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MID-ARGYLL, KINTYRE AND ISLAY TOURIST BOARD

CLYDE SEA ANGLING STUDY

Final Report

Prepared

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EXECUTIVE SUMMARY

1. In recent years there has been a sharp decline in demersal fish stocks in the Clyde. This decline is indicated by evidence from commercial landings, anglers' catches and scientific sources and is particularly severe in relation to cod.

2. Although there is a commercial demersal fishery in the Clyde, the most economically important fishery is trawling for nephrops. The decline in fish stocks is, however, more serious for the Sea Angling sector - angling clubs, boat hirers, tourist authorities and hotels report a sharp decline in sea angling activity in the Clyde.

3. Scientific evidence suggests that the observed decline in cod stocks is the result of the combined influence of poor 'recruitment' to the stock over a run of years and an increase in the level of commercial fishing effort. However, the widely held belief that stocks have been damaged by trawlers 'ploughing up' the sea bed is not supported nor is there evidence that pollution is a cause of declining stocks.

4. Nothing can be done to influence greatly the level of recruitment to the stock and if stocks are to be improved there must be a reduction in the intensity of fishing effort in the Clyde. Although conservation measures will ultimately improve commercial yields, the angling sector has a greater interest in measures which will increase the demersal stock level and the average size of fish than has the commercial sector. Moreover, measures to improve demersal stocks could have an adverse effect on nephrops landings. There is, therefore, some degree of conflict of interest between commercial and sport fishermen.

5. Sea angling supports around 200 jobs in the Clyde area but has the potential to support over 400 jobs if conditions improved. Commercial fishing supports around 1,200 jobs in the area and thus measures to assist sea angling which would threaten the basic viability of the commercial sector cannot be supported.

6. However, there is scope for measures which could produce substantial benefits for sea angling while exerting only a modest adverse effect on the commercial sector and indeed, producing some longer term benefits for commercial fishing. While there is no absolute certainty that any specific measures will be effective it is considered that the following package of measures would be effective:

   (i) a ban on all fishing with mobile gear north of a line from Dunoon to Cloch Point;

   (ii) a week-end ban on fishing with mobile gear in the Clyde;

   (iii) an increase in nephrops trawl mesh size to 80 mm codend; and, possibly,

   (iv) a reduction in otter board size.

7. These measures could result in the loss of 60 jobs through effects on the commercial sector and would also create some transitional loss of income to fishermen (though future yields would also increase). However, they would help to underpin the 200 existing 'angling generated' jobs which must be considered under threat and would be likely to result in some increase in employment within the overall maximum potential of 200 additional jobs.

8. It is recommended that these measures are introduced and reviewed after five years.

9. Improvement in fish stocks is an essential pre-requisite to any angling development or promotional activity. Indeed, there is a case for restricting promotional activity until angling prospects improve.

1.0 INTRODUCTION

Study Brief

1.1 This report presents the findings of a study of Sea Angling in the Clyde undertaken by PIEDA Ltd and the Scottish Marine Biological Association for the Scottish Tourist Board.

1.2 The study was commissioned in response to growing concern over the deteriorating quality of sea angling in the Clyde as indicated by trends in catch weights, specimen sizes and diversity of species taken. The deterioration appears to have been most severe in relation to (though not confined to) cod.

1.3 Sea Angling interests have tended to take the view that over-fishing by commercial trawlers is the root cause of the problem and that the relaxation of controls following the Inshore Fishing (Scotland) Act 1984 has exacerbated the problem.

1.4 The primary objectives of the study were as follows:

(i) to assess the decline in fish stocks in the Clyde;

(ii) to identify the causes of the decline and their likely relative importance;

(iii) to identify possible remedial measures;

(iv) to assess the economic impact of the decline in sea angling; and

(v) to identify steps to maximise the economic benefits of sea angling.

1.5 In interpreting and implementing this brief, the consultants have aimed to identify the conflict and economic 'trade-off' between angling and commercial fishing interests and so to set out the costs and benefits of possible remedial measures. The objective has been to identify specifically steps which will produce an overall net economic benefit, though the full range of options is discussed.

Report Structure

1.6 The contents of the report are as follows:

* Section 2 reviews the evidence relating to Clyde fish stocks, identifies causes of decline and considers remedial measures from a technical standpoint;

* Section 3 examines the economic significance of the commercial fishing industry of the Clyde;

* Section 4 considers the economic impact of Sea Angling; and

* Section 5 draws together the findings of previous sections, sets out a cost/benefit assessment of policy options and presents the recommendations made by the study team.

Some evidence provided by anglers relating to fish stocks is set out in Appendix 1, while Appendix 2 details the angling club data used in the study.

2.0 FISH STOCKS IN THE CLYDE

The Demersal Fishery

2.1 The demersal fishes are those fish which live on or close to the bottom and are generally treated separately from the pelagic fishes such as herring and mackerel which live in midwater. In the Clyde the principal demersal fishes are the gadoids which include cod, whiting, haddock and hake. Other demersal fishes include the dogfish, the skates and rays, monk or angler fish and the flat-fish.

2.2 The demersal fishes of the Clyde have been reviewed recently by Hislop (1986) and the following account draws heavily on that review. For management purposes the Clyde Sea area is part of ICES area VIa which includes the whole of the west coast of Scotland out to longitude 12 W, part of the west and north coast of Ireland as far south as 54 30 N and the north coast of Scotland between 4 and 12 N and to 60 N. This area is further subdivided into statistical rectangles which are one degree of longitude and one half of one degree of latitude. Four of these rectangles, 39E4 39E5 40E4 and 40E5 cover the Clyde but two of them also include parts of the North Channel and the Sound of Jura, the rectangles are shown in Figure 2.1 with the Clyde area shaded. Prior to 1979 the statistics of fish landed from the Clyde included fish from these two areas outwith the Clyde proper but since then the records kept by DAFS have distinguished fish landed from the Clyde only.

2.3 The Scottish coast is also divided into a series of fishery districts and two areas, Campbeltown and Ayr, cover the Clyde and other adjacent areas. The Fishery Officers are responsible for the collection of data on the species and quantities of fish landed, the method of capture and the amount of time spent fishing for their areas. Summaries of the data on landings from each district are published annually by DAFS in the Scottish Sea Fisheries Statistical Tables. These statistics are of limited value for an assessment of a fish stock because they only relate to the fish landed at ports within the district, some of which could have been caught in other areas.

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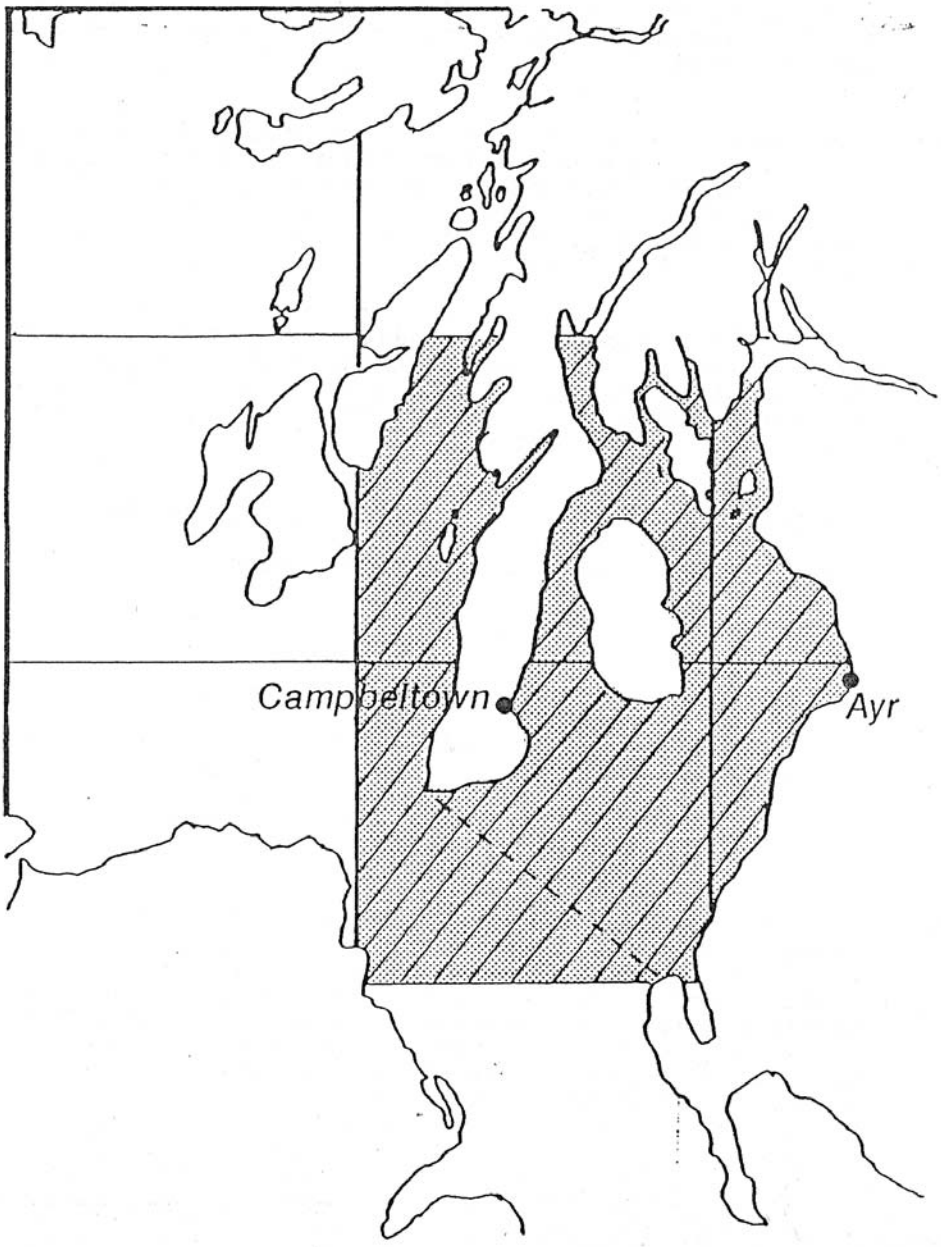
FIGURE 2.1

ICES STATISTICAL RECTANGLES



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2.4 The information on fish caught from the ICES statistical rectangles is not generally published, but Hislop (1986) has given details of the landings of all the major demersal fish species for the four areas which include the Clyde for the years 1960 to 1984. He also gives data on the effort in terms of hundreds of hours of fishing for the three principal fishing methods, seine netting, light trawling and nephrops trawling. This data is reproduced later in the report but must be used with some caution. The actual tonnages of each species landed must not be used as a measure of stock size because they depend on factors such as fishing method, the areas fished and market forces. A good example of the effects of market forces is given by Hislop in relation to the dramatic increase in saithe landings in the 1970s. In the 1960s, saithe had a low market value in Scotland but with the closure of many of the distance water grounds to English trawlers in the 1970's the market value increased and it became profitable to fish for saithe. The increased tonnages of saithe landed from the Clyde probably reflect a change to a directed fishery for saithe rather than an increase in stock size. An indication of the strength of a fish stock can be gained by expressing the weight of fish landed in terms units of fishing effort - Landings Per Unit Effort (LPUE). Assuming that there are no major changes in areas fished or towards a directed fishery, a sustained increase or decrease in LPUE can indicate an increase or decrease in stock size.

2.5 Statistics on commercial landings are therefore of limited value in assessing the state of fish stocks and scientists use a number of other methods such as mark recapture studies, acoustic surveys (mainly for pelagic species), egg and larval surveys and research vessel surveys. None of these methods have been used to any extent in the Clyde. Another method is cohort analysis (often referred to as virtual population analysis or VPA). This method depends on estimating the numbers of fish of each age or year class from market sampling of commercial catches. It is this method which is used to assess the fish stock of area VIa and it will be considered in more detail below but first it is important to consider the relationship between the Clyde fisheries and area VIa. Statistics on the total catches by all nations from each of the major ICES areas are published annually by ICES in Bulletin Statistique. Using this data together with the data for the Clyde from Hislop it can be shown that in the ten year period from 1975 to 1984 Clyde caught cod accounted for a mean of 9.4% of the total landings from VIa with a range of 6.3% to 12.9%. Corresponding figures for whiting were 6.8% (range 4.4% - 10.7%), for saithe 4.6% (range 2.0% - 9.1%) and for haddock 1.0% (range 0.5% - 2.2%). The relative

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importance of hake was more variable with a mean of 14.1% but a range of 5.5% to 38.5%. The landings of hake from the Clyde were particularly high in the period 1980 to 1982 but there is no clear relationship between the quite large annual variations both in the Clyde and area VIa as a whole. Thus the demersal landings from the Clyde are relatively insignificant in relation to the remainder ·of area VIa and it is not surprising that most of the conservation measures are based on the state of the stocks from the remainder of the Scottish west coast.

2.6 Before considering how the stocks of area VIa are assessed it is necessary to digress and explain briefly the biological basis for fisheries management. In the first few years of life, fish grow rapidly in length and weight and thereafter the annual increments in growth decrease. Ideally, to obtain maximum yield the fish should be allowed to grow until the end of the rapid growth phase before being harvested but as all age groups are usually mixed in the population it is seldom possible to capture a single age group. Since the fishing process also captures younger age groups the aim of management must be to minimise the capture of the younger fish and allow a reasonable number to survive and maximise the yield. One logical approach is to regulate the mesh sizes so that the younger fish escape capture and also impose minimum landing sizes to discourage fishermen from exploiting populations containing a high proportion of younger fish. A major problem with mesh size regulation arises in mixed fisheries where the optimum size for one ·species may allow the total catch of another species to escape. Regulation by mesh size alone would not prevent the adult stock from being seriously depleted through overfishing. It is therefore also necessary to regulate fishing effort such that a proportion of the stock survives to maximum size.

2.7 In a well managed fishery, the age or length at which fish start to be caught is matched to the level of fishing (fishing mortality) so that they advance together towards the optimum giving the maximum sustainable yield (MSY) per young fish (recruits) entering the fishery (MSYR). If fishing mortality is too high the yield per recruit will decrease. This is known as 'growth overfishing' and, provided the fishing is not at excessively high levels, no serious damage will be done to the population. If on the other hand fishing is excessive the size of the adult spawning stock will decline until it reaches too low a level to produce an adequate number of recruits and the fishery will collapse. This is known as 'recruitment over- fishing'. There are many

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ways that fishing effort can be regulated but in the EEC the main tool is to set a quota or total allowable catch (TAC) for each species and each area.

2.8 The scientific assessments and recommendations for area VIa in recent years can now be considered. The fishing mortality on the cod stocks at least since 1977 to the present has always been higher than that required to produce the maximum yield per recruit for the fishery and the advice has always been to reduce the fishing effort towards the ideal. In 1980 concern was expressed that the continuation of the high level of fishing mortality might lead to a decline in the spawning stock. In some years, when there was a particularly strong year-class recruiting to the fishery, the advice was to decrease effort further because landings would remain high despite the decreased effort. In 1982 it was noted that landings had increased steadily over the previous four years as a result of increased recruitment from the good year classes of 1978 and 1979, the latter being the highest on record; 1982 was also a good year class and in 1984 landings remained high as a result of a doubling of the recruitment from what it was ten years ago. The increase in recruitment led to an increase in the size of the spawning stock so that although the stocks were in a healthy state the exploitation was too great to achieve the maximum yield from the fishery.

2.9 In 1986 it was recognised that some of the early predictions may have been over-optimistic owing to errors in the reported age composition of the stock. The concern over the possibility that the level of fishing mortality may have been underestimated was reiterated in 1987 and it is now estimated that the stock is at an historically low level which may eventually require urgent conservation measures. The question arises as to how relevant these assessments are to the Clyde. To some extent this depends on whether the cod stocks of the Clyde form part of the main cod stock to the north and west of Scotland. There is little doubt that cod spawn in the Clyde but it is by no means certain that all of the stock originates from local spawning. If the Clyde cod are indeed a separate stock then it may be that the year class strengths of Clyde cod are not correlated with the remainder of the west coast and the advice for VIa may be inappropriate for the Clyde.

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2.10 The haddock stocks are also assessed by VPA but unlike cod, there is evidence that the year class strengths are correlated with those of the North Sea. Scientists have therefore used estimated year class strengths of the recruits based on the North Sea young fish surveys. The fishing mortality on haddock has always been too high to achieve maximum yield from the fishery but, despite this, stock size has increased from the levels of the mid 1970' s. Haddock tend to have large annual variations in year class strength and a single year class can dominate a fishery for a number of years (e.g. the exceptional 1967 year class in the North Sea). In area VIa the 1979 and 1983 year classes were particularly strong. The scientific advice has always been to reduce fishing effort towards a level which will give maximal yield.

2.11 Haddock landings in the Clyde have always fluctuated since the beginning of the century and there have been times when they have been scarce. In recent years they were relatively numerous between 1964 and 1972 compared with the period between 1975 and 1979. Although the eggs and larvae are found in the Clyde the possibility that some of the stock comes from outwith the Clyde area cannot be excluded.

2.12 The whiting of area VIa probably belong to a number of different spawning stocks and are characterised by particularly high growth rates. Landings increased from between 6,000 and 8,000 tons in the early 1960's to 19,000 tonnes in 1965 and remained high to 1979. The whiting stock has fluctuated without trend over the last 20 years. Fishing mortality has tended to decline in the last decade and recruitment has been below average since 1979 except for the good year class of 1983. Although landings have declined in recent years it is the result of poor recruitment and there appears to be no danger to the spawning stock. The scientific advice has been not to increase present mortality rates.

2.13 An April fishery for whiting in the Clyde is on mature fish with ripening gonads but the numbers decline rapidly after the onset of spawning either because they leave the Clyde or become inaccessible to capture. From tagging experiments in the 1960's it was inferred that when whiting become sexually mature in their second year they left the Clyde to spawn and that after spawning they dispersed over a wide area. More recent experiments have indicated that most of the recaptures are within the Clyde area. The evidence for whiting spawning within the Clyde is therefore somewhat conflicting but on

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balance it is probable that at least some of the stock is derived from spawning within the Clyde.

2.14 The stocks of saithe in area VIa have been much more difficult to assess for a number of reasons. Earlier estimates of the age composition of commercial catches used for VPA are in doubt because it was assumed that the landings of English and French trawlers were similar when in fact they were different. Fisheries for saithe also tend to be more directed than for other gadoids in VIa and effort fluctuates considerably according to demand. The life history of saithe, where the young are to be found close inshore, makes it difficult to access the strength of the pre-recruit year classes. There appears to have been a decrease in stock size since 1970 and the scientific advice has been to reduce the fishing effort.

