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SALMON Action Plan CONSULTATION

River Kent

July 2000

ENVIRONMENT AGENCY

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EXECUTIVE SUMMARY

This document is part of a national initiative to produce action plans for salmon management on the salmon fisheries of England and Wales by the year 2002.

The aim of the plan is to draw together the key elements of current fishery status, Conservation Limits, identified issues and required actions to improve the management of the salmon fisheries of the River Kent which flows into Morecambe Bay on its northernmost shores.

Within the plan there are detailed descriptions of the current fishery status and its historical trends. The current status of the fishery is examined in context with its performance against Conservation Limit.

The actions required to comply with Conservation Limits are addressed and methods of undertaking future work are proposed.

This document is intended to be dynamic, with opportunities for review occurring at regular intervals. For example, as the science of fisheries management improves, particularly in the setting of Conservation Limits, so the targets may be altered to reflect any improved methodology.

This plan will be of value to local fisheries interests and in a wider context to any group or organisation involved in the management of the aquatic habitat in which salmon live. Through detailed consultation it should represent the views of different parties and ultimately be a method through which future management of salmon populations in these catchments can be seen to be undertaken in an effective and accountable manner.

INTRODUCTION

In February 1996, the National Salmon Management Strategy was launched by the Environment Agency's predecessor the National Rivers Authority (NRA, 1996).

The strategy concentrates on four main objectives for the management of salmon fisheries in England and Wales. These are primarily aimed at securing the well being of the stock, but in doing so will improve catches and the associated economic returns to the fisheries. The four main objectives are :

(i) Optimise the number of salmon returning to homewater fisheries.
(ii) Maintain and improve fitness and diversity of salmon stocks.
(iii) Optimise the total economic value of surplus stocks.
(iv) Ensure necessary costs are met by beneficiaries.

These four objectives will be addressed through the Salmon Action Plans (SAPs) which the Agency will produce for each of its principal salmon rivers by the year 2002. Each plan will review the status of stock and fisheries on a particular river, identify the main issues limiting performance, and draw up a list of costed options to address these.

A new concept introduced by SAPs is that of setting Conservation Limits to assess stock and fishery performance – providing a more objective approach than has previously been possible (see Appendix 1). The processes of Conservation Limit setting and compliance assessment are developing ones and are likely to be improved upon in the coming years. Nevertheless, the Conservation Limits described in this document represent a sound starting point for using this important technique in the management of salmon stocks – one which has been successfully applied on Canadian rivers for a number of years and has recently been advocated by the North Atlantic Salmon Conservation Organisation (NASCO) to facilitate salmon management in the North Atlantic Commission Area.

In delivering each SAP it is essential that the Agency seeks the support (including in some instances the financial support) of local fishery and other interests. This collaborative approach is vital to secure the best way forward for our salmon rivers at a time when stocks are generally at an historic low, environmental pressures are as great as ever, and funding for salmon fisheries is diminishing. Hence the River Kent Salmon Action Plan presented here is for consultation and will be circulated widely.

The Final SAP that results from consultation will publicly define the Agency's intentions for salmon management, with a commitment to review progress on an annual basis. In turn, the local plans will be summarised in Regional and National plans which will guide the Agency's business activities in the wider context. Furthermore, each SAP will feed into Local Environment Agency Plans or LEAPs (the successors of Catchment Management Plans) which serve to integrate all environmental responsibilities within the Agency's remit, including management of air, land and water.

PART 1. DESCRIPTION OF CATCHMENT

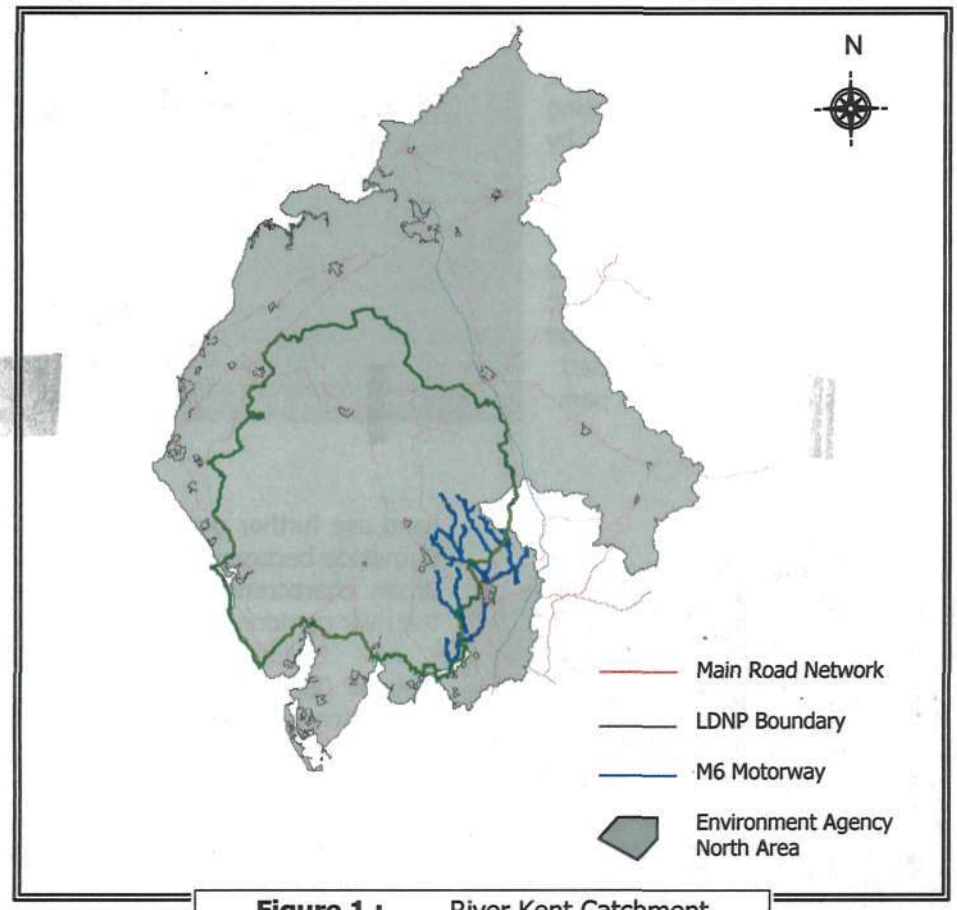

Figure 1 : River Kent Catchment

Include detailed maps – with latest ammendments from Ian D.

The River Kent catchment comprises the main River Kent and two major tributaries, the River Sprint and the River Mint with numerous other smaller tributaries. For the purposes of this document the sub-catchments will be described separately.

River Kent Between Kentmere & Kendal

Plate i : Good juvenile salmon habitat in Kentmere

The headwaters of the River Kent are located in the upper Kentmere Valley below the ridge of the High Street fells. Here the streams carry water into Kentmere Reservoir and then on down through the Kentmere valley.

No migratory fish species are found in this upper area of the catchment due to a natural obstruction to upstream fish passage above Kentmere village. Land use in this area is primarily agricultural with livestock grazing rough pasture.

Further down the river below the village of Kentmere the gradient of the river decreases and river corridor land use again is dominated by grazing livestock (Plate i). This is the upper limit of juvenile salmon distribution in this sub-catchment.

Further down the river, above the village of Staveley, the land use changes from domination by agriculture to a mixture of agriculture and woodland. The River Kent leaves the Lake District National Park at Staveley and flows out onto undulating farmland where it is joined from the west by the River Gowan.

The site illustrated in Plate ii was surveyed as part of a catchment-wide survey in 1999 and had moderate quality juvenile salmon habitat (limited by a lack of instream cover / refuge areas). The results from this site reflected that, with fair densities of both fry and parr being found.

Plate ii : Survey site upstream of confluence with Hall Beck showing limited juvenile salmon habitat.

Plate iii : River Kent at Burneside

Land-use further down the River Kent around Burneside becomes more mixed with increased urban characteristics effecting the nature of the river corridor.

Plate iii (left) shows another site included in the catchment-wide electric fishing survey downstream of Burneside Bridge. Here the physical juvenile salmon habitat is of a much higher quality than shown in Plate ii. Results from this site during the 1999 survey indicated excellent juvenile densities (170 fry $100m^{-2}$ and 40 parr $100m^{-2}$). For additional details on the Agency's Fisheries Classification Scheme please refer to Appendix 4.

River Kent between Kendal & the Kent Estuary

The River Kent is joined by one of its' major tributaries, the River Sprint approximately 2 miles north of Kendal before it is joined at the meetings (Plate iv) by the other tributary, the River Mint.

This large pool situated in the middle reaches of the catchment was created as part of the River Kent Flood Prevention Scheme and is a popular fishing area and is known to hold numerous salmon later in the season. It is likely that this pool provides very little, if any, rearing area for juvenile salmon.

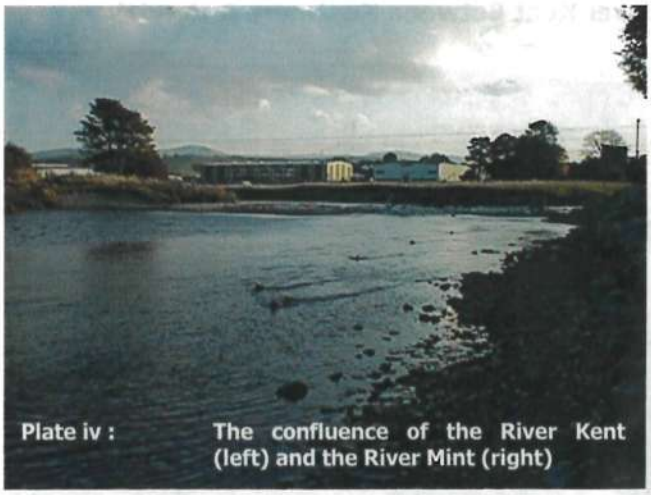

Plate iv : The confluence of the River Kent (left) and the River Mint (right)

Land use in this area of the catchment is a combination of agricultural (livestock), industrial and residential.

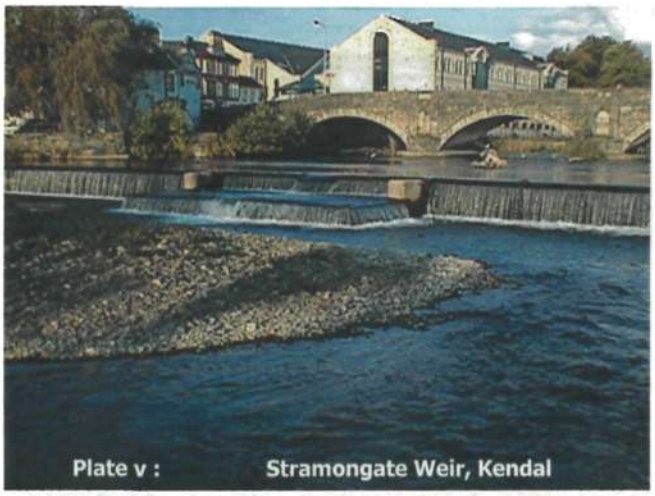

Plate v : Stramongate Weir, Kendal

Much of the River Kent through Kendal has undergone major modification as part of the River Kent Flood Prevention Scheme that was undertaken by North West Water during the period 1972 to 1977. The works involved channel widening and regrading for about 4½ miles of river including reducing the level of the riverbed, bridge modifications, and river wall construction.

Plate v (left) shows Stramongate Weir under low flow conditions; this is a popular area with the public to watch salmon as they make their way upstream under higher flows.

Force Falls is situated in the lower reaches of the River Kent and represents the upper limit of the Waste Fishery on the left bank. The Waste Fishery accounts for the majority of spring salmon caught on the Kent catchment before the beginning of June.

The river upstream, between Kendal and Sedgwick, travels through mainly agricultural land (improved pasture) with some steeply banked wooded areas. The river also passes through numerous deep limestone troughs popular with salmon anglers at Hawes near Natland and at Sedgwick a short distance upstream of Force Falls.

Plate vi : Force Falls with fish pass in foreground

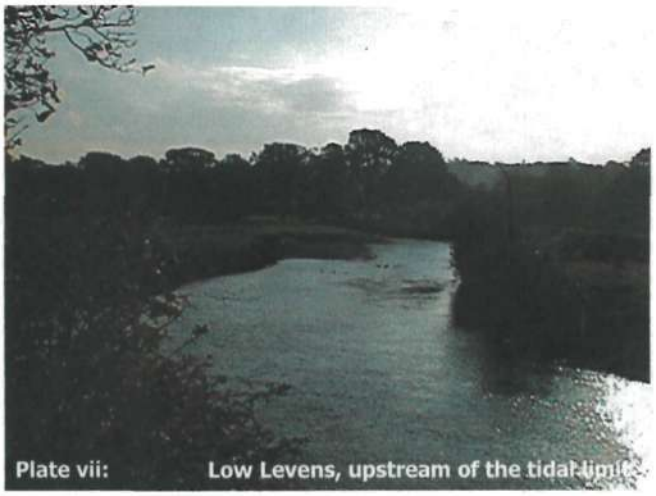

Plate vii: Low Levens, upstream of the tidal limit

Downstream of Force Falls the River Kent flows through Levens Park and on into the lower tidally affected river below Low Levens.

Fisheries exist in both Levens Park and at Sampool (downstream of Plate vi) which may also account for a proportion of spring salmon caught on the catchment.

River Sprint between Longsleddale and Burneside

The River Sprint flows through the glacial valley of Long Sleddale, flowing southeast and largely parallel to the River Kent from its source on Harter Fell.

Plate viii (right) shows the lower reaches of Stockdale Beck, which joins the River Sprint in its upper reaches.

A site approximately ½ mile upstream of Plate viii is a site sampled as part of the 1999 catchment survey. It had one of the highest densities of juvenile salmon found on the Sprint catchment.

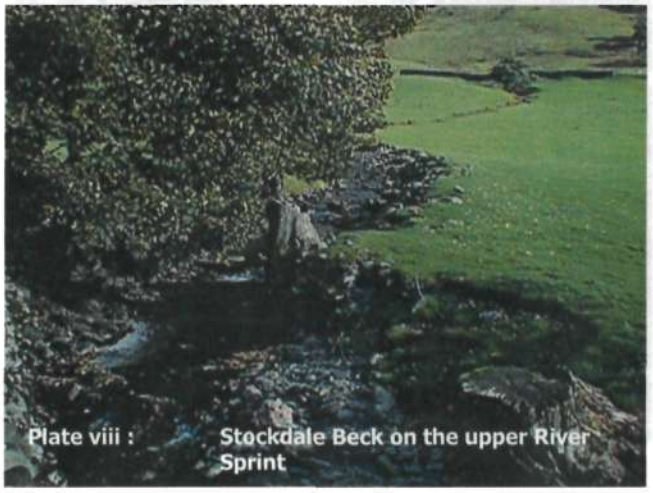

Plate viii : Stockdale Beck on the upper River Sprint

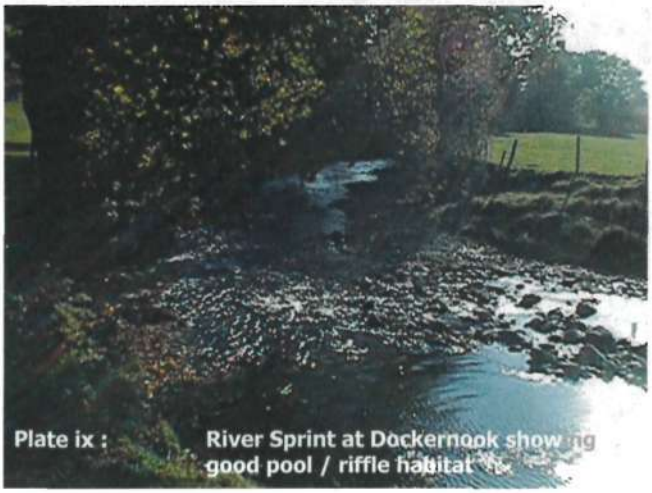

Plate ix : River Sprint at Dockernook showing good pool / riffle habitat

Unlike the Kent valley, which widens and narrows several times over its length, the Sprint valley is relatively uniform in width and has an even gradient.

