



*Awdurdod Afonydd Cenedlaethol
Rhanbarth Cymru*



*National Rivers Authority
Welsh Region*

USK SALMON

Recommendations for Action



ENVIRONMENT AGENCY



015537

USK SALMON – RECOMMENDATIONS FOR ACTION

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ENVIRONMEN
WELSH REC
ACCESSIO
CLASS No

SEPTEMBER 1992

**NATIONAL RIVERS AUTHORITY
WELSH REGION
ST. MELLONS
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ACKNOWLEDGEMENTS

This document draws on the contents of a large number of internal reports and documents of the National Rivers Authority. It therefore incorporates the work of many staff of the NRA and its predecessors, too numerous to list individually. Nevertheless, specific acknowledgement must be given to David Williams, for his comments on estuarine water quality; Paul Hilder, for providing catch data for the Wye; Sue Smith for providing information on riverine water quality; David Bunt, Rhys Morgan and Sue Price for their assistance in producing the report; and lastly the NRA bailiff force, whose recent work, particularly in the Severn Estuary, has done much to stem the decline in the legal fisheries.

FOREWORD

The renown of the Usk salmon has been chronicled for at least 1500 years since Drichan portrayed it in the 5th century AD. Gerald the Welshman 700 years later wrote of their plenty in Brecknock and in the reign of Elizabeth I Churchyard celebrated them:

"Than still of course in Oske doth salmon lie
And of good fish in Oske you shall not miss"

In 1782 a fish of 68½lbs, the largest recorded fish caught in Wales, was taken by coracles below Usk. Less than 100 years ago in 1903 Walter Gallichan was able to describe the Usk as the most famous salmon river south of the Tweed. This state of affairs was not achieved without a hard struggle. For much of the 19th century the River suffered from severe over netting, pollution of the industrial tributaries, abstraction for the canal and sewerage discharge from the towns along its banks. Only prolonged, determined efforts by a handful of men brought eventual success.

Today the picture is very different and bleak, with the salmon under threat from causes near and far. Whilst we hope to influence the latter it is incumbent upon us to do something about the former. For this reason the Local Fisheries Group asked the NRA to review the current position and bring forward recommendations to achieve an improvement. Guy Mawle is to be congratulated on an excellent paper which clearly sets out the current status. Unfortunately the NRA has to operate within certain guidelines and cannot always promote changes which many fishermen would like to see. For example, some might feel disappointed that a greater restriction of the netting effort is not suggested and that the NRA feels unable to tackle avian predation at present. Nonetheless this is a positive and constructive set of proposals which in conjunction with the recently introduced bye-laws controlling netting in the Severn Estuary offers an excellent opportunity for us to contribute towards a remedy. With the possibility of yet further threats such as the Usk Barrage looming it is essential that our own house be put in order.

We are temporary guardians of this wonderful heritage with the same responsibilities as our successful predecessors to do all that we can to return the River to what it can be. In this spirit I hope you will give your wholehearted support to these recommendations.



Andrew Baylis

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	CONTENTS	PAGE
1.	INTRODUCTION	1
2.	THE USK AND ITS TRIBUTARIES	2
2.1	The Catchment	2
2.2	River Flows and Abstractions	2
2.3	Water Quality	2
2.4	Obstructions to Migration	2
2.5	The Fisheries	3
3.	DEFINING THE PROBLEMS	4
3.1	The Rod Catch	4
3.1.1	Total Catch	4
3.1.2	Seasonal Catch	4
3.1.3	Salmon Weight	4
3.1.4	Angling Pressure	5
3.1.5	The Usk Relative to the Wye	5
3.2	Commercial Catches	5
3.2.1	Total Catch	5
3.2.2	Seasonal Catch	5
3.2.3	Salmon Weight	5
3.3	Timing of runs	6
3.4	The number of spawning salmon	6
3.5	Juvenile Production	6
3.5.1	Parr Densities	6
3.5.2	Smolt Production	7
3.6	Summary of Problems	
3.6.1	Decline of early-run, particularly large, salmon	7
3.6.2	Poorer than expected catch of late-run salmon	7
3.6.3	Possible decline in the overall salmon stock	7
4.	What is causing the problems?	8
4.1	Decline of early-run and large salmon: likely causes	8
4.1.1	Changes in the marine environment	8
4.1.2	Distantwater net fisheries	9
4.1.3	Ulcerative Dermal Necrosis (U.D.N.)	9
4.1.4	Exploitation in home water	10
4.1.4.1	Exploitation in the rod fisheries	10
4.1.4.2	Exploitation by licensed fisheries in the Severn Estuary	10
4.1.4.3	Illegal coastal netting	11

4.2	Poorer than expected rod catch of late-run salmon: likely causes	11
4.2.1	High sea fisheries	11
4.2.2	Pollution of the Usk Estuary	12
4.2.3	Abstraction	12
4.2.4	Coastal netting	13
4.3	Decline in the overall salmon stock: possible causes	13
4.3.1	Reduced spawning	13
4.3.2	Avian predation	14
4.3.3	Abstraction	14
4.4	What is causing the problems: summary	14
4.4.1	Decline of early-run and large salmon: likely causes	14
4.4.2	Poorer than expected rod catch of late-run salmon: likely causes	15
4.4.3	Decline in the overall salmon stock: possible causes	15
5.	ADDRESSING THE PROBLEMS – RECOMMENDATIONS FOR ACTION	16
5.1	Objectives	16
5.2	Exploitation	16
5.2.1	Rod Fisheries	16
5.2.1.1	Proposed constraints on early season angling	17
5.2.1.2	Catch-and-release, late season	17
5.2.2	Illegal fishing in-river	18
5.2.3	Coastal fisheries – licensed fishing	19
5.2.3.1	Proposed constraints on early season fishing	19
5.2.3.2	The balance between commercial and rod fisheries	20
5.2.4	Coastal fisheries – illegal fishing	21
5.2.5	Distantwater fisheries	21
5.3	Abstraction and river flows	22
5.3.1	Major abstractions	22
5.3.2	Changes in river flows	22
5.4	Pollution – Water Quality	22
5.4.1	Pollution of the estuary	22
5.4.2	Nutrient enrichment	23
5.5	Obstructions to migration	24
5.5.1	Existing obstructions	24
5.5.2	The proposed Usk Barrage	24
5.6	Avian predation	24
5.7	Restocking	25
5.8	The Rate of Recovery	26

5.9	Monitoring Stocks and Catches	26
5.9.1	Egg deposition	26
5.9.2	Juvenile salmonid stocks	27
5.9.3	Smolt output	27
5.9.4	Adult stocks and their exploitation	27
5.9.4.1	Anglers' catch returns	27
5.9.4.2	Trostrey fish counter	28
5.9.5	Targets	
5.10	Resources	28
6.	SUMMARY OF RECOMMENDATIONS FOR ACTION	30
7.	BIBLIOGRAPHY	33
8.	FIGURES	34
9.	TABLES	56
10.	APPENDIX 1 – Excerpt from the Hereford Times, 1913	65
11.	APPENDIX 2 – Byelaws to regulate sea fishing and protect salmon in the Severn Estuary from August 1992	- 66 -

1. INTRODUCTION

The National Rivers Authority has a statutory duty to maintain, develop and improve salmon fisheries (Water Act 1991). To fulfil this duty, the NRA considers that action is required to conserve and restore components of the Usk salmon stock upon which both commercial and rod fisheries depend.

This document aims to outline the reasons for the Authority concerns. Its specific objectives are:-

- (i) to document, within a historical context, the current status of the fisheries;
- (ii) to identify, as far as possible, the problems affecting the fisheries;
- (iii) to outline options for management action to rectify or mitigate these problems.

2. THE USK AND ITS TRIBUTARIES

2.1 The Catchment

- * The Usk rises in the Brecon Beacons and flows south east for about 100 km to join the Severn Estuary.
- * Apart from Newport and the industrialised Ebbw and Lwyd sub-catchments, the catchment is sparsely populated, being predominantly pastoral farmland, the largest towns are Brecon and Abergavenny (Fig. 1).

2.2 River Flows and Abstractions

- * The Usk, gauged by the NRA at Chainbridge (Fig. 1) has a median (50 percentile) daily flow of about 16 cumecs; with flows typically greater from October to April than from May to September (Fig. 2).
- * The headwaters of the river and several tributaries are impounded for public water supply (Fig. 1), though low level compensation flows are required to maintain the river.
- * Apart from the upland reservoirs, the riverine Usk supports three substantial abstractions, i.e. (i) at Brecon, where water is diverted by Newton weir into the Monmouthshire and Brecon Canal; and (ii) at Rhadyr and Llantrisant in the lower reaches for domestic and industrial supply, partly via storage in Llandegfedd reservoir (Fig. 1, Table 1).
- * Estuarine water is also abstracted, for cooling purposes, and returned at Uskmouth Power Station by National Power (Fig. 1). From 1962 to 1982, two power stations, A and B, operated on the site. Only Uskmouth B is now in operation.

2.3 Water Quality

- * The NRA surveys water quality by chemical analysis of water samples and by assessing the abundance and diversity of aquatic invertebrate life. These analyses indicate good water quality throughout most of the catchment (Fig. 3).
- * Acidification is affecting several Welsh rivers, but there is no indication that the Usk is affected, due to the characteristics of the local geology and soil types which can neutralise acidic precipitation.
- * In contrast to the river, the estuary suffers from poor water quality including low dissolved oxygen levels in summer under certain tidal and river conditions (Table 2); numerous discharges enter the estuary, including untreated sewage and a large heated effluent from Uskmouth Power Station.

2.4 Obstructions to Migration

There are now few structures on the main river to delay or obstruct salmon migration though some remain on certain tributaries (Fig. 4).

2.5 The Fisheries

2.5.1 Rod Fisheries

- * The open season for salmon angling has varied over the past 150 years (Table 3); it currently runs from 26th January to 17th October.
- * There are restrictions on angling methods with only artificial fly and spinning being permitted all season; bait fishing with worm, prawn or shrimp is restricted to the period 15th April to 30th September.

2.5.2 Commercial Fisheries

- * No commercial fisheries have operated within the Usk or its estuary since 1935.
- * Tag returns indicate that all the commercial fisheries in the Severn Estuary (Table 4) exploit salmon derived from the Usk (e.g. Fig. 5).
- * Licensed drift nets, limited since 1956 by Net Limitation Order to eight, fish in the vicinity of Uskmouth (from the 2nd March to 31st August); this public fishery has operated only since 1914. No fishing is permitted during a 48 hour period over the weekend.
- * A private putcher fishery also operates close to Uskmouth, at Goldcliffe (with an open season from April 16th to August 15th) though with no weekly close time. Patcher ranks have also operated at Redwick and Porton, but not since 1982.
- * For much of this century, a large, illegal drift net fishery has operated in the same area as the licensed nets off Uskmouth, the netsmen ostensibly fishing for sea fish.

3. DEFINING THE PROBLEMS

- The current status and trends in the fishery

3.1 The Rod Catch

3.1.1 Total catch

- * On average the recorded rod catch was substantially higher in the latter half of the 19th Century than in the 20th Century, despite comparatively lower fishing pressure (Figs. 6 & 7).
- * The reliability of the recorded catches in the 1800s is supported by one angler's individual catch records (Appendix 1).
- * Declared annual catches over the last 15 years have been generally low and included the two lowest recorded (i.e. 1976 and 1984).

3.1.2 Seasonal catch

- * The 'Early' catch (March-June inclusive) is now lower than at any time this century, except the period during the First World War when fishing effort was low (Usk Board of Conservators Report 1918) (Fig. 8).
- * There is little evidence, with the exception of 1988, of a corresponding increase in the 'Late' catch (July-September inclusive), although the late catch is now proportionately more important (Fig. 9).
- * The Late catch shows greater variation from year to year than the Early catch (Figs. 8 and 9), reflecting partly the availability of flows. Given the increasing importance of the Late catch over the last decade, the total annual catch has become less consistent over the last decade.

3.1.3 Salmon weight

- * The average weight of rod caught salmon has been declining from a peak in the 1920s and 1930s and is now similar to, if not lower than, in the late 19th Century when salmon were most abundant (Fig. 6).
- * Since 1966, the numbers of large salmon (over 14lbs) and, to a lesser extent, medium sized salmon (8-14lbs) have declined (Fig. 10). Prior to this date, different sizes of salmon were not separated in the catch record.
- * There has been no increase in the number of grilse (under 8lbs) caught except in 1985 and 1988. The high catches of grilse in these two years may reflect good angling conditions rather than a large stock of grilse (Fig. 11).
- * No salmon larger than 22lbs has been recorded from the Usk since 1986. From 1910 to 1950, the largest fish caught each year from the river was recorded in the Usk Board of Conservators annual reports: the weight of such fish was always greater than 30lbs and frequently more than 40lbs.

3.1.4 Angling Pressure

- * The number of licences sold for salmon fishing on the Usk rose from about 250 in the late 19th Century (when catches were highest) to about 1000 in the 1970s, when a regional licence system was introduced (Fig. 7).
- * Improvements in tackle technology are likely to have increased the effectiveness of angling.

3.1.5 The Usk relative to the Wye

- * The declared rod catches for the Usk and Wye have shown similar trends in the number and average weight of salmon caught for most of this century. However, since the 1960s, the Usk catch has declined relative to the Wye.
- * Based on the relationship between the two rivers' catches up to 1969, the subsequent rod catch should have been substantially greater than that recorded (Figs. 12 and 13).
- * On average, the Early catch should have been about 70 per cent greater than recorded. The Late catch should have been more than double that recorded (Table 5).

3.2 Commercial Catches

3.2.1 Total catch

- * The commercial fisheries in the Severn Estuary off Uskmouth exploit stocks from several rivers, particularly the Wye, as well as the Usk. Nevertheless, a substantial, though unknown, proportion of the salmon taken in Usk District drift nets and putcher ranks are likely to be Usk salmon.
- * In contrast to the rod fishery, the Usk drift net catch has been increasing, though variable, since the 1960s (Fig. 14). Since 1956 the number of licensees for this fishery has been limited to 8. The peak in catch during the 1930s reflects the higher fishing effort.
- * After a decline over the first half of the century, the number of salmon taken by the putcher ranks rose in the 1960s before falling again (Fig. 15). It is probable that these fluctuations partly reflect changes in fishing effort, though this is not well documented.

3.2.2 Seasonal catch

- * Since the mid-1960s, monthly catch data have been available which indicate a slight increase in the proportion of the catch taken in the last month of the season (Fig. 16).

3.2.3 Salmon weight

- * As in the rod fishery the average weight of salmon caught in both the drift net and putcher fisheries was greater in the first half of the century with a marked decline in the late 1940s and early 1950s (Figs. 14 and 15). However, unlike the rod fishery, there has been an increase in average weight in recent years, though whether this is a clear trend remains to be seen.

3.3 Timing of runs

- * An electronic fish counter has operated since 1975 on Trostrey weir about 15 kilometres above the tidal limit (Fig. 1). Different designs of counter have been tested although none have been proved accurate.
- * Despite the concern over the number of fish counted, the proportion of counts made in each month in theory provides an index of the number of large fish entering the middle reaches of the Usk.
- * Data are available for two periods (1975-78 and 1988-90).
- * On average, half the counts are made in the last three months of the year (October-December). However, there is considerable variation from year to year (Table 6).
- * The counter data imply that a large proportion of salmon do not currently enter the middle and upper reaches of the Usk until after the end of the angling season.
- * It is not clear whether the late running salmon are migrating from the sea or from the lower reaches of the river.

3.4 The number of spawning salmon

- * Intermittent counts have been made of salmon redds, though annual counts are available for the period 1961-1983.
- * Comprehensive redd counts have not been made since 1983.
- * The average number of redds counted each year in the most recent period, 1974-1983, was only 992, 36 per cent of the average count (i.e. 2760 redds per year) for the previous 10 years, 1964-1973.
- * Over the same period, the rod catch had dropped by 50 per cent (Table 7). Although the relationship between rod catch and redd count is poor, it would seem that the decline in rod catch since the 1960s has coincided with a drop in the number of salmon spawning.

3.5 Juvenile Production

3.5.1 Parr densities

- * Data on the abundance of juvenile salmon have only been collected since 1986, based on electrofishing surveys of individual sites approximately 50 metres long. Each site is placed into one of five classes (A-E), where A indicates highest densities, D, the lowest densities and E, the absence of both salmon fry and parr.
- * In 1991, 63 per cent of the 38 sites accessible to salmon were in classes D and E (Fig. 17). However, this may reflect the number of sites on tributaries (36 sites) as opposed to the main river (2 sites) which is likely to comprise a major area of salmon production.

- * Every year since 1987, 13 sites have been fished 'quantitatively' (i.e. to provide an estimate of total juvenile salmon density) while a further 12 sites have been fished 'semi-quantitatively' to obtain an index of fish density. Average densities of >0+ salmon parr, (i.e. more than 1 year old), were lowest in 1990 and 1991 for 'quantitative' and 'semi-quantitative' sites respectively (Table 8). However, differences between years were not statistically significant ($P < 0.05$) and may be spurious.

3.5.2 Smolt production

- * The number of smolts caught in the intake to the Uskmouth A and B power stations has been recorded since 1962. The number of smolts caught will reflect not only the size of the smolt run but also changes in the operation of the power stations. For example, after 1975 only Uskmouth B was operated after the beginning of April, and after 1981 Uskmouth A closed down completely. Full details of the pumping regime of the power stations are not available at present.
- * Despite these variations in abstraction, estimates of the smolt run can be derived for some years based on the proportion of tagged smolts captured at the power station. Table 9 suggests that the Usk smolt runs in 1987 and 1989 were substantially lower than in the 1960s. However, these differences need to be treated with caution as the confidence intervals for the estimates are wide.

3.6 Summary of problems

The problems may be listed under three headings:-

3.6.1 Decline of early-run, particularly large, salmon

- * Catches of early run have declined since the 1960s.
- * The average weight of salmon caught has declined since the 1930s, due mainly to the demise of large, early-run salmon.

3.6.2 Poorer than expected catch of late-run salmon

- * Relative to the catches in the late 19th century when small salmon (grilse) also dominated catches, the rod catch is currently very poor.
- * The catch of late-run salmon by anglers has not increased since the 1960s, except in years with high river flows.

3.6.3 Possible decline in the overall salmon stock

- * Relative to the Wye, the Usk rod catch of both early and late-run salmon has declined since the 1960s.
- * The number of salmon spawning may have declined since the 1960s.
- * The number of smolts entering the Severn Estuary may have declined since the 1960s.
- * The lowest recorded rod catches have occurred within the last 20 years (i.e. in 1976 and 1984).

4. WHAT IS CAUSING THE PROBLEMS?

4.1 Decline of early-run and large salmon: likely causes

- * The decline of this component of the stock is not confined to the Usk, but has occurred, to a greater or lesser degree, amongst many salmon stocks in Europe and North America.
- * The causes of the decline are therefore likely to be widespread phenomena, though local factors may also be significant.

4.1.1 Changes in the marine environment

- * For salmon stocks in general the relative abundance of multi-sea winter (MSW) salmon, as opposed to grilse (i.e. one sea winter salmon), is thought to be affected by climate.
- * Good runs of MSW salmon have tended to occur when the North Atlantic has been consistently warm, while cooler temperatures have tended to lead to grilse predominating.
- * Cycles in the abundance of grilse and MSW salmon therefore may follow cycles in sea temperature. Tony George¹ in an analysis of Scottish salmon catches has suggested the following cycles,

Period	Stock Abundance	
	MSW Salmon	Grilse
1780 - 1792	low	low
1793 - 1811	high	low
1812 - 1817	high	high
1818 - 1849	low	high
1850 - 1858	low	low
1859 - 1880	high	low
1881 - 1885	high	high
1886 - 1896	low	high
1897 - 1920	low	low
1921 - 1956	high	low
1957 - 1967	high	high
1968 - 1989	low	high
1990 -	low	low

¹ 'Climate and the salmon'. Salmon, Trout & Sea Trout. December 1991, 8-10

- * Every year since 1987, 13 sites have been fished 'quantitatively' (i.e. to provide an estimate of total juvenile salmon density) while a further 12 sites have been fished 'semi-quantitatively' to obtain an index of fish density. Average densities of >0+ salmon parr, (i.e. more than 1 year old), were lowest in 1990 and 1991 for 'quantitative' and 'semi-quantitative' sites respectively (Table 8). However, differences between years were not statistically significant ($P < 0.05$) and may be spurious.

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- * The catch of late-run salmon by anglers has not increased since the 1960s, except in years with high river flows.

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1886 - 1896	low	high
1897 - 1920	low	low
1921 - 1956	high	low
1957 - 1967	high	high
1968 - 1989	low	high
1990 -	low	low

¹ 'Climate and the salmon'. Salmon, Trout & Sea Trout. December 1991, 8-10

- * These cycles for Scottish salmon are broadly consistent with the rod catch on the Usk (Figure 6). The large catches and low average weight of Usk-salmon in the 1880s and 1890s occurred during a period favouring grilse. Catches then dropped markedly at the turn of the century, a period of low overall abundance of salmon in Scotland. The average weight of Usk salmon was greatest in the 1920s and 1930s, coinciding with the increased abundance of MSW salmon in Scotland. The lower average weight of the Usk salmon in the 1950s and 1960s may mirror the improved Scottish grilse stocks. The subsequent decline in the abundance of large, MSW salmon in the Usk also occurred in Scotland. Similarly, the overall salmon stocks have been comparatively poor in both Scotland and the Usk in the last few years.
- * It therefore appears that natural variations in the marine environment are likely to be an important reason for the decline in the catches of MSW salmon from the Usk. It cannot however be assumed that other factors, either at sea or in the river are not significant.