The Evidence from Commercial Fishery Statistics

2.15 The weights of all species of fish landed from the Clyde statistical rectangles are recorded by DAFS as is the method of capture. A record is also kept of the number of hours fished by each method. It is the number of hours fished or effort which is important if catches are to be compared from year to year. To be of value estimates of fishing effort must be consistent from year to year but a number of factors make this difficult to achieve. One example of a change in effort has already been cited namely a directed fishery for saithe which not only affects the landing per unit effort of saithe but of all the other species normally caught by the particular fishing method. Improvements in the power of fishing vessels net handling techniques, net design and fish detection all have the effect of increasing catches per unit effort.

2.16 The three most important gears used on the Clyde are the nephrops trawl, the light trawl and the seine net. The nephrops trawl and light trawl are essentially similar gears the main difference being that the nephrops trawl has a codend mesh of 70mm while the light trawl has a codend mesh of 80mm. Both trawls catch fish as well as nephrops but the regulations state that with the nephrops trawl a minimum of 30% by-weight of the catch must be nephrops and a maximum of 60% can be of a protected or pressure species such as cod. Since most fishing vessels carry both types of gear such a regulation is almost impossible to enforce and it is quite probable that if a vessel catches more fish

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than the quota allows with the nephrops trawl then they are landed as landed as having been caught by the light trawl. Before the introduction of the 1984 Act there were controls on the size of otter boards, and hence perhaps some consistency in effort, but with the abolition of controls it is likely that efficiency has improved markedly. The design of trawls is continually improving with the result that many areas once inaccessible to trawling are now exploited. All this points to a general conclusion that catch statistics based on trawl catches should be treated with some caution. The seine net is a much more traditional fishing gear which has been used in the Clyde for many years and it is likely that statistics derived from this gear are more reliable. (The value of Scottish seine net statistics in the North Sea is internationally recognised.)

2.17 Table 2.1 shows the tonnages of the major demersal fishes landed for the years 1960 to 1987. Table 2.2 gives the effort for each of the three major fishing methods, seine net, nephrops trawl and light trawl. The data have their limitations:

(a) the tonnages cannot be related to effort because the efforts of the three gears are not additive;

(b) the tonnages and effort are for the four ICES statistical rectangles which include fishing in parts of the North Channel and part of the Sound of Islay. DAFS estimate that in the period 1979 to 1984 10% of cod, 37% of haddock, 8% of whiting, 3% of saithe and 16% of hake were taken from outwith the Clyde Sea Area as defined in Figure 2.1.

(c) the boundary between ICES area VIa (West of Scotland) and area Vlla (Irish Sea) is in the North Channel. Each area has different TAC's (quotas) and misreporting of catches is a distinct possibility.

2.18 Figure 2.2 shows the changes in fishing effort (expressed as numbers of hours of fishing) for each of the methods. The decline in the seine net fishery reflects the gradual relaxation of the restrictions on trawling in the 1960's. There are, as noted above, restrictions on the relative weight of fish to nephrops which can make up the by-catch of a nephrops trawler. In practice this seems to be of little relevance because the recording of the method of catch in official statistics depends on the catch itself. It is summarised by Hislop (1986) thus “In reality there is little difference between the two trawling methods and

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the catch and effort data of a vessel are recorded in the official statistics under 'light trawl' or 'prawn trawl' depending on the proportions of whitefish and nephrops in her landing and on the mesh size of the net on her deck when she docks at the end of each trip."

2.19 The increase in nephrops trawling at the expense of light trawling may be artificial and also related to the fact that some vessels have sold their licences to land whitefish.

Cod: Clyde Seine Net Statistics

2.20 Data are available on fleet landings in tonnes and effort in hours of fishing for each of the quarters January to March, April to June, July to September and October to December for the years 1965 to 1987. Market sampling by DAFS has enabled them to apportion the landings into year classes (age groups) and estimate the number and weight of fish represented by each age group in each quarter. These data have their limitations:

(a) The area includes parts outwith the Clyde;

(b) Effort expressed as hours of fishing can cause problems because it takes no account of changes in the efficiency of the fishing method. Factors that could increase the landings for a similar time spent fishing are increased net size, increased vessel power, improved gear handling and improved navigation and fish detection. Changes to a directed fishery or a new location can also improve or diminish landings per unit effort. The Seine net is, however, the gear which has changed least over the years and Scottish Seine net statistics are frequently used by fishery scientists in the North Sea; and

(c) The codend mesh sizes and minimum landing sizes for cod mean that although some cod are landed as one year olds a large proportion either escape capture by passing through the meshes or if caught are discarded because they are undersize. There is no independent sampling of young fish in the Clyde and therefore the recruitment (year class strength) has to be estimated from the first fully recruited year class in the commercial catch namely the two year olds.

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Table 2.1

Annual Landings of Principal Demersal Species from the Clyde 1960-1987

Tonnes

	Cod	Whiting	Saithe	Haddock	Hake	Spurdog	Skate & Ray	Monk (Angler Fish)	Plaice	Total Demersal
1960	1146	2050	188	533	131	160	139	7	132	4753
1961	560	1587	105	350	433	104	140	16	123	3568
1962	440	1926	71	206	821	99	98	26	90	3941
1963	414	725	113	266	351	80	51	27	78	2147
1964	732	2220	113	634	177	73	45	23	106	4065
1965	1577	1672	324	855	650	141	104	58	277	5791
1966	1598	1913	474	660	1030	175	124	72	272	6530
1967	2160	3166	689	1093	905	279	170	63	286	9093
1968	2265	1511	602	888	783	320	206	53	267	7135
1969	2226	1402	890	789	645	319	167	63	205	6941
1970	1808	529	1911	699	654	252	117	83	163	6872
1971	1509	419	2129	568	543	308	112	99	160	6589
1972	1703	825	3638	663	688	403	133	146	159	8785
1973	1831	1017	6674	424	734	437	124	124	158	12191
1974	1565	598	3890	206	651	305	102	115	144	9794
1975	1492	845	2813	108	852	387	74	109	154	7324
1976	1582	1240	1571	129	503	431	98	138	183	6583
1977	1637	1095	1724	125	434	416	107	107	174	6597
1978	1524	1080	1790	110	463	294	99	91	163	5853
1979	1434	718	736	79	334	169	90	68	182	4083
1980	1716	1069	728	224	682	220	76	67	184	5169
1981	2329	1983	1405	403	1552	438	97	97	180	8696
1982	1861	1096	612	420	591	552	105	143	169	5740
1983	1351	1160	507	164	455	541	73	96	156	4647
1984	1348	804	704	186	265	561	67	62	183	4360
1985	1764	2024	1022	142	345	589	98	36	260	6583
1986	901	396	719	48	588	492	69	31	177	3679
1987	648	489	441	50	493	170	69	28	112	2787

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Table 2.2

Annual Fishing Effort : 1960 - 87
(Hundreds of Hours)

	Nephrops Trawl	Light Trawl	Seine Net
1960	0	+	885
1961	0	1	815
1962	0	0	640
1963	0	6	410
1964	0	2	449
1965	553	2	475
1966	710	68	436
1967	777	264	557
1968	825	147	484
1969	844	209	388
1970	710	313	226
1971	770	458	166
1972	1047	444	166
1973	1153	528	190
1974	905	345	139
1975	884	475	149
1976	984	329	110
1977	964	329	110
1978	808	571	98
1979	704	429	79
1980	1110	447	76
1981	1259	917	83
1982	1132	622	72
1983	1500	309	87
1984	1400	325	67
1985	1557	444	83
1086	1689	355	53
1987	1443	265	33

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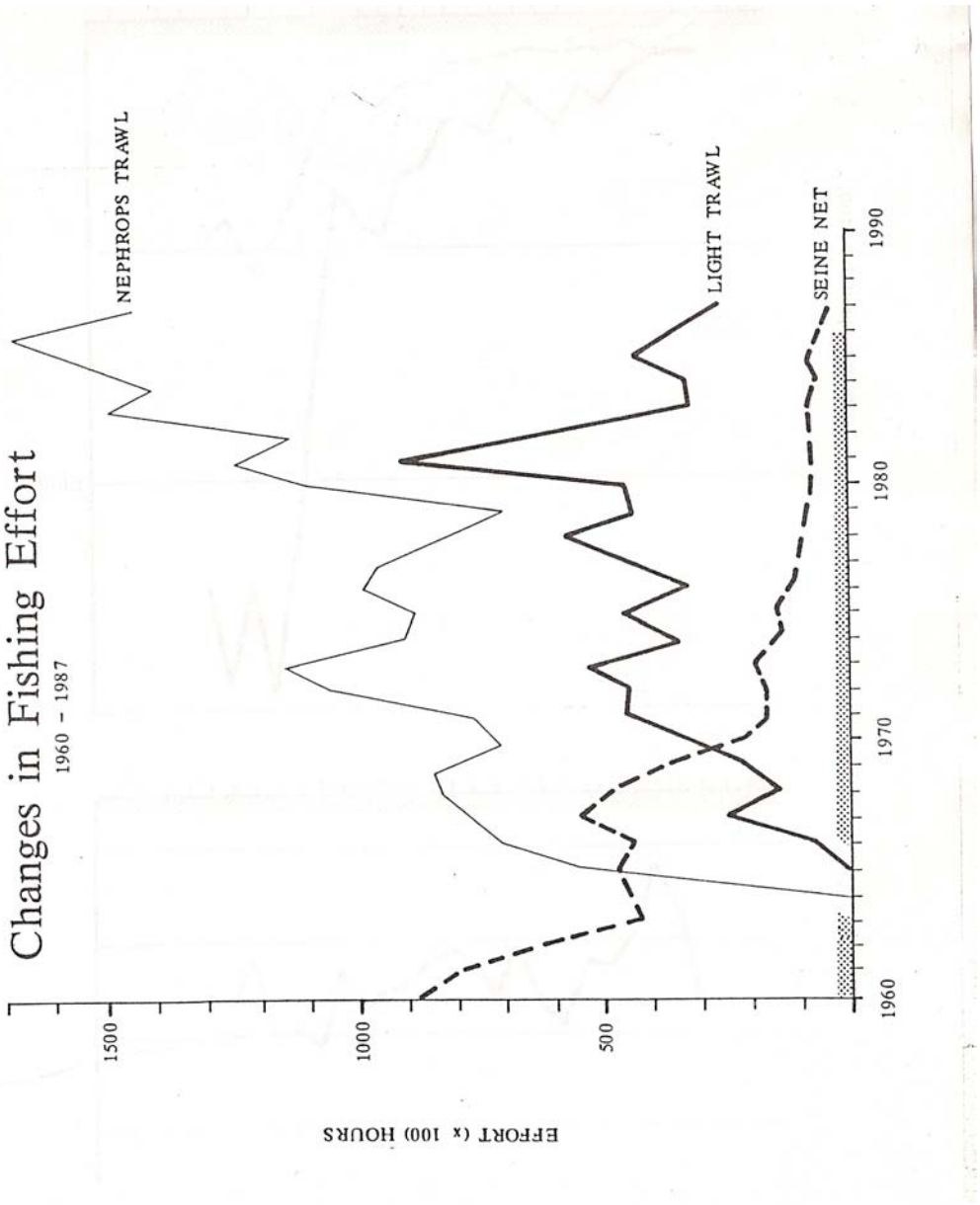
FIGURE 2.2


Changes in Fishing Effort
1960 - 1987
NEPHROPS TRAWL
LIGHT TRAWL
SEINE NET
1500
1000
500
1960
1970
1980
1990
EFFORT (x 100) HOURS

2.21 Figure 2.3 shows the landings, the effort and the landings per unit effort (LPUE) for the cod caught by the seine net for the period 1965 to 1987. Two year old cod are the first year class to be fully exploited by commercial trawls and the LPUE of this age group expressed as an index of abundance is the best estimate of year class strength in Clyde cod. These data are plotted in Figure 2.4a and show strong year classes in 1979 and 1981 and very poor year classes of fish spawned in 1982 and 1984. There is some evidence that the 1985 year class was stronger. An index of abundance calculated from similar data for the entire Scottish West Coast of Scotland landings shows similar trends (Figure 2.4b). Each year ICES publish recruitment estimates derived from VPA on the international landings for Areas VIa and VIIa and these are reproduced in Figure 2.4c and d respectively. The technique of VPA means that the estimates of numbers of recruits for the most recent years are the least reliable.

2.22 If the decline of the cod landings is the result of a combination of a series of poor year classes and increase fishing mortality then the stock of older fish in the population will decline and the fishery will become more and more dependent on the recruiting year classes. Figure 2.5a shows the relative proportions of two, three, four and five year old and over cod expressed as a percentage of the total number of cod of all ages less the partially recruited one year old fish. This shows how the landings are dominated by two year old fish, and to a lesser extent three year old fish, while four year and five year plus fish have not been important since the late 1960's.

Cod: Clyde Light and Nephrops Trawls

2.23 Similar data as for seine net are available for each of these trawls. These data have the same limitations as discussed above. In addition the value of effort as measured in hours of fishing is probably less reliable than for the seine net because of improved efficiency over the years. Although few would deny that illegal trawling was taking place in the Clyde long before the 1984 Act, the abolition of the 3 mile limit may have led to a more directed fishery in these previously prohibited areas with a consequent change in effort related statistics. The ending of restrictions on the size of otter boards will almost inevitably have led to the use of larger trawls and although the size of the vessels comprising the Clyde fleet has remained fairly constant, the power of many vessels may have increased.

