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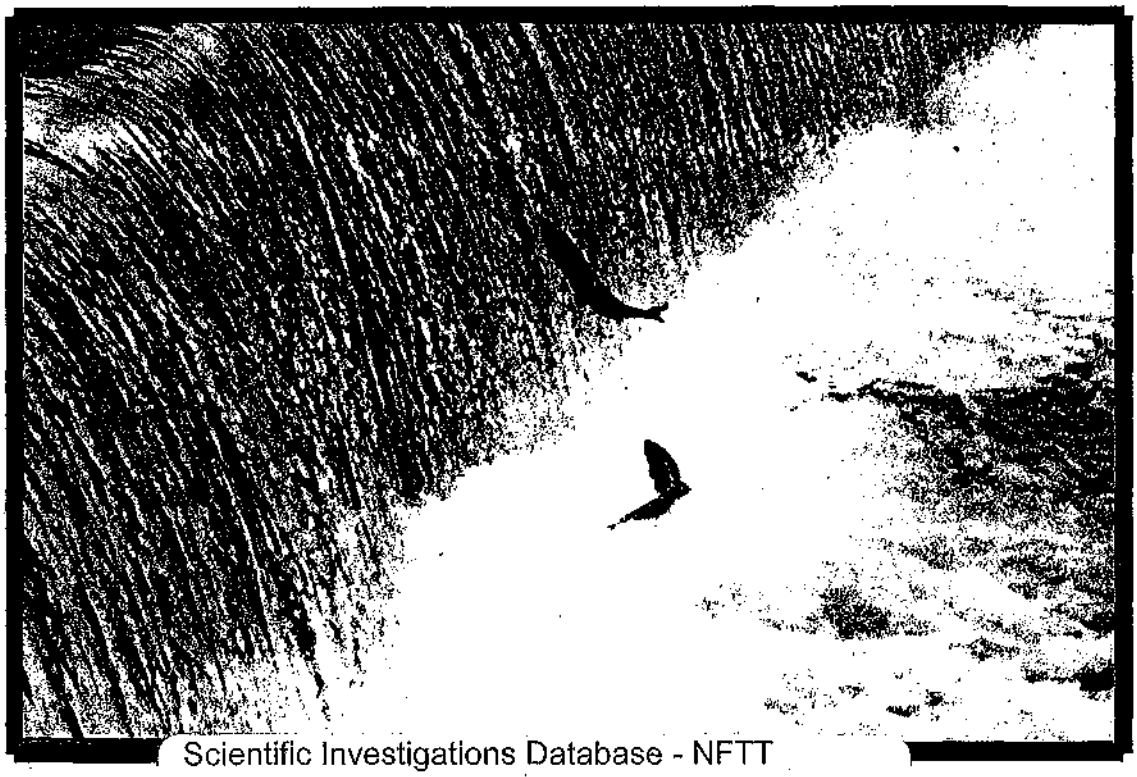
An Analysis Of The Historical Catch Data From The Migratory Salmonid Fisheries Of The River Ribble.



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Contents.

1. REPORT AIMS.

This report examines changes in the size and composition of the salmon and sea trout catches from the Ribble migratory salmonid fisheries during the years 1937 to 1991. Comparisons are made between the rod and net fisheries for both salmon and sea trout of the Ribble and Hodder. Patterns of catches shown by the Ribble fisheries are compared with those of other individual rivers and with patterns for the North West Region as a whole.

An attempt is made to identify if any relationship exists between catch and stock abundance. Catch patterns shown by the Ribble and Hodder salmon fisheries are compared with electronic resistivity counter data from the two rivers. Annual salmon catch patterns and redd count data are compared both locally and regionally.

Recommendations for future studies are made in the light of the report's findings.

2. INTRODUCTION.

2.1. The Ribble catchment.

The Ribble catchment is the largest and most diverse river system within NRA, North West's Central Area.

The river is approximately 100km in length and rises in a limestone area west of the Pennines. This produces water that is alkaline, has a high calcium content and is very clear. Water quality in the Ribble catchment is generally good and improving. From the head-waters downstream to the confluence with Stock Beck, the Ribble is a Class 1A river. From this confluence to Calder Foot the river is Class 1B. As a result of the influence of the Calder, there is a further decrease in water quality to Class 2 from this junction downstream to the tidal limit.

The Ribble has four major tributaries. The Hodder, which is Class 1A and slightly acidic and the Calder, Darwen and Douglas catchments, parts of which suffer from poor water quality, as a result of urban and industrial pollution.

2.2. The migratory salmonid fisheries of the Ribble.

The Ribble supports major recreational fisheries for both coarse and game fish. Within the Ribble estuary there are commercial net fisheries for salmon and sea trout as well as sea fish such as mullet and bass.

The River Hodder supports an important migratory salmonid rod and line fishery, as well as resident trout and coarse fish populations. The Douglas, Calder and Darwen

catchments do not presently sustain migratory salmonid fisheries, mainly because of their poor water quality, but do contain resident trout and coarse fish.

Historical perspective.

A.T.R. Houghton, in his book "The Ribble Salmon Fisheries" traced the history of the rivers' salmon and sea trout fisheries from medieval times to the 1950's. The book provides a graphic illustration of the rapid decline in the migratory salmonid rod and net fisheries during the latter part of the 19th and early 20th centuries. In 1867, the combined catch from the nets and rods was 15,100 salmon, yet by the end of the century the fishery had declined to such a degree that no salmon were caught in 1899 or 1900 by either the nets or rods.

This decline in the migratory salmonid fishery was attributed to pollution, overfishing and obstructions such as weirs which prevented upstream migration of adult fish. The Salmon and Freshwater Fisheries Act, 1923, had three major beneficial effects. It ensured the construction of fish passes to overcome obstructions to fish migration; it allowed the introduction of strict Fishery Board by-laws for the control of netting (in the form of a net limitation order which is still in force today) and it allowed for the employment of trained bailiffs to enforce the Act.

In 1930, the Ribble was stocked for the first time, using 20,000 fry from the River Thurso in Scotland. A similar stocking was carried out annually until 1939 and further stocking with Scottish fry continued intermittently into the 1950's. With improvements in water quality and with the effects of improved legislation, the fisheries showed a steady recovery and the combined catch of the rods and nets had risen to nearly 2,000 salmon by 1950.

Despite these improvements, the migratory salmonid fishery has never produced the level of catches seen in the early 19th century. This might in part be due to the use of inappropriate stock for the initial restocking programme. The Atlantic Salmon Trust guide-lines on stocking suggest that if it is necessary to stock with juvenile fish from another river system, this system should be chosen on the basis of it having a similar geography, geology and catchment profile as well as a salmon stock which is genetically similar. Clearly the Ribble and the Thurso are very different on the basis of these criteria and this might possibly be reflected in the lower catch levels now seen in the Ribble fisheries.

Therefore since the early 20th century, the Ribble stock has comprised of a residual indigenous stock crossed with stock of Scottish provenance. Over the years, the progeny of these fish will have become naturalised to the Ribble through natural selection. It would be sensible to

continue to use this stock for any future stocking programmes in the catchment.

In the mid to late sixties, the Ribble adult salmon and sea trout stocks were affected by the disease Ulcerative Dermal Necrosis (UDN).

Reports suggest that the impacts of this disease on the Ribble were not as severe as on other North West rivers, such as the Lune and the Kent. However, the reduction in catches by both the rod and net fisheries of the Ribble between 1966 and 1970 are probably largely attributable to UDN. The reduction in catches would not only be a direct result of fish mortalities caused by the disease, but also a result of a decrease in angling effort during the years in which stocks were affected.

The fisheries today.

The season for rod and line fishing for salmon runs from 1st February until 31st October and the season for migratory trout runs from 1st May until 15th October. In addition to national legislation (Salmon and Freshwater Fisheries Act, 1975) and local bye-laws, individual angling clubs often impose restrictions on permitted angling techniques for these species in their own waters. In general, both salmon and sea trout in the Ribble below Hodder Foot are fished for using fly, spinner, prawn and worm. Fishing methods on the Hodder and upper Ribble are more restricted and angling is usually by fly only, unless river flows exceed specified levels when spinning or worming are permitted. The specified levels are usually marked on the nearest roadbridge. Such method restrictions are enforced by the bailiffs of individual angling clubs.

Since the 1920's, the Ribble estuary has been subject to a Net Limitation Order, which allows six drift net licences to be issued each year. The fishery operates within a defined area and is strictly regulated. The netting season is from the 1st April to the last day of August and fishing can only take place from 6am on Monday until 6am on Saturday. The drift net used must not exceed 140 metres in length or be less than 82mm from knot to knot, which precludes the capture of all but the largest sea trout.

3. SOURCES OF INFORMATION.

The information used to compile this report has been obtained from fisheries records collated by the various authorities responsible for fisheries in the North West since the 1930's.

Catch data from the Ribble salmon and sea trout fisheries have been recorded annually since 1937. This information

is taken from catch returns made by both rod and line anglers and commercial netsmen.

The North West Water Authority, Rivers Division, produced annual reports which provide a more detailed summary of fisheries data from the region between 1974 and 1987. The NRA, North West Region, Fisheries Function, has produced an annual summary of fisheries statistics from 1988 to the present. The data from this set of annual reports (1974-1991) that have been analysed in detail within this report.

The summaries since 1974 include:

3.1. Net data.

Each licensed netsman is required, by law, to submit a catch return on a monthly basis throughout the netting season. These returns must give details of the species, number and size of any fish caught. Nil returns must also be submitted.

The fishery is closely monitored by the Fisheries Bailiff team and catch returns are checked by Fisheries staff for any errors and discrepancies. There has been a very slow turnover of netsmen operating in the estuary, which has helped to maintain a high degree of continuity in both the sources and quality of the catch information.

3.2. Rod data

All salmon and sea trout anglers are required, by law, to submit an annual return to the regulatory authority. This return must give details of the number, size, species and location of capture, for any fish caught.

