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An Economic Evaluation of Irish Salmon Fishing

II: The Irish Anglers

R. O'CONNOR, B. J. WHELAN and A. McCASHIN

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An Economic Evaluation of Irish Salmon Fishing

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II: The Irish Anglers

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An Economic Evaluation of Irish Salmon Fishing

INTRODUCTION

THIS paper reports on part of a study entitled an Economic Evaluation of Irish Salmon and Sea-Trout Fishing which is being sponsored by the Department of Agriculture and Fisheries and conducted by The Economic and Social Research Institute. The first part of the study, which dealt with salmon anglers from outside the Republic, has already been completed and the results published [1]. The terms of reference of the study together with some background information were given in the latter publication. This second part is concerned with Irish salmon anglers and particularly with assessing the extent and regional distribution of the economic effects of their activities. In both these papers, we attempt to find out what sort of people the anglers are; where and how often they fish, and, particularly, how much they spend and where this expenditure takes place. The concluding part of the study will deal with commercial fishermen and fishery operators, and in that paper we also hope to amalgamate our information on angling and on commercial fishing into a comprehensive picture of Irish salmon fishing.

As explained in Appendix B several methods may be used for making an evaluation of this nature depending on the purpose of the study. If the angling activity is considered from the point of view of its present contribution to income and employment the total expenditure method seems the best, whereas if it is considered from the standpoint of the satisfaction it affords to Irish anglers, other methods are probably more appropriate. In this study we were interested in looking at angling from both these points of view but because of the low visitation rates and the wide geographical distribution of the fishing waters it was impracticable to use any method other than the total expenditure approach for both of these purposes. Appendix B outlines some of the drawbacks of this method for the purpose of quantifying the satisfaction afforded to anglers by the angling activity (amenity value of resource) and readers should keep these points in mind when interpreting the results. It is our view, however, that under Irish conditions the expenditure of the Irish anglers tends to understate considerably the amenity value of the resource but as we have no means of arriving at a better estimate than this, we present the results as obtained.

We begin the present study by sketching a brief picture of Irish salmon

fishing. We then go on to describe the characteristics of Irish salmon anglers, the frequency and location of their fishing, the numbers and disposal of fish caught, and the opinions of the anglers on various questions relating to angling and the management of angling waters. The next section gives estimates of anglers' expenditure on various items related to their fishing, in order to determine the value of this recreation in the different fishery districts. The final section of the paper contains a brief analysis of the trends in catch and numbers of anglers in recent years, together with some tentative projections of the number of anglers and their expenditure in 1975. Appendix A gives some additional tables. Appendix B discusses the methodological issues involved in the study, Appendix C discusses some technical problems in sampling while a copy of the questionnaire used is given as Appendix D.

A SKETCH OF IRISH SALMON FISHING

Salmon and sea trout, having been spawned in an Irish river, remain there for about 1–3 years. They then undergo various physiological and behavioural changes and move downstream to the sea. The salmon travels long distances out in the Atlantic where it feeds and grows very quickly, and after a further 1–3 years it returns to the river of its birth. Salmon returning after one year's feeding in the sea are called grilse, and they usually weigh about 5–6 lb, while those fish which remain in the sea for longer reach heavier weights before returning as salmon proper. Specimen salmon can reach 30 or 40 lb weight but the normal weight is 10–12 lb. The life cycle of the sea trout is basically similar to that of the salmon, except that it does not travel such great distances, and is, of course, a smaller fish, averaging about 1lb. in weight.

The mortality rate at all stages of a salmon's life is very high. As a recently spawned alevin or fry, and also during its downstream migration as a smolt, it is subject to many predators: pike, trout, herons, otters etc. It is also quite susceptible to human interference in the form of water pollution, dredging etc. During its life in the sea, other predators (seals, large sea fish etc.) take their toll of salmon and sea trout. In recent years a further predator has begun to exploit the salmon on their maritime feeding grounds—man himself. Total landings of salmon from around the coasts of Greenland, the major feeding ground of Atlantic salmon* from both North America and Europe, have increased from 60 metric tons in 1960 to 2,139 metric tons in 1970.[2] Those salmon which escape the deep-sea netsmen around the coast of Greenland must

*The salmon found in all European and East American and Canadian rivers is known as the Atlantic salmon, as distinct from the Pacific salmon found in West American and Canadian waters. The Pacific salmon spawns only once and dies, while the Atlantic salmon may spawn several times.

face further nets on their return to Irish waters. Drift netsmen fish from trawlers some miles out to sea, using extremely long lengths of net suspended by corks near the surface, while draft netsmen fish from row boats in river estuaries. In the Letterkenny district, loop nets are used to fish from the shore, and in the Waterford and Lismore districts snap nets are also used.

Table A.1 of the Appendix shows that the pressure exerted by commercial fishing on salmon stocks has been increasing considerably since 1955. The total number of commercial licences† (i.e. licences for nets, traps, etc.) has risen from 1,244 in 1955 to 1,769 in 1970, and total commercial catch has increased more than proportionately from 1,015,000 lb in 1955 to 3,374,000 lb in 1970. If a fish evades the nets and succeeds in reaching the fresh water section of the river, it is liable to be caught by anglers, who have also become more numerous in recent years. Total angling licences rose from 6,604 in 1955 to a peak of 12,378 in 1965, after which they declined quite sharply to 9,676 in 1968, before rising to 10,506 in 1969 and 11,210 in 1970. The decline after 1965 seems to be related to the onset of salmon disease (Ulcerative Dermal Necrosis) which began to affect Irish salmon in 1964. Fortunately, this disease now seems to be on the wane. A more detailed analysis of the trends in the number of angling licences is given in the final section of the paper.

This catalogue of the possible misfortunes which may befall a salmon will explain why much concern has been expressed about the survival of the species. Obviously, if any of these factors increases the mortality rate of salmon or sea trout above a certain level, then the total population of these fish will begin to fall, and they may become extinct.

It is clear, therefore, that if the foregoing trends continue salmon stocks will come under increasing pressure in the years ahead, and that we should now be trying to devise policy measures which will allow us to make the most rational use of our salmon fishing resources. The design of such measures requires the most complete information possible on Irish salmon fishing, and the present study attempts to supply some of this information.

†A licence is legally required for salmon fishing by both anglers and commercial fishermen in Ireland. For the purposes of the Fisheries Acts, sea trout are regarded as salmon and the same licence is required to fish for them.