4.1.2 Distant water net fisheries

- * The fisheries of Greenland and Faeroes selectively exploit salmon destined to return to their home rivers after two or more years at sea. Both fisheries are known to exploit Usk salmon, from the capture of adult fish tagged in the Usk as smolts (Table 4).
- * The Greenland and Faeroes fisheries began taking large numbers of salmon in 1960 and 1979 respectively. This is well after the decline in average weight of Usk salmon first became apparent.
- * Together, the Greenland and Faeroes fisheries provided only 4 per cent of all microtags returned from Usk salmon tagged as smolts in the period 1984-89. Although tag returns indicate that the number of Usk salmon caught is comparatively small, it may represent a significant proportion of the potential MSW-component of the stock. These fisheries are not likely to be the cause of the decline in early-run salmon in the Usk but may be a contributory factor.
- * Comparatively large numbers of Usk tags are recorded from the Irish drift net fishery, but since this operates in summer and exploits mainly grilse, it is unlikely to have a significant impact on early-run, MSW stocks in the Usk.

4.1.3 Ulcerative Dermal Necrosis (U.D.N.)

- * The outbreak of this disease in 1968 resulted in the deaths of a large number of adult salmon. Several hundred unspawned salmon were removed from the river in both 1968 and 1969. Total losses were unknown.
- * The redd counts of 885 and 1771 in 1968 and 1969 respectively were the lowest recorded for the period 1964-73, when the average count was 2763.
- * The disease is likely to have killed proportionately more early-run salmon than later running grilse.
- * Since the time of return and age at maturity is in part genetically determined, the outbreak of U.D.N. may have altered the genetic composition of the Usk stock in favour of late-run fish.

- * U.D.N. was prevalent in other British rivers at this time. However, it is believed that the Hampshire Avon was not significantly affected and yet this river has also seen a decline in its run of early-run, large salmon.
- * U.D.N. may be a contributory factor in the decline of the Usk's early run of salmon but was probably not a primary cause.

4.1.4 Exploitation in home waters

4.1.4.1 Exploitation in the rod fisheries

- * The exploitation of a salmon stock by angling varies widely in the British Isles, most estimates suggesting anglers take between 15 and 40 per cent of salmon entering the river.
- * A crude estimate of exploitation of salmon entering the Usk can be made for the years 1961-83,
i.e. Rod exploitation =

$$\frac{\text{Rod Catch}}{(\text{Rod catch} + \text{Redd count})} = \frac{34,000}{115,00}$$
 which gives a figure of 30 per cent, similar to other rivers.
- * It is evident from studies on other rivers, including the Wye, Welsh Dee, North Esk in Scotland and Frome in Dorset, that the exploitation rate of early-run, multi-sea-winter salmon may be substantially greater than for the stock as a whole.
- * An analysis of catch statistics for the Wye by Gee and Milner (1980) suggested that the increase in angling pressure since the 1930s has been a major factor in the decline in the stock of early-run, large salmon. The exploitation rate for these fish was estimated to exceed 90 per cent, compared with less than 10 per cent exploitation of small salmon, mainly late-run grilse.
- * The decline in the average weight of rod caught salmon on the Usk mirrors that on the Wye. Increased angling pressure is therefore likely to have contributed to the decline in the Usk's stocks of large, early-run salmon.
- * Work on the River Frome in Dorset and the River Coquet in Northumberland suggests that the proportion of salmon taken by anglers increases as salmon stock declines. This implies that the rod fishery may be accelerating the decline in the Usk's stock of large, early-run salmon.

4.1.4.2 Exploitation by licensed fisheries in the Severn Estuary

- * The annual catch for the commercial fisheries in the Usk District averaged about 2200 salmon over the period 1986-90. About a quarter were taken before the end of May, and half before the end of June (Figure 16).
- * The exact proportion of Usk salmon in this catch is unknown, but a crude estimate, based on tag returns in the 1960s, suggests it is about one third. The remainder of the salmon would have been destined for other rivers, principally the Wye.

- * It is assumed that those salmon which were caught before the end of May would have contributed to the Usk's early run. Recently, the commercial fisheries in the Usk District have therefore been taking about 180 early-run Usk salmon each year. This is similar to the number of early-run Usk salmon taken by the rods (Figure 12).
- * Given the concern over the level of exploitation of early-run salmon by the rod fishery, the commercial catch in the Usk District is also likely to have contributed to the decline of the Usk's early-run.
- * The commercial fisheries in the Severn District, upstream of the Severn Bridge, also take Usk salmon. Although their total catch is large, it probably comprises mainly Wye and Severn salmon. The significance of these fisheries for the Usk's early run is unclear.

4.1.4.3 Illegal coastal netting

- * The illegal drift net fishery involving boats out of Newport will undoubtedly have been taking large numbers of Usk salmon including early-run fish. Observations on the number of boats involved in fishing in 1987 suggested that up to 8000 salmon would have been illegally taken, about four times the catch by licensed commercial fisheries in the Usk District. The impact on the Usk's salmon stock would presumably have been in proportion.

4.2 Poorer than expected rod catch of late-run salmon: likely causes

4.2.1 High sea fisheries

- * The Irish drift net fishery, both legal and illegal expanded dramatically in the 1970s and 1980s. It exploits mainly late-run salmon, predominantly grilse.
- * Irish fish markets are monitored for tagged salmon. Of 189 tags returned from adult salmon tagged as smolts in the Usk, 60 per cent were from Ireland, predominantly Eire.
- * It must be stressed that this apparently high return rate may reflect, in part, the more comprehensive monitoring of catches by the Irish compared to monitoring of catches in home waters.
- * It cannot be assumed that all the salmon taken in the Irish fisheries would otherwise have been available to the fisheries in home waters. Some of these salmon may have returned after the end of the fishing seasons.
- * Given these provisos, it is possible, if not probable, that the Irish drift net fishery may account for the comparatively low numbers of grilse returning to homewaters during the period of 'grilse abundance' in the 1970s and 1980s (see section 4.1.1). The numbers were low compared to the previous period of 'grilse abundance' in the 1880s and 1890s (Figure 6).
- * Tag returns for Wye salmon indicate that they are also exploited in this fishery. Therefore the Irish fishery does not explain why the Usk's rod catch of late-run salmon has been so poor since the 1960s when compared to the adjacent River Wye.

4.2.2 Pollution of the Usk Estuary

- * At times of low river flow, water quality in the Usk estuary during the summer does not meet the standards required for salmon to enter the river. Computer modelling has indicated that the removal of the various discharges of crude sewage would enable these standards to be met.
- * Salmon deterred by estuarine pollution from entering the Usk will be unavailable to the rod fishery until conditions improve. They may, however, remain available to the commercial fisheries, licensed and illegal.
- * Tracking of adult salmon in the Usk estuary using radio-telemetry in 1989 suggests that some salmon may be killed by poor water quality in the estuary. There is little evidence of large scale mortalities but the high turbidity would make observation of carcasses difficult.
- * Pollution of the Usk estuary is largely due to sewage from Newport. The status of this pollution in the late 1800s when large catches were made is unknown.
- * The impact of the large, heated effluent from Uskmouth Power Station on migration of both smolts and adult salmon has not been assessed.

4.2.3 Abstraction

- * Angling success for salmon on the Usk is related to river flow (Figure 11 and 18).
- * Tracking of adult salmon using radio-telemetry in the Usk and other rivers has shown that consistent, low flows will delay the migration of salmon through the estuary and up-river.
- * Summer flows on the Usk are typically low with occasional spates of short duration. The abstraction of a significant proportion of the flow would therefore be expected to reduce angling success by delaying salmon migration into and up the river.
- * Since the mid 1960s, Welsh Water PLC has been licensed in the summer to abstract from the lower reaches 60 per cent of that part of river flow which exceeds 455 million litres per day measured at Trostrey gauging weir. This permits the company to abstract up to a third of the daily river flow during small summer spates when flows are in the range of about 6 to 18 cumecs. At these flows the abstraction may have a significant impact on angling success (Figure 18).
- * The abstraction is likely to affect the migration and rod catch of both early and late run salmon. However, the impact on the rod catch of late run fish is expected to be greater because of the generally lower river flows from July to September, compared with flows in April and May.
- * Since estuarine water quality is in part dependent on river flows, the abstraction by Welsh Water from the lower reaches may exacerbate the poor water quality conditions in the estuary.

4.2.4 Coastal netting

- * Salmon deterred from entering the Usk because of unsuitable flows and estuarine water quality will tend to remain vulnerable to the commercial fisheries, both legal and illegal.
- * Since commercial fishing occurs mainly either side of Uskmouth, it is expected that Usk salmon would be proportionately more vulnerable than Wye salmon.
- * The combined impact of estuarine pollution, abstraction of summer flows and commercial fishing, particularly the illegal drift net fishery are likely to account for the comparatively poor rod catch of late-run salmon when compared to the Wye (Table 5).

4.3 Decline in the overall salmon stock: possible causes

- * The alleged decline in the number of smolts leaving the Usk is based on limited data at present. Nevertheless, it is possible to point to several factors in addition to those identified which may have caused such a decline.

4.3.1 Reduced spawning

- * It seems likely, in view of the reduced rod catch, that the reduced level of spawning observed in the late 1970s and early 1980s has continued.
- * Smaller salmon produce fewer eggs. Given the decline in average weight observed in the fisheries, the number of eggs laid will have declined more sharply than indicated by the redd count.
- * A reduction in egg deposition will not necessarily result in lower smolt production. Beyond a certain level of egg deposition, the number of smolts produced will be limited by the amount of suitable habitat for parr. It is not known whether the required egg deposition is achieved on the Usk.
- * The densities of older parr found in recent electrofishing surveys on the Usk (Table 8) are not low compared to average densities on other rivers in Wales (Figure 19). However, electrofishing sites are restricted almost exclusively to the tributaries and the surveys would not detect low densities of parr in the main river.
- * If smaller salmon are less able to spawn successfully in the main river than large salmon, the reduction in average weight of Usk salmon could result in the selective reduction of parr populations in the main river.
- * If egg deposition and the subsequent parr populations in the tributaries are in excess of the carrying capacity of the habitat, it is likely that some excess salmon will migrate downstream and colonise the main river. When egg deposition in the tributaries is only adequate to fill the tributaries, emigration to the main river will be reduced. Again this could result in reduced smolt production from the main river, while production in the tributaries is satisfactory.
- * In terms of area alone, the main river should be able to contribute a large proportion of total smolt output from the catchment. Even if smolt production from the tributaries is satisfactory, a reduction in production in the main river could substantially affect the overall smolt run.

4.3.2 Avian predation

- * Goosanders (*Mergus merganser*) are fish-eating ducks which have been present on the Usk at least since 1965, when the Usk River Board Report considered them to be "the chief predators of young game fish, particularly whilst the smolt run is in progress".
- * Goosander numbers are thought to have increased subsequently. A survey funded by the NRA indicated a population of 50 birds in the spring of 1990, compared with 20 birds in 1985.
- * No study of goosander diet has been made on the Usk, but it is clear from studies elsewhere that juvenile salmon, including smolts, are a major prey.
- * Goosander tend to prefer the main river as opposed to tributaries. Any impact of predation on populations of salmon parr will tend to be restricted to the main river. Since electrofishing surveys of parr populations have been largely confined to the tributaries, they provide little evidence either way about the impact of predation by goosanders on smolt production.
- * Cormorants have also become more abundant in the Usk catchment in recent years though numbers have not been assessed.
- * In theory, predation by birds could account for large numbers of parr and smolts. However, it is not clear to what extent this predation is in addition to other causes of mortality. If birds tend to take fish which would otherwise have died from other causes, they would not affect the number of returning adult salmon.

4.3.3 Abstraction

- * Seaward migration of smolts is partly dependent on river flow. In years when flows are low, the smolt run may be delayed.
- * The availability of higher flows on the Usk during the smolt run is related to the rod catch of 2 SW salmon two years later.
- * The abstraction by Welsh Water from the lower reaches on medium to low flows may possibly delay the passage of smolts through the lower river and estuary.
- * Any delay of smolts could affect their survival in the river, the estuary or at sea but the significance of the abstraction on smolt survival is unknown.

4.4 What is causing the problems: summary

4.4.1 Decline of early run and large salmon: likely causes

- | | |
|-----------------------|---|
| Primary causes : | * Change in marine environment |
| | * Increased exploitation by rod fisheries |
| Contributory causes : | * Distantwater fisheries |
| | * U.D.N. outbreak in 1960s |
| | * Coastal netting, particularly illegal |

4.4.2 Poorer than expected rod catch of late-run salmon: likely causes

- * Irish drift net fishery
- * Pollution of Usk estuary
- * Abstraction from the lower river
- * Coastal netting, particularly illegal

4.4.3 Decline in the overall salmon stock: possible causes

In addition to factors identified for early and late runs,

- * Reduced spawning
- * Avian predation
- * Abstraction from the lower river, affecting smolts.

5. ADDRESSING THE PROBLEMS - RECOMMENDATIONS FOR ACTION

5.1 Objectives

Three general objectives have been identified,

- * Protect and restore stock of early run and large salmon.
- * Maximise sustainable catch of Usk salmon within the Usk District.
- * Ensure, within natural bounds, conditions for unrestricted migration of salmon into and up the River Usk.

To achieve these objectives, further control of exploitation, abstraction, pollution and obstructions is required. Monitoring of stocks and fisheries must be continued and improved. As always further research is needed to assist future decision making, particularly in relation to predation.

5.2 Exploitation

5.2.1 Rod Fisheries

- * The marked reduction in the catch of early run salmon and the virtual extinction of the run of large salmon (>14lbs) have been described.
- * These characteristics of early running and long sea absence are believed to be genetically determined, in part at least, but the role of the environment is not clear.
- * The marine environment has been identified as a primary factor in the decline of the early run. The way it affects the early run is crucial. Two mechanisms may operate, i.e. through
 - (i) *gene expression*
 - or (ii) *gene selection*
- * If the marine environment is controlling *gene expression*, then many late-run salmon may actually carry genes for early-running. Given an appropriate change in marine conditions, salmon with these genes would become early-run. If this is the only mechanism operating, the future of the early-run and large salmon may not be threatened.
- * Alternatively, under the *selection* mechanism, marine conditions would have been less favourable for the survival of salmon carrying genes for early-running and long sea absence, when compared to survival of late run fish. If this mechanism has been operating, the abundance of genes for early running and long sea absence may currently be greatly reduced within the Usk's salmon population. The capacity of the early-run to recover will be poor and the future stock of large salmon in particular may be in jeopardy.
- * In order to safeguard the future of the Usk's fisheries, it is prudent to assume that the *selection* mechanism is operating.

- * Since angling exploits early-run and large salmon more heavily than those fish running later, it will also be selecting against the abundance of genes for these characteristics within the stock.
- * Action is therefore required to increase the number and proportion of early run salmon which spawn successfully.

5.2.1.1 Proposed constraints on early season angling

- * Byelaws should be promoted to reduce the exploitation by angling of early run and large salmon. Four options have been considered, including byelaw proposals recently recommended for the Wye (Table 10).
- * Estimates have been made of the reduction in catch and the number of (i) early run and (ii) large (>14lbs) salmon saved as the result of each option (Table 10).
- * These estimates are based on the recent monthly distribution of catches of large salmon (Figure 20) and of all salmon (Table 10) and the proportion of Usk salmon caught by different angling methods,

i.e.	Method	%
	Fly	22
	Spinner	60
	Bait	18

- * In making these estimates, it has had to be assumed that any salmon which would have been caught on spinner or bait, would not be caught on fly. In addition, it has been assumed that any salmon saved during the period when angling is restricted, will not be taken and killed later in the season when restrictions are lifted. The reductions in catch and numbers of salmon saved are therefore maximum estimates.

RECOMMENDATION 1: Angling by fly only until 1st July (i.e. Option 2 in Table 10) should be adopted for the following reasons,

- * More stringent restrictions are required early in the season than on the Wye because,
 - (i) The catch of large salmon from the Usk has averaged only 25 fish for the last five years, compared with an average catch of over 300 on the Wye. The condition of the Usk's stock of large salmon is therefore considered more serious.
 - (ii) The overall stock on the Usk is thought to be depressed in comparison to the Wye.

5.2.1.2 Catch-and-release, late season

- * Studies of radio-tagged salmon have indicated that they are most vulnerable to angling during their initial migration up-river. Once they have settled in a pool for a long period they become more difficult to catch. However, towards the end of the season as spawning time approaches, they tend to become vulnerable again.

- * A large proportion of those fish 'saved' early in the season should therefore survive angling during the summer.
- * After the end of September, bait fishing is currently prohibited but a fly only rule after August, as proposed for the Wye, is not considered appropriate for the Usk. It would unnecessarily reduce exploitation of late-run salmon and have a dramatic impact on total catch, reducing it by about 30%. It is considered preferable to try a voluntary catch-and-release policy for coloured salmon.

RECOMMENDATION 2:

- (i) Anglers should be encouraged to return coloured salmon, whether male or female, particularly large fish over 14lbs.
- (ii) Advice to anglers should describe how salmon should be handled so as to maximise their chances of survival when returned.
- (iii) The tackle trade should be encouraged to produce a knotless mesh net that can be fitted to anglers' existing landing net frames.

5.2.2 Illegal fishing in-river

- * Salmon are currently illegally taken by netting in-river and by gaff and snare during spawning.
- * At present, only a few people are thought to be regularly involved in such activities in the Usk catchment. However, this probably reflects in part the recent paucity of fish.
- * It is known that a significant number of people who have been involved in illegal fishing elsewhere live a short drive from the Usk. Any increase in stocks would probably be accompanied by an increased interest in the Usk from the poaching fraternity.
- * NRA bailiffs have recorded some notable successes in recent years, with one individual being fined £4,500 after pleading guilty to 14 charges.
- * The NRA has also increased pressure on outlets purchasing illegally caught salmon.
- * Despite these successes, it is known that suspected poaching activity has not been reported by fishery owners and anglers or reporting has been delayed.

RECOMMENDATION 3:

- (i) NRA enforcement within the Usk catchment should be maintained and, if possible, improved to ensure the protection of salmon saved by restrictions on legal exploitation.
- (ii) Anglers, fishery owners and the general public should be encouraged to report poaching activity as rapidly as possible.
- (iii) The NRA should ensure that its 24-hour emergency number is widely known throughout the angling community.

5.2.3 Coastal Fisheries - Licensed Fishing

5.2.3.1 Proposed constraints on early season fishing

- * Although the licensed commercial fisheries only take about a quarter of their catch before June (Figure 16), the size of the catch is such that a significant number of early-run salmon are taken.
- * As for the rod fishery, exploitation by the commercial fisheries of early run salmon should be constrained to allow this component of the Usk salmon stock to recover.
- * Options for achieving this are identified in Tables 11 and 12 and include,
 - (i) Reduction in the number of licences;
 - (ii) Extension of the annual close season;
 - (iii) Extension of the weekly close time
- * In making the estimates presented in Tables 11 and 12, it is assumed that catch is proportional to the number of licences operated and the available fishing time. As such, the numbers of salmon saved and reductions in catch presented are maximum estimates.
- * It is important to note that salmon saved by reduced fishing effort in the commercial fisheries will subsequently be available to the rod fisheries, albeit with restrictions on fishing methods or season. Given that angling is restricted to fly only prior to 1st July, perhaps up to 10 per cent of early-run, Usk salmon 'saved' from the net fishery would be subsequently taken by the rods.
- * The commercial fisheries exploit salmon stocks of the Wye and other rivers, as well as those of the Usk. The proportion of salmon saved which would enter the Usk is unknown. The best guess suggests that it might be about one third.
- * Details of the number of large salmon (>14lbs) taken in the putcher ranks are not available (Table 12). Estimates for the number of large salmon saved from the drift net fishery are based on recent monthly distributions of catches (Figure 20).
- * A reduction in the number of licences issued can only be achieved for the public drift net fishery under a Net Limitation Order (NLO). A review is required before 1995 when the current order expires. A reduction could probably be justified on the grounds of stock conservation. However, it would be relatively unselective between early and late running salmon compared to other options (Table 11). Nevertheless, this approach does have the merit of retaining the profit margin for the remaining six licences.

RECOMMENDATION 4: No licensed commercial fishing until 16th May (Option 3 in Tables 11 and 12) should be adopted in the Usk District for the following reasons,

- (i) It saves a comparatively large number of early-run and large salmon for a small reduction in overall catch.