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FIGURE 2.3

CLYDE COD - SEINE NET

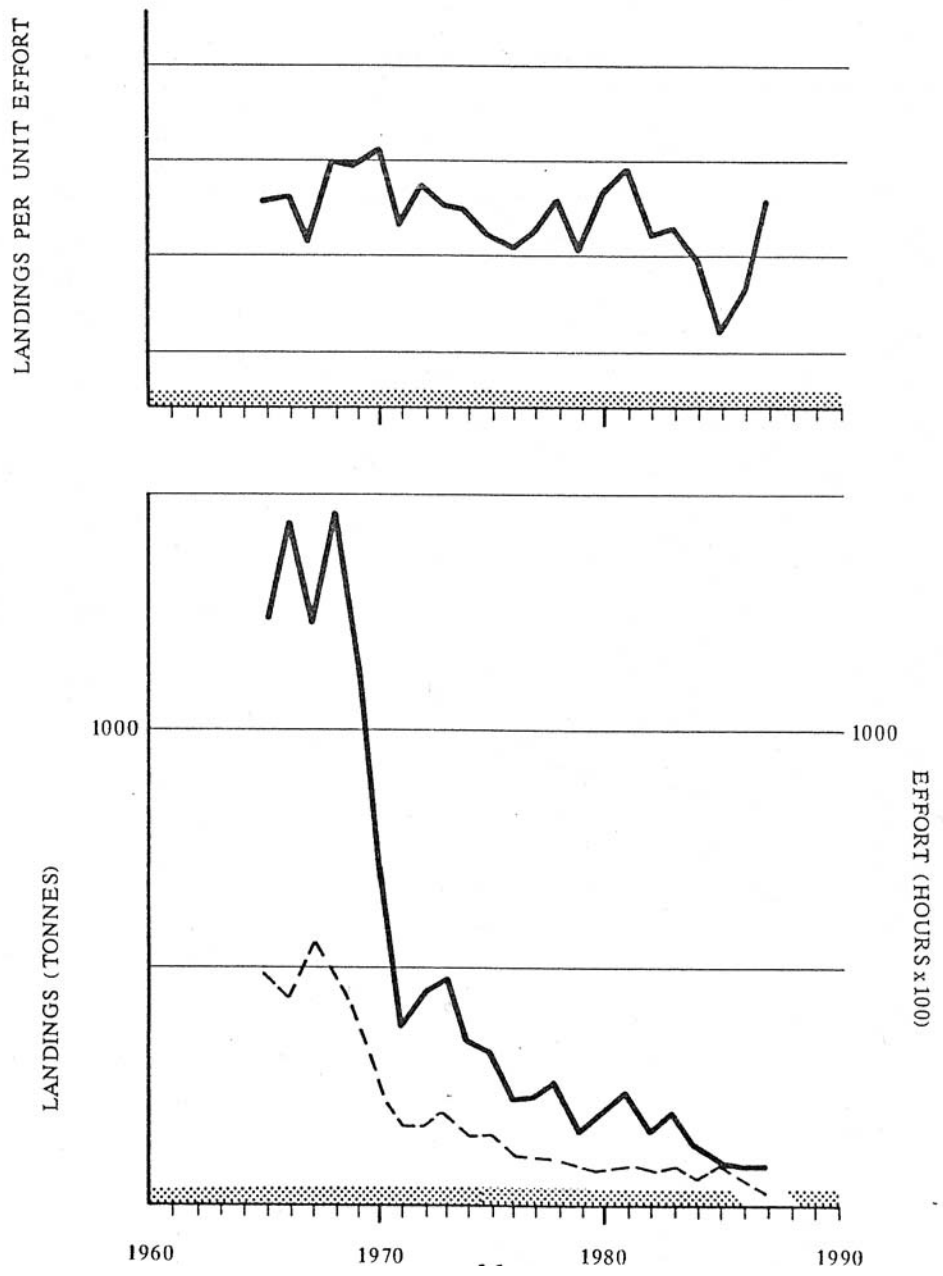

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FIGURE 2.4

Recruitment and Abundance

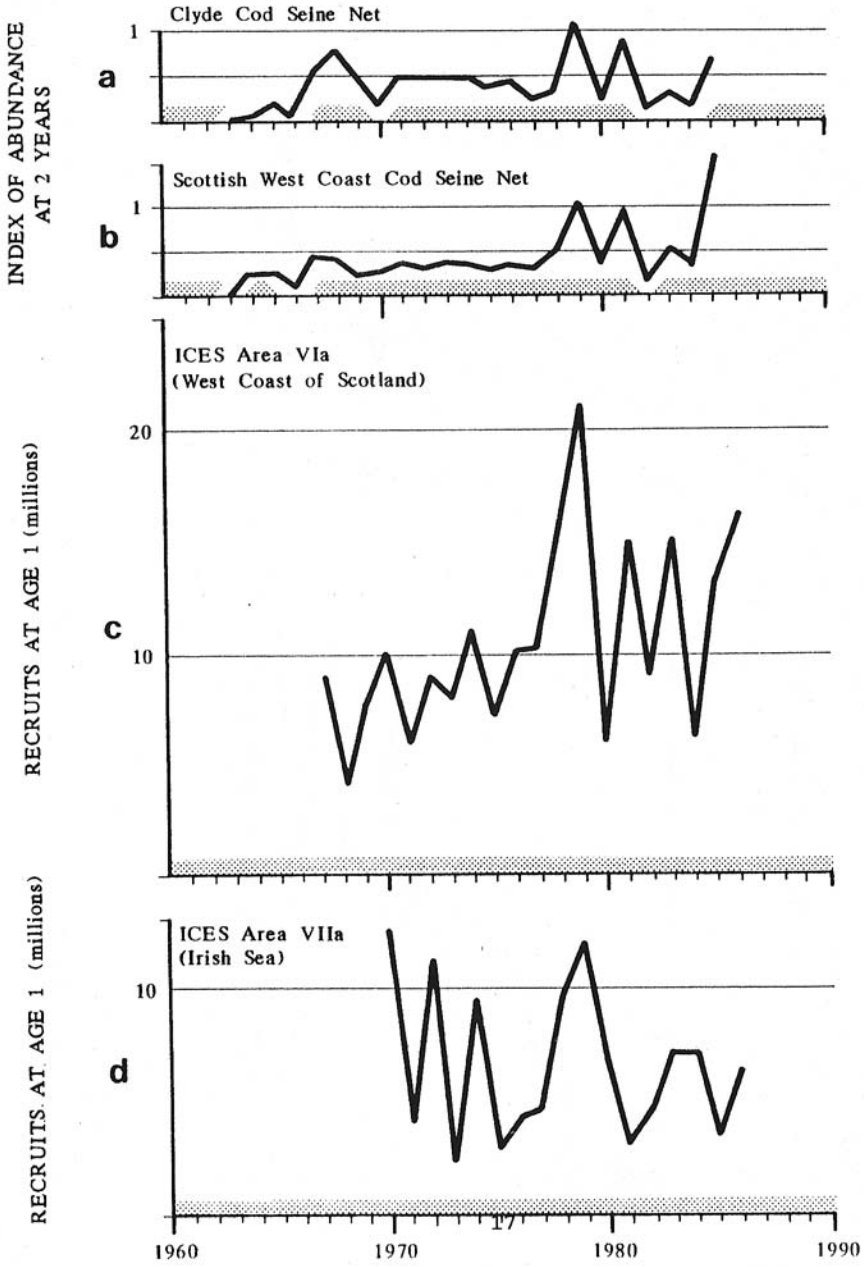

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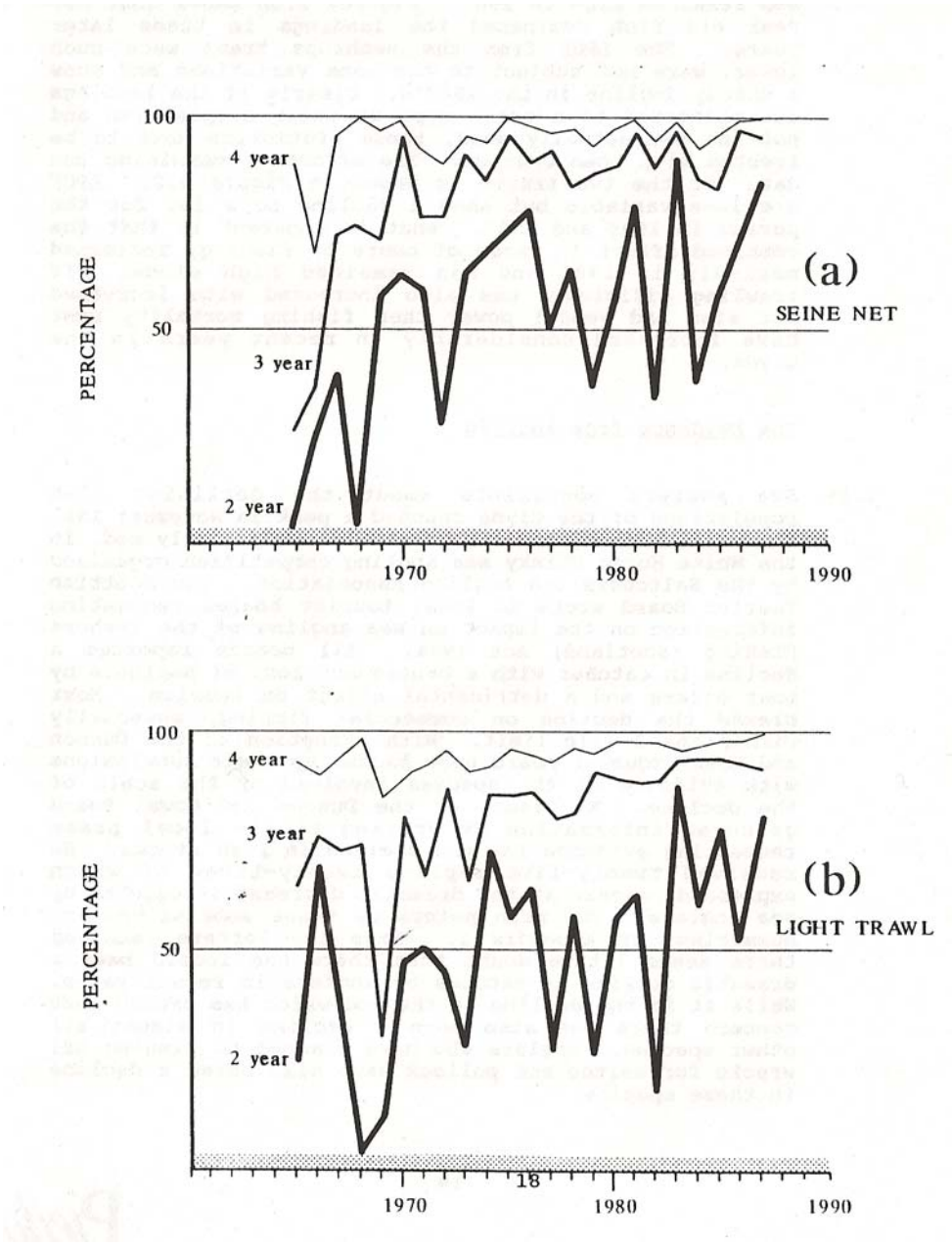
FIGURE 2.5

Clyde Cod Landings by Age



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2.24 Figures 2.6 and 2.7 show the landings, effort and LPUE for the light trawl and nephrops trawl respectively. LPUE of the light trawl increased dramatically in 1984 (NB the 1984 Act was not implemented until July 1985) and remained high in 1985. Figures 2.5b shows that two year old fish dominated the landings in these later years. The LPUE from the nephrops trawl were much lower, were not subject to the same variations and show a steady decline in the 1980's. Clearly if the landings are allocated to a trawl type by their composition and not the net actually used, these statistics have to be treated with some caution. The effect of combining the data for the two trawls is shown in Figure 2.8. LPUE are less variable but show a decline to a low for the period in 1986 and 1987. What is apparent is that the combined effort in terms of hours of fishing, increased markedly in 1981 and has remained high since. If trawling efficiency has also increased with increased net size and vessel power then fishing mortality must have increased considerably in recent years in the Clyde.

The Evidence from Anglers

2.25 Sea anglers complaints about the declining fish populations of the Clyde reached a peak in November 1986 following a drastic shortage of fish, especially cod, in the White Horse Whisky sea angling competition organised by the Saltcoats Sea Angling Association. The Scottish Tourist Board wrote to local tourist boards requesting information on the impact on sea angling of the Inshore Fishing (Scotland) Act 1984. All boards reported a decline in catches with a consequent loss of business by boat hirers and a detrimental effect on tourism. Most blamed the decline on commercial fishing, especially within the 3 mile limit. With exception of the Dunoon and Cowal Tourist Board none backed up their submissions with evidence of the species involved or the scale of the decline. Mr Clason of the Dunoon and Cowal Board gathered information by writing to the local press requesting evidence for the decline in fish stocks. He received twenty-five replies twenty-three of which expressed concern at the dramatic decrease in catches by sea anglers. The main points of these submissions are summarised in Appendix 1. From the letters received there seems little doubt that there has indeed been a dramatic decline in catches by anglers in recent years. While it is the decline of the cod which has caused most concern there has also been a decline in almost all other species. Anglers who have changed to fishing off wrecks for saithe and pollack have also noted a decline in these species.

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FIGURE 2.6

Clyde Cod Light Trawl

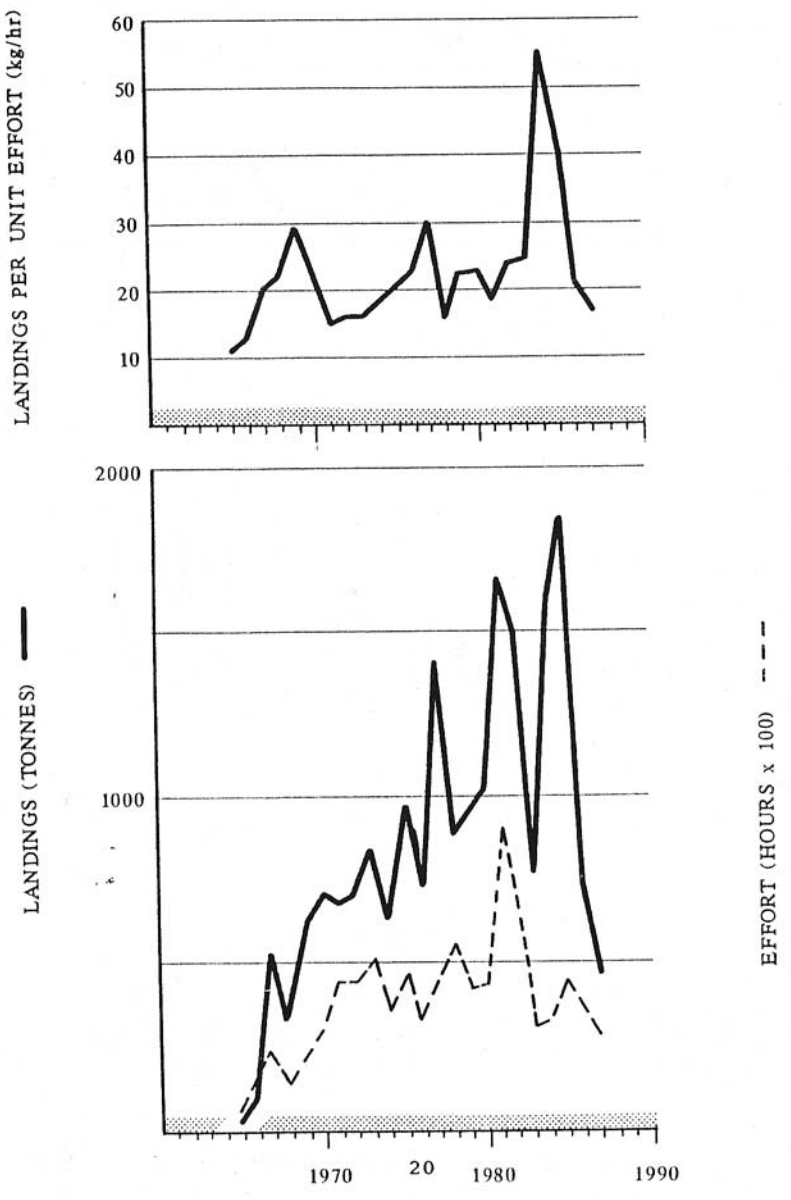

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FIGURE 2.7

Clyde Cod Nephrops Trawl

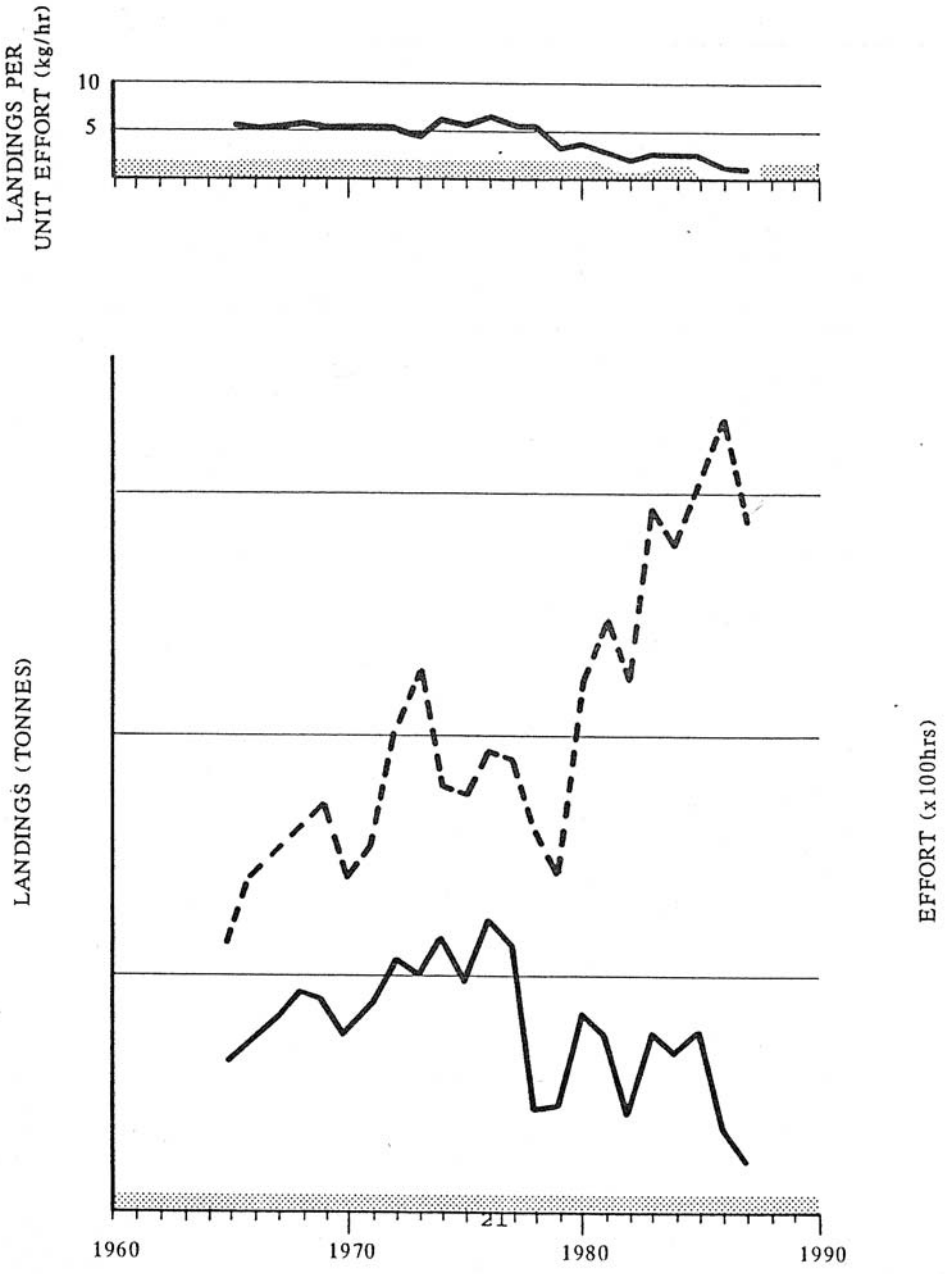

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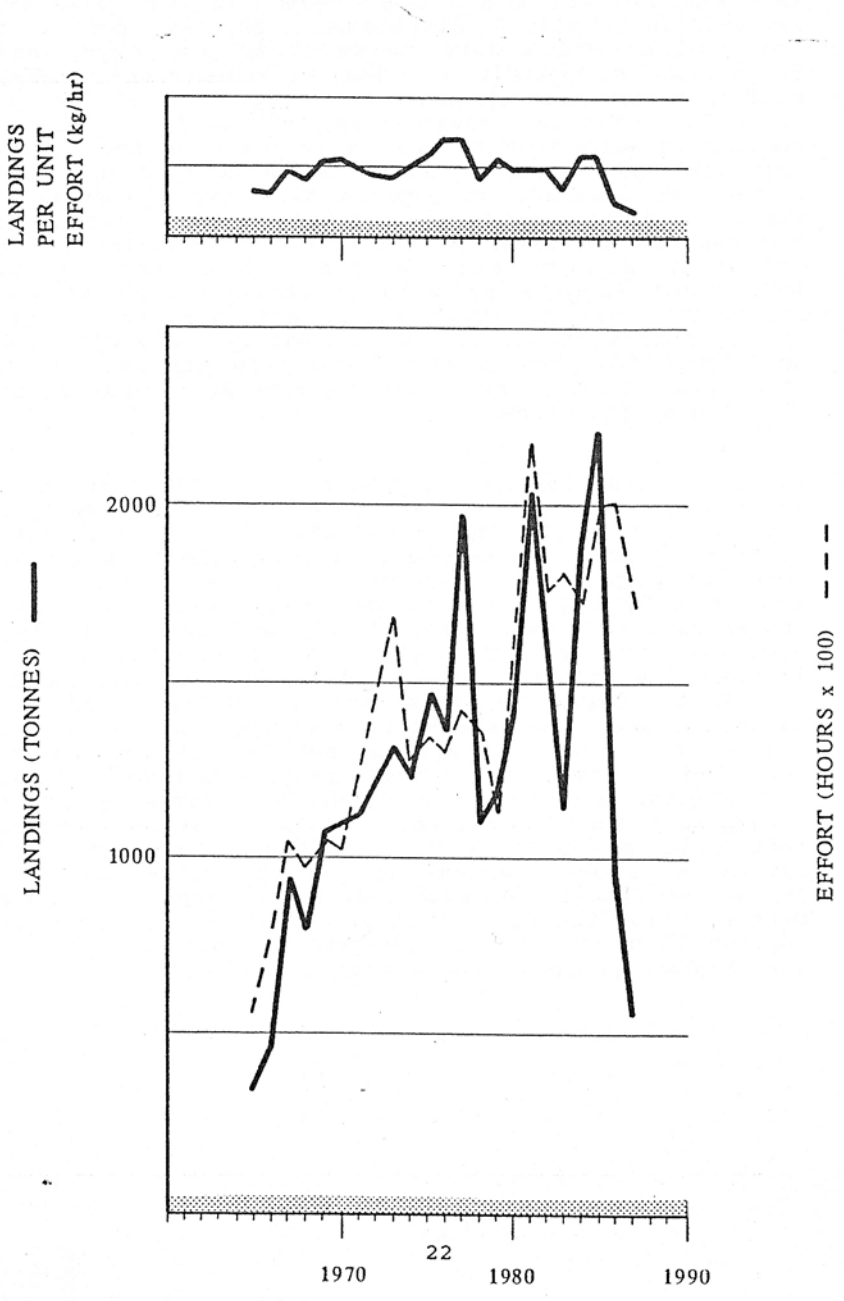
FIGURE 2.8

Clyde Cod
Combined Light Trawl & Nephrops Trawl



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2.26 Following the setting up of this study the SFSA agreed to circulate all their affiliated clubs seeking information on the decline in the catches. The information supplied was the method of fishing (boat or shore), the number of anglers, the aggregate catch and the main species caught. Almost all the returns gave information only for a few years and few give any information on individual catches. The main points of the replies which were relevant to the Clyde are summarised in Appendix 1. For an assessment of fish stocks, information on aggregate weights is of limited value and what is required is information on total numbers of each species and an estimate of the effort that went into catching them. Since most of the fish species of interest to anglers live for a number of years and fish are subject to large annual variation in the numbers surviving past the juvenile stages it is essential to try and ascertain from records of individual lengths or weights whether fish of any particular spawning (year class) dominate the catches over a period of years. Unfortunately information on individual fish was totally lacking in the returns to the SFSA. Further enquires produced more information from two of the clubs.

