

IMPLEMENTATION OF THE EC FRESHWATER FISH DIRECTIVE WATER QUALITY REQUIREMENTS FOR THE SUPPORT OF FISH LIFE

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National Rivers Authority

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EXECUTIVE SUMMARY

This report describes the implementation of the Council Directive on the quality of fresh waters needing protection or improvement in order to support fish life (78/659/EEC) in England and Wales and compares application of the Directive in the UK as a whole with other European Union Member States. The Directive was introduced in 1978, and since then the UK has designated over 56,000 kilometres of rivers and lakes, to come under the scope of the Directive. The National Rivers Authority (NRA) is responsible for monitoring the 19,370 kilometres of designated waters in England and Wales.

The Directive is concerned with the protection and improvement of fresh waters in order to support fish life. It sets standards of water quality for the protection of coarse and game fisheries, together with monitoring requirements. Although the Directive has yet to be formally translated into UK legislation, the NRA monitors freshwater quality in accordance with the requirements of the Directive and uses its powers to ensure that the standards laid down in the Directive are achieved. To date, two reports have been made to the European Commission, covering the results of surveys in 1984, and 1989, and the results of a third survey in 1992 have been forwarded to the Department of the Environment.

The first survey was carried out in 1984 by the Regional Water Authorities. Approximately 94% of designated stretches complied with the Directive. Non-compliance of designated stretches was commonly due to high ammonia levels or low dissolved oxygen. High levels of zinc were reported in the North East though these were thought to arise from natural mineral deposits, or mining which has since ceased. pH was also a common cause of non-compliance in upland areas of the North West and Wales.

The 1989 survey which was started by the Regional Water Authorities and completed by the newly formed NRA showed a slight decrease in compliance to 93% of the designated length. About half of the non-compliance was attributable to high ammonia levels. Farm drainage problems and sewage effluent discharges were identified as primary causes of failure. The effect of these discharges was exacerbated by low river flows following the hot dry summer of 1989.

Compliance improved in 1992 when 95% of the length designated complied with the requirements of the Directive. Water quality in many areas has shown improvement, reflecting both the benefits of recent investment programmes by the water industry and others to improve discharges, and the regulatory activities of the NRA.

Derogations were applied for zinc in areas of high mineralization where levels are naturally high, and for pH in upland waters which are susceptible to acidification. A relaxed total ammonia standard (in line with Government advice) was also applied to certain rivers, where there was evidence of healthy fish populations and where there was compliance with the non-ionized ammonia standard.

Pollution control work to resolve the outstanding compliance problems has been principally targeted at agricultural sources. The work is co-ordinated by the NRA's Rural Land Use Group and is organised on a river catchment basis. Emphasis is being placed on the definition of "best land use practices" for the prevention of pollution.

Where non-compliance with the total ammonia standard has been attributed to sewage treatment works discharges this has been resolved by reviewing the discharge consents.

The Directive has now been implemented by all Member States, but no comparative information was available from the European Commission. However some information was supplied when Member States were contacted directly, showing that implementation varies widely between Member States.

1 INTRODUCTION

This report provides an overview of the implementation of the European Community Directive on the quality of fresh waters needing protection or improvement in order to support fish life (78/659/EEC), commonly referred to as the "Freshwater Fish Directive" (Appendix A).

1.1 The Role of the NRA

The National Rivers Authority (NRA) was established on 1 September 1989 by the 1989 Water Act as a non-departmental public body with statutory responsibilities for water resources, pollution control, flood defence, fisheries, recreation, conservation and navigation in the "controlled waters" of England and Wales. "Controlled waters" are defined in the Water Act as all groundwaters, lakes, reservoirs, rivers, canals, estuaries and coastal waters to a distance of three nautical miles offshore. The enactments relating to the powers and responsibilities of the NRA were subsequently consolidated in the 1991 Water Resources Act.

Although the Directive requires a Member State to take action to implement the Directive, the Member State can delegate the operation of the requirements of the Directive to a "competent authority". The NRA has been identified by the Department of the Environment (DoE) and the Welsh Office (WO) as the competent authority to implement the requirements of this Directive. The Freshwater Fish Directive has not yet been formally translated into UK legislation, but nevertheless the NRA monitors freshwater fisheries in accordance with the requirements of the Directive and uses its powers so as to ensure that the standards laid down by the Directive are achieved.

The Freshwater Fish Directive aims to protect and improve water quality and forms a part of the NRA's water quality monitoring programme.

The actual management of fisheries is carried out by the NRA Fisheries Function. The fisheries resources for which the NRA is responsible are significant as a wildlife resource in need of conservation and protection, as well as a managed resource exploited both commercially and for recreational purposes. Details of the role of the NRA in fisheries management can be found in the NRA Fisheries Strategy document (NRA 1993a). However, this report concentrates on the responsibilities of the NRA in meeting the water quality requirements of the EC Freshwater Fish Directive.

2 EC FRESHWATER FISH DIRECTIVE

The Freshwater Fish Directive was adopted on 18 July 1978, and is one of some 20 Directives which apply to water quality. The NRA has to ensure that the requirements of these Directives are achieved in England and Wales, through the exercise of its powers, and as directed by the relevant Secretary of State. EC Directives are, it should be noted, agreements between the Commission and Member States; compliance or otherwise with each Directive is therefore a matter for the two relevant parties.

2.1 Development of the Directive

The primary purpose of the Directive is to allow fish to live in favourable conditions by the setting of water quality objectives for designated freshwaters. The Directive also refers to the requirement in Article 100 of the Treaty of Rome to approximate different national laws that might distort competition. However, in practice the impact of the Directive in equalizing the competitive conditions of polluting industries has been remote (Haigh, 1989). The Directive does not apply to waters in natural or artificial fish ponds used for intensive fish farming.

Discussions regarding the Freshwater Fish Directive were first started in 1974 (Bottomley, 1980). A Technical Working Group was set up to make recommendations for the Directive, and a draft Directive was produced by August 1976. Two main considerations were the water quality requirements for freshwater fish, and the problems of tainting of fish flesh destined for human consumption. Great use was made of technical reports published by the European Inland Fisheries Advisory Commission (EIFAC) which propose water quality criteria for European freshwater fish.

The standards in the draft Directive did not always relate to the technical Working Group's recommendations. Two main difficulties were posed by the draft Directive; firstly, who would be responsible for designation, and, secondly, were the parameters realistic? These were debated in the European Parliament (14 January 1977), in the report of the Economic and Social Committee (23 February 1977) and both Houses of Parliament in the UK. They were eventually resolved in an amended version of the Directive (Haigh, 1989).

The draft Directive had implied that all waters capable of supporting freshwater fish should be designated. In the final version it was agreed that the designation of waters was to be at the discretion of the Member States. A number of parameters were altered, including temperature, dissolved oxygen, phosphate and phenols and the nitrate parameter removed.

The final version of the Directive, as notified on 20 July 1978, was very much a compromise, and has been criticised for allowing Member States to designate very few waters. It was also felt that the standards offered little protection for the very cleanest rivers (Haigh, 1989).

The Directive does not offer protection for consumers of fishery products. This is dealt with in a more recent Directive 91/493/EEC, which lays down the health conditions for the production and the placing on the market of fishery products.

2.2 The Directive and its Standards

Following notification of the Directive in 1978 Member States were required to designate two categories of water: those suitable for salmonids and those suitable for cyprinids. Annex I to the Directive sets out fourteen physical and chemical parameters for which imperative (I) and guideline (G) values were given for the two categories of designation. Initial designations were

required by 20 July 1980 with a detailed report on compliance to be submitted to the EC five years later in 1985. Reports were then to follow at regular intervals. Member States were required to initiate pollution reduction programmes with the intention that the designated waters conform to the values set within the five years.

The classifications "salmonid" and "cyprinid" waters refer to two broad categories of fish. Salmonid waters have the potential to support fish of the family Salmonidae, mainly salmon and trout, but also grayling. Cyprinid waters support fish from the family Cyprinidae plus pike, perch and eel. The salmonid standards are stricter than the cyprinid standards, reflecting the higher quality of water which salmonids need to survive and reproduce. The main species of fish which belong to these two basic categories in the UK are shown in Table 1 (Banarescu *et al* 1971).

Table 1: Common species of freshwater fish found in the UK

Class of Water	Habitat Characteristics	Species	Latin name
Salmonid	Upper fast flowing reaches of rivers and upland lakes. Water cold with high oxygen levels and low nutrient status. Chalk streams.	Salmon	<i>Salmo salar</i>
		Sea and Brown trout	<i>Salmo trutta</i>
		Char	<i>Salvelinus alpinus</i>
		Grayling	<i>Thymallus thymallus</i>
Cyprinid	Lower reaches of rivers and ponds near bottom of river catchments. Surrounding land usually agricultural and the waters rich in nutrients and plant life. Slower flowing water, lower oxygen content.	Common carp	<i>Cyprinus carpio</i>
		Tench	<i>Tinca tinca</i>
		Barbel	<i>Barbus barbus</i>
		Gudgeon	<i>Gobio gobio</i>
		Crucian carp	<i>Carassius carassius</i>
		Silver Bream	<i>Blicca bjoerkna</i>
		Common bream	<i>Abramis brama</i>
		Bleak	<i>Alburnus alburnus</i>
		Rudd	<i>Scardinius erythrophthalmus</i>
		Roach	<i>Rutilus rutilus</i>
		Dace	<i>Leuciscus leuciscus</i>
		Chub	<i>Leuciscus cephalus</i>
		Orfe	<i>Leuciscus idus</i>
		Minnnow	<i>Phoxinus phoxinus</i>
		Eel	<i>Anguilla anguilla</i>
Perch	<i>Perca fluviatilis</i>		
Pike	<i>Esox lucius</i>		

Annex I of the Directive specifies the following physical and chemical parameters which are listed as either mandatory (I) or guideline (G) values.

- temperature (where there is a thermal discharge) (I only) ;
- dissolved oxygen (G and I) ;
- pH (I only) ;
- suspended solids (G only) ;
- biological oxygen demand (BOD) (G only) ;
- total phosphorus (guidance note) ;
- nitrites (G only) ;
- phenolic compounds (guidance note) ;
- petroleum hydrocarbons (guidance note) ;
- non-ionized ammonia (G and I) ;
- total ammonium (G and I) ;
- total residual chlorine (I only) ;
- total zinc (I only) ; and
- dissolved copper (G only) .

The standards for these parameters are contained in Annex I of the Directive. Member States were required to set standards no less stringent than the I values, and were to endeavour to respect the values in column G. For several parameters (total phosphorus, phenolic compounds and petroleum hydrocarbons) no absolute values were set, but guidance notes were provided. In addition to the required standards, the Annex specifies methods of analysis or inspection and minimum sampling and measuring frequencies, along with guidance on various aspects of sampling strategy. The Annex specifies that the total of NH_4 and NH_3 in solution should be measured as total ammonium using a colourmetric method. Improved methodology now in use measures the total of NH_4 and NH_3 as total ammonia, and this terminology is used for compliance assessment in England and Wales. Where total ammonia is referred to in this report it is equivalent to the total ammonium referred to in the Directive.

The designated waters are deemed to comply if the specified standards are met on an annual basis as follows:

- 95% of the samples for the parameters; pH, BOD, non-ionized ammonia, total ammonia, nitrites, total residual chlorine, total zinc, and dissolved copper;
- temperature and dissolved oxygen standards must be met by the percentage of samples quoted in Annex I;
- the average suspended solid concentration should be compliant with the standards quoted in Annex I.

In accordance with Article 11 of the Directive, derogations may be given by Member States for certain parameters as follows:

- for maximum temperature, pH and suspended solids in the case of exceptional weather or special geographical conditions;
- for other parameters when designated waters undergo natural enrichment so that the values set out in Annex I are not respected.

Minimum sampling frequencies are specified in Annex I, and Article 7 of the Directive provides for reduction in sampling frequency in areas of very high quality.

2.3 Implementation in England and Wales

At the time of issue of the Directive, the Water Authorities in England and Wales already had powers to control discharges to all inland waters and to take samples (see Section 2.8). No new legislation has so far been formulated to implement the Directive in the UK.

Initially in October 1978, the DoE sent a guidance circular and a copy of the Directive to the Water Authorities, advising that many of the functions inherent in the Directive were to be delegated to the Water Authorities.

The guidance circular of 1978 suggested that a working group be set up to prepare more detailed advice on the Directive. The result of the subsequent working group was an eighteen page "Advice Note" (DoE, 1979) which was sent by the DoE to the National Water Council, to be forwarded to the Water Authorities.

The 'Advice Note' provided interpretation and commentary on many aspects of the Directive and comprised the view of the Government with respect to implementation. The main points covered were:

- designation and Water Authority expenditure ;
- setting of standards for parameters ;
- derogations ;
- sampling strategy ;
- migration of fish species ;
- tidal limits ;
- mine workings ;
- storm sewage ; and
- reporting to the Commission.

The Government considered that the implementation of the Directive should not have an undue effect on the expenditure plans of the Water Authorities. The Working Group agreed that the aim should be to designate as many waters as possible consistent with this approach, but those initially designated should already meet the appropriate standards, or be capable of doing so by July 1985 after improvements which were already programmed.

Water Authorities were requested to provide DoE with lists of designations by 30 May 1980 for forwarding to the EC by July 1980, including:

- river name ;
- classification (salmonid or cyprinid);
- length of designated stretch and indications of start and finish points; and
- 'G' values set for any parameter which differed from those suggested in the 'Advice Note'.

2.4 UK Designations

The advice note from the DoE clarified several other issues on designation of waters:

- The designation of waters was not a once-and-for-all exercise, and there was no reason why a stretch of water which was not included in the initial designation should not be designated at some time in the future.
- Where waters were clearly cyprinid in nature, but through which migratory salmonids passed, they should be designated as cyprinid. Only waters which sustained a breeding population of salmonid species were to be designated as salmonid.
- In tidal areas, where the boundary between fresh water and saline water was not clear, a pragmatic approach was suggested based on the presence of freshwater fish species.
- Following the abandoning of mine workings, the steps needed to deal with any consequent pollution should be considered by the Water Authority. If it was felt that it would require excessive resources to maintain the designation, the authority could de-designate the affected water under Article 4.3 of the Directive.

In July 1980 the DoE sent the EC a list of waters designated in England, Wales, Scotland and Northern Ireland. Additional designations were notified in 1981 and 1985. In England and Wales the Government's advice appears to have been followed with only two Water Authorities initially designating waters which did not already comply with the standards. Initial designations were nevertheless extensive, with some Water Authorities designating over 50% of their total watercourse length (Haigh, 1989). Table 2 gives the total lengths of water designated in the UK since 1980.

Table 2: Total designations under the Freshwater Fish Directive (river lengths are approximate and in km)

Area	1980	1981/82	1990
England & Wales	17 000	19 200	19 300
Scotland	33 000	34 100	35 600
Northern Ireland	1 100	1 100	1 100

Approximately 90% of the total UK designations are for salmonid waters although in England and Wales salmonid designations represent about 67% of the total. The designations in England and Wales receive further discussion in Chapter 3.

Still waters also fall within the scope of the Directive. In some Regions these have been identified separately and given a surface area, in others they have been included in a river stretch, and have been recorded as a length.

2.5 Sampling Programme

For certain parameters a minimum frequency of sampling is laid down in Annex I of the Directive. The Directive allows for the reduction of sampling frequency where it appears that the quality of the water is appreciably higher than the values set. Where there is no pollution or risk of deterioration in water quality the sampling frequency may be reduced to zero (Article 7). Sampling is carried out as part of the NRA's water quality monitoring programme, and takes account of these guidelines.

2.6 Compliance Assessment in the UK

The DoE's advice to the competent authorities regarding compliance assessment was largely to follow the standards and analytical methods detailed in the Directive (DoE, 1979).

Special advice was given for the assessment of non-ionized ammonia. The value for non-ionised ammonia should be calculated from the total ammonia, pH and temperature, assuming a maximum pH of 8.0. This advice was based on research which showed that:

- a) it is the concentration of non-ionized ammonia at the gill surface of fish which determines the toxicity of ammonia; and
- b) respiratory release of carbon dioxide from fish gills produces localized pH reduction.

It was decided that residual chlorine, phenolic compounds and petroleum hydrocarbons were unlikely to be of general significance in the UK and that these substances should only be tested for where discharges of such substances might affect fish flesh bound for human consumption. In many cases less frequent analyses for zinc and dissolved copper were also suggested (DoE, 1980).

The hardness bandings for the total zinc and copper standards used in the UK are shown in Table 3. These give standards more stringent than the Directive, but correspond to the standards which were being developed in the UK and finally published in DoE Circular 7/89 on the implementation of the Dangerous Substances Directive (DoE, 1989).

Table 3: Hardness bandings for zinc and copper used in the UK

Hardness mg/l CaCO ₃	Zinc mg/l		Copper mg/l	
	Salmonid	Cyprinid	Salmonid	Cyprinid
0-50	0.03	0.3	0.005	0.005
50-100	0.2	0.7	0.022	0.022
100-250	0.3	1.0	0.04	0.04
250 +	0.5	2.0	0.112	0.112

Compliance in the UK as assessed by DoE is based on I values alone; G values have not been used to assess compliance. In the majority of cases the monitoring strategy involved monthly sampling, thus if one sample were to fail it would result in non-compliance with respect to the 95% standard. When the Directive was adopted it was agreed by the Commission that where monthly samples were taken, eleven of the twelve should meet the standards to achieve compliance (DoE, 1978).

2.7 Application of Derogations in the UK

Under Article 11 of the Directive, derogations can be granted for certain substances. A derogation allows the standards to be exceeded in cases of exceptional weather or geographical conditions, or natural enrichment of the water from substances leaching from the soil.

The Government applied to the EC for a number of 'national' derogations for certain circumstances in which it was not envisaged that particular parameter values could be respected. These included:

- intensively navigated shallow waters, where the effect of boats was to raise suspended solid levels ;
- canals and other still waters due to their often eutrophic nature and high BOD ;
- flood events, including naturally high river flows, which have the general effects of raising BOD and suspended solid levels ; and
- tidal "stem-back" in freshwater.

In addition to these the Government invited the competent authorities to apply for 'local' derogations to cover specific or regional circumstances. It was also suggested that possible failures due to diffuse run-off from agricultural land might be derogated for as natural enrichment.

Despite this advice only four of the ten Regional Water Authorities in England and Wales initially applied for Article 11 derogations. The majority of these were for pH and zinc where local geology would have caused failures. Further applications were made for derogations as failures due to natural causes were encountered.