The quality of these data, as a record of the number of salmon and sea trout caught in the Ribble catchment each year, is dependent upon both the proportion of anglers who complete a return each year and the accuracy with which these returns are completed. Nil returns must also be submitted.

Unfortunately an analysis of catch per unit effort cannot be carried out, because no angling effort data is recorded. However licence sales are recorded and provide a crude indication of fishing effort. Unfortunately the format used to record licence sales has not been consistent and for this reason the information is not examined in any detail within this report.

The size of the catch from a fishery has been identified as being dependent upon the parameters of stock density, fishing effort and the catchability of the stock (Gulland, 1969).

The number of fish available for exploitation by a fishery has also been shown to affect angling success.

For example, a strong relationship between catch and fish counts, taken at a counter downstream of the fishery on the previous day, was found in the River Erriff salmon fishery (O'Farrell, M.M., Whelan, K.F., Joyce, T. and Whelan, B.J. 1989).

It has been shown that most, but not all, of the variation in annual and monthly catch for the Burrishoole fishery in Ireland was attributable to stock levels, fishing effort and environmental factors (Mills, C.P.R, Mahon, G.A.T and Piggins, D.J. 1986). Of these the most important single determinand of catch was found to be fishing effort.

Gee (1980), found that salmon rod catches in the upper Wye were recorded near the peaks of the hydrograph and that the highest catch rates coincided with falling water levels. Alabaster (1970), suggested that the relationship between angling success and flow was related to fish movement. Banks (1969), highlighted the difficulty of determining the likely effects of the many possible stimuli which the salmon will receive from covariable factors such as temperature, turbidity, atmospheric pressure, cloud cover, pH and conductivity.

Clearly there are many factors affecting the rod catch from a fishery and the relationship between them is complex. This report attempts to identify a possible relationship between catch and stock abundance in the Ribble. However, no attempt has been made to investigate the other factors affecting angling success.

3.3. Redd counts.

Each year since 1974, Fisheries Bailiffs have surveyed the principal salmon and sea trout spawning becks in the North West Region and made a visual estimate of the number of salmon and sea trout redds present.

No set number of redd surveys were carried out each year, nor was any particular method used to count the redds. A large variation in both redd counting effort and accuracy could therefore be expected between different years and between rivers.

3.4. Resistivity counter data.

Three electronic fish counters have been operated in the Ribble catchment since 1974. The counters are situated at Winckley Hall near the foot of the River Hodder and on the Ribble at Waddow Hall (near Clitheroe) and Locks weir (near Settle). Each counter records the number of adult migratory salmonids passing either up or downstream over a set of electrodes, which are set into the bed of a fish pass.

In 1992, the counters were upgraded to 'Logie' type counters, which are more accurate than the original

equipment. The older counters were limited in their ability to accurately size fish. The counters at Winckley Hall and at Waddow Hall could distinguish between fish of greater or less than 4 pounds in weight, so some crude differentiation between salmon and sea trout is possible from data recorded at these sites.

However no validation of the counter performance has been carried out and the counter data should be treated as a monitor of trends in the annual abundance of fish, rather than a definitive count of population numbers. There is doubt over the operational effectiveness of the old counters and reported problems of low counts, false counts and equipment failure were common, particularly at the Waddow and Winkley sites.

3.5. Exploitation rates.

The exploitation rate of a fish stock is the percentage of that stock which the fishery takes in a specified period of time.

It is not considered that accurate exploitation rates by the Ribble net or rod fisheries can be calculated from the available data because of a lack of information on stock levels. Combined exploitation rates by the Ribble fisheries have been estimated to be as high as 85% using the available catch and fish counter data (Small,I. University of Liverpool Dept of Zoology. 1992, Pers. Comm.). However, the counter data are not believed to be of sufficient accuracy to be used for this purpose. No attempt to calculate exploitation rates has been made within in this report.

4. RESULTS AND DISCUSSION.

4.1. Ribble salmon catches, 1937-1991.

The annual salmon rod, net and total catches for the Ribble catchment from 1937-1991 are shown in Figure 1. Overall, the graph shows an increasing trend in reported rod catches since 1937, with a peak in 1980 of 956 fish. The lowest recorded catch was just 33 fish in 1959.

Since 1974 (when the NWWA Annual Summary of Fisheries Data was first produced), there has been an overall increase in reported rod catches with peak catches in 1974, 1980 and 1988. Since 1970, the total reported rod catch has been at a similar level to the commercial net catch and was in fact higher than the net catch in several years, including 1974, 1980 and 1991.

This increase in reported catches may well have been partly due to both an increase in angling effort and an increase in the effort put into data collection. For example, seasonal salmon licence sales increased between 1974 and 1990 (Figure 2).

In 1989, there was a large decrease in reported catch followed by a slight recovery in 1990 and 1991. This decrease in recorded catch was not to a lower level than has occurred in some previous years.

In contrast, the annual salmon drift net catch for the same period shows a decreasing trend since 1937. The highest recorded catch was 1770 fish in 1948 with a minimum of 106 fish in 1956. There was a large decline in catch in 1989 but as for the rod fishery, this decline was not to a lower level than has been seen previously.

4.2. Ribble sea trout catches, 1937-1991.

The annual sea trout rod catch for the Ribble catchment from 1937-1991 is shown in Figure 3. The graph shows a decreasing trend in reported catches from 1937-1978. Reported catches over this period ranged from a peak of 1,706 fish in 1938 to a minimum catch of 85 fish in 1968. Subsequently, there was an increasing trend in reported catches from 1968-1991, with peak levels of 862 fish and 848 fish in 1980 and 1988 respectively.

4.3. Comparison between salmon and sea trout rod catches both from the River Ribble and from other rivers in the North West Region.

Catches of sea trout from the River Ribble (1974-1991) were strongly correlated with those of salmon for the same period (r_S=0.666, P<0.01). In other words, years in which a good catch was made by the salmon rod fishery also tended to produce a good catch from the sea trout fishery.

This might be due to salmon and sea trout rod catches being affected by fishing conditions in a similar way, or could indicate that sea trout and salmon stock levels in the Ribble catchment followed a similar annual pattern over this period, so that the stock available to each fishery varied in a similar way.

No correlation was found between annual sea trout and salmon rod catches throughout the North West Region as a whole. This may indicate that over this wider geographical area, different fishing conditions and/or significant annual differences in stocks of available fish were affecting salmon and sea trout catches.

4.4. Comparison between salmon rod and net catches both from the River Ribble and from other rivers in the North West Region.

There was a strong correlation between the annual catches of the Ribble rod and net fisheries from 1974 to 1991. (r_S=0.792, P<0.01). Years in which a good catch was made by the rod fishery also tended to be years when high catches were recorded from the net fishery. Conversely, a

poor annual catch from the rod fishery tended to coincide with a poor annual catch by the drift nets.

This correlation between the rod and net catches might result if the same environmental factors influenced fishing success. For example, a similar catch pattern for the net and rod fisheries could occur if environmental conditions, such as patterns of river flow and temperature, affected both fisheries in a similar way.

However, the two fisheries operate in very different environments and use different fishing methods. Therefore it seems much more likely that the similarity between the catch patterns of the two fisheries is due to the fact that they exploit a common stock and that catches for both fisheries are related to the number of fish available.

The differences in actual numbers of fish caught by the two fisheries each year are probably accounted for by differences in fishing method, annual fishing effort and fishing conditions.

Using catch data from rivers throughout the entire North West Region, no correlation was found between the total salmon rod and net catches (1976-1991). This suggests that on a regional level, the nets and/or rods are exploiting the available stock in a different way to that seen on the Ribble. This is not surprising considering the different types of net fisheries and methods of fishing found in the region (eg. drift nets, haaf nets and lave nets).

4.5. Exploitation of different Ribble salmon stock components.

The adult salmon stock which returns to the Ribble is known to be composed of three major components; spring, and autumn runs of multi sea-winter salmon and a summer and autumn run of one sea-winter grilse. However, the exact proportion of these components has not yet been determined and almost certainly fluctuates on an annual basis.

It was established in the previous section that there is a strong correlation between Ribble rod and net catches (1974-1991). This might seem unlikely given the difference in fishing season between the two fisheries, which precludes the nets from exploiting spring fish which are available to the rods, and the mesh size of the drift nets which should prevent the capture of smaller grilse.

However, rod catches of spring fish only form a small proportion of the total rod catch each year and as such would not significantly reduce the correlation between the catches from the two fisheries.

Spring, summer and autumn rod catches for Ribble salmon from 1976 to 1991 are compared in Figure 4. The seasonal catch pattern for the Hodder over the same period is shown in Figure 5. The graphs show that both the Ribble and Hodder are predominantly autumn fisheries, with a smaller proportion of summer fish and only occasional spring salmon.

Also evidence from catch returns and scale samples from the drift net fishery indicates that the mesh size used does not prevent the grilse component of the stock from being exploited. For example, of the 20 scale samples taken from net caught salmon in 1991, 12 (60%) were from grilse and of the 24 scale samples taken in 1992, 7 (29%) were found to be from grilse. In the catch returns from the net fishery only salmon of less than 4lbs in weight are recorded as grilse. However, the actual weight records for fish caught show that numbers of fish of between 5lbs and 8lbs are caught each season, and these are likely to be mainly grilse.

The seasonal catch pattern for the net fishery (1976-1991) is shown in Figure 6. It can be seen that peak catches were made at the end of the netting season in August. This is consistent with the hypothesis that the net fishery exploits both the grilse and summer/autumn multi sea-winter components of the Ribble stock.

Thus the strong correlation between Ribble rod and net catches can be explained by the fact that both types of fishery predominantly exploit the same components of the available stock.

