The use of Catch Statistics to Monitor Fishery Change

Coarse Fish Study -Synopsis

Technical Report
W141

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Statement of use
This report is aimed at fisheries managers and scientists and is to provide an overview of the methods available for collecting catch data from pleasure and competition coarse anglers.

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Amendments
Any corrections or proposed amendments to this manual should be made through the regional Agency representative on the Water Resources National Abstraction Licensing Group.

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EXECUTIVE SUMMARY

The overall objective of the R&D contract was to develop methods for estimating the stock size of migratory salmonids from catch statistics data and to examine new techniques for the collection of this data. However, due to the large degree of varaition in the datasets for a range of underlying reasons, it became obvious that to achieve estimates of stock size would be a difficult goal to achieve. Therefore the project focused towards examining methods for accounting for the variability in the data sets and for estimating trends of runs of fish into rivers. This work was coulped with an examination of the temperoral and spatial variability with and between river systems and the development of alternative data collection methods. As a result of the not being able to derive formulae to estimate of absolute stock size, it was agreed that the title of the project be changed. Outputs for the project are presented for migratory salmonids in R&D Technical Reports W27 and W139 and for coarse fish in R&D Technical Reports W140 and W141.

Compilation and examination of catch data sets for coarse fish were conducted during 1992-4. Few data sets were obtained for coarse fish other than those already known to exist from published sources of angling competition results.

Coarse angler survey methods, analogous to the creel census techniques widely used in the United States, were developed for recreational anglers. These surveys provided a high encounter rate with anglers who had caught fish allowing large data sets to be rapidly compiled. Problems in identifying, counting and measuring fish were encountered as a result of anglers not retaining fish in keepnets or because they refused to allow the survey officer to view their catch. It has been suggested that Agency survey officers should be given statutory powers to examine anglers' catches. Nevertheless acceptable data were collected for several lowland rivers and a detailed survey of the River Weaver and River Dane demonstrated that the method was cost effective in providing data.

A photographic method was developed to obtain a record of the anglers' catches. The size of the fish could be calculated using a GIS/CAD system and the species identified from the photographic record. This provided detailed qualitative data and a record of the exploitation of the stock which can be collected easily and effectively in mixed species coarse fisheries.

It is considered that coarse angler surveys have the potential to allow the establishment of a national database of coarse fish catches on large river systems and recommendations on how this could be achieved are made in the report. Results could be collected on a regional basis and submitted to a national centre. The collation of anglers' catch data should be established on the basis that long-term data sets will be required to determine trends within the fish stocks. Surveying techniques are also applicable to examining stillwater systems at a regional level.

Detailed catch data were obtained from angling competitions using the same photographic techniques as employed in the recreational angler surveys. Individual

angler catches were recorded and provided distribution data along the competition stretch of the river. These data also indicated that competition anglers have a higher catch rate than pleasure anglers although this may be biased towards particular species. This method was successfully on the River Weaver and Trent. As a result of a possible decline in the number of angling competitions on large lowland rivers, as the popularity of intensively stocked small stillwaters increases, the monitoring technique has not been recommended as a long term collection method for a national database. However, it has the potential for regional implementation and for specific surveys on rivers and stillwaters.

Both the surveys of pleasure and competition anglers could be used to obtain quantitative data using mark recapture techniques. However, it is not recommended as a regular method because of the time that would be involved and the difficulties in meeting the underlying assumptions of mark recapture models, therefore producing data of doubtful quality.

Long term qualitative catch data collected on a range of large lowland rivers are likely to be of greater value to the Agency especially when coupled with other techniques. This information should be stored on an easily accessible database that is available to fisheries staff in all regions.

KEY WORDS: Coarse Fish, Angling, Angler Surveys, Angling Competitions, Catch Rate, Population Monitoring

1.0 INTRODUCTION

The specific objectives of R&D Technical contract W27 were to develop methods and techniques to estimate coarse fish stock size from anglers' catch statistics data. There are no suitable sampling techniques available at present for providing quantitative estimates of coarse fish stock size on large lowland rivers. At the start of the project it was quickly established that quantitative estimates of stock size for coarse fish would be an unattainable goal due to the complexities of the population dynamic of multi-species coarse fisheries. Long-term qualitative data have previously been used to identify the trends in coarse fish population abundance and species composition. However, the collection of catch data from coarse anglers has been relatively limited to specific studies on a regional basis.

Therefore the objectives of the contract were changed to develop cost-effective methods for the collection of data from coarse anglers which would have the potential to be applied on a national basis. The development of the methods would seek to provide qualitative relative abundance data which would be of sufficient detail to enable the fishery manager to determine long-term changes in the coarse fish stocks and develop appropriate management strategies. The title of the project has been changed to reflect these changes in objectives and is now entitled ' The Use of Catch Statistics to Monitor Fishery Change'.

2.0 COARSE ANGLER SURVEYS

2.1 INTRODUCTION

Creel census or angler survey techniques have been extensively developed and used in the USA as a method for assessing the stock of fisheries. However, such methods have received relatively little attention in the UK and have usually concentrated on examining competition anglers' results.