Land use within Long Sleddale is dominated by the farming of livestock. Some loss of bankside and instream habitats has occurred in this area of the catchment as a result of poor land management practice.

The River Sprint has some angling opportunities predominantly on its lower reaches for salmon, sea trout and brown trout.

River Mint between Bannisdale and Kendal

The River Mint's headwaters are situated on the slopes of High House Fell and initially flow in a southeasterly direction on its way towards Kendal and its confluence with the main River Kent.

Plate x shows the upper Mint catchment below the confluence of Bannisdale and Ashtead Becks. This area has an excellent diversity of habitat used by both salmon and trout.

Land use, as with the majority of the upper Kent catchment, is again dominated by livestock farming.

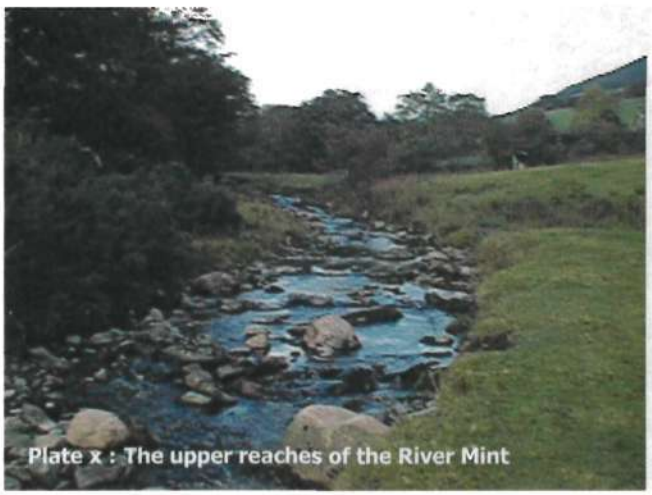

Plate x : The upper reaches of the River Mint

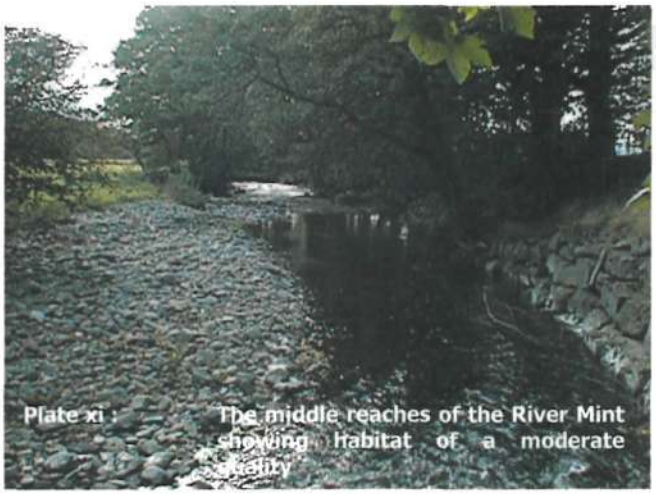

Plate xi : The middle reaches of the River Mint showing habitat of a moderate stability

As the river continues downstream it turns to flow in a southwesterly direction and is joined by the tributaries of Lightwater, Thursgill, Lambrigg and Flodder becks.

The quality and quantity of instream habitat suitable for juvenile salmon fluctuates in this area of the Mint catchment. Some areas are predominantly bedrock, affording little cover for juveniles, whereas other have excellent habitat diversity and support healthy populations of young salmon.

As the River Mint flows towards Kendal it continues through agricultural and latterly industrial land before joining the main River Kent at Mintsfeet.

The lower Mint has had some re-engineering work undertaken historically and much of its banks have been reinforced with blockstone. Not all of this work has had the desired effect of preventing erosion as can be seen in Plate xii where the blockstone walling has been scoured out and the bankside stability has been compromised. This may also have a negative effect on juvenile habitats.

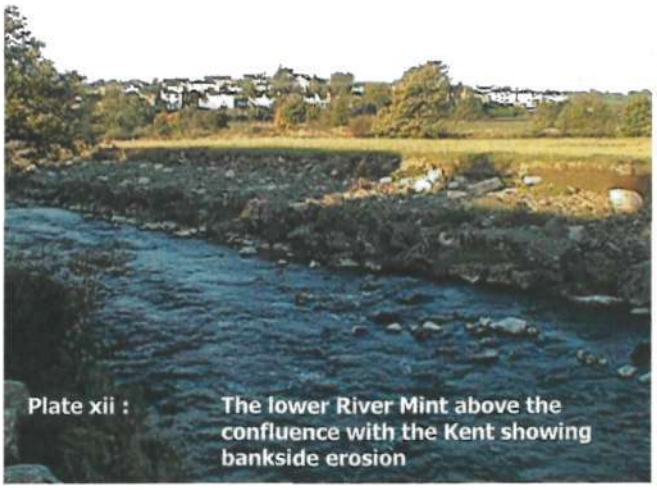

Plate xii : The lower River Mint above the confluence with the Kent showing bankside erosion

Table 1 : River Kent Catchment Summary Information

RIVER KENT CATCHMENT SUMMARY	
SURFACE AREA (KM^2)	214.77 km^2
LENGTH (KM)	35 km
TOPOGRAPHY (MAX. ELEVATION OF WATERSHED)	750 m
GEOLOGY	**UPPER REACHES :** Ordovician Borrowdale Volcanic Group **MIDDLE REACHES :** Silurian Bannisdale Slates Group **LOWER REACHES :** Dinantian Carboniferous Limestone
WATER RESOURCES Annual Average Rainfall @ Kentmere Hallowbank **RIVER FLOW (CUMECS* @ SEDGWICK)** Mean Daily Flow Dry Weather Flow (Q_{95})** Minimum Flow Mean Annual Flood Flow * Cumec = cubic metre per second (m^3/s) ** Q_{95} = Flow exceeded 95% of the time.	1914.4 mm 9.358 m^3/s 1.040 m^3/s 0.380 m^3/s 175.0 m^3/s

WATER QUALITY : GENERAL QUALITY ASSESSMENT (GQA 1998)			**LONG TERM WATER QUALITY OBJECTIVES**	
CLASS	**LENGTH (KM)**	**DESCRIPTION**	**RIVER ECOSYSTEM CLASS**	**LENGTH (KM)**
A	69.9	Good	RE1	63.7
B	0.0	Good	RE2	6.2
C	0.0	Fair	RE3	0.0
D	0.0	Fair	RE4	0.0
E	0.0	Poor		
F	0.0	Bad		

LENGTH OF DESIGNATED SALMONID FISHERIES (KM) (78/659EEC) (NWWA 1979)	66.7 km

S.W to see by pm 11th June
+ then forward to Liz Black + Co.
requesting acceptance for your agreement.

19/6 - Still awaiting SW to forward to Board — needs to have amendments prior to this, but not yet rtnd'd to KH for action

Rebecca to liaise with Cameron to finalise maps. 10th June.

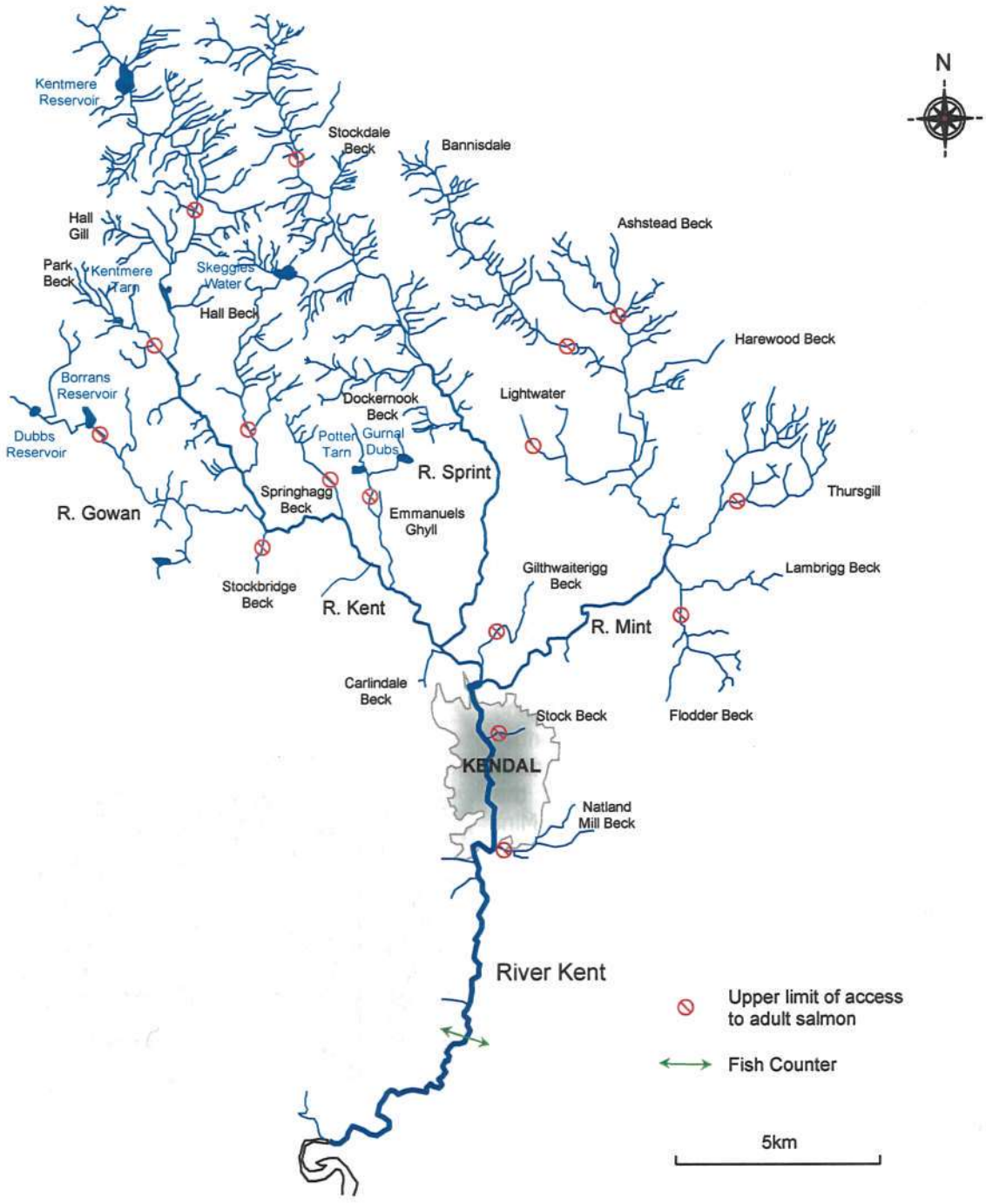

Figure 2 : River Kent Catchment Illustrating Fish Counter & Obstructions To Upstream Passage Of Adult Salmon.

PART 2. DESCRIPTION OF THE FISHERIES (ROD & NET)

Rod Fishery ~ General

SEASONS	Salmon	February 1st	to	31st October
	Migratory Trout	May 1st	to	15th October

The main period of angling effort for salmon on the River Kent catchment occurs between August and October.

New salmon byelaws have recently been introduced nationally in order to protect stocks of early run salmon. These byelaws will last for a period of ten years.

The new national byelaws are as follows :-

- A delay in the salmon and sea trout netting season to 1st June; a few specified fisheries, none of which are in Cumbria, may still net for sea trout before this date though any salmon caught must be returned immediately with the least possible injury.
- Any angler catching a salmon before 16th June must return it with minimum injury.
- Angling for salmon before 16th June can only be with artificial fly or artificial lure.

Other Regional byelaws also exist to afford protection to the species, including Byelaw 22 prohibiting fishing at Stramongate Weir on the Kent between 20 metres above and 50 metres below the crest of the weir.

Rod Fishery ~ River Kent

Area

The majority of salmon fishing occurs on the main river from Kendal downstream to its tidally affected lower reaches. Some of the most productive reaches are at the Watercrook fishery (below) on the outskirts of Kendal and the Hawes Trough area a few miles downstream.

A small number of associations, the two major ones being the Kent (Westmorland) Angling Association and the Waste Fishery, control angling on the waters downstream of Kendal. Salmon fishing also occurs upstream of the town on the main river and the Sprint and Mint tributaries although to a lesser extent, these waters are also controlled by a number of associations. The largest of these being the Kent (Westmorland) Angling Association.

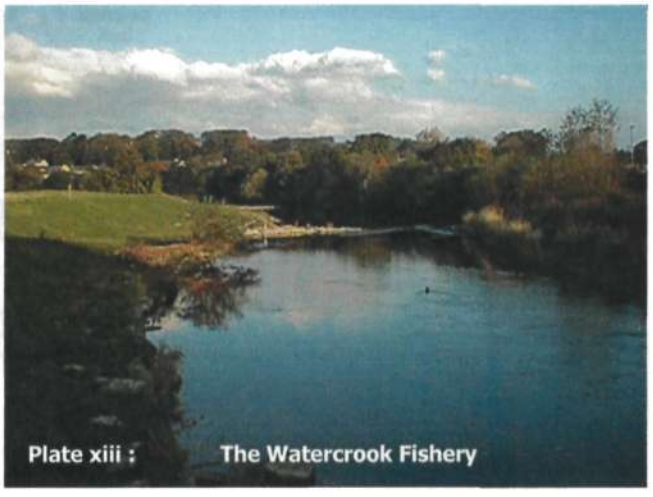

Plate xiii : The Watercrook Fishery

Methods

A variety of methods are used throughout the catchment and during the season including fly, spinners, baits and other lures. Use of baits, weights, and hooks is restricted according to the Environment Agency North West Region Byelaws. Some fishery owners may also have their own voluntary restrictions on methods and baits. In addition to restrictions on the methods used to catch salmon the Byelaws also have restrictions on certain areas of the Kent catchment where fishing for salmon is prohibited (Environment Agency 2000).

Net Fishery ~ General

SEASON	June 1st to 31st August
METHOD	Lave Net (see Appendix 5 for descriptions of type and use).
NET LIMITATION ORDER (NLO)	8 Nets (expires May 2002).
WEEKLY CLOSURE	06:00 Saturday to 06:00 Monday.
AREA	"Kent Estuary" meaning that part of the estuary of the River Kent seaward of a line drawn parallel to and 350m below the Kent Viaduct at Arnside.