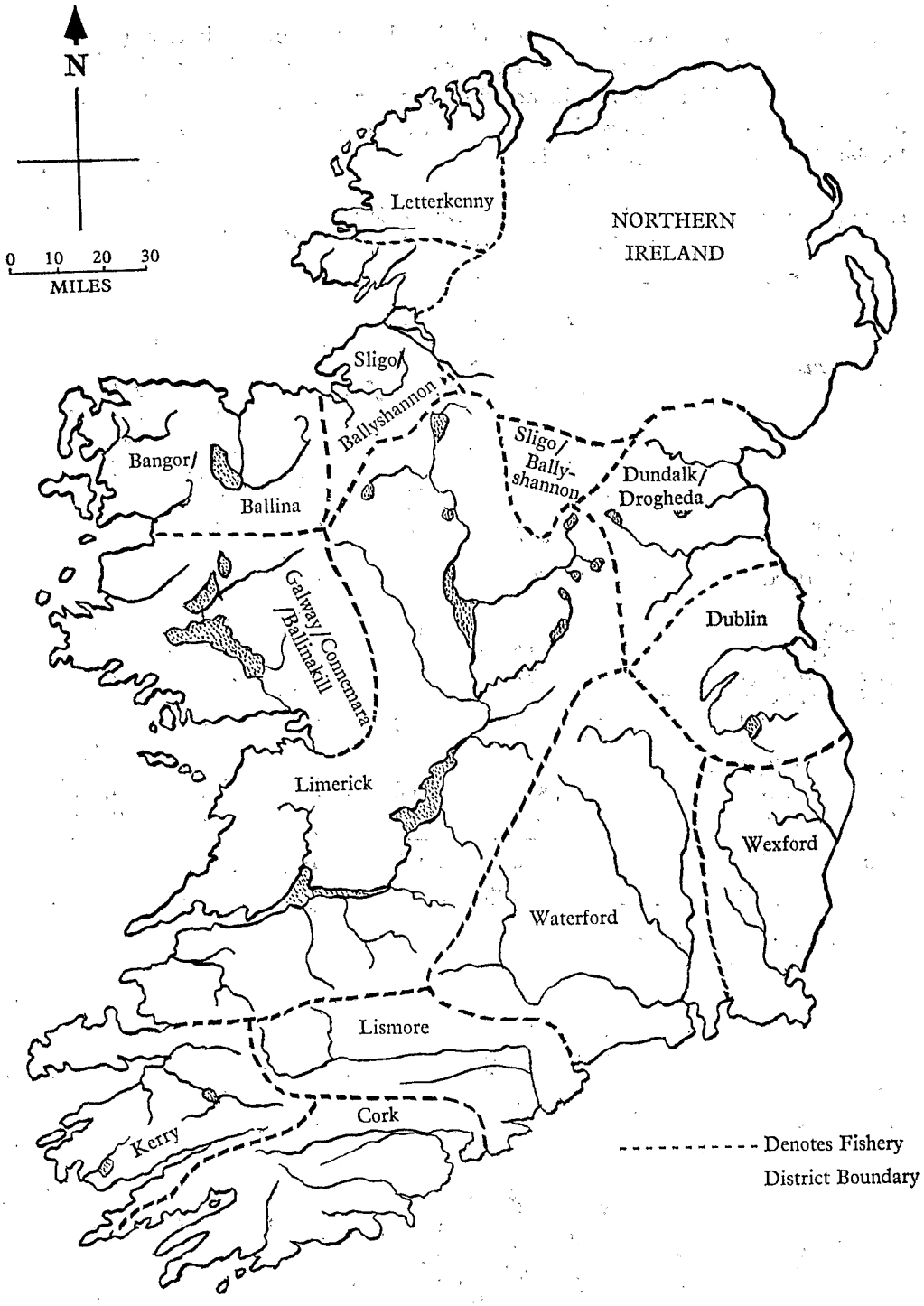
THE SURVEY

Pilot Survey

In December 1969 a pilot survey was carried out in respect of anglers who had taken out salmon angling licences during the 1969 season. The aims of this survey were to decide on size and method of stratification of the sample, pre-test a questionnaire, test the response rate and discover any other problems likely to arise in the full study. A sample of 135 anglers was selected from the 1969 licence counterfoils, kindly provided by the Fisheries Branch of the Department of Agriculture and Fisheries. In all, ninety-three completed schedules were obtained, leaving forty-two who were unable to co-operate for a variety of reasons. Encouragingly, only one angler refused to co-operate; six anglers fished commercially (and were therefore excluded); and thirty-five others could not co-operate for other reasons (illness, change of residence etc.). On the whole the pilot questions were well answered and it was felt that the questionnaire was reasonably satisfactory. Examination of the results showed that the expenditure of Dublin anglers was much more variable than that of anglers from other districts and it was therefore considered necessary in the main study to sample a larger proportion of Dublin anglers than other anglers.

The Main Survey

The full-scale survey of Irish anglers was carried out in 1970–71. A sample of 611 anglers was selected at random from the 1970 licences issued to Irish anglers. The sample was stratified by fishery district in which the licence was issued and variable sampling fractions were used to ensure sufficient numbers of anglers in each district. "Fishery Districts" are administrative units based on the catchment areas of the larger rivers. For the purpose of this study we combined some of the 17 original districts to give the twelve districts shown on the map. A total of 586 usable schedules were obtained, giving an overall response rate of 96 per cent. Table 1 shows the total number of licences issued, the number of anglers sampled, and the number responding, all classified by fishery district. In this table and throughout the paper "District of Issue" refers to the district in which the licence was issued, and "District of Residence" to the district in which the angler resided. The first row of Table 1 shows that 813 Dublin residents took out salmon licences in 1970, whereas there were only 377 licences issued in the Dublin district. Thus, a clear majority of anglers living in Dublin took out licences in districts other than their home district, reflecting the tendency for Dublin anglers to travel further than others for their salmon fishing. On the other hand, the western districts where salmon fishing is most



Ireland: Showing Fishery Districts as used in this study, and also main river systems.

abundant (Kerry, Galway/Connemara/Ballinakill, Bangor/Ballina) had more licences issued than there were local anglers as a result of anglers visiting these districts from outside. It should be noted when interpreting this table that about forty per cent of the licences issued to Irish anglers were valid for all fishery districts irrespective of district of issue.

Table 1: *Number of Licences Issued to All Irish Anglers in 1970, Number of Anglers Sampled and Number of Anglers Responding, Classified by Fishery District*

Fishery District	*Total Licence Holders*		*Number Sampled*	*Respondents District of Residence*	
	District of Issue	*District of Residence*		*Number*	*Per Cent of Number Sampled*
	(1)	(2)	(3)	(4)	(5)
1. Dublin	377	813	180	160	88·9
2. Wexford	302	269	33	33	100·–
3. Waterford	860	902	45	45	100·–
4. Lismore	214	245	32	32	100·–
5. Cork	551	570	56	56	100·–
6. Kerry	511	423	32	31	96·9
7. Limerick	1,371	1,339	39	38	97·4
8. Galway/Connemara/ Ballinakill	505	363	38	37	97·4
9. Bangor/Ballina	446	292	45	44	97·8
10. Sligo/Ballyshannon	306	316	39	39	100·–
11. Letterkenny	515	508	36	35	97·2
12. Drogheda/Dundalk	538	456	36	36	100·–
Total	6,496	6,496	611	586	96·0

RESULTS OF SURVEY

As pointed out above, a higher proportion of anglers from Dublin than from other districts was selected in order to increase the precision of the results. For this reason, valid figures can only be derived by taking these disproportionate sampling rates into account, and all the averages, percentages and estimated totals given below have been appropriately weighted.

Characteristics of Anglers

Age, Income and Occupation

Table 2 shows the percentage distribution of Irish and visiting anglers by age, occupation and income, together with roughly comparable data for the total male population of Ireland. The age distributions of Irish and visiting anglers are broadly similar, although a slightly higher percentage of the visiting anglers are in the "60 and over" category. Compared with the total male population of Ireland, Irish salmon anglers tended to be concentrated in middle-age groups: 49 per cent of them were aged 40–59 as compared with 33 per cent of the total population. The results of the National Angling Survey in Britain [3] indicate that British game fishermen are a good deal younger on average than either Irish or visiting salmon anglers. From the figures given in the latter survey, it can be estimated that approximately 57 per cent of British game fishermen were under 40, which compared with our estimate of 35 per cent for Irish salmon anglers, and 31 per cent for visiting salmon anglers. However, it should be borne in mind that this may reflect, at least partly, the different age-structure of the British population, and also that the term "game fishing" includes brown-trout fishing as well as salmon fishing.

Irish salmon anglers are not drawn in equal proportions from all occupations; only about 10 per cent of them were employed in agriculture, compared with about 36 per cent for the total male population, while about 27 per cent were in the "Professional, managerial employer" class, compared with about 9 per cent for the total population. In contrast, a much higher proportion (about 60 per cent) of visiting salmon anglers were in the "Professional etc." class. The most striking feature of the table, however, is the high proportion of manual employees among the Irish salmon anglers (44 per cent compared with 31 per cent for this group in the population as a whole) indicating that in Ireland salmon angling is not confined to the better-off section of the community.

Table 2: *Age, Occupation and Income Distribution of Irish Anglers, Visiting Anglers and of the Male Population of Ireland*

Age				*Occupation*				*Income*		
Age Group	*Visiting* Anglers*	*Irish Anglers*	*Population of Ireland†*	*Occupation*	*Visiting* Anglers*	*Irish Anglers*	*Population of Ireland†*	*Income Group (£)*	*Visiting* Anglers*	*Irish Anglers*
		Per Cent				*Per Cent*				*Per Cent*
Under 20	4·2	6·1	13·3	Agriculture	4·6	10·3	36·1	1,000 and under	8·6	46·1
20–29	9·8	13·0	17·0	Professional etc.	60·0	26·9	8·5	1,001–2,000	17·9	29·1
30–39	17·0	16·0	15·3	Non-manual Employees	7·2	11·6	21·5	2,001–3,000	16·0	9·8
40–49	21·6	27·3	16·8					3,001–4,000	8·6	6·6
50–59	19·8	21·4	15·8	Manual Employees	9·1	43·5	31·0	4,001–5,000	10·7	2·0
60 and over	21·1	15·4	21·9	Other, unknown	19·1	5·0	2·9	More than 5,000	27·0	2·0
Unknown	6·5	0·7	—					Unknown	11·2	4·4
Total	100	100	100	*Total*	100	100	100	*Total*	100	100
Base n=	430	586	—	*Base n=*	430	586	—	*Base n=*	430	586

*See O'Connor and Whelan (*op. cit.*). "Visiting" means visiting the Republic of Ireland.

†Population figures are based on data for males from the Census of Population 1966. The survey age category "under 20" is assumed to be comparable with the population aged 15–19.

This is borne out by the figures in the income section of Table 2 which show that in 1970 about 46 per cent of Irish anglers had incomes of £1,000 per annum and under while only 2 per cent were in the over £5,000 bracket. As might be expected, the incomes of the visiting anglers followed a very different pattern, only 9 per cent being in the £1,000 per annum and under category, while about 27 per cent had incomes of more than £5,000. Unfortunately, we do not have data on the distribution of income in Ireland with which to compare the salmon anglers' distribution. We should mention that data on incomes is notoriously difficult to collect by surveys and that the incomes reported by Irish anglers look somewhat low in view of the anglers' occupational distribution.