Coarse anglers in the UK can be split into three groups:

- Pleasure or recreational anglers
- Competition anglers
- Specimen anglers

Pleasure anglers form the largest component of the different types of anglers and it was considered that these would form a good initial source of data on fish stocks from their catches. Therefore a survey method required development which would provide data of sufficient detail to assist in management of the fishery yet be simple and cost-effective to implement on a national basis.

2.2 SURVEY DESIGN

The sport of angling in the UK differs significantly from the USA. The design of an angler survey for UK coarse anglers would therefore need to reflect these differences. The main differences can be summarised as:

1. The large physical size of American fisheries mean that they can only be partially surveyed in a day and careful statistical consideration needs to be applied to the survey design. Most UK fisheries can be completely surveyed within a single day.
2. US anglers rarely adopt a catch and release policy, although attitudes are changing. UK coarse anglers nearly always operate a catch and release and so the catch may not be available for examination.
3. US angling is dominated by the capture of large predatory species which can be contrasted to UK coarse anglers which regularly catch small fish and species as part of their sport.

2.3 PRELIMINARY COARSE ANGLER SURVEY DEVELOPMENT

A preliminary coarse angler survey was undertaken during the first year of the contract to test its suitability under field conditions. A survey form was designed to record the following information:

- Angler catch (number of each species and size distribution)
- Angler effort (fishing time and recollected seasonal effort)
- Angler behaviour (i.e. location on the fishery)
- Other information (i.e. willingness to participate in logbook schemes)

Surveying was undertaken on an informal random basis on a range of riverine, stillwater and canal fisheries in England and Wales. The anglers catch was recorded during surveying by examination or based on the angler's recollection.

In the preliminary study 656 anglers were interviewed over 27 interview days. A total of 5497 fish were captured by anglers (based on examined and recollected catches).

The summary conclusions from the results of the survey were:

- Angler survey methods were readily applicable to coarse pleasure anglers.
- The relatively high encounter rate with anglers and their high catch rates on popular fisheries gives the potential to collect data on the exploited stock.
- The distribution of anglers demonstrates a contagion around access points to fisheries which allows the targeting of areas to improve the encounter rate (see Figure 1).

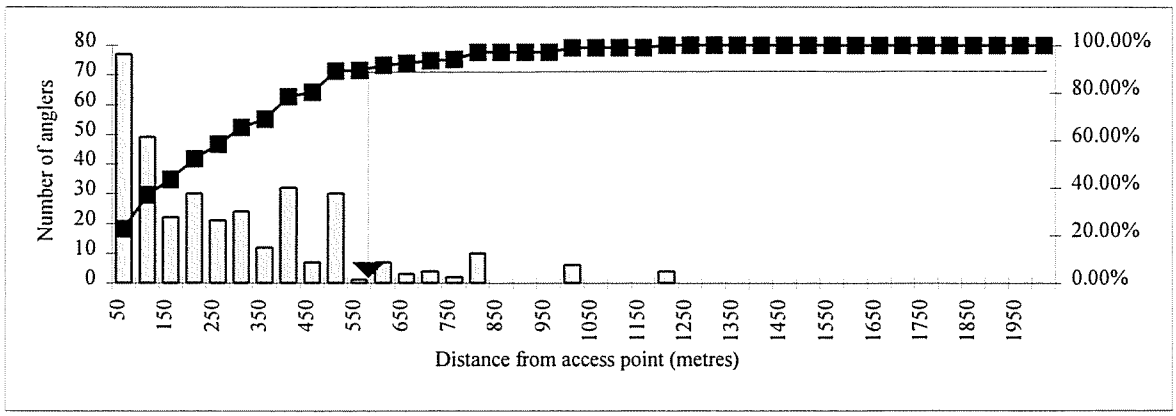

Figure 1: Distance from access points of anglers' fishing positions on riverine fisheries

- Anglers' recollection of their catch in terms of sizes, numbers of species can not be relied upon due to inaccuracies. This result identified the need to develop a rapid method for assessing the species and size composition of anglers' catches.
- Angler survey techniques can provide useful information on anglers' behaviour and use of a fishery.
- Logbooks for coarse pleasure anglers are not appropriate to collect catch data. This results from the difficulties presented by recording the large numbers of fish and species caught, a poor recollection of catches and anglers failing to return the logbooks.

2.4 DEVELOPMENT OF METHOD FOR RECORDING ANGLERS' CATCHES

The preliminary coarse angler survey identified a need, because of resistance to examination of catches, to develop a cost effective method of rapidly recording an anglers' catch. The technique had to enable the recording of the catch by species and lengths of individual fish, whilst involving the minimum of handling and disruption to the angler. A photographic method was developed for the purpose combined with a Computer Aided Design (CAD) software package to allow analysis to extrapolate the fish lengths from the photographs.

The method comprises placing batches of fish in a shallow plastic tray and covering them with a thin perspex sheet. A photograph is then taken from directly above the tray. It was found that the best pictures resulted from the use of a yellow tray with an automatic focus camera and fast film (400 ASA) to avoid the use of the flash.

The photographs of the catch were analysed using a CAD system with digitising tablet which allowed the known size of the tray to be scaled in the photographs. The lengths of the fish could then be calculated.