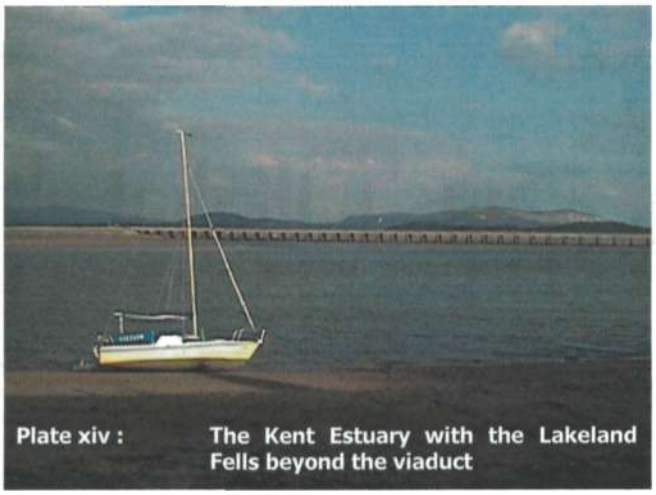

Plate xiv : The Kent Estuary with the Lakeland Fells beyond the viaduct

Tues. 17th

Reb/Kate to revise – send to SW by mid next wk.
on the copy

SW to get definitive view on trent SAP from Cameron. Yes.

2.1 CATCHES & CATCH EFFORT

Rod Catch

Information on the proportion of MSW and grilse in the rod catch has only recently become available with changes in the way catches are reported nationally. Details on the composition of the declared rod catch for the River Kent in terms of timing and the MSW / grilse components can be seen in section 3.1. Declared rod catch data can be seen in Appendix 3.

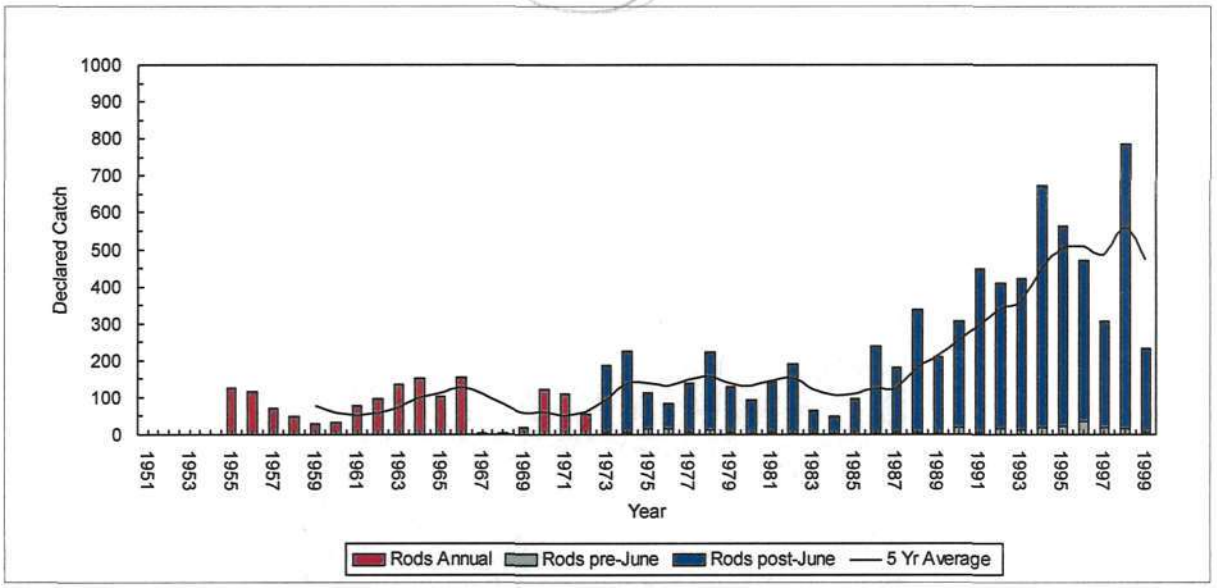

Figure 3a : Declared Salmon Rod Catch For The River Kent (1951-1999)

Historic declared rod catch data exist for the River Kent for well over forty years. However, rod catch data prior to 1973 was recorded as an annual figure and as such no breakdown between pre and post 1st June rod catches were possible.

- *The **declared** rod catch for salmon on the River Kent peaked in 1998 at almost 800 fish.*
- *Unlike other rivers in the area and nationally there was no peak in **declared** rod catches in the 1960s.*
- ***Declared** catches remained relatively low until the mid 1980s since which time they have risen markedly. The increases around this time may have been partly due to the opening up of nursery areas in the upper Kent catchment following improvements to fish passage. This would have the potential to dramatically increase freshwater production and consequently rod catches.*
- *There is a small but significant spring run of fish on the River Kent which has resulted in an average of 18 spring salmon falling to the rods during the period 1993 to 1997. These fish are caught in the lower reaches of the river and as such have not been recorded by the fish counter situated further upstream at Basinghyll on the lower River Kent.*
- *Historic rod catch declaration rates are known to have been inconsistent. Pre 1993 these have been estimated to be in the order of 50%. However, since the issue of rod licence catch-return reminders in 1993, declaration rates have increased to approximately 90%.*

Net Catch

Historic declared net catch data for the Kent Estuary salmon fishery exists for the period 1952 to 1999. Monthly breakdown of catches are only available from 1974 and thus no details on spring run (i.e. pre 1st June) catches can be determined.

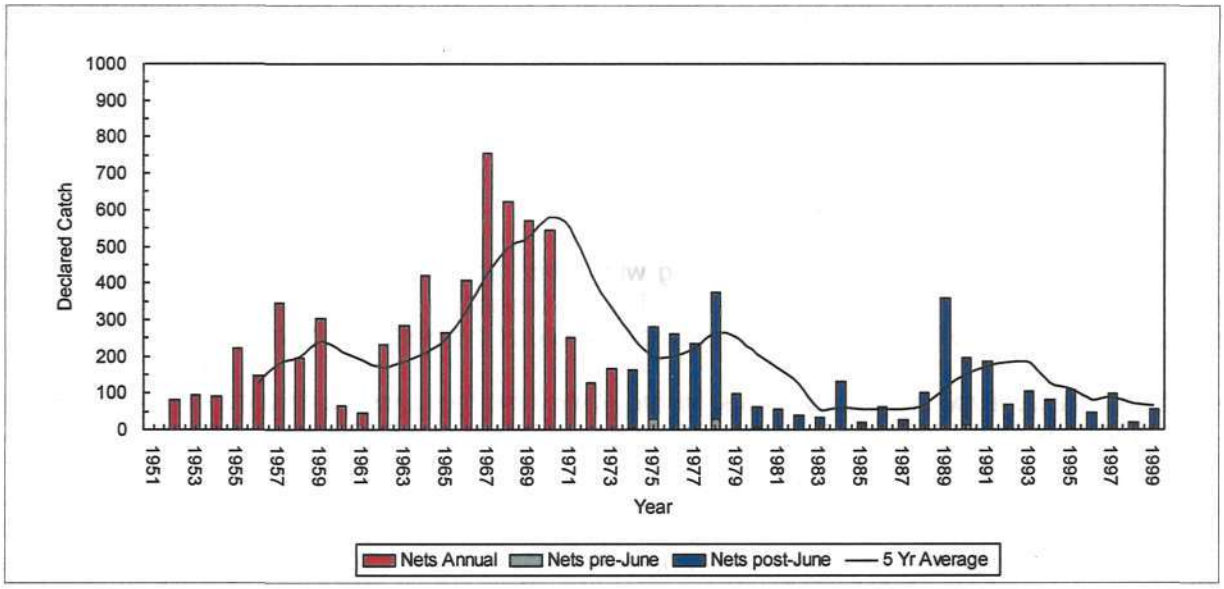

Figure 3b : Declared Salmon Net Catch For The River Kent (1951-1999)

- *The declared net catch for salmon on the Kent Estuary peaked in 1967 at almost 800 fish.*
- *Catches have fluctuated since the late 1960s with a general downward trend.*
- *Very few spring fish have been caught by the net fishery in recent years, the peak catch occurring in 1978 accounted for 30 fish.*
- *Care should be taken when interpreting the net catch data as catches are strongly governed by the availability and quality of sandbars within the estuary. For example in 1998 record rod catches were seen on the River Kent but due to higher than average river flows few suitable areas were available for netting and consequently catches were comparatively low.*

Table 2 : River Kent Rod & Net Catch Summary

	Pre – 1st June Catch		Post – 1st June Catch		Annual Catch		Catch Per Licence Day	
	1999	5yr mean (1994 – 1998)	1999	5yr mean (1994 – 1998)	1999	5yr mean (1994 – 1998)	1999	5yr mean (1994 – 1998)
Rods	8	22	225	537	233	559	0.056	0.094
Nets	0	0	55	71	55	71	0.437	0.668

Salmon versus Sea Trout Catches

Within the rod fishery on the River Kent sea trout have dominated catches until the mid 1980s when declared catches of salmon began to rise to a point where current catches are very similar between the two species.

This may be indicative of a change in rod fishing effort towards salmon fishing and away from the traditional practice of fly-fishing for sea trout during the hours of darkness.

Within the net fishery on the Kent Estuary salmon have dominated catches throughout the entire period 1952 to 1999.

Rod Fishery Exploitation Levels

Exploitation rates play an important role, along with other factors such as the proportion of females within a population and their fecundity, in assessing egg deposition estimates. As the River Kent has a fish counter at Basinghyll on the lower river, some estimate of the exploitation rate can be made.

- *Historical extant rod exploitation rates on the River Kent have been estimated from fish counter data (Cragg-Hine, 1988 cited in Solomon & Potter (1992)) to be 13.0%.*

- *More recent work shows rod exploitation rates to be higher. Currently fish counters are unable to distinguish between salmon and sea trout without additional investigation. It is therefore proposed that underwater cameras will be installed during the current year (2000/01) in order to determine the numbers of each specie (salmon, sea trout, or other) crossing the counter and consequently rod exploitation estimates. Until data from this study has been collected and processed it has been decided that exploitation levels determined from the River Leven will be used. These figures are 25.9% for grilse and 36.3% for multi-sea-winter salmon (average of 29%).*

Net Fishery Exploitation Levels

- *As this fishery exploits fish destined for the Rivers Kent, Winster, Gilpin and Bela, no accurate extant fishery exploitation level is available.*

- *The net fishery represents 2.4% to 39.1% of the total catch on the Kent, with an average of 18.4% over the period 1990 to 1999.*

Contributions To Distant Water & Home Water Fisheries

CEFAS in partnership with the Agency and the Irish have been using microtag returns to examine the effect of the Irish Fishery on English and Welsh salmon stocks (a final report is expected at the end of 2000). For this a simple comparison of raised tag recovery rates was made on a river by river basis but summed over several years (1984-98). For this period, the recapture rate in the (Southern) Irish Fishery per 10,000 wild smolts tagged was 23.14 for the River Dee (Welsh) and 43.69 for the River Kent. However, the comparisons is not as neat as it might be, as it only involves small numbers of recoveries and is based on a single years data for the Kent (i.e. there are likely to be differences between years).

Differences in the marine exploitation of wild salmon smolts between the River Kent and River Dee could be due to many factors, including handling of smolts, migration patterns at sea etc.

2.2 NON BIOLOGICAL FISHERY DESCRIPTION

2.2.1 PARTICIPATION

Rod Fishery

The level of participation of resident and visiting anglers in a fishery has large implications on the economic value of the fishery. However, information on the breakdown of this participation has only been available since 1997. The tables below are derived from information taken from statutory rod licence catch returns.

Table 3a : River Kent Rod Fishery Participation

TOTAL ANGLERS			
NUMBER		DAYS FISHED	
1999	5yr mean (1994 – 1998)	1999	5yr mean (1994 – 1998)
383	411	3543	4365

Table 3b : Proportion Of Visiting & Local Anglers Fishing The Kent Catchment

YEAR	N° OF ROD LICENCES USED ON THE KENT	LOCAL ANGLERS (%)	VISITING ANGLERS (%)	UNKNOWN (%)
1997	411	17.3%	35.5%	47.2%
1998	515	21.4%	72.2%	6.4%
1999*	408	37.3%	62.7%	0.0%

* 1999 data provisional

For the purposes of this document the split between visiting and local anglers has been made using the postcode information on rod licence returns. Those anglers fishing the Kent catchment for salmon who live in the postcode areas LA7 to LA9 inclusive are defined as being local anglers, (i.e. those anglers living in close proximity to the river).

Table 3c : Net Fishery Participation

LICENSEES		ENDORSEES		TOTAL NETSMEN		TIDES FISHED	
1999	5Yr Mean (1994-98)	1999	5Yr Mean (1994-98)	1999	5Yr Mean (1994-98)	1999	5Yr Mean (1994-98)
8	8	-	-	8	8	126	112

2.2.2 ECONOMIC EVALUATION

Value To Fishery Owners & To Salmon Anglers

The mean regional value of a rod caught fish has been adapted from Radford *et al* 1991, taking inflation into account.

The market value of a fishery can be calculated by multiplying the value of a rod caught fish with the mean annual rod catch, although this will need adjustment for the proportion of fish which are not declared (multiply by 1.10, Small 1991).

Calculation of Nett Economic Value

There is no single parameter that can be used to express the value of a salmon fishery, since different parameters of value reflect the differing perspectives of those associated with the fishery. For example, anglers value the rod fishery in a different way to local traders, who benefit from the anglers' expenditure.

Table 4a : Value To Fishery Owners (Market Value) & To Salmon Anglers (Anglers' Consumers' Surplus)

Mean Declared Rod Catch 1990 – 1999	Mean Total Rod Catch 1990 – 1999	Mean Regional Value Per Salmon	Market (Capital) Value To Rod Fishery	Ratio Anglers' Consumers' Surplus : Market Value	Anglers' Consumers' Surplus
461	507	£7000	£3.5 Million	1:1	£3.5 Million

The mean regional value per salmon was calculated to be in the order of £7000. However, recent discussions with angling concerns within the area put this figure at around £4000.

The accurate estimation of the economic value of a given fishery is difficult, as there is a lack of catchment specific data. As the characteristics of a fishery may vary from one catchment or area of the country to another, any attempt to quantify the economic value of the fishery will be, by necessity, based on broad assumptions and estimates of the parameters involved. However, some parameters of value may be added together to present an estimation of the cumulative value of the fishery.
This **Nett Economic Value** can be defined as the sum of :

- *Value to fishery owners (market value of fishing rights)*
- *Value to anglers (Consumers' surplus)*
- *Value to netsmen (Profits from sale of catch) ~ assumed to be negligible*

The anglers' consumers' surplus can be defined as the difference between what anglers are willing to pay for their fishing and what they actually pay. The anglers' consumers' surplus on a river is the sum of the different surpluses of the individual anglers who fish it. Radford (1984) estimated this value to vary considerably between rivers. For the purposes of this document, a conservative value of 1:1 has been adopted.