4.6. Comparison between salmon and sea trout rod catches from the Ribble and Hodder.

When considering rod catches for both salmon and sea trout from the Ribble and Hodder, a complicating factor is the number of fish caught in the Ribble below Hodder Foot. These fish may have been destined to spawn in either of the two rivers but are recorded as 'Ribble' fish and are treated as such for the purpose of this report. A further breakdown of the catch data to indicate the proportion of fish caught in a particular areas of the catchment each year would be useful. This information might be available from the archives of angling clubs which traditionally fish particular beats on the river.

a) Salmon.

The reported salmon rod catches for the Ribble and Hodder from 1974 to 1991 are compared in Figure 7. There was a strong correlation between the reported catch patterns from the two rivers (r_S=0.634, P<0.01). Years in which a good reported catch was made by the salmon rod fishery on the Ribble also tended to produce a good reported catch from the Hodder. Conversely, a poor reported annual catch

from the Ribble tended to coincide with a similarly poor year for the Hodder anglers.

As with the correlation between the reported salmon and sea trout catch patterns, this strong correlation could be due to a similarity in fishing conditions from year to year, and/or the annual pattern of stock levels in the two rivers.

As shown in Figures 4 and 5, both the Ribble and Hodder are predominantly autumn fisheries, with a smaller proportion of summer fish and occasional spring salmon.

b) Sea trout.

There was a strong correlation between the annual pattern of reported sea trout rod catches for the Ribble and Hodder between 1974 and 1991 (r_s=0.612, P<0.01). Good reported annual sea trout catches on the Ribble tended to coincide with good reported annual catches from the Hodder.

As for the salmon fishery, this strong correlation between the Ribble and Hodder reported catch patterns might be due to a similarity in fishing conditions from year to year, and/or a similarity in the annual pattern of stock levels in the two rivers.

The seasonal catch patterns for sea trout on the two rivers are similar (Figures 8 and 9). On both rivers the least catch of fish is in May and June, followed by increased catches in July and August and a smaller catch in September and October.

4.7. Comparison between annual salmon catches from the Ribble, Hodder and other salmon and sea trout fisheries in the North West Region.

The annual recorded rod catches of salmon from the Ribble and Hodder (1974-1991), are compared with the total annual reported salmon rod catch from the North West Region for the same period in Figure 10. (NB. The total North West Region rod catch is divided by 10 to enable it to be shown on the same axis as the Ribble and Hodder rod catches).

There was a strong correlation between annual catches from the Ribble and Hodder salmon rod fishery and the North West total (r_s=0.567, P<0.01). A similar, strong correlation was found between reported sea trout rod catches for the region as a whole and for the Ribble and Hodder over the same period (r_s=0.660, P<0.01).

The annual salmon rod catches from the rivers Ribble, Hodder, Lune and Eden from 1974 to 1991, are shown in Figure 11. As you would expect,given the strong correlation between the Ribble and Hodder rod catches and those of the North West Region, there is a great deal of

similarity between the annual catch patterns of these four individual rivers. However the trends in numbers of fish caught each year are very different. The Eden and Lune show a trend of increasing catches over this period whereas the catch levels for both the Ribble and Hodder remained fairly constant.

At present the reasons for this difference are not known but it is likely to be a reflection of one or more of the following factors:

i. Water quality and water quantity in the respective rivers and estuaries.

ii. The juvenile production of the catchments. This in turn will be related to the availability of spawning and nursery habitat, food availability, the number and distribution of successful spawners each year, predation, disease and environmental factors.

iii. Angling effort and fishing conditions.

iv. Netting exploitation rates and the methods of netting used.

However assuming similar sea survival of these stocks, which is likely, it seems probable that the difference in catch levels are mainly a reflection of different levels of smolt production from the four rivers.

4.8. Comparison between salmon rod catches and counts of salmon redds.

Figure 12 shows the annual salmon rod catches from the Ribble and Hodder between 1976 and 1991 compared with the annual salmon redd count data for the same period. No redd counting took place in the Ribble catchment in 1976, 1979 or 1980 due to high flows during the spawning season.

The Spearman's Rank correlation (r_s) used for other statistical analyses in this report failed to demonstrate a correlation between the annual pattern of Ribble and Hodder salmon catches and the annual pattern of salmon redd counts. However, the less powerful Ives and Gibbons correlation coefficient (Gibbons, 1976) showed a weak relationship to exist (r_n= 0.636, $P<0.05$). This showed that a correlation exists between annual increases and decreases in the level of catch compared to the previous year and increases and decreases in the number of redds observed.

Given both the large variability in effort invested in redd counting between years and the likely variability in the accuracy of catch return data it is surprising that any correlation was found between catch and redd numbers. Since the numbers of redds are related to the number of spawning fish present, this result indicates that there

could well be a relationship between catch levels and stock abundance in the Ribble catchment.

A stronger correlation was seen between the total reported rod catch for the North West Region and the total redd count for the same area between 1974 and 1991 (r_s=0.558, P<0.05). This might be expected as a result of the increase in sample size of the regional data, which would to some degree compensate for the variability in data quality from individual catchments. This result further suggests that a relationship exists between catch and stock levels.

4.9. Comparison between catch levels and fish counter data from the Ribble and Hodder.

If a relationship exists between annual catch and stock abundance, as illustrated by the correlation between annual rod catches and redd counts, then a correlation would also be expected between the annual rod catches from the Ribble and Hodder and the data recorded annually by the three fish counters which operate in this catchment.

There was a strong correlation between the annual Ribble salmon rod catches and fish counts at Locks Weir, between 1976 and 1991 (r_s=0.643, P<0.01). The clear relationship that exists between counts at this site and annual catch levels lends further evidence to suggest that there is a relationship between annual catch and stock abundance in the Ribble. It is interesting to note that this relationship exists despite the fact that this counter is located upstream of the main salmon angling areas of the Ribble.

However, no correlation exists between fish counts recorded either at Waddow Hall counter on the Ribble and Ribble salmon rod catches (1976-1991) or between counts at Winkley Hall on the Hodder and the Hodder salmon rod catches over the same period.

Given the strong correlation between rod catches and fish counts found at Locks Weir, the absence of any such correlation for the Waddow and Winkley counts strengthens previously held doubts about the accuracy of the count data generated at these two sites. Problems have been highlighted at both Waddow and Winkley counters over the years and in 1992 new 'Logie' counters were installed at all three sites on the Ribble. This new equipment is far more accurate and sensitive than the previous counters. It is vital that validation of the new counters is carried out, to assess their accuracy in future years.

5. CONCLUSIONS.

1. Annual reported rod catches of salmon from the Ribble catchment showed an increasing trend from 1937-1991, with a peak catch of 956 fish in 1980. In 1989 there was a large decrease in reported catch followed by a slight recovery in 1990 and 1991.

2. In contrast, the net fishery showed a decline in catches during the same period. The peak catch from the net fishery was 1770 fish in 1948, with a minimum catch of 106 fish in 1956. Since the early 1970's, both the rod and net fisheries have produced similar levels of annual catches.

3. Annual reported rod catches of sea trout from the Ribble catchment showed an increasing trend from 1968-1991, with a peak catch of 862 and 848 fish in 1980 and 1988 respectively.

4. The strong correlation in annual catch patterns for the Ribble salmon net and rod fisheries indicates that both fisheries are generally exploiting the same components of the available stock. Catch returns and scale samples indicate that the main components exploited are the grilse and multi sea-winter summer/autumn fish.

5. No correlation exists between the reported annual North West net and rod salmon catch. This indicates that at a regional level, a greater degree of selectivity by different fisheries for particular stock components is found. This might result from differences in mesh size and fishing techniques between the net fisheries of different river systems.

6. The close correlations shown to exist between the rod catches of salmon from the Ribble, Hodder and the other North West region salmon rivers, suggests that a common factor or suite of factors determines the regional pattern of rod catches.

7. Similar correlations were found between the annual catches of rod caught sea trout from the Hodder, Ribble and in the region as a whole. This suggests that, as for the salmon rod catches, one or more common factors determine a regional pattern of annual sea trout rod catches.

8. Despite the common trend in the annual regional pattern of salmon rod catches, the Ribble, Hodder, Lune and Eden show different trends in the absolute numbers of salmon caught each year. Annual salmon rod catches from the Lune and Eden (1980-1991) have increased to a much higher level than rod catches from the Ribble and Hodder during the same period. The cause of this difference is unknown but could be due to different levels of smolt production from the four rivers.

9. The correlation between redd counts and annual salmon catches at both a regional level and, to a lesser degree, at a local level on the Ribble and Hodder, indicates that a relationship exists between the level of catch and the abundance of spawning fish in any particular year.

10. There was a strong correlation between the annual reported salmon rod catches from the Ribble and the number of fish counted at Locks Weir between 1976 and 1991. However, no correlation between salmon catches and counts was found at either Waddow or Winkley counters. This reinforces previously held doubts about the accuracy of the count data generated at these two sites.

6. RECOMMENDATIONS

1. Emphasis should be placed on the collection of high quality catch per unit effort (CPUE) data from Ribble anglers and netsmen. Comparison between the Ribble and other rivers in the North West Region can only be made if this information is gathered in a consistent manner across the entire region. The Logbook scheme should be continued, expanded and where necessary this information should be supplemented by annual catch returns and creel censuses.

2. Exploitation rates (catch/stock x 100) of salmon and sea trout by the Ribble net and rod fisheries should be calculated. For the net fishery this would require mark and recapture and/or radio tracking studies in the estuary. Exploitation rates by the recreational fishery could be calculated by using fish counter and catch return data. The evaluation of exploitation rates would enable informed policies to be developed for the control of exploitation to protect stocks, should it be found necessary.

3. Scale samples and fish lengths and weights should be obtained from as many rod and net caught fish as possible, in order to examine the population structure and the different stock components exploited by these fisheries.

4. Emphasis should be placed on obtaining high quality count data from the new counters on the Ribble and Hodder. In particular, counter validation at these sites should be carried out as soon as possible. Accurate counter data will enable the relationship between catch and stock abundance to be assessed more fully.