Membership of Clubs and Syndicates

A fair amount of Irish salmon angling is controlled by clubs. These are voluntary groups of anglers who combine together in a formal manner to lease and manage certain waters. Annual subscriptions are generally fairly low (about £2–£10) and entry to the clubs is generally open, though it is sometimes restricted. Syndicates are smaller groups of anglers, usually numbering from about three to ten, who combine to lease the fishing rights of a certain stretch of

Table 3: *Estimated Numbers of All Irish Anglers and Percentage of Anglers who are Members of Angling Clubs and Angling Syndicates, Classified by District of Residence*

District of Residence	*Membership of Angling Club*		*Membership of Angling Syndicates*	
	Number	*Per Cent*	*Number*	*Per Cent*
Dublin	336	41·3	86	10·6
Wexford	65	24·2	16	6·1
Waterford	481	53·3	60	6·7
Lismore	46	18·7	62	25·0
Cork	306	53·6	20	3·6
Kerry	232	54·8	*	*
Limerick	956	71·4	71	5·3
Galway/Connemara/Ballinakill	226	62·2	29	8·1
Bangor/Ballina	226	77·3	6	2·3
Sligo/Ballyshannon	70	53·8	*	*
Letterkenny	377	74·3	14	2·9
Drogheda/Dundalk	304	66·7	26	5·6
All Districts	3,209	49·4	390	6·0

*None in sample.

water and share the fishing. They are usually less formally organised than clubs, the subscription is often higher and entry more difficult.

About half of the Irish anglers are members of angling clubs, although, as Table 3 indicates, this proportion varies according to the anglers' district of residence. Club members constitute between 70 per cent and 77 per cent of the anglers resident in Limerick, Letterkenny and Bangor/Ballina. The angling populations of the eastern districts show lower proportions of club members, 41 per cent of Dublin anglers, 24 per cent of Wexford anglers and 19 per cent of Lismore anglers for example. Syndicates seem to have much less support than clubs among the salmon anglers; only 6 per cent of the latter claimed to be syndicate members. Lismore anglers who had the lowest club membership of all districts had a syndicate membership rate of 25 per cent, the highest of all the districts. Dublin anglers had a syndicate membership of 10·6 per cent while there were no syndicate members in the Kerry or Sligo/Ballyshannon samples.

Angling Activity

Frequency and Location of Fishing

The questionnaire, which is shown in Appendix D, asked respondents to differentiate between local fishing trips, defined as trips to waters less than twenty miles from their home, and other fishing trips. An examination of the data on the number and location of days fished suggested that very few of these local trips were to districts outside the angler's district of residence. In this and subsequent sections we therefore use the term "local" to refer to an angler's district of residence.

Table 4 shows the estimated total number of days fished locally and non-locally, the estimated total number of trips to non-local waters, and the average number of days fished per angler, both locally and non-locally. Local trips were assumed to be day-trips. In this and subsequent tables the totals given are grossed up estimates for the whole population of salmon anglers. The aggregate number of days fished (rod days) in local water was estimated at 254,000 and about 15,000 in non-local waters. There were about 11,000 non-local trips giving an average number of rod-days per trip of 1·4, which suggests that much of the non-local fishing is conducted at weekends. Clearly, the Dublin-based anglers fish substantially more away from home than do other anglers who reside in good fishing areas and fish for the most part in their local fishery district. For example, Lismore, Kerry and Letterkenny anglers fished between 45 and 55 days locally during the year. Fishing patterns in different districts appear to be influenced by the length of time during which salmon fishing is

Table 4: *Estimated Total and Average Number of Days Fished in Local and Non-Local Waters, Total Number of Trips and Average Days Fished per Angler, Classified by District of Residence of Angler*

District of Residence	*Estimated Total Days Fished in*		*Estimated Total Trips to Non-Local Waters*	*Average Days Fished per Angler in*	
	Local Waters	*Non-Local Waters*		*Local Waters*	*Non-Local Waters*†
Dublin	5,021	9,029	6,554	6·1	11·1
Wexford	12,733	214	195	47·3	*
Waterford	44,739	1,740	722	49·6	1·9
Lismore	11,010	392	314	44·9	1·3
Cork	23,676	1,099	1,099	41·5	1·9
Kerry	23,455	—	—	55·4	*
Limerick	59,550	882	882	44·5	*
Galway/Ballinakill/ Connemara	11,566	166	166	31·9	0·5
Bangor/Ballina	11,182	153	153	38·3	0·5
Sligo/Ballyshannon	12,705	201	114	40·2	0·6
Letterkenny	24,356	219	219	47·9	0·4
Drogheda/Dundalk	14,199	1,166	327	31·1	2·6
All Districts	254,192	15,261	10,745	39·1	2·3

*The number of anglers in these districts who fished non-locally was too small to permit the calculation of valid averages.

†The averages in this column are based on the numbers of anglers in each district who travelled outside their local district to fish.

possible: anglers from districts like Lismore and Kerry which have both spring and summer salmon fishing tend to fish more days during the season than do anglers from districts where salmon fishing is confined to the summer months.

Type of Party and Size of Party

The anglers who went on some non-local fishing trips were asked to specify the type of party with which they usually travelled on these trips. Table 5 shows the responses to this question, classified by district of residence, and also the number of anglers who did not make trips outside their local waters. These latter anglers were substantially in the majority in all districts, with the exception of Dublin. Of the total anglers, 14 per cent travelled outside their local areas with parties of fishermen, 7 per cent travelled with family parties, 4 per cent travelled alone while 74 per cent made no angling trips outside their local waters.

Table 5: *Estimated Numbers of All Irish Anglers who usually Travel with Different Types of Party, Classified by District of Residence*

District of Residence	*Type of Party Usually Travelled with on Non-Local Trips*				*No trips outside Local Waters*	*Total*
	Family Party	*Party of Fishermen*	*Alone*	*Other Party*		
			Number of Anglers			
Dublin	223	341	132	35	82	813
Wexford	8	9			252	269
Waterford	80	40	60	20	702	902
Lismore		31	7		207	245
Cork	60	102	21		387	570
Kerry		13			410	423
Limerick		106			1,233	1,339
Galway/Connemara/ Ballinakill		89	29		245	363
Bangor/Ballina	14	26	6		246	292
Sligo/Ballyshannon	33	8			275	316
Letterkenny	29	29	43		407	508
Drogheda/Dundalk	25	114	13		304	456
All Districts, Numbers	472	908	311	55	4,750	6,496
Per Cent	7·0	14·2	4·3	0·7	74·0	100·–

Table A.2 of the Appendix classifies total days fished by district and type of water (i.e. private, club, hotel etc.). As can be seen from this table, local fishing tends for the most part to be conducted in free* waters (38·9 per cent) and club waters (31·9 per cent), while 44·5 per cent of non-local days were spent in private waters and only 23·4 per cent and 22·9 per cent respectively in free waters and club waters. This pattern reflects, firstly, the fact that anglers fishing locally have a thorough knowledge of fishing conditions and of the availability of rental-free waters, as well as being members of local clubs, and secondly, the tendency for the well-off anglers to fish non-locally more so than others and to pay the higher rental usually charged in private waters. The number in the party with which the angler travelled averaged about 2–3 persons, and the figures did not show much variation as between parties of fishermen, family parties and other parties.

*Here and throughout the paper, the term "free water" means waters which are not strictly preserved and which may normally be fished free of charge. In the eyes of the law there is no "free fishing" in any fresh water river or lake.

Purpose of Non-Local Trips and Species Fished

Salmon angling may sometimes be combined with other activities such as family outings or business affairs. To determine the extent to which this occurs among Irish anglers, respondents were asked to specify the purposes of their non-local trips. The responses to this question, shown in Table 6, reveal that salmon angling is rarely combined with other activities. Of the estimated 10,745 non-local trips by all Irish anglers 10,106 (95 per cent) were for the specific purpose of salmon/sea-trout fishing with 2·4 per cent for the purpose of general family holidays.

Table 6: *Estimated Total Number of Non-Local Trips by all Irish Anglers, Classified by Purpose of Trip*

Purpose of Trip	*Number*	*Per Cent*
(1) Specially for Salmon/Sea-Trout angling	10,106	94·1
(2) General Family Holiday	262	2·4
(3) Combination of (1) and (2)	29	0·3
(4) Business, Other, etc.	348	3·2
	10,745	100

Anglers who take out salmon-fishing licences may also fish for species other than salmon or sea trout. The distribution of responses to the question "Do you fish for species other than salmon or sea trout?" is given in Table 7. For ease of interpretation the original responses of "often" and "occasionally" have been summed to give the category "total positive responses", and "seldom" and "never" have been summed to give "total negative responses".