- (ii) The reduction in catch of early-run, Usk salmon is similar to that faced by the rod fishery under the recommended option (Option 2 in Table 10), assuming a third of the current commercial catch is of Usk salmon.

i.e. Reduction in catch of Usk salmon in commercial fishery,

$$= (232 + 104)/3 \rightarrow 112$$

Reduction in catch of Usk salmon in rod fishery,

$$= 138 - (\text{about } 10 \text{ per cent of saving in commercial fishery})$$

$$= 138 - (0.1 \times 112)$$

$$= 127$$

- (iii) The reduction in catch of large, Usk salmon by the drift nets is roughly equivalent to that faced by the rod fishery.

i.e. Reduction in catch of large, Usk salmon in commercial fisheries

$$= (61 + \sim 15)/3 = 25$$

Reduction in catch of large, Usk salmon in rod fishery

$$= 17 - (\text{about } 10 \text{ per cent of saving in commercial fishery})$$

$$= 17 - (0.1 \times 25)$$

$$= 14$$

- * The reductions in catches resulting from the constraints on both commercial and rod fisheries will be most significant in the short-term. In the medium and long term, catches in both fisheries should improve as stocks increase.
- * If the proportion of Usk salmon in the commercial catch is greater than a third, the impact of the commercial fisheries in the Usk District on the Usk stock will be greater than indicated. Similarly, the other commercial fisheries within the Severn Estuary may take a significant number of Usk salmon.

RECOMMENDATION 5: Ways should be examined of assessing the composition of stocks exploited by the various commercial fisheries within the Severn estuary.

5.2.3.2 The balance between commercial and rod fisheries

- * The measures recommended above for the control of the commercial fisheries are aimed at the conservation and improvement of stocks for the future benefit of all fisheries. However, the current level of exploitation by the commercial fishery might be additionally reduced to benefit the rod fishery. Clearly, any such change in the balance of exploitation should reasonably be accompanied by compensation to the commercial fishermen.

- * Compensation of commercial fishermen not to fish should be paid by those who would benefit, i.e. fishery owners and anglers: Assuming the commercial fishermen are amenable to the principle, a potential mechanism for raising funds would be charges paid to the NRA by owners of the rod fisheries. The NRA might then act as a broker between the rod and commercial fisheries.
- * Since a large proportion of salmon taken in the Usk District's commercial fisheries are destined for the Wye, contributions for compensation should be raised from rod fishery owners on both the Usk and Wye.

RECOMMENDATION 6: The desirability and practicality should be explored of raising funds to pay commercial fishermen not to fish, for the benefit of the rod fisheries on the Usk and Wye.

5.2.4 Coastal fisheries - illegal fishing

- * Given the magnitude of this problem, control of the illegal drift net fishery should and has received the highest priority.
- * Since 1987, a unit of NRA bailiffs has been focused on the fishery. The unit has achieved considerable success in reducing the level of netting activity by some 70 per cent (Figure 21).
- * After careful collection of data on the activities and catches of unlicensed netting by the bailiffs, the NRA has promoted byelaws under the Salmon Act 1986 to control sea fishing off Newport.
- * These byelaws, which were confirmed on 5th August 1992 by the Secretary of State for Wales, include the prohibition of drift netting for sea fish (Appendix 2).

RECOMMENDATION 7: The new sea fisheries byelaws should be brought into operation immediately.

- * It is envisaged that the enforcement of the new byelaws should reduce illegal salmon netting in the estuary to a marginal problem.
- * Both rod and licensed commercial fisheries are expected to benefit. Even without the byelaws, rod catches were better than expected in 1989 and 1990 (Table 13). These apparent improvements may reflect the effectiveness of bailiff enforcement in the estuary, although the predictions of rod catch presented are not wholly reliable.
- * Due to the paucity of stocks of early-run salmon, it is not considered advisable to rely solely on the further reduction in illegal fishing to achieve the required improvement in stocks. Constraints on the legal fisheries as outlined are considered necessary to safeguard the future of the fisheries.

5.2.5 Distantwater fisheries

- * The fisheries off Greenland, Faeroes and Ireland are obviously outwith the control of the NRA.

- * The tagging studies on mainly hatchery reared smolts by the NRA and its predecessor have demonstrated the potential significance of these fisheries for Usk salmon stocks and their associated homewater fisheries.

RECOMMENDATION 8: The NRA should promote additional fish tagging and monitoring of catches using wild smolts to quantify the impact of distantwater fisheries on homewater fisheries. Where appropriate the results of past and proposed tagging work should be made available to bodies concerned with the regulation of distantwater fisheries.

5.3 Abstraction and river flows

5.3.1 Major abstractions

- * The likely impact on the salmon fisheries of the major abstractions by Welsh Water Plc are described in Section 4.2.2.

RECOMMENDATION 9: The NRA should discuss with Welsh Water Plc the possibility of reducing the level of abstraction at Rhadyr and Llantrisant during late spring and summer when river flows are less than 18 cumecs.

- * The NRA is seeking to improve monitoring of the major abstractions from the river by Welsh Water and British Waterways.
- * Under the conditions of the current Welsh Water Licences, abstraction rates are defined as a daily volume. This can result in large variations in abstraction within a 24 hour period to ensure the daily volume condition is complied with.

RECOMMENDATION 10: The Authority should discuss with Welsh Water a variation of the licence for Rhadyr to incorporate a condition to ensure a continuous rate of abstraction within any 24 hour period.

5.3.2 Changes in river flows

- * Anglers frequently comment that the Usk drops more rapidly after a spate than it used to, limiting the availability of good angling conditions. Increased drainage of farm land is usually cited as the cause of the increased flashiness of the river. Neither claim has been substantiated or investigated.

RECOMMENDATION 11: The NRA should investigate whether patterns of river flow have changed over the past few decades; and if changes have occurred, what factors may be relevant (e.g. rainfall, land drainage).

5.4 Pollution - Water Quality

5.4.1 Pollution of the estuary

- * The primary concern over water quality is pollution of the estuary.
- * In 1985, the former Welsh Water Authority proposed a 3 phase improvement strategy:
 - (i) Refurbishment and extension of the Ponthir sewage treatment works.

- (ii) Interception of the remaining untreated sewage discharges on the East Bank and transfer to Nash Sewage Treatment Works (STW).
- (iii) Interception of the untreated sewage discharges on the West Bank and transfer to Nash STW.

- * Phase (i) commenced in April 1991 and is due for completion in the spring of 1993.
- * The NRA requires that phases (ii) and (iii) be undertaken. All untreated sewage discharges must be intercepted and given full treatment. Storm sewage overflows will have to be constructed to modern standards. The discharge of primary treated sewage from Caerleon STW will also need to be given secondary treatment.
- * The timing of these improvement works will require agreement with Welsh Water Plc on a reasonable and practical timescale. The NRA can impose appropriate requirements and timescales, however, they must be reasonable. Achievement is unlikely before 1998.
- * The European Community's Urban Waste Water Treatment Directive 1991 apparently requires that all untreated sewage discharges from a population greater than 2000 must be fully treated by the year 2006. The largest discharges must receive full treatment by 2001.
- * In the event of the Usk Barrage Bill receiving Parliamentary approval, the above improvements will be required by the NRA to be completed one winter before barrage closure. The Bill is however being opposed by the NRA in accordance with its duties, principally in relation to fisheries and conservation.

RECOMMENDATION 12: The NRA should agree and impose a reasonable timescale for Welsh Water Plc to provide satisfactory treatment of all sewage discharges to the Usk estuary.

RECOMMENDATION 13: The NRA should review the consent for the thermal effluent from Uskmouth Power Station.

5.4.2 Nutrient enrichment

- * In January 1992, the NRA published a report entitled 'The Influence of Agriculture on the Quality of Natural Waters in England and Wales'. This report notes a variety of changes in farming practices since the 1950s (e.g. fertiliser use, land drainage) which may affect water quality in rivers.
- * Although occasional fish kills due to agricultural pollution have occurred in the Usk catchment, there is no evidence that such kills have contributed significantly to the decline of the Usk salmon fisheries.
- * It is possible, however, that significant enrichment of the Usk has occurred and that subtle effects, either good or bad, may be operating on the salmon population.

RECOMMENDATION 14: The NRA should analyse long-term records of water quality in the Usk catchment to assess evidence of nutrient enrichment.

5.5 Obstructions to migration

5.5.1 Existing obstructions

- * In 1990, the NRA surveyed the potential obstructions to salmon migration existing on the Usk system.
- * Although the Usk is remarkably free of obstructions compared with many other river systems, some improvements in facilities for fish passage are desirable.
- * A major concern on the main river is Brecon weir which obstructs upstream migration under low flows, exacerbated by the abstraction to the canal. In 1991, the NRA used gravel spoil gleaned from flood defence maintenance works to improve the channel structure below the weir. Nevertheless, improved fisheries for fish passage are required on the right hand side of the weir.
- * Improvements in fish passage facilities at obstructions on the tributaries would be desirable to encourage full use of available nursery area and to minimise accumulations of adult fish below obstructions which would be susceptible to illegal fishing.

RECOMMENDATION 15: The NRA should investigate ways of improving fish passage at Brecon weir and other existing obstructions, including prioritising requirements for improvements and identifying the resources required.

5.5.2 The proposed Usk Barrage

- * A Bill is currently before Parliament proposing the construction and operation of a tidal barrage on the Usk Estuary.
- * The NRA, together with various conservation and fisheries interests, has petitioned against the Bill because of the potential damage to fisheries and wildlife anticipated.

RECOMMENDATION 16: The NRA should continue to oppose the Usk Barrage Bill to protect the salmon fisheries unless it can be satisfied that adequate mitigation of anticipated damage can be achieved. In the event of the Bill being enacted, the Authority should seek the maximum possible protection of the salmon fisheries.

5.6 Avian predation

- * In March 1992 the NRA (Welsh Region) presented a paper to its Regional Fisheries Advisory Committee expressing the firm opinion that there is currently no evidence linking the rise in goosander (and possibly cormorant) numbers with serious damage to fish stocks. Consequently, the Authority could not currently support calls for a cull of either species.
- * The paper did however make a series of recommendations, which were subsequently approved by the Committee, i.e.
 - (i) The Region should not support licences to cull goosander or other avian predators until firm evidence becomes available that they are causing serious damage to fish stocks.

- (ii) The Region should continue to monitor population trends of goosander on a 5 yearly basis, and institute a similar programme for cormorants. In addition, local studies (such as that currently proposed for the river Wye) should be undertaken as appropriate, to help place the issue of predation into the context of other factors affecting a catchment.
- (iii) The Region supports national moves to undertake R&D work in relation to the avian predators issue, and urges that this work should be undertaken in collaboration with other agencies involved in the predation issue. Such work should reflect the prominence of the issue within the Welsh Region.
- (iv) The Juvenile Salmonid Monitoring Programme should be continued to provide baseline data on the status of juvenile stocks.

RECOMMENDATION 17: In view of the concerns over salmon stocks in the Usk, a local study on the impact of predation by goosander and cormorants should be undertaken, as soon as resources permit, to complement Regional initiatives.

5.7 Restocking

- * Restocking with young salmon is frequently proposed by fishermen as a solution to a decline in stocks. However, unless it is carried out on a large scale any possible benefits are likely to be negligible. However, large-scale restocking is likely to be prohibitively expensive and is itself potentially damaging.
- * Stocking with juvenile salmon in the Usk is now confined to about 5000 smolts per year, derived from wild Usk salmon. These fish are reared at the NRA's unit at Cynrig near Brecon. This stocking relates to an historical commitment in mitigation for the entrainment of smolts at Uskmouth Power Station.
- * All smolts stocked are microtagged but reported returns of tagged adult salmon to the commercial and rod fisheries in homewaters have been very low. From 81,000 smolts stocked, only 45 recaptures of adult salmon have been reported, of which 9 were from anglers (Table 4).
- * While reported recaptures have been slightly higher in recent years, the cost per adult fish caught amounts to several thousand pounds. Smolts cost about £1 each to produce and stock.
- * To put this in perspective, if the licence income from all the anglers and commercial fishermen within the District were expended solely on restocking, direct returns to the Usk fisheries would amount to about half a dozen salmon per year.
- * Restocking as traditionally practised is not likely to provide a practical solution to maintaining and enhancing the early run of salmon.
- * In addition, large-scale restocking involves risks of damaging the salmon population, particularly by degrading the genetic composition of the stock, even assuming, as would be required, that wild Usk salmon were used as broodstock.
- * A recent NRA report by Gough, Winstone and Hilder (see Bibliography), examined the potential of artificial propagation as a tool to enhance stocks of early-run salmon on the Wye. Although this report highlights the problems of cost and potential damage, it also recommends further assessment.

RECOMMENDATION 18: The following recommendations of Gough *et al* are endorsed, ie.

- (i) Expert advice be sought on the feasibility of, and the appropriate genetic techniques required for, the specific enhancement of the early salmon run by artificial propagation.
- (ii) The genetic and cost implications of a captive breeding programme be investigated.
- (iii) Trials be undertaken to assess the potential of safely holding early run salmon for long periods so that they are available for broodstock. Artificial propagation should only be employed to enhance the early run of Usk salmon if it is practical, cost-effective and presents a negligible risk to the stock.

5.8 The Rate of Recovery

- * Without exploitation, the stock of early run and large salmon could recover very rapidly provided that natural survival rates were favourable.
- * The greater the exploitation rate permitted, the slower the rate of recovery. If the rate of exploitation permitted is too high, the stock may be driven to extinction.
- * These points are demonstrated in Figure 22, which shows a hypothetical stock-recruitment curve. Even starting from a very low level, without exploitation a salmon stock may recover after a generation (i.e. 6 years for large salmon). At an exploitation rate of 50 per cent, recovery would take two generations (i.e. 12 years), while exploitation rate of 75 per cent, recovery would take four or five generations (i.e. up to 30 years). With an exploitation rate of 90 per cent, the stock would be destroyed.
- * It should be stressed that this figure is hypothetical and presents a simplistic view. Nevertheless, if the recommendations proposed are pitched at the right level, it is expected that stocks and catches of early run and large salmon should have improved substantially after two generations (i.e. 12 years).

RECOMMENDATION 19: If the stocks of early run and large salmon have not improved after 12 years, further constraints on exploitation of these fish should be considered.

- * The greater the survival rate of smolts at sea, the greater the exploitation rate that can be sustained in homewaters without reducing the stock. Survival rates for early run salmon are thought to be poor at present. When conditions at sea once again become favourable for the survival of early-run salmon, exploitation rates of this component of the population may be increased again.

5.9 Monitoring stocks and catches

- * The impact of the management action proposed in this report needs to be monitored to provide as sound a basis as possible for future management of the fisheries. Information is required on the different stages of the salmon's life cycle and also the different components of the stock.

5.9.1 Egg deposition

- * Methodical redd counts have not been made in the Usk catchment since 1983.

RECOMMENDATION 20: Annual redd counts should recommence in 1992 following the methods employed previously.

5.9.2 Juvenile salmonid stocks

- * Currently the Juvenile Monitoring Programme is concentrated on the tributaries for practical reasons. The main river provides a large proportion of available nursery area, yet juvenile stocks in this area are largely unmonitored. If larger salmon are more likely to use the main river than the tributaries for spawning and avian predation tends to be focused on the main river, the usefulness of the Juvenile Monitoring Programme is limited.

RECOMMENDATION 21: Methods of monitoring juvenile stocks in the main river should be assessed and if practical employed.

5.9.3 Smolt output

- * National Power carry out a smolt rescue annually at Uskmouth Power Station and have maintained records since the 1960s. Although the numbers caught have been regularly reported to the NRA and its predecessors, information on the extent and pattern of pumping is also believed to be on record. With this information it may be possible to estimate the size of the smolt run in each year. Furthermore, these estimates might be related to redd counts for the spawning seasons from which the smolts were derived. A stock-recruitment curve for the Usk might therefore be derived which could allow the required spawning escapement for the river to be defined.
- * Information on the timing and size of smolt runs and smolt age might also be usefully related to environmental conditions in the river.

RECOMMENDATION 22: The NRA should request full records of pumping regimes and and smolt capture from National Power and review the usefulness of this information for future management of Usk salmon stocks.

5.9.4 Adult stocks and their exploitation

- * The runs of salmon in the Usk must be monitored to identify whether the expected improvements in stocks occur. In addition to redd-counting (see Recommendation 19), the monitoring techniques currently available are:-
 - Catch returns
 - the Trostrey fish counter

5.9.4.1 Anglers' catch returns

- * The introduction of the national rod licence, which occurred in January 1992, has changed the system for collecting anglers' catch returns. As a result, the proportion of the rod catch reported will change. Furthermore, it is likely that the national system for monitoring anglers' catches will be changed again within the next few years. There will therefore be no consistent measure of the level of anglers' catches from year to year.

- * The most comprehensive catch statistics for any river in England and Wales have been collected on the Wye. Returns are obtained from fishery owners rather than from anglers. As well as ensuring a high level of reporting, this method enables catches in different sections of the river to be assessed.
- * A list of fishery owners on the Usk has recently been compiled.

RECOMMENDATION 23: As from 1993, catch returns should be requested from the owners of individual rod fisheries on the Usk, using a similar system to that employed on the Wye.

5.9.4.2 Trostrey fish counter

- * A different design of electronic fish counter, the 'Logie', is currently being tried at Trostrey. An interim report on its validity is scheduled for January 1993.
- * The Trostrey counter is potentially a vital tool for monitoring changes in the number of early-run and possibly large salmon. However, it is clearly important that it is able to differentiate between salmon and other species, particularly shad and coarse fish which migrate upstream in May and June.

RECOMMENDATION 24: Provided the new design of counter proves satisfactory, it should be employed at Trostrey to provide a complete and consistent index of upstream movements of salmon from 1993 for at least 10 years.

5.9.5 Targets

- * Monitoring of salmon populations has most relevance if the results are measured against defined expectations. Deviation from these targets over a given number of years should trigger management action.
- * The definition of targets is difficult at present, particularly since some of the monitoring techniques are new or have changed. Furthermore, as conditions change and knowledge increases so expectations may need to be reviewed. Nevertheless, defined targets would aid close scrutiny of the Usk salmon population and its associated fisheries.

RECOMMENDATION 25: Within the next five years, targets should be defined for the following parameters,

- * Spawning escapement
- * Juvenile parr densities in different parts of the catchment
- * Smolt output, if measurable
- * The proportion of large salmon in the rod catch
- * The proportion of early-run salmon counted at Trostrey weir

5.10 Resources

- * Given the scope of many of the recommendations, considerable resources will be required if they are to be implemented by the NRA.

- * Resources are always limited and action by the NRA will be constrained by both finance and manpower.
- * At present, ways are being considered nationally of raising funds for fisheries improvements under section 142 of the Water Resources Act-1991.

RECOMMENDATION 26: Those recommendations for action requiring additional NRA resources should be prioritised and timescales identified for implementation.

6. SUMMARY OF RECOMMENDATIONS FOR ACTION

RECOMMENDATION 1: Angling by fly only until 1st July (i.e. Option 2 in Table 10 should be adopted for the following reasons,

- (i) It saves the greatest number of early-run salmon;
- (ii) It saves the greatest number of large salmon;
- (iii) Overall catch is reduced on average by a maximum of only 26 per cent;
- (iv) Angling can continue through the existing season.

RECOMMENDATION 2:

- (i) Anglers should be encouraged to return coloured salmon, whether male or female, particularly large fish over 14lbs.
- (ii) Advice to anglers should describe how salmon should be handled so as to maximise their chances of survival when returned.
- (iii) The tackle trade should be encouraged to produce a knotless mesh net that can be fitted to anglers' existing landing net frames.

RECOMMENDATION 3:

- (i) NRA enforcement within the Usk catchment should be maintained and, if possible, improved to ensure the protection of salmon saved by restrictions on legal exploitation.
- (ii) Anglers, fishery owners and the general public should be encouraged to report poaching activity as rapidly as possible.
- (iii) The NRA should ensure that its 24-hour emergency number is widely known throughout the angling community.

RECOMMENDATION 4: No licensed commercial fishing until 16th May (Option 3 in Tables 11 and 12) should be adopted in the Usk District for the following reasons,

- (i) It saves a comparatively large number of early-run and large salmon for a small reduction in overall catch.
- (ii) The reduction in catch of early-run, Usk salmon is similar to that faced by the rod fishery under the recommended option (Option 2 in Table 10), assuming a third of the current commercial catch is of Usk salmon.
- (iii) The reduction in catch of large, Usk salmon by the drift nets is roughly equivalent to that faced by the rod fishery.

RECOMMENDATION 5: Ways should be examined of assessing the composition of stocks exploited by the various commercial fisheries within the Severn estuary.