Following the report made to the Commission on the 1984 survey, which included stretches where the total ammonia standard was exceeded in some cyprinid waters, further advice was given by the DoE. The Directive allows for a relaxed standard to be applied where there are no harmful effects on the fish population (Note 4 to Annex I). The Water Authorities were invited to make use of this provision, in certain cases of low water temperature and reduced nitrification. The allowed standard would, in general, be 3 mg/l (DoE, 1985).

2.8 UK Legislation Relevant to the Directive

The UK has a long history of legislation to protect and improve fisheries. Before the formation of the NRA the majority of responsibilities with regard to fisheries lay with the Regional Water Authorities. The statutory responsibilities of the NRA in relation to fisheries, although amended by the Water Act 1989, remain largely as those stated in the Salmon and Freshwater Fisheries Act 1975.

The Salmon and Freshwater Fisheries Act 1975 states that it is an offence to discharge poisonous or injurious matter into waters containing fish, and the Rivers (Prevention of Pollution) Acts of 1951 and 1961, the Water Act 1973 and the Control of Pollution Act 1974, provide additional powers to protect the aquatic environment.

In 1978 the Freshwater Fish Directive was adopted by the European Community. The NRA was formed by the Water Act of 1989, which described its principle responsibilities. The Water Act of 1989 was later consolidated into the Water Resources Act of 1991.

2.9 Classification of Water Quality and Statutory Water Quality Objectives.

The Water Resources Act of 1991 provided for the development of new schemes for the classification of controlled waters. In December 1991 the NRA published its proposals (NRA 1991a) for the introduction of statutory Water Quality Objectives (WQOs), under the Water Resources Act 1991. The scheme is based upon the uses to which waters may be put, and water quality standards which support these uses will be developed. Five uses are proposed for rivers: River Ecosystem, Special Ecosystem, Water Sports, Industrial/Agricultural Abstraction, and Abstraction for Potable Supply. In this scheme proposed targets of water quality are to be given a statutory footing.

The NRA envisages that WQOs will play a key role in water quality planning in the future. Proposals will be based on current uses, and on desired improvements in water quality to support additional uses, taking into account the requirements of EC Directives. It is expected that proposals will be developed for a number of pilot catchments in 1994.

2.9.1 River Ecosystem Classification

One of the proposed use classes is the River Ecosystem. Water quality standards have been developed, and incorporated into The Surface Waters (River Ecosystem) (Classification) Regulations 1994, which were laid before Parliament on 19 April 1994. The River Ecosystem Classification Scheme comprises five tier classes, and when implemented every stretch of river will be given an associated target class, to be maintained or achieved after improvement. Classes RE1 and RE2 broadly equate to the salmonid waters in the Directive, classes RE3 and RE4 to cyprinid waters, and a further class RE5 applies to poorer quality water.

The River Ecosystem Classification is applicable to all freshwaters, and will therefore have a wider influence than the Directive. It also offers a higher degree of protection for the very cleanest rivers, within the class RE1. Compliance is assessed using a statistical method, for example, for un-ionized ammonia and zinc, a 95 percentile is calculated, and degrees of confidence given for the result. This compares favourably with the definitive pass or fail which results from the 95% of samples approach used in the Directive.

Monitoring for the River Ecosystem Classification and the Directive will be integrated wherever possible, allowing for the differences between the two schemes.

2.9.2 General Quality Assessment Scheme

The NRA has introduced a General Quality Assessment Scheme, to assess and report upon the quality of rivers in England and Wales. This replaces the old National Water Council classification scheme. Rivers and canals are now classified into six bands, A to F, according to quality. The classification is based on the levels of sanitary determinands (BOD, dissolved oxygen and ammonia), as well as biological surveys of the benthic macro-invertebrate

communities. Nutrient status and aesthetic quality components are also being investigated. Further details are published in the document River Quality The Government's Proposals: A Consultation Paper (DoE, 1992b), and the NRA Water Quality Series Report: The Quality of Rivers and Canals in England and Wales 1990 to 1992, (NRA 1994).

3 RESULTS IN ENGLAND AND WALES

3.1 Introduction

The results of three surveys, carried out in 1984, 1989 and 1992 are presented in this report. The results for 1989 are presented in map form (Figures 1 to 10) for the ten NRA Regions in England and Wales. The data for all three surveys are summarised in Tables 5, 6 and 7 and given in more detail in Tables 9, 10 and 11 in Appendix B.

In 1993 the NRA reorganized into eight Regions, but for the purpose of historical comparison, the old ten Region structure has been used.

3.2 Reports to the Commission

Under Article 16 of the Directive, Member States are required to submit a detailed report to the Commission five years following initial designations, and at regular intervals thereafter. The UK submitted two five yearly reports (1984 and 1989). The reporting frequency was changed to three yearly intervals, in anticipation of the Standardised Reporting Directive (see Section 5.1).

The 1984 survey was carried out in England and Wales by the ten Regional Water Authorities. In accordance with Article 16 of the Freshwater Fish Directive the results of the 1984 survey were reported to the European Commission in 1985 by the DoE. This "Article 16 Report" also contained results for Scotland and Northern Ireland. The Article 16 Report consisted of an inventory of river stretches designated as salmonid and cyprinid fisheries, a list of stretches with derogations, a list of stretches failing to comply with the Directive and the reasons for non-compliance. The report was accompanied by a set of maps summarising this information. The text of the 1985 Article 16 Report was not available for inclusion in this report, having been produced by the Water Authorities prior to the formation of the NRA. It was therefore only possible by scrutinizing the maps to give the number of stretches, but not the total length failing to comply.

Results of the 1989 survey were reported to the European Commission in 1990. The report was similar in structure to that produced in 1985 with a text detailing designations, sampling points, derogations and non-compliance, and maps summarising this information. The competent authority in England and Wales changed from the Regional Water Authorities to the NRA during the survey, with the NRA being responsible for assessing the data and producing the compliance report.

Results from the 1992 survey, consisting of a list of non-compliant sites together with reasons for non-compliance and remedial action planned to improve the situation, sites with derogations, and sites with reduced sampling frequency, were forwarded to the DoE in June 1993. A summary of the results of the 1992 survey is included in this report. The Standardised Reporting Directive 91/692/EEC (see section 5.1) will require reports to be submitted to the Commission on a three yearly basis. The first report will be sent to the Commission in 1996 covering the monitoring years 1993/4/5.

3.3 Designations

A total of 19,157.6 kilometres of designated waters and 734.9 hectares of lakes or reservoirs were surveyed in 1984. Between the 1984 and 1989 surveys, 12 new designations were made in Northumbria and South West Regions; these comprised salmonid rivers and three reservoirs.

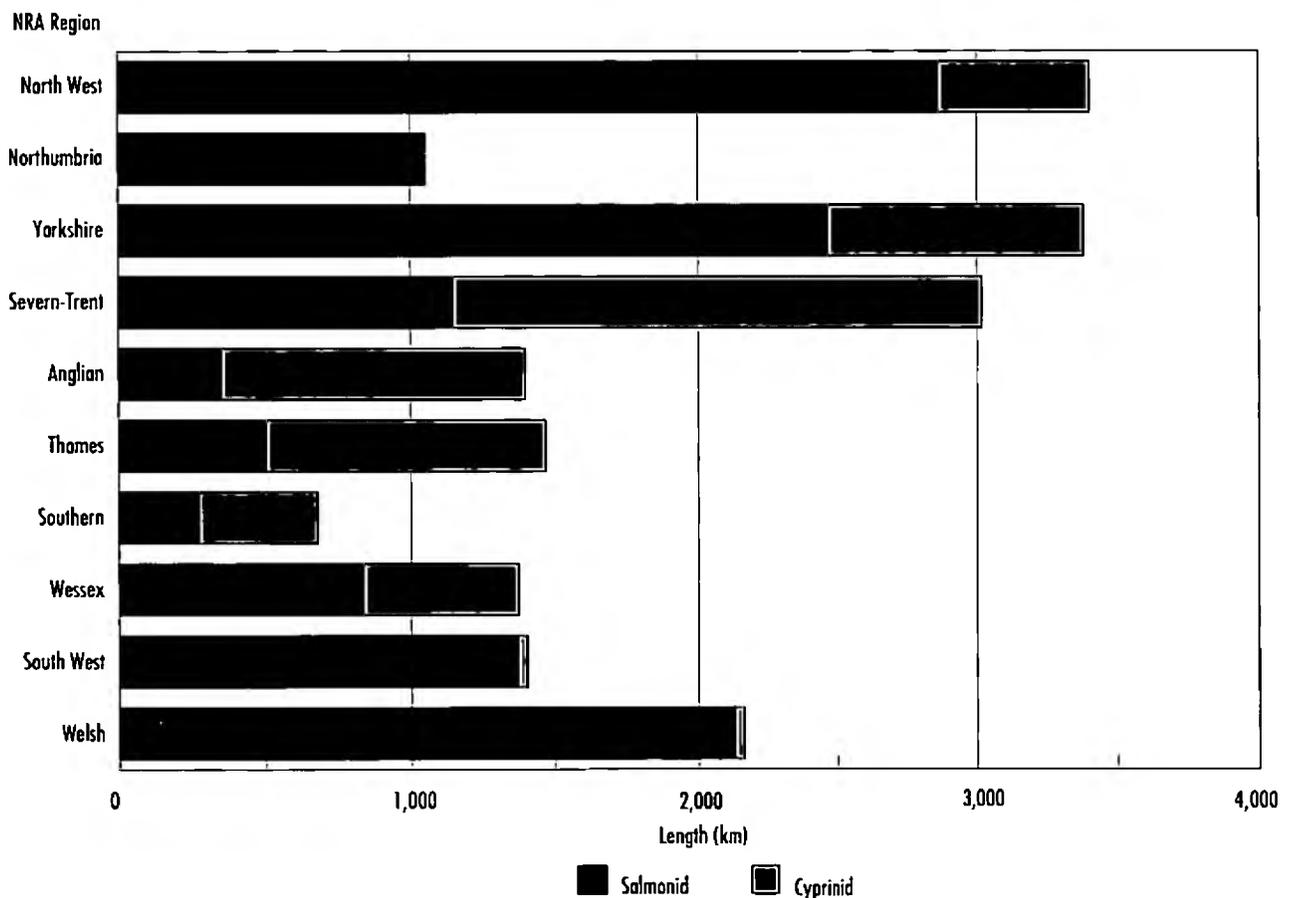
Since the initial designations, the Regional Water Authorities and subsequently the NRA Regions have rationalised their sampling programmes and reassessed the length of designated stretches. Some of the initial designations have been amended, as more accurate length assessments were made. The figures are shown below in Table 4.

Table 4: Designations in England and Wales, 1984 to 1992

Year of Survey	Rivers (kilometres)		Still Waters (hectares)	
	Salmonid	Cyprinid	Salmonid	Cyprinid
1984	12,827.7	6,329.9	383.3	351.6
1989	12,910.8	6,407.2	833.5	351.6
1992	12,986.8	6,348.6	960.2	353.0

The length of designated river within each of the ten NRA Regions in 1992 is displayed in Figure 11. The upland topography associated with much of the North West, Northumbria, Yorkshire, South West and Welsh Regions has resulted in their designations being predominantly salmonid. In the lower lying and therefore more urbanised or agricultural catchments of Severn-Trent, Anglian, Thames and Southern Regions, cyprinid designations predominate.

Figure 11: Designations in England and Wales (1992)



3.4 Summary of the 1984 Survey Results

Table 5: Summary of 1984 survey results

	Length (kilometres)	Surface area (hectares)	Number of stretches
Designations	19,157.6	734.9	2000 (approx)
Non-compliance	no data	no data	118

The percentage of stretches complying in 1984 was 94%. From a total of approximately 2000 designated river stretches, 118 stretches failed to comply. The proportions of salmonid and cyprinid waters failing were approximately equal.

The parameters most commonly causing non-compliance were pH, total ammonia, non-ionised ammonia and dissolved oxygen.

Article 11 Derogations were made to 57 stretches, by four of the Water Authorities: Northumbria, Severn-Trent, South West and Welsh. The majority of these derogations were for pH and zinc where exceedences occurred naturally due to the local geology of the areas concerned. Several zinc derogations in the Northumbria Water Authority area were associated with abandoned mines. A total ammonia standard of 1 mg/l was applied to all sites.

3.5 Summary of the 1989 Survey Results

Table 6: Summary of 1989 survey results

	Length (kilometres)	Surface area (hectares)	Number of stretches
Designations	19,318.0	1185.1	no data
Non-compliance	1407.6	429	157

In 1989, 93% of the 19,318 km of designated water complied with the Directive. The 1407.6 km of non-compliant waters comprised 619.5km of salmonid waters and 788.1km of cyprinid waters. Of the still waters, 64% complied. Figure 12 summarises the non-compliance figures on a Regional basis. Wessex, Anglian and South West Regions showed the greatest proportion of failures with the other Regions showing non-compliance in less than 10% of their waters.

Article 11 derogations were made to 89 of the designated stretches. Five NRA Regions (Anglian, Thames, Southern, Yorkshire and Wessex) made no derogations. The majority of derogations were for pH and zinc in areas where local geology and land drainage would have caused failures for these parameters, for example the Rivers Nent and Allen (see Figure 2).

Under Note 4 to Annex I of the Directive, there is a provision for relaxing the total ammonia standard from 1 mg/l to 3 mg/l, where there are healthy fish populations. A relaxed total ammonia standard was applied for the first time in 1989, to 73 stretches of cyprinid Class 2 rivers, where ammonia levels could exceed 1 mg/l but showed healthy fish populations.

3.6 Summary of the 1992 Survey Results

Table 7: Summary of 1992 survey results

	Length (kilometres)	Surface area (hectares)	Number of stretches
Designations	19,335.4	1313.2	2211
Non-compliance	962.3	147.0	124

In 1992, 95% of the total length designated in England and Wales complied with the Directive. 962.3km or 5% of the 19,335.4 km of designated water exceeded the standards in the Directive. This comprised 435.2 km salmonid and 527.1 km cyprinid waters. Some 57 hectares of salmonid and 90 hectares of cyprinid still waters also exceeded the standards, which accounted for 11% of the total surface area monitored.

Reasons for exceedences varied from Region to Region. Farm pollution and run off from agricultural sources after rain was responsible for high total ammonia levels in Wessex and North West Regions. Low river flows, following several years drought caused problems in Thames and Anglian Regions. This led to reduced dilution of effluent from sewage treatment works, causing ammonia exceedences. Low flow rivers were subject to nutrient enrichment in many areas, the resulting algal blooms causing dissolved oxygen and pH failures.

In some cases failure to comply was due to a one-off pollution incident and work could be done to improve the situation. The majority of failures were due to discharges from sewage treatment works and diffuse pollution from agricultural sources.

Article 11 derogations were made to 119 stretches. Five Regions, Anglian, Yorkshire, Thames, Wessex and Southern, made no derogations. The majority of derogations were for pH in acidic upland areas, and zinc in areas of high mineralisation, such as Wales, the North East and parts of the South West. There were additionally 26 stretches where a relaxed total ammonia standard (Note 4 to Annex I) was applied in the Thames, Yorkshire and Severn-Trent Regions.

3.7 Comparison of Survey Results

Figure 12 shows the comparison between the lengths failing to comply with the Directive in 1989 and 1992.

Figure 13 shows the proportions in which the different chemical parameters caused non-compliance. In all three surveys total ammonia was the most common cause of non-compliance. Dissolved oxygen and non-ionised ammonia also accounted for a high proportion of the exceedences. Farm drainage problems and poor effluent quality from sewage treatment works were given as the primary causes of failure. Many Regions expressed the view that the effects of these pollution problems were exacerbated by low flows caused by the hot, dry summer of 1989, and associated algal blooms. In South West and Anglian Regions, low flows were a direct cause of non-compliance.

3.8 Discussion of Results

Figure 14 shows the number of designated stretches failing to comply with the Directive in 1984, 1989 and 1992.

