted for drinking water, it complies with the requirements for A2* water (v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)	(i) Average BOD probably not greater than 2 mg/l (ii) Average ammonia probably not greater than 0.5 mg/l (iii) Visible evidence of pollution should be absent (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 (v) Class 1A and Class 1B together are essentially the Class 1 of the River Pollution Survey (RPS)	Water of less high quality than Class 1A but usable for substantially the same purposes
2 Fair Quality	(i) DO greater than 40% saturation (ii) BOD not greater than 9 mg/l (iii) Where water is abstracted for drinking water it complies with the requirements for A3* water (iv) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)	(i) Average BOD probably not greater than 5 mg/l (ii) Similar to Class 2 of RPS (iii) Water not showing physical signs of pollution other than humic colouration and a little foaming below weirs	(i) Waters suitable for potable supply after advanced treatment (ii) Supporting reasonably good coarse fisheries (iii) Moderate amenity value
3 Poor Quality	(i) DO greater than 10% saturation (ii) Not likely to be anaerobic (iii) BOD not greater than 17 mg/l. This may not apply if there is a high degree of re-aeration	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
4 Bad Quality	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
X	DO greater than 10% saturation		Insignificant watercourses and ditches not usable, where the objective is simply to prevent nuisance developing

Notes

(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.

(b) The BOD determinations refer to 5 day carbonaceous BOD (ATU). Ammonia figures are expressed as NH_4.

(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.

(d) EIFAC (European Inland Fisheries Advisory Commission) limits should be expressed as 95 percentile limits.

* 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.

LIST OF DETERMINANDS

Determinand	*Salmonid Waters*		*Cyprinid Waters*	
	G	*I*	*G*	*I*
(a) Temperature (max) (b) Temperature rise		⩽ 21.5°C ⩾ 1.5°C		⩽ 28°C ⩾ 3°C
Dissolved oxygen (mg/l O_2)	50% ⩾ 9 100% ⩾ 7	50% ⩾ 9	50% ⩾ 8 100% ⩾ 5	50% ⩾ 7
pH		6--9		6--9
Suspended solids (mg/l)	⩽ 25		⩽ 25	
B.O.D. (A.T.U.) (mg/l)	⩽ 5*		⩽ 8*	
Nitrites (mg/l)	⩽ 0.2*		⩽ 0.5*	
Non-ionized ammonia (mg/l)	⩽ 0.005	⩽ 0.025	⩽ 0.005	⩽ 0.025
Total ammonium (mg/l NH_4)	⩽ 0.04	⩽ 1	⩽ 0.2	⩽ 1
Total residual chlorine (mg/l HC1O)		⩽ 0.005		⩽ 0.005
Zinc (mg/l)		⩽ 0.3		⩽ 1
Copper (mg/l)	⩽ 0.04		⩽ 0.04	

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

APPENDIX IV N.R.A. FISH SURVEY SITE CODING SYSTEM

The following habitat codes are used by NRA(Thames region) Fisheries staff,and are based on ROD and EEC legislation criteria:-

1.EEC DESIGNATED WATERCOURSES

Code	Description
A	1A Salmonid
B	1A Coarse
C	1A/1B Salmonid
D	1A/1B Coarse
E	1B Salmonid
F	1B Coarse
G	2/1B Salmonid
H	2/1B Coarse
I	2 Salmonid
J	2 Coarse

2.ROD WATERCOURSES

Code	Description
K	1A
L	1A/1B
M	1B
N	2/1B
O	2
P	3/2
Q	3
R	4/3
S	4
T	Unclassified

A 2 digit code for a watercourse is combined with the above and an individual site number to provide a unique 4 digit code for each site. Thus SH01 - SH=Shill brook, 0=2(ROD), 1=individual site.