- RECOMMENDATION 6:** The desirability and practicality should be explored of raising funds to pay commercial fishermen not to fish, for the benefit of the rod fisheries on the Usk and Wye.
- RECOMMENDATION 7:** The new sea fisheries byelaws should be brought into operation immediately.
- RECOMMENDATION 8:** The NRA should promote additional fish tagging and monitoring of catches using wild smolts to quantify the impact of distantwater fisheries on homewater fisheries. Where appropriate the results of past and proposed tagging work should be made available to bodies concerned with the regulation of distantwater fisheries.
- RECOMMENDATION 9:** The NRA should discuss with Welsh Water Plc ways of reducing the level of abstraction at Rhadyr and Llantrisant during late spring and summer when river flows are less than 18 cumecs.
- RECOMMENDATION 10:** The NRA should discuss with Welsh Water a variation of the licence for Rhadyr to incorporate a condition to ensure a continuous rate of abstraction within any 24 hour period.
- RECOMMENDATION 11:** The NRA should investigate whether patterns of river flow have changed over the past few decades; and if changes have occurred, what factors may be relevant (e.g. rainfall, land drainage).
- RECOMMENDATION 12:** The NRA should agree and impose a reasonable timescale for Welsh Water Plc to provide satisfactory treatment of all sewage discharges to the Usk estuary.
- RECOMMENDATION 13:** The NRA should review the consent for the thermal effluent from Uskmouth Power Station.
- RECOMMENDATION 14:** The NRA should analyse long-term records of water quality in the Usk catchment to assess evidence of nutrient enrichment.
- RECOMMENDATION 15:** The NRA should investigate ways of improving fish passage at Brecon weir and other existing obstructions, including prioritising requirements for improvements and identifying the resources required and available.
- RECOMMENDATION 16:** The NRA should continue to oppose the Usk Barrage Bill to protect the salmon fisheries unless it can be satisfied that adequate mitigation of anticipated damage can be achieved. In the event of the Bill being enacted, the Authority should seek the maximum possible protection of the salmon fisheries.
- RECOMMENDATION 17:** In view of the concerns over salmon stocks in the Usk, a local study on the impact of predation by goosander and cormorants should be undertaken, as soon as resources permit, to complement Regional initiatives.

RECOMMENDATION 18: The following recommendations of Gough *et al* are endorsed,

- i.e.
- (i) Expert advice be sought on the feasibility of, and the appropriate genetic techniques required for, the specific enhancement of the early salmon run by artificial propagation.
 - (ii) The genetic and cost implications of a captive breeding programme be investigated.
 - (iii) Trials be undertaken to assess the potential of safely holding early run salmon for long periods so that they are available for broodstock. Artificial propagation should only be employed to enhance the early run of Usk salmon if it is practical, cost-effective and presents a negligible risk to the stock.

RECOMMENDATION 19: If the stocks of early run and large salmon have not improved after 10 years, further constraints on exploitation of these fish should be considered.

RECOMMENDATION 20: Annual redd counts should recommence in 1992 following the methods employed previously.

RECOMMENDATION 21: Methods of monitoring juvenile stocks in the main river should be assessed and if practical employed.

RECOMMENDATION 22: The NRA should request full records of pumping regimes and and smolt capture from National Power and review the usefulness of this information for future management of Usk salmon stocks.

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RECOMMENDATION 24: Provided the new design of counter proves satisfactory, it should be employed at Trostrey to provide a complete and consistent index of upstream movements of salmon from 1993 for at least 10 years.

RECOMMENDATION 25: Within the next five years, targets should be defined for the following parameters,

- * Spawning escapement
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- * Smolt output, if measurable
- * The proportion of large salmon in the rod catch
- * The proportion of early-run salmon counted at Trostrey weir

RECOMMENDATION 26: Those recommendations for action requiring additional NRA resources should be prioritised and timescales identified for implementation.

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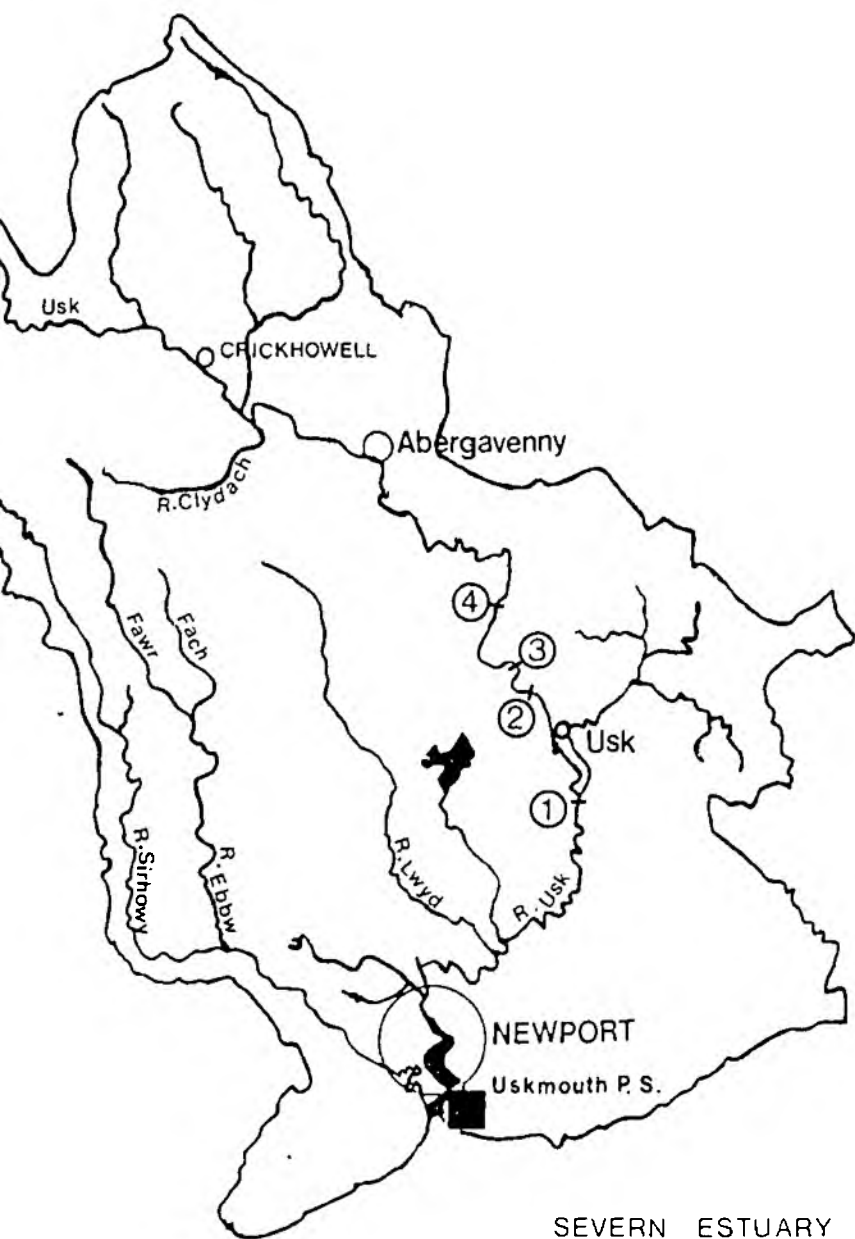
Solomon, D.J. and Potter, E.C.E. (1992). The measurement and evaluation of the exploitation of Atlantic salmon. Atlantic Salmon Trust. 38 pp



Figure 1:

The Usk Catchment

- ① Llantrisant Abstraction Point
- ② Rhadyr Abstraction Point
- ③ Trostrey Gauging Station
- ④ Chainbridge Gauging Station



River Usk Mean Monthly Flow 1970 - 1988

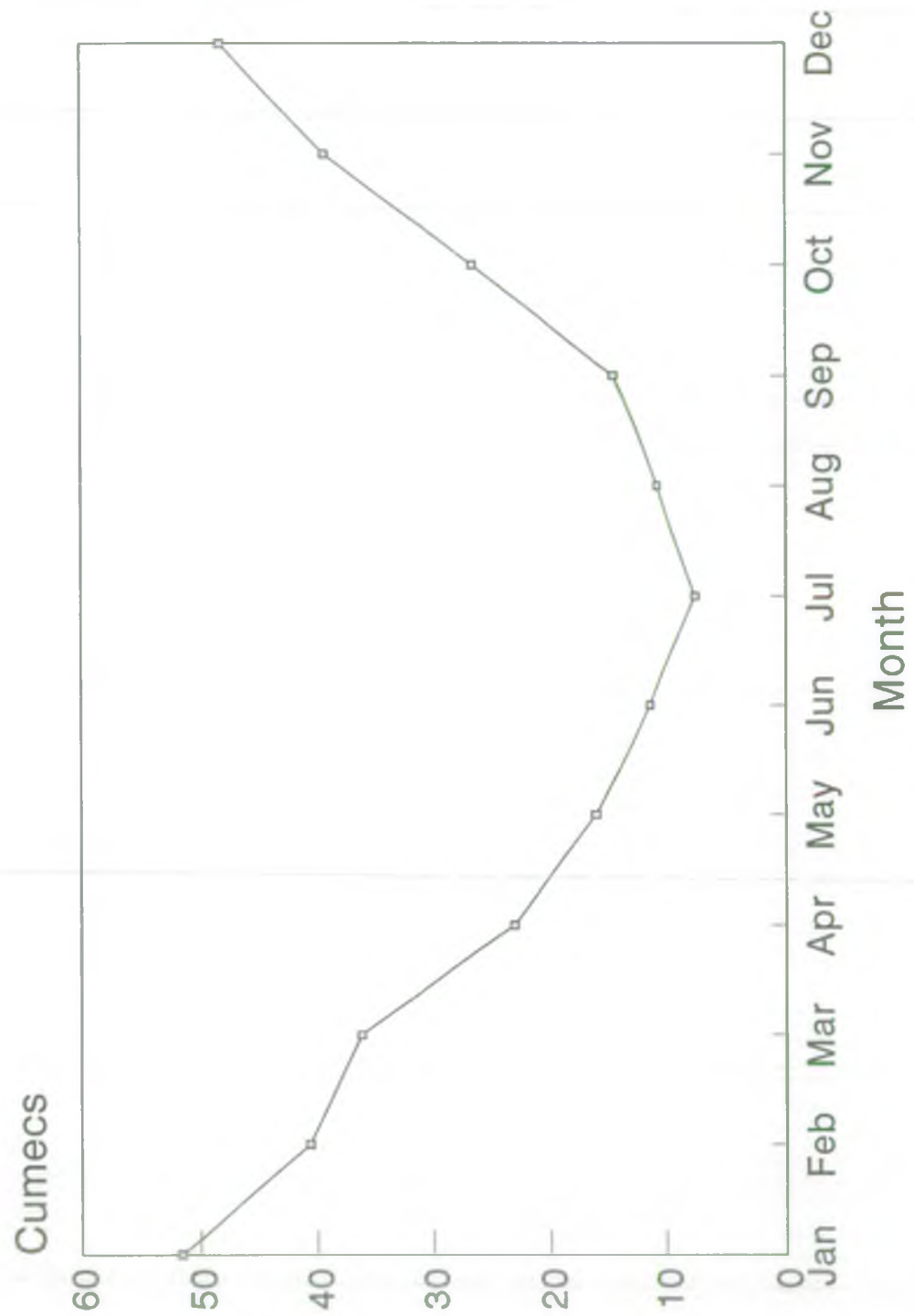


Figure 2: Average daily river flows gauged at Chainbridge for each month over the period 1976-1988

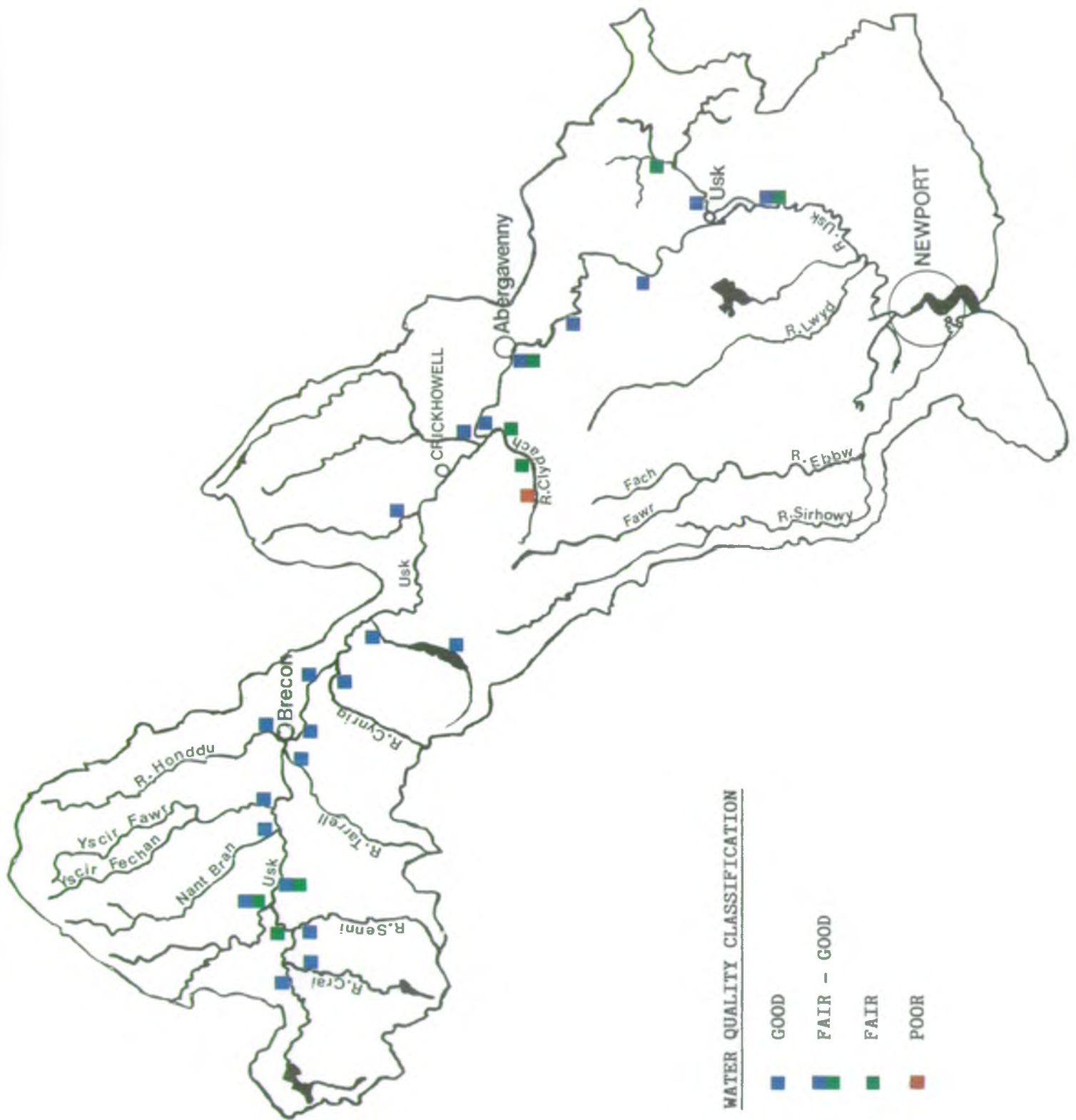


Figure 3: Water quality in the Usk catchment in 1990/91, excluding the Lwyd and Ebbw subcatchments, as indicated by surveys of aquatic invertebrates



Obstructions Preventing the Upstream Migration

- Man made - All Flows
- Natural
- ▲ Man made - Low Flows
- ▲ Natural

Figure 4:

Obstructions to the upstream immigration of salmon on the Usk



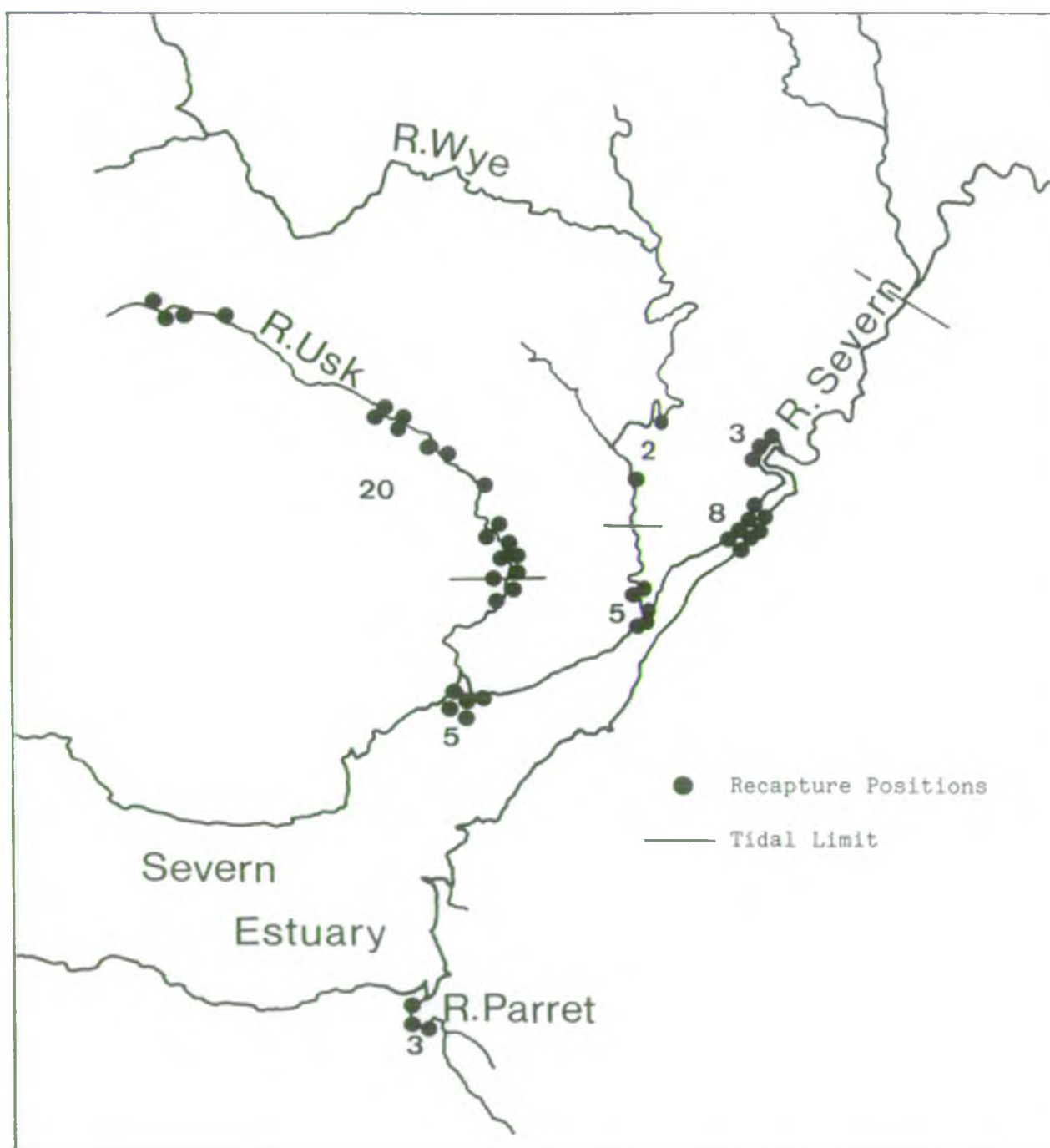


Figure 5: Recapture positions within the Severn Estuary, River Wye and River Usk of adult salmon tagged as smolts (wild) between 1954 and 1968 on the River Usk; adapted from Swain (1982)

Usk Salmon Rod Catch

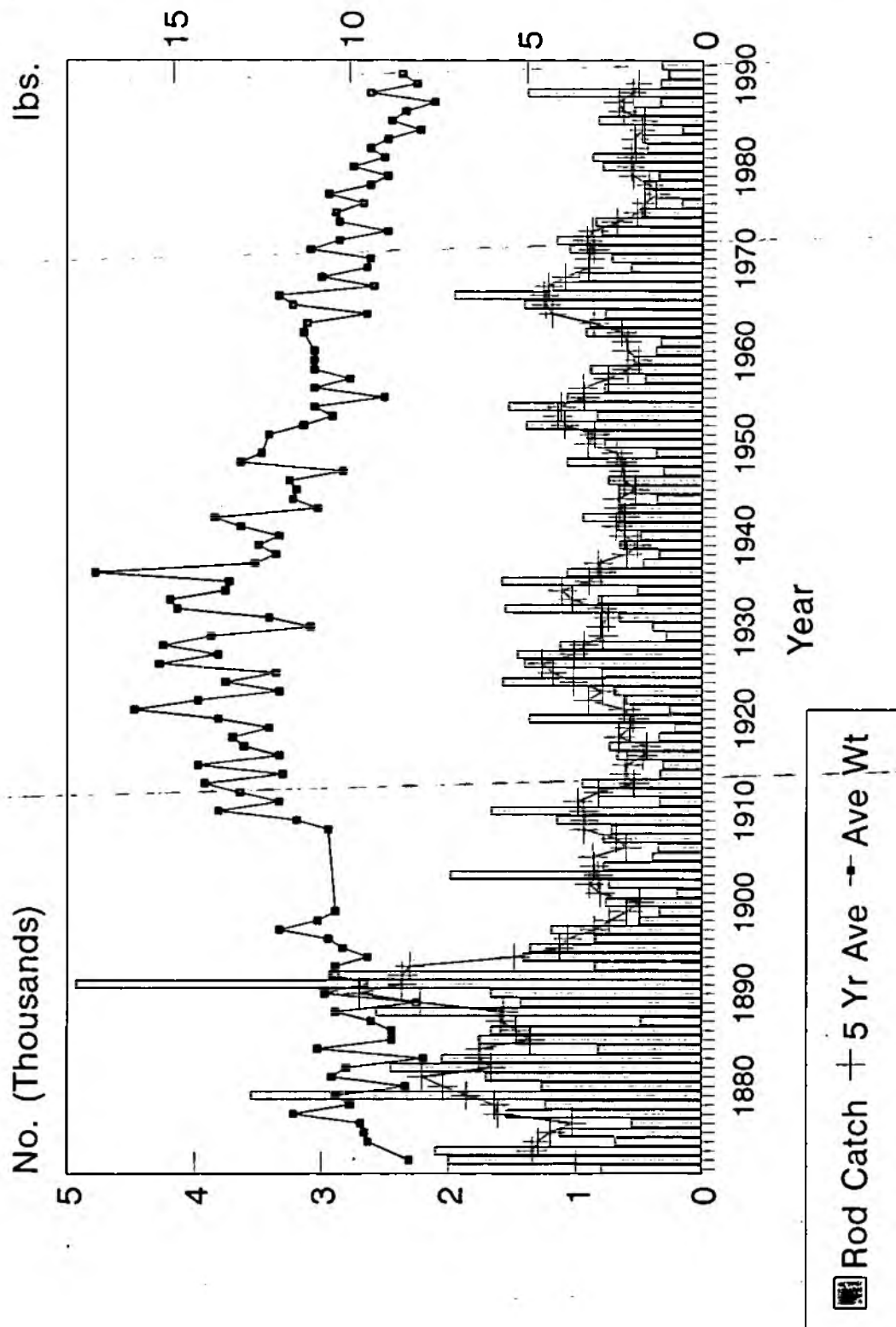


Figure 6: Annual declared rod catch of salmon, 1871-1991, from the River Usk, showing number and average weight