Figure 12: Non-compliance in England and Wales in 1989 and 1992

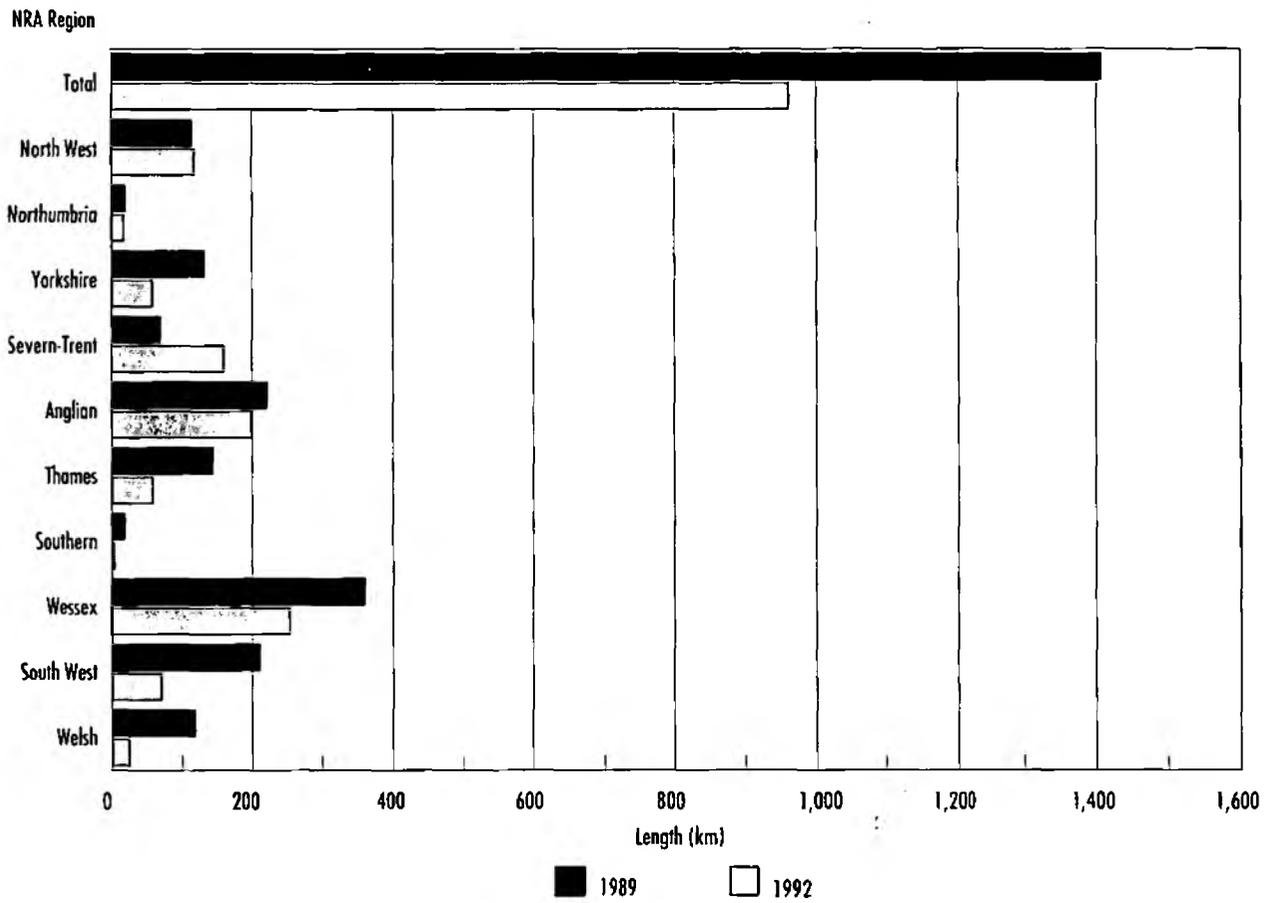


Figure 13: Parameters causing non-compliance

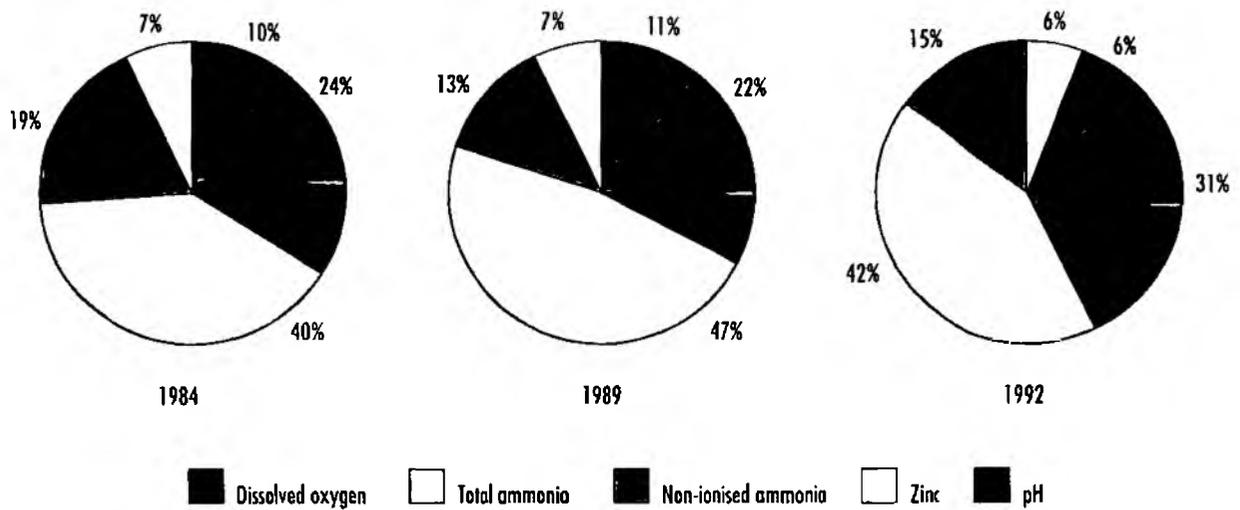
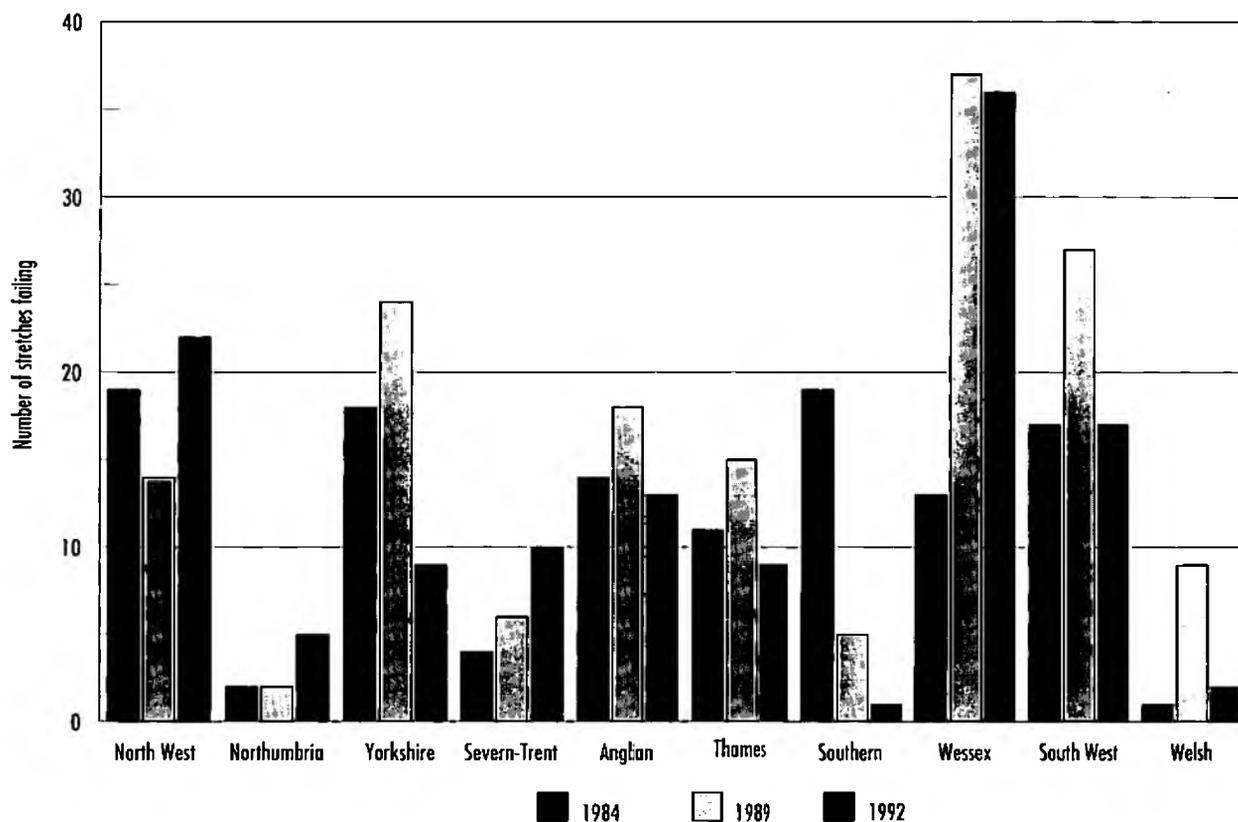


Figure 14: Number of stretches failing to comply in 1984, 1989 and 1992



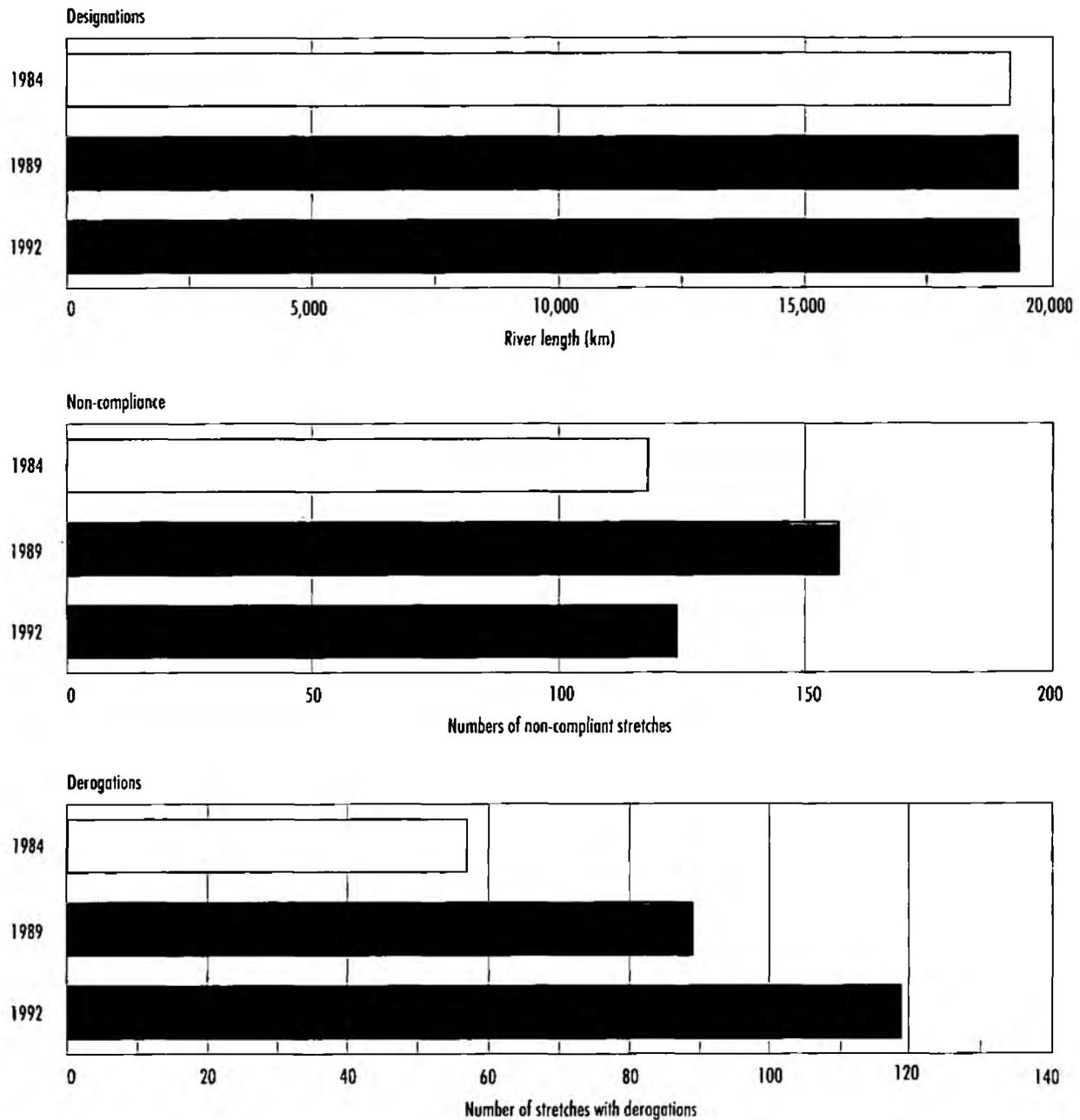
Between 1984 and 1989, the number of stretches failing to comply increased from 118 to 157. This increase was evenly divided between salmonid and cyprinid waters. An increase in compliance was noted in North West and Southern Regions; Northumbria remained the same but seven Regions showed a deterioration. The increase in failures exceeds the proportional increase that might occur due to the increased number of designations. The number of stretches failing to comply fell from 157 in 1989 to 119 in 1992, and the total length failing also decreased from 1407.6 km in 1989 to 962.3 km in 1992. Changes in designations, derogations and compliance over the three reporting years are shown in Figure 15.

In both 1984 and 1989, non-compliance was commonly due to total ammonia or dissolved oxygen levels. Generally, this was attributed to agricultural run-off and poor performance of sewage works; the effects of these being exacerbated by the low flows in the summer of 1989. Between 1984 and 1989, the number of designated stretches with Article 11 derogations increased from 57 to 89.

There is evidence to suggest that the increase in compliance in 1992 was due to a real underlying improvement in river quality since the 1989 survey. Since 1991 there has been a reduction in the number of reported agricultural pollution incidents (NRA 1993c). Regulations controlling the storage of silage, slurry and agricultural fuel oil which came into force in September 1991 have been partly responsible for the reduction in agricultural pollution.

Farm inspection campaigns carried out by NRA Regions have identified discharges of farm effluents which put the river environment at risk. Advice has been given which aims to minimize discharges and so reduce the risk of pollution.

Figure 15: Comparisons between 1984, 1989 and 1992



Considerable investment using grant aid from MAFF has allowed farmers to improve the storage and handling of farm waste according to the regulations. Farmers have been encouraged to adopt “best land use practices”. For example, the NRA has developed and promoted the concept of farm waste management plans for the disposal of slurry to land in order to reduce the risk of pollution from land runoff. The trend in the reduction in pollution incident may be, in part, due to the increased use of “big bale” storage of silage (NRA and MAFF, 1989).

The performance of sewage treatment works is being addressed in improvement plans being actioned by the Water Service Companies.

3.9 A Regional Perspective

3.9.1 North West Region

The northern half of the Region has largely compliant salmonid waters (Figure 1). This contrasts greatly with the area south of the R. Ribble where the majority of rivers are not designated. More than 84% of the designated waters are salmonid rivers.

Major changes between 1984 and 1989 appear to be the result of increased derogations for pH. In 1984, stretches of the R. Esk and R. Duddon failed on this parameter due to drainage from acid moorlands. Derogations for these stretches ensured compliance in 1989. The overall number of non-compliant stretches decreased from 19 in 1984 to 14 in 1989. In 1992 the number of stretches failing to comply increased again to 22.

Farm drainage accounted for non-compliance with the total ammonia standard in the River Weaver during 1989 and 1992. Farm inspection campaigns are being carried out to prevent this type of pollution.

3.9.2 Northumbria and Yorkshire Region

3.9.2.1 Northumbria

There are 48 lakes or reservoirs (23 salmonid and 25 cyprinid) designated within the Northumbria Region. Northumbria Region (Figure 2) is unique in having all its river stretches designated as salmonid waters.

There were only two non-compliant stretches in both 1984 and 1989, but this rose to five in 1992. The 1989 exceedences were due in one case to a farm pollution incident and in the other to poor quality sewage effluent at a sewage works where a short term reduction in performance occurred. The 1992 exceedences were due in three cases to poor quality effluent from sewage treatment works. The consents are being reviewed, and work to improve nitrification at one works is being completed. A further exceedence was attributed to an abandoned industrial site.

The number of Article 11 derogations increased from 9 in 1984 to 17 in 1992. This was accompanied by an increase in designations (7 salmonid stretches totalling 76 km) in 1989.

3.9.2.2 Yorkshire

Some 73% of the river length is designated as salmonid (Figure 3) and although no new designations were made in the period 1984 to 1989, several additions were made to the original list prior to the 1984 report. The majority of the catchments in the southern half of the Region remain undesignated because of the high level of industrial activity in the area. Historically, these rivers have suffered from severe urban and industrial pollution.

There was a small increase in the number of non-compliant stretches from 18 in 1984 to 24 in 1989. There were 9 exceedences in 1992, all due to high ammonia levels. In most cases the ammonia was from poor quality effluent from sewage treatment works.

In 1984, Yorkshire Water Authority made no Article 11 derogations, but in 1989 eight stretches were given a relaxed total ammonia standard by Yorkshire Region. This increased to 10 stretches in 1992.

3.9.3 Severn-Trent Region

Within Severn-Trent Region (Figure 4), approximately 40% of designations (by length) are for salmonid waters. The majority of these flow from the Welsh hills in the west of the Region, where there is little industry. Other parts of the Region are heavily industrialised, and have fewer, predominantly cyprinid designations.

The number of stretches failing to comply rose from 4 in 1984, to 6 in 1989, and 10 in 1992. Article 11 derogations decreased from 6 to 2 between 1984 and 1989, and increased to 7 in 1992. In 1989, 27 sites had relaxed total ammonia standards, and this was reduced to 7 sites in 1992, where there were healthy fish populations.

Exceedences were caused by poor quality sewage effluent in some cases, and high pH levels caused by algal blooms.

The designated lakes and reservoirs in the Region were either reported within their respective river systems, or given a separate surface area.

3.9.4 Anglian Region

The majority of designations in Anglian Region (Figure 5) (75% by length) are for cyprinid waters, reflecting the lowland and slow flowing nature of most of the rivers within the Region. Significant stretches of these large lowland rivers remain undesignated. No new designations were made in the period 1984 to 1992.

Thirteen designated stretches did not comply with the Directive in 1992, compared with 18 in 1989 and 14 in 1984. Poor quality sewage treatment works effluent and agricultural discharges were responsible for some failures, but it was also thought that the low flows and algal blooms prevalent in the summer of 1989 were responsible for many of the dissolved oxygen and total ammonia exceedences. This also appeared to be the main problem in 1992, when at least nine of the exceedences (for dissolved oxygen and total ammonia) were drought related. The remaining four were in nutrient rich areas where excess algal growth caused elevated pH.

No Article 11 Derogations have been requested by the Region.

3.9.5 Thames Region

Cyprinid waters account for 65.7% of the designated river length in Thames Region (Figure 6). The majority of salmonid designations are in the upper catchments of the Thames tributaries flowing out of the chalk of the Cotswold and Chiltern hills.

There were nine exceedences in 1992, compared to 15 in 1989, and 11 in 1984. The majority of exceedences in both 1984 and 1989 were attributed to poor quality sewage treatment works effluent. This was also the case in 1992, and low river flows led to depleted oxygen levels. Many of these problems are now being addressed through the water industry capital investment programme.

A relaxed total ammonia standard of 3 mg/l was applied to 38 sites in Thames Region in 1989, although in 1992 only 9 of these exceeded the normal 1mg/l standard.

3.9.6 Southern Region

The majority (62%) of the designations in the Southern Region (Figure 7) are for cyprinid waters, although the Region also contains some nationally important salmonid waters. For example, the Test catchment is one of the most important salmonid fisheries in the south of England.

Southern Region have not made any Article 11 derogations and showed the greatest improvement in compliance with numbers of failing stretches decreasing from 19 to 5 (3% of designated length) in the period 1984 to 1989. The majority of these failures were associated with poor quality sewage treatment works effluent. Improvements were made to some of the sewage works, and consent conditions reviewed. Only one site failed in 1992. This was due to large amounts of weed growth in the Chichester Canal causing low dissolved oxygen levels.

3.9.7 South Western Region

3.9.7.1 Wessex

In Wessex Region 60% of the designated waters are salmonid (Figure 8). The majority of non-designated stretches are small headwaters or within the complex drainage system of the Somerset Levels.

The number of non-compliant stretches increased from 13 in 1984 to 37 (26% of designated length) in 1989. In 1989, the majority of failures were associated with poor quality sewage treatment works effluent and agricultural pollution. These problems were exacerbated by the low flow conditions prevailing in the summer.

In 1992, 36 sites exceeded the standards. Diffuse farm pollution caused or contributed to many of the exceedences. In particular, run off following heavy rainfall onto land to which slurry had been applied caused high ammonia concentrations in many areas. Farm waste containment improvement programmes are being carried out throughout the catchment by the NRA in co-operation with the Agricultural Development and Advisory Service (ADAS).