Table 4b : Value To Kent Estuary Netsmen

Species	Mean Declared Weight Of Catch (1995-99)	Price per kg	Gross Revenue	Nett Profit	Capitalised Nett Profit
Salmon	188 kg	£3.30	£600	£360	£2500
Sea Trout	2 kg	£2.50	£5	£3	£20

Table 5 : Nett Economic Value Of The River Kent Fishery

Value	£
To Fishery Owners	£3,500,000
To Salmon Anglers	£3,500,000
To Netsmen	£2,500
Minimum Nett Economic Value	£7,000,000

Anglers Expenditure

A figure of £40 has been given as the expenditure per day by anglers as derived from the total spent by salmon and sea trout anglers on fishing in England and Wales (estimated as £20 million per year), and the total number of days fished per year (500,000) taken from catch return data. (Radford *et al* 1991).

Table 6 : River Kent Anglers Expenditure

MEAN DECLARED DAYS FISHED 1995 – 1999	MEAN TOTAL DAYS FISHED 1995 – 1999	EXPENDITURE PER DAY	TOTAL EXPENDITURE
4717	7075	£35	£250,000

However, as the majority of angling on the River Kent is carried out by visiting anglers, and the remainder (about 25%) by local anglers, a modified estimate of £35 has been used. In addition, since not all licence holders report their fishing effort (ca. 66%), the mean days fished figures are minimum estimates and require some adjustment. The level of participation can therefore be calculated by multiplying the minimum estimates by 1.5.

Kate's draft → SW
for comment. 17-6-03

PART 3. DESCRIPTION OF STOCKS, CURRENT STATUS & RELEVANT TRENDS

Monitoring Facilities & Programmes ~ River Kent

- *Electrofishing surveys targeted at juvenile salmonids have been undertaken historically. Data are available from recent catchment-wide strategic surveys undertaken in 1993 and 1999 covering over 80 sites, and from limited surveys in 1997, 1989, 1987, 1986, and 1985.*

- *Redd count information is available annually from 1974 although the quality of this data is weather dependent. This information is more useful to describe the distribution of spawning within the catchment rather than to ascertain the absolute levels of spawning activity.*

- *Smolt trapping has been undertaken on the main River Kent at Basinghyll since 1995 (with the exception of 1998). Smolts were micro-tagged in order to increase our understanding of marine survival and angler exploitation rates on the catchment. Further details on the trapping operations can be seen in section 3.2.*

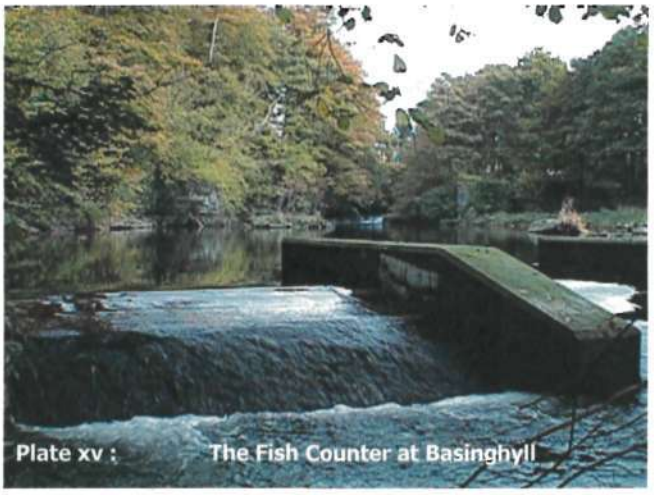

Plate xv : The Fish Counter at Basinghyll

- *Fish counter data from the site at Basinghyll (4.5 km above the tidal limit) are available from 1989 to date. Data are recorded continuously for fish numbers, size, direction of travel, and conductivity of the water. The counter is a full river width counter and as such should account for all fish entering the river and passing this point. NB the counter is unable to distinguish between salmon and sea trout.*

- *As mentioned in section 2.1 more recent rod exploitation rates on the River Kent are likely to be much higher than the 13% estimated by Cragg-Hine (1988), (cited in Solomon & Potter (1992)). Currently fish counters are unable to distinguish between salmon and sea trout without additional investigation. It is therefore proposed that underwater cameras will be installed during the current year in order to determine the numbers of each specie (salmon, sea trout, or other) crossing the counter and consequently rod exploitation estimates. Until data from this study has been collected and processed it has been decided that exploitation levels determined from the River Leven will be used. These figures are 25.9% for grilse and 36.3% for multi-sea-winter salmon (average of 29%).*

3.1 ADULT SALMON RUN

Knowledge of the size of the adult run and its composition are critical to the management of the salmon fisheries since:

- The commercial viability of the salmon fisheries are dependent upon the size of the run.
- The level of catch directly affects the spawning escapement.
- The size and composition of the spawning escapement directly effects the numbers of eggs that may be deposited and hence future juvenile production.
- The level of juvenile production directly influences the maintenance and enhancement of the salmon stock.

Run Timing & Age Composition

- *Adult salmon runs appear to be dominated by summer and autumn runs of fish (based on declared rod catches and fish counter data). Declared rod catches for salmon pre 1st June for the period 1973 to 1999 ranges from 0% (1985) to 19% (1976) of the total declared catch.*

- *Based on the split between one-sea-winter (1SW) and multi-sea-winter (MSW) salmon being approximately 8½lbs (based on scale reading data), declared weights of rod caught fish suggest on average 76.7% of fish to be grilse (range 72% to 81.3%) and 23.3% of fish to be MSW salmon (range 18.7% to 28%) based on data from 1992 to 1999.*

Spawning Escapement & Egg Deposition

- *Spawning escapement for the River Kent based on declared rod catch data and exploitation estimates suggest that the average escapement of salmon was 1600 fish in the period 1992 to 1999, (range 657 to 2267).*

- *Based on the River Kent salmon stock characteristics, the above escapement results in an average egg deposition of 3.82 million ova over the period 1992 to 1999, (assumes a 9% post rod fishery loss and 57.7% female fish).*

Table 7 : Run Size & Timing

METHOD (E.G. TRAP OR COUNTER)	PRE JUNE		JUNE – OCTOBER		POST OCTOBER		ANNUAL	
	1999	Mean 1995 – 1998	1999	Mean 1995 – 1998	1999	Mean 1995 – 1998	1999	Mean 1995 – 1998
COUNTER	20	26	806	1114	109	230	935	1370

The data above is an estimate of species composition from the fish counter data, based on the species composition determined from trap data on the River Lune at Forge Weir. On completion of the validation of the counter using underwater cameras, more accurate estimates will become available.

3.2 JUVENILE ABUNDANCE

The distribution of juvenile salmon in the Kent catchment is widespread and is continuing to spread to areas previously devoid of salmon (e.g. the upper reaches of the River Gowan). A large proportion of salmon production occurs within the main river itself and the River Kent above Kendal. Calculations based on mean juvenile salmon densities and river widths shows the main river Kent (below its confluence with the River Mint) accounted for approximately 35% of salmon parr production in 1999 (37% in 1993). The upper Kent above Kendal is also an important area contributing 18% of the total salmon parr production (21% in 1993). Other areas of the catchment also contribute significantly to the overall production of juvenile salmon on the catchment, (River Sprint 30% (14% in 1993)).

The upper reaches of the River Kent, particularly above the Bowston area, have become important juvenile salmon rearing areas since the construction of fish passes within existing weirs in 1986. Adult salmon were quick to utilise these areas and the subsequent increase in rod catches from 1990 may, in part, be due to the increased production of the catchment as a result of the opening up of this significant sub-catchment area, (See Figure 3a).

Densities of both life-stages of juvenile salmon (fry and parr) were found to be fair to excellent at most accessible sites during both the 1993 and 1999 surveys.

Table 8a : River Kent Juvenile Salmon Abundance ~ 1993

% Sites In Each Juvenile Abundance Class (0+ & >0+ Combined)					
A	B	C	D	E	F
21.7% (13)	20.0% (12)	13.3% (8)	15.0% (9)	13.3% (8)	16.7% (10)

Table 8b : River Kent Juvenile Salmon Abundance ~ 1999

% Sites In Each Juvenile Abundance Class (0+ & >0+ Combined)					
A	B	C	D	E	F
25.5% (14)	12.7% (7)	14.5% (8)	16.4% (9)	14.5% (8)	16.4% (9)

Note : Inaccessible sites removed from tables 8a and 8b. Bracketed figures indicate the number of sites in each grade.

Figures 4a and 4b (pages 26 and 27) illustrate salmon parr equivalents (N°s per $100m^2$) at sites surveyed throughout both catchments. This is derived from the estimated density of fry (i.e. 0+ salmon) divided by the appropriate fry equivalence ratio (3.9:1) and added to the estimated density of parr (i.e. >0+ salmon) (Mainstone *et al* 1994). For example a site with fry densities of 45 per $100m^2$ and parr of 14 per $100m^2$ would have a salmon parr equivalent density of (45 ÷ 3.9) + 14 = 25.54 per $100m^2$.

Further details on the interpretation of juvenile electrofishing data can be seen in Appendix 4.

Smolt runs on the Kent catchment

Smolt trapping has been undertaken by the Agency at Basinghyll (fish counter site) on a number of occasions during the 1990s. The trapping season generally commenced during mid April and continued until numbers had declined to the extent that trapping was no longer productive (generally early June).

The trap is temporarily located within the fish counter channel for the study period and sampled a proportion of the total spring smolt migration. In some years it was possible to determine an estimate for total smolt run using marked recapture methods. The total spring smolt run in 1995 was estimated to be approximately 25,000 fish.

Key characteristics of the Kent smolt migration are :

- *Peak smolt migration tends to occur when water temperatures rise towards 10°C and between the hours of dusk and dawn.*
- *Although flow is believed to play an important role in the triggering of migration it appears that water temperature is the over-riding factor.*
- *Salmon smolts range in size from 11cm (1 year olds) to 20cm (3 year olds), but the majority are 2 year old fish averaging 14cm.*

3.3 DISTRIBUTION OF JUVENILE SALMON WITHIN THE KENT CATCHMENT

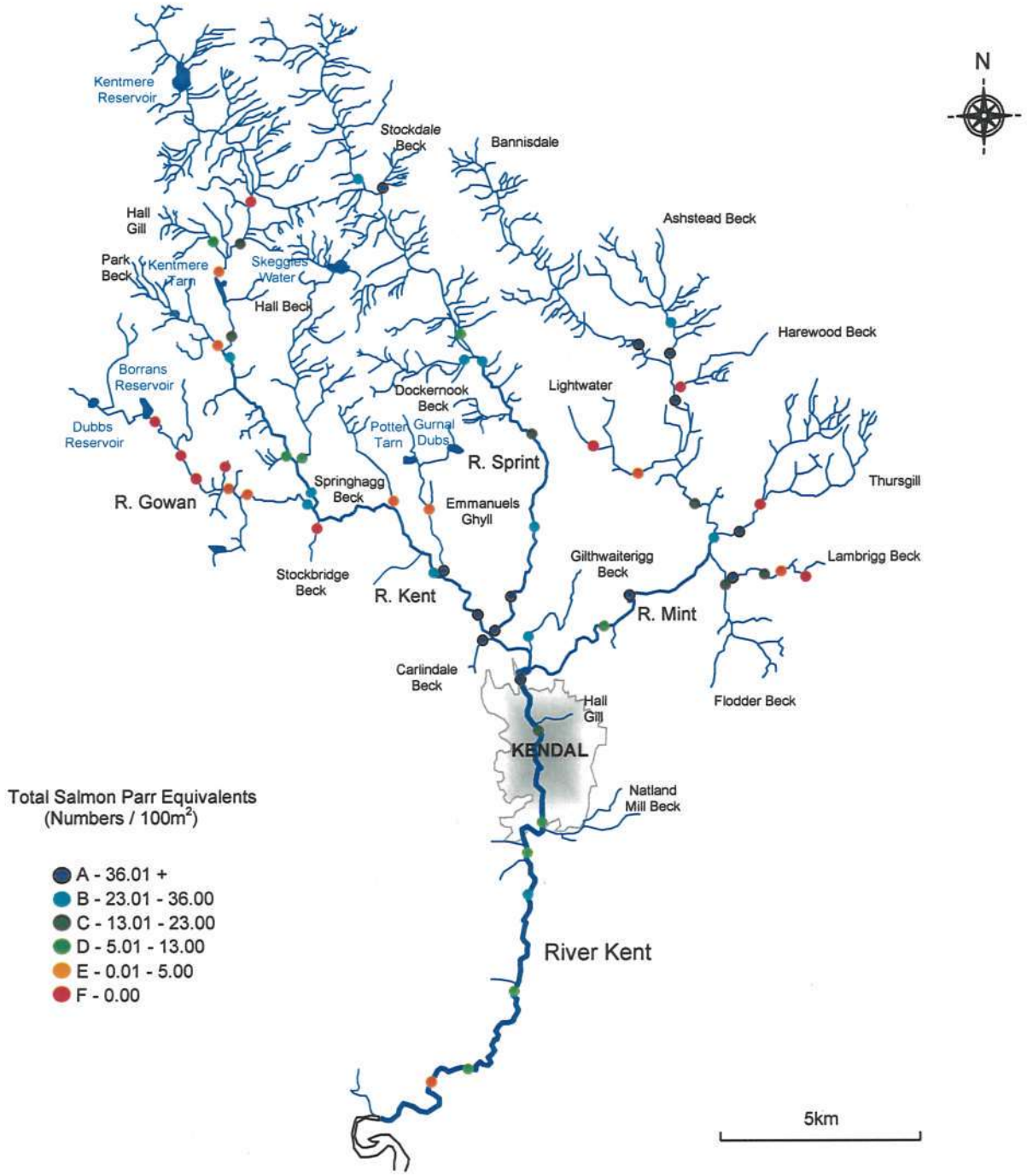

Figure 4a: River Kent Total Salmon Parr Equivalents Distribution Map ~ Accessible Sites (1993)