2.27 To be of value for an assessment of a fish population information from sea anglers ought to satisfy several important criteria. The method and location of fishing must be as constant as possible (e.g. there is little point in comparing catches made from a boat with those from the shore), catches can vary seasonally and comparisons of annual variations must take this into account, numbers and weights of fish caught are of little value unless there is some measure of the amount of effort involved in their capture and the length and weight of each fish should be recorded and samples of scales or ear bones should be kept so that age can be recorded. There have been many studies of fish populations, especially in freshwater where by prior arrangement and with the co-operation of anglers useful information has been obtained on the fish populations of rivers and lakes. Unfortunately such studies are rare for marine fish and no such information appears to have been kept for the Clyde. It is the normal practice of angling clubs to record aggregate weights, weights of the largest specimens and numbers of fish.

2.28 The Isle of Arran angling club provided the following information to the Dunoon and Cowal Tourist Board for the catches of the Lamlash Sea Angling Festival which is held over two days in May. Total catches were as follows:

1972	1,650 lb
1973	1,385 lb
1974	1,417 lb
1984	600 lb
1985	448 lb
1986	281 lb

This information is of limited value because there is no indication of the number of anglers involved in each year. Further enquiries to the club revealed that the competition was held from boats of approximately 16 foot long with an average of 10 to 12 anglers in each. The competition was fished over two days of seven hours each the exceptions being 1972 (1 day) and 1986 when 3 hours were lost to bad weather. No individual numbers or weights were recorded except for the heaviest fish of each species. Information on the number of anglers competing enabled the average weight of fish caught by each angler per 10 hours of fishing to be calculated. Results are shown in Table 2.3. There is a steady decline between the 1970's and the 1980's but one which is not quite so dramatic as in the figures which take no account of fishing effort.

Table 2.3

Lamlash Sea Angling Festival - Catches

Year	Total Catch (lbs)	No. Anglers	Catch/Angler/10 hrs.
1972	1,650	128	18.4
1973	1,385	120	8.2
1974	1,417	150	6.7
1984	600	130	3.6
1985	448	100	2.5
1986	281	100	2.6
1987	297	68	3.1

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2.29 The other angling club to provide information was the Irvine Sea Angling Club who sent their competition record books dating back to 1973. The club runs a summer and winter boat league which means that a competition is scheduled to take place most months. Inevitably competitions are cancelled for various reasons but the club has a good record over the years with 8 to 10 competitions each year. About 80% of the competitions were held between Fairlie and Girvan with the majority being in Irvine Bay. The remainder except for a few off Arran were in the Gourock to Helensburgh area. The record books give the number of specimens of each fish species and the total aggregate weight of the catch for each angler and also the type and weight of the heaviest specimen caught in the competition. It is not always clear how many of the anglers listed in the book actually competed and to avoid confusion catches are expressed in terms of anglers with recorded catches. There is no information on the duration of the competitions but it was hoped that by combining the results of all competitions held in a year that total effort would be comparable from year to year.

2.30 The information abstracted for each competition included the number of anglers who recorded a catch, the number of anglers who included cod in their catch, the total number of cod caught and the total number of all other species of fish caught. Figure 2.9 shows how the average number of cod caught per angler has changed over the period. The catch rates were particularly high in 1981, 1983 and 1984 but reached an all time low in 1986 and increased again in 1987. A similar trend is apparent when the number of cod is expressed as a percentage of all fish caught (Figure 2.10). The average weight of all fish caught is interesting (Figure 2.11) in that it tends to mirror the cod catches until 1984 and then despite declining cod catches increases. This results from a change in the club's activities to fishing for pollack in the autumn of 1985 and early part of 1986. No competitions were held during the winter/ spring of 1986/1987.

2.31 Although individual weights were not routinely recorded these are available for the heaviest fish of a competition and if an angler only caught a single fish then its weight is his aggregate weight. In this way it was possible to obtain the weights of 232 individual cod. Figure 2.12 shows diagrammatically how the cod are distributed in one quarter pound groupings and indicates that most fish were between three quarters of one pound and two pound in weight which means that one and two year old fish make up the majority of fish caught by anglers. Figure 2.13 shows the distribution of weights for cod which were the

IRVINE SEA ANGLING CLUB 1973 -1987

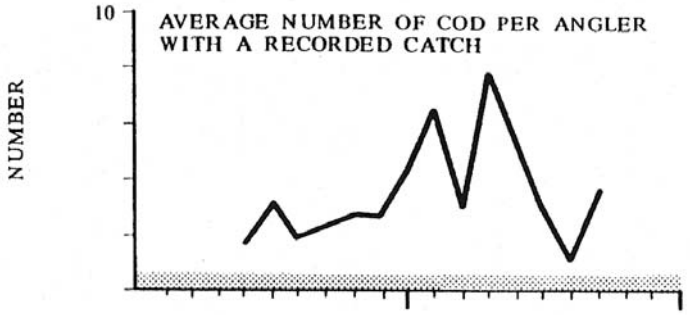

FIGURE 2.9

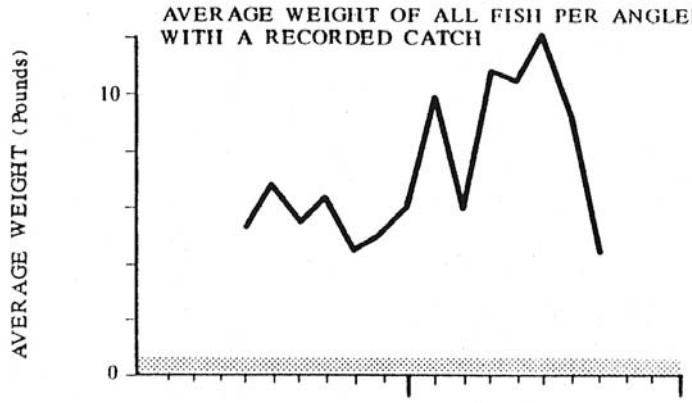

FIGURE 2.10

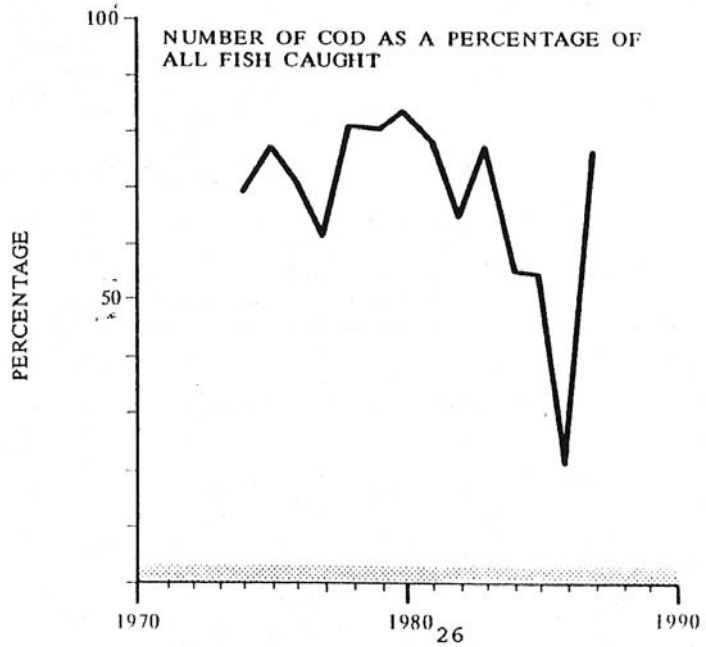

FIGURE 2.11

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FIGURE 2.12
IRVINE SEA ANGLING CLUB

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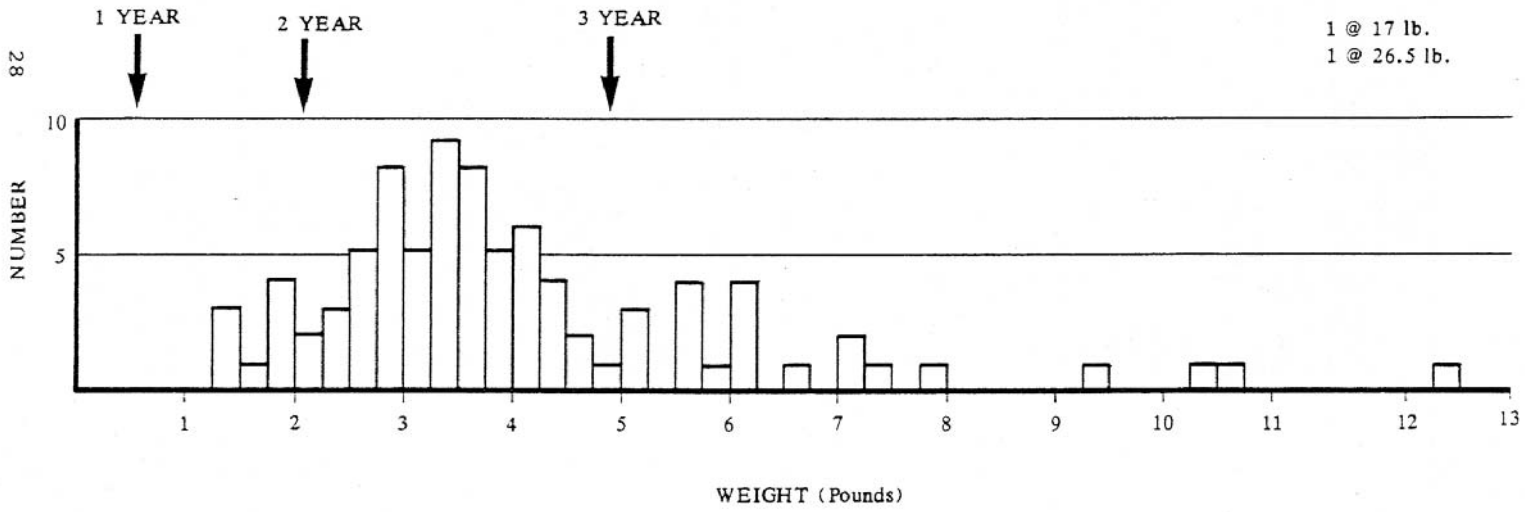
FIGURE 2.13

IRVINE SEA ANGLING CLUB
1973–1987

Frequency of weights of cod where cod was the heaviest fish caught



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heaviest specimens in the competition. The heaviest fish were mostly between two and four pounds and are therefore mainly two years old with a few three year olds. Larger fish were fairly infrequent and appeared to be more common in the 1970s.

2.32 The general conclusion from the evidence of the anglers, which unfortunately is largely anecdotal, is that a decline in fish stocks has undoubtedly taken place and that this was particularly apparent in 1985 and 1986. This decline, at least in the lower Clyde, may have been all the more prominent because of a series of good years for cod in the early 1980s, as shown by the Irvine SAC's returns. This period where the number of cod caught was high may not have been so apparent to anglers because fewer larger fish were caught. The situation in the sea lochs is much less clear and the anecdotal evidence seems to suggest that the decline has been occurring over a longer period. The results obtained from the Irvine club's records are valuable in that they give the information that it is one and two year old cod which make up the bulk of anglers catches and the occasional older (and larger) fish which adds to the attraction of the area.

The Regulation of Commercial Fishing in the Clyde

2.33 A detailed account of the history of the regulation of inshore fishing in Scottish waters is given in the report of the Scottish Inshore Fisheries Committee which was published in December 1970. It is this report which led to the Inshore Fishing (Scotland) Act 1984 and which is blamed by most anglers for the decline in sport fishing in the Clyde. This report is concerned with all the inshore waters of Scotland and what follows is a brief summary of the regulations as they have applied to the Clyde.

2.34 Fishery regulations in the Clyde extend back to 1851 when there was a conflict between traditional drift netting and a new form of circle netting (beach seining) for herring in Loch Fyne; drift netting was declared the only legal method of fishing for herring. This ban was repealed in 1867. The drift net fishermen then claimed that beam trawling was injurious to the herring fisheries and, in 1885, the Fishery Board was given powers to control beam trawling. Meanwhile otter trawling was spreading to Scotland and in 1885 both beam and otter trawling were prohibited within a limit of 3 miles from low water mark and in other areas specified by byelaws of the Herring Fishery (Scotland) Act. The

prohibition was relaxed in the Clyde between 1889 and 1908 when beam trawling was permitted within certain areas for a part of the year.

2.35 Meanwhile, developments were taking place in the use of the circle net. In 1901 it became unlawful to fish for herring on the Ballantrae Bank (a major herring spawning ground) by this means but this ban was repealed in 1910. The circle net was then modified by the addition of a bag and footrope (flounder seine) and was intended for the capture of flat-fish in shallow water. This was banned in 1898 within the exclusive fishery limit and the same act also prohibited the dragging of any net on the seabed other than for the capture of herring, sprats, sparlings and shellfish. In 1905 this prohibition was relaxed in the Clyde in relation to operations in certain areas by small boats. In the 1920s the Danish seine was introduced into Scotland and rapidly replaced the flounder net. In 1921 this method of fishing was permitted by boats not exceeding 40 foot for the capture of whitefish anywhere in the Clyde.

2.36 The development of the nephrops fisheries in the 1950's began with the Danish seiners but it was soon found that light otter trawls were much more efficient at catching nephrops and that some of the best grounds were in areas where trawling was banned. Following representations by fishermen, trawling for nephrops was permitted in the Firth of Clyde by vessels of less than 70 foot in 1962. Trawling was still prohibited within the 3 mile limit and was only permitted at all between May and September. There were added restrictions on the size of the otter boards (and hence the size of the trawl) and a stipulation that not more than 25% by weight of fish other than nephrops could be landed. In 1968 some amendments in relation to the nature but not the dimensions of the otter boards were made and fishing was permitted throughout the year.

2.37 Another development was the advent of pair trawling in the 1960s. This was prohibited in the Clyde by a gentlemen's agreement but following an enquiry in 1968 a bye-law was passed in 1969 which allowed pair trawling in the Firth except on the Ballantrae Bank and during the months of February and March.

2.38 In 1967 the Secretary of State for Scotland appointed a committee under the chairmanship of Lord Cameron to review the law governing fishing in Scottish coastal waters. After taking evidence from a wide variety of organisation the committee recommended that the regulations governing beam and otter trawling and seining within the 3 mile limit should be rescinded five years after the publication of their report (date of publication December 1970) and thereafter otter trawling by vessels of 80' or over should continue to be prohibited for a further three years. They also recommended that the Secretary of State should be given powers to control fishing where there was an incompatibility of methods or in the interests of conservation and also to regulate fishing by licensing or prohibiting landings of sea fish.

2.39 This report led to the Inshore Fishing (Scotland) Act 1984 which repealed most of the existing legislation and allowed fishing by all methods within the three mile limit. This act came into force in July 1985. At the same time an order was brought into force aimed at aiding conservation. In the Clyde fishing except for herring, mackerel and sprat was restricted to vessels not exceeding 70'. To safeguard Clyde herring stocks and particularly the spring spawners on the Ballantrae Bank a licensing system was introduced by DAFS.

2.40 It is relevant to this study to consider some of the evidence presented to and the conclusions drawn by the Cameron report particularly as they apply to the Clyde. The report considered the legislation allowing pair trawling in the Clyde and concluded that pair trawling for herring was no more detrimental to herring stocks than ring netting. The committee considered the special interests of the sea angler both in the Clyde and other Scottish waters but although recognising that the sport had developed under the aegis of the three mile limit and that it had an important tourist value, rejected the contention that commercial fishing should be restricted in certain areas in the interests of sea angling. The committee considered in some detail the complex fishing regulations existing at the time in the Clyde and in particular the anomaly that seiners of less than 40' were allowed to fish within the 3 mile limit but trawlers of all sizes were excluded. The committee maintained that many of the arguments for retaining the status quo related to the structure of the fleet, 50 per cent of which was under 40'. They recommended the removal of restrictions and suggested that the fishermen should be given time and assistance to adjust to the new regulations.

2.41 In general terms DAFS have been satisfied with the functioning of the 1984 act but they recognise that there are certain areas that may require additional safeguards and a consultation paper was issued in April 1988. In relation to the Clyde, they note the numerous representations which have been made by anglers and tourist interests on the current scale of fishing activity in the Clyde and the effect this is having on fish stocks. They also acknowledge that commercial fishermen are now operating in areas which were once the almost exclusive domain of anglers. DAFS also recognise the importance of the commercial fishing industry of the Clyde and rule out the complete closure of the area to mobile gear fishing (Seines, trawls etc.). Various options are being considered to resolve the conflict between the fishing industry and the anglers. A weekend ban on the use of mobile gear has been proposed by the Clyde Fisherman's Association but DAFS point out that this may not be effective because extra fishing effort might be directed to the remainder of the week. Other methods of conserving stock such as an increase in mesh size might be considered. Another possibility might be to prohibit the use of mobile gear in the most favoured angling grounds in the upper Clyde. An example of such a prohibited area might be north of a line between Dunoon and Cloch Point.