Many of the watercourses are penned during the summer months in order to maintain water levels for livestock watering. Nutrient concentrations frequently build up in the penned stretches, causing surface algal blooms. This results in a reduction in dissolved oxygen within those penned watercourses.

Several exceedences were also caused by a paper mill breaching its discharge consent conditions. The mill has now installed a new effluent treatment plant.

3.9.7.2 South West

The vast majority (98%) of designated river length in South West Region (Figure 9) is for salmonid waters. The Region also designated 25 lakes or reservoirs, the majority of which were also salmonid. Between 1984 and 1989, three reservoirs and one river stretch (all salmonid) were added to the list of designations.

In 1984, South West Water Authority made Article 11 derogations to 20 stretches. These were for high and low pH (due to algal activity and acid drainage respectively), and for zinc (due to local geology). These derogations were maintained in 1989 and increased to 29 stretches in 1992.

Numbers of non-compliant stretches in the Region increased from 17 in 1984 to 27 in 1989 with a large number of the recent exceedences being due to high amounts of zinc in the local geology. Other exceedences were the result of agricultural run-off, often exacerbated by the prolonged low flows in 1989. The number of exceedences fell to 17 in 1992, largely as a result of improved base flows.

3.9.8 Welsh Region

The upland and fast flowing nature of many of the rivers in the Region (Figure 10) is reflected in the majority being designated as salmonid waters (over 98% by length). Non-designated stretches are most notable in the mining valleys of the south.

In 1984, Welsh Water Authority made Article 11 derogations to 22 river stretches, in 1989 this was increased to 35, and by 1992 there were 42 stretches with derogations. All of these were for zinc or pH in areas where local geology or acid drainage would have caused the standards to be exceeded. The pH problem has been exacerbated by acidification in some upland catchments.

Numbers of non-compliant stretches increased from one in 1984 to nine (6% of designated length) in 1989, and then fell back to two in 1992. The majority of failures in 1989 were reported as being due to low flows exacerbating problems associated with agricultural run-off. The two failures in 1992 were due to high zinc concentrations, and may be given derogations in future if the source of the zinc is shown to be natural.

4 APPLICATION OF THE DIRECTIVE IN OTHER MEMBER STATES

4.1 Implementation in Member States

Member States were required, under the Directive, to designate salmonid and cyprinid waters by July 1980, and to apply the standards within the Directive and ensure compliance with them by July 1985. These deadlines did not apply to those countries joining the EC after the publication of the Directive in August 1978, ie Spain and Portugal.

Member States were required to report to the Commission on the designated waters, including details of compliance, reasons for failures, derogations and revisions to designated waters.

In October 1985 it was reported that only four Member States other than the UK had made designations under the Directive. These designations were very much smaller proportionately than those of the UK (Haigh, 1989). The Directive has now been implemented in all Member States although to differing extents and with modifications, such as the addition of extra parameters. Many Member States already had legislation in force regarding water quality for other uses such as abstraction for drinking water. Differences between Member States also exist with respect to frequency of sampling.

In order to evaluate the implementation of the Directive in other Member States the NRA commissioned WRc to conduct a review. The results of this review (WRc, 1992) were used during the preparation of this report. Member States which had provided inadequate responses for the original review were contacted again during this study.

As a consequence of confidentiality issues, no information was obtained directly from the European Commission, and the responses from individual Member States to a questionnaire were varied. No response was received from the relevant body in Greece, and little information from Denmark. Both bodies were contacted again in this study although no responses have been received. The details on the implementation of the Directive within individual Member States are discussed below.

4.2 Belgium

The Belgian National Government implemented the Directive with the Royal Decisions of 17/2/84 and 9/12/87. The designation of waters was carried out by the Flemish and Walloon Regional Authority Governments through Executive Decrees in 21/10/87 and 20/7/89 respectively, with the Walloon Decree being revised on 25/10/90. Twenty five salmonid and 130 cyprinid waters were designated and no revisions have been made to these.

Belgium has implemented all the standards detailed in the Directive with additional parameters being the biotic indices "Indice biologique global" and "Belgian biotic index". These biological parameters have no set standards and sampling is carried out once every two years. In the Flemish Region chemical sampling is carried out by the Flemish Environment Company, the Institute of Hygiene and Epidemiology, the Administration of Environment and the Provincial Institute of Hygiene, Antwerp. In the Walloon Region the Division des Pollution Industrielles of the Ministry of the Region accredits various laboratories to carry out the chemical and biological sampling and analysis.

Comments were made to the effect that the EC nitrite standard for salmonid waters (0.01 mg/l NO₂) was too stringent, but no problems were expressed concerning any other parameters.

Implementation of the Directive was not difficult as Belgium already had in place several National Water Quality Classification schemes covering water oxygen balance (key parameters include percentage oxygen saturation, biochemical oxygen demand and ammoniacal nitrogen content) and biological quality (relying on the reduction in community diversity and the progressive loss of certain groups of clean water fauna in response to increasing pollution). In addition to these national classification schemes an analysis for mercury, cadmium, chromium, copper, zinc and lead was carried out during 1978-1982. A classification scheme has been devised for cadmium levels in surface waters, as a consequence of Belgium being the second largest producer of cadmium in Europe. Analytical data regarding water quality has been published annually, since 1975, by the Institute of Hygiene and Epidemiology.

4.3 Denmark

The Danish Environmental Protection Agency is in the process of implementation of the Directive. No information on lengths designated or compliance was available. However guidelines were published in 1983 by the Danish EPA for surface water quality planning for water courses and lakes, and for coastal waters. These guidelines recognised various quality objectives for water bodies according to their use and current status.

These included objectives for watercourses classified as:

- areas for spawning and juvenile stages of salmonids;
- salmonid waters; and
- cyprinid waters.

For each objective, water quality criteria appear to have been based upon the relevant EC Directives. Water quality monitoring is carried out by the 14 Regional Councils under the general guidance of the EPA.

4.4 France

France had already designated 21 stretches on three rivers prior to October 1985. Full implementation of the Directive was carried out in December 1991 with the National Decree (91/1283), under which waters are classified as either salmonid or cyprinid. The salmonid waters include various rivers and three lakes, whilst the cyprinid waters include rivers, lakes and canals.

France is divided into 96 departments and sampling is conducted at a departmental level by a range of different organisations which collectively constitute the "Police des Eaux".

The sampling methods are defined in the Arrêté of 26 December 1991 which is associated with the National Decree, and the analysis of the samples is carried out at approved laboratories. This Arrêté also outlines the methods of reporting to the Commission, i.e. data from the departments is compiled by the Ministry of the Environment, which then reports, via the "Secrétariat Général du Conseil Interministeriel pour des Questions Economiques Européennes" to the EC.

Several national water quality classification schemes have been established, the most widely used being the 'Multipurpose Scale' which has been used since 1971. Four quality classes based on specific uses range from Class 1A to Class 3 and an additional 'no classification' category. Quality objectives giving ranges of values for a number of physical, physico-chemical,

chemical and biological parameters relate to each class. The ranges are most often based upon other EC water quality Directives. Water quality surveys are published every five years.

4.5 Germany

Germany has designated both salmonid and cyprinid fisheries, with the Water Authorities from each Länder (State) being responsible for the monitoring. Once the data have been collated, the responsible Ministries produce reports which are co-ordinated by the Bavarian Länder which then produces a national response for the EC sent via the Federal Ministry for the Environment.

Standards applied in Germany are believed to be similar or identical to those listed in the Directive.

The EC agreed that the former East Germany should be given until 31/12/92 to comply with the Directive. No reports have been received regarding compliance. There has been a national water quality classification in place since 1985, which involves biological, ecological and physico-chemical measurements. The classes vary from Quality Class 1 (unburdened to slightly burdened) to Quality Class IV (excessively polluted).

4.6 Greece

No information was received regarding compliance with the Directive, although the EC hinted that Greece had designated waters and had reported these to the Commission (WRC, 1992). Responsibility for surface water quality monitoring lies with the municipalities (for larger towns and cities) and the communities (for smaller towns and villages). These operate under the supervision of the Regional Planning, Urban Development and the Environment.

There is no national surface water quality classification scheme as yet, but use-related classification schemes which recognise 'beneficial uses of surface waters' for example, water supply, bathing, fishing and irrigation, are in place.

4.7 Republic of Ireland

Although a small number of waters were designated as early as 1985, the Directive was not officially implemented until 1988 with the introduction of the EC (Quality of Salmonid Waters) Regulations (Eire Stationery Office, 1988, cited in WRC, 1992) and the accompanying guidance note. A single on-line lake and 1317 km of river were designated as salmonid waters; no cyprinid designations were made.

Although the responsibility for monitoring lies with the 155 local authorities the majority of sampling is coordinated by the Water Resources Division of An Foras Forbartha (The National Institute for Physical Planning and Construction Research).

Table 8 summarises compliance data for Eire. Ireland has set its own 'I' values for certain parameters, including BOD, nitrite and non-ionized ammonia. Sampling is carried out monthly. Nitrite, apparently due to high levels in otherwise clean rivers, has proved to be the most problematic parameter.

An increase in physico-chemical monitoring was required to implement the Directive, as historically the majority of water quality monitoring has employed biological techniques (Newman, 1988).

Table 8: Summary of compliance with the standards in the EC Freshwater Fish directive in the Republic of Ireland

Parameter	% Compliance
Nitrite	66.1
Suspended solids	85.8
Dissolved oxygen	88.0
Total zinc	91.4
Non-ionized ammonia	96.2
Dissolved copper	96.7
BOD	97.2
Total ammonia	97.5
pH	97.8

Source : WRC, 1992

4.8 Italy

The Freshwater Fish Directive was implemented by the Italian Government in January 1992. Formal designations were not required until January 1993 and no information regarding the existence of designations was provided. Criteria for designation of waters were identified in the legislation, and were mainly sites of natural or scientific interest, and state, regional and national parks.

Responsibility for designation and monitoring lies with the 20 regional authorities with information being collated by the Department of the Environment. Italian legislation requires the regions to submit biennial reports to the DoE regarding water quality, fishery status and suggestions for water quality improvements.

Variations to the standards laid down in the Directive include:

- 'I' values have been set for suspended solids, BOD, nitrite and dissolved copper;
- 'G' values have been set for total phosphorus, phenolic compounds and petroleum hydrocarbons;
- values have been set for seven additional parameters (anionic surfactants, arsenic, cadmium, chromium, mercury, nickel and lead); and
- a more stringent 'I' value for residual chlorine.

4.9 Luxembourg

Under legislation passed on 27 December 1980, Luxembourg in October 1982 designated 412.9 km of rivers and a single lake, representing 60% of total river length. Designated waters are monitored by the Administration of the Environment three times a year and full compliance with the Directive has been achieved. The results for 1982-84 and 1985-88 were reported to the European Commission on 25 April 1986 and 6 June 1989 respectively. However the standards for certain parameters (eg BOD, nitrites and ammonia) were less

stringent than those laid down in the Directive. An ambitious pollution prevention programme largely aimed at reducing ammonia from urban wastewater treatment works is currently underway (Hansen, 1991 cited in WRc, 1992).

4.10 Netherlands

The Directive has been fully implemented in the Netherlands and recent additions to the list of designated waters included the first salmonid designation. The Ministry of Transport and Public Works (MTPW), Rijkswaterstaat, is responsible for the designation of state waters whilst the designation of regional waters is the responsibility of the Provinces. The Rijksinstituut voor Integraal Zoeywaterbeheer en Afvalwaterbehandeling (RIZA) and the waterboards are responsible for monitoring state and regional waters respectively and it is RIZA who submits reports to the EC.

Within the Netherlands all standards which have been set are mandatory ('T' values) and the major variations to the Directive include:

- less stringent standards for suspended solids, BOD, nitrite and total ammonia (these only receive 'G' values in the Directive);
- more stringent standards for non-ionized ammonia and zinc, and a copper standard more stringent than the Directive's 'G' value;
- a standard has been set for phosphorus; and
- a reduced pH range.

Monthly monitoring is carried out. Compliance criteria are generally 90 percent of samples. The most problematic parameters appear to be nutrient related; ammonia, and phosphate.

Water quality improvement programmes have been formulated for state waters (MTPW, 1991 cited in WRc, 1992) in accordance with the Rhine and North Sea Action Programmes. These are largely directed at improvements in wastewater treatment, nutrient removal and usage control.

4.11 Portugal

The Directive was implemented by the Portuguese Law of Water Quality (74/90) and monitoring is carried out on a monthly basis by the Ministry for the Environment and National Resources. Standards are identical to those in the Directive except that a guide value has been set for total phosphorus.

4.12 Spain

As a recent addition to the EC, Spain is in the process of implementing the Directive. Provisional designations (31 salmonid and 115 cyprinid) have been identified (ICONA, 1991 cited in WRc, 1992) by the Spanish Ministry of Agriculture Fisheries and Food. These provisional designations are based on the quality of fish communities present in the waters rather than on water quality or fisheries potential. Differences between national standards and those laid down in the Directive include:

- more stringent values for dissolved oxygen; and

- standards have been set for total phosphorus.

Only one set of standards has been produced however and it is unclear whether these are guideline or imperative values.

5 FUTURE DEVELOPMENTS

5.1 Standardised Reporting Directive (91/692/EEC)

The Standardised Reporting Directive, adopted in December 1991, aims to rationalise and improve the transmission of information from Member States to the Commission and the publication of reports concerning certain EC Directives relating to the protection of the environment. Reporting of those Directives amended or supplemented by 91/692/EEC will in future be in standard formats based on questionnaires or outlines drafted by the EC. Depending on the particular Directive, reporting shall be annually, or at intervals of three years as in the case of the Freshwater Fish Directive.

The first report from the Member States to the EC for Directive 78/659/EEC will cover the period 1993 to 1995 inclusive and will be submitted to the Commission by DoE before 1 September 1996.

The present intention is that reporting by the competent authorities to the DoE should be annually, with the DoE reporting to the EC, as previously stated, at intervals of three years.

5.2 Revision of the Directive

At the European Summit held in December 1993 in Brussels, European Heads of State and Government examined the Commission's review of EC laws, in the light of the principle of subsidiarity enshrined in the Maastricht Treaty on European Union.

The Commission was given a mandate at the previous Edinburgh Summit, in December 1992, to review water quality Directives in the light of scientific knowledge and technical progress. The aim was to maintain and improve existing standards, but give more responsibility to national, regional and local administrative bodies. All of the proposals will need to be developed by the European Commission and negotiated by all twelve Member States taking into account the opinion of the European Parliament. This process could take some time, and until then the existing Directive remains in force.

The proposals include the repeal of the Freshwater Fish Directive and its replacement with a new framework Directive on "ecological quality of surface waters". This will give Member States more flexibility in defining certain parameters. Whilst the EC standards will concentrate on quality and health related parameters, it is expected that other types of standards, such as those which relate to aesthetics will be left to the Member States to regulate. The revision of the Directive is not expected to result in a relaxation of the present standards.

6 REFERENCES AND FURTHER READING

Banarescu, P., Blanc, M., Gaudet, J.-L. and Hureau, J.-C. (1971) European Inland Water Fish, A Multilingual Catalogue. Food and Agriculture Organisation of the United Nations, Fishing News (Books) Ltd.

Bottomley, P.E. (1980) The Freshwater Fish Directive. IWES Scientific Symposium on ECC Directives. IWES, London. 100pp.

CEC (Council of the European Communities) (1978) Directive on the quality of fresh water needing protection or improvement in order to support fish life (78/659/EEC). Official Journal of the European Communities L222, 14.8.78.

CEC (Council of the European Communities) (1991a) Directive laying down the health conditions for the production and the placing on the market of fishery products (91/493/EEC). Official Journal of the European Communities L268, 24.9.91.

CEC (Council of the European Communities) (1991b) Directive standardising and rationalising reports on the implementation of certain Directives relating to the environment (91/692/EEC). Official Journal of the European Communities L377, 31.12.91.

DoE (Department of the Environment) (1978) Interpretation of the EEC Directive on the quality of fresh waters needing protection in order to support fish life (78/659/EEC)

DoE (Department of the Environment) (1979) Advice on the implementation of the EEC Directive on the quality of fresh waters needing protection or improvement in order to support fish life.

DoE (Department of the Environment) (1980) Letter to Director General, Environment and Consumer Protection Service, Brussels, of 24 July 1980, Ref 262/19, on Council Directive 78/659/EEC on the quality of fresh waters needing protection or improvement in order to support fish life.

DoE (Department of the Environment) (1985) Circular on Council Directive 78/659/EEC (Freshwater Fish) - Total ammonium.

DoE (Department of the Environment) (1989) Circular 7/89 Water and the Environment. The implementation of European Community Directives on pollution caused by certain dangerous substances discharged into the aquatic environment.

DoE (Department of the Environment) (1990) Freshwater Fish Directive (78/659/EEC) Article 16 Report (1989 Survey Results). United Kingdom.

DoE (Department of the Environment) (1992a) The UK Environment. Government Statistical Service. HMSO London.

DoE (Department of the Environment) (1992b) River Quality - The Government's Proposals; A Consultation Paper. DoE.

DoE (Department of the Environment) (1994) The Surface Waters (River Ecosystem) (Classification) Regulations.

Haigh, N (1989) EEC Environmental Policy and Britain. IEEP. Bell and Bain Ltd, Glasgow.

HMSO (1991) Water Resources Act 1991, HMSO London.

Howarth, W (1988). Water Pollution Law. Shaw and Sons Ltd, London.

Howarth, W. (1990). The Law of the National Rivers Authority. NRA and Univ. College of Wales. 119pp.

Newman, P.J. (1988) Classification of Surface Water Quality: Review of Schemes used in EC Member States. WRc, Medmenham.

NRA and MAFF (1989) Water Pollution from Farm Waste, 1989. England and Wales.

NRA (1990) National Rivers Authority, Corporate Plan 1990/1991. NRA London.

NRA (1991a) Proposals for Statutory Water Quality Objectives. Water Quality Series No. 5. NRA, Bristol.

NRA (1991b) The Quality of rivers, canals and estuaries in England and Wales: Report of the 1990 Survey. Water Quality Series No. 4. NRA, Bristol.

NRA (1993a) NRA Fisheries Strategy. NRA, Bristol.

NRA (1993b) Recommendations for a Scheme of Water Quality Classification for Setting Statutory Water Quality Objectives. NRA, Bristol.

NRA (1993c) Water Pollution Incidents in England and Wales - 1992. Water Quality Series No. 13. NRA, Bristol.