Usk Salmon Rod Catch

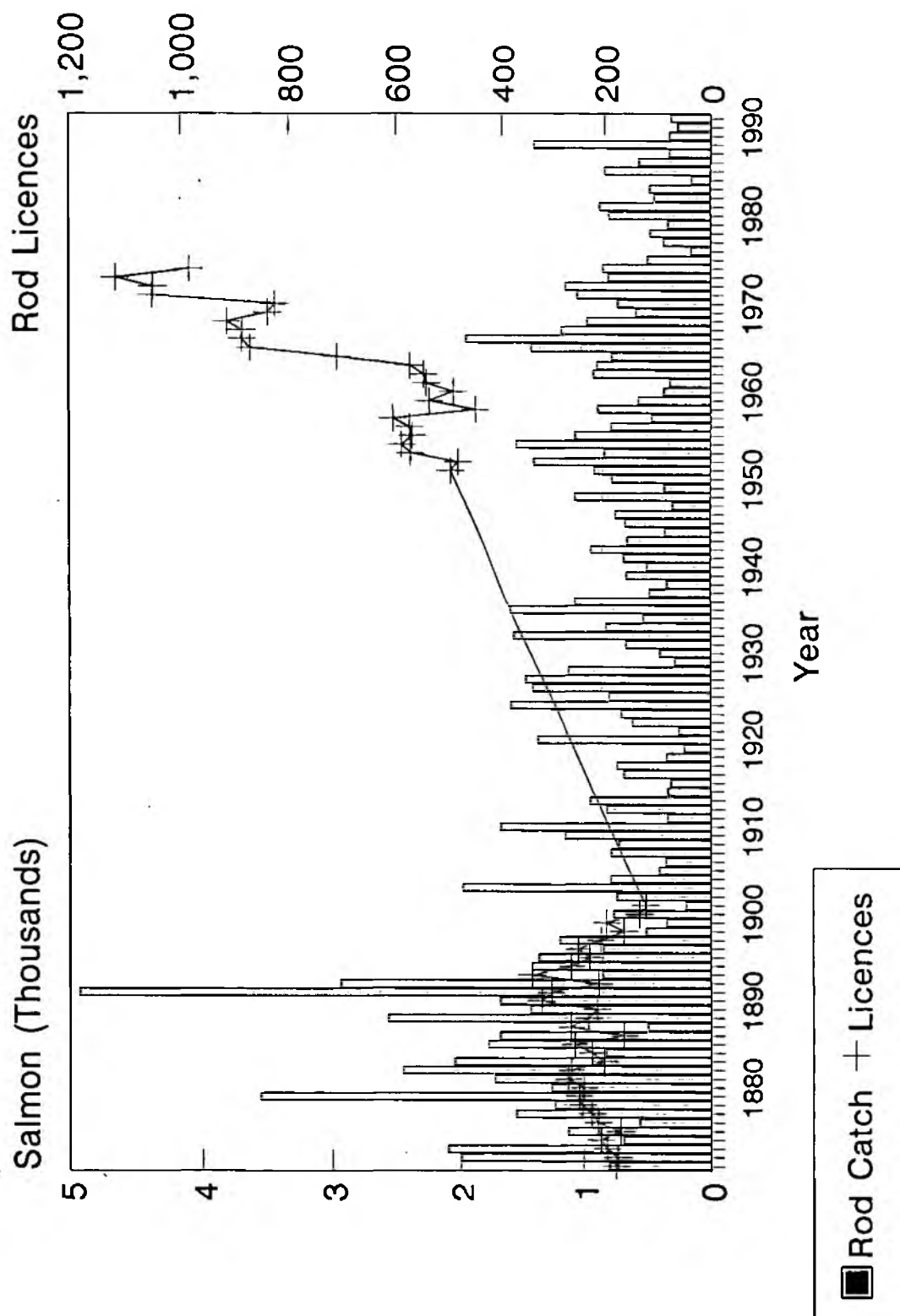


Figure 7:

The no. of rod licences sold for salmon fishing on the River Usk, 1871-1902 and 1952-1975 shown in relation to the declared rod catch

Usk Salmon Rod Catch Early Run (March - June)

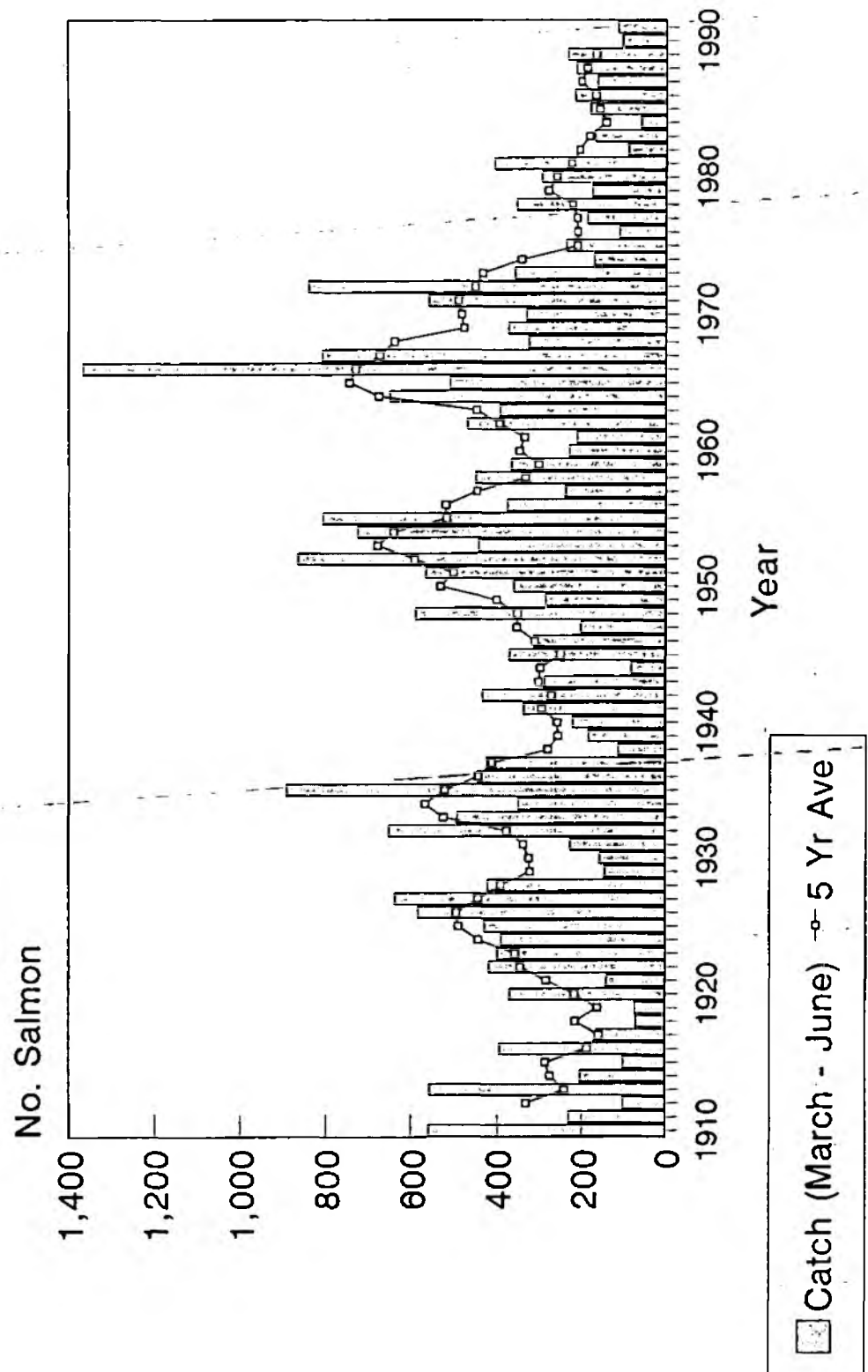


Figure 8: The Early (March-June inclusive) rod catch of salmon, 1871-1991, from the River Usk with a 5-year moving average

Usk Salmon Rod Catch Late Run (July - September)

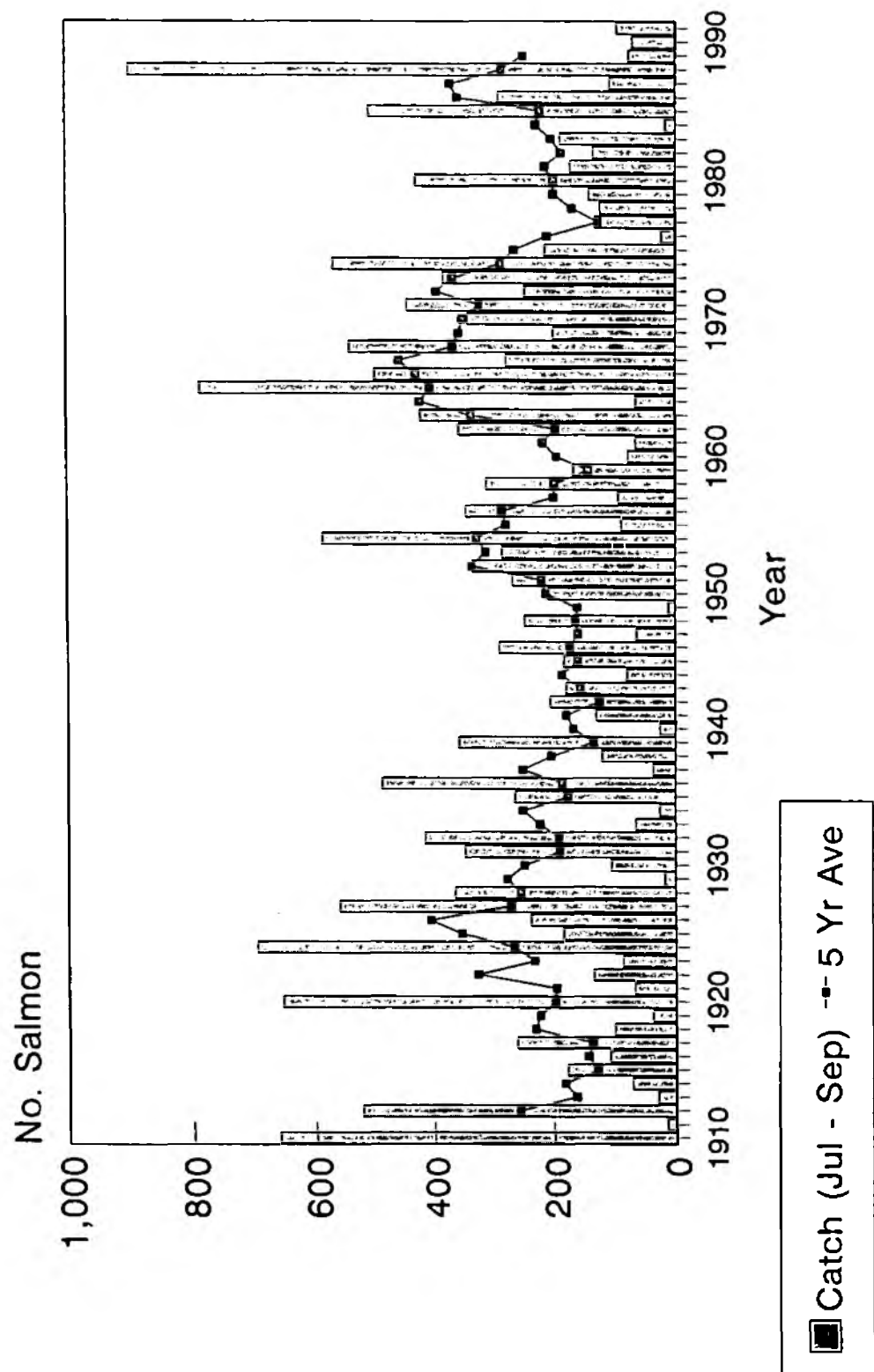


Figure 9: The Late (July-September inclusive) rod catch of salmon, 1871-1991, from the River Usk with a 5-year moving average

River Usk - Declared Rod Catch

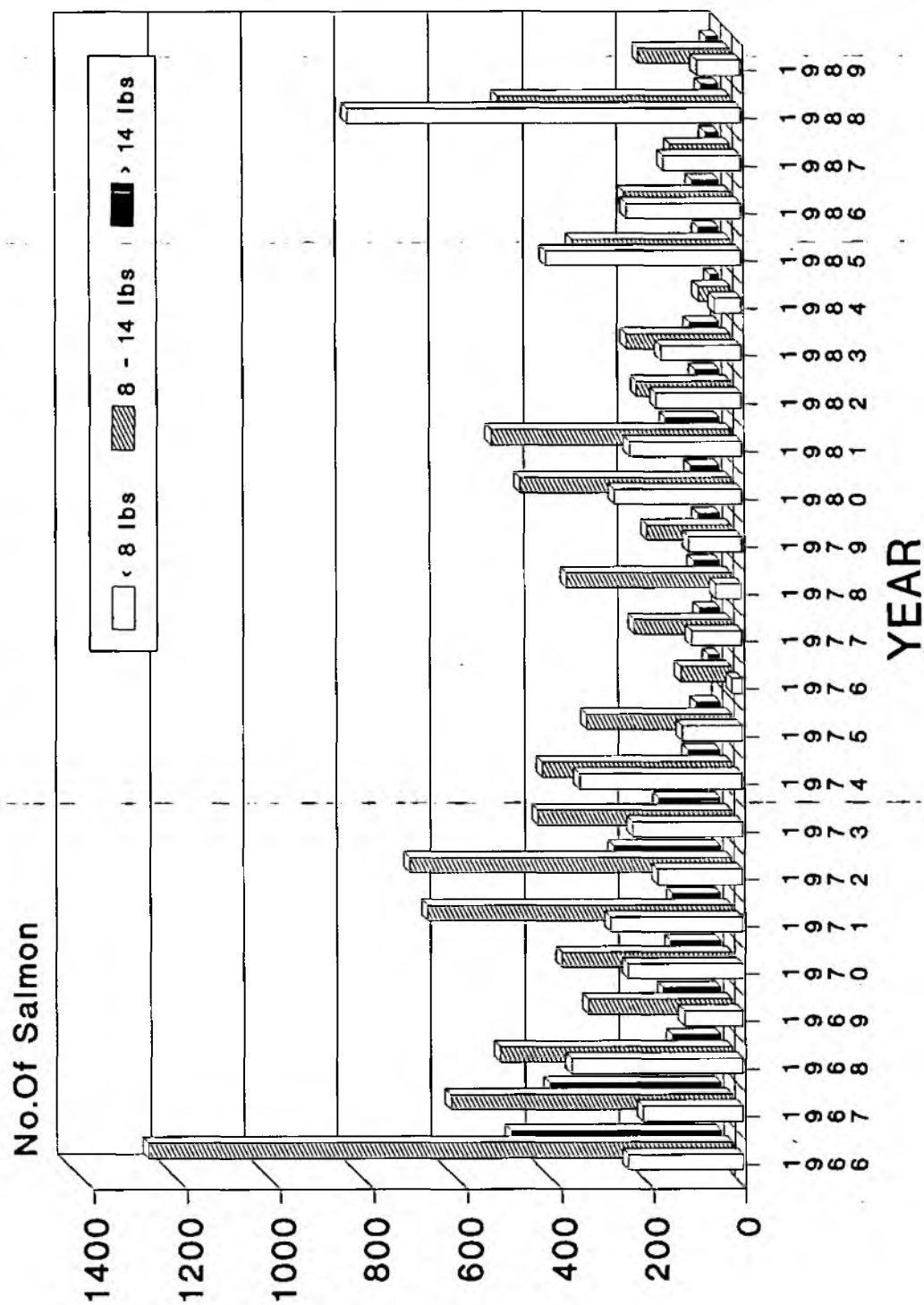


Figure 10: The annual rod catch of salmon in three separate weight classes from the River Usk, 1966-1989

River Usk - Grilse Catch Against Flows July to September.

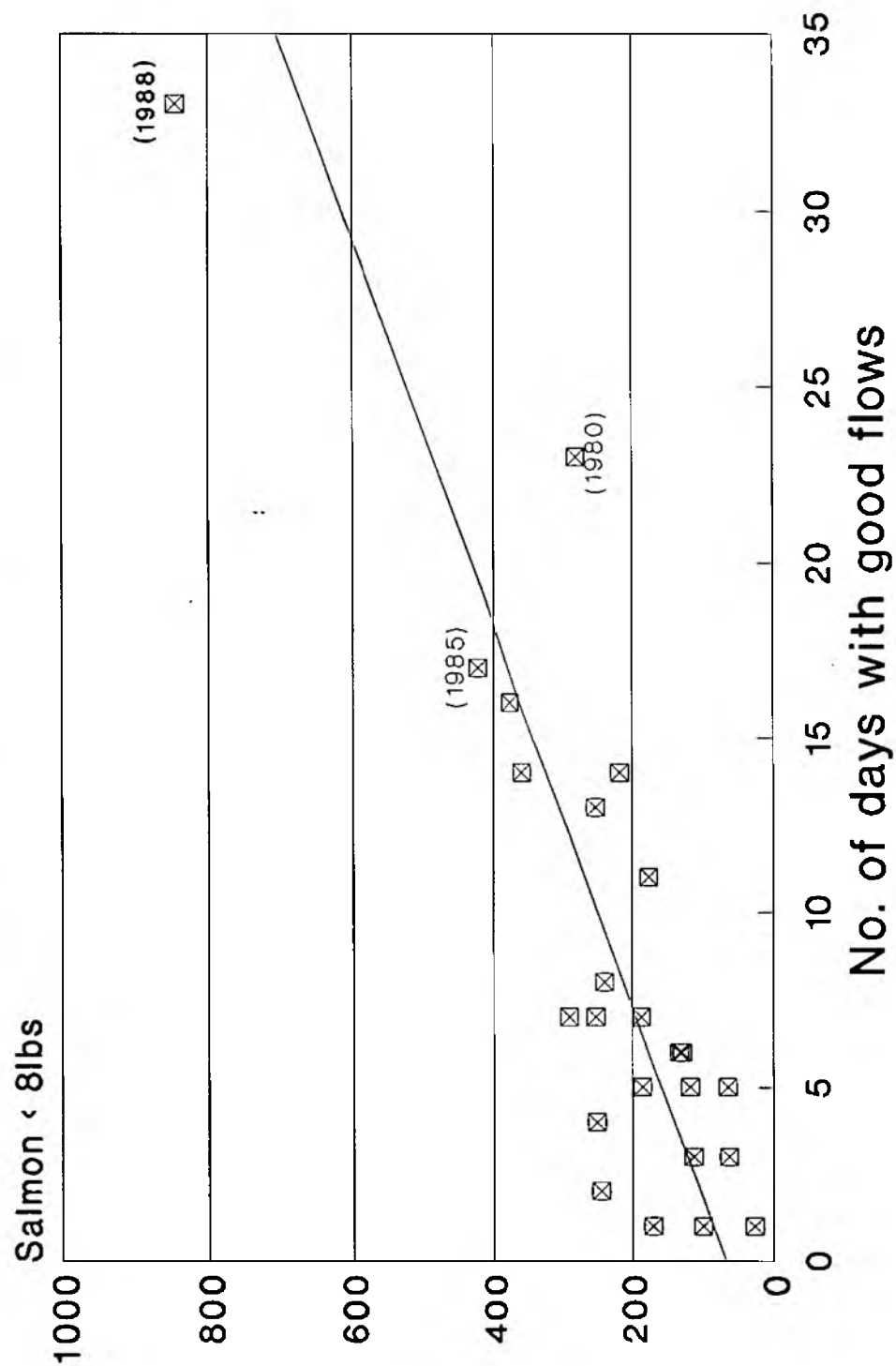
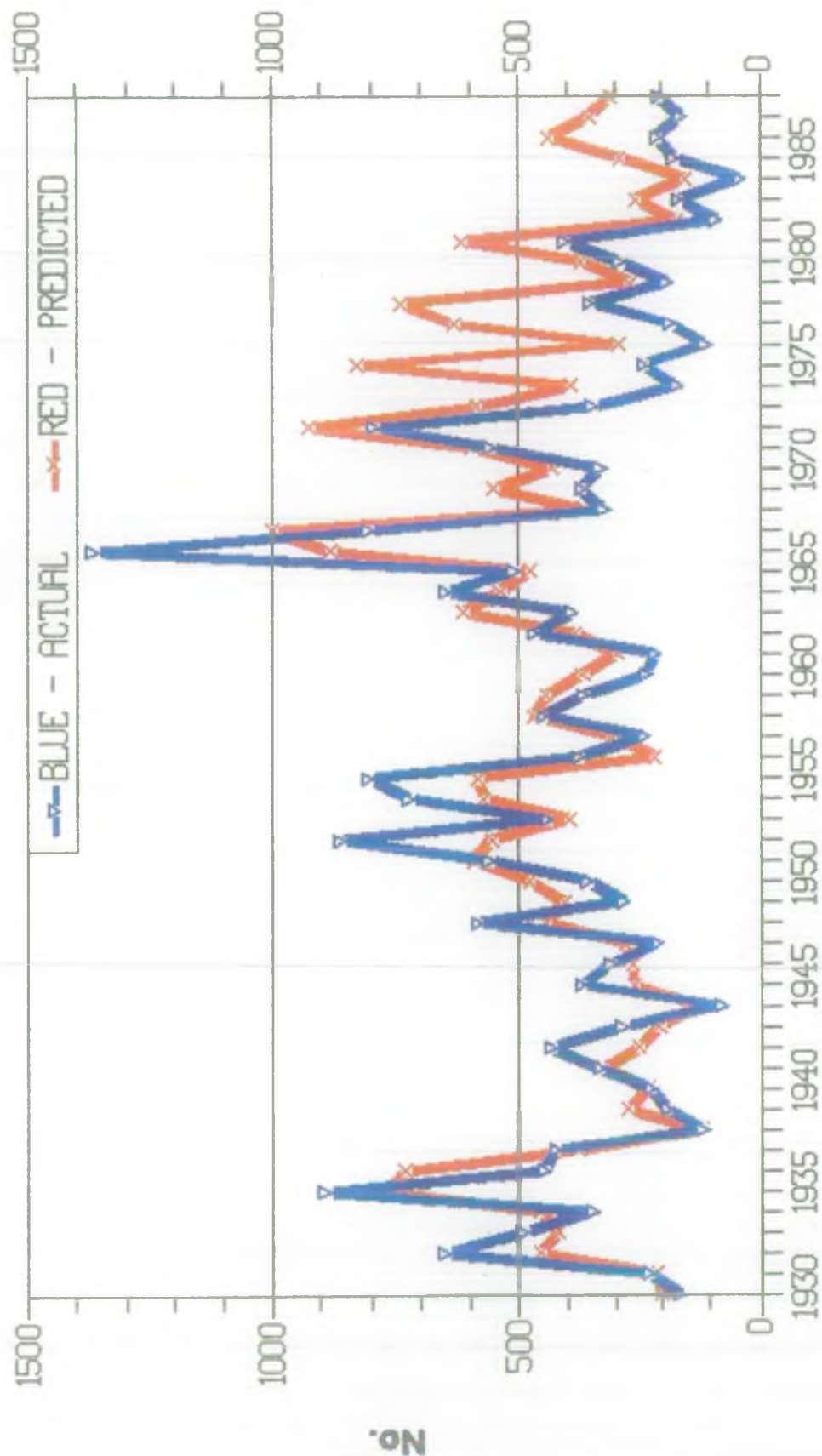