2.42 In order to conserve herring stocks, DAFS are proposing to close the Clyde herring fishery between 1 January and 30 April. A further possible measure would be to ban fishing on the Ballantrae Bank during the herring spawning period (early February to mid April). Enforcing such a ban would require a ban on activity over a much wider area. DAFS do not propose to introduce this measure but would consider any effective proposal.

Conclusions on Stock Change Causes

2.43 The evidence discussed above suggests that the fish stocks of the Clyde have declined as a result of increased intensity of fishing combined with, in the case of cod, low recruitment in recent years. The increase in the intensity of fishing within the Clyde area is difficult to quantify, first, because the statistics include part of the North Channel and the area to the west of the Mull of Kintyre and, second, because the measurement of effort in terms of hours of fishing obscures probably quite substantial changes in the efficiency of trawling in recent years involving the size and design of the trawls, increased power of

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the vessels, improved net handling and better fish detection.

2.44 DAFS recognise in their consultative document (April 1988) that "compared with the period when the Cameron Committee were looking at inshore fishing, the level of fishing effort in the Firth of Clyde is much higher, stocks of fish are at a much lower level and the introduction of the new inshore fishing regime has meant that commercial fishermen are now operating to a greater extent in areas formerly fished almost exclusively by anglers". In the annual report of the University Marine Biological Station at Millport for 1985/86 it is stated that orders for the supply of specimens for teaching and research had declined due to "a surprising but continuous scarcity of round fish in the Clyde. This scarcity is almost certainly due to an increase in the intensity of fishing following changes in fishery regulations". Although the anglers are most concerned about the decline in the cod for which the Clyde was once famous there is a widespread opinion in the submissions from anglers that there has been a decline in all species.

2.45 Recruitment refers to the fish entering the exploited fishery for the first time. In the case of cod this can occur at the end of their second year of life. The number of fish which recruit to the fishery each year depends how successful the early life history stages are at surviving to this stage. Although there is undoubtedly a relationship between stock size and eventual recruitment, in many fish species the stock size would have to be at a dangerously low level for this to be a significant factor. Probably the most vulnerable stage in the life of a fish is the stage from hatching, through first feeding until it metamorphoses into a form resembling the adult. Most fish spawn in the spring and hatching is matched to a time when the appropriate food (which is often very specific) is most abundant in the plankton as a result of the spring bloom. If for some reason the fish hatch out of phase with the food production there could be a high mortality and the resulting year class would be poor.

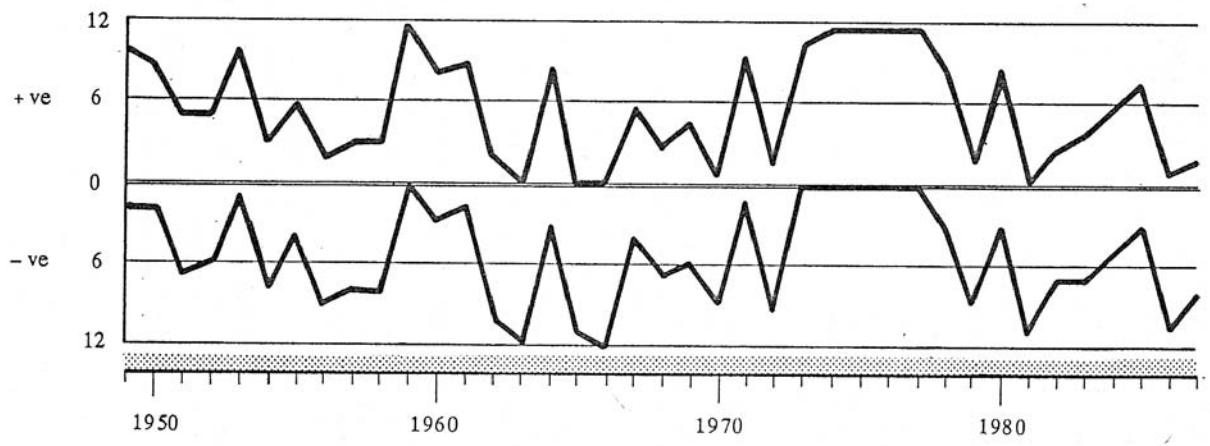
2.46 The rise and fall of many fish populations has been associated with a match or mismatch with food production. For example the 'gadoid outburst' when landings of fish of the cod family in the North Sea increased almost five fold in the 1960's is widely held to be the result of an improved match between the young fish and their food as a result of climatic change. The larval and juvenile stages of fish very largely depend on water movements for their dispersal to the all important nursery grounds. Changes in the patterns of water movements from year to year could have significant effects on eventual recruitment to the exploitable stock. There are many other instances of climatic change having considerable influences on fish stocks. Perhaps one of the best documented in British waters is the Russell Cycle in the Plymouth area. A period of warming which began in the 1930's peaked between 1945 and 1950 and reverted to the cooler conditions of the 1920's in the 1960's had considerable impact on the distribution and abundance of a wide range of marine organisms including fish.

2.47 Unfortunately, long term hydrographic observations are not available for the Clyde with the exception of surface temperature records for Millport. Figure 2.14 shows how annual mean monthly temperatures have varied over the years from 1949 to 1987. The more recent information was compiled by kind permission of Professor J A Allen of the University Marine Station. The annual variations in abundance of a sand burrowing mollusc have been shown to be linked to these temperature changes but as yet no changes in fish populations have been linked.

2.48 The herring fisheries of the Clyde are well documented and have undergone considerable changes over the years. Between 1930 and 1960 most of the herring caught in the Clyde were spawned in the spring but in the late 1960's herring spawned in the autumn began to dominate the catches and this has remained so to the present. Historical accounts indicate that similar declines in spring spawners have occurred in the 19th century. The spring spawners spawn within the Clyde while the autumn spawners are derived from fish spawned outwith the Clyde. The decline of the spring spawners on the Ballantrae Bank is well documented but the reasons for the decline are uncertain.

FIGURE 2.14

Temperature Anomalies at Keppel Pier Millport



The top line shows the number of months in the year where the mean temperature exceeded the long term monthly mean. The bottom line is the number of months when the temperature was below the long term mean.

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2.49 Many of the other factors can have an effect on the survival of young pre-recruit fish. Although fish are vulnerable to pollution at all stages of their lives the larval and juvenile stages are probably most at risk and this may be compounded by the fact that the nursery areas of many fishes tend to be close to the coast where pollution is often greatest. The effluents from about half of Scotland's population and industry drain into the Clyde Estuary, the discharges are well monitored and controlled and water quality is improving, although there is no room for complacency. There is no evidence to link changes in fish populations with pollution in the Clyde.

2.51 Predation on fish of all ages, but especially the younger stages, can have a significant effect on survival. The interactions between fish species and their predators are complex and ever changing. For example, a spur dogfish which feeds mainly on young herring may change to fishes of the cod family if herring are scarce. Sea birds are also significant predators of fish. The species which have increased in numbers in the Clyde are the gulls, gannets and fulmars which not only feed on natural food but man-made food such as offal and discards from fishing vessels. Small bird species such as the terns and kittiwakes which depend on small surface living fish such as sand eels and the herring family have declined in abundance. Sea mammals are also important predators of fish. There has been dramatic change in the seal population of the Clyde in the last decade with the common seal being replaced by the grey seal. The differences in diet between the two species are not clear cut but there is a suggestion that grey seals eat larger fish than common seals. Vastly increased sightings of the common dolphin have been reported in the Clyde in the last ten years. Thus although predation must be important in the Clyde, as in other areas the complexity of the interactions between predator and prey in the food web of the sea makes it impossible to quantify its significance.

2.51 It is often stated by anglers, and sea angling interests, that repeated trawling of areas of the seabed is 'ploughing up' or 'denuding' the sea bed with adverse effects on food supply for fish. While the removal of some of the larger invertebrates on the seabed have an effect on the food supply of fish, most of the fish preferred by anglers do not rely on bottom living organisms for their food. The view that the effects of trawling on the sea bed are of particular significance is not correct.

2.52 Commercial fishing can also have an effect on the survival of the pre-recruit stages. Once the young fish leave the nursery ground and join the main adult stock they are subjected to the fishing effort and will either pass through the meshes of the cod end or be caught and later discarded as undersized fish. Some of the fish which escape through the codend will be damaged but it is difficult to estimate the mortality from this source. Discarding depends on the mesh size used in the trawl and the minimum permitted length that can be landed. Although information on discards have been collected, the data is considered too unreliable to be used by ICES for stock assessment purposes. Discarding of cod and whiting is probably quite a significant source of mortality in the Clyde as in other areas such as the Irish Sea.

Remedial Measures

2.53 It the fish stocks of the Clyde are to be improved, the intensity of fishing must be reduced as there is relatively little that can be done to influence recruitment (except perhaps to reduce discarding by increasing mesh sizes). The extent to which the Clyde stocks are dependent on recruitment from outside is not known. In their consultative document, DAFS have suggested three possible ways of improving fish stocks, and thus reducing if not resolving the conflict between anglers and commercial fishing. These are considered below.

2.54 A Ban on Commercial Fishing at Weekends. This is the measure favoured by the Clyde Fishermen's Association and they counter the argument that greater effort would be directed to weekday fishing by pointing out that most of the fishery is for nephrops, claiming that fishing for this species is limited to dawn and dusk so that extra fishing at other times would be unprofitable. However the time at which nephrops emerge from their burrows varies with depth and Bailey et al (1986) sum up the situation in the Clyde as follows "In the Clyde where nephrops occur over a wide depth range, peak periods of emergence occur throughout the twenty-four hour period". It is also argued by DAFS that the present level of fishing at weekends is not large. A weekend ban would therefore be of limited value in reducing fishing mortality. There must also be some doubt as to how well such a ban could be enforced unless it was a total ban on all commercial fishing and not simply trawling.

2.55 Increase in Mesh Size. The aim of increasing mesh sizes would be to ensure that more fish survive to join the spawning stock and to maximise the yield from the fish. In the North Sea it has been calculated that if cod were the only species of importance then the yield of cod would be maximised at a mesh size of 150mm or more. However, in a mixed fishery which includes haddock and whiting, a mesh size of 90 - l00mm might be a suitable compromise (the current mesh size is 85mm). The problem in the Clyde is that the mixed fishery also includes nephrops. The nephrops fishery has a higher cash value than the combined demersal catch. A similar situation exists in the Irish Sea and much has been written on the interaction of the nephrops and cod fisheries in the Irish Sea and possible management strategies. An increase in the mesh size would reduce the catches of nephrops in the short term but in the long term would increase yields as nephrops reached a larger size before capture. Increased mesh sizes would also increase the yield from the fisheries for cod, whiting etc. and reduce discards. There is however a further complication in that, at least in the Irish Sea, cod are a major predator on nephrops and, therefore, improving the survival of cod could reduce the stocks of nephrops. Increasing mesh sizes in isolation, while improving yields, will do relatively little to reduce the intensity of fishing which is depleting the stocks of older fish in the population. If mesh sizes were to be increased serious consideration should be given to resolving the present anomalies in reporting catches caused by the two different mesh sizes, A unified mesh size for the Clyde might also aid enforcement.

2.56 Prohibition of Mobile Gear in Selected Areas. The Cameron Report recognised that the 3 mile limit was not effectively enforced and one of the submissions made by anglers was that enforcement should be concentrated on angling grounds instead of being spread over a wide area. The report rejected the idea that certain areas should be restricted to sport fishing. The Cameron committee's hope that good relations between anglers and commercial fishermen would lead to voluntary restrictions has not been achieved.

2.57 A ban on the use of mobile gear in selected areas, such as north of a line between Cloch Point and Dunoon might go some way to reducing conflict between anglers and commercial fishermen. The critical question is whether it would improve the stocks in the restricted areas. Unfortunately little is known of the biology and behaviour of the demersal fish of the Clyde. There is some evidence that spawning occurs within the Clyde, but this does not establish that fish stocks in

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the area can be 'isolated' from developments outside the area.

2.58 The nursery areas of cod, whiting, saithe and flat-fish tend to be close inshore and in shallow areas such as sea lochs. It would seem reasonable to suppose that protected areas would be populated by young fish. There is evidence from the sea lochs in the Oban area that the movement of fish out of the nursery areas is depth related. For example, young whiting will leave the shallower lochs completely during the first winter but in some deeper loch will remain, albeit in reduced numbers, for a second year. The very deepest lochs support populations of older fish which can produce a local spawning. A closure of the upper Clyde area might provide a sanctuary for smaller one and two year old fish but it is doubtful whether it would lead to an increased stock of older fish as these would be much more widely dispersed and subject to fishing mortality elsewhere within the area.

2.59 Another problem which would need to be considered is fishing pressure by anglers. In the 1970's when the cod fishery on the Gantocks was at its height, the catches were large. A reported catch of over 1000 lb by three anglers, if multiplied up over the year, would amount to a considerable tonnage of fish.

2.60 Angling could exert considerable pressures on fish stocks and if a protected area resulted in improved catches some consideration would have to be given to limiting angling effort, especially as many more people have their own transport, boats and more leisure time than in the 1970's. In Germany where anglers are licensed it has been estimated that in the highly organised charter vessel fishery for cod in the Baltic, anglers account for one fifth of the entire cod catch.

2.61 If it is agreed that the intensity of fishing is a key factor in the decline of Clyde fish stocks, all of the above suggestions will go some way to alleviating the problem. In most fisheries the standard method of controlling effort is by quota restrictions. The Clyde forms part of ICES area VIa and quotas in this area for demersal fish have seldom been fully utilised. Unfortunately it is unlikely that the EC would accept separate quotas for the Clyde demersal fish and in any event, they would be difficult to enforce given the proximity to other ICES areas. A reduction in the number of vessels licenced to fish would certainly help to reduce fishing effort and DAFS should consider whether the issuing of licences to fish for nephrops

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only does anything to aid conservation. The restriction of vessels to less than 70' is an effective conservation measure but might be even more effective if combined with restrictions on the size of otter board as was the case before the 1984 act.

Further Research

2.62 The discussion of the scientific evidence has emphasised the areas of uncertainty. Particular uncertainty attaches to the impact on fish stocks of by-catches of demersal fish which are discarded by nephrops trawlers without knowledge of discards, and in particular of their seasonal or geographical variation, it is difficult to assess the impact of nephrops trawling on the demersal stock. It is proposed, therefore, that DAFS consider further research into this topic. The results of such research might indicate that restrictions on nephrops trawling when young cod, or other fish, are in their nursery areas would be warranted.

2.63 Any future scientific assessments of fish stocks of interest to anglers would be greatly assisted if anglers or angling clubs were encouraged to collect information of the type indicated in paragraph 2.27. As a minimum, it would be of benefit if the following data could be collected in relation to fishing trips:

- lengths and/or weights of individual specimens of all fish caught;
- location, date and time of capture;
- method of fishing;
- number of anglers fishing;
- length of time spent fishing.

It would be useful if a body such as the SFSA could coordinate the collection and archiving of this information so that it is readily available for scientific use.

3.0 COMMERCIAL FISHING

3.1 This section assesses the economic impact of commercial fishing activity in the study area. Consideration is given first to an analysis of the numbers of boats operating out of Clyde ports, the age and size structure of the fleet, the methods of fishing adopted and the numbers directly employed.

The Clyde Fleet

3.2 For statistical and administrative purposes, DAFS divides the Clyde Fishing region into two Districts. These are the Campbeltown District which covers the Western side of the Clyde area and Ayrshire District covering the Eastern side. However, both Districts include ports located outwith the study area and therefore, where it has been possible to do so, the statistics have been adjusted to refer only to the following ports:

Ayrshire District	Campbeltown District
Ayr (including Dunure)	Campbeltown
Gourock	Carradale
Inverkip	Rothesay
Largs	Tarbert
Troon	
Girvan (including Maidens)	

3.3 The latest figures indicate that there are 137 commercial fishing boats registered as operating out of the above ports. This total refers to all boats of over 30ft in length using mobile fishing gear. Thus, it includes 2 large light trawling vessels of over 70ft in length whose size excludes them from fishing in the Clyde area. The total does not include boats of under 30ft or those using static fishing gear such as creels and line fishing. No official data are available on these classes of boat but it is estimated that in 1985 there were around 106 static gear boats, mainly creelers, of between 30ft and 40ft in length, operating in the Clyde fishing region.

3.4 Table 3.1 lists details of the number of boats registered at each Clyde port.

Table 3.1

Boats Registered at Clyde Ports

Port	Number of Boats
Ayr	32
Girvan	16
Troon	12
Largs	7
Gourock	4
Inverkip	4
Total, Ayr District	75
Carradale	19
Tarbert	19
Campbeltown	14
Rothesay	10
Total, Campbeltown District	62
Total, Clyde Fleet	137

3.5 The fleet is split evenly between the Ayr (55%) and Campbeltown (45%) Districts. The port of Ayr which includes Dunure, is seen to dominate the Eastern fleet with 43% of all boats registered in this District based at Ayr. On the other hand, the Campbeltown District boats are more evenly spread over the four ports.

3.6 As Table 3.2 shows, the Clyde fleet consists predominantly of older boats. Of the 131 boats for which details of the year of build were available, 53% are over 20 years old and only 8% are under 5 years old. Overall the average age of the boats is 22 years with a similar figure applying to boats in both Ayr and Campbeltown District ports. Although the average age is similar across ports of the 22 boats under 10 years old 75% operate out of ports in the Ayr District.

Table 3.2

Age Structure of the Clyde Fleet

(Age in Years)

	Under 5	5 -> 10	11 ->20	Over 20	Average
Ayr	4	4	15	9	17
Gourock	2	1		1	11
Inverkip		1		2	45
Largs		1		5	28
Troon			3	8	26
Girvan	2	1	3	10	22
Ayr District	**8**	**8**	**21**	**35**	**21**
Campbeltown			5	9	23
Carradale			6	11	23
Rothesay	1	1	4	4	20
Tarbert	2	2	4	10	20
Campbeltown District	**3**	**3**	**19**	**34**	**22**
Clyde Fleet	**11**	**11**	**40**	**69**	**22**

Note: Row sums may not add up to the totals shown in Table 3.1 as details of age were not available for some boats.