NRA (1994) The Quality of Rivers and Canals in England and Wales (1990 to 1992). Water Quality Series No.19. NRA, Bristol.

Solbe, J. (1988) Water Quality for Salmon and Trout. Atlantic Salmon Trust, Pitlochry, Scotland.

WRc (1992). The Implementation of the EC Freshwater Fish Directive in Member States (Draft Final Report). Report to NRA. 39pp.

APPENDIX A

COUNCIL DIRECTIVE

of 18 July 1978

on the quality of fresh waters needing protection or improvement in order to support fish life
(78/659/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Articles 100 and 235 thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament (1),

Having regard to the opinion of the Economic and Social Committee (2),

Whereas the protection and improvement of the environment necessitates concrete measures to protect waters against pollution, including waters capable of supporting freshwater fish;

Whereas it is necessary from the ecological and economic viewpoint to safeguard fish populations from various harmful consequences, resulting from the discharge of pollutant substances into the waters, such as, in particular, the reduction in number of fish belonging to a certain species and even in some cases the disappearance of a number of these species;

Whereas the programmes of action of the European Communities on the environment of 1973 (3) and 1977(4) provide that quality objectives are to be jointly drawn up fixing the various requirements which an environment must meet, *inter alia* the definition of parameters for water, including waters capable of supporting freshwater fish;

Whereas differences between the provisions already in force or in preparation in the various Member States as regards the quality of waters capable of supporting the life of freshwater fish may create unequal conditions of competition and thus directly affect the functioning of the common market; whereas laws in the field should be approximated as provided for by Article 100 of the Treaty;

(1) OJ No C30, 7.2. 1977, p. 37.

(2) OJ No C77, 30.3. 1977, p. 2.

(3) OJ No C112, 20.12. 1973, p. 3.

(4) OJ No C139, 13.6. 1977, p. 3.

Whereas it is necessary to couple this approximation of laws with Community action aiming to achieve, by means of wider-ranging provisions, one of the Community's objectives in the field of environmental protection and the improvement of the quality of life; whereas certain specific provisions must be laid down in this connection; whereas, since the specific powers of action required to this end have not been provided for in the Treaty, it is necessary to invoke Article 235 thereof;

Whereas, in order to attain the objectives of the Directive, the Member States will have to designate the waters to which it will apply and will have to set limit values corresponding to certain parameters; whereas action will be taken to ensure that the waters so designated will conform to these values within five years of this designation;

Whereas provision should be made that waters capable of supporting freshwater fish will, under certain conditions, be deemed to conform to the relevant parametric values even if a certain percentage of samples taken does not comply with the limits specified in the Annex;

Whereas to ensure that the quality of waters capable of supporting freshwater fish is checked, a minimum number of samples should be taken and the measurements relating to parameters set out in the Annex should be carried out; whereas such sampling may be reduced or discontinued in the light of the quality of the water;

Whereas the Member States are unable to control certain natural circumstances and it is therefore necessary to provide for the possibility of derogating from this Directive in certain cases;

Whereas technical and scientific progress may make necessary the rapid adaptation of certain of the requirements laid down in the Annexes to this Directive; whereas, in order to facilitate the introduction of the measures required for this purpose, a procedure should be laid down whereby close cooperation would be established between the Member States and the Commission within a Committee on Adaptation to Technical and Scientific Progress,

HAS ADOPTED THIS DIRECTIVE:

Article 1

1. This Directive concerns the quality of fresh waters and applies to those waters designated by the Member States as needing protection or improvement in order to support fish life.

2. This Directive shall not apply to waters in natural or artificial fish ponds used for intensive fish-farming.

3. The aim of this Directive is to protect or improve the quality of those running or standing fresh waters which support or which, if pollution were reduced or eliminated, would become capable of supporting fish belonging to:

- indigenous species offering a natural diversity, or
- species the presence of which is judged desirable for water management purposes by the competent authorities of the Member States.

4. For the purposes of this Directive:

- salmonid waters shall mean waters which support or become capable of supporting fish belonging to species such as salmon (*Salmo salar*), trout (*Salmo trutta*), grayling (*Thymallus thymallus*) and whitefish (*Coregonus*),
- cyprinid waters shall mean waters which support or become capable of supporting fish belonging to the cyprinids (*Cyprinidae*), or other species such as pike (*Esox lucius*), perch (*Perca fluviatilis*) and eel (*Anguilla anguilla*).

Article 2

1. The physical and chemical parameters applicable to the waters designated by the Member States are listed in Annex I.

2. For the purposes of applying these parameters, waters are divided into salmonid waters and cyprinid waters.

Article 3

1. Member States shall, for the designated waters, set values for the parameters listed in Annex I, in so far as

values are listed in column G or in column I. They shall comply with the comments contained in each of these two columns.

2. Member States shall not set values less stringent than those listed in column I of Annex I and shall endeavour to respect the values in column G taking into account the principle set out in Article 8.

Article 4

1. Member States shall, initially within a two year period following the notification of this Directive, designate salmonid waters and cyprinid waters.

2. Member States may subsequently make additional designations.

3. Member States may revise the designation of certain waters owing to factors unforeseen at the time of designation, taking into account the principle set out in Article 8.

Article 5

Member States shall establish programmes in order to reduce pollution and to ensure that designated waters conform within five years following designation in accordance with Article 4 to both the values set by the Member States in accordance with Article 3 and the comments contained in columns G and I of Annex I.

Article 6

1. For the purposes of implementing Article 5, the designated waters shall be deemed to conform to the provisions of this Directive if samples of such waters, taken at the minimum frequency specified in Annex I at the same sampling point and over a period of 12 months, show that they conform to both the values set by the Member States in accordance with Article 3 and to the comments contained in columns G and I of Annex I, in the case of:

- 95% of the samples for the parameters: pH, BOD₅, non-ionized ammonia, total ammonium, nitrites, total residual chlorine, total zinc, and dissolved copper. When the sampling frequency is lower than one sample per month, both the abovementioned values and comments shall be respected for all the samples,
- the percentages listed in Annex I for the parameters:

temperature and dissolved oxygen,

- the average concentration set for the parameter: suspended solids.

2. Instances in which the values set by Member States in accordance with Article 3 or the comments contained in columns G and I of Annex I are not respected shall not be taken into consideration in the calculation of the percentages provided for in paragraph 1 when they are the result of floods or other natural disasters.

Article 7

1. The competent authorities in the Member States shall carry out sampling operations, the minimum frequency of which is laid down in Annex I.

2. Where the competent authority records that the quality of designated waters is appreciably higher than that which would result from the application of the values set in accordance with Article 3 and the comments contained in columns G and I of Annex I, the frequency of the sampling may be reduced. Where there is no pollution or no risk of deterioration in the quality of the waters, the competent authority concerned may decide that no sampling is necessary.

3. If sampling shows that a value set by a Member State in accordance with Article 3 or a comment contained in either of columns G or I or Annex I is not respected, the Member State shall establish whether this is the result of chance, a natural phenomenon or pollution and shall adopt appropriate measures.

4. The exact sampling point, the distance from this point to the nearest point where pollutants are discharged and the depth at which the samples are to be taken shall be fixed by the competent authority of each Member State on the basis of local environmental conditions in particular.

5. Certain reference methods of analysis for the parameters concerned are set out in Annex I. Laboratories which employ other methods shall ensure that the results obtained are equivalent or comparable to those specified in Annex I.

Article 8

Implementation of the measures taken pursuant to this

Directive may on no account lead, either directly or indirectly, to increased pollution of fresh water.

Article 9

Member States may at any time set more stringent values for designated waters than those laid down in this Directive. They may also lay down provisions relating to other parameters than those provided for in this Directive.

Article 10

When fresh waters cross or form national frontiers between Member States and when one of these States considers designating these waters, these States shall consult each other in order to determine the stretches of such waters to which the Directive might apply and the consequences to be drawn from the common quality objectives; these consequences shall be determined, after formal consultations, by each State concerned. The Commission may participate in these deliberations.

Article 11

The Member States may derogate from this Directive:

- (a) in the case of certain parameters marked (0) in Annex I, because of exceptional weather or special geographical conditions;
- (b) when designated waters undergo natural enrichment in certain substances, so that the values set out in Annex I are not respected.

Natural enrichment means the process whereby, without human intervention, a given body of water receives from the soil certain substances contained therein.

Article 12

Such amendments as are necessary for adapting to technical and scientific progress:

- the G values for the parameters, and
- the methods of analysis,

contained in Annex I shall be adopted in accordance

with the procedure laid down in Article 14.

Article 13

1. A Committee on Adaption to Technical and Scientific Progress (hereinafter called 'the Committee'), consisting of representatives of Member States and chaired by a Commission representative, is hereby set up for the purpose laid down in Article 12.

2. The Committee shall draw up its rules of procedure.

Article 14

1. Where the procedure laid down in this Article is to be followed, matters shall be referred to the Committee by its chairman, either on his own initiative or at the request of the representative of a Member State.

2. The Commission representative shall submit to the Committee a draft of the measures to be adopted. The Committee shall deliver its opinion on the draft within a time limit set by the chairman having regard to the urgency of the matter. It shall act by a majority of 41 votes, the votes of the Member States being weighted as provided for in Article 148(2) of the Treaty. The chairman shall not vote.

3. (a) The Commission shall adopt the measures envisaged where they are in accordance with the opinion of the Committee.

(b) Where the measures envisaged are not in accordance with the opinion of the Committee, or if no opinion is adopted, the Commission shall without delay submit a proposal to the Council concerning the measures to be adopted. The Council shall act by a qualified majority.

(c) If, within three months of the proposals being submitted to it, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 15

For the purposes of applying this Directive, Member States shall provide the Commission with information concerning:

- the waters designated in accordance with Article 4 (1) and (2), in summary form,

- the revision of the designation of certain waters in accordance with Article 4(3),

- the provisions laid down in order to establish new parameters in accordance with Article 9,

- the application of the derogations from the values listed in column I in Annex I.

More generally, Member States shall provide the Commission, on a reasoned request from the latter, with any information necessary for the application of this Directive.

Article 16

1. Member States shall, five years following the initial designation in accordance with Article 4(1), and at regular intervals thereafter, submit a detailed report to the Commission on designated waters and the basic features thereof.

2. After prior consent has been obtained from the Member State concerned, the Commission shall publish the information obtained.

Article 17

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive within two years of its notification. They shall forthwith inform the Commission thereof.

2. Member States shall communicate to the Commission the texts of the main provisions of national law which they adopt in the field governed by this Directive.

Article 18

This Directive is addressed to the Member States.

Done at Brussels, 18 July 1978.

For the Council
The President
M. LAHNSTEIN

Parameter	Salmonid waters		Cyprinid waters		Methods of analysis or inspection	Minimum sampling and measuring frequency	Observations						
	G	I	G	I									
1. Temperature (°C)	<p>1. Temperature measured downstream of a point of thermal discharge (at the edge of the mixing zone) must not exceed the unaffected temperature by more than:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="width: 50%; text-align: center;">1.5°C</td> <td style="width: 50%; text-align: center;">3°C</td> </tr> </table> <p>Derogations limited in geographical scope may be decided by Member States in particular conditions if the competent authority can prove that there are no harmful consequences for the balanced development of the fish population.</p> <p>2. Thermal discharges must not cause the temperature downstream of the point of thermal discharge (at the edge of the mixing zone) to exceed the following:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="width: 50%; text-align: center;">21.5 (0)</td> <td style="width: 50%; text-align: center;">28 (0)</td> </tr> <tr> <td style="width: 50%; text-align: center;">10 (0)</td> <td style="width: 50%; text-align: center;">10 (0)</td> </tr> </table> <p>The 10°C temperature limit applies only to breeding periods of species which need cold water for reproduction and only to waters which may contain such species.</p> <p>Temperature limits may, however, be exceeded for 2% of the time.</p>				1.5°C	3°C	21.5 (0)	28 (0)	10 (0)	10 (0)	Thermometry	Weekly, both upstream and downstream of the point of thermal discharge	Over-sudden variations in temperature shall be avoided
1.5°C	3°C												
21.5 (0)	28 (0)												
10 (0)	10 (0)												
2. Dissolved oxygen (mg/l O ₂)	50% > 9 100% > 7	50% > 9 When the oxygen concentration falls below 6 mg/l, Member States shall implement the provisions of Article 7 (3). The competent authority must prove that this situation will have no harmful consequences for the balanced development of the fish population	50% > 8 100% > 5	50% > 7 When the oxygen concentration falls below 4 mg/l, Member States shall implement the provisions of Article 7 (3). The competent authority must prove that this situation will have no harmful consequences for the balanced development of the fish population	Winkler's method or specific electrodes (electro-chemical method)	Monthly, minimum one sample representative of low oxygen conditions of the day of sampling However, where major daily variations are suspected, a minimum of two samples in one day shall be taken.							

Parameter	Salmonid waters		Cyprinid waters		Methods of analysis or inspection	Minimum sampling and measuring frequency	Observations
	G	I	G	I			
3. pH		6 to 9 (0) (')		6 to 9 (0) (')	Electrometry calibration by means of two solutions with known pH values, preferably on either side of, and close to the pH being measured	Monthly	
4. Suspended solids (mg/l)	< 25 (0)		< 25 (0)		Filtration through a 0.45 µm filtering membrane, or centrifugation (five minutes minimum, average acceleration of 2800 to 3200g) drying at 105°C and weighing		The values shown are average concentrations and do not apply to suspended solids with harmful chemical properties. Floods are liable to cause particularly high concentrations
5. BOD ₅ (mg/l O ₂)	< 3		< 6		Determination of O ₂ by the Winkler method before and after five days incubation in complete darkness at 20 ± 1°C (nitrification should not be inhibited)		

Parameter	Salmonid waters		Cyprinid waters		Methods of analysis or inspection	Minimum sampling and measuring frequency	Observations
	G	I	G	I			
6. Total phosphorus (mg/l P)					Molecular absorption spectrophotometry		<p>In the case of lakes of average depth between 18 and 300 m, the following formula could be applied:</p> $L < 10 \frac{\bar{Z}}{T_w} (1 + \sqrt{T_w})$ <p>where:</p> <p>L = loading expressed as mg P per square metre lake surface in one year.</p> <p>\bar{Z} = mean depth of lake in metres</p> <p>T_w = theoretical renewal time of lake water in years</p> <p>In other cases limit values of 0.2 mg/l for salmonid and of 0.4 mg/l for cyprinid waters, expressed as PO_4, may be regarded as indicative in order to reduce eutrophication.</p>
7. Nitrites (mg/l NO_2)	< 0.01		< 0.03		Molecular absorption spectrophotometry		

Parameter	Salmonid waters		Cyprinid waters		Methods of analysis or inspection	Minimum sampling and measuring frequency	Observations
	G	I	G	I			
8. Phenolic compounds (mg/l C ₆ H ₅ OH)		(?)		(?)	By taste		An examination by taste shall be made only where the presence of phenolic compounds is presumed.
9. Petroleum hydrocarbons		(?)		(?)	Visual By taste	Monthly	A visual examination shall be made regularly once a month, with an examination by taste only where the presence of hydrocarbons is presumed.
10. Non-ionised ammonia (mg/l NH ₃)	< 0.005	< 0.025	< 0.005	< 0.025	Molecular absorption spectrophotometry using indophenol blue or Nessler's method associated with pH and temperature determination	Monthly	Values for non-ionized ammonia may be exceeded in the form of minor peaks in the daytime
In order to diminish the risk of toxicity due to non-ionized ammonia, of oxygen consumption due to nitrification and of eutrophication, the concentrations of total ammonium should not exceed the following:							
11. Total ammonium (mg/l NH ₄)	< 0.04	< 1 ⁽⁴⁾	< 0.2	< 1 ⁽⁴⁾			
12. Total residual chlorine (mg/l HOCl)		< 0.005		< 0.005	DPD-method (diethyl- <i>p</i> -phenylenediamene)	Monthly	The I-values correspond to pH = 6 Higher concentrations of total chlorine can be accepted if the pH is higher

Parameter	Salmonid waters		Cyprinid waters		Methods of analysis or inspection	Minimum sampling and measuring frequency	Observations
	G	I	G	I			
13. Total zinc (mg/l Zn)		< 0.3		< 1.0	Atomic absorption spectrometry	Monthly	The I-values correspond to a water hardness of 100 mg/l CaCO ₃ . For hardness levels between 10 and 500 mg/l corresponding limit values can be found in Annex II.
14. Dissolved copper (mg/l Cu)	< 0.04		< 0.04		Atomic absorption spectrometry		The G-values correspond to a water hardness of 100 mg/l CaCO ₃ . For hardness levels between 10 and 300 mg/l corresponding limit values can be found in Annex II.

- (1) Artificial pH variations with respect to the unaffected values shall not exceed ± 0.5 of a pH unit within the limits falling between 6.0 and 9.0 provided that these variations do not increase the harmfulness of other substances present in the water.
- (2) Phenolic compounds must not be present in such concentrations that they adversely affect fish flavour.
- (3) Petroleum products must not be present in water in such quantities that they:
 - form a visible film on the surface of the water or form coatings on the beds of water-courses and lakes,
 - impart a detectable 'hydrocarbon' taste to fish,
 - produce harmful effects in fish.
- (4) In particular geographical or climatic conditions and particularly in cases of low water temperature and of reduced nitrification or where the competent authority can prove that there are no harmful consequences for the balanced development of the fish population, Member States may fix values higher than 1 mg/l.

General observation:

It should be noted that the parametric values listed in this Annex assume that the other parameters, whether mentioned in this Annex or not, are favourable. This implies, in particular, that the concentrations of other harmful substances are very low.

Where two or more harmful substances are present in mixture, joint effects (additive, synergic or antagonistic effects) may be significant.

- G = guide.
- I = mandatory.
- (0) = derogations are possible in accordance with Article 11

ANNEX II

PARTICULARS REGARDING TOTAL ZINC AND DISSOLVED COPPER

Total Zinc

(see Annex I, No 13, 'Observations' column)

Zinc concentrations (mg/l Zn) for different water hardness values between 10 and 500 mg/l CaCO₃:

	Water hardness (mg/l CaCO ₃)			
	10	50	100	500
Salmonid waters (mg/l Zn)	0.03	0.2	0.3	0.5
Cyprinid waters (mg/l Zn)	0.3	0.7	1.0	2.0

Dissolved copper

(see Annex I, No 14, 'Observations' column)

Dissolved copper concentrations (mg/l Cu) for different water hardness values between 10 and 300 mg/l CaCO₃:

	Water hardness (mg/l CaCO ₃)			
	10	50	100	300
mg/l Cu	0.005 (1)	0.022	0.04	0.112

(1) The presence of fish in waters containing higher concentrations of copper may indicate a predominance of dissolved organo-cupric complexes.