5. The facilities at Waddow trap should be fully exploited. They can be used for collecting scale samples, population composition studies, screening for microtagged fish, counter validation and broodstock selection. The installation of other trapping sites at Locks weir and on the Hodder should be considered to allow comparisons to be made between different areas of the catchment.

6. Stock assessment should be used to gather as much information as possible on annual variations in the juvenile densities and likely smolt output from the Ribble catchment. In this way, the relationship between juvenile output and adult return can be studied. The installation of a smolt trap at a representative site in the catchment should be considered.

7. A standard protocol for redd counting should be adopted and further effort put into the development and use of this technique. Effort data for redd counting should be recorded in an attempt to better define the relationship between catch, stock abundance and numbers of spawning fish.

8. Emphasis should be placed on obtaining high quality catch data from those areas of the Ribble where there is a mixed salmonid and coarse fishery and where angling clubs tend to have a large and changing membership. In particular it has been very difficult to obtain high quality catch data from the Ribble below Calder Foot and it is essential that this shortfall is rectified.

9. Further investigation of the factors which might be determining regional catch patterns and possibly stock levels, should be considered. Such studies would require high quality data on a wide range of parameters, such as seasonal river flow, and seasonal temperatures. The effects of these parameters on each stage of the salmonid life cycle and angling success would have to be quantified.

10. The compilation of a report such as this has been difficult because of changes that have been made in the way that data has been recorded over the years. These changes have resulted from:

i. Regional boundary changes
ii. Changes in legislation.
iii. Changes in the specific type of information collated in reports.

If the maximum benefit is to be gained from the recording of historical fisheries data, it is vital that in the future a consistent format for reporting is adopted and that the existing historical record is transformed to fit this new format where possible.

The collation of data on a catchment by catchment basis would provide the best format for such data records.

7. REFERENCES.

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FIGURES.

Ribble salmon fishery.
Annual catch data, 1937-1991.

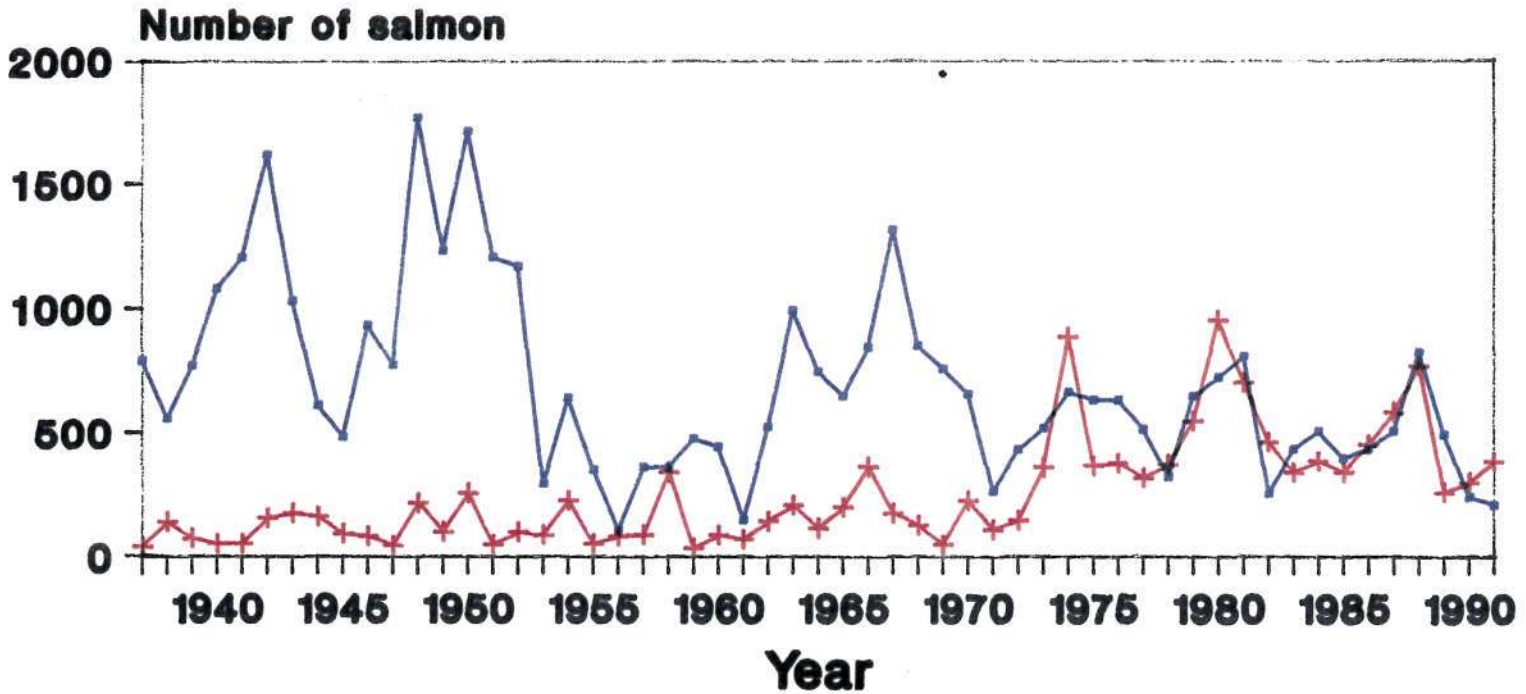

Figure 1.

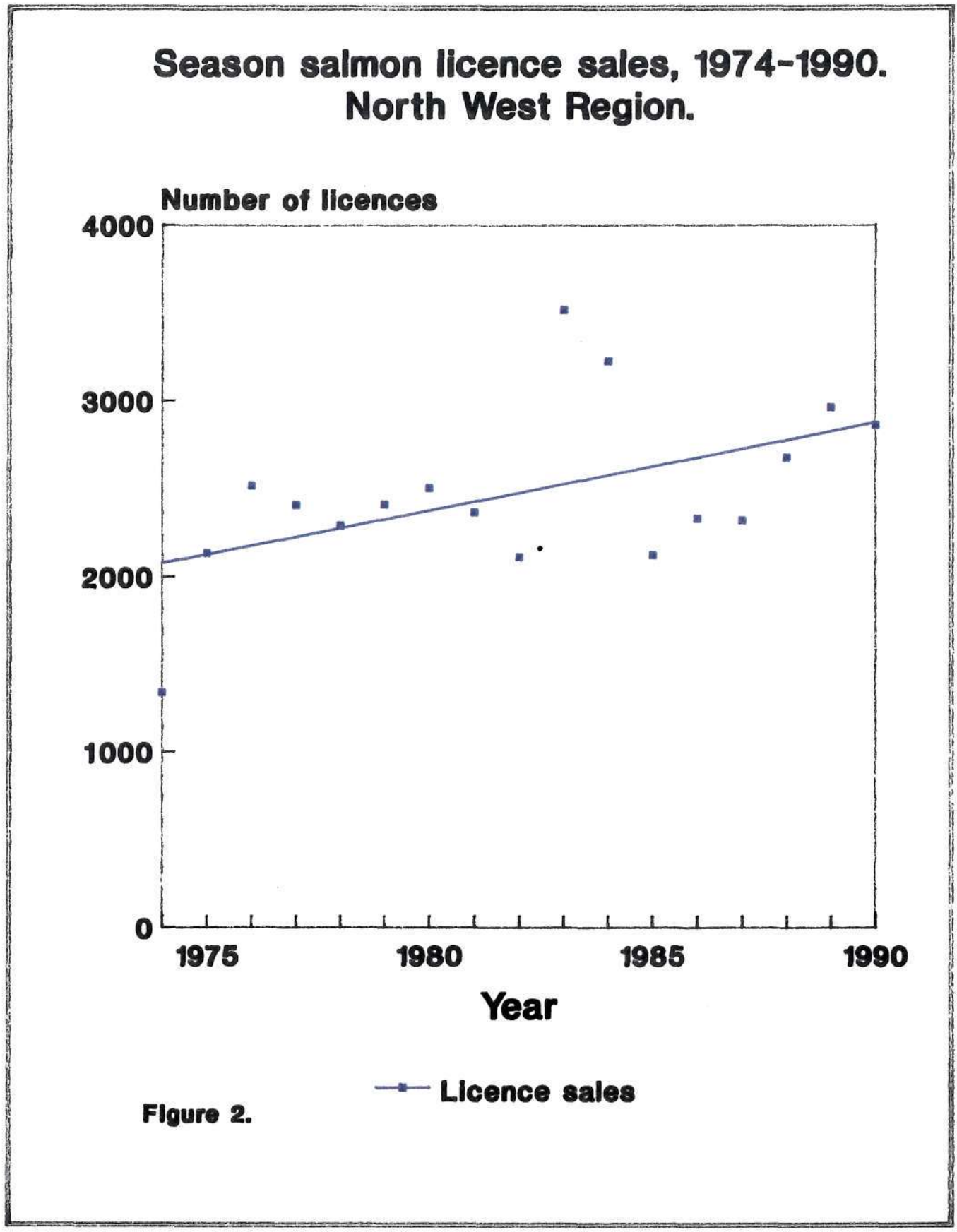
Season salmon licence sales, 1974-1990.
North West Region.
Number of licences
4000
3000
2000
1000
0
1975
1980
1985
1990
Year
Licence sales

Figure 2.

Ribble sea trout fishery.
Annual catch data, 1937-1991.