3.7 These figures reflect the long standing practice among Clyde fisherman of replacing their boats with second hand vessels and a reluctance to invest in new vessels. Amongst the reasons for this are the prohibitive costs of purchasing purpose built boats and the fact that most of the technological advances relevant to the industry have been in the realms of gear and electronic equipment, which can be fitted to older boats, rather than in vessel design. Fishermen therefore concentrate investment resources on gear.

3.8 As mentioned above, the official statistics refer to boats greater than 30ft in length and Table 3.3 gives more details on the size of boats by port. The vast majority of boats are under 60ft in length, accounting for 88% of the total. All but one of the vessels in the largest size category (over 60ft) operate out of the eastern ports with most operating out of Ayr. This is partly due to the nature of the fishing activity carried out by the larger boats; eastern ports give readier access to waters outwith the Clyde area. Most of the small boats are based at ports in the upper reaches of the Clyde, including the Kintyre Peninsula, where they are afforded generally calmer conditions.

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Table 3.3

Length Structure of the Clyde Fleet

(Length in Feet)

	30 -> 39	40 -> 49	50 -> 59	Over 60
Ayr	5	7	9	11
Gourock	4			
Inverkip	3	1		
Largs	7			
Troon	4	1	5	2
Girvan	5	3	6	2
Ayr District	**28**	**12**	**19**	**15**
Campbeltown	2	2	9	1
Carradale	6	4	9	
Rothesay	8	2		
Tarbert	8	4	7	
Campbeltown District	**24**	**12**	**15**	**1**
Clyde Fleet	**52**	**24**	**45**	**16**

3.9 When registering their boats, owners are required to intimate the major method of fishing adopted. Although the boats need not concentrate all of their fishing effort on the stated method, this information provides the most reliable guide to the activities of the Clyde fleet.

3.10 Table 3.4 gives details of the methods adopted by Clyde based boats. The vast majority of boats concentrate on fishing for shell fish (over 82% of all boats) with nephrops trawling (77%) by far the most popular method. Around 76% of boats operating out of Ayr District ports fish mainly for nephrops while all but two of the Campbeltown District boats fish mainly for shellfish.

3.11 Some of the ‘shellfish' boats will turn to fishing for demersal species during the spring months when nephrops are scarcer, but it is impossible to give an accurate estimate of the proportion which do so. However, discussions with a small number of boat owners have indicated that this effort can be expected to be relatively minor in relation to the size of the nephrops fleet.

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Table 3.4

Fishing Methods Adopted by the Clyde Fleet

	Seine Nets	Light Trawl	Pair Trawl	Nephrops Trawl	Scallop Dredging	Creel Fishing
Ayr	3	5	1	21	2	
Gourock				4		
Inverkip		1		3		
Largs				6		1
Troon		3	1	8		
Girvan	1	3		12		
Ayr District	**4**	**12**	**2**	**54**	2	1
Campbeltown			2	12		
Carradale				12	7	
Rothesay				10		
Tarbert				18	1	
Campbeltown District			**2**	**52**	8	
Clyde Fleet	**4**	**12**	**4**	**106**	10	1

3.12 For around seven months of the year the four pair trawlers concentrate on herring fishing with the remainder of the year spent fishing for nephrops or demersal species.

3.13 The seine netters and light trawlers operate mainly out of the more southerly Ayrshire ports. Of these, two are larger light trawlers which concentrate their fishing effort on demersal species outwith the Clyde area. Around 8 of the others fish for both pelagic and demersal species but spend a large proportion of their time in areas such as the North Channel, between the Northern Irish and Scottish coasts.

3.14 As discussed earlier, concentration on nephrops fishing has grown since the late 1950's and early 1960's. Until then the Clyde had been one of the major herring fisheries on the west coast and even attracted a large number of boats from outwith the area during the herring season. This change reflects a combination of increasingly severe conservation constraints on herring fishing and the attraction of a relatively steadier income to be derived from nephrops.

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3.15 The official statistics on the Clyde Fleet provide information on the normal numbers of crew employed on each boat. In the absence of additional information on the intensity of the fishing effort of each boat, it is not possible to provide an accurate estimate of how these numbers are split between full-time and part-time employment. However, on the basis of our discussions with boat owners and DAFS officials, the number employed on a part-time basis on boats of the type referred to here is expected do be low. Therefore, the official data is taken to provide a measure of full-time jobs.

3.16 The heavy dependence on shellfish by the Clyde Fleet is reflected in the structure of employment in the industry. As Table 3.5 shows, out of a total number of 486 crewmen, 394 (or 81% of the total) work on boats which concentrate their effort on shellfish. This dependence is more marked for boats from the Campbeltown District with 95% of crewmen employed in shellfishing, as opposed to the 71% of those on boats from Ayr District. Nephrops trawlers account for the vast majority of employment, providing employment for 73% of all Clyde fishermen and 80% and 67% of those on boats operating out of Campbeltown and Ayr Districts respectively.

Table 3.5

Crewmen: By Method in the Clyde Fleet

	Seine Nets	Light Trawl	Pair Trawl	Nephrops Trawl	Scallop Dredging	Creel Fishing	Total
Ayr	13	24	5	86	8		136
Gourock				9			9
Inverkip		2		6			8
Largs				18		2	20
Troon		13	6	24			43
Girvan	5	14		43			62
Ayr District	**18**	**53**	**11**	**186**	**8**	**2**	**278**
Campbeltown			10	39			49
Carradale				42	29		71
Rothesay				27			27
Tarbert				58	3		61
Campbeltown District			**10**	**166**	**32**		**208**
Clyde Fleet	**18**	**53**	**21**	**352**	**40**	**2**	**486**

Economic Impact of Commercial Fishing

3.17 Estimates can now be made of the contribution which commercial fishing in the Clyde makes to the economy of the study area. This contribution is measured in terms of the employment and income generated by the industry.

3.18 The commercial fishing industry will impact on the economy of the study area in three main ways. These are:

(i) the employment and income associated with those actively involved in commercial fishing;

(ii) the employment and income associated with those involved in onshore industries which provide services for the fleet or which depend on the output of the fleet; and

(iii) the economic impact of the expenditure generated by the incomes of those directly and indirectly employed.

Direct Economic Impact

3.19 As mentioned above, the employment generated by commercial fishing boats operating out of ports in the study area is estimated at 486. However, this figure may not represent an accurate estimate of the number directly employed in fishing activity in the study area. First, it includes employment on boats that spend at least part of their time fishing in waters other than the Clyde. For instance, many of the nephrops trawlers, from both Ayr and Campbeltown Districts, spend part of the summer months fishing in areas to the west of the Clyde, travelling as far north as Mallaig and the Minches. This is because, at this time of the year, calmer conditions allow the smaller boats to venture further afield and leave the shelter of the Clyde.

3.20 Second, the figures do not include those actively engaged in fishing on boats of under 30ft in length or which use static gear. The estimate given above indicates that the latter class is not insignificant. However, the activities of static gear boats are not an issue in the present study.

3.21 Little in the way of official information exists which would allow precise quantification of the income derived from employment in the industry. One possible source is the "Scottish Inshore Fishing Fleet Costs and Earnings Survey" produced by DAFS. Unfortunately, the response rate from boats in the Clyde Region has been extremely low and, therefore, the survey provides no information that can be used with confidence.

3.22 The approach adopted here is to make use of information provided by a small sample of boat owners in the area. Those discussions revealed, unsurprisingly, that the incomes of crew members will depend upon a number of factors which result in substantial variation in crew members' earnings between boats. Those factors include the method of fishing adopted, the intensity of fishing effort expended by each boat, the number of crew members, the skills of the skipper and, indeed, luck. However, a consensus view emerged that whilst income per crew member can range from £7,000 to over £18,000 per annum, £10,000 per annum represents a reasonable average.

3.23 On the basis of this figure and the number employed, then the total gross income accruing to those employed in fishing is estimated at £4.9 million p.a.

3.24 This figure does not represent the total income generated as it ignores the earnings accruing to boat owners. Most of the fishermen in the Clyde Region are share-fishermen which means that once fishing expenses have been deducted from the value of a boat's sale of the catch, the remainder is divided into two shares of approximately equal size. One of these is divided amongst crew members and other represents the gross income of the boat owner. This implies that for every £1 paid to the crew in the form of earnings, £1 will accrue to the boat owner and so the gross income of boat owners can also be estimated at around £4.9 million.

3.25 In order to arrive at an estimate of net profit, the owners' expenditure on boat expenses must be subtracted. These expenses will include the costs of repairs and maintenance, interest charges incurred in servicing any loans taken out to purchase the boat or new equipment, insurance and other operating expenses. Those expenses will vary from boat to boat and from year to year but, on average, are estimated to be 75% of gross income. This yields on estimate for total net profits of £1.2 million.

3.26 On the basis of these two estimates, therefore, the total pre-tax incomes derived from fishing in the study area will be in the region of £6.1 million p.a.

On-Shore Activity

3.27 The on-shore sector has two main elements, those activities which supply the fleet and those which use the raw materials produced by the fleet e.g. the processors. According to figures provided by DAFS, 1,774 persons were employed by the on-shore sector of the industry in the Clyde Region during 1987. Of these, 1,433 were full-time and 341 were part-time employees. These figures are presented, by category of employment, in Table 3.6.

Table 3.6

Employment in the On-Shore Fishing Industry

	Full-Time	Part-Time
Merchants & Salesmen	948	277
Boat Builders & Repairs	247	6
Other Services	42	14
Retail Sector	193	38
Miscellaneous	3	6
	1,423	341

3.28 The first category of employment, Merchants and Salesmen, includes freshers, processors and buyers. Of these, processing employment accounts for the majority and many of those jobs do not depend upon supplies of fish caught in the study area, as supplies are drawn from distant sources. Of the remaining jobs, many are provided directly at the major fish landing ports of Ayr and on the Kintyre Peninsula. Although these workers will handle catches from outwith the study area, this employment is more closely related to the operations of the Clyde Fleet.

3.29 The second category of employment, boatbuilders, may also overstate the importance of fishing in the Clyde. The total for this category includes employment at both the Campbeltown and Girvan boat builders which rely for much of their business on orders from fishermen outwith the area. However, these yards do spend some of ·their time servicing and repairing boats from the Clyde Fleet. The remainder of the employment in this category is comprised of engineers, painters, electricians and others who spend the majority of their time engaged in Clyde Fleet related activity.

3.30 The third category, other services, includes chandlers and riggers, ice manufacturers, fuel suppliers net repairing and fish transporting services. These jobs are almost wholly dependent on the Clyde Fleet. Retail sector jobs refer to Fishmongers, Fish Hawkers and Fish Friers. Although some of the sales of this group will involve the catch of the Clyde fleet, these jobs are probably not dependent on the existence of the fleet to any great degree.

3.31 The final category, miscellaneous, includes Harbour staff and SFO employees, most of whose jobs depend largely on the operations of the Clyde Fleet.

3.32 It is difficult to give any exact assessment of how many of the jobs listed above are directly supported by the operating expenditures of the Clyde fleet or owe their continued existence to the catches of the fleet. Nevertheless, a large proportion of these jobs would be placed at risk if there was no fishing activity in the area. A conservative estimate would be that 500 onshore jobs depend on commercial fishing in the Clyde area. If it is further assumed that average value added per employee among these workers is £15,000 annum, then £7.5 million additional gross incomes will be generated in the area as a result of the fishing activity.

3.33 For analytical purposes, the Clyde fishing industry can best be perceived as an integrated industry consisting of the catching sector, the processing sector and the suppliers of certain inputs and services. On the basis of the above evidence, it is estimated that this 'industry' supports around 1,000 jobs and generates £13.5 million p.a. of local incomes.

Multiplier Effects

3.34 The fishing industry, as defined above, will generate further income and employment in two ways. Fishing boats, processors and other firms will purchase inputs and services from outside the sector. Some of these purchases will be made locally creating jobs and incomes (the indirect impact). The second impact (the induced impact) will arise from the expenditure of the incomes earned within the fishing sector and its supplying sectors. These incomes will be spent in a wide variety of ways, impacting on many economic sectors and creating incomes and jobs in local businesses - though most of the impact will occur outside the local economy.

3.35 The additional income and employment created by the indirect and induced impacts can be estimated using local multipliers. The multiplier is the ratio of total income (or employment) impact to the direct income (or employment) impact. The results of a wide range of studies suggest that, at the level of an area such as the study area, the value of this multiplier will be about 1.2; thus every £1 of income directly created will result in a total increase of incomes at the local level of £1.2. The impact consists, therefore, of £1 direct impact and £0.2 indirect and induced impact. On this basis, the incomes created in the fishing industry (broadly defined) can be expected to lead to the creation of a further £2.7 million of local incomes through the multiplier effect. Similarly, the 1,000 jobs in the industry may support a further 200 jobs locally. These are relatively conservative estimates.

3.36 In summary, the existence of a Clyde Fishery is estimated to result in the generation of over £16 million of annual income in the study area and to support over 1,200 jobs. At least 50% of these jobs are in the most rural parts of the study area - principally in the Kintyre peninsula. The employment generated by the industry may account for as much as 9% of employment in the Kintyre peninsula.

3.37 The estimates given above relate to the total impact of the industry and not to the impact of changes in the level of fishing activity. This issue will be discussed further below.

4.0 ECONOMIC IMPACT OF SEA ANGLING

Introduction

4.1 Assessing the economic impact of sea angling poses far greater difficulties than is the case with commercial fishing. There is no sea angling industry or sector as such and the economic impact of the activity depends upon the expenditure of those people who come to the area in order to fish. Their expenditure impacts on a variety of sectors, the main immediate beneficiaries include hotels, shops, boat hirers, restaurants, cafes and pubs. Moreover, the level and pattern of expenditure will vary very considerably between different types of visitor and, indeed, from individual to individual.

4.2 For convenience, we may distinguish three broad groups of anglers:

- local residents;
- day trippers, mainly from other parts of Scotland;
- longer stay visitors.

In the third, and possibly second, categories there will be individuals whose main reason for visiting the area is not to fish but who undertake some angling on a casual basis. So far as such 'casual' anglers are concerned, it is only the expenditure arising specifically from the angling activity which is part of the 'impact' of ' sea angling.

4.3 The economic impact of angling by local residents will be very limited except where they spend money on boat hire. Angling trips made by visitors will have more potential for economic impact through expenditure on boat hire, food, drink and accommodation.

4.4 To assess the scale of economic impact it is necessary to have data on the number of angling trips made each year and the level and structure of expenditure by the people making those trips. No specific data on these topics were available to the study. For the purposes of the study, a survey has been undertaken of anglers in Scottish Angling Clubs. The survey generated 78 responses from a sample of 200 (a relatively good response for a postal survey) and provided information on attitudes to the Clyde as an angling area as well as expenditure information. Estimates of the level of sea angling activity have had to be based on national data.

4.5 In considering the impact of sea angling in the Clyde area, it is useful to distinguish between actual and potential impact. There is little doubt that sea angling activity in the area has declined in recent years. Boat hirers report a considerable decline in activity and many of the Sea Angling Clubs which were approached for data on catches or on expenditure by members reported that they no longer fish the Clyde. So far as this study is concerned, it is the potential impact of angling which is of most interest since this indicates the economic benefits which could accrue from an improvement in fish stocks and angling conditions. The economic impact of the decline in sea angling is considered further later in this section. The potential impact of sea angling is considered in section 5.

4.6 Attention is given first to the evidence relating to the level of sea angling activity in the Clyde. Expenditure levels are then discussed with reference to the survey data and then estimates of economic impact are made.

Sea Angling Activity

4.7 There is little doubt that angling, in general, constitutes one of the most popular participation sports in the UK. However, there is little in the way of published information on participation rates and the expenditure habits of anglers. Most of the information that is available is taken from surveys of sports activities and the estimates presented below are based on the publication "Countryside Sports: Their Economic Significance" published by the Standing Conference on Countryside Sports in 1983 (SCCS, hereafter). This in turn makes extensive use of the two National Angling Surveys (NAS), for 1969-70 and 1979-80, carried out by National opinion Polls and also makes use of information in the General Household Survey (GHS).

4.8 It is estimated that in 1979-1980 there were approximately 1.79 million active sea anglers in Great Britain over the age of 12. This was 0.5 million above the figure reported in 1969-70 and is witness to the dramatic increase in participation in sea angling during the 1970's.

4.9 The NOP survey also estimated that there were 350,000 coarse, game and sea anglers in Scotland but, unfortunately, did not give a breakdown of the numbers involved in each category of angling.

By using estimates of membership of the various angling associations in Scotland, and by applying the England and Wales percentages of the number of anglers who are members of associations, the SCSS estimated that there were 72,000 sea anglers in Scotland. However the Scottish Federation of Sea Anglers consider that this figure overstates the true number involved but have not provided, an alternative estimate.

4.10 The SCCS report highlights the wide variation in the number of fishing trips reported by the NAS and GHS surveys. For instance, the former estimated a total of 105 million fishing trips in 1979-80 whilst the GHS estimate was 28 million. Part of this divergence can be attributed to the coverage of each survey as the GHS excluded those in the 12-15 age group and would have missed anglers fishing less frequently than once per month. The SCCS document presents compromise estimates of numbers of fishing trips, by type of activity, with additional information on special trips and fishing trips whilst on holiday. Those figures are presented in Table 4.1.

Table 4.1

Numbers of Fishing Trips in Great Britain
(million p.a.)

	Area of Residence		
	England & Wales	Scotland	Great Britain
No. of Ordinary Fishing Trips of	36.99	2.65	39.64
which Sea Angling	10.77	0.42	11.19
Special Trips	1.30	0.40	1.70
Holiday Trips	1.10	0.10	1.20

4.11 Here "special trips" are defined as trips involving at least one night away from home while 'holiday' trips refer to fishing trips which are incidental to the main purpose of the holiday. The 'special' and 'holiday' fishing trip estimates made by SCCS relate· not only to sea angling but to all types of angling activities. Estimates of the number of sea angling trips in these categories can be made by assuming the proportion of sea angling trips in each category is the same as is the case with 'ordinary' trips. Estimates are given in Table 4.2.

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Table 4.2

Numbers of Sea Angling Trips
(millions p.a.)

	Area of Residence		
	England & Wales	Scotland	Great Britain
Ordinary Trips	10.8	0.42	11.2
Special Trips	0.4	0.06	0.5
Holiday Trips	0.3	0.02	0.3
Total	11.5	0.5	12.0

4.12 Of the estimated total number of fishing trips, the vast majority (90%) are day trips undertaken by sea anglers resident in England and Wales. In contrast, only 4% of all trips are undertaken by Scottish sea anglers while 6% are trips by non-Scottish anglers and involve a significant amount of travel or a night away from home.