The districts where a relatively high proportion of anglers (over 60 per cent) stated that they fished for other species, either often or occasionally, were Dublin, Waterford, Lismore, Limerick and Letterkenny. There were relatively low percentages of anglers from Wexford, Kerry, Galway/Connemara/Ballinakill, and Bangor/Ballina who fished for other species. This pattern seems to be related to the availability of salmon and sea-trout fishing in a district relative to the availability of other types of angling. For instance, the western districts of Kerry, Connemara, Ballinakill, and Bangor have little coarse fishing, and their brown trout, though numerous, tend to be small. On the other hand, districts like Lismore, Limerick, and Drogheda have very good brown-trout and coarse fishing. Another factor which presumably influences the pattern shown in Table 7 is the relative density of population in the district,

Table 7: *Percentage distribution of responses by Irish Anglers to the question "Do you fish for species other than salmon/sea trout?" Classified by District of Residence and Occupation of Angler*

District of Residence	*Responses*							
	Often	*Occasionally*	*Total Positive Responses*	*Seldom*	*Never*	*Total Negative Responses*	*No Answer*	*Total*
				Per Cent				
Dublin	57·5	20·0	77·5	7·5	10·6	18·1	4·4	100
Wexford	12·1	30·3	42·4	12·1	45·5	57·6	—	100
Waterford	35·6	33·3	68·9	8·9	20·0	28·9	2·2	100
Lismore	21·9	43·8	65·7	12·5	21·9	34·4	—	100
Cork	26·8	28·6	55·4	17·8	23·2	41·0	3·6	100
Kerry	12·9	9·7	22·6	3·2	74·1	77·3	—	100
Limerick	36·8	26·3	63·1	2·6	34·2	34·2	2·6	100
Galway/Connemara/ Ballinakill	32·4	16·2	48·6	10·8	37·8	48·6	2·7	100
Bangor/Ballina	18·2	20·5	38·7	11·4	50·0	61·4	—	100
Sligo/Ballyshannon	20·5	33·5	53·8	12·8	33·3	46·1	—	100
Letterkenny	51·4	14·3	65·7	25·7	8·6	34·3	—	100
Drogheda/Dundalk	11·1	38·9	50·0	11·1	36·1	47·2	2·8	100
Occupation								
Agricultural	18·3	25·2	43·4	11·8	44·5	55·9	0·7	100
Professional	35·1	28·0	63·1	11·5	19·6	19·6	5·8	100
Non-Manual Employee	38·7	22·2	60·9	10·6	28·4	39·1	—	100
Manual Employee	30·4	28·4	58·8	7·3	35·7	43·0	0·6	100
Other and Unknown	32·4	15·5	47·9	6·0	44·6	50·6	1·5	100
Total	31·3	26·3	47·5	9·2	31·1	40·3	2·1	100

which results in the district's salmon and sea-trout fishing being fairly heavily utilised, so inducing anglers to turn to other species. This factor is possibly operative in Dublin and in Drogheda/Dundalk.

The distribution of the responses between various occupational groups was more uniform, although it is to be noted that of those in agricultural occupations only 42·4 per cent fish for other species, the corresponding proportion for the remaining groups being about 60 per cent. However, this dichotomy between agricultural and other occupations no doubt reflects the differences between densely populated and sparsely populated regions referred to above.

Bednights of Anglers and their Dependants

The total number of bednights spent by all Irish anglers and their dependants was estimated at 31,433 and nearly 20,000 of these bednights emanated from the Dublin district of residence. In analysing the sample data on bednights, it was found that the number of bednights spent in certain districts was very small. For this reason we have collated most of the districts under regional headings and the constituent districts of the regions are given in the rows of Table 8.

While the aggregate number of bednights spent by Irish—as against foreign—anglers is rather small the areas visited are substantially the same. Western districts with considerable amounts of fishing acted as the host districts for most of the overnight visits: the number of bednights spent in the South-Western and Western regions were about 8,000 and 13,000 respectively. Of those spent in the South-Western district, 6,000 were spent in Kerry and 2,000 in Limerick. Of those in the Western district, 7,000 were spent in Galway/Connemara/Ballinakill and 5,000 in Bangor/Ballina. An inspection of the table also shows that a high proportion of these overnight visits to the popular districts were by Dublin-based anglers, and in fact Dubliners appear to be the anglers who travel most extensively and who stay overnight in the locality in which they are fishing.

Most of the bednights, (70·5 per cent) were spent during the summer months of July, August and September and the period during April to June was next most popular, about 21 per cent of the bednights being spent at that time. These figures, which are given in Table 9, are almost identical with the figures for foreign anglers although a slightly higher proportion of the "Irish" bednights (7·5 per cent) compared to the visitors' bednights (4·6 per cent) were in the first quarter. There are divergent trends, however, between the native and visiting anglers with regard to the type of accommodation used. A much larger proportion of the foreign visitors, than the Irish anglers' bednights were in hotels, the respective percentages were 46·3 and 25·4, while a very much higher proportion of the Irish bednights were spent with relatives/friends. Several

Table 8: *Estimated Total Number of Bednights spent by all Irish Anglers and their Dependants, Classified by District in which Bednight was spent and District of Residence of Angler*

District of Residence		*Region in which Bednight Spent*				
		Eastern and South-Eastern	*South-Western*	*Western*	*North-Western*	*All Regions*
				Number		
Eastern and South Eastern Region	Dublin	2,266	6,456	9,969	1,045	19,736
	Drogheda/Dundalk Wexford Waterford Lismore	1,305	618	1,138	2,813	5,874
South-Western Region	Cork Kerry Limerick	410	614	186	737	1,947
Western Region	Galway/Connemara/Ballinakill Bangor/Ballina	40	—	961	—	1,001
North-Western Region	Sligo/Ballyshannon Letterkenny	1,707	—	273	895	2,875
Total		5,728	7,688	12,527	5,490	31,433
Per Cent		18·2	24·4	39·9	17·5	100·—

Table 9: *Number and Percentage of Bednights by Irish and Visiting Anglers and their Dependants, Classified by Time of Year and Type of Accommodation*

Time of Year	*Irish Anglers*		*Visiting Anglers*	
	Number	*Per Cent*	*Number*	*Per Cent*
January-March	2,371	7·5	4,150	4·6
April-June	6,519	20·7	20,143	22·4
July-September	22,146	70·5	65,473	72·7
October-December	397	1·3	229	0·3
Total	31,433	100	89,995	100
Type of Accommodation				
Hotel	7,988	25·4	41,648	46·3
Guesthouse and Farmhouse	4,121	13·1	13,330	14·8
Camping/Caravan	4,358	13·9	8,401	9·3
Rented house/Chalet	3,410	10·8	17,543	19·5
Relatives/Friends	8,817	28·1	7,676	8·5
Other	2,739	8·7	1,397	1·6
Total	31,433	100	89,995	100

explanations may be advanced to explain this divergence. In the first place, Irish anglers are likely to have more relatives and friends in other districts than do foreigners. Secondly, Irish anglers are in general considerably less well off than foreign anglers and so are more constrained by financial considerations. Thirdly, foreign anglers probably have less information about the Irish accommodation market. Finally, the typical Irish angler's fishing trip is a short week-end affair, whereas to the foreigner his fishing trip to Ireland is probably his main holiday of the year and so justifies a higher standard of comfort.

Fishery Rental

Average rental per rod/day in the different types of water in different districts is shown in Table 10. As can be seen from this table, rental in private waters at £0·48 per rod/day is more expensive than in any of the other types of water.

The figures for club and hotel waters were, respectively, £0·20 and £0·30 per day, while the amount charged in most public body and other waters was negligible. Not unexpectedly the district where the highest overall level of rental payment was incurred was Lismore (£0·56 per rod/day), followed by Galway/Connemara/Ballinakill (£0·42 per rod day) and Bangor/Ballina (£0·23 per rod/day). However, the highest single level of rental payment was found in private waters in Galway/Connemara/Ballinakill, where an average fee of £1.61 per rod/day was charged.

Table 10: *Average Rental per rod/day for various Types of Water in the Different Districts*

Fishery District	*Private*	*Club*	*Hotel*	*Public Body and Other*	*All Districts*
			£ per rod/day		
Dublin	0·03	0·17	—	0·05	0·14
Wexford	0·38	0·36	—	—	0·18
Waterford	0·39	0·06	—	—	0·22
Lismore	0·86	0·16	—	—	0·56
Cork	0·29	0·17	—	—	0·15
Kerry	0·09	0·10	—	0·22	0·04
Limerick	0·04	0·12	0·70	0·39	0·11
Galway/Connemara/Ballinakill	1·61	0·12	0·50	0·03	0·42
Bangor/Ballina	0·56	0·16	—	0·18	0·23
Sligo/Ballyshannon	0·08	0·62	0·14	0·03	0·16
Letterkenny	0·06	0·28	—	0·03	0·03
Drogheda/Dundalk	0·69	0·06	—	—	0·13
All Districts	0·48	0·20	0·30	0·04	0·16

A comparison of the data in Table 10 with the similar figures computed for the foreign visiting anglers indicates that for most districts and types of water the Irish anglers seem to pay significantly less per rod/day than the visitors. For example, the average rental paid per rod/day in all types of water by out of state (visiting) anglers was £2·9 in Lismore, £1·9 in Galway/Connemara/Ballinakill, and £1·3 in Bangor/Ballina*. Furthermore, the highest rental charged to the latter anglers was £4·0 per rod/day in private waters in Lismore. An examination of the separate data on local and non-local rental seems to indicate that Irish anglers fishing non-locally pay somewhat higher rental fees than do Irish anglers fishing locally. It thus seems that local Irish anglers pay the lowest rentals and out-of-state visitors the highest, while Irish anglers fishing non-locally pay an intermediate level of rental. This pattern probably reflects two factors: (i) the relative income levels of the three groups (ii) the advantages enjoyed by locals (and, to a certain extent, by non-local Irish anglers) of being "on the spot". Local anglers know the best locations and can fish when conditions are most suitable. They are therefore able to obtain good fishing even on the cheaper stretches of water. In contrast, anglers from outside the area (particularly from abroad) must make arrangements sometime in advance and thus may tend to go to the more expensive waters where they feel assured of a catch even under unfavourable conditions.