APPENDIX B

APPENDIX B

Table 9: Freshwater Fish Directive (78/659/EEC) Summary of 1984 Monitoring for England and Wales

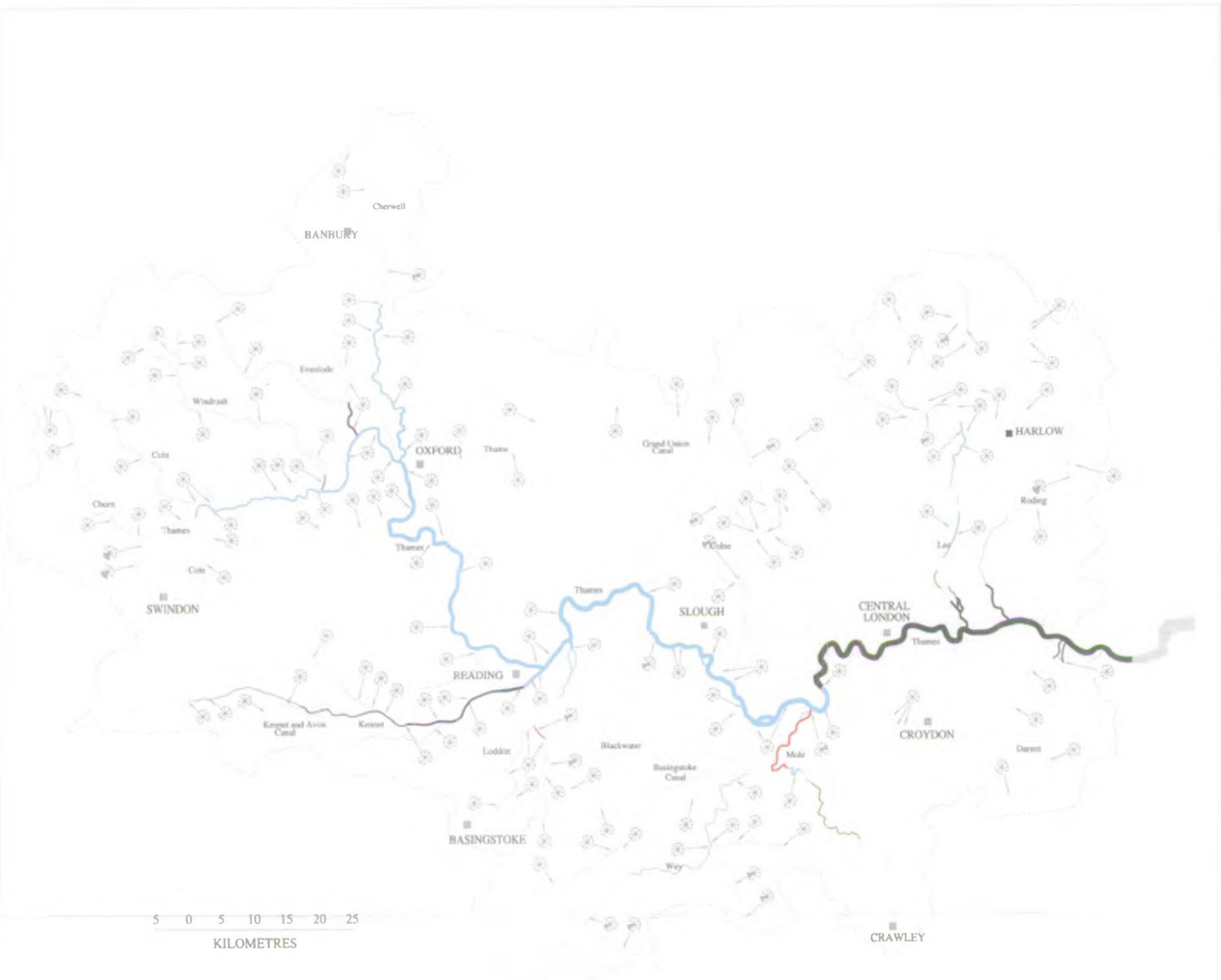
Region	Designations (length km or area ha)			Compliance Failures (number of stretches)			Failing Parameters	Article 11 Derogations (number of stretches)
	Salmonid	Cyprinid	Total	Salmonid	Cyprinid	Total		
North West	2854.9 km	539.0 km	3393.9 km	14	5	19	pH and non ionized ammonia	none
Northumbria	994.0 km	0 km	994 km	2	0	2	total ammonia and zinc	9
Severn-Trent	1181.3 km	1821.9 km	3003.2 km	2	2	4	total ammonia, non ionized ammonia and pH	2 (low pH) 4 (high pH)
Yorkshire	2465.3 km	908.2 km 230 ha	3373.5 km 230 ha	5	13	18	non ionized ammonia, total ammonia and dissolved oxygen	none
Anglian	352.0 km	1047.5 km	1399.5 km	3	11	14	zinc, pH, total ammonia, non ionized ammonia, dissolved oxygen	none
Thames	479.5 km	1039.6 km	1519.1 km	0	11	11	total ammonia	none
Southern	273.3 km	353.1 km	626.4 km	2	17	19	total ammonia and dissolved oxygen	none
Wessex	832.0 km	555.6 km	1387.6 km	6	7	13	total ammonia and dissolved oxygen	none
South West	1298 km 383.3 ha	30.7 km 121.6 ha	1328.7 km 504.9 ha	16	1	17	dissolved oxygen	20
Welsh	2097.4 km	34.3 km	2131.7 km	1	0	1	pH	22
Totals	12827.7 km 383.3 ha	6329.9 km 351.6 ha	19157.6 km 734.9 ha	51	67	118		57

Table 10: Freshwater Fish Directive (78/659/EEC) Summary of 1989 Monitoring for England and Wales

Region	Designations (length km or area ha)			Compliance Failures length km (number of stretches)			Failing Parameters	Article 11 Derogations (number of stretches)
	Salmonid	Cyprinid	Total	Salmonid	Cyprinid	Total		
North West	2854.9 km	539.0 km	3393.9 km	38.9 (8)	75.1(6)	114 (14)	total and non ionized ammonia pH	11 pH, 1 zinc
Northumbria	1070.0 km	0 km	1070 km	19 (2)	0	19 (2)	total ammonia	8 pH 4 non ionized ammonia 1 dissolved oxygen 4 zinc
Severn-Trent	1181.3 km	1821.9 km	3003.2 km	5 (1)	63.9 (5)	68.9 (6)	non ionized ammonia pH and dissolved oxygen	1 low pH 1 high pH
Yorkshire	2465.3 km	908.2 km 230 ha	3373.5 km 230 ha	34	98.5	132.5 (24)	non ionized and total ammonia, pH and dissolved oxygen	none
Anglian	352 km	1047.5 km	1399.5 km	83.5	137.5	221 (18)	pH, dissolved oxygen total and non ionized ammonia	none
Thames	479.5 km	1039.6 km	1519.1 km	6.8	137.9	144.7 (15)	total and non ionized ammonia and dissolved oxygen	none
Southern	266.4 km	430.4 km	696.8 km	0	17.6 (5)	17.6 (5)	total ammonia, dissolved oxygen and pH	none
Wessex	832 km	555.6 km	1387.6 km	130	229.9	359.9 (37)	total and non ionized ammonia, dissolved oxygen and pH	none
South West	1312 km 833.5 ha	30.7 km 121.6 ha	1342.7 km 955.1 ha	183 km 429 ha	27.7 km	210.7 km 429 ha (27)	dissolved oxygen total ammonia pH and zinc	18 pH 3 zinc
Welsh	2097.4 km	34.3 km	2131.7 km	119.3 (9)	0	119.3 (9)	total and non ionized ammonia and dissolved oxygen	26 zinc 16 pH
Totals	12910.8 km 833.5 ha	6407.2 km 351.6 ha	19318.0 km 1185.1 ha	619.5 km 429 ha	788.1 km	1407.6 km 429 ha (157)		89

Table 11: Freshwater Fish Directive (78/659/EEC) Summary of 1992 Monitoring for England and Wales

Region	Designations (length km or area ha)			Compliance Failures length km (number of stretches)			Failing Parameters	Article 11 Derogations (number of stretches)
	Salmonid	Cyprinid	Total	Salmonid	Cyprinid	Total		
North West	2857.7 km	541.9 km	3399.6 km	45.6	72.4	118.0 (22)	dissolved oxygen total and non ionized ammonia	17 pH
Northumbria	1051.4 km 16.2 ha	0 km 1.4 ha	1051.4 km 17.6 ha	17.5	0	17.5 (5)	total and non ionized ammonia	12 zinc 5 pH 1 dissolved oxygen
Severn-Trent	1148.4 km 37.5 ha	1869.2 km	3017.6 km 37.5 ha	41.2	119.0	160.2 (10)	total and non ionized ammonia, pH and zinc	6 pH 1 dissolved oxygen
Yorkshire	2466.9 km	911.9 km 230.0 ha	3378.8 km 230 ha	5.3 km	52.3 km	57.6 km (9)	non ionized and total ammonia	none
Anglian	352 km	1047.5 km	1399.5 km	52.2	147.7	199.9 (13)	pH, dissolved oxygen and total ammonia	none
Thames	503.6 km	966.5 km	1470.1 km	41.7	16.3	58.0 (9)	total ammonia, dissolved oxygen and pH	none
Southern	273.3 km	404.7 km	678.0 km	0	3.5	3.5 (1)	dissolved oxygen	none
Wessex	836.0 km	538.8 km	1374.8 km	139.7	113.9	253.6 (36)	total and non ionized ammonia, dissolved oxygen and zinc	none
South West	1370.5 km 906.5 ha	33.8 km 121.6 ha	1404.3 km 1028.1 ha	67.9 km 57.0 ha	2.0 km 90 ha	69.9 km 147 ha (17)	dissolved oxygen total ammonia and zinc	21 pH 9 zinc 1 dissolved oxygen
Welsh	2127.0 km	34.3 km	2161.3 km	24.1	0	24.1 (2)	zinc	34 zinc 15 pH
Totals	12986.8 km 960.2 ha	6348.6 km 353 ha	19335.4 km 1313.2 ha	435.2 km 57.0 ha	527.1 km 90 ha	962.3 km 147 ha (124)		119



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Article 16 Report for 1989

UNITED KINGDOM
AREA 6

National Rivers Authority Region
Thames

QUALITY OF FRESH WATERS DESIGNATED AS NEEDING PROTECTION
OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE

- SALMONID (Complies with directive)
- SALMONID (Does not comply)
- CYPRINID (Complies with directive)
- CYPRINID (Does not comply)
- NON-DESIGNATED (Selected rivers only)

REASONS FOR NON-COMPLIANCE (Non-complying parameters)

- TEMPERATURE
- DISSOLVED OXYGEN
- pH
- NON-IONIZED AMMONIA
- TOTAL AMMONIUM
- TOTAL RESIDUAL CHLORINE
- TOTAL ZINC

- SAMPLING POINT
- SAMPLING POINT (At which an article 11 derogation has been granted)
- REDUCED SAMPLING FREQUENCY (Shown as a dot (·) outside segment [Article 7(2)])
- Segment is excluded for zero samples (example - parameter 4 is not tested)

RIVER FLOW RANGE
Cubic metres per second
Calculated long-term average flow

- < 0.31
- > 0.31 - 0.62
- > 0.62 - 1.25
- > 1.25 - 2.50
- > 2.50 - 5.00
- > 5.00 - 10.00
- > 10.00 - 20.00
- > 20.00 - 40.00
- > 40.00 - 80.00
- > 80.00

- CANALS
- ESTUARIAL WATER LIMIT
- ESTUARIAL WATER

UNITED KINGDOM
AREA 10

National Rivers Authority Region
Welsh

QUALITY OF FRESH WATERS DESIGNATED AS NEEDING PROTECTION
OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE

- SALMONID (Complies with directive)
- SALMONID (Does not comply)
- CYPRINID (Complies with directive)
- CYPRINID (Does not comply)
- NON-DESIGNATED (Selected rivers only)

REASONS FOR NON-COMPLIANCE (Non-complying parameters)

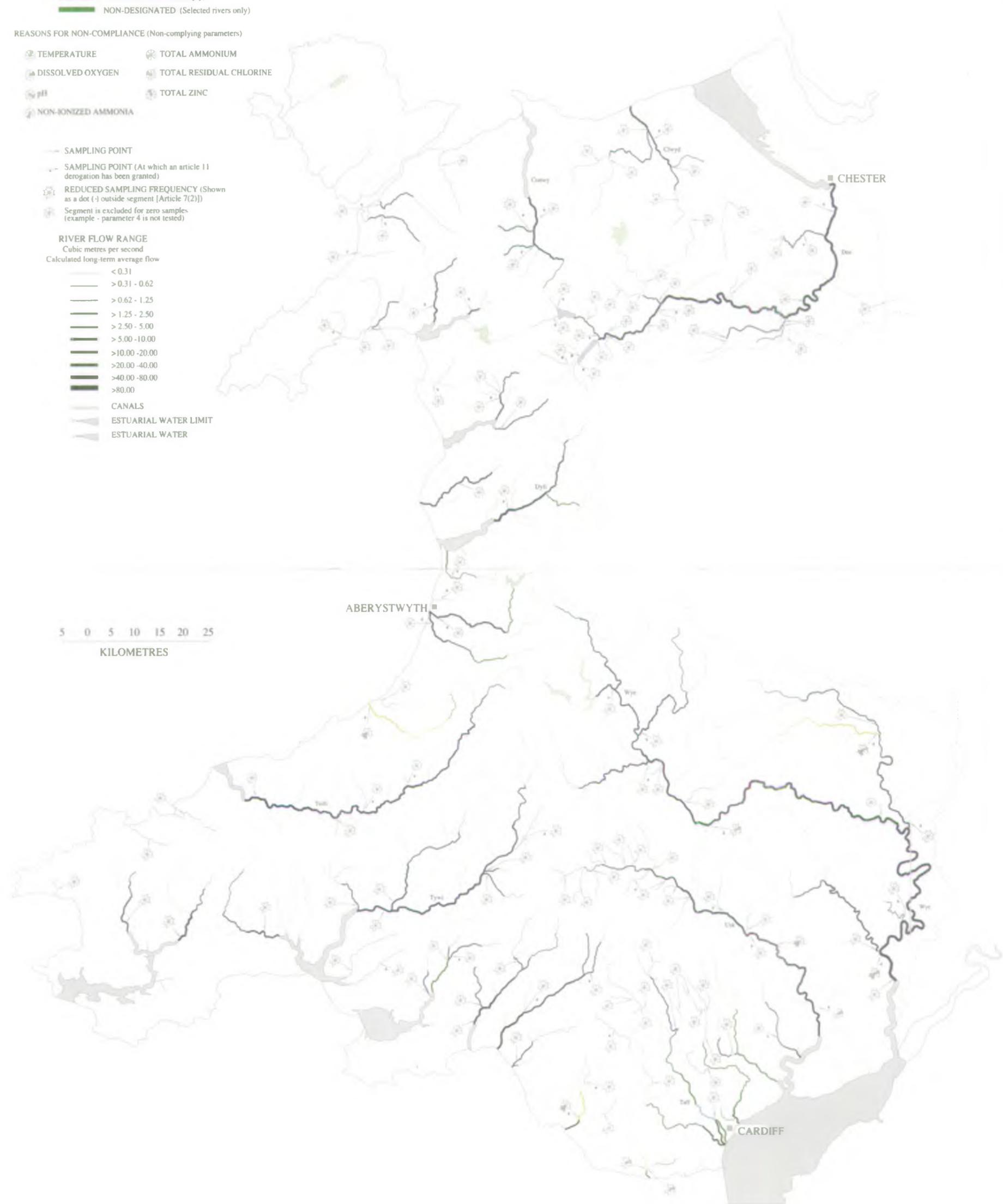
- TEMPERATURE
- DISSOLVED OXYGEN
- pH
- NON-IONIZED AMMONIA
- TOTAL AMMONIUM
- TOTAL RESIDUAL CHLORINE
- TOTAL ZINC

- SAMPLING POINT
- SAMPLING POINT (At which an article 11 derogation has been granted)
- REDUCED SAMPLING FREQUENCY (Shown as a dot (-) outside segment [Article 7(2)])
- Segment is excluded for zero samples (example - parameter 4 is not tested)

RIVER FLOW RANGE
Cubic metres per second
Calculated long-term average flow

- < 0.31
- > 0.31 - 0.62
- > 0.62 - 1.25
- > 1.25 - 2.50
- > 2.50 - 5.00
- > 5.00 - 10.00
- > 10.00 - 20.00
- > 20.00 - 40.00
- > 40.00 - 80.00
- > 80.00

- CANALS
- ESTUARIAL WATER LIMIT
- ESTUARIAL WATER



5 0 5 10 15 20 25
KILOMETRES



COUNCIL DIRECTIVE 78/659/EEC
Article 16 Report for 1989

UNITED KINGDOM
AREA 9

National Rivers Authority Region
South West

QUALITY OF FRESH WATERS DESIGNATED AS NEEDING PROTECTION
OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE

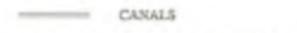
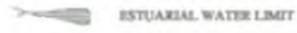
- SALMONID (Complies with directive)
- SALMONID (Does not comply)
- CYPRENID (Complies with directive)
- CYPRENID (Does not comply)
- NON-DESIGNATED (Selected rivers only)