4.13 In order that these estimates can be used to provide measures of the potential use of the study area as a location for sea angling trips, a number of adjustments must be made. First, the figures reported above are based on data for 1979-80 and it is probable that the growth evident in the numbers of sea anglers during the 1970's has, to some extent, continued until the present time. In the absence of alternative information, it can be assumed that the annual growth rate, of around 3.5% per annum, experienced during the 1970's has been maintained. Applying this growth rate to the numbers of trips, and assuming the same rate applies to each type of trip, yields the estimates given in Table 4.3.

Table 4.3

Estimates of Sea Angling Trips in 1988
(million)

	England & Wales	Scotland	Great Britain
Ordinary	14.2	0.55	14.75
Special	0.5	0.08	0.60
Holiday	0.4	0.03	0.40
Total	11.5	0.5	12.0

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4.14 Second, some estimate of the numbers of trips to the study area is required. This is even more problematic as there is no information on the geographical distribution of trips. It is possible to estimate that, the maximum potential number of trips to Scottish destinations will be around 1.6 million (the total number minus 'ordinary' i.e. 'day' trips made by English and Welsh anglers, assuming that day trips to the Clyde constitute an insignificant proportion of day trips by such anglers). However, the actual level of trips will be far below this maximum.

4.15 The number of angling trips associated with 'non-angling' holidays will, of course, be determined primarily by general patterns of holidaymaking. Annual 'domestic' holiday trips in Great Britain are estimated by the British Tourist Authority at 73,000,000. Around 25% of these trips will involve seaside destinations. The data quoted above indicated that holidaymakers undertook 430,000 sea angling trips, thus it can be deduced that 2.4% of trips to seaside destinations involve some 'casual' sea angling.

4.16 Tourist Board data indicate that annual holiday trips to the Clyde Coast and to Argyll amount to around 700,000. Using the figures discussed in the previous paragraph, it may be estimated that around 17,000 angling trips will be made by these holidaymakers in the Clyde area. This level of activity will, however, be relatively insensitive to changes in angling conditions or promotion since the basic holiday trips are not made for angling purposes.

4.17 So far as 'ordinary' angling day trips are concerned, the Clyde's market is primarily Scotland. There is little doubt that this activity is sensitive to fishing conditions. In the survey of anglers carried out as part of the present study, around 30% of the anglers surveyed had given up fishing the Clyde over the last five years as a result of poor catches. This sample was biased towards members of clubs known to be active in the Clyde area and included many 'local' anglers. Among this group of respondents, which was biased towards fishermen likely to fish the Clyde and relatively highly motivated to respond to the survey, around 74% fished the Clyde. These respondents were all from the West of Scotland; contacts with Sea Angling Clubs in other parts of Scotland, which were made in order to obtain information on catches, indicated that few, if any, clubs outside the West of Scotland now fish the Clyde.

4.18 If the view is taken that 75% of West of Scotland fishermen will fish the Clyde, while only a negligible proportion of fishermen from other parts of Scotland will now do so, it can be estimated that the Clyde will attract around 30% - 40% of 'ordinary' Scottish angling trips. Few of these trips will involve overnight stays - indeed in the survey 69% of those fishing the Clyde reported no expenditure on overnight accommodation.

4.19 At present, the level of holiday fishing trips to the Clyde - particularly by non-Scottish anglers - appears to be low. With one exception, boat hirers on the Clyde reported substantial declines in their level of activity over the last five years. This decline has also been accompanied by a relative shift towards business from casual anglers/tourists and away from organised parties. Most boat hirers also report a relative decline in non-Scottish trade, with organised parties from the North of England no longer in evidence. Hotels also report very little angling-related traffic.

4.20 The Scottish Leisure Survey (undertaken in 1981) indicated that about 7% of holidays taken in Scotland were 'sporting' holidays. Applying this ratio to the estimate of total domestic holiday trips to the study area reported above would produce a figure of 50,000 'sporting' trips - not all of which would be sea angling trips. At present, about 600,000 sea angling holidays/ special trips are undertaken in Great Britain each year. The Clyde must compete for these trips with many other destinations including Devon, the South Coast of England, the Yorkshire Coast and North East England. In current fishing conditions, it is unlikely that the Clyde can attract even 10% of these trips. In the light of the above figures, a reasonable estimate of 'special' sea angling trips to the Clyde would be 25,000.

4.21 The level of overseas tourism associated with sea angling appears to be minimal. Only one boat hirer reported any foreign visitors in angling parties either at present or in the past.

4.22 Table 4.4 summarises the estimates discussed above.

Table 4.4

Clyde Sea Angling - Trip Estimates

	p.a.
Ordinary Trips	200,000
Special Trips	25,000
'On Holiday' Trips	17,000
	242,000

Expenditure

4.23 Economic impact depends upon the number of trips and the level of expenditure per trip. Estimates of expenditure per trip are discussed below. These are based upon the results of the SCCS study and the survey conducted in the course of the present study. The SCCS results will be considered first.

4.24 The SCCS study reported estimates of expenditure incurred by sea anglers in the course of pursuing their activity. Here it was estimated, on the basis of NAS results, that English and Welsh Anglers incurred the following average expenditures by trip type:

	Average Expenditure on Sea Angling (1980 prices)
Ordinary Trips	£7.37
Special Trips	£52.09
'On Holiday' Trips	£9.27

4.25 This includes expenditure on items such as travel, food and drink, match fees and permits, bait, boat hire and fuel, tackle and other costs. Again there was no separate information for Scottish anglers.

4.26 Ignoring the complications involved in disaggregating each of these items of expenditure, and assuming, instead, that all money is spent in the area in which fishing occurs, then the estimated number of trips to the Clyde could generate as much as £3 million of expenditure, at 1980 prices. This is comprised of the following:

Ordinary	£1.5 million
Special	£1.3 million
Holiday	£0.2 million
	£3.0 million

4.27 Adjusting these figures for movements in the retail price index since 1980 to the present implies an estimated expenditure of £4.6 million.

4.28 These figures may be compared against the estimates derived from the survey undertaken for the study. This survey indicated that the expenditure of anglers fishing the Clyde was as set out in Table 4.5.

Table 4.5

Clyde Sea Anglers Expenditure per Trip
(mean)

	Day Trippers	Overnight Stays
	£	£
Accommodation	0.0	3.8
Food/Drink	3.6	7.1
Boat Hire	5.3	4.1
Tackle	2.6	3.6
Bait	2.2	2.6
Travel	5.3	6.1
Other	0.2	1.3
Total	19.2	28.6

4.29 The day trip figures in Table 4.5 may be biased upwards by some surprisingly high individual expenditure responses. The overnight stay figures are rather low and reflect a large element of the sample which reported no expenditure on accommodation. This appears to be the result of anglers staying with friends and camping out informally. It is also evident that some respondents interpreted overnight stays to include all-night fishing trips. Among those respondents who did pay for accommodation, average expenditure was £12.20.

4.30 Not all expenditure will have an impact on the local economy. Expenditure which does not take place locally will not affect the local economy - travel is the most obvious item which does not impact locally and should, as a minimum, be removed from the expenditure estimates. In the light of the results of the survey, it is suggested that the figures for 'ordinary' and 'holiday' trips are based on the survey results with the travel expenditure removed. The 'special trips' figure would remain the figure quoted earlier - the survey results evidently reflect relatively short distance trips made by anglers based relatively near to the Clyde. Table 4.6 presents the revised figures.

Table 4.6

Clyde Sea Angling: Annual Expenditure
(1988 prices)

	Expenditure per trip	Trip Numbers	Total Expenditure
	£	£	£
Ordinary Trips	13.9	200,000	2,780,000
Special Trips	81.0	25,000	2,025,000
Holiday Trips	13.9	17,000	236,000
Total		243,000	5,041,000

4. 31 The results produced by the two estimates are broadly similar. Local expenditure of £5 million could be expected to produce, on the basis of previous study results, around 170 jobs - mainly relatively low paid. If a level of value-added per employee, in sectors affected by this expenditure, of £15,000 is assumed then total direct income generation would be £2.5 million. The multiplier effects discussed earlier would raise this income impact to about £3 million while the total employment impact would rise to approximately 200.

4.32 In brief, it is estimated that, at present, sea angling in the Clyde may support 200 jobs and produce local incomes of £3 million. An improvement in sea angling conditions might be expected to increase this impact significantly.

Impact of the Decline in Sea Angling

4.33 In estimating the current economic impact of Clyde sea angling, it has been necessary to draw upon and combine information from a number of sources. The estimates made are considered to be most reasonable which can be made but they do not have a high degree of precision though the order of magnitude is considered to be correct. These problems are intensified in attempting to estimate the impact of the decline in sea angling in the area - there are no figures available which indicated with any precision the degree of decline which has taken place.

4.34 Nevertheless information is available from a number of sources. As noted above, boat charter operators (and hotels) report a drastic decline over the last few years in the level of business associated with sea angling. So far as the boat hirers are concerned, this impact is particularly adverse in the upper Clyde - operators there do not have a significant 'general' tourist market to which they can switch (e. g. by running pleasure cruises). Not all of the boat hirers could give precise figures for the decline in business but, among those businesses providing figures, the decline appears drastic. One firm reported hires in early 1988 running at only 15% of the 1985 level and only 36% of the 1987 level. Another business had reduced its level of activity to 13% of the previous level. It should also be said that one boat hire firm did not report a decline in angling business.

4.35 It was also noted above that the survey of sea anglers undertaken for this study indicated a sharp decline in the level of angling in the Clyde. As noted above, around 30% of the anglers surveyed had given up fishing the Clyde in the last five years. This is an interesting result since the sample was biased toward members of clubs which were considered likely to fish the Clyde.

4.36 In the light of the above, it would be reasonable to assume that angling in the Clyde has fallen by 30% in the last five years (this assumption is conservative given the information on declining trade among some boat hirers). Applying this estimate of decline to the current economic impact of angling would suggest that the decline has led to the loss of around 90 jobs with a local income loss of a little over £1 million p.a. These estimates are conservative and, for example, make no allowance for the possible loss of overseas tourism.

4.37 An improvement in angling conditions would enable the area to recover the lost income and employment estimated above. Moreover, there would be scope for expanded promotion of sea angling and the attraction of new custom in a growing market. The potential gain from improved sea angling, involving the recovery of 'lost' business and the attraction of new business, is considered in more detail below.

5.0 POLICY OPTIONS

Introduction

5.1 While scientific analysis leaves some uncertainty as to the causes of the decline in fish catches in the Clyde, the weight of evidence discussed above indicates that a decline has taken place in fish stocks as a consequence of the combined effects of poor recruitment and intensified fishing effort. Although a decline in fish stocks is unwelcome to commercial fishermen and anglers alike, it is of more fundamental significance to the angling sector. The commercial fishing industry can be sustained by nephrops trawling and by current levels of fish landings. However, current conditions are very unfavourable for sea angling and, in the absence of an improvement in catches, continued decline in the level of activity is likely.

5.2 Estimates were made above of the current economic impact of the sea angling in the area. Given trends in activity, these estimates may already over-state the benefits of sea angling. However, a revived current sea angling sector could have a substantially greater economic impact on the area. The potential returns from an improvement in sea angling will be considered before attention is turned to policy options.

Sea Angling Potential

5.3 It was estimated above that sea angling in the Clyde currently supports about 200 jobs in the area around the Firth and generates above £5 million of local incomes. A substantial element of this impact relies on the expenditure of Scottish-based anglers and, consequently, involves relatively little net effect at the level of the Scottish economy. Nevertheless, this income and employment must now be considered 'at risk'.

5.4 An improvement in fishing conditions in the Clyde would be likely to increase substantially the level of activity by Scottish-based anglers, but would also greatly enhance prospects for attracting fishing visitors and their expenditure to Scotland. A return of conditions on the Clyde to an acceptable state might be expected to have the following effects:

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(i) an increase in the Clyde's share of the 'Scottish' market and some increased level of activity by, currently disillusioned, Scottish anglers - the potential impact is 100,000 - 150,000 extra trips with associated expenditure of £1.4 million to £2 million;

(ii) a substantial increase in trips to the Clyde by other British anglers - the potential number of trips would be between 20,000 and 50,000 with associated expenditure of £1.6 million to £4 million; and

(iii) renewed potential for the attraction of foreign anglers.

5.5 Considering only the 'domestic' tourists, a revival of fishing prospects In the Clyde combined with effective promotion, could produce the results set out in Table 5.1. The potential benefits are significant.

Table 5.1

Clyde Sea Angling - Potential Impact
(Marginal Impact of Improved Conditions on Domestic Tourism)

	Trips	Expenditure	Income	Employment (Jobs)
Low	120,000	£3m	£1.8m	125
High	200,000	£6m	£3.6m	250

5.6 The impact of overseas visits is more difficult to assess since estimates of the scale of the market must be speculative. The experience of sea angling in Ireland provides a useful comparison, the activity has been heavily promoted as part of the Irish tourist 'product'.

5.7 The Bord Failte estimate that around 48,000 'specialist' anglers visit Ireland each year. The majority of these anglers are on coarse fishing and game fishing trips. The data on sea angling combine two elements which overlap to an unknown degree. It is estimated that 4,000 overseas visitors engage in sea angling from the shore while 5,000 hire boats. These two categories overlap in that some anglers undertake both activities. The Bord Failte estimate that each overseas ‘angling visitor’ spends around £220 per trip in Ireland; no separate figures are available for types of angler. On this basis, sea angling in Ireland will

involve annual expenditure of between £1.1 million and £2 million p.a. Despite recent promotional success, sea angling is seen as the 'poor relation' in the overall angling market. In comparison, about 38,000 visitors will undertake some coarse angling while over 12,000 will fish for brown trout.

5.8 It is obvious from the above figures that many anglers visiting Ireland engage in more than one type of fishing - the numbers quoted above sum to well over the total of angling visitors. This is a relevant factor in considering the 'pulling power' of sea angling - a significant proportion of anglers would appear to be drawn to Ireland because of the variety of opportunities available. The Clyde does not represent an area providing such a mixture of activity.

5.9 In considering the relevance of the Irish experience it should also be borne in mind that Great Britain is the principal source of visitors to Ireland. Over 55% of tourists (excluding Northern Ireland visitors) visiting Ireland are British. If visitors from Northern Ireland are added to the calculation then almost 70% of visitors to the Irish Republic are British. Consequently, the potential for attracting foreign visitors to the Clyde may be rather less than an initial assessment of the Irish figures would suggest.

5.10 A revival of fishing on the Clyde would undoubtedly enable Scotland to attract some English visitors who presently go to Ireland. These visitors are in a sense already accounted for in the figures for 'special trips' discussed above but it may be that the Clyde could also attract additional visitors staying for longer periods and spending more than the average figure quoted above. As a generous estimate, it will be assumed that a 'revived' Clyde could attract 5,000 anglers p.a. who would either be foreigners or would be UK anglers 'switching' from foreign destinations. The Irish data suggests that these visitors would spend around £1 million which would provide local income of around £600,000 and 40 jobs.

5.11 The various estimates made above can now be drawn together. Measures which are effective in reviving sea angling in the Clyde would help to protect existing jobs and create the potential for new jobs. The various estimates are set-out in Table 5.2. If conditions in the Clyde do not improve then some proportion of the existing jobs and income will be lost. It is impossible to say with confidence what proportion that might be but a conservative estimate would be that 40% of the actual income and jobs could be lost. It follows that the economic benefit of effective measures to revive sea angling would be the creation/protection of between 240 and 370 local jobs and the creation or retention of local income amounting to between £4,500,000 and £6,000,000. Around 200 of these jobs and £3,000,000 of this income would be additional to the Scottish economy as well as to the local economy.

Table 5.2

Economic Impact of Clyde Angling

	Low		High	
	Jobs	Income	Jobs	Income
Potential	165	£2,500,000	290	£4,200,000
Actual	200	£5,000,000	200	£5,000,000
Total	365	£7,500,000	490	£9,200,000

5.12 The economic impact, even the potential impact, of sea angling remains far less than the economic importance of commercial fishing. No measure which would eliminate or greatly damage the fishing industry in order to protect angling would, therefore, be justified. However, there may be score for measures which would have only limited adverse effects on commercial fishing. Moreover, the scope for effective action will depend upon underlying biological and ecological circumstances. The 'remedial options' are considered below.

Remedial Options

5.13 The fundamental conclusion of section 2.0 was that any systematic improvement in Clyde fish stocks - the basic requirement for improved angling - will require a reduction in the intensity of fishing effort. The means by which this reduction in effort could be secured are as follows:

(i) a total ban on mobile gear in the Clyde;
(ii) a week-end ban on fishing with mobile gear;
(iii) increasing the mesh size of nets;
(iv) prohibition of mobile gear in selected areas;
(v) reducing quotas or licences;
(vi) restriction on otter board size.

5.14 Option (i) can be dismissed at once. This measure would destroy the Clyde fishing industry. Few of the boats in fleet are capable of fishing outside the sheltered waters of the Clyde except in fair weather and the closure of the Clyde fishery would leave the majority of the fleet with no alternative fishing grounds. Option (v) is also of limited relevance - the creation of a Clyde 'quota' is not practicable and a restriction of nephrops licences would be a relatively drastic step at this juncture. The week-end ban appears to offer only very limited benefits but could be included in a package of measures.

5.15 The measures which require more careful consideration are:

- increasing mesh size;
- prohibition of mobile gear in selected areas;
- restriction of otter board size.

5.16 It is a feature of all of the remedial measures considered that the scientific evidence provides only an uncertain guide to their effectiveness. While it is clear that a substantial increase in mesh size, say to 150mm, would strengthen cod stocks (and ultimately increase the cod yield) this option is not open in the mixed fishery of the Clyde. Rather, what may be feasible is an increase in minimum mesh size for nephrops to the same size as for light trawls (80mm codend). This adjustment would lead to a short-term fall in nephrops catches but with a subsequent increase in yield. It is also the case that any increase in the cod population would lead to increased predation on nephrops - but this is a feature of any solution which increases cod stocks.

5.17 The benefit of a modestly increased mesh size is less certain - it could be expected to lead to some increase in the average size of cod in the population with obvious benefits in terms of both commercial yield and angling catches. Nevertheless, this measure would not significantly reduce the overall intensity of fishing efforts and would have only a slight effect on overall stock levels.