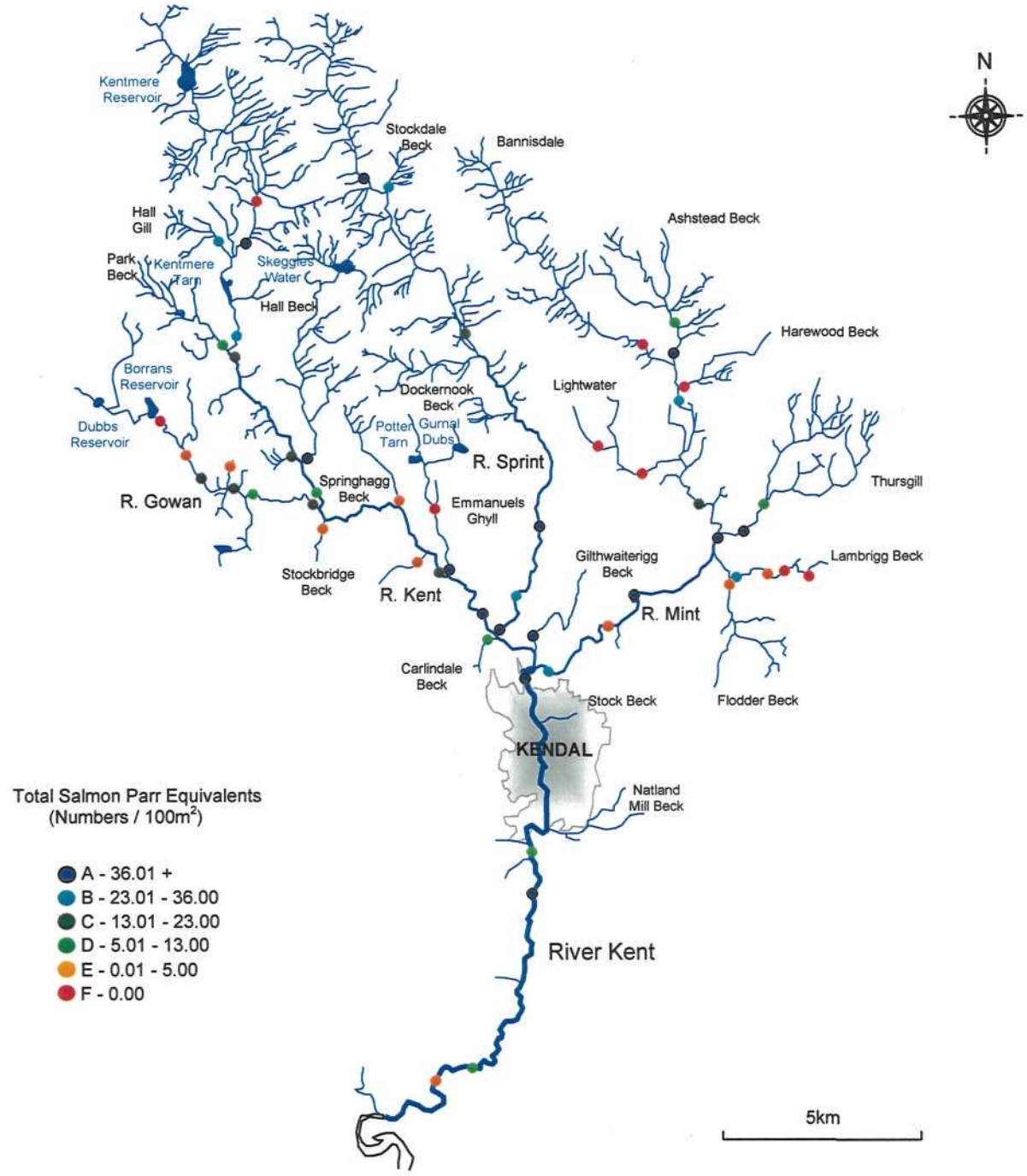

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Figure 4b : River Kent Total Salmon Parr Equivalents Distribution Map ~ Accessible Sites (1999)

PART 4. ASSESSMENT OF STOCK & FISHERIES PERFORMANCE

4.1 CONSERVATION LIMITS

Several performance targets may be utilised in the management of salmon fisheries. The Agency has determined under its National Salmon Strategy (NRA 1996) that Conservation Limits (now referred to as Conservation Limits) are the most appropriate. The type of target that is used in Salmon Action Plans is based on the concept of **gain.** This represents the surplus adult fish potentially returning to the river system above the level required to replace the spawning stock from which they were generated. They are thus the fish which could be taken by the various fisheries exploiting each river's stock (the high seas fisheries, the coastal net fishery, and the rod fishery) without leading to a reduction in stock size. It is therefore desirable to identify a spawning target associated with the point where gain is at the maximum sustainable level (Maximum Gain or MG). This point is also referred to by NASCO as the 'Minimum Biologically Acceptable Level (MBAL)' or, more recently, 'Conservation Limit' (CL) below which (ideally) stocks should not fall. To help protect against this, the Agency compliance scheme (below) will only record a 'pass' if egg deposition exceeds the CL value for at least 4 years in 5, on average. Hence, in practice, the true 'spawning target' for the Kent lies somewhere above the CL value. Further details on MBAL can be seen in Appendix 1.

Table 9 : Estimates Used To Calculate River Kent Conservation Limit

TARGET			VALUE		
Conservation Limit (CL) ~ Egg Deposition (MG)			314 100m^{-2} or 2.14 million		
Spawners Required To Meet CL			816		
Estimates Used To Calculate The Above :					
GIS Area	=	68.13 Hectares	Post Rod Fishery Mortality	=	9%
Fecundity	=	4541	Rod Exploitation	=	29%
Females	=	57.7%	Rod Catch Declaration	=	91%

The River Kent Conservation Limit (CL) has been 'transported' from the River Bush, Northern Ireland, which is one of the few rivers in Europe where the relationship between the number of salmon eggs deposited and number of smolts produced is known. The transportation procedure has been developed by the Water Research Centre (WRc) and takes into account differences in juvenile rearing habitat between the River Bush and the River Kent. The CL also accommodates local differences in stock characteristics such as the contribution of 1SW and MSW fish (Table 9). In addition it also recognises differences in productivity between different systems (i.e. smolt output is estimated according to the mix of habitat types in relation to their respective altitudes and stream area). For further details on stock characteristics applied to Conservation Limit calculations please refer to Appendix 7.

4.1.1 CONSERVATION LIMIT (CL) ~ COMPLIANCE ASSESSMENT & INTERPRETATION

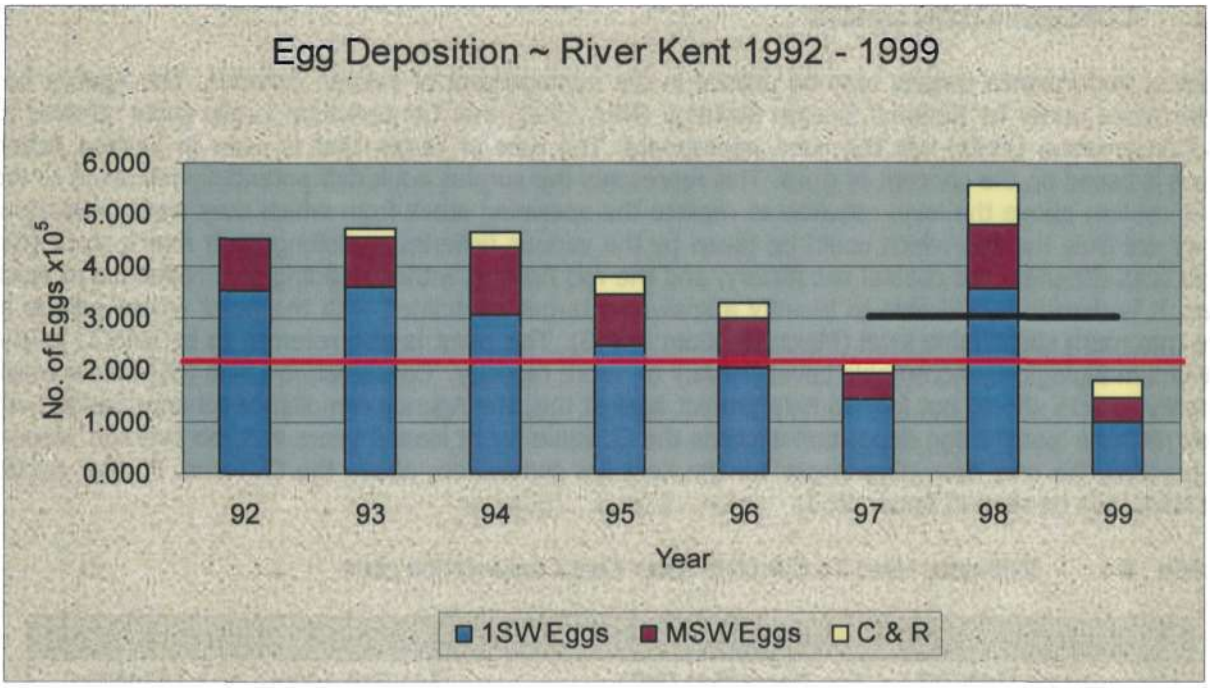

Figure 5 : River Kent Egg Deposition Rates
(Red line denotes CL level of egg deposition (MG); black line denotes failure episode)

There are a number of assumptions that need to be considered when examining the accuracy of the back calculation of egg deposition and assessment of compliance with the maximum gain (MG) target. Where such information exists, values specific to the Kent have been used, but in the absence of river specific data, estimates or assumptions derived from other sources have been applied (see Appendix 7). The above graph illustrates the contribution towards the overall egg deposition from those fish that were returned to the river by anglers from 1993 to 1999 (i.e. the catch and release component).

Maximum smolt production estimates for the Kent catchment equate to and egg deposition of nearly 3 million eggs. Figure 5 therefore confirms that the catchment is also performing well in terms of the estimated maximum production from freshwater.

Egg deposition estimates have been based on a calculation of the size of the salmon population derived from the total rod catch (the declared rod catch raised by a factor to take into account under-reporting), and the exploitation of the grilse and multi-sea-winter components of the salmon population. It should also be noted that the procedure for estimating the total rod catch from the declared rod catch assumes that all undeclared fish are grilse. This in practice may underestimate the proportion of multi-sea-winter fish in the population.

Compliance with Conservation Limit can be measured in a number of ways dependent on the data available within the catchment under investigation. In all cases the important factor is how many fish escape to spawn and in what proportion (male/female, grilse (1SW)/MSW), as this will determine egg deposition rates. MSW salmon tend to be larger and mostly female thus having the potential to lay down more eggs.

As the Agency will be undertaking work to estimate river specific exploitation rates on the Kent in the coming year (2000/01), a proposed method of compliance checking has been modelled based on a calculation using declared rod catch data. It is known that relationships exist between the number of fish caught by rod angling and the number of fish present within a river system, although yearly variations due to angling effort, river conditions and declarations rates will occur. The compliance shown in figures 5 is based on this modelled salmon escapement.

Table 10 : River Kent Egg Deposition

CURRENT (TOTAL N° OF EGGS) 1999	TARGET (N° OF EGGS)	HAS COMPLIANCE FAILED WITHIN LAST 3 YEARS? (Y/N)
1,784,670	2,140,719	Y

Compliance against the Conservation Limit has been examined for the period 1992 to 1999 (Figure 5). A compliance test has been developed by WRc to identify statistical failures against the Conservation Limit. This examines performance in blocks of three years with the sequence of egg shortfall or surplus in each block determining whether a 'failure', 'near miss' or 'pass' has occurred. For example, one or no shortfalls in a three-year sequence would constitute a clear pass, whereas three consecutive years of shortfall would highlight a clear failure.

However, for intermediate scenarios the rules become more complex, such that sequences of 'shortfall-shortfall-surplus' or 'surplus-shortfall-shortfall' constitute a near miss but 'shortfall-surplus-shortfall' constitutes a failure. This occurs because there is a good chance that the near miss scenarios could result from a single poor year class in freshwater which affects adult returns in two consecutive years, whereas the fail sequence is more likely to result from a more lasting impact. An additional rule states that once a failure has occurred, the next block of three years to be examined should not start until immediately after the failure sequence.

It can therefore be concluded that the River Kent is currently failing to meet its Conservation Limit, albeit driven by a marginal failure in 1997.

4.1.2 FISHERY PERFORMANCE AT CONSERVATION LIMIT SPAWNING LEVELS

Rod Fishery

A total rod catch of 366 salmon relates to the Conservation Limit level of egg deposition for the River Kent, which may result in a declared rod catch in the range 277 to 333 salmon (dependent on declaration rates – see Table 9, and Appendix 6). The current mean declared rod catch (1990 – 1999) is 482 salmon.

4.2 FRESHWATER PRODUCTION

The River Kent catchment is the most productive catchment in South Cumbria for salmon. Juvenile salmonid densities are probably close to carrying capacity across the majority of the catchment, suggesting a potentially good return of adult salmon (and sea trout) in the future. Further management may only be necessary on individual, localised sites, where in-stream and riparian habitat improvement may be beneficial.

Comparing the 1999 results to the last survey in 1993, salmon fry densities have faired the best, as twenty-four sites have improved, fourteen sites have declined, and thirty-eight sites have not changed. Salmon parr densities showed little significant change as forty-eight of all the sites have not altered, eighteen sites have declined, and ten sites have improved.

The Agency is currently investigating the potential of increasing the diversity of instream habitats through the application of sympathetic flood defence maintenance

4.3 DIVERSITY & FITNESS

The diversity of any salmon stock in relation to fish sizes and run timings are a key interest to fishery owners, anglers, and netsmen. The maintenance and improvement of stock diversity is one of the main objectives within the Strategy for the Management of Salmon in England and Wales (NRA 1996).

Analysis of the genetic make up of salmon stocks on the River Leven in South Cumbria revealed that catchment's stock to have three genetically discrete stock components. It is likely that each of the stock components is genetically suited to its environment and as such any modification / dilution of the genetic sub populations may result in reduced vigour of the stock (McCubbing & Hartley 1994).

The situation is *likely* to be a similar one on the River Kent and the same outcomes are likely should the stock be 'genetically polluted'.

Recent salmon genetic analyses have suggested that the potential for MSW salmon may be inherent within all Atlantic salmon stocks. However, the active preservation of MSW salmon is considered important as NASCO have made their preservation an international priority for salmon management. Furthermore in terms of promoting a stock recovery, as previously stated, MSW fish are predominantly female and being larger in size deposit significantly more eggs. The higher the MSW component of the spawning escapement the greater the potential for sustaining the stock.

In response to the concerns of NASCO the Environment Agency has introduced a series of new National Byelaws – see Part 2.

Reb. to revise by Fri 20th.

PART 5. LIMITING FACTORS

The factors that limit salmon production can be broadly categorised into those occurring during the freshwater and marine phases of the salmon life cycle. It is essential that the limiting factors be managed to either limit or rectify their effects to enable the salmon stock to recover.

5.1 FRESHWATER PHASE

The freshwater phase of the life cycle of a salmon is much more within the control of the Agency and the riparian owners. Whilst marine factors may exert significant effects, the greatest potential for positive management of the stock is in the freshwater phase.

Freshwater Issues On The Kent Catchment

- *Bird predation on juvenile salmonids is occurring within the Kent catchment. A national investigation into general bird predation of fish (funded by MAFF & DETR) was undertaken to determine their impact. Subsequently the Salmon and Freshwater Fisheries Review Group have made numerous recommendations on the appropriate control of such species (MAFF 2000).*

  The Agency's position on the subject of fish eating birds can be seen in Appendix 8.

- *Sheep dipping and pollution - Insecticide dips have been used for a number of years to control ectoparasite infestations in sheep. Two types of dip are now commonly in use – containing either organophosphate (OP) compounds or synthetic pyrethroids (SP). The latter have recently become more popular because of human health problems associated with the use of OP dips, however SP dips are 100 times more toxic to aquatic insects such that a few drops released into a small stream can wipe out invertebrate life for hundreds of metres downstream. Pollution events associated with these chemicals are not normally directly lethal to fish although there is great concern about the indirect effect of eliminating the invertebrate food supply. The sub-lethal effects of these substances are also less well understood. Juvenile salmon and trout are particularly at risk because of their abundance in upland areas where sheep farming tends to be concentrated.*

  Chemical and biological monitoring to establish the extent and impact of pollution by OP and SP sheep dip was begun by the Agency in 1997. Since the problem was first recognised the Agency have been working closely with other government bodies and farming organisations to promote best practice for the use of sheep dip. Since January 1999, new Groundwater Regulations implemented as part of the EEC Groundwater Directive have required authorisation by the Agency for disposal of sheep dip (and other substances) to land. The benefits of this new legislation, the ongoing public awareness campaign and other initiatives to reduce the incidence of sheep dip pollution will continue to be closely monitored.