APPENDIX V

FISH HEALTH

EXAMINATION DETAILS

EXAMINATION REF: WYF(S30)025
SHILL BROOK, ASTON

FISH SPECIES	LENGTH RANGE (cm)	WEIGHT RANGE (g)	AGE RANGE	SEX
Chub	22.0 - 30.2	135.4 - 386.4	(4+)-(5+)	Male Female
Dace	16.7 - 18.6	55.9 - 84.7	(2+)	Male Female
Pike	20.5 - 39.8	45.5 - 433.8	(1+)-(2+)	Male Female
Roach	19.7	121.2	(1+)	Male

PARASITES PRESENT:

FISH SPECIES	NO EXAMINED	PARASITE	LOCATION	PREVALENCE (PERCENTAGE INFESTATION)	INTENSITY (DEGREE OF INFESTATION)
Chub	6	*Pomphorynchus laevis*	Gut	Present	Light
Dace	2	No parasites found			
Pike	7	*Acanthocephalus lucii*	Gut	14	Light
		Bunodera luciopercae	Gut	14	Light
		Triaenophorus nodulosus	Gut	86	Light
Roach	1	No parasites found			

APPENDIX V1

FISH MORTALITIES

5/5/89 - Shill Brook upstream of Black Bourton. 30 brown trout mortalities counted. Cause unknown.

8/6/87 - Shill Brook at Bampton. More than 100 mixed coarse fish mortalities. Cause unknown.

31/5/87 - Shill Brook between Black Bourton and Bampton. Several dead brown trout. Cause unknown.

24/5/87 - Highmoor Brook and Shill Brook above Bampton. More than 100 mixed coarse fish and trout. Cause unknown.

RESTOCKING

21/7/89 - Shill Brook at Black Bourton. 474 brown trout @10-15cm. Total weight 23kg.

3/12/87 - Shill Brook at Mill bridge, Bampton. 250 brown trout @14-15cm. Total weight 14kg.

3/12/87 - Shill Brook at Carterton STW. 250 brown trout @14-15cm. Total weight 14kg.

26/5/87 - Shill Brook at Carterton STW. 100 brown trout @250g. Total weight 25kg.

(April 1988 - Great Brook within 1km of Shill Brook confluence. 10,000 small roach.)

APPENDIX VII

POLLUTION INCIDENTS (May '87 to June '90)

N R A Thames Region - Environmental Quality

Printed on :Thursday 09/08/1990

Site :Number 1 District Oxford

Watercourse	Incident Type	Incident Date	Fisheries Involved
SHILL BROOK/HIGHMOOR BRK	Not Known	24/05/1987	Yes
SHILL BROOK	No Information	31/05/1987	Yes
SHILL BROOK	Not Known	30/06/1987	No
SHILL BROOK	Oil	07/10/1987	No
SHILL BROOK	Agricultural	30/11/1987	No
SHILL BROOK	Oil	17/12/1987	Yes
SHILL BROOK	Sewage	11/02/1988	No
TRIB. OF SHILL BROOK	Sewage	08/02/1988	No
SHILL BROOK	Oil	17/03/1988	No
SHILL BROOK	Oil	26/07/1988	No
SHILL BROOK	Oil	28/09/1988	No
SHILL BROOK	Chemical	11/11/1988	No
SHILL BROOK	General	28/11/1988	No
Trib. Shill Brook	Oil	08/01/1989	No
Shill Brook	Chemical	15/05/1989	Yes
SHILL BROOK	Oil	10/08/1989	No
SHILL BROOK CATCHMENT	Oil	30/08/1989	No
SHILL BROOK	Oil	08/11/1989	No
SHILL BROOK	Agricultural	17/11/1989	No
Shill Brook	General	08/12/1989	No
Peppershill Brook	Agricultural	10/01/1990	No
Shill Brook	General	09/01/1990	Yes
TRIB. OF SHILL BROOK	Oil	26/02/1990	No
Ditch Trib. Shill Brook	Agricultural	24/02/1990	No
Shill Brook	General	01/03/1990	No
TRIB. OF SHILL BROOK	Sewage	18/03/1990	No
Shill Brook Tributary	General	31/05/1990	No
Ditch Trib.Shill Brook	Sewage	14/06/1990	No

SUMMARY OF BIOMASS FOR EACH SITE