5.18 The economic cost of increasing mesh sizes cannot be quantified with confidence. The cost is essentially a matter of deferred income in that initially reduced catches would be compensated by later increases in yield - though the transition period could be painful for some fishermen. There would also be some capital cost in terms of gear written off and replaced. Nevertheless, although the costs would be real, they would not threaten the survival of the industry.

5.19 In considering proposals for closure of specific areas to mobile gear, due regard must be had to the continued viability of the commercial sector and the possibilities of enforcement. This former consideration rules out closure of very large sectors of the Firth while the latter consideration argues against attempts to designate as closed tracts of the relatively open lower Firth. These considerations point strongly towards closure of relatively enclosed areas in the sea lochs and Upper Clyde. Angling is by no means confined to the Upper Clyde and takes place, for example, off Ayr, Girvan and Arran. However, 'protection' of areas in the Lower Clyde is not really feasible.

5.20 The effectiveness of selective closure in terms of fish stocks is uncertain. There is a high probability that stocks of one and two year old fish would increase but the impact on the stocks of older fish is much less certain. Nevertheless, this measure does have a high probability of achieving at least some beneficial effect.

5.21 The most feasible closure would involve areas north of a line from Cloch Point to Dunoon. This would lead to the loss of some herring fishing and would affect the more general activities of boats from Gourock, Largs, Inverkip and Rothesay. The boats from these ports account for about 13% of employment in the fleet. The ban could, therefore, be considered to put 'at risk' 13% of the total economic impact of the Clyde fishing industry. However, the issue is more complicated; boats denied access to the Upper Clyde waters would fish elsewhere - intensifying effort, increasing catches and exerting some adverse impact on the earnings of boats from other ports. Given that the 'Upper Clyde' boats do not concentrate all of their effort in the suggested closure area and given that some alternatives do exist, it would be reasonable to estimate that the proposed closure could cost as much as 5% of the current employment, output and economic impact of the Clyde Fishing industry. This amounts to some 60 jobs and £800,000 of annual income.

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5.22 Reducing the size of otter boards would reduce the efficiency of trawling and thus decrease fishing effort. The technical effectiveness of this measure would depend upon the precise changes made in specifications. Clearly, this measure would reduce the size of catches though fishermen as well as anglers would ultimately benefit from increased yields. The 'cost' involved would, as with mesh sizes, be essentially a matter of lost income today compensated by increased yields in future. Nevertheless, the short-run problems inflicted on fishermen could be serious.

Trade-Offs

5.23 The remedial proposals may usefully be divided according to whether benefits to sea angling would be entirely at the expense of commercial fishing or there would be benefits to both sectors (though the net balance of advantage for the commercial sector might still be unfavourable). Closure of areas to mobile gear falls firmly in the first category. This is a measure which could benefit sea angling at the expense of commercial fishing. The other proposals would have, at least, some potential benefits for the commercial sector in terms of increased future yields - though short run costs to the sector could be significant.

5.24 Table 5.3 seeks to summarise, in a 'balance sheet' format, the costs and benefits to the main options considered above. The scale of 'benefits' is particularly problematic in that there is no certainty that any of these measures would be sufficient to secure the retention and potential development of the economic activity associated with sea angling. 'Actual' benefit will be some, unknown, proportion of potential benefit.

5.25 There is a strong case for conservation measures in the Clyde both in the interest of sea angling and in that of the demersal fishery. The existence of the nephrops fishery, and its commercial dominance, complicates matters for there is no clear conservation argument in favour of restrictions from the viewpoint of nephrops trawling, though the measures could, ultimately, increase nephrops yields.

Table 5.3

Clyde Angling - Remedial Measures

Balance Sheet

Measure		Benefits	Cost
(i)	Complete Closure of Clyde to Mobile Gear	Maximum Potential Gain: - 370 jobs - £6 million income	Destruction of Commercial Sector: - loss of 1,200 jobs - loss of £16 million income
(ii)	Week-end Ban on Mobile Gear	Slight reduction in pressure on stocks: minimal benefit.	Negligible
(iii)	Nephrops Mesh Size Increase	Reduce mortality in Cod: more larger fish. Longer term increased nephrops and demersal yield.	Transitional loss of income by nephrops trawlers
(iv)	Closure of Area North of Cloch Point/Dunoon to Mobile Gear	Improved angling in Upper Clyde: protection of existing jobs and some expansion, will secure a proportion of maximum potential of 370 jobs.	Loss of up to 60 jobs through contraction in fishing sector.
(v)	Reduce Otter Board Size	Uncertain - will reduce effort and support stocks.	Short-term loss, longer term increased yield.

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Recommendations

5.26 Despite the uncertainty over the impacts of remedial measures, the actual and potential impacts of sea angling are sufficient to warrant the introduction of positive measures so long as the impact of these remedies on the commercial sector is commensurate with the benefits generated. In view of these uncertainties, any new programme of measures should be reviewed for effectiveness within a relatively short period.

5.27 The potential benefit of improved sea angling was estimated at around 370 jobs (created and protected) with an associated income impact of £6 million. It cannot, however, be proved that the measures discussed will have that level of impact. The estimates of potential impact were based on the assumption that angling conditions become very favourable; the measures discussed here should improve angling but they may not be capable of improving it to a degree which would maximise the economic potential of angling.

5.28 The benefit which will be realised in terms of increased sea angling is, therefore, uncertain. The costs of the measures proposed here are also uncertain - though the degree of uncertainty is much less. However, even a partial realisation of the potential of sea angling would produce substantial economic benefits and it appears likely that these would outweigh the adverse impact on commercial fishing of the relatively limited measures discussed particularly as some of the measures would produce off-setting benefits for commercial fishing.

5.29 The findings of this report lead to the conclusion that the following measures should be introduced:

(i) closure to all mobile gear of the area north of a line from Cloch Point to Dunoon;

(ii) a weekend ban on fishing with mobile gear throughout the Clyde;

(iii) an increase in the mesh size for nephrops trawls to 80mm codend; and, possibly,

(iv) changes in the maximum size of otter boards.

Measure (i) would put directly 'at risk' around 60 jobs with associated incomes of £800,000. The other measures would produce some transitional loss of income for the commercial sector. If the measures proved technically effective, the benefits arising from improved angling could involve up to 370 jobs - though the actual benefit is likely to fall well short of this level. Nevertheless, the balance of probability is that the benefit would exceed costs.

5.30 In view of the uncertainties involved, the impact of the measures proposed should be reviewed after no more than five years. After that lapse of time it should prove possible to assess impacts on fish stocks, angling activity and commercial fishing. At some point, if angling activity revives strongly in the 'protected' area, it may prove necessary to consider licensing or other controls on angling.

5.31 Measures for more active promotion and development of the sector must await improvement in stocks and in the quality of angling. The Irish experience indicates that the benefits of a high profile effort to promote the sector may not be very great in terms of increased activity. The Clyde will attract anglers primarily by virtue of providing good quality angling and the usual media will publicise any tangible improvements in the quality of angling.

5.32 When such improvements are evident, consideration could be given to increasing the promotional effort for the area in relation to sea angling. Measures would involve enhanced advertising, specialist leaflets, encouragement to the tourist industry to promote sea angling packages and direct contacts with Sea Angling Clubs as a form of 'sales mission'. However, it must be emphasised that any promotional effort in advance of improvements in the quality of angling would not only be inappropriate but could seriously damage the area's market potential. To attract visitors who would then experience poor quality angling would create a poor image for the area and undermine longer term marketing.

APPENDIX 1

ANGLERS' COMMENTS

W Dempster. Ardentinny. Fished Loch Long since 1947: Teemed with fish of many varieties, especially saithe, dogfish, flounder and seatrout but now all declined: also notes that summer shoals of porpoise, basking shark and seal are now rare: beds of mussels, cockles and wilkes (sic) all but extinct.

J H Henderson. Strachur. Disappearance of local range of fish round the Cowal shores: also concerned about the decline in wildlife (seals, gannets and others) which occurred in 1985/86: recent decline in fish stocks in upper Loch Fyne reaching an all time low in 1986: the Newtown angling club's annual contest in July had catches of one or two mackerel in the winning boats and zero recordings were in the majority.

J G Morrison. Strachur. Supports Henderson: Although catches were low in 1985 lythe (pollack/coalfish) were fairly good: not a single lythe in 1986.

J E Poole. Manchester. General decline, no detailed evidence.

P C Frankish. Arran. Fishing variable since 1979 but trend is down: no haddock in 1986 and only heard of one being caught: hardly any cod and usually too small to take: mackerel shoals much smaller: not aware of changes in flat-fish but fish smaller and greater number with blemishes (boils): Regularly fishes from May to September from Holy Isle to Kildonan: even pollack, which is not trawled, is reduced: blames commercial fishing including clam dredgers and landing of undersized fish.

K Morgan. Gourock. Catches from bad to unbelievable: no records.

S McIntyre. Gourock. Keen angler; been on prawn trawler and surprised by lack of fish except for small hake which do not survive: flat-fish survive: blames larger vessels fishing from Girvan and further afield for destroying the spawning grounds of haddock and cod.

D Watt. Greenock. Both charterer and diver: blames trawlers: only gets fish from wrecks between Gourock and Inverkip: these are mainly saithe and weights have been decreasing.

Cloch Caravans. Loss of business caused by dramatic reduction in catches: gives cod as an example.

H Walker. Skelmorlie. Vice-chairman Saltcoats Sea Angling Association: White Horse competition attracts some 1,200 anglers: alarmed by decline in catches over past 6-7 years: no cod out of 1,153 entrants in November 1986: 5 years ago 25lbs. of codling would win the event.

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B M Hodgson. Rosneath. Shore fished Gareloch since 1983: 2-3 years ago fish could be caught anywhere now rarely catch anything: blames trawlers.

C B Gibson. Glasgow. Petition to DAFS complaining of trawling on spawning grounds on upper Clyde. Records from January '86 to December '86. Cod 6, haddock 0, whiting c.10-12, herring 2, conger 0, mackerel 2: before trawling this would have been a good days fishing: 2 days fishing off Arran in June 1986 yielded 1 spurdog and 2 foul hooked herring.

Modern Charters Ltd.. Clynder. Decline in charter business.

B Douglas. Helensburgh. Regular fisher in Loch Long, Loch Goil, Holy Loch and Gareloch since 1975: detailed diary since 1981: catches limited to needs: expected improvements with increased local knowledge but in recent years results disastrous: 1986 virtually gave up except when mackerel were in and even this was poor. General notes:

Cod 1975 – 1980. Excellent standard of fishing, regularly taking fish of 6 to 12lbs, occasionally catching 15lbs and losing heavy fish. 1980 – 1983. Rapid deterioration from this time rarely taking cod of 4lb. Many small cod undersized. 1983 - 1986. Progressive deterioration to virtually nil catches anywhere north of Hunter's Quay. 1986 - cod catches extremely rare all fish undersized (under 8").

Mackerel from 1980 this started to become patchy, shoals appearing much later in the year and generally very broken-up small groups. 1985 and 1986 summers included totally blank days despite fishing in ideal conditions.

Saithe and pollack. As with mackerel this species (sic) becomes less frequent from 1980: fish mostly undersized.

Thornback: until 1978 this species had been plentiful in the Ardpeaton to Coulport area. It suddenly vanished in 1978 (had been available up to 10lb or so).

Rock cod similar experience to cod had been available up to 6–8lbs. regularly.

Blames trawling also includes details of fishing areas and an assessment of the quality of fishing based on a scale of 1 to 10. This shows general decline for all species.

J J Thomson. Helensburgh. Dramatic decline in cod. All that is left for anglers are a few saithe and pollack over wrecks and dabs, flounders and plaice over shallow ground where trawlers cannot operate. Some sample catch data from December 1984 to January/February 1986 from dinghy. In Helensburgh/Gareloch area catches of cod in 1985 ranged from 47 to 3 with 2 rods but weekly fishing from March to October 1986 caught 1 cod of approx 1/4lb. Blames trawlers including one fishing up to the Erskine Bridge.

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C Moar. Clynder. Boat hirer: drastic decline in business. 6 years ago could fill a basket of good fish, cod, flatfish etc: now can fish the length and breadth of Loch round to Gourock and Loch Long and catch nothing.

T H Nugent. Gourock. Angler since 1958: 1958-1965 pier fishing large thornback rays to 8lb and cod to 6lb. 1966-1969 boat angling in Loch Goil many spurdogs to 14lb: 180lb of cod in one hour, up to 15lb and average 8lb. Conger and haddock on Dunoon Bank: 1970-1975 good cod on Dunoon Bank - one session in 1971 yielded 190lb 5 at 5-15Ibs, 2 at 22lb and one at 40.5lb just under Scottish record. From mid 1970's major fall in weights and types of fish: in 1986 only caught 14 cod the largest of 2.5Ib. Today the Clyde has no spurdogs, no thornbacks and no haddock. Some flatfish on shoreline: now fishes for coalfish and pollack on wrecks and off jetties: blames trawlers.

Falkirk Sea Angling Club. Fished Clyde for 20 years. 15 years ago catches of 11 different species recorded, including cod, whiting, haddock, plaice, spurdogs, conger, saithe and pollack: recently in a couple of competitions off Gourock only caught saithe: Blames overfishing and effluent from atomic power stations.

Gareloch and Loch Long Civil Service Angling Club. 1985-1986 catches one third of previous season. Steady decline in numbers and size of fish caught in past few years. Compares 1985/86 total numbers and weight with previous year (no mention of effort to catch these amounts but in letter states that have difficulty getting members to use the club boat) .

K Devlin. Inverkip. Fished Clyde, mainly off Inverkip since 1940. Gave up keeping records 15 years ago. 20 years ago average catch was 36 fish for 4 or 5 people in 2.5 hours. Now almost no fish except migrant mackerel and saithe: Last good cod catch in August 1985 (23 of good size). Whiting has disappeared in the last 20 years. On the South Skelmorlie Bank haddock and dogfish have gone and migrant cod were common to about 4 years ago. Loch Fyne and the Kyles of Bute are not so bare of fish. The cod are heavily infected with worm and lythe, saithe, mackerel and herring survive but other white fish have been thinned out. Blames anti-fouling paint and overfishing.

A Holt. Paisley. Records of catches from 1969 to 1972 when catches were so bad that they were not worth recording. No information on locality or effort.

B Russell. Dumbarton. Kept records and notes since 1976 (catches given are best catches only). Good fishing in 1976/77. 1978 Lochs Long and Goil died as far as angling is concerned: read good reports of Gantocks: 1979 superb fishing on Gantocks for cod whiting etc.: 1980 continued good boat fishing but shore deteriorating: 1981 like Loch Long, Gantocks died, bigger fish scarce and shore fishing remained poor: 1982 shore fishing not worth the effort: boat fishing fairly reliable and rewarding but Gantocks extinct: larger fish scarce:

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1983 fishing poor but rewarding in Helensburgh/Greenock area. 1984 shore fishing poor but large catches of cod of 1.5 to 4lb east of line between Gourock and Kilcreggan: large fish scarce and areas west of above line which are intensely trawled devoid of fish: 1985 large catches of cod in Greenock area Oct/Nov 1985: 1986 no cod in inner Clyde: All smooth ground in deep water devoid of any type of sizeable fish: Only fishing in shallow water for flatfish and small pollack and coalies over wrecks. Blames trawling.

K Macintosh. Largs. Skipper of charter boat. Records 1976 to 1981. Cod max bag 1977 120lb: 1981 25lb: largest fish 1977 9lb 1981 3.5Ib. Haddock 1977 largest fish 5.25lb. 1981 only one all year. In 1977 could guarantee at least one cod over 5lb every trip but in 1981 largest was 4.5lb all year: notes a large increase in worms in cod: from 1981 to 1983 specialised in pollack and never caught less than 90lb in half a day with a maximum of 164lb. Returned all fish of less than 4lb and only fished once per month on different marks. Fished most marks in 1986 and never caught a fish of over 3lb. Coalfish reducing in size but still present. Spurdog decreased drastically by late 1970's and now unknown. Blames trawlers.

A letter from the Isle of Arran Sea Angling Association gives some details of the Lamlash Sea Angling Festival held over two days in May: gives total weight of fish landed for 1972 to 1974 and for 1984 to 1986 which show a marked drop. Also a decline in quality and species of fish. No cod or haddock in 1986.

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APPENDIX 2

ANGLING CLUB RESPONSES

Scottish Aviation S.A.C. Data for 1986 and 1987 only: Locations too variable to be of value.

Inverary S.A.C. 1987 results from fixed shore locations; catches variable; no information on how they compare with earlier years.

Aberdeen Airport Angling Club Results from one 1987 competition only.

Northfield S.A.C. Records of shore competitions for 1984 and 1986 to 1988; some evidence of improved cod catches in 1988.

Edinburgh and Meadowbank S.A.C. No data; comments on general decline.

Ayr S.A.C. No data; club no longer holds competitions in the Clyde.

Sea Pirates S.A.C. No data; club no longer holds competitions in the Clyde.

Ferranti S.A.C. Have not fished Inner Clyde since 1982; only two boat trips in 1985 and 1986.

Albion S.A.C. 1986 and 1987 data only from wide range of venues.

Beachcasters S.A.C 1987 data only; all shore fishing; very small catches.

Lothians and Borders Police Information for 1983 to 1986 of catches off Gourock by same boat-hirer; Ceased fishing after poor returns in 1986.

Towerlands S.A.C. Results of shore and boat outings 1985 to 1988; no evidence of significant trends over this period.

Cockenzie and Portseton Royal British Legion Angling Club. Shore fishing results 1985 to 1987; no real trends.

South Queensferry Angling Club. Some useful boat records between 1981 and 1987.

Troon S.A.C. 1987/88 data only; notes best catch of cod in recent years at the end of 1987; general decline in all species.

Anderston S.A.C. 1987/88 data only; boat and shore; variable catches from different venues.

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Irvine S.A.C. Some useful data from Irvine Bay for 1984 to 1987; drastic decline in 1986 led to cancellation of outings, some improvement in 1987.

Grange Hotel S.A.C. Shore fishing 1988 only.

Leith S.A.C. Gave up fishing the Clyde 5 or 6 years ago.

Hamilton and District S.A.C. Data for 1983 to 1987; locations too variable to be of value; comments on the small numbers of cod throughout this period.

North Berwick S.A.C 1988 data only; very poor catches.

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