*See O'Connor and Whelan, *op. cit.*, Table 12, p. 28.

However, too much should not be read into the observed differences between rentals paid by locals and non-locals, since the numbers of observations involved were rather small. For this reason the detailed breakdown of average rental as between local and non-local anglers is not given here (although Table A.3 gives this breakdown for the estimated total rental paid by all Irish anglers). When fishery rentals from Table 10 were compared with catch figures from Table 11 no significant correlation could be found between the two sets of data. This is not unexpected as there are many other factors which may influence pricing decisions such as the scenic quality of the fishery, its location convenient to a large centre of population, its operation in conjunction with a good hotel, tradition etc.

Catch and Disposal of Catch

Table 11 shows average catch per rod/day of salmon and sea trout classified by fishery district and type of water. Private waters show consistently better catches than other waters although the difference is more noticeable in the case of salmon than of sea trout. In the districts of Kerry, Drogheda/Dundalk, Galway/Connemara/Ballinakill and Bangor/Ballina the catch per rod/day of salmon was particularly good, over 2 lb. per rod/day in each of these districts. Club waters in certain districts also had good catch figures, for example the districts of Bangor/Ballina, Letterkenny, Kerry and Sligo/Ballyshannon. There were also good catches in some public body and other waters, especially in Galway/Connemara/Ballinakill where the catch of salmon was 2·4 lb. per rod/day in these waters.

The best catches of sea trout were also in private waters. Not surprisingly, this type of water yielded a catch of 3·3 lb. per rod/day in Galway/Connemara/Ballinakill, a district which is famous for its sea-trout fishing. Free waters in some of the western districts also showed high figures for sea-trout catch, for instance Sligo/Ballyshannon and Bangor/Ballina. While the average catch for private waters in all districts was only 0·7 lb. per rod/day, and was exceeded by the figure for hotel waters, this is probably due to the extremely low catches of sea trout recorded in the districts of Lismore, Limerick and Sligo/Ballyshannon, (0·1 lb.) Waterford (0·2 lb.) and Letterkenny (0·3 lb.).

Table 12 shows the quantity and value of salmon consumed and sold, together with the quantity and value of sea trout caught, both expressed as averages per angler and classified by the district of residence of anglers. The quantity of salmon consumed is valued at the average price received for salmon sold by anglers from the district of residence concerned. Since the quantity of sea trout sold by anglers in the sample was small, we do not give a breakdown of the disposal of sea-trout catch and confine ourselves to giving the total quantity

Table 11: *Average Salmon and Sea-Trout Catch Per Rod/Day by District Fished and Type of Water*

District of Residence	*Private*	*Club*	*Hotel*	*Public Body and Other*	*Free*	*All*
			Lb. per Rod/Day			
(a) *Salmon*						
Dublin	1·1	0·6	—	1·2	—	0·7
Wexford	1·7	0·3	—	—	1·2	1·4
Waterford	0·5	0·6	—	0·7	0·4	0·5
Lismore	1·4	—	—	—	0·3	1·0
Cork	0·5	0·8	—	—	0·7	0·7
Kerry	2·8	1·1	1·1	—	0·5	0·6
Limerick	0·4	0·2	0·1	1·2	1·0	0·8
Galway/Connemara/Ballinakill	2·7	0·9	1·5	2·4	0·4	1·6
Bangor/Ballina	2·3	2·1	1·2	0·8	1·0	2·1
Sligo/Ballyshannon	1·1	1·0	—	0·8	0·4	0·8
Letterkenny	1·9	1·8	—	1·5	1·0	1·4
Drogheda/Dundalk	3·2	0·6	—	—	0·5	1·3
All Districts	1·7	0·7	0·8	1·2	0·7	1·0
(b) *Sea Trout*						
Dublin	0·7	0·1	—	—	0·1	0·1
Wexford	0·5	0·1	—	—	0·8	0·6
Waterford	0·2	0·0	—	0·7	—	0·1
Lismore	0·1	0·7	—	—	0·4	0·2
Cork	0·4	0·4	—	—	0·6	0·4
Kerry	0·6	0·3	0·8	—	0·9	0·2
Limerick	0·1	0·4	0·1	0·1	0·1	0·1
Galway/Connemara/Ballinakill	3·3	0·4	2·3	0·6	0·3	1·3
Bangor/Ballina	1·1	0·3	1·7	1·2	1·9	0·8
Sligo/Ballyshannon	0·1	0·6	—	—	3·2	0·3
Letterkenny	0·3	0·6	—	0·1	0·2	0·2
Drogheda/Dundalk	1·2	0·7	—	—	0·4	0·8
All Districts	0·7	0·3	0·8	0·3	0·3	0·4

0·0 means that the average was less than 0·05.
—means that no anglers fished in this type of water and district.

caught together with its value at the overall average price received for sea trout sold (24p per lb.) On average, the anglers each caught about 40 lb. of salmon valued at about £16, of which they sold 23 lb. (57·2 per cent) and consumed 17 lb., yielding an income from salmon sales of about £9 per angler. However, anglers from certain districts, such as Dublin and Galway/Connemara/Ballinakill, sold only a small proportion of their salmon, while anglers in other districts sold over three-quarters of their catch. Thus Kerry anglers sold 86 per cent,

Table 12: *Disposal of Catch per Angler of Salmon and Sea Trout, Classified by District of Residence*

District of Residence	*Salmon Catch per Angler*						*Per Cent of Salmon Catch Sold*	*Sea-Trout Catch per Angler*		*Total Value of Combined Catch of Salmon and Sea-Trout*
	Quantity			*Value*						
	Consumed	*Sold*	*Total*	*Consumed*	*Sold*	*Total*		*Quantity*	*Value*	
		lb.			£			*lb.*	£	£
Dublin	15·6	4·6	20·2	8·4	2·5	10·9	22·8	13·7	3·3	14·2
Wexford	12·6	40·1	52·7	4·4	14·1	18·5	76·0	33·1	7·9	26·4
Waterford	17·7	17·7	35·4	7·9	7·9	15·9	50·5	8·8	2·1	18·0
Lismore	8·1	37·1	45·2	3·0	13·7	16·7	82·0	10·1	2·4	19·1
Cork	14·7	16·0	30·7	6·3	6·8	13·1	52·0	23·9	5·7	18·8
Kerry	8·4	51·7	60·1	3·6	21·9	25·5	85·9	21·4	5·1	30·6
Limerick	6·5	30·1	36·6	2·3	10·8	13·1	82·3	5·3	1·3	14·4
Galway/Connemara/Ballinakill	20·4	2·8	23·2	7·3	1·0	8·3	11·9	21·7	5·2	13·5
Bangoı/Ballina	30·4	43·2	73·7	12·2	17·3	29·5	58·7	25·2	6·0	35·5
Sligo/Ballyshannon	13·8	18·1	31·8	6·6	8·7	15·3	53·0	14·9	3·6	18·9
Letterkenny	46·0	25·6	71·6	15·1	8·4	23·5	35·7	16·8	4·0	27·5
Drogheda/Dundalk	25·7	15·0	40·7	11·8	6·9	18·7	43·9	32·3	7·8	26·5
All Districts	17·0	23·0	40·1	6·7	9·1	15·8	57·2	15·9	3·8	19·6

Wexford anglers 76 per cent and Lismore anglers sold 82 per cent of their catch.