It was found that if the method was pursued correctly that good quality photographs could be obtained which allowed all species of fish greater than 5cm to be identified.

A comparison was undertaken between measured fish lengths and estimates derived from the photograph to determine the accuracy of the method. The results of this analysis are presented in Figure 2.

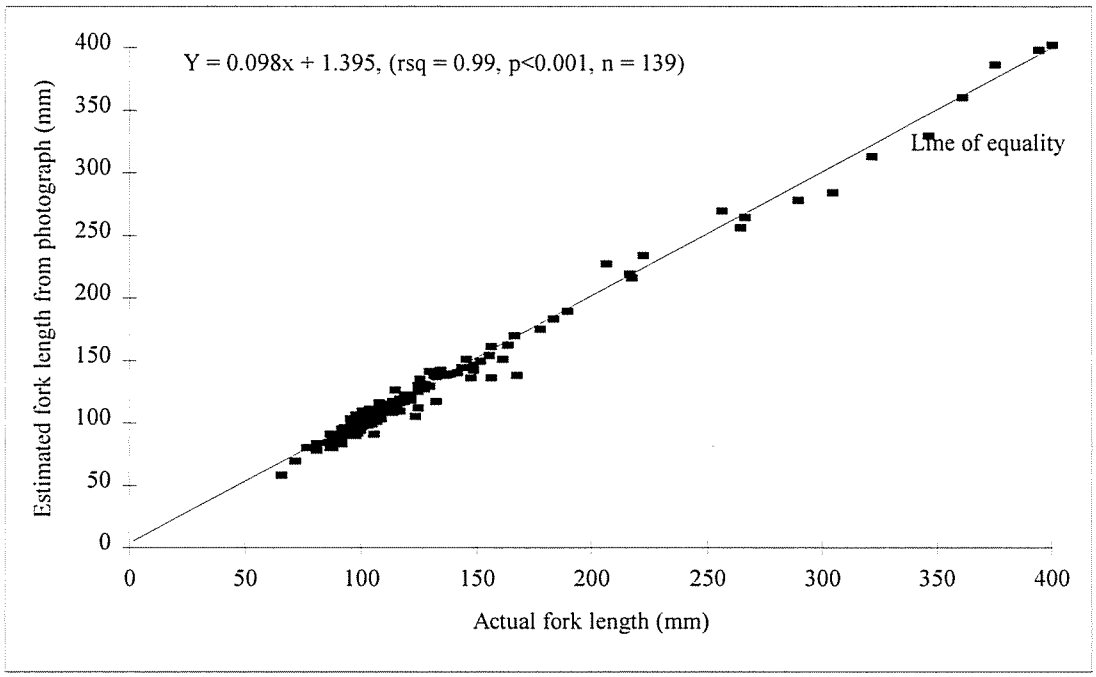

Figure 2: Regression of estimated individual fish lengths from photographs against actual measured lengths

The photographic technique may also demonstrate other advantages. For example, the photographs will demonstrate any health problems, such a external lesions that may be present in the fish stock. The technique may also be applicable for recording catches of fish by standard sampling methods which may potentially increase the number of sites that can be surveyed in a day.

2.5 INTENSIVE ANGLER SURVEY DEVELOPMENT

Following the preliminary survey and development of the photographic methodology an intensive angler survey was pursued. Two fisheries in the North West were selected for surveying:

- The River Weaver (large slow-flowing channelised river)
- The River Dane (small river with natural features)

No formal randomisation or stratification of the survey program was made as the main purpose of the surveying was to determine the level of information that could be collected. Surveying was undertaken between 8am and 6pm as it was found that there were few anglers present on the fisheries outside this time. If low numbers of anglers were encountered it was found that both fisheries could be surveyed entirely during a single day.

Anglers were interviewed at the fishery by the survey who asked questions to allow the survey form to be completed. The angler was then asked to recollect their catch and to allow the catch to be photographed.

Comparison samplings were undertaken by standard sampling techniques to provide comparative results. The additional sampling was as follows:

1. River Weaver - Seine netting (were the marginal shelf was absent) and boom boat electric fishing
2. River Dane - Electric fishing surveys

2.5.1 Results and findings of intensive survey

A total of 1087 angler interviews were conducted by a single surveyor. The following summarise the results of the interviews:

- The use of angler survey techniques coupled with the photographic method is a readily applicable technique for obtaining catch data from coarse anglers.
- Pleasure anglers captured a wide range of sizes and species of fish and the majority interviewed were fishing for any species available.
- The highest encounter rate with anglers occurred during July (Figure 3) as did the highest mean number of fish per angler.