  Although the Kent catchment has suffered from a small number of SP pollution incidences (on the Gowan, Sprint and Mint) none have been detected in the past two years. The impact of these incidents has not been detected in the 1999 juvenile salmonid survey suggesting that the Agency's initial fears for fish stocks may not have been fully borne out.

- *Habitat quality and stability are integral to the well being of all fish species. Salmon have particular preferences in terms of instream habitat for each of its life stages. It is therefore essential that good habitats are protected and areas requiring attention are identified and remedial actions proposed. Although the Kent catchment has many areas of excellent habitat quality there are still a few areas requiring further attention.*

5.1.1 LIFE CYCLE & ASSOCIATED LIMITING FACTORS

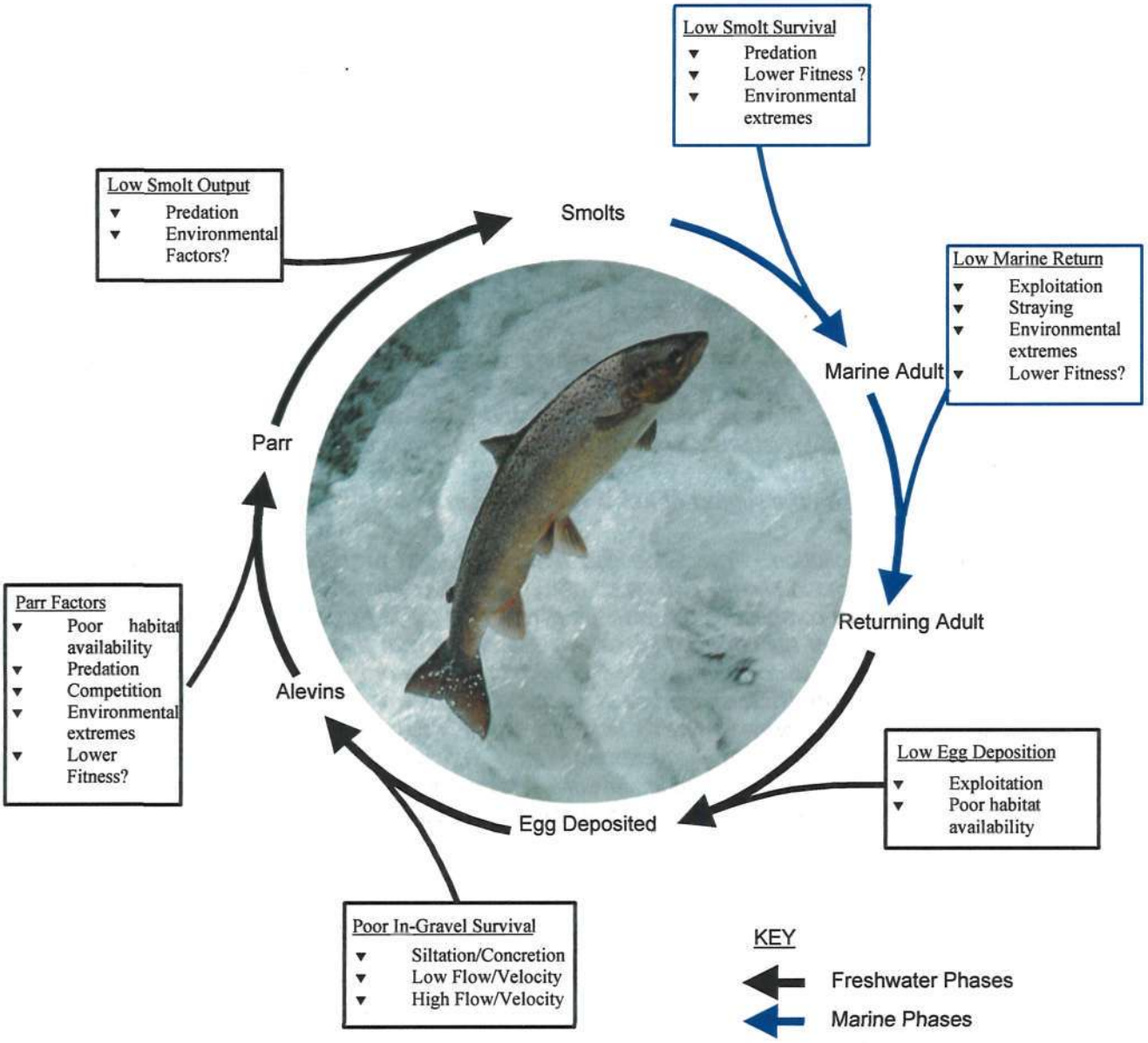

Figure 6 : Salmon Life Cycle

5.2 MARINE PHASE

The marine phase of the life cycle of a salmon is largely outside of the control of the Environment Agency. Natural mortality and the marine fisheries are considered the key factors and are discussed in greater depth in the following section.

5.2.1 NATURAL MORTALITY

Advice to NASCO suggests that natural mortality during the marine phase, although variable has been increasing over the last 5-10 years. Fewer smolts are therefore surviving to become salmon. Changes in ocean climate may be a factor. The abundance at sea of salmon, which would return as multi-sea-winter fish, is strongly related to the availability of ocean at temperatures preferred by salmon (6-8°C). The amount of such suitable thermal habitat has been lower in the 1980s and 1990s than during the 1970s (Reddin and Friedland 1996).

5.2.2 GREENLAND FISHERY

There has been a net fishery on the West Coast of Greenland since the 1960s. Catches peaked in 1971 at 2689 tonnes. Since 1976, only Greenland vessels fish this area and a quota has usually limited the catch agreed by NASCO. Since 1993 the quota has been related to estimates of the pre-fishery abundance of salmon and has been declining. The fishery exploits only salmon that would have returned to Europe or North America as multi-sea-winter (MSW) fish. Prior to recent negotiated reductions in the quota for this fishery, the exploitation rate on the MSW component of English and Welsh stocks was estimated to be in the region of 10% to 20%. In 1998, only a subsistence quota was allowed, amounting to 11 tonnes of which 2 to 3 tonnes were probably of European origin, mostly from the UK and Ireland. Current levels of exploitation of English and Welsh MSW salmon by this fishery are therefore at very low levels.

5.2.3 FAROES FISHERY

Also developed in the 1960s, this fishery uses long-lines. The catch peaked at 1027 tonnes in 1981 but exploits salmon of mainly northern European origin. Since 1991, the Faroes quota, agreed with NASCO, has been bought-out by the North Atlantic Salmon Fund.
Prior to these buy-outs, tag recoveries indicated that exploitation of salmon of English and Welsh origin were very low, perhaps 1%. Since the buy-outs began only a small research fishery has operated, in some years. Currently, exploitation is therefore negligible.

5.2.4 INTERNATIONAL FISHERY

An unregulated high seas fishery operates in international waters by countries that are not signatories to the NASCO convention. In 1995, annual catches were thought to have been 25 to 100 tonnes, comprising predominantly European stocks. Diplomatic efforts by NASCO have been made to restrict landings of these catches. There is no evidence that this fishery still operates, although surveillance has been limited.

5.2.5 IRISH FISHERY

The reported catch of salmon in Ireland increased from about 700 tonnes in the 1960s to a peak of over 2000 tonnes in the mid 1970s. This coincided with the expansion of a coastal drift net fishery. Of the Irish salmon catch, some 600 tonnes in 1998, probably more than half is taken by the drift nets. In 1997, new regulations were introduced restricting fishing to daylight within 6 miles of the coast and delaying the start of drift netting until 1st June. Tagging studies indicate that prior to these regulations, the Irish drift nets took a significant though variable proportion of the stock destined for English and Welsh rivers. Exploitation rates were low (~1%) for stocks in the North East of England, higher (~5%) for rivers in the North West, and highest (perhaps 10% to 20%) for rivers on the South Coast of England and Wales. The effects of the new regulations on the level of exploitation have not been assessed.

5.2.6 IMPACT OF FISHERIES FOR OTHER SPECIES

The potential catch of salmon post-smolts in marine fisheries continues to be a matter of concern. The fishery with the greatest potential for such a by-catch is probably the mackerel fishery near the Faroes and in the international area of the Norwegian Sea. There is very little evidence that post-smolts are caught but the problem is difficult to assess.

The British Government has proposed measures to ban sandeel fishing along the East Coast of England and Scotland. This would principally be to protect certain bird species but it might also benefit stocks of salmon and sea trout.

PART 6. ISSUES & PROPOSED ACTIONS (For Consultation Purposes)

The table below is by no means exhaustive and is intended to be a starting point, listing limiting factors affecting salmon on the Kent catchment and proposing actions to alleviate or eliminate their effects. One of the key purposes of the consultation phase of the Salmon Action Plan for the River Kent is to seek the views of interested parties in order to allow the final plan to be as comprehensive as possible in its determination of limiting factors.

Table 11 : River Kent Issues & Actions

ISSUE	LIMITING FACTORS	OPTIONS	RESPONSIBILITY	COST (£K)	PRIORITY
Net marked fish (salmon and sea trout) being caught in May / June	Potential to reduce in-river survival. Indication of possible illegal exploitation at sea.	Reporting of all net marked fish to Agency personnel to determine timing, extent of problem and proportion of stock affected	Anglers / Agency	None	H
Apportioning fish counter data into species	Requirement for accurate, river specific, exploitation estimates for salmon.	Validate fish counter @ Basinghyll with the use of underwater cameras	Agency	£7k (estimate)	H
Assessment of :- **a) Fecundity** **b) Smolt survival** **c) Male / Female**	Assessment of parameters may allow Conservation Limits to be refined.	Monitor smolt numbers. Micro-tagging programme. Adult trapping for age / sex determination and smolt survival. Scales submission.	Anglers / Agency Anglers / Agency Agency Agency / Anglers	£5k yr^{-1} £20k £5k yr^{-1} (plus set-up costs) £0.1k yr^{-1}	M L M M
Illegal Fishing	Illegal exploitation of salmon stocks by poachers.	Continue to protect salmon stocks from exploitation and maximise the effectiveness of fisheries enforcement activities.	Agency	£30k yr^{-1}	H
Protection of salmon stocks from over exploitation	Reduce in-river exploitation to maximise number of spawners.	Adoption of catch and release as a voluntary code of practice by angling clubs. Promotion of catch and release particularly towards the end of the season.	Angling Clubs / Riparian Owners Agency	None None	H H

Comments on Table to be discussed at review mtg 24/6.

Table 11 : River Kent Issues & Actions (continued)

ISSUE	LIMITING FACTORS	OPTIONS	RESPONSIBILITY	COST (£K)	PRIORITY
Habitat Protection	Impact of in-catchment works.	Screening of planning and Agency consent applications.	Agency	£3k yr^{-1} (Ongoing)	H
		Support Cumbria Biodiversity Action Plan	Agency	Unknown	H
	Instream and bankside habitats may be restricting juvenile fish production in few parts of the catchment.	Identify areas suitable for habitat improvement / stabilisation.	Agency / Fishery Owners & Riparian Owners / FRCA	Variable inter-functional Costs	H
Availability of suitable spawning substrate (as part of LEAP action shown in Table K2)	Gravel removal as part of flood defence works (particularly in and around Kendal)	Develop a collaborative approach sympathetic to the ecology of the river	Agency	Costs being currently prepared	M
Historic habitat modification of the River Gowan as part of flood defence works (as part of LEAP action shown in Table K3a)	Habitat quality and quantity	Specific assessment of habitat.	Agency	Staff Time	H
Impact of effluent discharges (as part of LEAP action shown in Table K4)	Utilisation of anti-foam at Kendal WwTW	Monitor water quality	Agency / NWW Ltd	Staff Time	H
	Control of trade effluent	Monitor water quality	Agency / NWW Ltd	Staff Time	H
Potential SSSI / SAC designation of part of the catchment	Possible impact on salmon due to catchment management which targets the primary features of the SSSI / SAC	Liaison between agencies and fisheries interests to support the conservation of salmon stocks	English Nature / Agency	Staff Time	H

PART 7. FUNDING THE PLAN

7.1 THE FUNDING BACKGROUND

The Environment Agency currently spends about £21.5m on salmon and sea trout fishery management, of which about £13.6m comes from nett rod and net licence receipts the remainder being made up through grant in aid (GIA) from MAFF. GIA has decreased in real terms in 1999 / 2000 as there was no change in funding to reflect inflation, (i.e. remaining at £7.4m). The future funding of fisheries work is currently being discussed at various levels both within an outside the Agency. The Government proposes to cut its GIA contribution to fisheries in 2001 / 2002 by 30% and should this be confirmed the work of the Agency in this area is likely to be severely impacted. However, the recent publication of the Salmon and Freshwater Fisheries Review Group Report (MAFF 2000) recommends substantial **increases** in funding to the Environment Agency's fisheries function, and as such lobbying of the Government to reconsider its position over funding is currently underway.

7.2 WHAT ARE WE DOING NOW

Considerable work is undertaken annually on both catchments in the monitoring and protection of the salmonid fisheries. These generally relate to anti-poaching work and monitoring. However, specific problems have been identified within these routine operations, many of which have undergone or are undergoing further investigations. A summary of current and future issues and actions is included in Table 12.

7.3 COLLABORATING FUNDING

Collaborative funding as a method of financing fisheries improvement works has gained increased importance in recent years largely due to the limitations to GIA funding for the fisheries function of the Agency. Whilst internally collaborative projects between functional groups has increased, there has as yet been limited collaboration between the Agency and external groups.

Future collaborative funding will be essential if many of the Actions and Issues requiring work are to progress in the short term.

Possible collaborative organisations such as; English Nature, The National Trust, The National Parks Authority, Land Owners, Fishery Owners, Angling Clubs and local industry.

Wherever possible the Agency will pursue the possibility of collaboratively funded projects, whether in financial or manpower assistance.