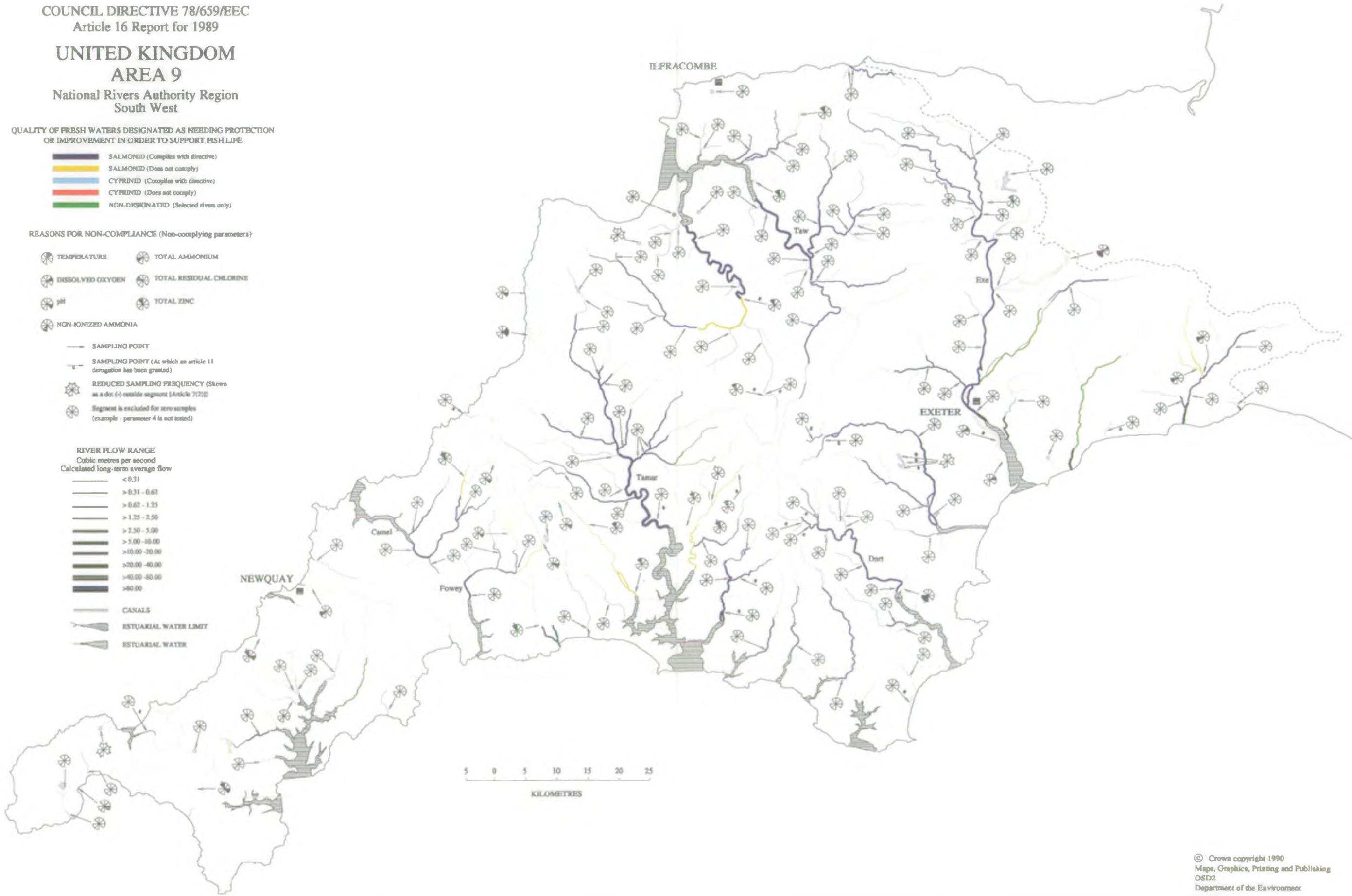
REASONS FOR NON-COMPLIANCE (Non-complying parameters)

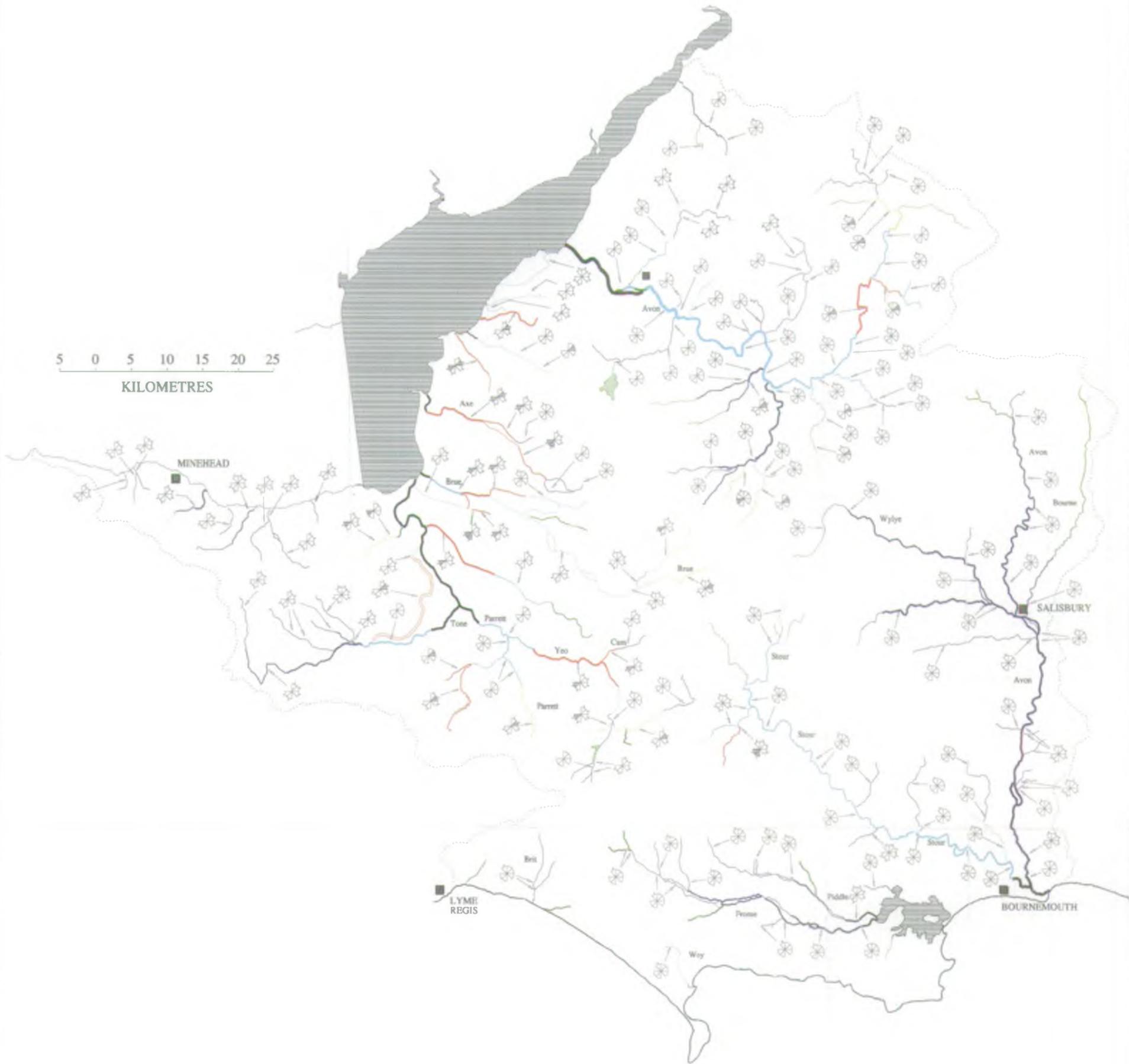
-  TEMPERATURE
-  TOTAL AMMONIUM
-  DISSOLVED OXYGEN
-  TOTAL RESIDUAL CHLORINE
-  pH
-  TOTAL ZINC
-  NON-IONIZED AMMONIA
-  SAMPLING POINT
-  SAMPLING POINT (At which an article 11 derogation has been granted)
-  REDUCED SAMPLING FREQUENCY (Shown as a dot (-) outside segment (Article 7(2)(d))
-  Segment is excluded for zero samples (example - parameter 4 is not tested)

RIVER FLOW RANGE
Cubic metres per second
Calculated long-term average flow

-  < 0.31
-  > 0.31 - 0.62
-  > 0.62 - 1.25
-  > 1.25 - 2.50
-  > 2.50 - 5.00
-  > 5.00 - 10.00
-  > 10.00 - 20.00
-  > 20.00 - 40.00
-  > 40.00 - 80.00
-  > 80.00

-  CANALS
-  ESTUARIAL WATER LIMIT
-  ESTUARIAL WATER





COUNCIL DIRECTIVE 78/659/EEC
Article 16 Report for 1989

UNITED KINGDOM

AREA 8

National Rivers Authority Region
Wessex

QUALITY OF FRESH WATERS DESIGNATED AS NEEDING PROTECTION
OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE

- SALMONID (Complies with directive)
- SALMONID (Does not comply)
- CYPRINID (Complies with directive)
- CYPRINID (Does not comply)
- NON-DESIGNATED (Selected rivers only)

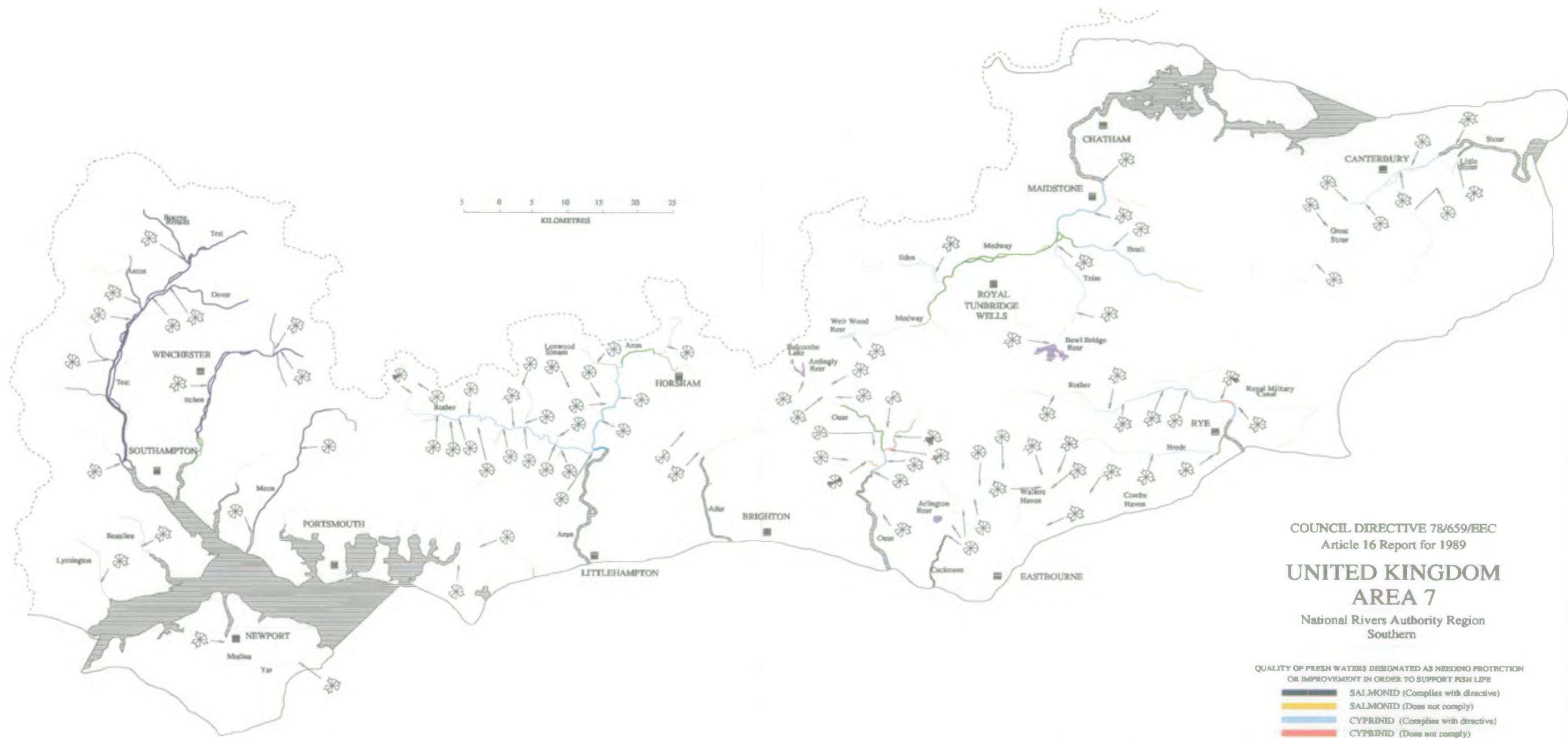
REASONS FOR NON-COMPLIANCE (Non-complying parameters)

-  TEMPERATURE
-  DISSOLVED OXYGEN
-  pH
-  NON-IONIZED AMMONIA
-  TOTAL AMMONIUM
-  TOTAL RESIDUAL CHLORINE
-  TOTAL ZINC
-  SAMPLING POINT
-  SAMPLING POINT (At which an article 11 derogation has been granted)
-  REDUCED SAMPLING FREQUENCY (Shown as a dot (+) outside segment (Article 7(2)))
-  Segment is excluded for zero samples (example - parameter 4 is not tested)

RIVER FLOW RANGE
Cubic metres per second
Calculated long-term average flow

-  < 0.31
-  > 0.31 - 0.62
-  > 0.62 - 1.25
-  > 1.25 - 2.50
-  > 2.50 - 5.00
-  > 5.00 - 10.00
-  > 10.00 - 20.00
-  > 20.00 - 40.00
-  > 40.00 - 80.00
-  > 80.00

-  CANALS
-  ESTUARIAL WATER LIMIT
-  ESTUARIAL WATER



COUNCIL DIRECTIVE 78/659/EEC
 Article 16 Report for 1989
UNITED KINGDOM
AREA 7
 National Rivers Authority Region
 Southern

- QUALITY OF FRESH WATERS DESIGNATED AS NEEDING PROTECTION OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE
- SALMONID (Complies with directive)
 - SALMONID (Does not comply)
 - CYPRINID (Complies with directive)
 - CYPRINID (Does not comply)
 - NON-DESIGNATED (Selected rivers only)

- RIVER FLOW RANGE
 Cubic metres per second
 Calculated long-term average flow
- < 0.31
 - > 0.31 - 0.62
 - > 0.62 - 1.25
 - > 1.25 - 2.50
 - > 2.50 - 5.00
 - > 5.00 - 10.00
 - > 10.00 - 20.00
 - > 20.00 - 40.00
 - > 40.00 - 80.00
 - > 80.00

- REASONS FOR NON-COMPLIANCE (Non-complying parameters)
- TEMPERATURE
 - TOTAL AMMONIUM
 - DISSOLVED OXYGEN
 - TOTAL RESIDUAL CHLORINE
 - pH
 - TOTAL ZINC
 - NON-IONIZED AMMONIA

- SAMPLING POINT
- SAMPLING POINT (At which an article 11 derogation has been granted)
- REDUCED SAMPLING FREQUENCY (Shown as a dot (•) outside segment [Article 7(2)])
- Segment is excluded for zero examples (example - parameter 4 is not tested)

COUNCIL DIRECTIVE 78/659/EEC
 Article 16 Report for 1989
UNITED KINGDOM
AREA 1
 National Rivers Authority Region
 North West

QUALITY OF FRESH WATERS DESIGNATED AS NEEDING PROTECTION
 OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE

-  SALMONID (Complies with directive)
-  SALMONID (Does not comply)
-  CYPRINID (Complies with directive)
-  CYPRINID (Does not comply)
-  NON-DESIGNATED (Selected rivers only)

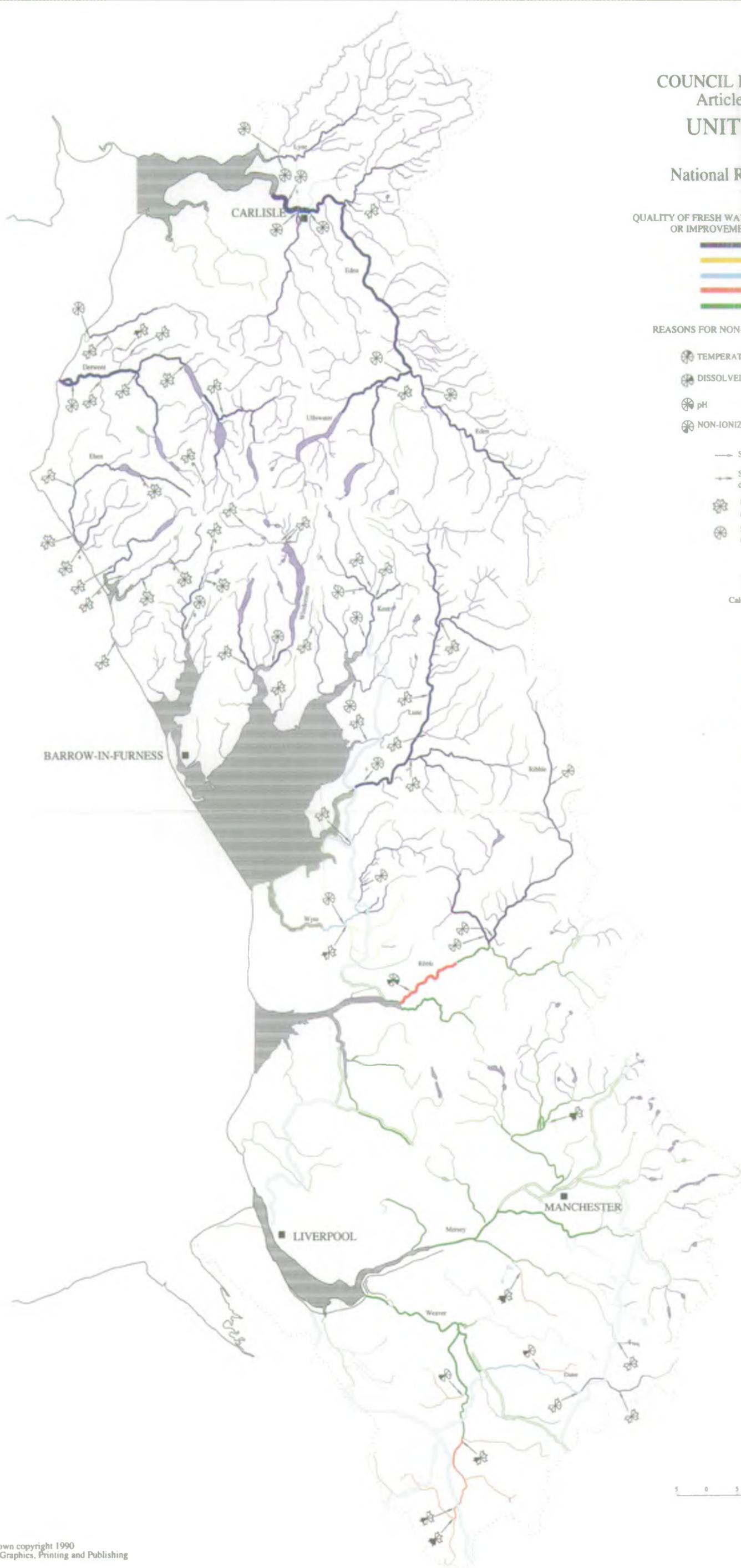
REASONS FOR NON-COMPLIANCE (Non-complying parameters)