The value of catch sold per angler is thus fairly substantial, and in certain districts such as Kerry and Limerick is a significant proportion of average expenditure per angler. This suggests that some Irish anglers may earn more from catch sales than they expend on salmon fishing, and so should be more appropriately considered as commercial fishermen rather than sport anglers. To investigate this, we expressed each angler's catch sales as a percentage of his total expenditure on salmon and sea-trout angling, and then classified the anglers in the sample by the size of this percentage. The results of this exercise are shown in Table 13. As this table shows, about 64 per cent of all anglers had catch sales of less than 10 per cent of their total expenditure on salmon and sea-trout angling, while about 13 per cent of anglers received more for their sales of salmon and sea trout than they spent on angling for these species. These proportions show wide variations as between different districts. Hardly any of the Dublin anglers earned a significant proportion of their angling expenditure from catch sales, over 94 per cent of them having catch sales which constituted 10 per cent or less of their total expenditure. In Kerry, only 36 per cent of

Table 13: *Percentage Distribution of Anglers, Classified by the Value of their Catch Sales (Salmon+Sea Trout) and District of Residence*

District of Residence	*Value of Catch Sales as Percentage of Total Expenditure on Angling*					
	10 and under	*11–50*	*51–100*	*101–150*	*Over 150*	*Total*
	Per Cent of Anglers in Category					
Dublin	94·4	4·5	0·6	0·0	0·6	100–.
Wexford	57·6	15·2	6·0	0·0	21·2	100–.
Waterford	47·8	17·8	8·8	4·4	11·1	100–.
Lismore	68·8	18·8	3·1	0·0	9·4	100–.
Cork	69·5	16·1	3·6	3·6	7·2	100–.
Kerry	35·5	6·4	19·4	12·9	25·8	100–.
Limerick	52·6	21·0	10·5	7·9	7·9	100–.
Galway/Connemara/ Ballinakill	91·4	2·9	5·8	0·0	0·0	100–.
Bangor/Ballina	50·0	20·3	13·7	4·5	11·4	100–.
Sligo/Ballyshannon	68·5	13·1	5·3	2·6	10·4	100–.
Letterkenny	61·0	13·9	8·4	11·2	5·6	100–.
Drogheda/Dundalk	59·9	22·8	11·5	2·9	2·9	100–.
All Districts	63·7	14·9	8·1	4·8	8·4	100–.

anglers had catch sales which constituted 10 per cent or less of expenditure, while almost 40 per cent had earnings from catch sales which exceeded their expenditure. Other districts with considerable proportions of anglers whose catch sales exceeded their expenditure were Wexford (21 per cent of anglers in this category), Limerick and Bangor/Ballina (16 per cent each). However, we cannot infer that these anglers' motivation in fishing is entirely or even primarily to earn income: they may very well fish for both sport and income.

Since some small number of anglers fish commercially* it has been suggested to us that these should be restricted in the same manner as net fishermen, i.e. by a shorter fishing season and the imposition of a weekly close time. This does not seem to be feasible for a number of reasons. In the first place, it would be impossible to distinguish between commercial and sport anglers and hence all anglers would have to be restricted in the same way. Secondly, since most angling is done at weekends the weekly close time would have to be during mid-week when little angling is done anyway. Finally, since only about ten per cent of the total salmon catch is taken by anglers, and only about 3 per cent by "commercial" anglers, restrictions such as those mentioned above would not have an appreciable effect on stocks.

Grossed up Figures for Catch

The total catch of salmon by Irish anglers, in terms of both quantity and value, is shown in Table A.4 of Appendix A, broken down by amount consumed and amount sold, together with the total catch of sea trout in both quantity and value terms. It may be seen from this table that the total catch of salmon was estimated at about 261,000 lbs. valued at about £103,000. Of this, about 112,000 lb., valued at £44,000 was estimated to have been consumed by the anglers and the remaining 149,000 lb. valued at £59,000 was sold. About 104,000 lb. of sea trout were caught the value of which was estimated at about £25,000. The total value of the salmon and sea-trout catch by all Irish anglers was therefore estimated at about £128,000. The district whose residents had the highest total value of catch (£19,000) was Limerick, while Waterford anglers caught salmon and sea trout to the value of £16,000, and Letterkenny anglers about £14,000 worth of salmon and sea trout.

The interpretation of the value of catch in economic evaluation is discussed Appendix B, and for the reasons mentioned there it has not been taken into account in arriving at the value to the economy of angling by Irish anglers. As we stated in the introduction, the total expenditure method is the one we have adopted and we believe that the addition of the value of catch to total expenditure would involve double-counting.

*We define a commercial angler as one who receives more for salmon sold than he spends on salmon angling. We estimate that there were about 860 such anglers in the State in 1970 and that they caught a total of 102,000 lb. of salmon or an average of 118 lb. of salmon each.

Table 14: *Survey Estimates and Official Figures for Total Rod/Line Catch of Salmon and Sea Trout in the Different Fishery Districts* (1970)

Fishery Districts	*Estimated Total Catch of Salmon (Rod/Line 1970)*				*Estimated Total Catch of Sea Trout (Rod/Line 1970)*			
	Survey			*Official Figures*	*Survey*			*Official Figures*
	Irish Anglers	*Visiting Anglers*	*All Anglers*	*All Anglers*	*Irish Anglers*	*Visiting Anglers*	*All Anglers*	*All Anglers*
				lb.				
Dublin	3,359	—	3,359±(2,332)	1,957	655	—	655	1,265
Wexford	18,733	7,842	26,575±(18,562)	3,880	9,018	209	9,227	1,977
Waterford	22,528	680	23,208±(8,012)	12,243	5,911	296	6,307	1,703
Lismore	11,478	3,183	14,611±(5,868)	7,739	2,609	87	2,696	2,204
Cork	15,824	628	16,452±(4,585)	10,859	10,673	637	11,368	2,913
Kerry	28,500	6,455	34,955±(10,648)	9,996	13,712	8,749	22,461	10,378
Limerick	46,717	1,334	48,051±(30,301)	24,512	6,878	279	7,157	7,634
Galway/Connemara/Ballinakill	21,119	7,659	28,778±(21,073)	10,539	19,227	10,808	29,979	11,494
Bangor/Ballina	28,349	4,423	32,772±(9,397)	22,101	11,211	4,963	16,174	7,572
Sligo/Ballyshannon	10,648	4,370	15,018±(5,740)	8,640	4,612	488	5,100	2,534
Letterkenny	33,658	6,010	39,668±(15,541)	19,145	5,025	2,747	7,772	6,429
Drogheda/Dundalk	19,981	3,428	23,409±(16,983)	7,238	13,665	1,492	15,157	4,547
All Districts	260,894 (±48,355)	46,012 (±12,004)	306,906 (±49,983)	136,859	103,196	30,755	133,951	60,650

Note: Official figures for total rod/line catch of salmon and sea trout were taken from Sea and Inland Fisheries Report, 1970, Appendices 16 and 17, pages 55 and 56 respectively.
Figures in brackets are the confidence intervals about the estimates at the 95% level of significance.

Comparison of Catch Results from Survey with Official Figures

In the paper on the visiting anglers [1] estimates were presented of the total catch by these anglers and it was pointed out there that those estimates were unexpectedly high in light of the official figures for the catch by all anglers. Table 14 again shows these estimates of visiting anglers' catch, along with estimates of the catch of Irish anglers* and the published official figures. The divergence between the survey estimates and the official figures is, as the table shows, quite large. Official figures for 1970 show the total rod and line catch of salmon as 137,000 lb. while the survey estimates give a total of 307,000 (±49,983) and the respective estimates of the sea-trout catch are 60,700 and 134,000 lb. The figures in brackets are the confidence intervals of the sample results at the 95 per cent level of significance+. These are further discussed in Appendix C. Even when allowance is made for these intervals, however, there is a wide divergence between the two sets of figures, the official figures being much lower than the survey results.

The Department's figure for 1970 is based on a voluntary return of catch, mainly by holders of seven-day licences, modified in the light of the knowledge of field staff. The response rate varied widely from district to district but from the information given to us we estimate that it was less than 20 per cent for the country as a whole. In addition to the volunteer bias in this type of enquiry the catch by holders of these short-period licences is likely to be significantly less than that by holders of full season licences. Hence, unless the modification by the field staff was very considerable, there could be a serious downward bias in the official figures. We are therefore prepared to accept our own estimates in preference, since they are based on a representative sample of all licence holders, were obtained by trained interviewers and are therefore not subject to volunteer bias. Detailed breakdowns of our estimates of the total catch of salmon and sea trout by Irish anglers are given in Tables A.5 to A.8 inclusive.

Opinions of Irish Anglers

Question 16 of the questionnaire (see Appendix D) asked anglers about any changes which they felt had taken place in salmon and sea-trout fishing in the waters which they fished since they first started fishing. Anglers could comment on as many as three waters and in respect of each water they were asked why they felt these changes had taken place. Since the question asked about changes which had occurred since the respondent began salmon fishing, anglers who had only recently begun to fish for salmon were basing their

*It should be noted that the survey figures in Table 14 are classified by the district in which the fish were caught, in contrast to Table 12 and A.4 where the classification was by district of residence.

+We did not calculate standard errors for the sea-trout catch, but we believe that these would be fairly similar to those calculated for salmon catch.

Table 15: *Percentage Distribution of Opinions Expressed by Irish Salmon Anglers as to the Degree of Change in Fishing Conditions in the Different Fishery Districts*

Fishery District Commented on	*Degree of Change*					*Total*	*Numbers of anglers making one or more comments*
	Serious Decline	*Moderate Decline*	*Much the Same*	*Moderate Improvement*	*Great Improvement*		
				Per Cent			
Dublin	100	—	—	—	—	100·—	24
Wexford	78·8	7·8	11·5	1·9	—	100·—	49
Waterford	88·3	6·3	5·4	—	—	100·—	56
Lismore	79·2	7·6	13·1	—	—	100·—	37
Cork	78·3	11·2	7·3	3·2		100·—	47
Kerry	58·8	17·0	17·2	4·1	7·9	100·—	46
Limerick	38·2	22·8	8·8	9·2	3·2	100·—	49
Galway/Connemara/ Ballinakill	40·6	15·3	33·7	5·2	5·2	100·—	56
Bangor/Ballina	53·4	23·1	11·9	5·7	6·0	100·—	66
Sligo/Ballyshannon	69·8	9·3	19·0		1·8	100·—	39
Letterkenny	51·1	12·2	32·7	4·0		100·—	41
Drogheda/Dundalk	56·3	15·4	22·5	5·3	0·5	100·—	61
All Districts	64·4	14·2	15·0	4·2	2·2	100·—	

answers on experience different from that of anglers who had been salmon fishing for many years. It is quite possible, for instance, that salmon fishing could have improved relative to the position a few years ago, but it may have declined relative to what it was many years previously.