PART 8. CONSULTATION PLAN

If you have any comments on this Draft Salmon Action Plan please send them in writing by 31st August 2000 to :

Ben Bayliss
Environment Agency
Ghyll Mount
Gillan Way
Penrith 40 Business Park
Penrith
CUMBRIA
CA11 9BP

Table 12 : Consultation Schedule

STEP	CONSULT WITH	MEANS	AIM	TIMESCALE
1	Agency Staff	Circulate Draft Plan Internally	Account for Agency cross functional comments	**April 2000**
2	National Salmon Group	Copy Draft Plan	Quality check, ensure consistency across Agency	**April 2000**
3	RFERAC & AEG	Circulate agreed draft plan and brief Committee	Raise awareness of and publicise process; receive initial comments; initiate external consultation	**April 2000**
4	External interest groups ~ angling clubs and associations; fishery owners; fisheries consultatives; fisheries improvement associations; conservation groups; S&T Assoc; AST; NFFO; SFC's; MAFF; CLA; LA's; EN; NT; LDNP; CoCo.	a) Press release(s) b) Arrange meeting for all interests c) Circulate draft document to known contacts d) Offer officer attendance at relevant additional meetings	a) Raise awareness and publicise consultation process b) Provide opportunity for all interests to view and comment c) Provide one event to explain and discuss plan with a range of interests d) Provide opportunities to raise standard of understanding and discussion	**June 2000**
5	Review feedback Redraft plan and extend / amend actions and responsibilities section	Officer Group	Account for external comment; Accommodate accepted new proposals for actions and for responsibilities	**October 2000**
6	RFERAC, AEG & NSG	Submit final draft to all groups	Final Endorsement	**November 2000**
7	RMT		Final Approval	**November 2000**
8		Publish Final Plan and publicise	Achieve wide ranging awareness of plan and commitment to it	**December 2000**

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PART 10. GLOSSARY OF TERMS & ABBREVIATIONS

Accessible habitat	The total area of the catchment accessible to adult salmon.
Alevins	Juvenile salmon during the life stage between hatching and absorption of the yolk sac, whereupon they become free swimming and referred to as fry.
Buffer strips	Areas adjacent to the river channel where natural vegetation is allowed to thrive, thereby reducing the chemical and particulate (silt) elements of surface water run-off from surrounding land entering the river.
CEFAS	The Centre for Environment, Fisheries and Aquatic Science.
DETR	Department for the Environment, Transport and the Regions.
Escapement	The stock remaining after exploitation.
Extant	When applied to fish stocks (e.g. extant stock) refers to the total population of that year class at any point in time.
Fecundity	The total number off eggs produced by one mature female.
Fitness	Specific genetic adaptation to a particular environment.
Fry/0+	Fry are fish that have hatched out in the current year, normally in May for salmon and trout. They normally range in size from 4 - 7.5cm at the time of year of these surveys.
FWAG	Farming and Wildlife Advisory Group
GIS	Geographic Information System, a computer programme used to estimate river channel measurements from high-resolution digital maps.
Grilse	Grilse are salmon that have spent only one winter at sea before returning to freshwater.
GQA	General Quality Assessment. The scheme is used to make periodic assessments of the quality of the river water in order to monitor geographical trends and changes over time. The scheme is comprised of four components – general chemistry, biology, nutrients and aesthetics.
ICES	International Council for the Exploitation of the Seas.
LDNP	Lake District National Park
MAFF	Ministry of Agriculture Fisheries and Food.
MBAL	Minimum Biologically Acceptable Level. Defines from a stock recruitment curve the level of spawning required to maximise the sustainable catch.
Microtag	A coded wire rod 1.5mm long and 0.25mm diameter, inserted into the nasal cartilage (snout) of fish. Detectable in live fish, but only readable after removal.
Multi-Sea-Winter (MSW)	As the name implies this refers to fish that have spent two or more winters at sea before returning to freshwater.

NASCO North Atlantic Salmon Conservation Organisation. A convention of signatories including all North Atlantic countries with salmon interests, which advises and formulates policy on the management / exploitation of salmon stocks. As a member of the EU, the UK is represented by their delegation to NASCO.

NRA The National Rivers Authority, predecessor of the Environment Agency.

Parr/>0+ Parr are salmon or trout that are normally 8 - 16cm long and have parr marks on the sides of the body (i.e. dark vertical bars). Also known as >0+ (greater than 0+) fish these parr are fish which are one year old or older. For salmon these fish are all destined to smolt and run to sea.
For trout the >0+ group includes all ages other than 0+ (i.e. parr and adult fish) and therefore can include both fish destined to smolt and run to sea, and adult trout which remain resident in freshwater.

Post-rod mortality Mortality which takes place after the end of the angling season but before spawning. In the absence of local information, a default value of 9% (from radio-tracking studies) is assumed for this mortality when estimating egg deposition.

Precautionary Principle Set out by the Rio Declaration as :
"When there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation".

Redd A redd is the "nest" which female salmon and trout cut to lay their ova in. Redds have a characteristic shape and in low, clear waters can be counted and mapped.

Run The number of adult salmon ascending, or smolts descending, a river in a given year.

SAC Special Area of Conservation.

Salmonid A salmonid is a member of the family salmonidae which includes salmon, trout and charr.

Smolt Smolts are the silvery stage of salmon or sea trout at which they migrate to sea. Smolts are typically 12 - 16cms long.

SSSI Site of Special Scientific Interest. A designation, administered by English Nature, intended to conserve the biological interest of a given site through legal restrictions on development / management practices.

Straying The habit of some salmon to return to rivers other than that of their parent stock.

The Agency The Environment Agency, successors to the National Rivers Authority (NRA).

WRc Water Research Centre

Year Class All the fish which hatch in one particular year belong to the same year class. The success or "strength" of a year class depends upon a number of factors and it can vary greatly from year to year.

PART 11. APPENDICES

APPENDIX 1. CONSERVATION LIMITS IN MANAGEMENT

In setting Conservation Limits, the Environment Agency is following the recommendation of NASCO (1995) and drawing on an extensive body of experience in the use of Conservation Limits for salmon management in North America since 1977. The basic rationale behind this approach is outlined below.

The main reason for using Conservation Limits in salmon management is to provide an objective standard against which to assess the status of the river's salmon stock. The standard is selected to ensure the long-term sustainability of the stock and the fishery it supports. The principle is simple. The numbers of salmon a river can produce (and consequently the catches that result) are a function of the quality and quantity of accessible spawning and rearing area. This is why, in general, big rivers have larger catches and have correspondingly bigger total spawning requirements than small rivers. Thus, for any given size of river there should be a preferred or optimum level of stock which the Conservation Limit seeks to define.

There are three stages in the use of Conservation Limits: setting the limit, estimating actual egg deposition and assessing compliance against the Conservation Limit. The procedures used are described in detail elsewhere (Environment Agency, 1996).

The Environment Agency defines Conservation Limits in terms of optimum spawning levels, expressed as egg deposition (eggs laid per $100m^2$, or the total number of eggs per river). This is because spawning level is regarded by salmon biologists as the primary factor controlling the number of smolts likely to come out of a river section. On average, more eggs deposited means more smolts being produced, up to some level beyond which output levels off or may even decrease. This occurs because young salmon are strongly territorial and there is a maximum number that a river section can support. This level of production is often referred to as the carrying capacity. If data are available, then for a given river a curve can be plotted showing the change in smolt production (or adult "recruiting" back to fisheries) accompanying increasing spawning stock level. This is known as a "stock-recruitment" (S-R) curve. A characteristic feature of such curves, even when numbers are accurately and precisely measured, is the wide variation in recruitment which occurs at any one stock level; this is mainly due to the effects of random factors influencing survival.

The target chosen for SAPs is derived from one recommended by NASCO which defines, from an S-R curve, that level of spawning which maximises the sustainable catch (total catch, comprising all marine and freshwater fisheries), and it is termed the **M**inimal **B**iologically **A**cceptable **L**evel (**MBAL**). If exploitation rate increases above the sustainable catch level then, although catch may temporarily increase, the stock will eventually reduce. Thus, MBAL is a threshold spawning level below which it is inadvisable to go. Indeed, in order to give some leeway on the estimate it is preferable to establish a long term spawning level rather higher than MBAL to insure against the effects of unforeseen exceptional events leading to low survival. Some buffer is incorporated into the statistical compliance procedure adopted in SAPs, but it may be felt that more insurance is desirable. This should be a local management decision and depends on circumstances, for example particular uncertainty over the deposition estimates may lead a manager to set a higher Conservation Limit to reduce risk of the potentially damaging effect of overfishing.

Because S-R curves are not available for most rivers the procedures use one taken from the River Bush in Northern Ireland, where long term studies have given a working model of the relationship between spawners and recruits. The shapes of S-R curves are controlled by the productivity of the freshwater habitat and the survival rate. So, correcting for these features allow the Bush model to be transported to other rivers. This gives an improved approximation of a river-specific Conservation Limit.

It is most important to recognise Conservation Limits for what they are - valuable, objective reference points to guide managers in local stock assessment and a standard framework to report stock status nationally.

Moreover, although Conservation Limits have been internationally accepted as a good working practice for some years, there is still a need for improvements in understanding and methodology.

Numerous factors *could* lead to misinterpretation of a Conservation Limit set for a whole river. A particular problem is the possibility of stock structuring on large rivers, which in theory might require Conservation Limits to be set for different stock components originating from different parts of the catchment and having different age,
run, and exploitation characteristics. Currently, such tight sub-catchment management is impracticable, although special measures to protect or enhance run components, particularly spring-running fish, must be brought in when they are shown to be necessary. It may be possible for some rivers to define objectively separate Conservation Limits for grilse and multi sea-winter fish, and this is the subject of continuing research.

Therefore, nominal "passing" or "failing" of Conservation Limits *in isolation* does not guarantee a correct management decision. Professional scientific judgement, combined with consideration of the full range of other factors acting on a fishery is essential to come to the correct conclusions.

APPENDIX 2. CATCHMENT SPECIFIC ISSUES ~ RIVER KENT

The following issues affecting the catchment have been extracted from the Local Environment Agency Plan for South Cumbria and modified for inclusion within this Salmon Action Plan.

Table K1 : The Need for the Protection and Enhancement of the Area's Biodiversity

ACTION	RESPONSIBILITY		TOTAL COST (AGENCY)	1998 / 1999	1999 / 2000	2000 / 2001	2001 / 2002	2002 / 2003	2003 / 2004	EA PRIORITY AND LEAD FUNCTION
	LEAD	OTHER								
Identify and undertake collaborative projects in the LEAP area to safeguard existing habitats and species where the Agency is identified as contact point or lead partner by the Cumbria Biodiversity Action Plan.	EN EA Cumbria Biodiversity Partnership CWT LDNPA Land-owners		Cost Unknown Subject to funding being available	✓	✓	✓	✓	✓	✓	**National** Fisheries, Ecology & Recreation

Table K2 : Areas at Risk from Flooding

ACTION	RESPONSIBILITY		TOTAL COST (AGENCY)	1998 / 1999	1999 / 2000	2000 / 2001	2001 / 2002	2002 / 2003	2003 / 2004	EA PRIORITY AND LEAD FUNCTION
	LEAD	OTHER								
Arrad Marsh, Poaka Beck, River Rothay, **River Kent** Investigate the viability of options to resolve potential flooding problems (considering conservation and economic aspects) and promote projects accordingly.	EA		£251k	✓ £80k	✓ £91k	✓ £40k	✓ £40k	✓	✓	**Normal Duties** Flood Defence

Table K3a : Opportunities for River Restoration & Habitat Conservation

ACTION	RESPONSIBILITY		TOTAL COST (AGENCY)	1998 / 1999	1999 / 2000	2000 / 2001	2001 / 2002	2002 / 2003	2003 / 2004	EA PRIORITY AND LEAD FUNCTION
	LEAD	OTHER								
Assess fish habitats and prepare action plans for the River Gowan	EA		Cost Unknown Subject to funding being available	✓	✓					**Area** Fisheries, Ecology & Recreation Flood Defence

Table K3b : Opportunities for River Restoration & Habitat Conservation

ACTION	RESPONSIBILITY		TOTAL COST (AGENCY)	1998 / 1999	1999 / 2000	2000 / 2001	2001 / 2002	2002 / 2003	2003 / 2004	EA PRIORITY AND LEAD FUNCTION
	LEAD	OTHER								
Undertake habitat enhancement collaborative projects on Rivers **Kent**, Crake, Leven & Duddon (**Complete**).	Riparian Owners Angling Interests EA		£3k	✓	✓					**Area** Fisheries, Ecology & Recreation

Table K4 : Adverse Impact of Effluent Discharges

ACTION	RESPONSIBILITY		TOTAL COST (AGENCY)	1998 / 1999	1999 / 2000	2000 / 2001	2001 / 2002	2002 / 2003	2003 / 2004	EA PRIORITY AND LEAD FUNCTION
	LEAD	OTHER								
Investigation of Mercury levels. (**Complete**)	EA		£3.6k	✓						**Area** Environmental Protection
Continued utilisation of anti-foam at Kendal WwTW. A permanent solution to resolve this issue has been included in NWW AMP3 process.	NWW Ltd		Staff Time	✓	✓	✓	✓	✓	✓	**Area** Environmental Protection
Control of trade effluent inputs to sewer, which then find their way to the WwTW.	NWW Ltd		Staff Time	✓	✓	✓	✓	✓	✓	**Area** Environmental Protection

Table K5 : Premature Storm Discharges at Sewage Treatment Works

ACTION	RESPONSIBILITY		TOTAL COST (AGENCY)	1998 / 1999	1999 / 2000	2000 / 2001	2001 / 2002	2002 / 2003	2003 / 2004	EA PRIORITY AND LEAD FUNCTION
	LEAD	OTHER								
Rebuild Staveley WwTW **(Complete)**	NWW Ltd		Staff Time		✓					**Normal Duties** Environmental Protection

Appendix 3. Declared Catch Summary

Table 13a : Declared Rod Catch Data For The River Kent

Year	Salmon	Sea Trout	Year	Salmon	Sea Trout
1955	125	696	1977	137	279
1956	117	494	1978	222	271
1957	71	802	1979	128	441
1958	48	295	1980	93	386
1959	29	335	1981	143	228
1960	32	349	1982	189	244
1961	77	150	1983	63	124
1962	98	447	1984	47	67
1963	136	322	1985	97	148
1964	150	271	1986	239	186
1965	103	363	1987	179	413
1966	153	477	1988	338	361
1967	4	133	1989	209	245
1968	4	55	1990	307	253
1969	19	70	1991	448	449
1970	122	211	1992	408	305
1971	108	314	1993	422 (43)	451 (213)
1972	55	161	1994	673 (88)	633 (295)
1973	185	589	1995	562 (101)	333 (219)
1974	224	306	1996	469 (93)	450 (229)
1975	114	201	1997	306 (58)	299 (191)
1976	84	144	1998	786 (227)	576 (311)
			1999	233 (90)	280 (139)

NB Released Total In Brackets.