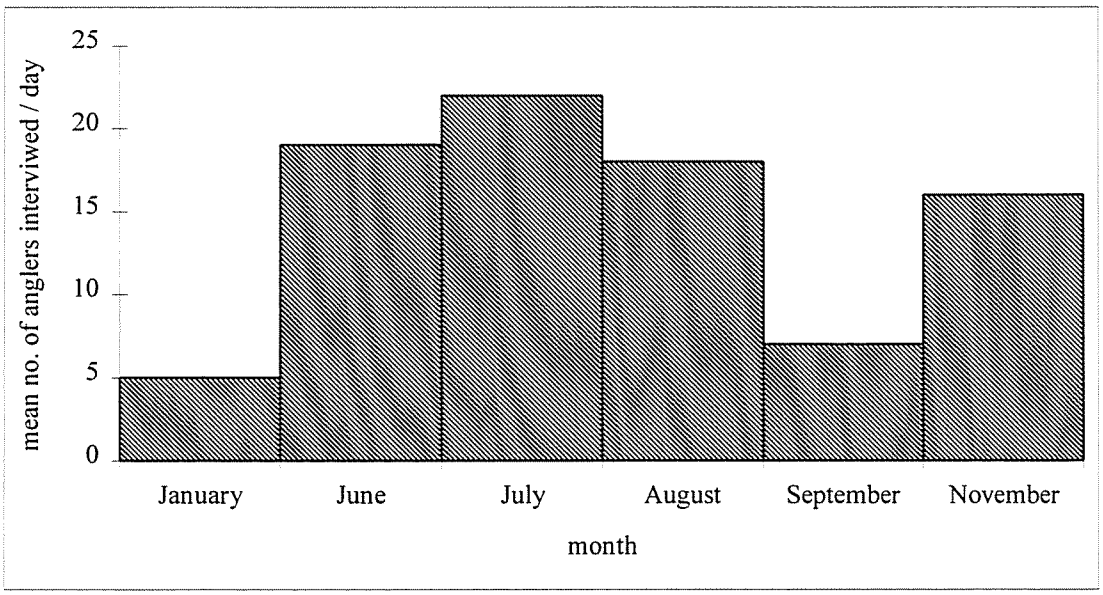

Figure 3: Mean number of anglers interviewed per survey day by month

- The greatest amount of fishing effort by coarse pleasure anglers, based on recollection, occurs through the summer months (June to September).
- 29% of anglers did not use a keepnet to retain their catch.
- Anglers demonstrated a contagious distribution around access points to the fishery.

- Anglers recollections of catches were demonstrated to be poor with a tendency to mis-identify species and overestimate the number of fish caught.
- The photographic method allowed length frequency histograms of the exploited stock to be constructed for the dominant species (see Figure 4 and Figure 5).

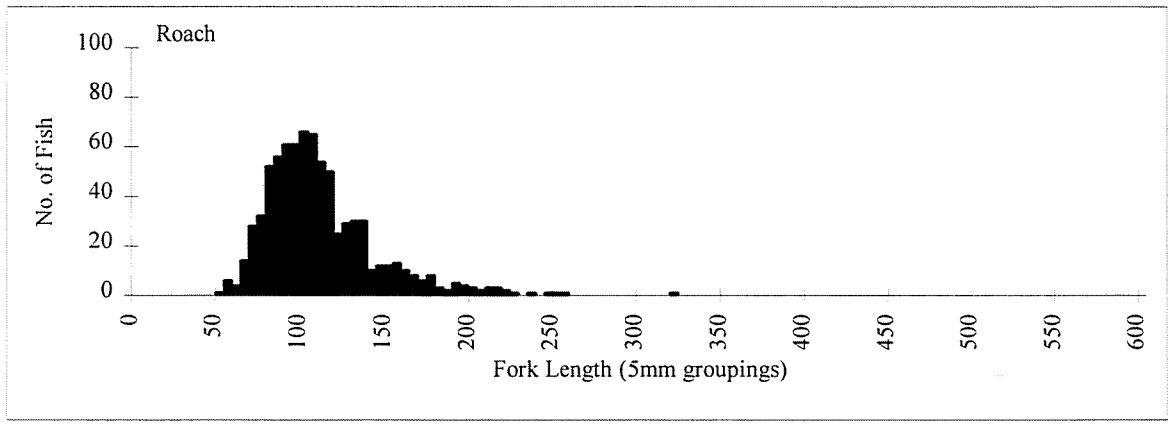

Figure 4: Length frequency histogram for roach from anglers' photographed catches from the River Weaver

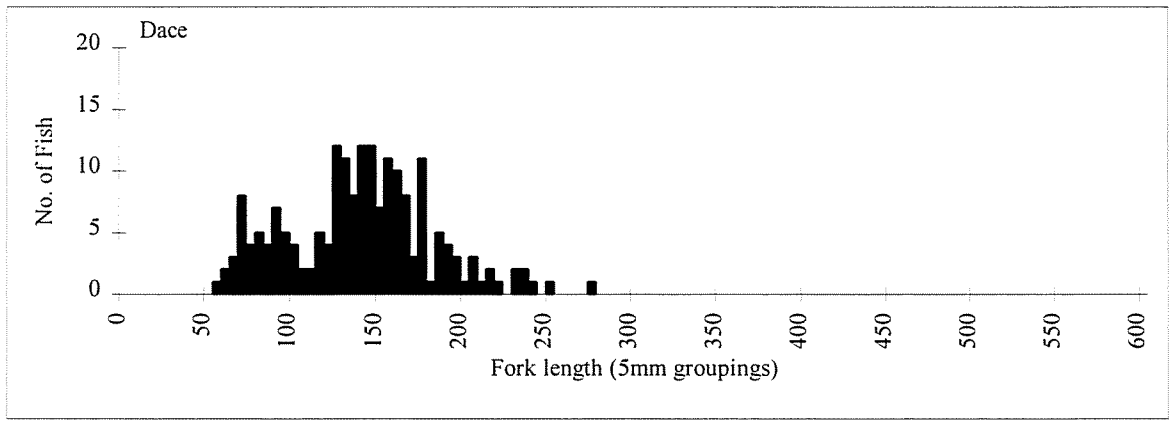

Figure 5: Length frequency histogram for dace from anglers' photographed catches from the River Dane