Figure 11: The annual rod catch of salmon less than 8lbs from the River Usk in relation to the frequency of good angling flows (15-30 cumecs) recorded at Chainbridge during July to September, 1966-1989

Usk Salmon Rod Catch

March-June

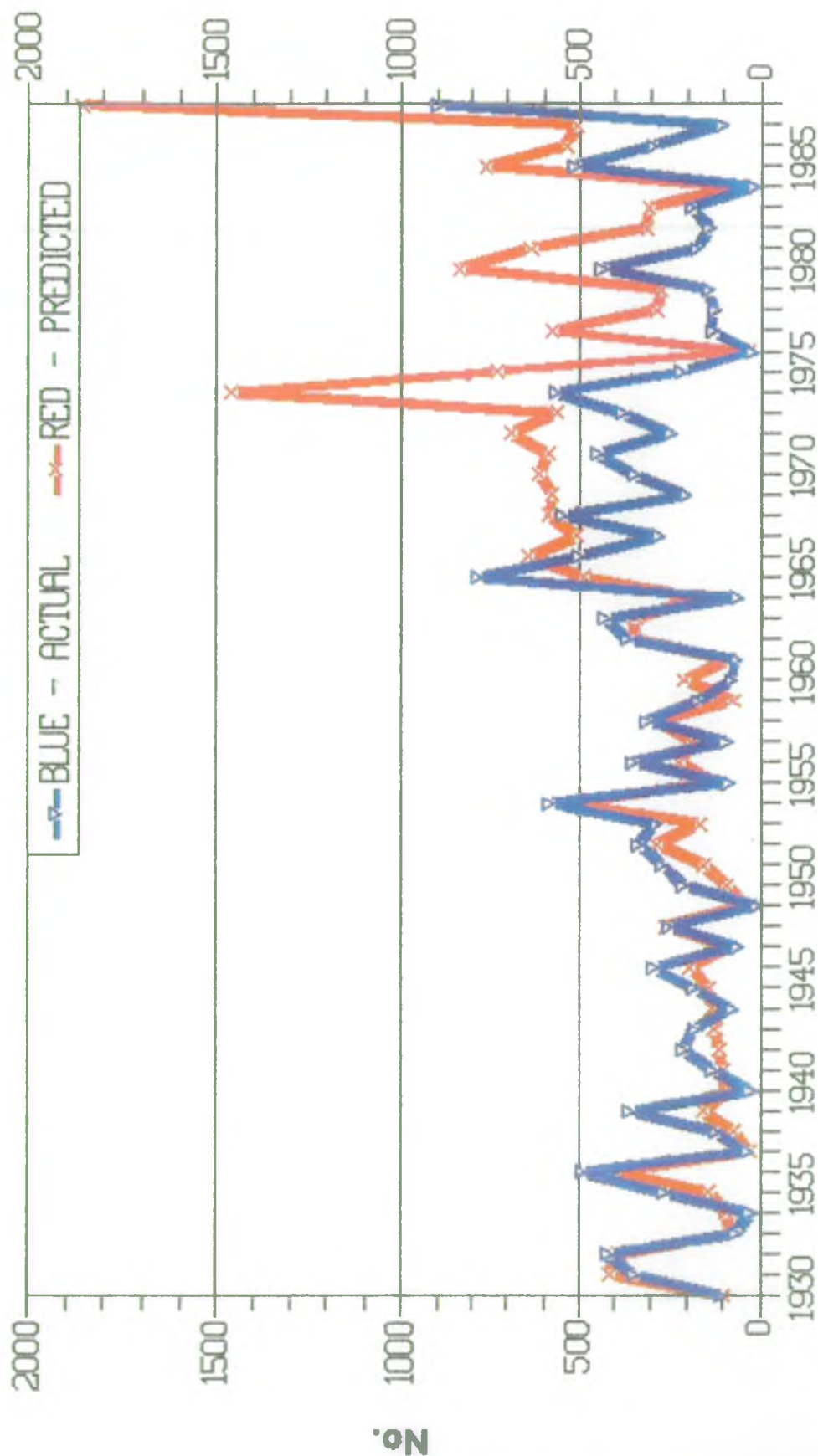


PREDICTIONS BASED ON RELATIONSHIP BETWEEN USK & WYE CATCHES 1925-69

Figure 12: The Early rod catch of salmon from the Usk, 1930-88, shown in relation to the predicted catch: predictions are based on the relationship between the Usk and Wye rod catches from 1925-1969

Usk Salmon Rod Catch

July-September



PREDICTIONS BASED ON RELATIONSHIP BETWEEN USK & WYE CATCHES 1925-69

Figure 13: The Late rod catch of salmon from the Usk, 1930-88, shown in relation to the predicted catch: predictions are based on the relationship between the Usk and Wye rod catches from 1925-1969

Usk District Salmon Commercial Catch Drift Nets and Stop Nets

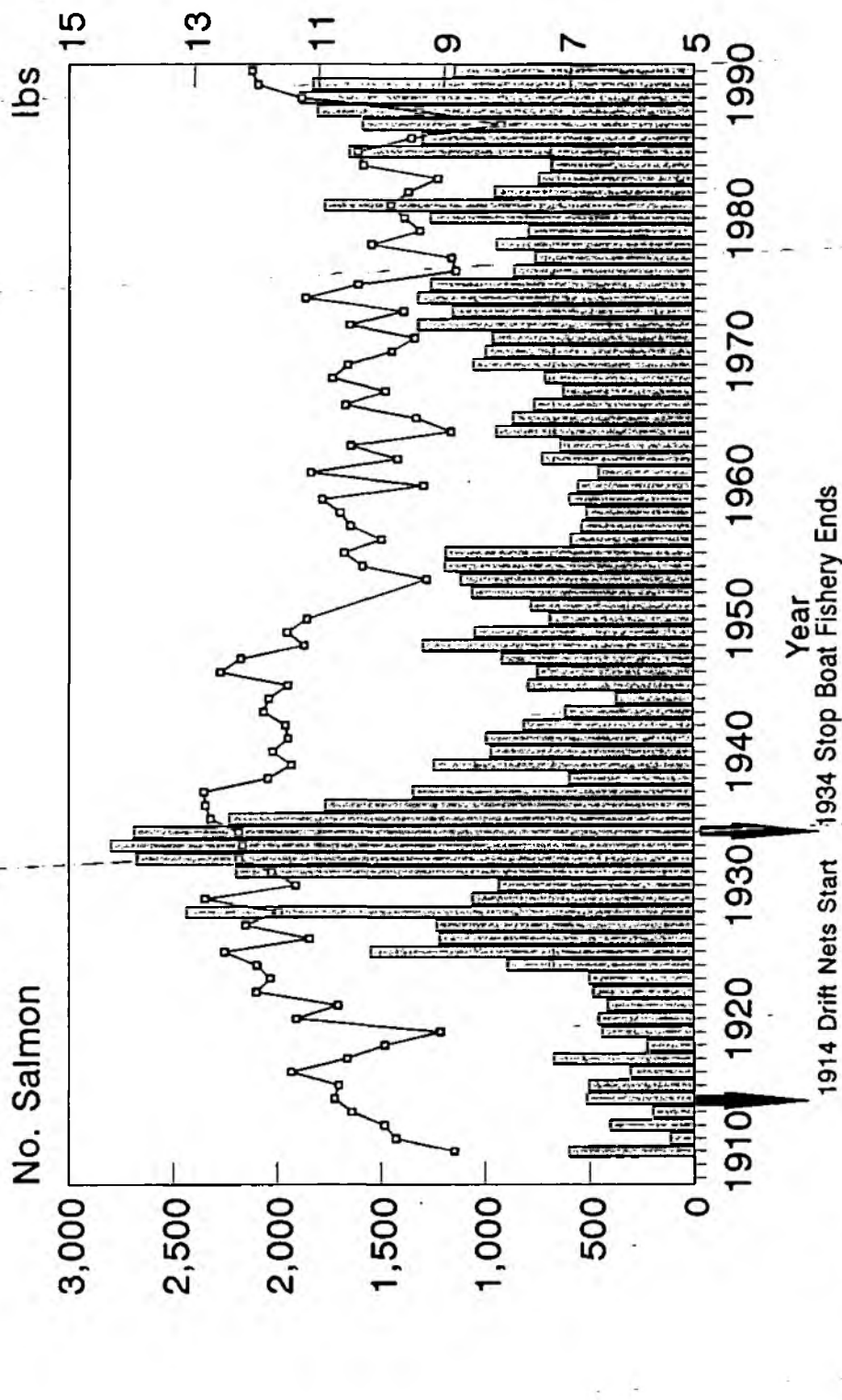


Figure 14:

The annual catch of salmon for the licensed net fisheries in the Usk District, showing number and average weight, 1910-1991. The drift net fishery commenced in 1914; the stop net fishery ended in 1934.

Usk District Salmon Commercial Catch Putchers

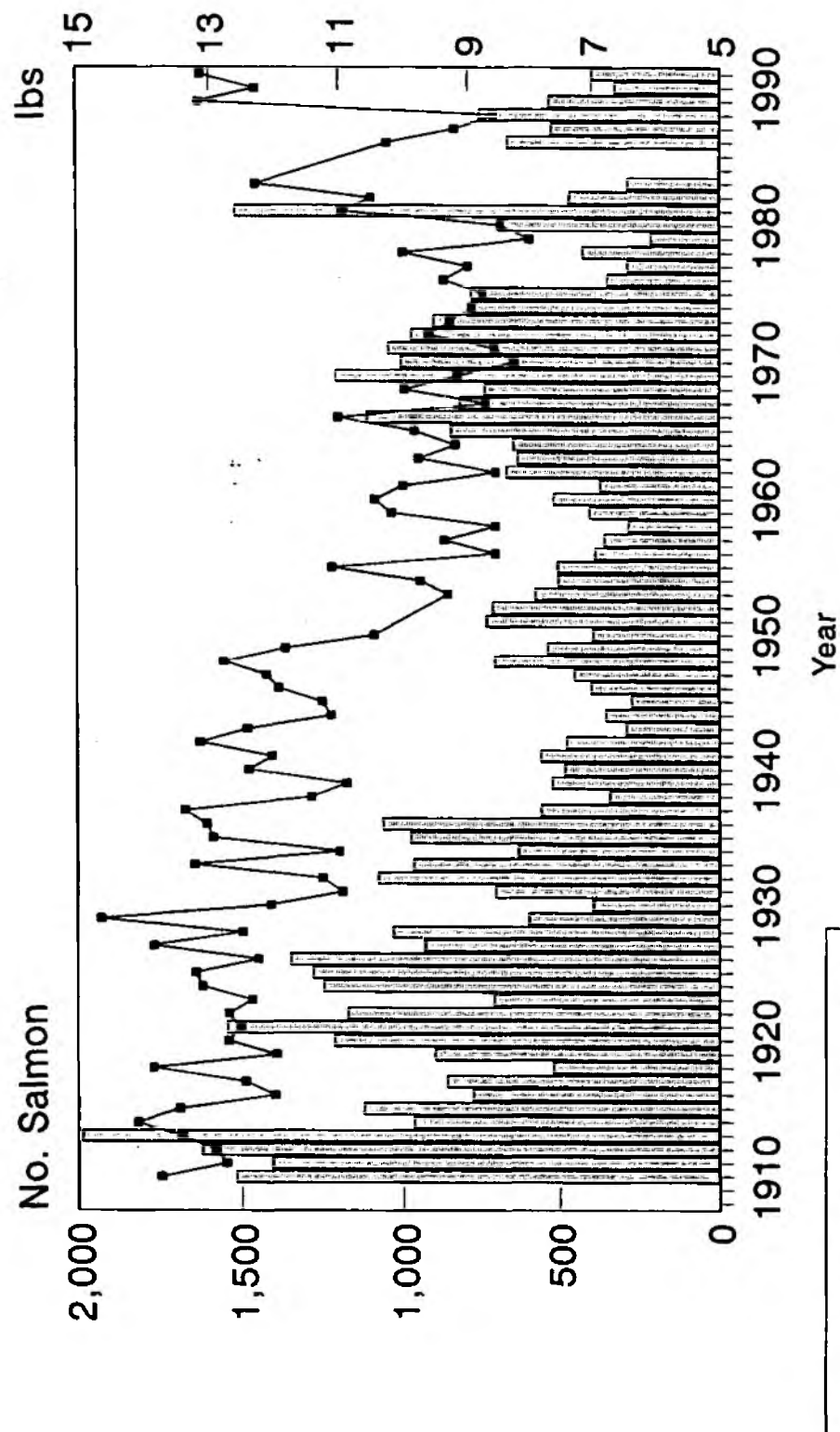
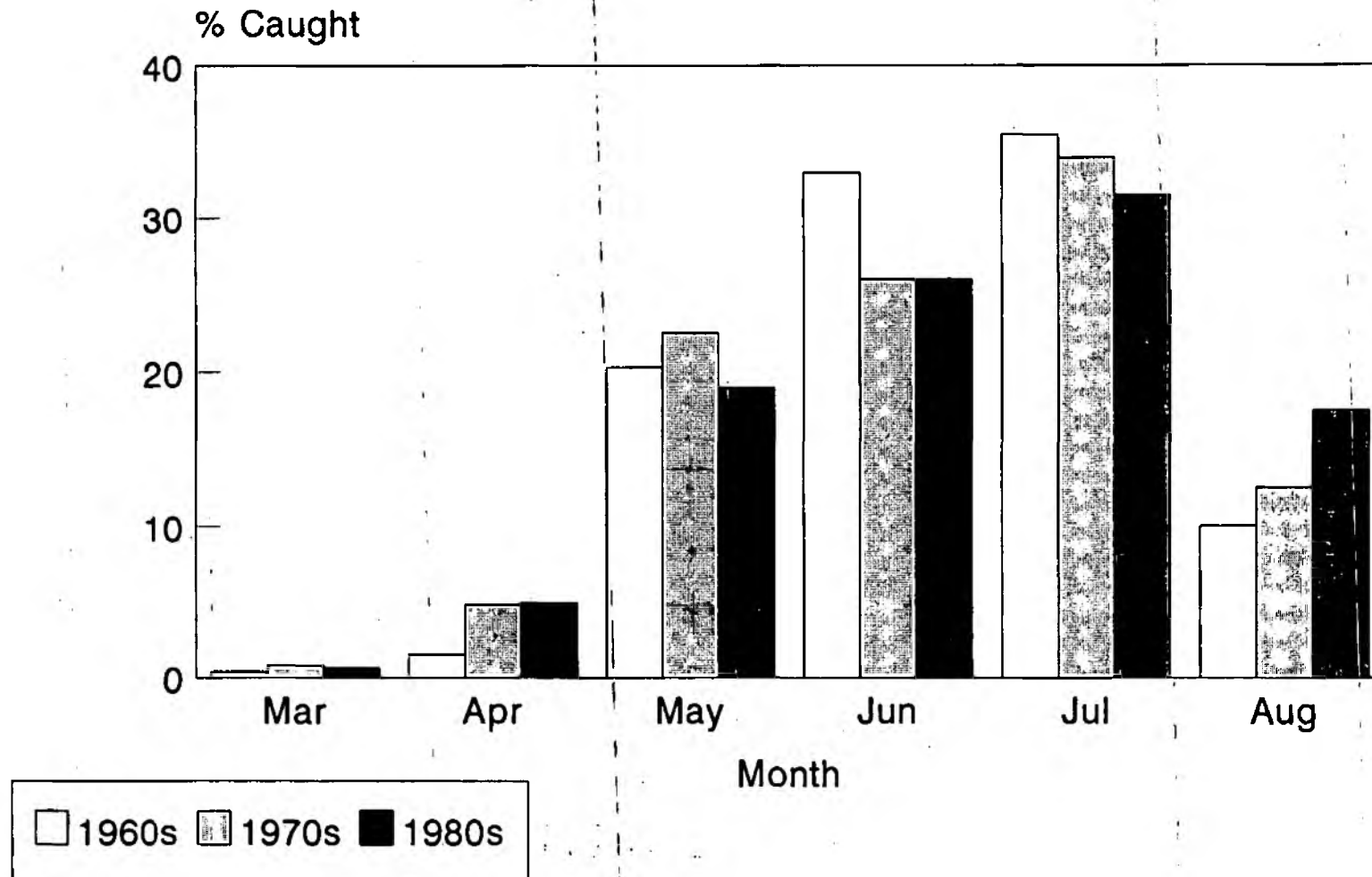


Figure 15: The annual catch of salmon for the putcher ranks within the Usk District, showing number and average weight, 1910-1991

Usk District Commercial Salmon Catch Average Monthly Proportion Caught per Decade

Figure 16:

The proportion of the commercial salmon catch within the Usk District taken in each month of the season, averaged for the 1960s, 1970s and 1980s