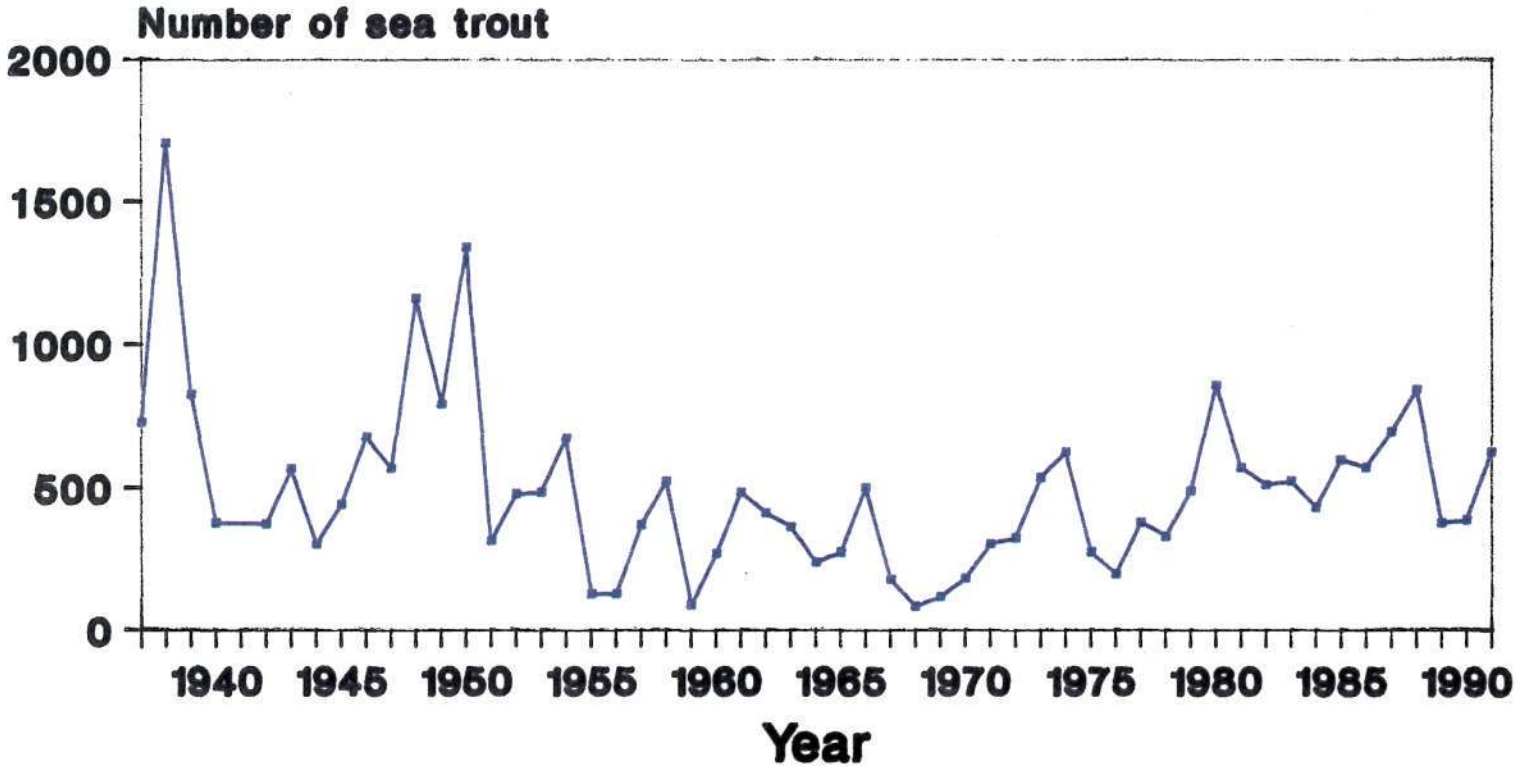

Figure 3.

Rod catch data includes River Hodder.

RIBBLE SALMON ROD CATCH 1976-1991.

COMPARISON BETWEEN SPRING, SUMMER AND AUTUMN CATCHES.

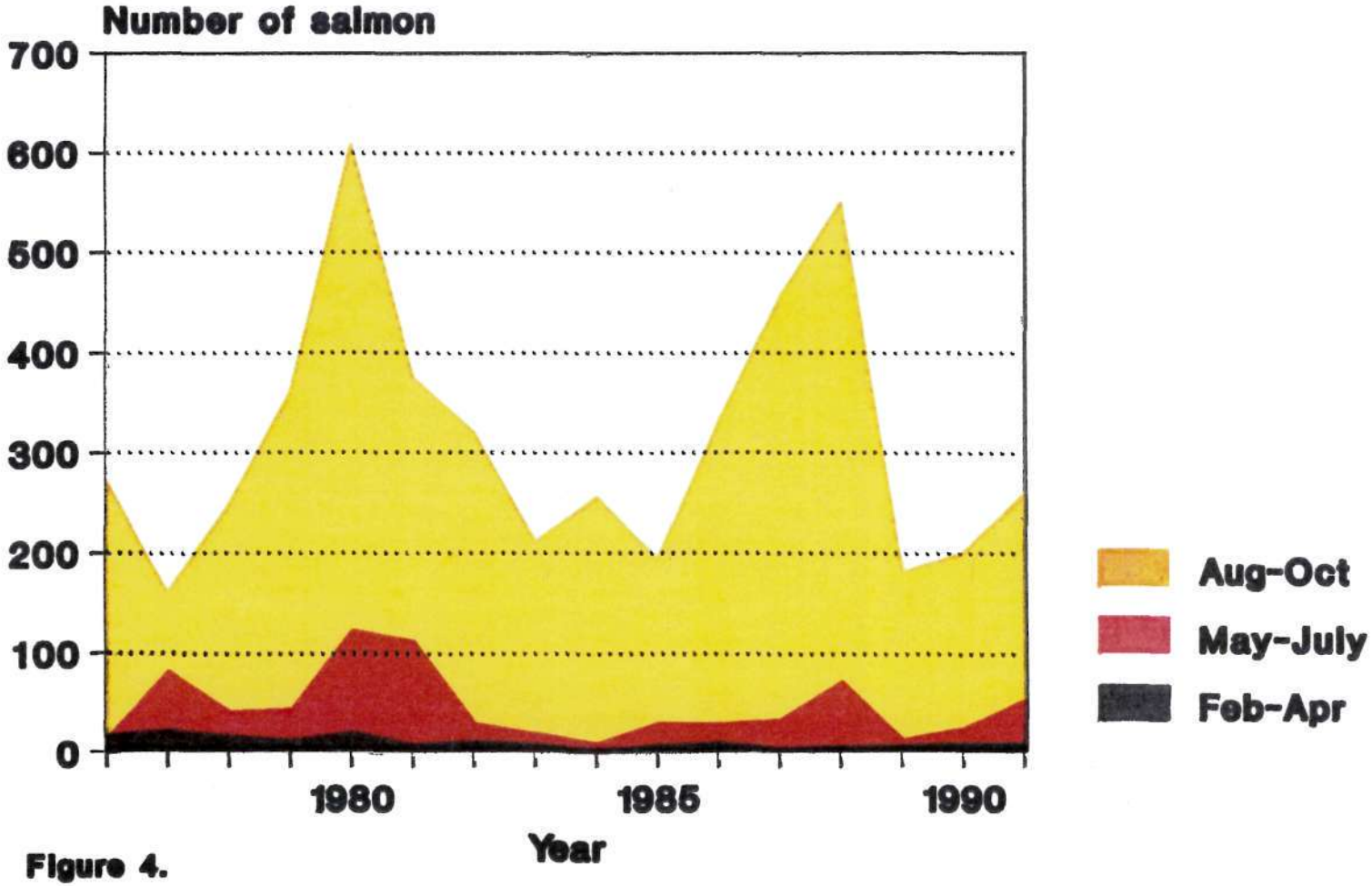

Figure 4.

HODDER SALMON ROD CATCH 1976-1991.
COMPARISON BETWEEN SPRING, SUMMER AND AUTUMN CATCHES.