- Angler surveys provided catch data results which were comparable to those obtained by standard sampling techniques and provided more detailed information for certain species.
- Angler surveying was shown to be a cost-effective method, assuming a high encounter rate can be achieved, when compared to standard sampling methods.

The main advantage of the technique over existing sampling methodologies is its suitability for use on all waterboby types, including large rivers whilst being cost effective in terms of equipment and personnel and sampling an extensive area. The technique may also provide information on the seasonal distribution of stocks and correlation of catches with specific habitat types and features. Angler surveys also put the Agency in direct contact with one of their customers, the anglers. Such a customer focused approach should allow the Agency to gain a greater understanding of the

requirements of coarse anglers from recreational fishery. This is considered fundamental for the management of these fisheries for angling purposes.
Recommendations have been provided in the main report on refinements that can be made to the survey design. This includes information on selecting survey sites, design of survey forms, stratification and randomisation and analysis of survey data. Further recommendations were provided on implementing angler surveys by the Agency on a national and regional basis. It was highlighted that the setting up of a national angler survey system would need to be undertaken with a view to long-term data collection which are required to establish trends of population trends in fisheries.

3.0 MONITORING OF ANGLING COMPETITIONS

3.1 INTRODUCTION

The development of methods for collection data from large angling competitions was studied as part of the coarse fish component of the contract. The Agency currently pursues a 3 year rolling programme of stock assessments for both migratory salmonids and coarse fish at selected riverine sites in England and Wales. Within this programme there are approximately 2000 sites surveyed by electric fishing and seine netting and 320 sites by angler census surveys. However, most stock assessments undertaken within this programme are from small rivers (DOE 1983), where effective samplings by standard techniques can be undertaken. The usefulness of some of the information presently collected for coarse fish management may be questioned since many of these selected sites may hold little direct value as recreational fisheries.

A shift of emphasis towards an increased collection of coarse fish catch statistics and examination of fishery performance would potentially provide the Agency with data with which they may respond to the enquiries and complaints of one of their customers, the anglers. Such a shift in emphasis would require considerable commitment from the Agency because long-term data sets are required to identify changes in the fish stocks. This may be one of the main reasons why the collection of catch statistics for coarse fish has not been widely adopted. Additionally, analysis of coarse angling catches would allow examination of the exploited component of the fish populations. For the purpose of this contract exploitation has been defined as those components of the fish community which are vulnerable to capture by angling.

Angling competitions have previously been used to provide such catch statistics (e.g. North & Hickley (1981)), as they can be relatively easily accessed compared with the that from pleasure anglers. The methods employed for the collection of data, although cost-effective, have provided data of limited detail although sufficient to identify trends in relative abundance. It should be considered that the monitoring of angling competition has arisen due to the absence of other suitable sampling methods for large lowland rivers, although has only is only currently undertaken on a limited basis. This methodology was taken a step further by Cooper & Wheatley (1981) who collected all the fish in large tanks at the end of the competition for the production of length frequency histograms. Kell (1991) by monitoring the number of bream captured at each peg in a competition was able to show the contagious distribution of bream. Kell

concluded that such contagion would be difficult to demonstrate by other methods without collecting a large number of samples.
Previous workers have noted that competition anglers may be highly selective in the size and species of fish they catch by exploiting specific components of the stock by employing certain tactics (Cooper and Wheatley 1981, Cowx and Broughton 1986). Therefore bias is created in the resulting catch. However, the catches are a direct indication of the exploited stock The decision on which tactic to employ will be dependant on whether the match is a league or open competition (team or individual event). Additionally, a combination of the angler's knowledge of the waterbody and the initial catches made at the start of the match are likely to be the main influencing factors on the methods used by the anglers through the match duration. However, the methods employed may vary during the match to maintain the catch rate.

3.2 ANGLING COMPETITION METHODOLOGY DEVELOPMENT

The objective for development of the angling competition system was to derive a method of recording and collating individual catches of anglers with respect to species composition and the size of individual fish. The new methodology development requirements of the new method were that it must provide:

1. An individual angler's catch needs to be retained after the competition.
2. A rapid and accurate method of recording each angler's catch.
3. The methods and tactics employed by each angler through the duration of the match needs to be recorded.
4. The collection of data should not cause inconvenience to the participating anglers.