RIVER USK SALMON DENSITIES 1991 SURVEY

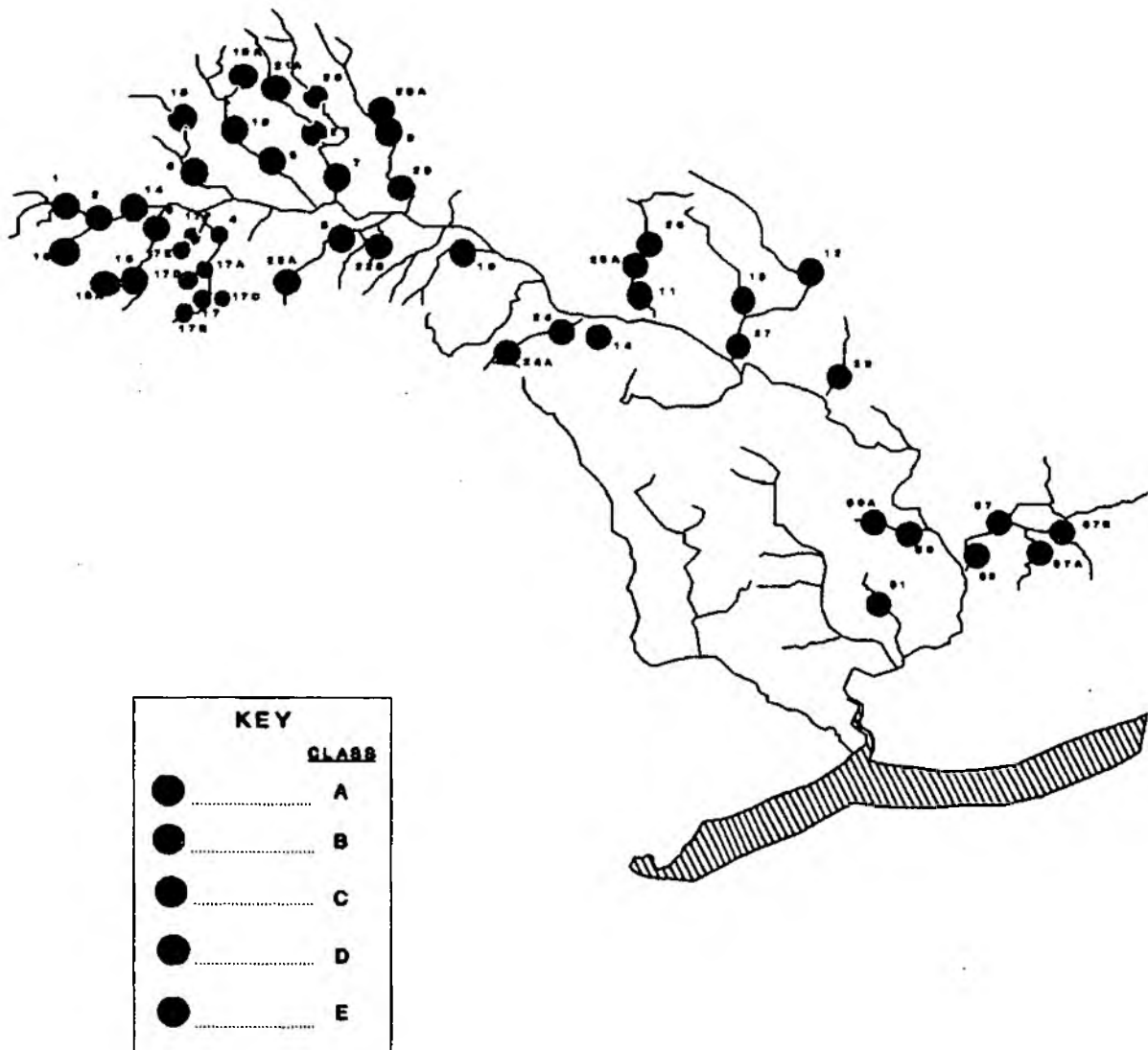


Figure 17: Density of juvenile salmon in the Usk Catchment in Summer 1991

A = Excellent
B = Good
C = Moderate
D = Poor
E = Absent

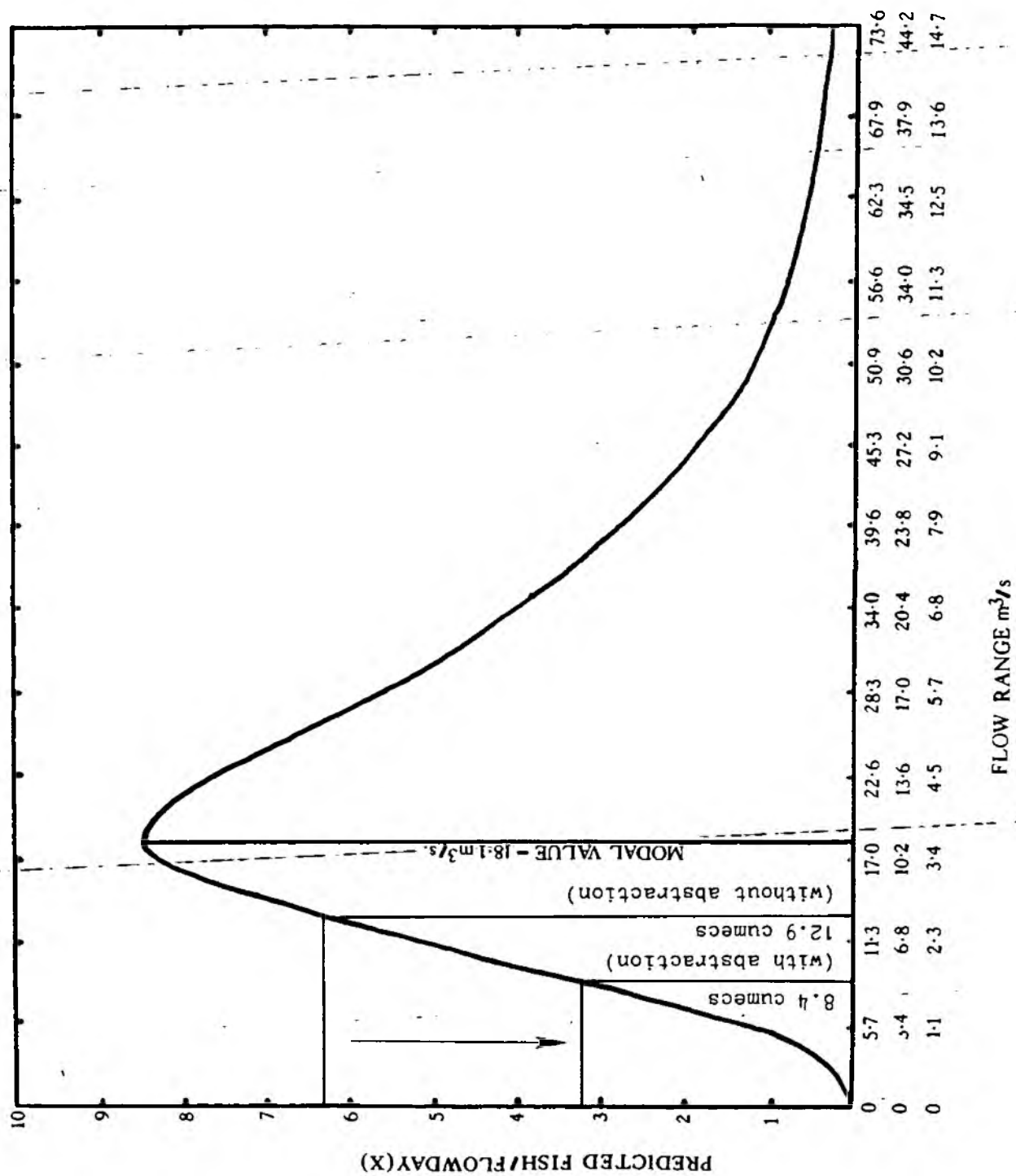


Figure 18: The relationship between the salmon rod catch per day and river flow at Chainbridge in 1965: adapted from Usk River Authority 1st Annual Report 1966 to show the potential impact of the licensed abstraction by Welsh Water from the lower Usk

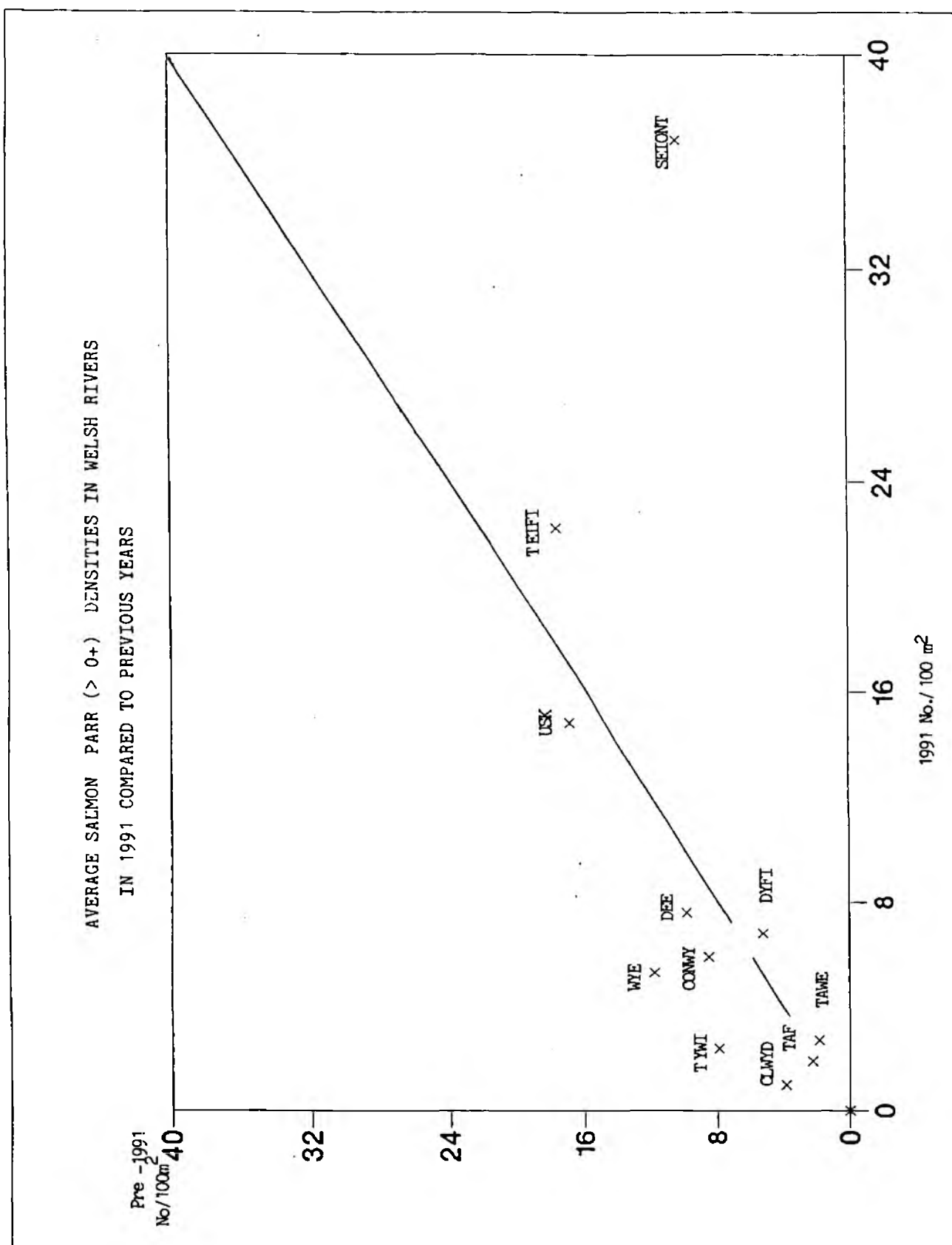


Figure 19: Average densities of salmon parr (>0+) in quantitative electrofishing sites on Welsh rivers surveyed in 1991, compared to densities previously found

Monthly Distribution of the Catch of Salmon (>14 lbs.) 1987 - 1991

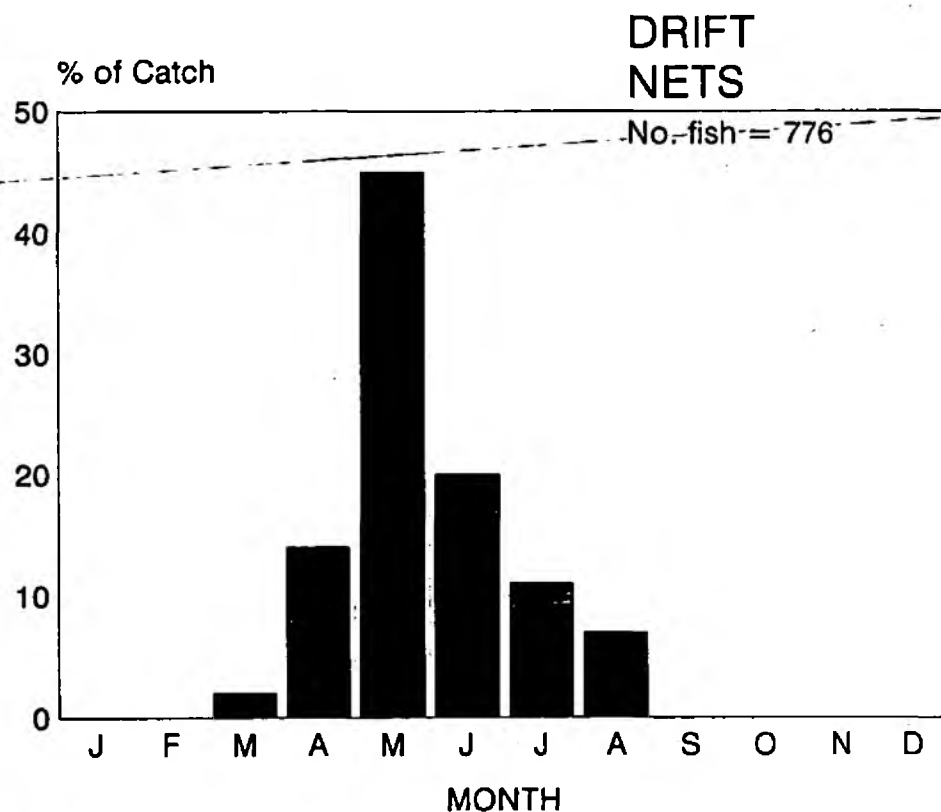
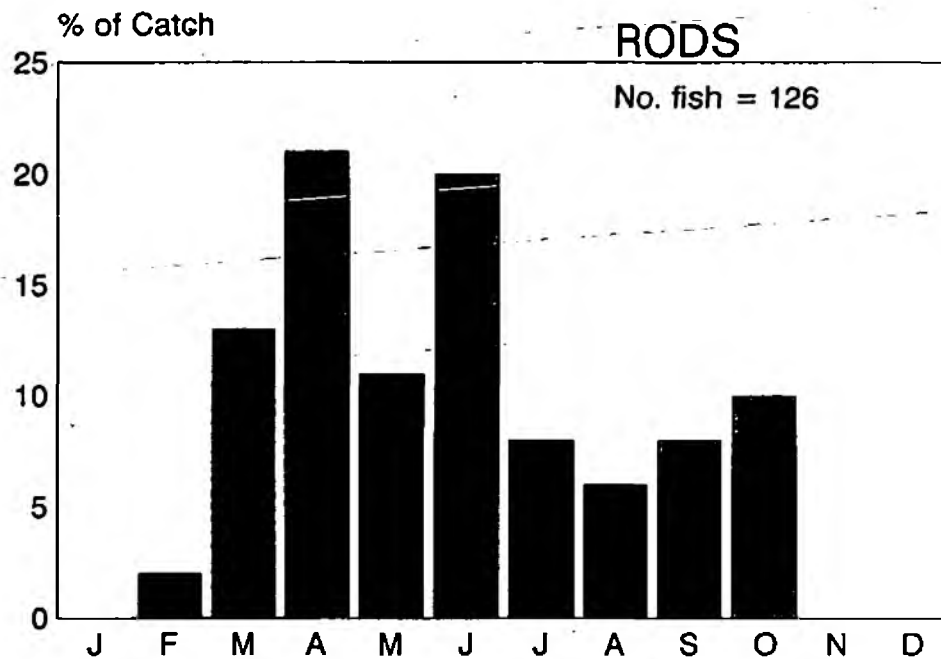
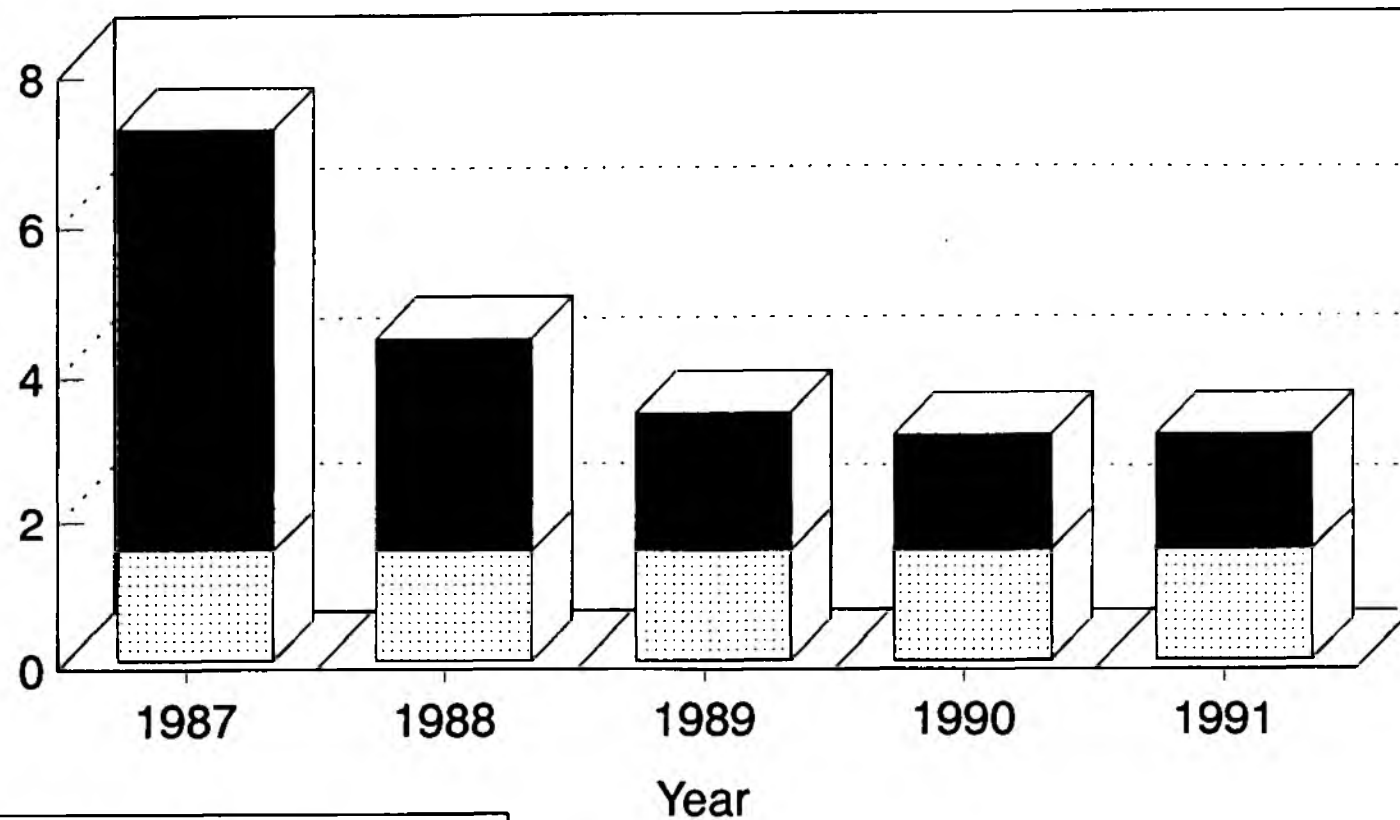


Figure 20: The monthly distribution of the catch of large salmon (>14lbs) in the period 1987-1991, by the rods (126 salmon) and the drift nets (776 salmon).

Severn Estuary Netting

April - September

Mean No. Boats Fishing/Day



■ Licensed ■ Unlicensed

Figure 21:

The average number of boats per day observed drift netting in the Severn Estuary off Newport 1987 - 1991.