Table 15 shows that the vast majority of anglers thought that a decline had occurred. About two-thirds of the comments suggest that a serious decline had set in, while one-seventh suggest that the fishing conditions were much the same. The small remainder of the opinions were to the effect that some degree of improvement—moderate (4·2 per cent) or great (2·2 per cent)—had taken place. However, these overall figures conceal sizeable variations from one district to another. It appears that the districts of Dublin, Wexford, Waterford, Lismore and Cork were seen by practically all those who commented on them to be in a state of considerable decline. There was complete unanimity among those commenting on Dublin waters that a serious decline had occurred, while about 95 per cent of the comments referring to Waterford, 87 per cent to Lismore, 90 per cent to Cork and 87 per cent to Wexford, suggested a decline of some degree, with the category "serious decline" alone comprising over 70 per cent of all these comments. Equally apparent is the fact that very few suggested that any improvement, either great or moderate, had occurred in eastern and south-eastern areas. As most respondents confined their comments to their local waters which they presumably know very well, it seems clear that a serious decline has taken place in the quality of Irish salmon angling in recent years.

The overwhelming majority of the opinions which suggest a decline make it important to see why anglers felt this decline had occurred, and the reasons they gave are shown in Table 16. Anglers could mention up to three reasons, and it is the percentage of times that each reason was mentioned which is tabulated in Table 16. The overall distribution of reasons suggests that salmon disease, excessive netting and pollution were, in that order, the most frequently occurring causes of decline. Very small percentages of the opinions related to other causes such as poaching, Greenland netting, lack of re-stocking, drought and various other reasons. However, as with the data on the degree of change in fishing, we need to look at the figures for the separate districts since the overall figures conceal some important variations. According to the anglers, the urbanised districts of Dublin and Cork were noticeably more affected by pollution than were other districts. Roughly a quarter of the total reasons given in respect of these districts mentioned pollution, and anglers commenting on other fairly densely populated areas also attributed considerable blame to pollution: 17·1 per cent of the reasons given for Waterford's alleged decline blamed pollution, while the corresponding figure for Drogheda/Dundalk was 18·1 per cent, and for Lismore 20·9 per cent. Excessive netting (i.e. fishing commercially with drift nets and draft nets in the open sea and in the estuaries

Table 16: *Percentage Distribution of Reasons Given by Irish Anglers for the Decline in Fishing Conditions in 1970, Classified by Fishery District Commented On*

Fishery District Commented on	*Reason for Decline*										*Total*
	Salmon Disease	*Excessive Netting*	*Pollution*	*Drainage/Hydro Schemes*	*Drought*	*Over-Fishing*	*Poaching*	*Lack of Restocking*	*Greenland Netting*	*Other Reason*	
					Per Cent.						
Dublin	34·4	9·2	25·2	—	—	6·1	25·2	—	—	—	100
Wexford	59·7	2·0	12·9	6·3		8·6	3·3	2·0	3·3	2·0	100
Waterford	33·0	31·4	17·1	0·5	3·4		4·4	2·0	0·5	8·2	100
Lismore	39·7	21·5	20·9			2·4	4·6	3·9	2·4	4·6	100
Cork	39·9	8·7	27·8	0·8	1·7	5·3	5·3	1·7	5·3	3·4	100
Kerry	41·0	22·4	15·3	—	2·7	11·2	3·8	—	—	3·6	100
Limerick	64·6	5·6	3·8	5·9	3·4	4·9		5·9		5·9	100
Galway/Connemara/ Ballinakill	14·2	22·9	17·4	2·5	8·5	9·7	7·7		7·5	9·7	100
Bangor/Ballina	20·7	15·8	6·9	31·1	2·2	1·5	6·5	1·1	7·1	7·1	100
Sligo/Ballyshannon	36·2	20·6	4·5	2·3	2·3	2·3	20·6	9·0	2·3		100
Letterkenny	4·6	50·6	7·8		1·2	2·4	5·3	17·7	3·4	7·0	100
Drogheda/Dundalk	16·4	16·8	18·1	20·8	1·7	8·5		2·2	7·1	8·5	100
All Districts	36·7	18·9	13·7	6·5	2·6	4·6	4·5	3·9	3·0	5·8	100

of the rivers) was widely blamed for the decline in salmon fishing—especially in the districts with abundant fishing. In Letterkenny, for example, over half (51 per cent) of the reasons given for the alleged decline related to excessive netting, with very little importance being attached to pollution or salmon disease. Excessive netting does not figure so prominently in any other district as it does in Letterkenny, although in the case of the districts of Galway/Connemara/Ballinakill, Kerry, Lismore and Waterford over 20 per cent of the reasons given fell under the heading of excessive netting. A final point to notice is that in Bangor/Ballina (where a major arterial drainage scheme had just been completed on the river Moy) and Drogheda/Dundalk (where a similar scheme was in progress on the river Boyne) drainage/hydro-electric schemes were seen to be the most important factor in causing the decline in fishing, and this is in sharp contrast to the minimal weight attributed to this factor in all other regions.

The validity of anglers' opinions as to the causes of the decline in fishing are, however, open to some question, since an ordinary angler will not have the technical knowledge required to make scientific judgements on the subject. Casual observation, hearsay, and the group attitudes and interests of anglers may all play a part in determining their opinions on this topic. In brief, then, the most sensible conclusions seem to be that (i) the quality of salmon angling has declined (ii) anglers believe that this decline is due to several factors, either alone or in combination, and the most commonly mentioned of these are: salmon disease, pollution and excessive netting.

The final opinion item which produced worthwhile results referred to the anglers' opinions on the best type of management for Irish salmon fishing. This is a topic which has caused some controversy in recent years, and it raises many difficult issues of legality, equity and efficiency. Its investigation would really require a very detailed study with rather different focus from that of the present paper which is an attempt to evaluate the economic benefits being derived from salmon fishing. However, we did feel that it was worthwhile to attempt to obtain an overall, and therefore rather crude, assessment of anglers' feelings on the subject, and for this reason we included Question 19 (see Appendix D). This question, the results of which are shown in Table 18, gave anglers three choices: they could opt for private management (roughly speaking, the *status quo*); co-operative management, by which we meant management of *all* waters in the country somewhat along the lines of management by angling clubs; or state or public ownership.

Forty-one per cent of all anglers preferred public ownership, 28 per cent preferred co-operative ownership, 22 per cent preferred private ownership, and the balance either did not respond or expressed some other preference. There appears to be a general tendency for anglers in younger age groups, lower income groups, and certain occupational groups to prefer public or co-operative

management as against private management. Thus about 40 per cent of anglers in the under £2,000 income groups prefer public control, which contrasts with only 24 per cent of those in the over £5,000 income category. Conversely, high percentages of high income anglers and low percentages of low income anglers prefer private ownership. In fact 63·9 per cent of the anglers in the £4,001–5,000 income group prefer private ownership of angling waters. A similar pattern of preferences can be found in the occupational distribution. Higher than average proportions of the manual employee and non-manual employee classes prefer public ownership: the respective proportions for these two groups were 46·4 per cent and 53·3 per cent, while the proportions for the agricultural and professional categories were 25·4 and 33·5 per cent respectively. When the anglers were classified on the basis of age it was found that the older anglers

Table 17: *Percentage Distribution of Preferences Expressed for Different Types of Fisheries Management, Classified by Age, Occupation and Income*

	Type of Management Preferred				*Total*
	Private	*Co-operative*	*Public*	*Other**	
Occupational Group					
Agricultural	35·1	35·1	25·4	4·3	100
Professional	28·5	28·0	33·5	9·9	100
Non-Manual	18·8	23·0	53·3	4·9	100
Manual	15·8	30·6	46·4	7·2	100
Other*	34·2	29·2	36·7	—	100
Age Group					
Under 20	44·2	22·2	29·6	3·9	100
21–30	16·2	35·2	45·1	3·6	100
31–40	17·4	23·8	51·7	7·1	100
41–50	16·8	27·1	46·3	9·8	100
51–60	25·4	25·8	40·7	8·2	100
Over 60	30·9	34·6	26·6	7·9	100
Unknown	7·0	46·5	11·3	35·2	100
Income Group					
£1,000 and under	20·9	32·8	37·9	8·4	100
£1,001—£2,000	15·7	30·7	45·5	8·1	100
£2,001—£3,000	25·6	18·2	45·5	10·7	100
£3,001—£4,000	27·8	29·8	42·4	—	100
£4,001—£5,000	63·9	27·9	—	8·2	100
More than £5,000	52·6	23·4	24·0	—	100
Unknown	40·2	18·0	32·2	9·6	100
Club Members	19·3	36·7	38·2	5·8	100
Syndicate Members	28·4	18·4	40·9	12·3	100
All Anglers	22·2	28·4	41·4	8·0	100

*Includes no answer.

seemed to prefer private ownership while the younger people were generally in favour of public ownership.