3.2.1 Photographic record of catches

The photographic method developed in the angler survey methodology was applicable as a technique for rapidly recording individual match anglers' catches along a match stretch of river. This would enable detailed information on the composition, size distribution and spatial distribution of catches of different species to be established.

3.2.2 Keepnets

A large number of keepnets were purchased which allowed individual angler's catches to be retained after weighing at the end of the competition. The anglers were then free to go, leaving the processing of catches to be undertaken.

3.2.3 Angling Methods

The interviewing and monitoring of the methods and tactics employed through the duration of the match was undertaken. It was considered that the collection of long-term data may allow biases in catch associated with the use of particular methods, baits and tactics to be established.

A full method statement for the monitoring of angling competitions is presented in Appendix 3 of the main report. Additional sampling by boom boat electric fishing and seine netting was undertaken in conjunction with the matches attended on the River Weaver to provide comparative data.

3.3 COMPETITION MONITORING

Three large angling matches on the River Weaver and a Division 2 National Competition on the River Trent were attended in association with the Agency to test the developed methodology.

3.3.1 Results and findings of angling competition monitoring

The conclusions of all the matches attended are summarised as follows:

- Angling match monitoring can provided detailed information on the exploited stock of a fishery, although long-term data would be required to identify trends within the fish stocks.
- The combination of use of keepnets combined with the photographic method allowed detailed information on the composition and size distribution of individual angler's catches to be recorded.
- Recorded angler catches compare favourably with the results achieved by other sampling techniques and demonstrated better performance for some species (see Figure 6, 7 and 8 for roach from the River Weaver).