-  TEMPERATURE
-  TOTAL AMMONIUM
-  DISSOLVED OXYGEN
-  TOTAL RESIDUAL CHLORINE
-  pH
-  TOTAL ZINC
-  NON-IONIZED AMMONIA

-  SAMPLING POINT
-  SAMPLING POINT (At which an article 11 derogation has been granted)
-  REDUCED SAMPLING FREQUENCY (Shown as a dot (+) outside segment [Article 7(2)])
-  Segment is excluded for zero samples (example - parameter 4 is not tested)

- RIVER FLOW RANGE
 Cubic metres per second
 Calculated long-term average flow
-  < 0.31
 -  > 0.31 - 0.62
 -  > 0.62 - 1.25
 -  > 1.25 - 2.50
 -  > 2.50 - 5.00
 -  > 5.00 - 10.00
 -  > 10.00 - 20.00
 -  > 20.00 - 40.00
 -  > 40.00 - 80.00
 -  > 80.00

-  CANALS
-  ESTUARIAL WATER LIMIT
-  ESTUARIAL WATER



UNITED KINGDOM
AREA 2

National Rivers Authority Region
Northumbria

QUALITY OF FRESH WATERS DESIGNATED AS NEEDING PROTECTION
OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE

-  SALMONID (Complies with directive)
-  SALMONID (Does not comply)
-  CYPRINID (Complies with directive)
-  CYPRINID (Does not comply)
-  NON-DESIGNATED (Selected rivers only)

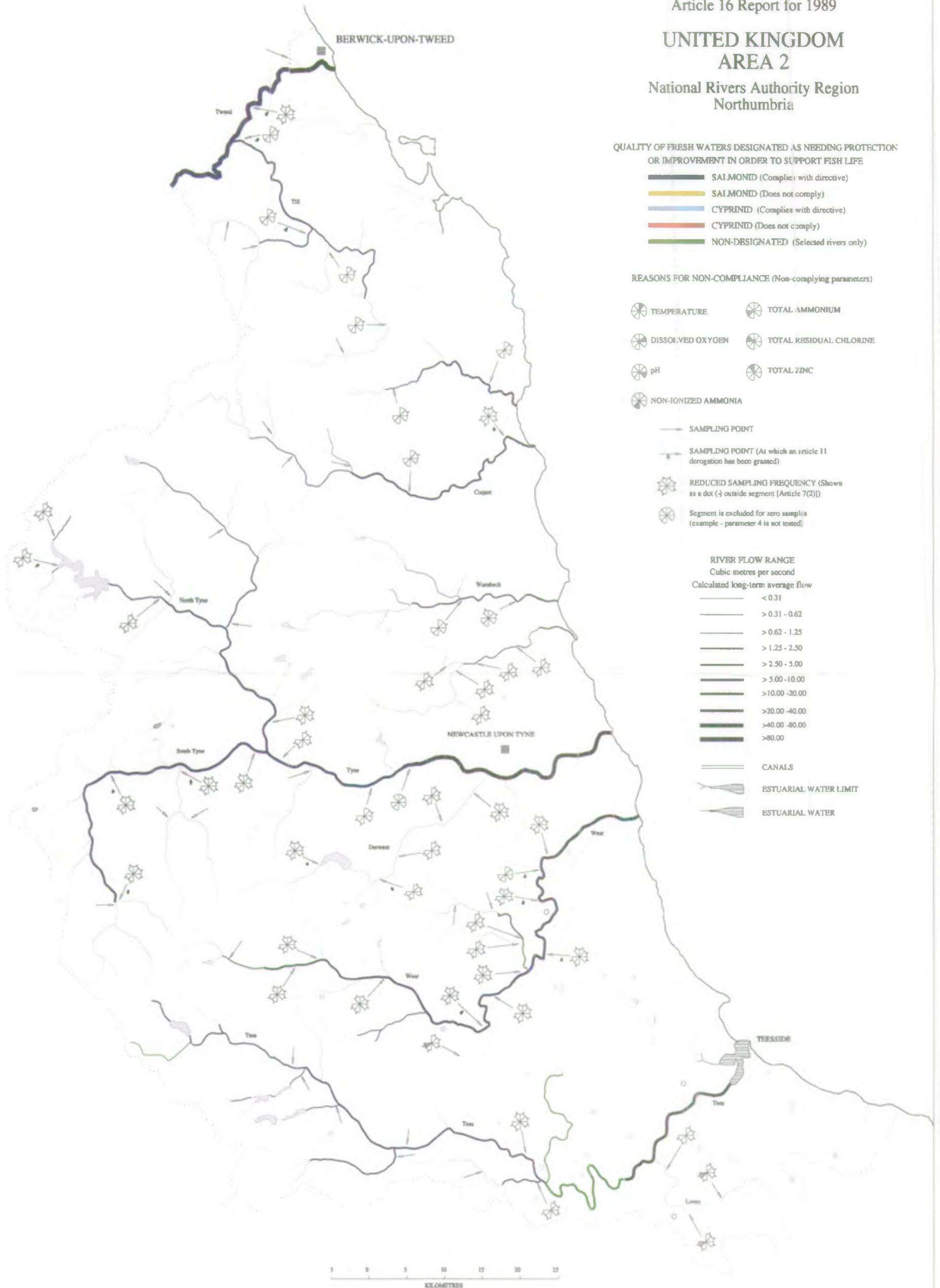
REASONS FOR NON-COMPLIANCE (Non-complying parameters)

-  TEMPERATURE
-  DISSOLVED OXYGEN
-  pH
-  NON-IONIZED AMMONIA
-  TOTAL AMMONIUM
-  TOTAL RESIDUAL CHLORINE
-  TOTAL ZINC
-  SAMPLING POINT
-  SAMPLING POINT (At which an article 11 derogation has been granted)
-  REDUCED SAMPLING FREQUENCY (Shows as a dot (•) outside segment [Article 7(2)])
-  Segment is excluded for zero samples (example - parameter 4 is not tested)

RIVER FLOW RANGE
Cubic metres per second
Calculated long-term average flow

-  < 0.31
-  > 0.31 - 0.62
-  > 0.62 - 1.25
-  > 1.25 - 2.50
-  > 2.50 - 5.00
-  > 5.00 - 10.00
-  > 10.00 - 20.00
-  > 20.00 - 40.00
-  > 40.00 - 80.00
-  > 80.00

-  CANALS
-  ESTUARIAL WATER LIMIT
-  ESTUARIAL WATER





COUNCIL DIRECTIVE 78/659/EEC
Article 16 Report for 1989

UNITED KINGDOM
AREA 3

National Rivers Authority Region
Yorkshire

QUALITY OF FRESH WATERS DESIGNATED AS NEEDING PROTECTION
OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE

- SALMONID (Complies with directive)
- SALMONID (Does not comply)
- CYPRINID (Complies with directive)
- CYPRINID (Does not comply)
- NON-DESIGNATED (Selected rivers only)

REASONS FOR NON-COMPLIANCE (Non-complying parameters)

- TEMPERATURE
- DISSOLVED OXYGEN
- pH
- NON-IONIZED AMMONIA
- TOTAL AMMONIUM
- TOTAL RESIDUAL CHLORINE
- TOTAL ZINC
- SAMPLING POINT
- SAMPLING POINT (At which an article 11 derogation has been granted)
- REDUCED SAMPLING FREQUENCY (Shown as a dot (·) outside segment [Article 7(2)])
- Segment is excluded for zero samples (example - parameter 4 is not tested)

RIVER FLOW RANGE
Cubic metres per second
Calculated long-term average flow

- < 0.31
- > 0.31 - 0.62
- > 0.62 - 1.25
- > 1.25 - 2.50
- > 2.50 - 5.00
- > 5.00 - 10.00
- > 10.00 - 20.00
- > 20.00 - 40.00
- > 40.00 - 80.00
- > 80.00

- CANALS
- ESTUARIAL WATER LIMIT
- ESTUARIAL WATER

COUNCIL DIRECTIVE 78/659/EEC
Article 16 Report for 1989

UNITED KINGDOM
AREA 4

National Rivers Authority Region
Severn-Trent

QUALITY OF FRESH WATERS DESIGNATED AS NEEDING PROTECTION
OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE

- SALMONID (Complies with directive)
- SALMONID (Does not comply)
- CYPRINID (Complies with directive)
- CYPRINID (Does not comply)
- NON-DESIGNATED (Selected rivers only)

REASONS FOR NON-COMPLIANCE (Non-complying parameters)

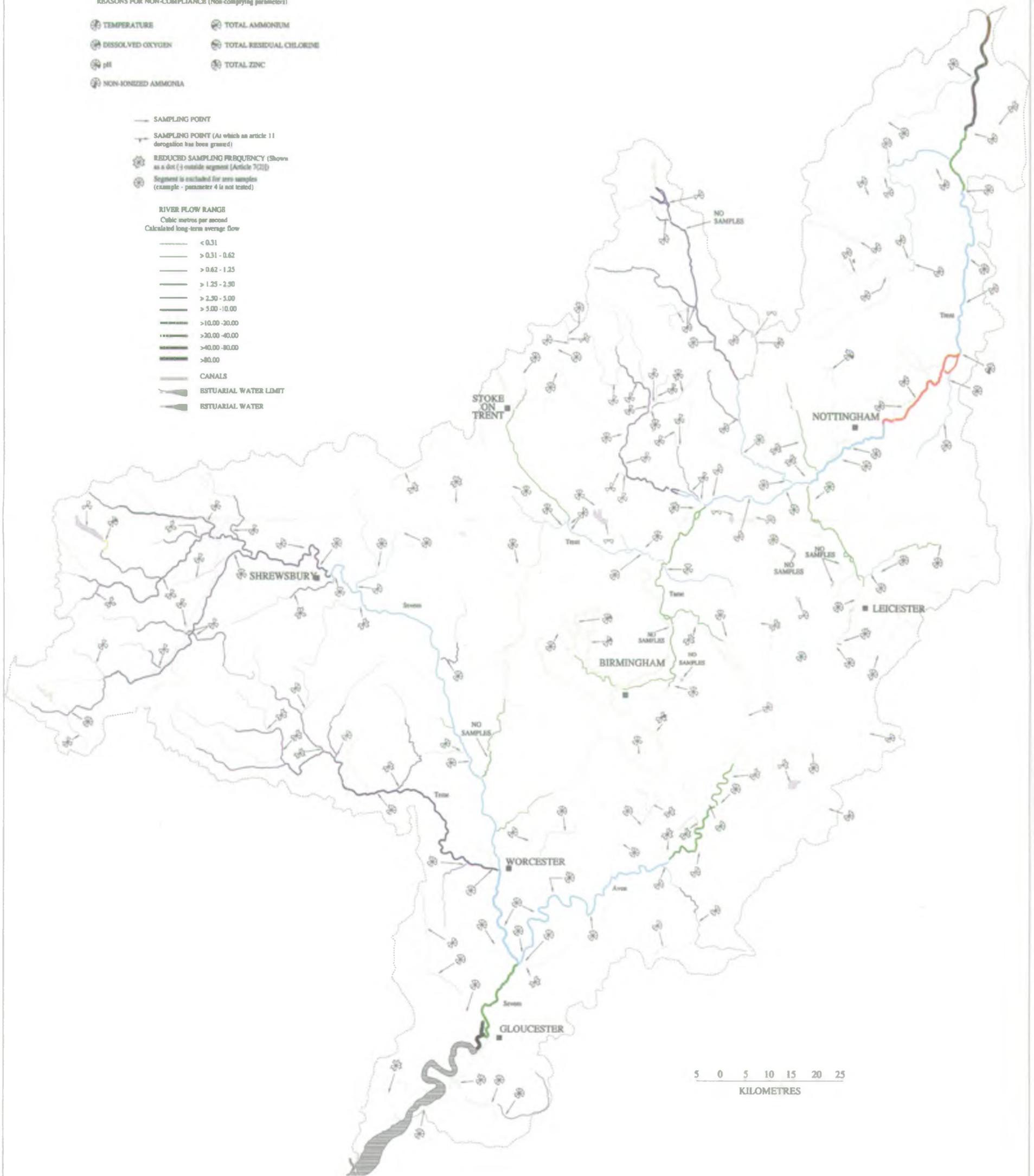
- TEMPERATURE
- TOTAL AMMONIUM
- DISSOLVED OXYGEN
- TOTAL RESIDUAL CHLORINE
- pH
- TOTAL ZINC
- NON-IONIZED AMMONIA

- SAMPLING POINT
- SAMPLING POINT (At which an article 11 derogation has been granted)
- REDUCED SAMPLING FREQUENCY (Shown as a dot (\cdot) outside segment (Article 7(2)(c))
- Segment is excluded for area samples (example - parameter 4 is not tested)

RIVER FLOW RANGE
Cubic metres per second
Calculated long-term average flow

- < 0.31
- > 0.31 - 0.62
- > 0.62 - 1.25
- > 1.25 - 2.50
- > 2.50 - 5.00
- > 5.00 - 10.00
- > 10.00 - 20.00
- > 20.00 - 40.00
- > 40.00 - 80.00
- > 80.00

- CANALS
- ESTUARIAL WATER LIMIT
- ESTUARIAL WATER



COUNCIL DIRECTIVE 78/659/EEC
Article 16 Report for 1989

UNITED KINGDOM
AREA 5

National Rivers Authority Region
Anglian

QUALITY OF FRESH WATERS DESIGNATED AS NEEDING PROTECTION
OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE

- █ SALMONID (Complies with directive)
- █ SALMONID (Does not comply)
- █ CYPRINID (Complies with directive)
- █ CYPRINID (Does not comply)
- █ NON-DESIGNATED (Selected rivers only)

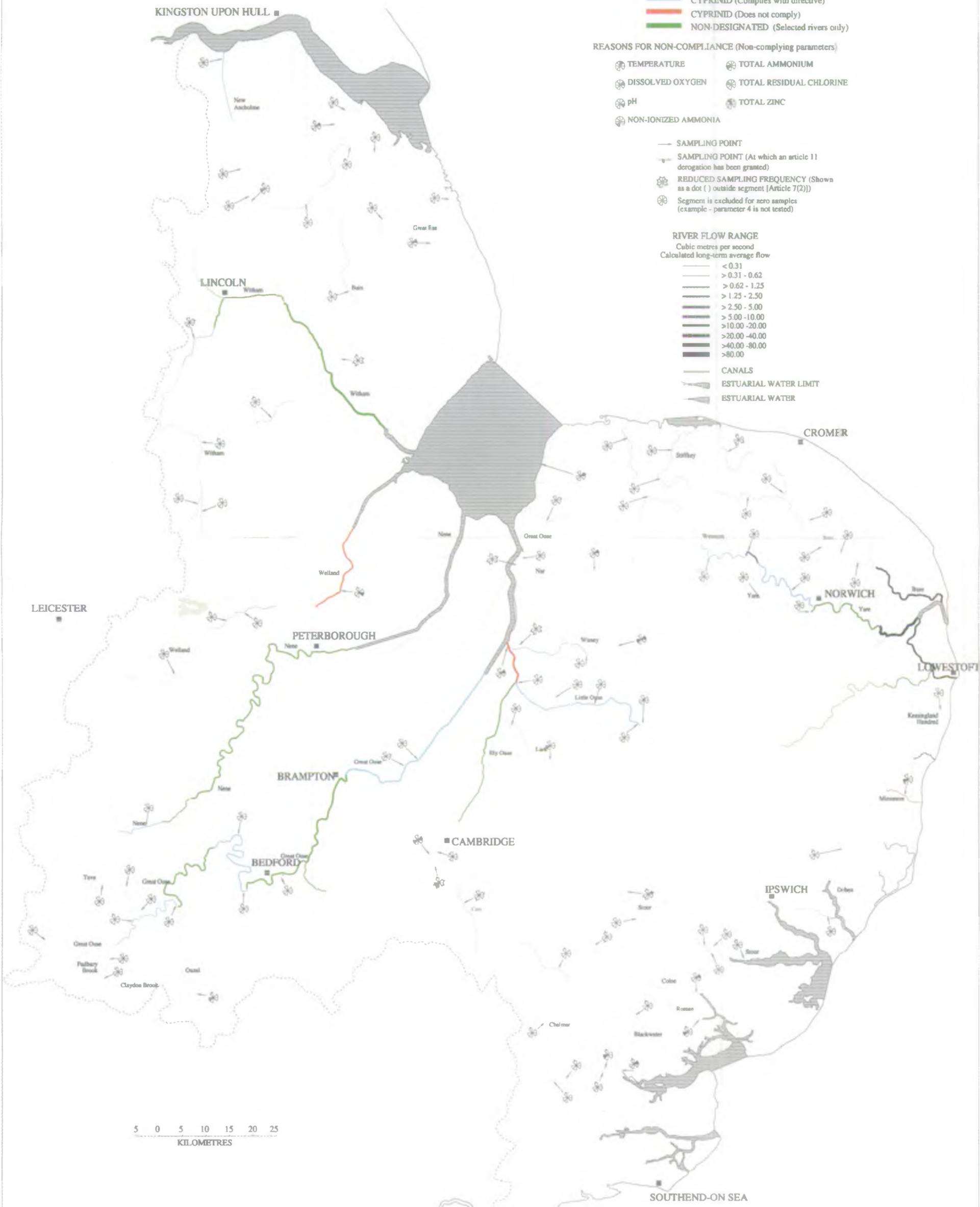
REASONS FOR NON-COMPLIANCE (Non-complying parameters)

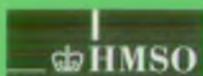
- TEMPERATURE
- DISSOLVED OXYGEN
- pH
- NON-IONIZED AMMONIA
- TOTAL AMMONIUM
- TOTAL RESIDUAL CHLORINE
- TOTAL ZINC

- SAMPLING POINT
- SAMPLING POINT (At which an article 11 derogation has been granted)
- REDUCED SAMPLING FREQUENCY (Shown as a dot (.) outside segment (Article 7(2)))
- Segment is excluded for zero samples (example - parameter 4 is not tested)

- RIVER FLOW RANGE
Cubic metres per second
Calculated long-term average flow
- < 0.31
 - > 0.31 - 0.62
 - > 0.62 - 1.25
 - > 1.25 - 2.50
 - > 2.50 - 5.00
 - > 5.00 - 10.00
 - > 10.00 - 20.00
 - > 20.00 - 40.00
 - > 40.00 - 80.00
 - > 80.00

- CANALS
- ESTUARIAL WATER LIMIT
- ESTUARIAL WATER





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