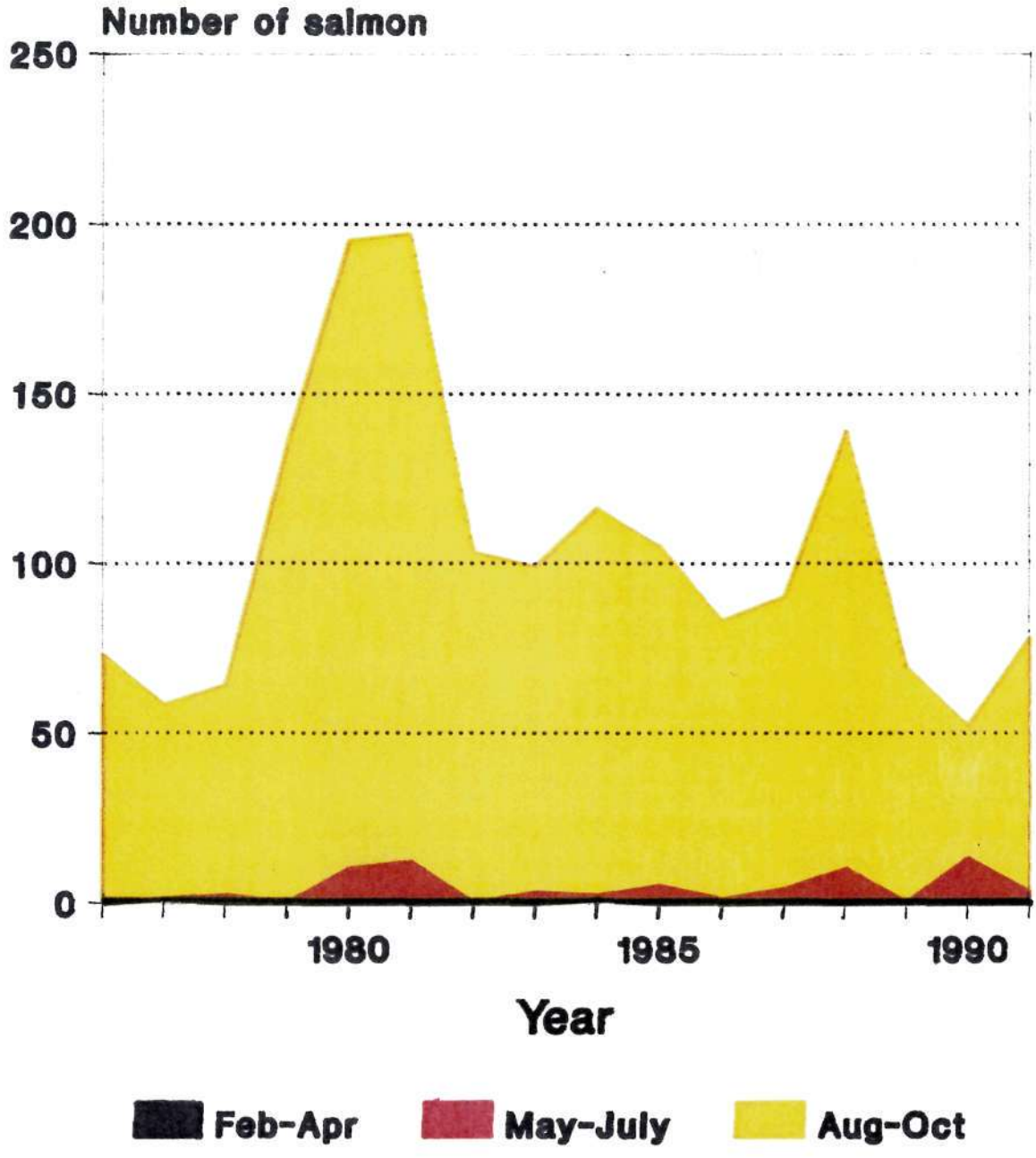

Figure 5.

Ribble salmon fishery
Monthly net catch data

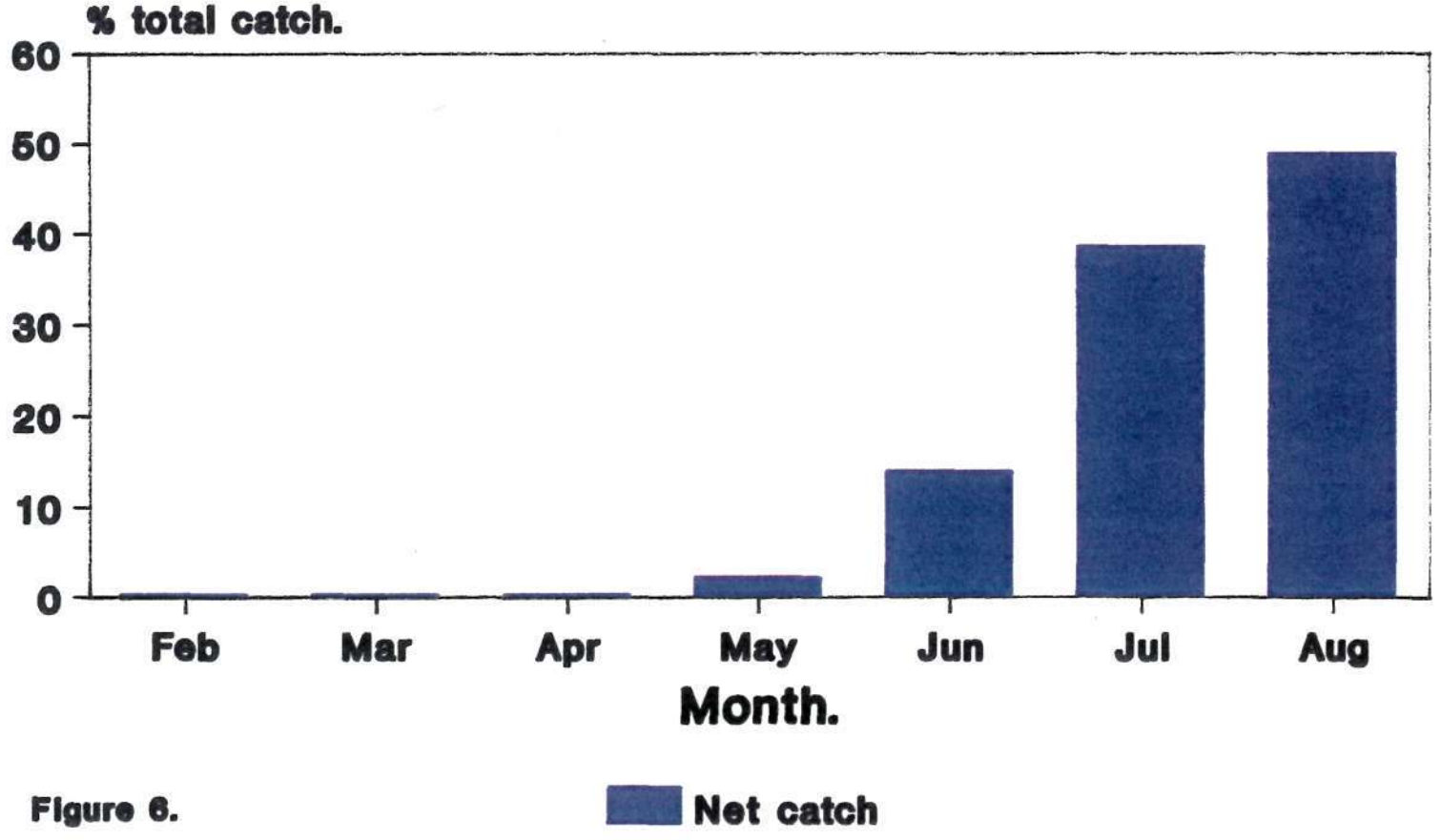

Figure 6.

Percentage of total catch (1974-1991).

SALMON ROD CATCHES, 1976-1991.

Comparison between annual rod catches on the Ribble and Hodder.

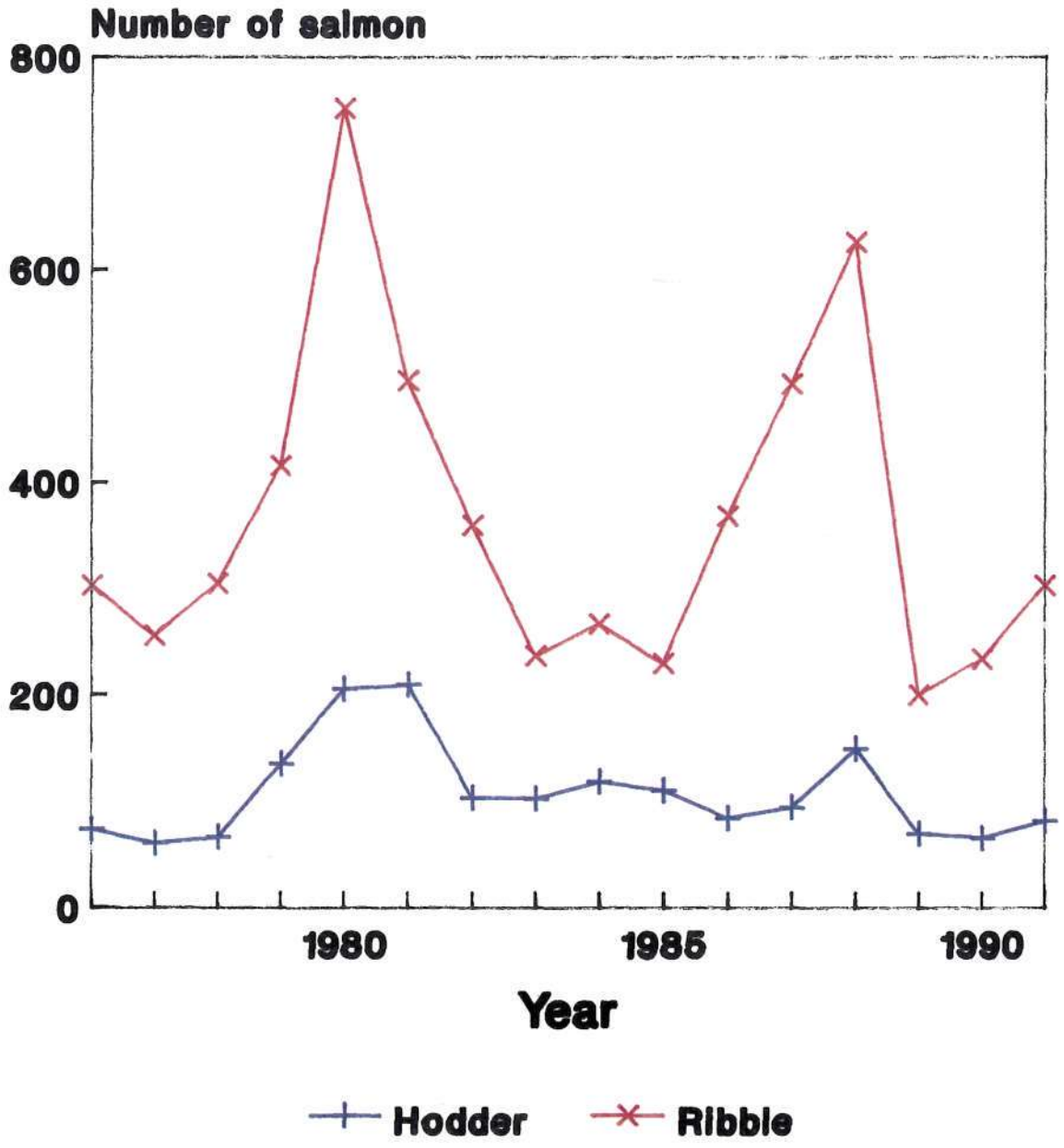

Figure 7.

RIBBLE SEA TROUT ROD CATCH, 1976-1991.
COMPARISON BETWEEN SPRING, SUMMER AND AUTUMN CATCHES.