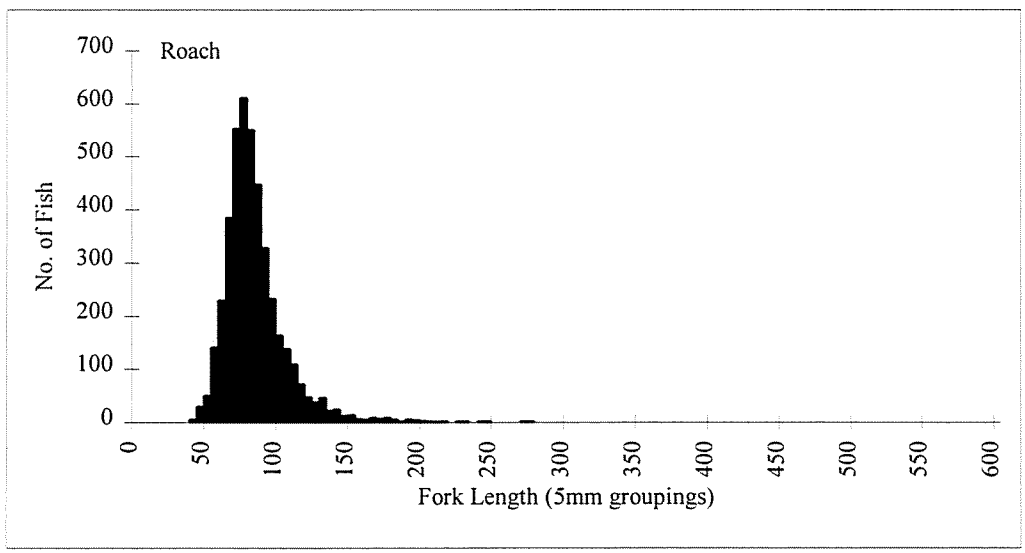

Figure 6 : Anglers' catch of roach from River Weaver match 24/10/93

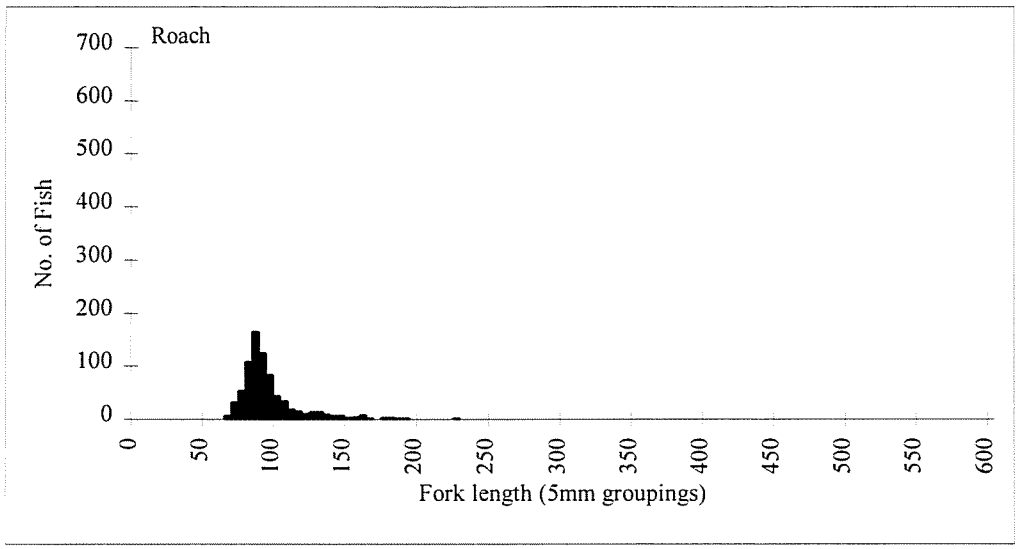

Figure 7: Seine netting sample of roach following River Weaver match 24/10/93

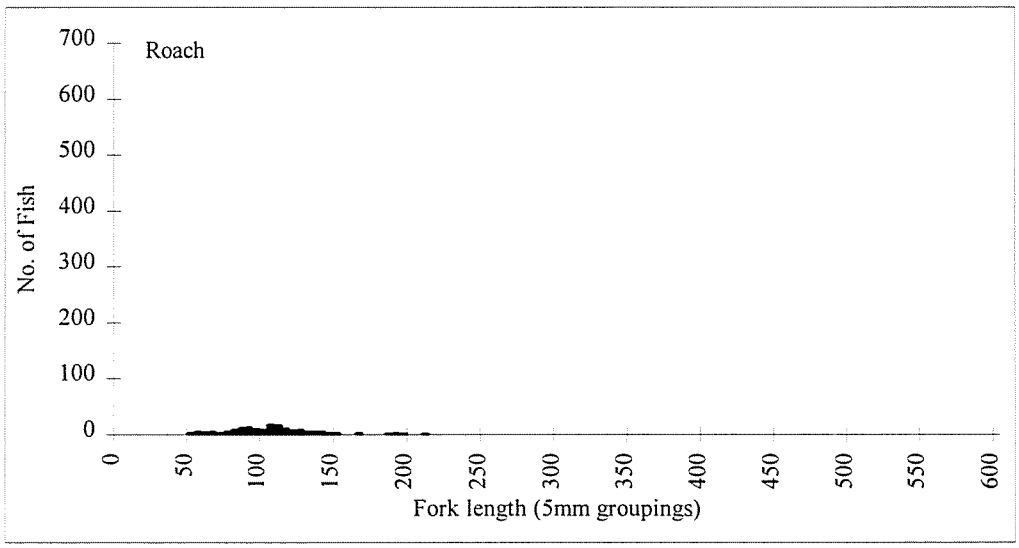

Figure 8: Boom boat electric fishing sample of roach from the River Weaver (25/9/93)

- The attendance of matches during the Summer / early Autumn period is likely to result in the capture of greater numbers of fish of a wider range of species and will therefore provide more information on the fish stock.
- The recording of individual angler catches allows the distribution of species along a fishery to be examined and the identification of areas of the fishery which may be performing poorly.
- Individual angler catch species composition may be used to correlate the presence of different fish species to different habitat types.
- If a certain species within a fishery requires particular examination (e.g. pike or barbel) then specific matches may be organised. In such matches the anglers would be requested to target this species for capture. The timing of such matches must be carefully considered, in particular the time of year and day.

- Angler interviews allowed the changes in angling tactics and target species to be detected through the period of a competition and under different river conditions (see Figures 9 and 10). The January match resulted in the capture of considerably more bream which was attributed to anglers using the ledger method.

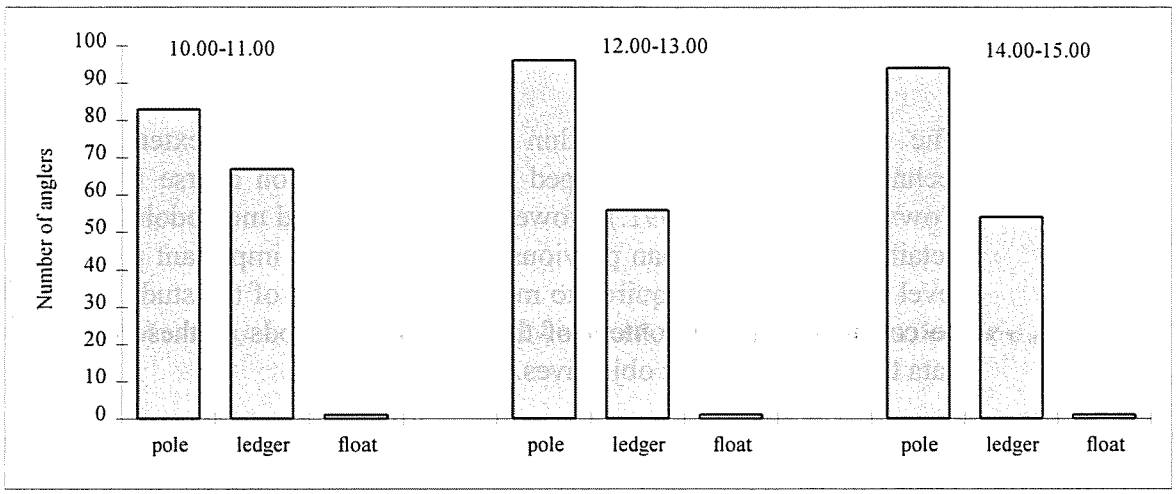

Figure 9: Use of angling techniques during River Weaver match (24/10/93)