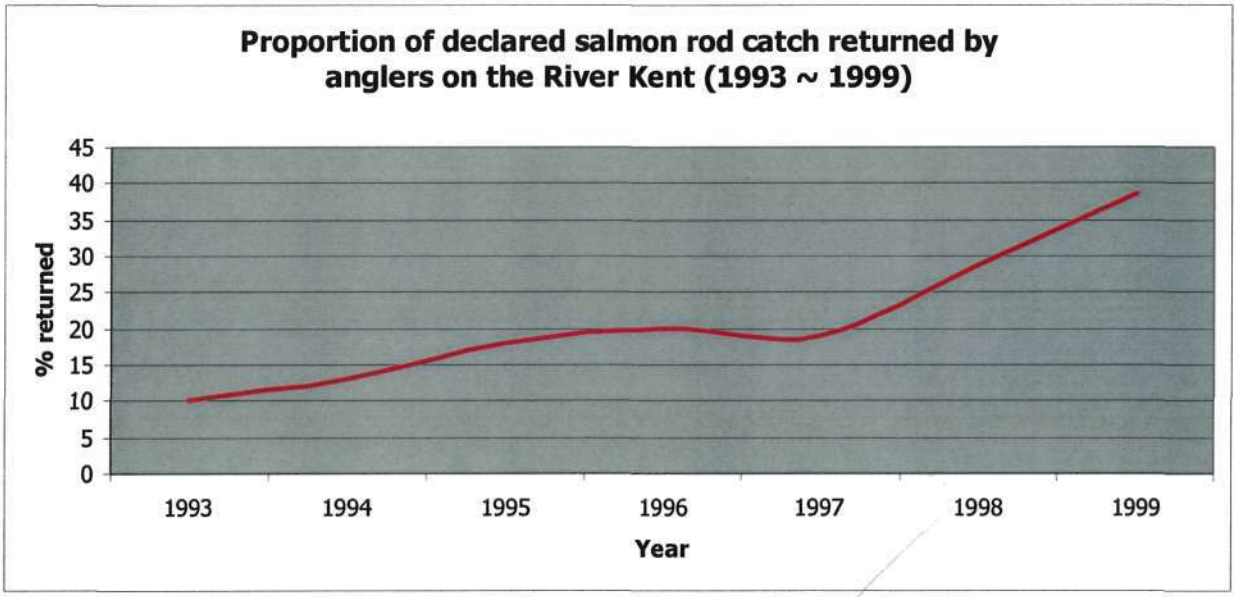
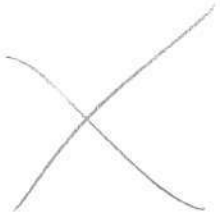


Figure 7 : Indication of the increase in catch and release of salmon on the River Kent

Table 13b : Declared Net Catch Data For The Kent Estuary Lave Net Fishery

YEAR	SALMON	SEA TROUT	YEAR	SALMON	SEA TROUT
1955	222	4	1977	236	70
1956	145	8	1978	374	91
1957	345	2	1979	97	20
1958	194	4	1980	61	22
1959	304	12	1981	55	12
1960	65	-	1982	39	46
1961	44	1	1983	31	11
1962	232	3	1984	131	43
1963	284	4	1985	20	5
1964	420	7	1986	61	13
1965	265	3	1987	26	5
1966	407	16	1988	102	27
1967	756	20	1989	357	80
1968	623	12	1990	197	10
1969	571	23	1991	185	18
1970	543	32	1992	68	6
1971	252	16	1993	104	-
1972	128	5	1994	82	1
1973	166	20	1995	109	1
1974	163	9	1996	45	-
1975	279	38	1997	99	1
1976	260	59	1998	20	1
			1999	55	5



APPENDIX 4. A GUIDE TO THE INTERPRETATION OF JUVENILE ELECTRIC-FISHING DATA

The juvenile salmon data presented in this report has been generated as part of the Agency's strategic monitoring programme. The data collected during the survey is used to calculate a population estimate and thereby the densities of salmonids present. The densities calculated are then used to classify the fishery.

The Fisheries Classification Scheme

Since 1997, all fisheries population data from sites within England and Wales have been classified using the National Fisheries Classification Scheme, which superseded all previous classification schemes. In order to allow a valid comparison of grades across a wider geographical area, an increased range of fishery types and data types, a statistical approach was used. This looked at a large national data set, and split it into quintiles based on fish densities. This resulted in the top 20% of sites from any given data set could be given a Grade A, irrespective of fishery type or data collection method. The next 20% could then be graded as B, and so on allowing class boundaries to be defined for all data and fishery types as shown below.

Table 14 : National Fishery Classification Scheme ~ Grading

GRADE	DESCRIPTION	INTERPRETATION
A	Excellent	In the top 20% for a fishery of this type.
B	Good	In the top 40% for a fishery of this type.
C	Fair	In the middle 20% of fisheries of this type.
D	Fair	In the bottom 40% for a fishery of this type
E	Poor	In the bottom 20% for a fishery of this type
F	Fishless	No fish of this type present.

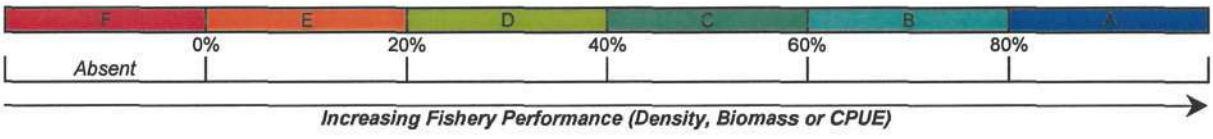


Figure 8 : Class Boundaries, With % Of Sites Shown In Relation To Grade.

APPENDIX 5. NETTING BYELAWS ON THE KENT ESTUARY

Definition of a Lave Net :

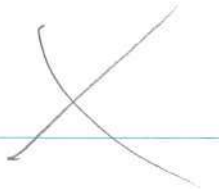
Lave nets shall, for the purposes of the byelaws be of single netting of mesh measuring when wet not less than 50mm in extension from knot to knot or 200mm round the four sides and which shall be constructed to form a bag or purse attached to a yoke in the shape of a "V", the widest part of which shall not exceed 2 metres, and which shall be fitted with a hand shaft to the apex of the yoke.

(Taken from Environment Agency North West Region Fisheries Byelaws).

Definition of Lave Netting Practices :

The manner of using a lave net shall be by one person standing or moving in the water and supporting or holding the net and lifting or scooping any fish. No person shall use a lave net in proximity to a fixed net, designed to catch other fish, in such a way that the migratory fish are restricted in movement by such fixed net thereby facilitating their taking in the lave net.

(Taken from Environment Agency North West Region Fisheries Byelaws).



APPENDIX 6. CORRECTION FACTORS FOR DECLARED ROD CATCHES 1986 - 1999

1986-91: Prior to 1992 there was no national rod licence and the 10 different regions of the National Rivers Authority (NRA) employed different systems of licensing and obtaining anglers catch returns for their respective areas. Different correction factors should therefore be applied in different regions during this period.

Table 15a : Declaration & Return Rates ~ 1986 to 1991

REGION	ANGLERS RETURN RATE (%)	DECLARATION RATE (%)	CORRECTION FACTOR
NORTHUMBRIA	30-40	0.64	1.56
YORKSHIRE	85-100	0.97	1.03
SOUTHERN	100 (General licences)	1.00	None
WESSEX	65-80	0.91	1.10
SOUTH WEST	45-50	0.77	1.30
SEVERN-TRENT	65-85	0.91	1.10
WELSH	60-65	0.83	1.20
NORTH WEST	20-30 (1986-90) 70 (1991)	0.50 0.88	2.00 1.13

1992-3: In 1992 a national rod licence was introduced. For these two years there was no separate salmon licence, so the number of salmon anglers is more difficult to estimate than usual. Due to the low licence price, the number of anglers who fished for salmon is thought to have been substantially greater. Also it was impossible to send a catch return reminder so the return rate was very poor.

Table 15b : Declaration & Return Rates ~ 1992 to 1993

	RETURN RATE (%)	DECLARATION RATE (%)	CORRECTION FACTOR
National	20-30	0.53	1.90

1994-8: With the introduction of a separate migratory salmonid licence in 1994, a catch return reminder became possible and was introduced. Catch return rates increased three-fold and the accuracy of catch returns substantially improved.

Table 15c : Declaration & Return Rates ~ 1994 to 1999

	RETURN RATE (%)	DECLARATION RATE (%)	CORRECTION FACTOR
National	71-76	0.91	1.10

Calculation of correction factor: The correction factors are calculated from the equation:

Actual catch = Declared catch x ((0.3/ Return rate)+0.7)

Adapted from:
Small, I. (1991). Exploring data provided by angling for salmonids in the British Isles. p 81-91 in Catch effort sampling strategies, their application in freshwater fisheries management. Ed. I. Cowx. Fishing News Books.

APPENDIX 7. VALUES & INFORMATION USED IN CALCULATION OF CONSERVATION LIMITS & DEPOSITION ESTIMATES

Standard spreadsheets have been developed by the Agency for the calculation for the calculation of Conservation Limits and egg deposition estimates. The calculations are complex and it is not possible to present them here but it is hoped that by presenting the data and its sources it will be clearer to people what data and assumptions have been used.

Data presented are those used in the standard Environment Agency Salmon Action Plan spreadsheet for estimating the numbers of eggs laid down in each river.

Table 16a : Values used in egg deposition estimates in the Kent catchment

	1992	1993	1994	1995	1996	1997	1998	1999
Declared rod catch	408	422	673	562	469	302	786	233
No. of salmon released	---	43	88	101	93	58	227	90
Reporting rate	53%	53%	91%	91%	91%	91%	91%	91%
Corrected catch	770	796	740	618	515	336	864	256
Run available to rods*	2807	2909	2643	2228	1829	1213	3131	913
Egg Deposition (millions)	4.537	4.723	4.679	3.804	3.316	2.123	5.575	1.785
Mean fecundity of grilse	3972	3883	3941	3649	3805	3812	3682	3764
Mean fecundity of MSW	6101	5933	6002	6216	6058	5985	6048	6072

* Calculated by dividing estimated total rod catch by the extant exploitation rate separately for grilse and MSW.

STOCK CHARACTERISTICS APPLIED TO THE KENT CATCHMENT

Table 16b : Additional stock characteristic data used in egg deposition estimates in the Kent catchment

Extant exploitation rate (annual rod catch / annual run)	All	29%[1]
	Grilse	27%[2] (extant rate of 0.29/1.12)
	MSW	36%[2] (extant rate of 0.29/0.8)
Female proportion of stock	Grilse	55.1%[3]
	MSW	68.7%[3]
Age weight relationship[4]	Grilse	All fish under 4lbs 98% of 4lbs – 5lbs 97% of 5lbs – 6lbs 96% of 6lbs – 7lbs 60% of 7lbs – 8lbs 38% of 8lbs – 9lbs 14% of 9lbs – 10lbs 17% of 10lbs – 11lbs 7% of 11lbs – 12lbs
	MSW	2% of 4lbs – 5lbs 3% of 5lbs – 6lbs 4% of 6lbs – 7lbs 40% of 7lbs – 8lbs 62% of 8lbs – 9lbs 86% of 9lbs – 10lbs 83% of 10lbs – 11lbs 93% of 11lbs – 12lbs All fish over 12lbs
Survival of released fish	All	80%[5]

1 Based on River Leven (S. Cumbria) exploitation rate until video validation of Kent counter gives river specific data
2 Derived from data gathered on the River Dee (Aberdeenshire) by J Webb
3 Derived from River Kent catch data and catchment area
4 Derived from River Kent scale reading data 1992 – 1998
5 Based on data gathered from the River Dee (Aberdeenshire) by J Webb

APPENDIX 8. THE ENVIRONMENT AGENCY'S POSITION ON FISH-EATING BIRDS

- The Agency has no legal powers to issue licences to control predation by shooting fish eating birds. These powers lie with the Ministry of Agriculture Fisheries and Food (MAFF), or the National Assembly for Wales (NAW).

- The Agency welcomes publication of the findings of the major research programme into issues concerning the impact of fish-eating birds on inland waters. The results on breeding and wintering numbers of birds, and the movement of cormorants, the project which the Agency part-funded, has added considerably to previous knowledge. The studies on the impact of cormorants on some small stillwater fisheries support the previous evidence that significant losses of fish can occur. Results regarding the impact on larger stillwaters and rivers suggest that impact by fish eating birds is a problem for specific fisheries rather than a general problem.

- The Agency's current policy position is based on the following points :

    - There is a well established legal process for fishery owners to pursue if they consider fish-eating birds are having a serious impact on their fishery;
    - The Agency recognises the concerns of anglers and fishery owners;
    - Where serious damage to a fishery is occurring the Agency will support licensed shooting; and
    - The Agency will continue to provide information to fishery and conservation interests, as well as ADAS, to help determine the impact on fisheries.

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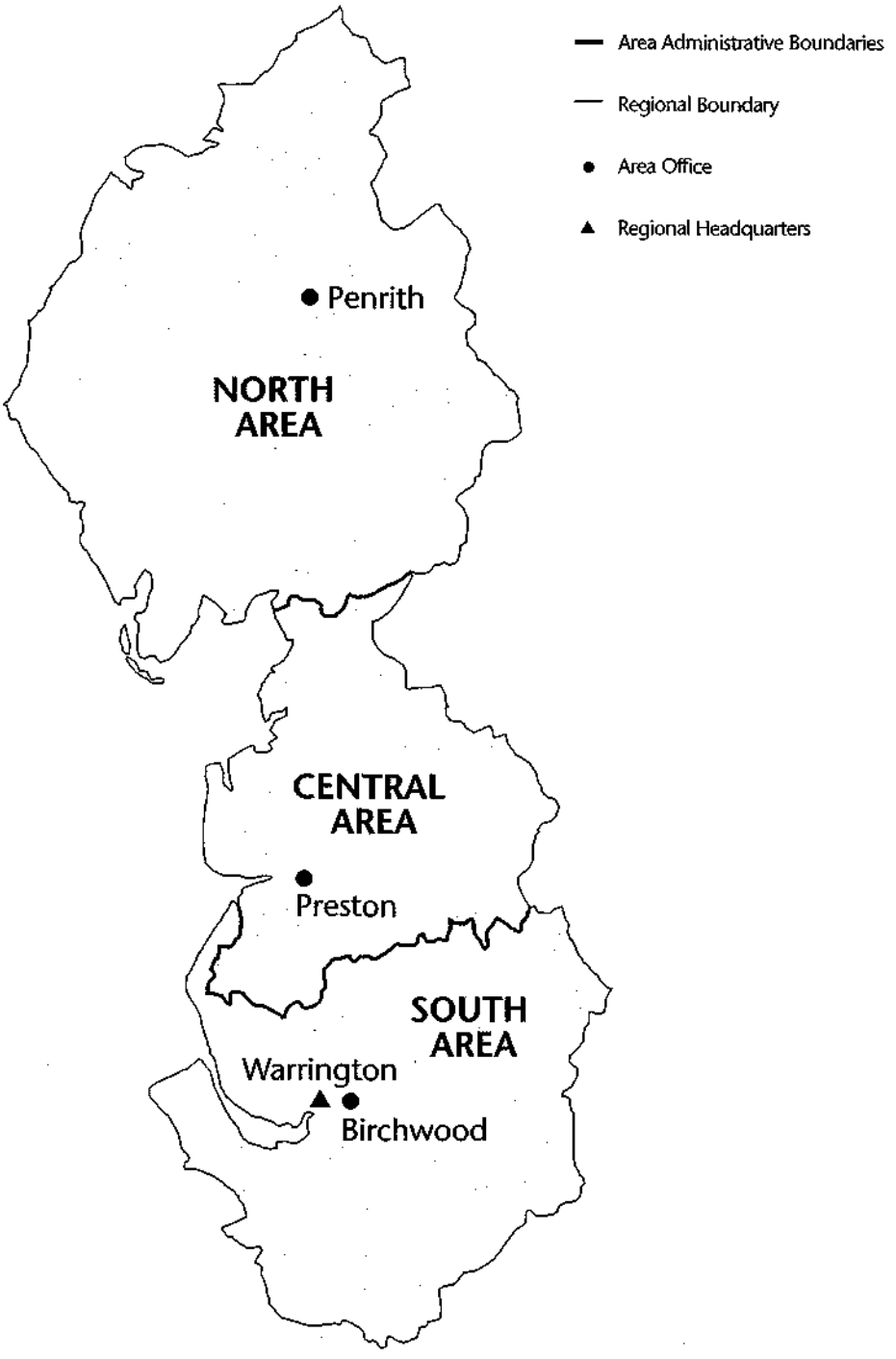

Internet World Wide Web www.environment-agency.gov.uk

For general enquiries please call your local Environment Agency office. If you are unsure who to contact, or which is your local office, please call our general enquiry line.

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0645 333 111

The 24-hour emergency hotline number for reporting all environmental incidents relating to air, land and water.

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