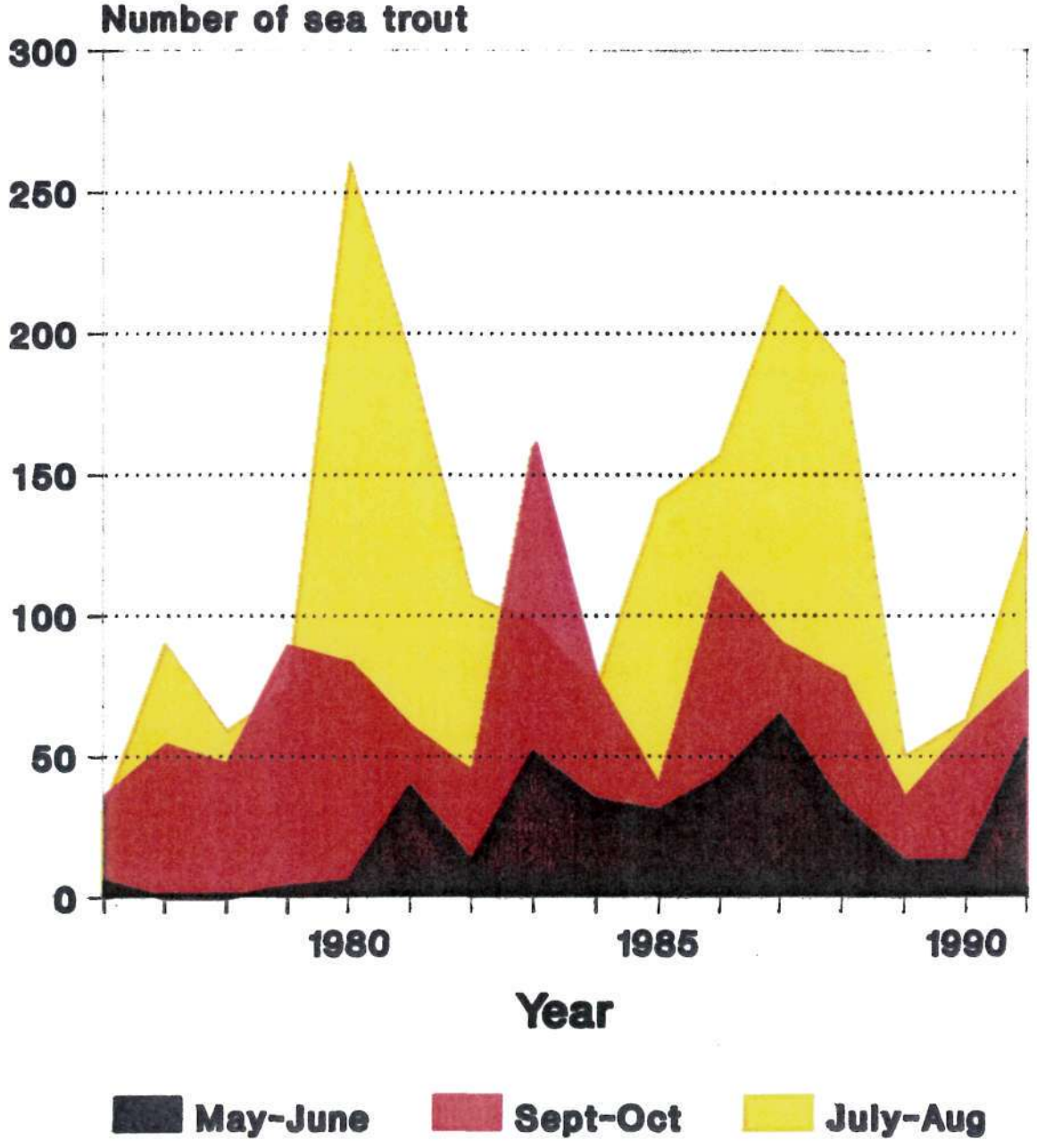

Figure 8.

HODDER SEA TROUT ROD CATCH, 1976-1991
COMPARISON BETWEEN SPRING, SUMMER AND AUTUMN CATCHES.

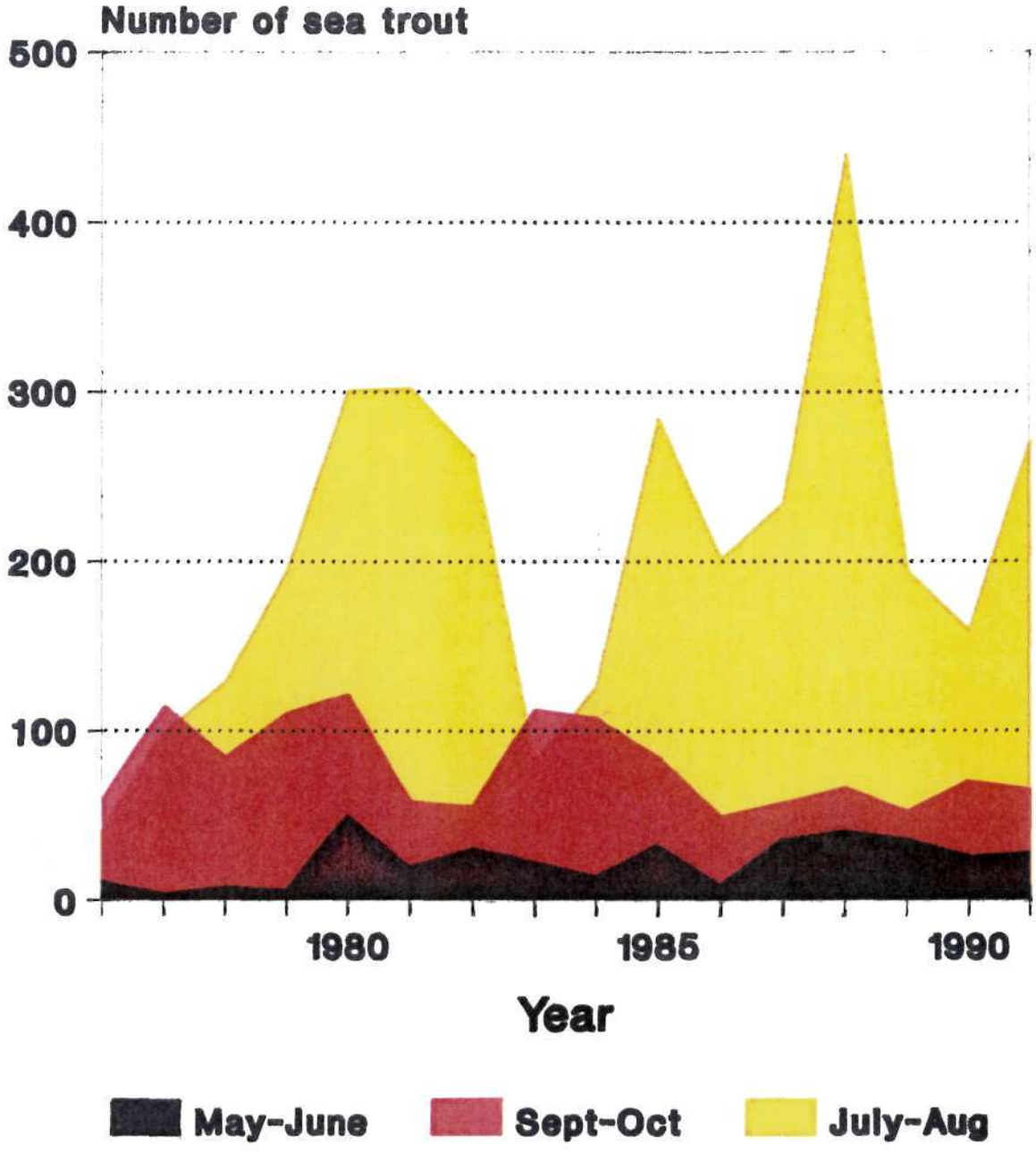

Figure 9.

SALMON ROD CATCHES, 1976-1991.

Comparison between annual rod catches; Ribble, Hodder & North West Region.