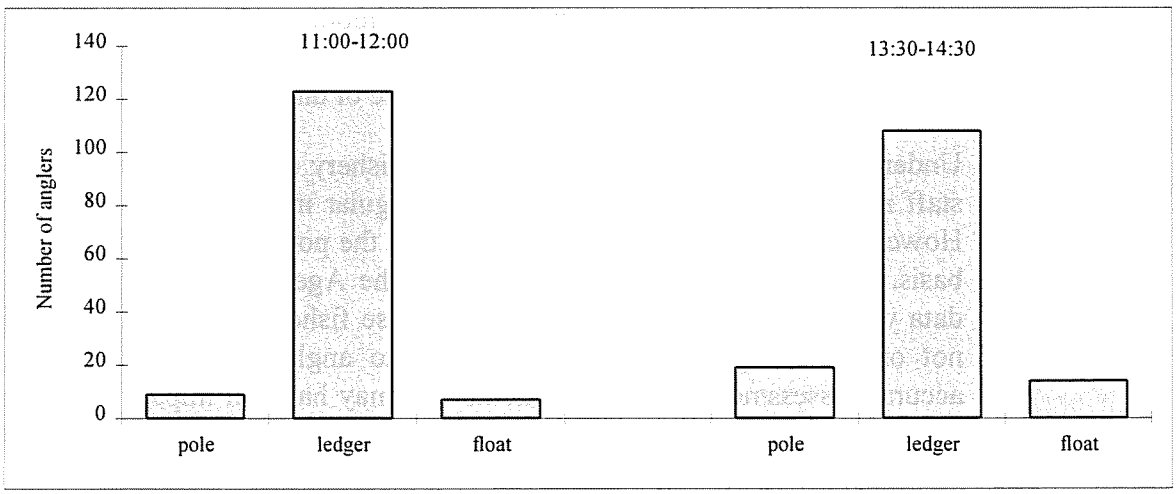

Figure 10: Use of angling techniques during River Weaver match (23/01/94)

- The use of angling match monitoring was more cost effective than sampling by standard techniques and has the additional benefit of indicating the spatial distribution of the fish stocks.
- Angling competition monitoring may be set up on a national basis with key rivers or for specific regional studies. As with the angler surveys the Agency will require a long-term commitment to monitoring.

Details were provided in the main report of how the Agency might use the angling match monitoring method as a sampling tool by the Agency on a national and regional basis. Details were provided on arranging attendance at angling competitions and highlighted the importance of feed-back to maintain the co-operation of the anglers. The logistics and staff requirements for the monitoring method were described in full in the main report.

4.0 OVERVIEW

The methods developed within this contract are an extension to the successful techniques previously developed by other studies on coarse fish catch statistics (e.g. Cowx 1991, Axford 1991.). However, the developed methodology provides much more detailed information than previous techniques. The important point is to determine the level of information required to meet the objectives of the study. The objectives should be considered in the context of the previous methods as these may provide sufficient data to meet the study's objectives.

The use of angling catch statistics from angler surveys and organised angling competitions can provide useful relative abundance data on fish stocks in fisheries that are difficult to sample by standard sampling techniques. Both methods are suitable for replacement of these techniques. Collated pleasure and match data may also be used to supplement information collected by other sampling methods. However, in water bodies where few data may be obtained by standard sampling methods the monitoring of anglers' catches may provide the major source of data on the fish stocks.

Under its present organisation the Agency fishery departments are unlikely to have the staff resources to implement a full scale regular monitoring of large angling matches. However, the angler survey techniques have the potential to be developed on a national basis. A large, long-term commitment by the Agency towards the collection of catch data will provide better knowledge on coarse fishery dynamics. This information will not only be important when responding to angling enquiries but will allow more accurate assessments of developments that may have an impact on a fishery. This will allow the Agency to provide a better response to their customers and will assist in public relations.

The present study has not allowed the derivation of formulae to estimate stock size for a coarse fishery. It has developed methods of collection of coarse fish catch statistics that will provide meaningful relative abundance information to the fishery manager. It may be possible to elucidate the relationship between catch and stock, in absolute terms on canal fisheries that can be quantitatively sampled by standard techniques. However, the extrapolation of this information to other waterbody types and species and the high degree of variability in catch depending on both water and temperature conditions will prove this a difficult aim to achieve.

It is considered that the correlation of regular catches of a particular species with certain habitat features may be a more appropriate way of examining a fishery, particularly for rehabilitation schemes or improving the potential of a fishery.

Long-term data sets will be required to determine the habitat preferences of each coarse fish species regarding flow, temperature, substrate, depth, spawning/ nursery habitat and in-river features. However, once these data are obtained then practicable measures may be presented for improving a fishery or explaining the decline of a particular species.

Perhaps one of the most important components of the methodologies described is to maintain the liaison between the angling bodies and the Agency. Of particular importance is the feedback of information to participating angling clubs at the end of the study. This response may take the form of a short report written in layman's terms or through a general meeting between the Agency and the angling club. From our experience an organised meeting provides a good medium for dissemination of the information. Such meetings act as a general forum between the club and Agency and from a public relations side have many positive benefits. The Agency should also encourage angling clubs to keep records of angling competition catches on their waters for weight caught per peg and an indication of the dominant species in the catches.

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