Effect of proposed byelaw changes on stocks and catches

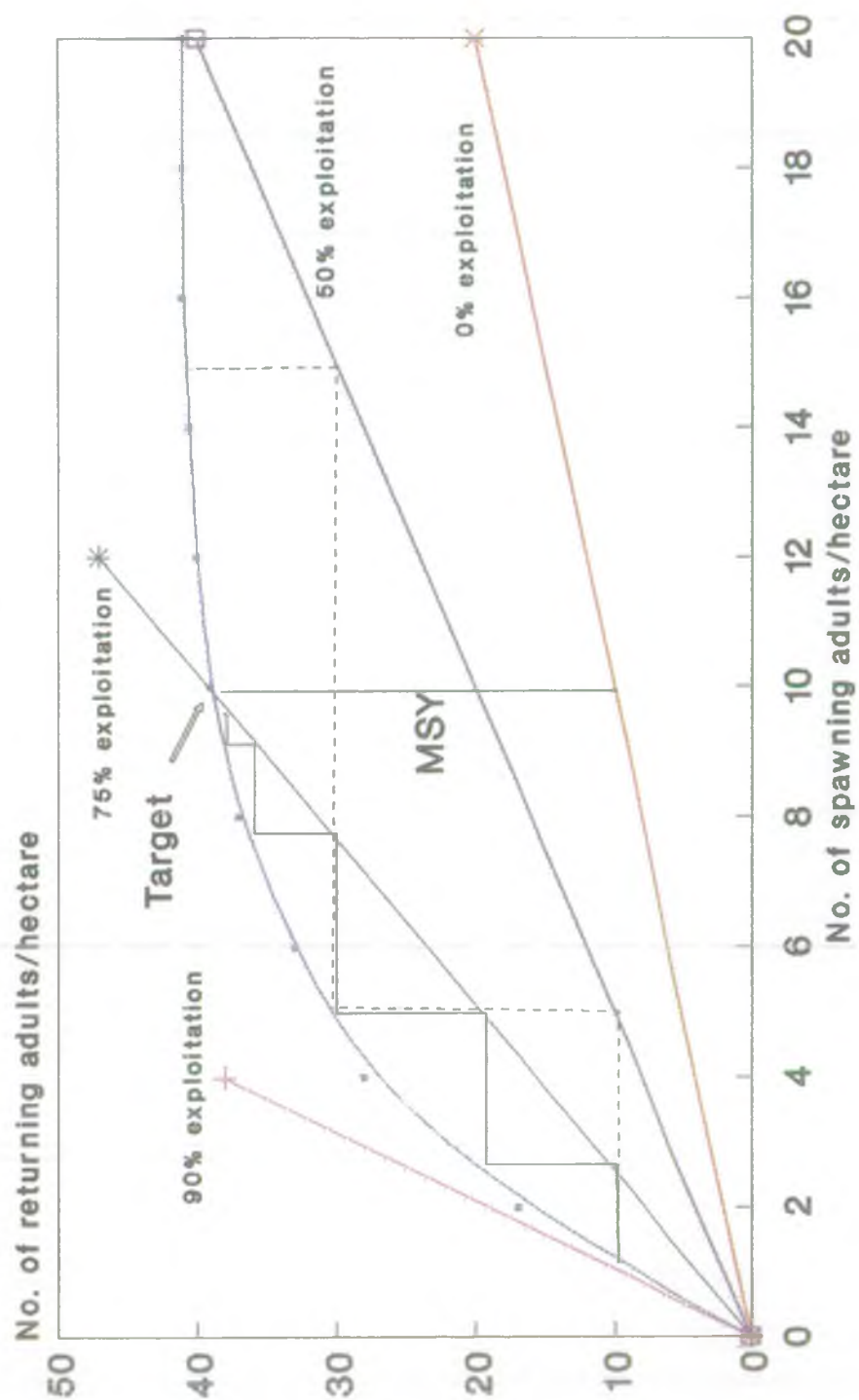


Figure 22: A hypothetical stock recruitment curve for Usk salmon showing the impact of different exploitation rates on the rate of recovery from the stock levels. MSY represents the maximum sustainable yield.

Table 1: Details of major abstractions from the Usk

Abstraction Point	Abstractor	Authorisation	Constraints on abstraction
Newton weir, Brecon	British Waterways Board	Act of Parliament 1793	No constraints defined in the Act, except a requirement to pay damages to interests affected downstream. By agreement between canal owners and Usk Board of Conservators, abstraction has been limited for most of this century to about 22 MI/d. Estimates since 1982 indicate abstractions up to 59 MI/d.
Llantrisant	Welsh Water PLC	NRA Licence (originally 1960s)	Up to 77 MI/d (equivalent to 0.9 cumecs at a constant rate)
Radyr	Welsh Water PLC	NRA Licence (originally 1960s)	<p>1 February-31 October: Up to 60 per cent of the unsupported river flow in excess of 455 MI/d (=5.3 cumecs) may be taken by the combined abstractions at Rhadyr and Llantrisant.</p> <p>1 November-31 January: Up to 100 per cent of the unsupported river flow in excess of 455 MI/d may be taken by the combined abstractions.</p> <p>At any time:</p> <ul style="list-style-type: none"> (i) Rhadyr abstraction cannot exceed 318 MI/d. (ii) When unsupported river flows are less than 455 MI/d other constraints operate.

Sampling Point	Minimum Dissolved Oxygen (mg/l)
Caerleon Bridge	3.5
Castle Bridge, Newport	3.3

Table 2: Minimum dissolved oxygen concentrations recorded at two sampling sites in the Usk estuary for the period 1988-1991

Open Season (Inclusive)		
Years	Rods	Nets
c.1846-1872	15th March-13th October	-
1873-1898	2nd April-1st November	-
1898-1928	2nd March-1st November	2nd March-31st August
1929-1958	15th February-30th October	
1959-1981	15th February-30th September except upstream of Talybont 15th February-15th October	" "
1981-1992	26th January-17th October	" "

Table 3: Usk District: Open seasons for salmon fishing

Table 4: Reported captures of Usk salmon tagged as smolts

		Distantwater Fisheries					Severn Estuary Fisheries				Rod Fisheries		Returns from other rivers
Tagging Period	No. of Smolts	Greenland	Faeroes	Eire	Northern Ireland	Other	Usk District	Severn District	Wye District	Other	Usk	Wye	
1958-64	10,435 (WILD)	6	—	1	—	—	5	11	5	3	20	2	—
1984-89	81,436 (REARED)	6	2	90	20	6	36	8	—	—	9	4	8

* Swain, A. (1982): The migrations of salmon (*Salmo salar* L.) from three rivers entering the Severn estuary. J. Cons int. Explor. Mer. 40(1): 76-82

Months	1970-1988		% Difference (Predicted-Actual) Actual
	Actual Catch	Predicted Catch	
'EARLY' March-June (inclusive)	262	353	73%
'LATE' July-September (inclusive)	284	612	115%

Table 5 The average declared Usk Rod Catch Early and Late, for the period 1970-88 compared to the catches predicted from the relationship with the Wye from 1929-69

Year	Proportion of annual count occurring in October-December
1975	65%
1976	30%
1977	82%
1978	59%
1988	16%
1989	29%
1990	66%
Average	50%

Table 6: Counts of upstream movements at Trostrey weir for the periods 1975-78 and 1988-90

	1964-73	1974-83	% Reduction
Redd counts	2763	992	36
Rod catch	1063	531	50

Table 7: Average redd counts and rod catch for two periods 1964-73 and 1974-83

	1987	1988	1989	1990	1991
'Quantitative' sites (12)	16.3	14.7	26.9	8.6	14.8
'Semi-quantitative' sites (11)	7.0	6.5	10.6	5.6	5.5

Table 8: Mean densities of salmon parr (>0+) 1987-91 (No. per 100m²) at monitoring sites within the Usk catchment, excluding the Lwyd and Ebbw subcatchments

Year	Estimated number of smolts (95% Confidence Limits)	
1962	295,400	
1963	102,900	
1964	252,500	
1967	253,676	
1968	160,457	
1969	238,051	
1970	186,285	
1971	114,125	
1987	84,328	(41,008-177 356)
1989	106,276	(77,435-148,228)

Table 9: Estimates of size of wild smolt population in the River Usk, 1962-1964, 1967-1971, 1987 and 1989.

From: M. W. Aprahamian and G. O. Jones (1989): Usk Salmon Smolt Investigations.
NRA Tech. Memo. PL/EAE/89/34

Table 10: Management Options for reducing the rod catch to increase the number of early run and large salmon which survive to spawn.

REGULATIONS	AVERAGE CATCH (BASED ON 1987-91)			MAX. REDUCTION IN CATCH BEFORE 1 JULY (%)	MAX. NO. OF EARLY RUN SALMON SAVED	MAX. REDUCTION IN CATCH OF LARGE SALMON (%)	MAX. NO. OF LARGE SALMON SAVED	MAX. REDUCTION IN TOTAL CATCH (%)
	BEFORE 1 MAY	BEFORE 1 JUNE	BEFORE 1 JULY					
EXISTING (i) Fly and spinner only up to 15 April (ii) Fly, spinner and bait from 15 April to 30 September	65	117	177	-	-	-	-	-
OPTION 1: No fishing up to 1 June Then as existing	-	-	60	66	117	47	12	22
OPTION 2: Fly only up to 1 July Then as existing.	14	26	39	78	138	68	17	26
OPTION 3: Fly only up to 1 June	14	26	86	51	91	36	9	17
OPTION 4: (i) Fly only up to 1 May (ii) Fly and spinner only up to 1 June (iii) Fly only after 31 August Then as existing except no use of float at any time. (NB: This option is proposed for the Wye)	14	57	117	34	60	42	11	43

Table 11: Management Options for reducing the licensed drift net catch to increase the number of early-run and large salmon which survive to spawn

REGULATIONS	AVERAGE CATCH (BASED ON 1987-91)			MAX. REDUCTION IN CATCH BEFORE 1 JULY (%)	MAX. NO. OF EARLY RUN SALMON SAVED	MAX. REDUCTION IN CATCH OF LARGE SALMON (%)	MAX. NO. OF LARGE SALMON SAVED	MAX. REDUCTION IN TOTAL CATCH (%)
	BEFORE 1 MAY	BEFORE 1 JUNE	BEFORE 1 JULY					
EXISTING Drift nets: 2 March - 31 August 8 Licences; 42 hours close time	86	378	823	-	-	-	-	-
OPTION 1: 6 Licences (Otherwise as existing)	65	284	617	25	206	25	39	25
OPTION 2: No fishing until 1 June (8 Licences)	-	-	445	54	378	62	96	22
OPTION 3: No fishing until 16 May (Otherwise as existing)	-	146	591	28	232	39	61	14
OPTION 4: No fishing until 1 May (Otherwise as existing)	-	378	737	10	86	17	26	5
OPTION 5: Weekly close time extended to 96 hours (i.e. 6 a.m. Saturday- 6 a.m. Wednesday until 1 July (Otherwise as existing)	52	227	494	40	329	33	51	20

REGULATIONS	AVERAGE CATCH (BASED ON 1987-91)			MAX. REDUCTION IN CATCH BEFORE 1 JULY (%)	MAX. NO. OF EARLY RUN SALMON SAVED	MAX. REDUCTION IN CATCH OF LARGE SALMON (%)	MAX. NO. OF LARGE SALMON SAVED	MAX. REDUCTION IN TOTAL CATCH (%)
	BEFORE 1 MAY	BEFORE 1 JUNE	BEFORE 1 JULY					
EXISTING Putchers: 16 April - 15 August	15	104	244	-	-	-	-	-
OPTION 2: No fishing until 1 June	-	-	140	49	104	Unknown	Unknown	20
OPTION 3: No fishing until 16 May	-	45	184	25	60	Unknown	Unknown	12

Table 12: Management Options for reducing the putcher catch to increase the number of early-run salmon which survive to spawn

	1989	1990
Declared Usk rod catch of salmon	326	263
Predicted Usk rod catch of salmon	167	149

Table 13: The annual catches of rod-caught salmon declared for the Usk in 1989 and 1990, compared to predictions based on the rod catch in the Wye and flows at Chainbridge

10. APPENDIX 1: EXCERPT FROM THE HEREFORD TIMES, 1913

OLD RECORD TAKES ON THE RIVER USK

To the Editor of the Hereford Times

Sir. - It will be interesting again to place on record the wonderful catches made by this skilful rod fisherman.

The Usk has recently fallen from that high pinnacle of success, and further abstraction of its summer flow of pure water has to be most jealously watched, and if possible stopped.

I append a copy of Mr. Alfred Crawshay's letter to me, giving the particulars of his catches.

JOHN LLOYD

15, Chepstow Place, London, W, March 4th 1913

[COPY]

Lechside,
New Cumnock,
Ayrshire.
March 2nd 1913

Dear Mr. Lloyd - Tudor Crawshay has forwarded me your letter. In 1891 I caught 324 salmon in the Usk, weighing 3,513 lbs, and I did not fish from September 25th to October 26th, as I was away shooting in Scotland. Had I not gone I am quite sure I should have caught at least another 100 as the river was more or less in order the whole time and swarming with fish. I caught 15 in the day three times, and 16 once in the day that year. In 1888 I caught 264, weighing 2,758 lbs. On July 30th I caught 20, and that day I rose, lost and caught 58 fish.

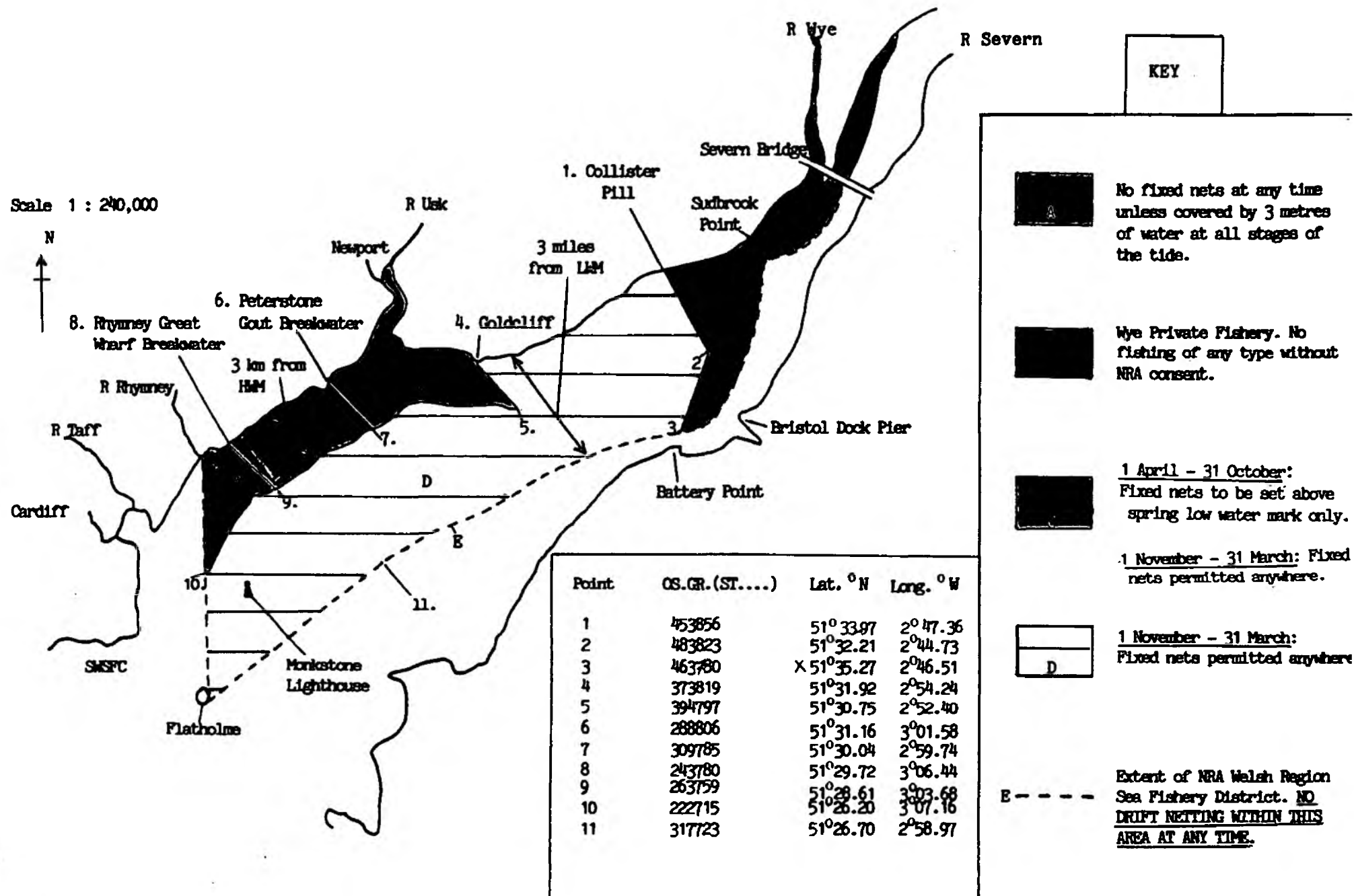
In 1873 I caught on October 15th 28 fish. These are my best catches. My best years with trout were in 1882 and 1884, 658 lbs and 643 lbs. My best day was on the Skethrog Water when I caught, with the water dead low and as clear as gin, 57 fish, 28lbs.

I shall be only too glad if I can give you any more information. -

Yours sincerely

(Signed) J. Crawshay

GUIDELINES TO SEA FISHERY BYELAWS OPERATIONAL IN THE SEVERN ESTUARY
REGULATED BY THE WELSH REGION OF THE NATIONAL RIVERS AUTHORITY



NATIONAL RIVERS AUTHORITY
WELSH REGION

GUIDELINES TO REGULATION OF SEA FISHING WITHIN THE SEVERN ESTUARY

1. INTRODUCTION

- 1.1 This leaflet has been prepared by the Welsh Region of the National Rivers Authority (NRA, Welsh Region). It describes new byelaws which were confirmed by the Secretary of State for Wales on 11 August 1992 within that part of the Severn Estuary where NRA Welsh Region has jurisdiction for sea fishing.
- 1.2 The aim of this leaflet is to give easy-to-follow guidance only. It is *not a legal document*. Copies of the byelaws are available from: The Taff/Usk District Fisheries Manager, NRA, St Mellons, Cardiff CF3 0LT. Tel: (0222) 770088.
- 1.3 Part of the Severn Estuary (Cardiff Bay) is regulated by the South Wales Sea Fisheries Committee (SWSFC). Detailed information on all SWSFC byelaws, including regulations governing fishing methods, is contained within a SWSFC byelaw booklet, available from SWSFC, Queens Buildings, Cambrian Place, Swansea, SA1 1TW. Tel. (0792) 654466.
- 1.4 Fishermen should familiarise themselves with new and existing byelaws and national legislation before undertaking any fishing activity. Failure to adhere to the regulations could result in seizure of fishing gear and prosecution.
- 1.5 Fishing for or taking salmon and sea trout continues to be legal only with a licensed instrument and when the terms of the licence are observed.

2. GUIDELINES

Reference to the accompanying map and table should be made when interpreting these guidelines.

2.1 Byelaw 2 – Interpretation

2.1.1 The Authority's area is that defined by the dotted line (E) on the map. In this area the Welsh Region of the NRA is the Sea Fisheries Committee. Between Flatholme and the most South Westerly point of the Wye Fishery (Grid reference ST 463780), line (E) is defined as: a straight line between the lighthouse on Flatholme and NGR ST 317723.

2.1.2 The area to the west of the line drawn south from the mouth of the River Rhymney to the lighthouse on Flatholme is regulated by the South Wales Sea Fisheries Committee (SWSFC).

2.2 Fishing Methods

All methods of fishing for sea fish are hereby prohibited in the Authority's area apart from those listed below. Anyone fishing by unauthorised methods shall be guilty of an offence.

2.2.1 Byelaw 3 – Placing and Use of Fixed Engines (Nets)

- Area (A)** (Orange) No fixed net is to be operated at any time unless it is covered by at least 3 metres of water at all stages of the tide.
- Area (B)** (Pink) This is the Wye Fishery owned by the NRA. No fishing of any type in this area (including licensed netting for salmon) is permitted without the written consent of the NRA.
- Area (C)** (Green)
- (i) During the period *1 April - 31 October* fixed nets are to be set above the (spring) low water mark only.
 - (ii) During the period *1 November - 31 March* fixed nets are permitted anywhere.
- Area (D)** (blue hatched) Fixed nets are permitted anywhere during the period *1 November - 31 March*.

2.2.2 Byelaw 4 – Method of Construction and Manner of Use of Fixed Engines

Where the use of fixed nets is permitted according to byelaw 3 above, they shall be in accordance with the following conditions:

- (i) The maximum length shall be 200 metres.
- (ii) No iron or metal supports for nets and no wire netting shall be used.
- (iii) Where nets are set close to channels or streams, no part of the net should be set into or over the channel.
- (iv) No two nets shall be set closer than 200 metres from each other.
- (v) When the net or its fixings are in position, its location is to be clearly marked with visible floating buoys.
- (vi) The owner's name shall be clearly displayed on at least one of the stakes or marker buoys.
- (vii) All fixed nets shall be cleared of fish at least once every two tides.
- (viii) Any salmon or sea trout caught shall be returned to the sea whether alive or dead. If alive, it shall be returned with as little injury as possible.

The following shall apply only to nets set above the (spring) low water mark:

- (ix) NO PERSON SHALL USE MORE THAN ONE NET AT ANY ONE TIME.
- (x) NETS SHALL BE PLACED PARALLEL TO THE SHORE (UNLESS OTHERWISE AUTHORISED IN WRITING BY THE NRA).

2.2.3 USE OF OTHER INSTRUMENTS

The following are also permitted for taking sea fish in the Authority's area (except in the Wye Fishery).

- (i) A single beam trawl where the effective length of the beam is no greater than 4 metres.
- (ii) A single otter trawl where the length of the headline between the other boards does not exceed 20 metres.
- (iii) A net used for fishing for salmon which has been licensed by the Authority, except during the weekly close time or the annual close season.

2.2.4 Use of Rod and Line

- (i) Fishing by rod and line shall be permitted everywhere in the Authority's area, provided it is from the foreshore.
- (ii) Fishing by rod and line from a boat shall be permitted everywhere in the Authority's area except in the Wye Fishery.
- (iii) Fish are only to be taken when hooked in the mouth.
- (iv) All sea fish hooked otherwise than in the mouth shall be returned to the water without delay, whether alive or dead, and if alive, with as little injury as possible.
- (v) A landing net may be used as an auxiliary to a rod and line.
- (vi) A barbless gaff may be used as an auxiliary to a rod and line.

2.2.5 Byelaw 7 - Protection for Certain Acts

The above restrictions shall not apply to:

- (i) Any officer of the Authority acting in his official capacity.
- (ii) Any person who, with the written permission of the Authority, used such methods:
 - (a) for some scientific purposes;
 - (b) for the purpose of artificial propagation;
 - (c) for the purpose of stocking or restocking;
 - (d) for the purpose of preservation, improvement, exploitation or development of a fishery.