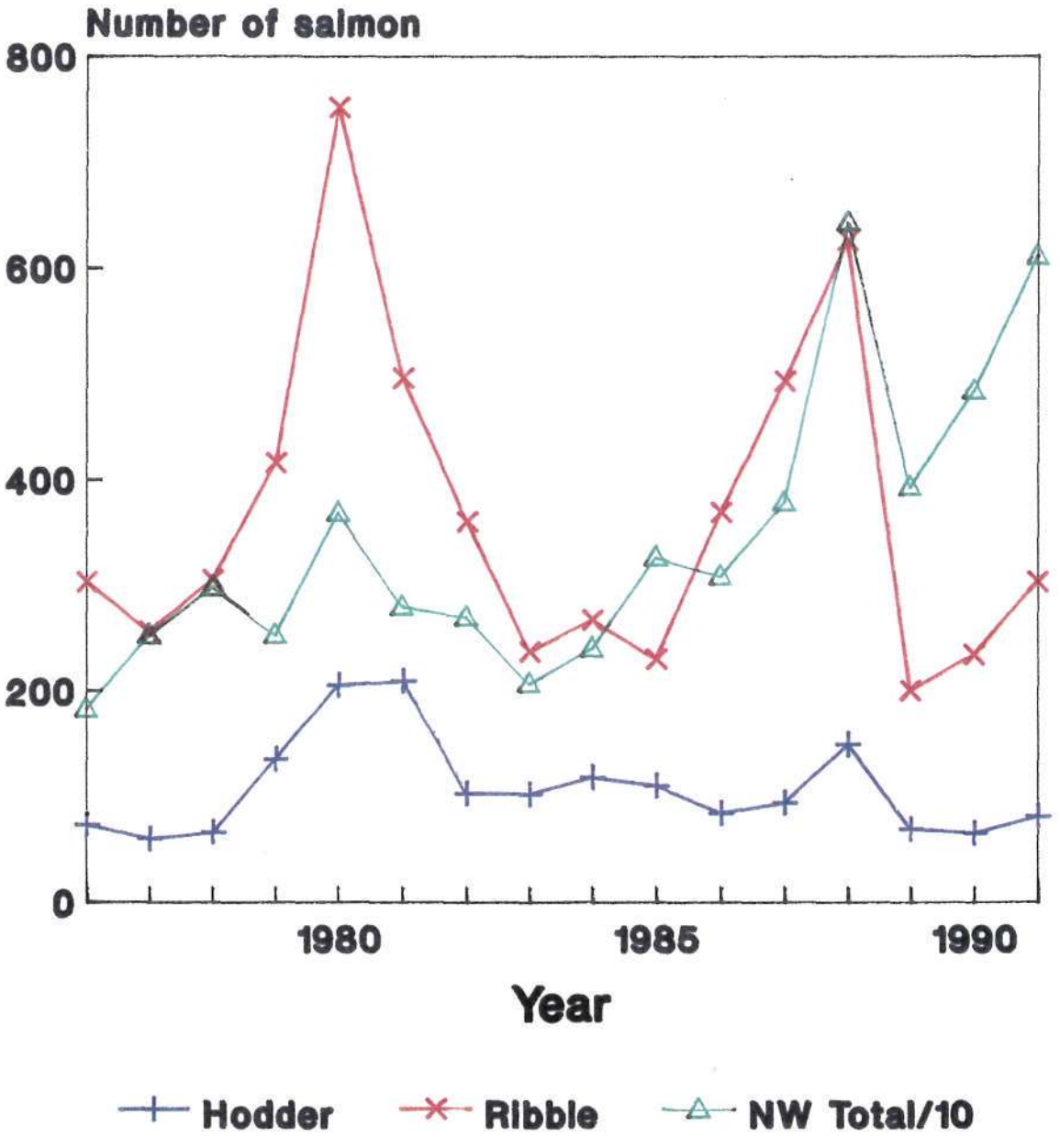

Figure 10.

SALMON ROD CATCHES, 1976-1991.

Comparison between annual rod catches on the Ribble, Hodder, Lune & Eden.

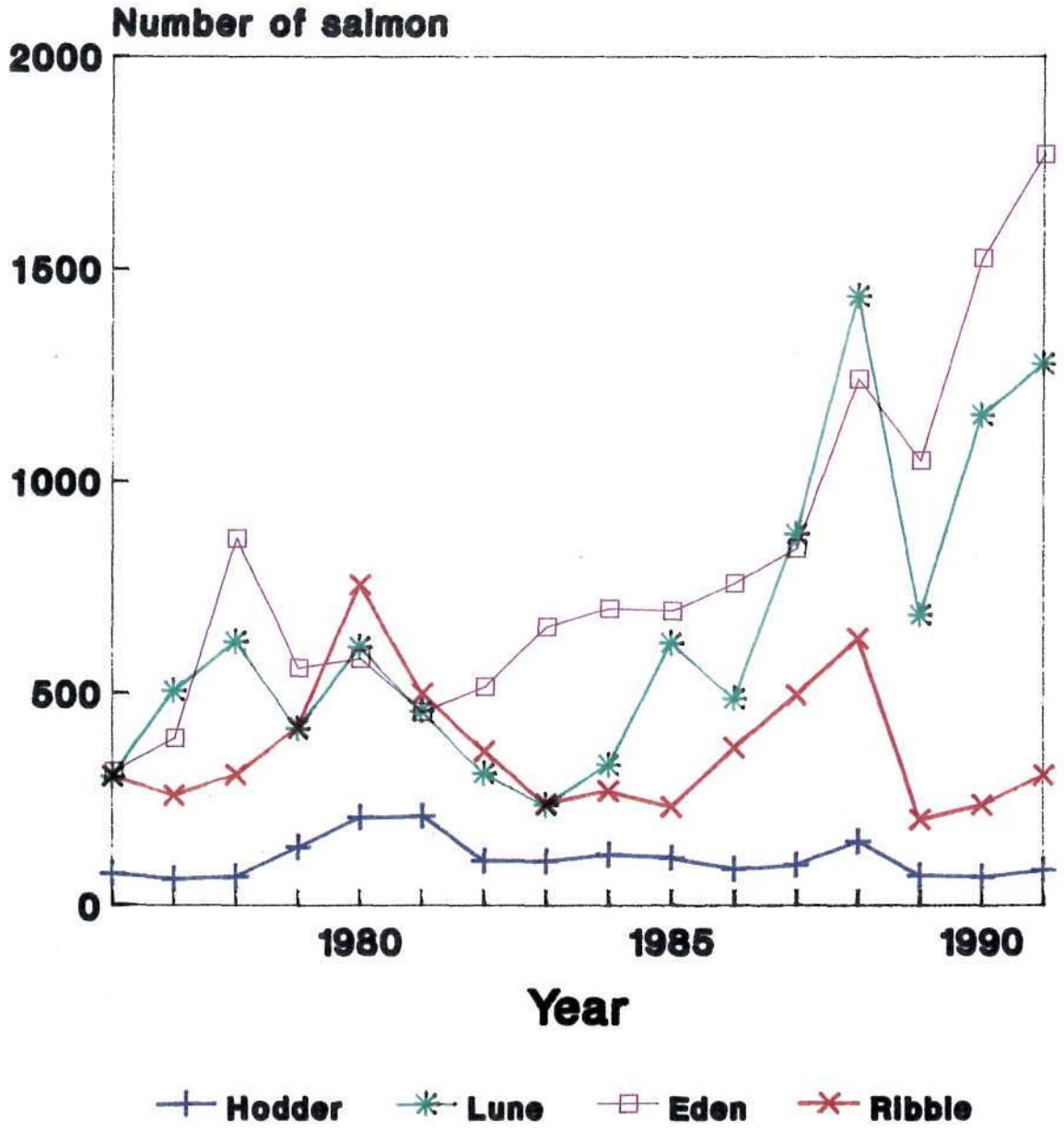

Figure 11.

SALMON ROD CATCHES, 1976-1991.

Comparison between annual rod catches and redd counts on the Ribble and Hodder

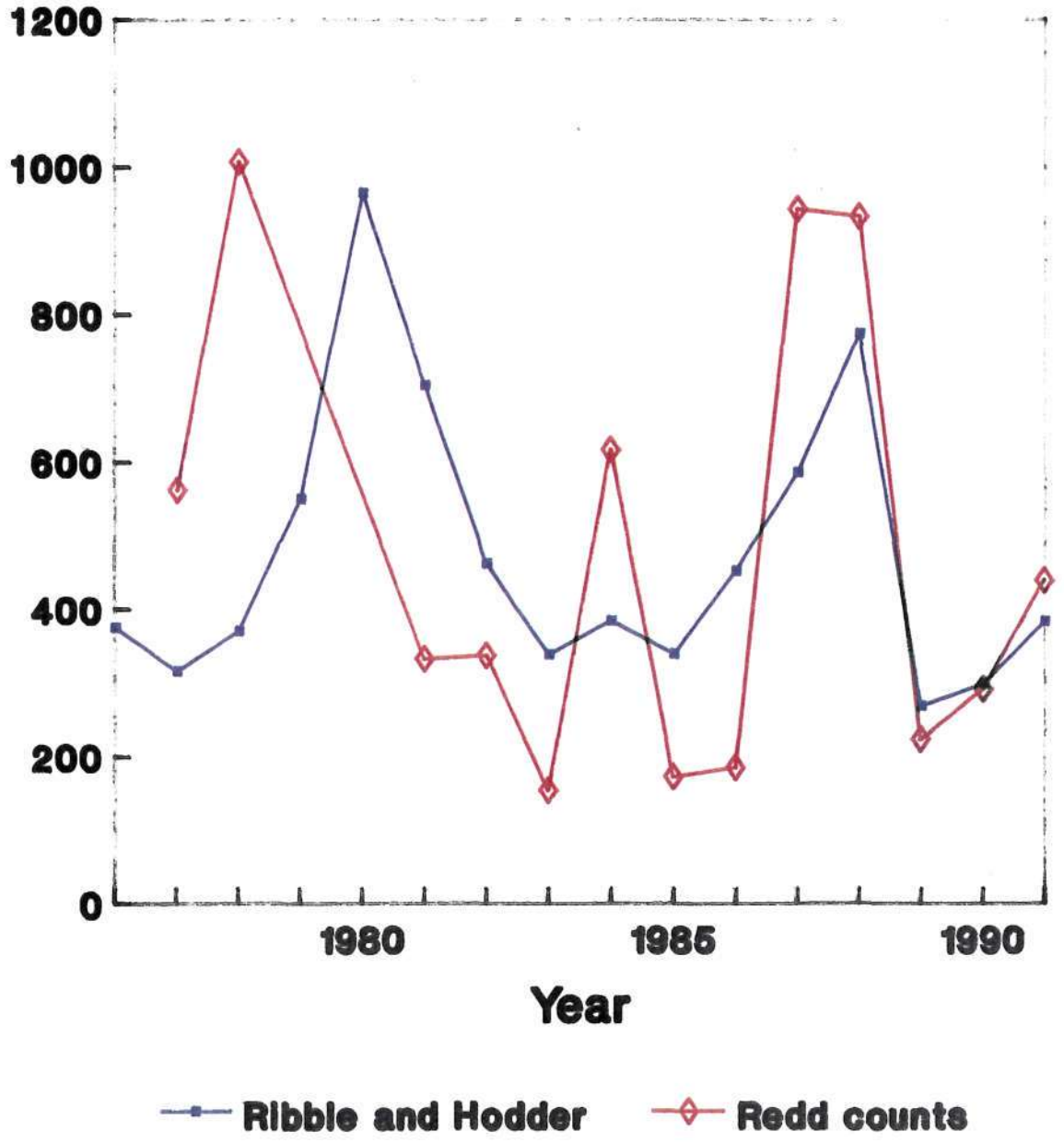

Figure 12.