It was thought likely that club members would support co-operative ownership, while syndicate members would be more likely to regard themselves as private owners and hence would favour private ownership. This expectation appears to be borne out by the data. The last two lines of Table 17 show that 28 per cent of syndicate members preferred private ownership as opposed to 19 per cent of club members, while only 18 per cent of syndicate members opted for co-operative ownership, compared with 37 per cent of club members.

There was, in fact, considerable support for co-operative ownership regardless of the way in which the sample was classified. Support for the co-operative idea dropped below 20 per cent in only one case (£2,001–£3,000 income group) and was as high as 35 per cent among the agricultural occupations group.

Expenditure of Irish Anglers

Since the principal objective of our study was to make an economic evaluation of salmon angling, the data on expenditure is of particular importance, and it was collected in considerable detail. In the following tables we are therefore able to give quite fine breakdowns of various totals, but too much reliance should not be placed on the figures for small sub-divisions of expenditure. Reference should be made to the confidence intervals which are given along the margins of most of the tables, and which indicate the precision (roughly speaking, the likelihood of error) of the estimates. For example, the figure of £2·7 at the bottom of the column headed "All overheads" in Table 18 indicates that we are 95 per cent confident that the true mean expenditure per angler lies between £16.6 and £22·0 (19.3 ± 2·7). It should be borne in mind that the figures for individual fishery districts which are based on sub-sets of the total sample are less precise, since the smaller the number of observations the wider the confidence interval. We deal with the expenditure data in the following order: average expenditure per angler, average expenditure per rod/day and finally grossed up figures for total expenditure.

Average Expenditure per Angler in 1970

The average local expenditure per angler on different items, classified by District of Residence, is given in Table 18. Certain of the items in this table require some explanation. "Clothes, boots" refers to items of clothing specifically bought for salmon fishing. Expenditure on purchases of "Boats, Engines and Boathouses" is presumed to reflect depreciation of capital equipment since it represents the average annual replacement cost of these items. Expenditure on repairs to these items is also included. "Accommodation and meals" refers to accommodation and meals purchased on salmon and sea-trout fishing trips.

Rental includes subscriptions to clubs as well as payments to private owners.

While the averages vary considerably from district to district, the average local expenditure for all anglers was about £30 of which £19 was spent on overheads. Tackle and lures constituted the main overhead item, and in districts where there is a considerable amount of lake fishing, expenditure on boats was important. Smaller amounts of about £5 each were spent on travel (mainly petrol), while a similar amount was spent on non-travel items (the most important item of which was fishery rental).

There is a tendency for the locally incurred expenditure of anglers resident in good fishing districts to be substantially greater than that of those resident in poorer fishing districts. For example, the highest average local expenditure (£55) was by Bangor/Ballina anglers followed by those from Letterkenny, Galway/Connemara/Ballinakill and Sligo/Ballyshannon all of whom spent £40 or more per angler. Those anglers who reside in the eastern districts, however, were inclined to spend much less in their local fishery district on all of the items. The Wexford anglers were the extreme case of this type—they incurred on average about £18 locally while the corresponding figures for the Drogheda/Dundalk, Dublin and Waterford anglers were £20, £21 and £22 respectively.

The low average local expenditure of the anglers resident in the eastern districts is more than counterbalanced by their relatively high level of non-local expenditure, which is shown in Table 19, classified in the same way as was local expenditure above. It can be clearly seen from this table how much the expenditure pattern of Dubliners differs from that of anglers from other districts. Most of the Dubliners' non-local expenditure, which totalled about £97 per angler, was on non-travel items such as accommodation, meals and fishery rental. The only other anglers who appear to expend significant amounts non-locally are also resident in eastern or urbanised areas—such as Dundalk/Drogheda, Cork and Waterford. A more aggregated version of the expenditure data is given in Table 20, and in percentage form in Table A.9 of Appendix A.

As can be seen from Table 20, Dubliners' expenditure is far and away the highest of all, at an average of £118 per angler, of which £97 (82 per cent) was spent outside the Dublin district. There were fairly high proportions of non-local expenditure by anglers from the relatively urbanised districts of Waterford (37 per cent) Cork (38 per cent) and Drogheda/Dundalk (49 per cent), while in the remaining districts the vast bulk of an angler's expenditure was incurred in his local district.

The difference between the expenditure pattern of Dubliners and that of other anglers is further emphasised by the final column of Table 20 which shows total expenditure per rod/day. Dubliners spent, on average, about £7 per rod/day, while Kerry anglers spent only about 40p. The large variation in these figures is due to both the much lower expenditure of non-Dubliners, and to the fact that non-Dubliners tend to fish more days per season than do Dubliners.

Table 18: *Average Local Expenditure per Angler in* 1970 *Classified by Item of Expenditure and District of Residence of Angler*

District of Residence	*Overhead Items*						*Travel Items*			*Non-Travel Items*					*All Local Expenditure*
	Licence	*Tackle, Lures*	*Clothes, Boots*	*Boat, Engines and Boathouses*	*Other*	*All Overheads (a)*	*Petrol/ Oil*	*Other*	*All Travel (b)*	*Accm./ Meals*	*Boatmen, Gillies*	*Rental*	*Other*	*All Non-Travel (c)*	*(a+b+c)*
							£ per angler								
Dublin	1·9	5·6	2·3	2·4	1·4	13·8	1·9	0·1	1·9	0·1	0·1	5·4	0·2	5·8	21·5±(8·9)
Wexford	2·6	8·1	2·5	1·5	—	14·6	2·0	0·0	2·0	0·8	—	0·7	—	1·5	18·1±(6·0)
Waterford	3·1	6·2	3·5	1·5	0·2	14·4	5·3	0·2	5·5	—	—	2·0	0·3	2·4	22·3±(4·8)
Lismore	3·2	5·3	2·4	0·1	—	11·0	7·9	0·0	7·9	—	—	25·8	—	25·8	44·7±(27·5)
Cork	3·2	6·5	3·3	—	1·5	14·6	5·5	0·4	5·9	2·2	—	6·5	1·0	9·7	30·2±(8·4)
Kerry	3·3	2·6	2·8	4·9		13·6	4·9	0·0	4·9	—	—	3·5	—	3·5	22·0±(7·2)
Limerick	2·7	6·6	4·7	8·2	2·0	24·2	4·6	0·0	4·6	0·3	—	3·3	—	3·6	32·4±(10·4)
Galway/Connemara/ Ballinakill	2·8	5·0	3·6	1·7	1·3	14·5	10·8	2·7	13·5	1·6	4·9	3·7	3·1	13·4	41 3±(14·7)
Bangor/Ballina	3·1	9·6	3·4	15·1	4·7	36·1	7·4	—	7·4	1·1	0·2	7·4	3·0	11·7	55·2±(25·7)
Sligo/Ballyshannon	3·2	9·8	3·3	10·8	0·7	27·8	6·5	0·3	6·8	1·2	1·5	1·4	0·5	4·5	39·2±(14·1)
Letterkenny	3·0	15·2	4·7	9·7	3·7	36·3	6·1	—	6·1	—	—	1·3	0·1	1·4	43·7±(20·8)
Drogheda/Dundalk	2·9	6·5	1·8	—	0·3	11·5	5·2	—	5·2	0·1	0·1	2·2	0·7	3·2	19·8±(6·3)
All Districts	2·8 ±(0·1)	7·0 ±(1·0)	3·4 ±(0·4)	4·7 ±(2·2)	1·4 ±(0·7)	19·3 ±(2·7)	5·2 ±(0·8)	0·2 ±(0·3)	5·4 ±(0·9)	0·5 ±(0·4)	0·4 ±(0·2)	4·3 ±(1·6)	0·6 ±(0·3)	5·7 ±(0·6)	30·5 ±(3·7)

Note: 1. Due to rounding errors the figures in each cell do not necessarily add to the row total shown.
2. The figures in brackets are the confidence intervals about the estimates at the 95 per cent level of significance.

Table 19: *Average Non-Local Expenditure per Angler in* 1970 *Classified by Item of Expenditure and District of Residence of Angler*

District of Residence	*All Overheads** (a)	*Travel Items*			*Non-Travel Items*					*All non-Local* (a+b+c)
		Petrol/Oil	*Other*	*All Travel* (b)	*Accommodation/meals*	*Boatmen/Gillies*	*Rental*	*Other*	*All non-Travel* (c)	
				£ per angler						
Dublin	9·8	16·4	2·4	18·7	31·9	11·0	11·8	13·8	68·4	97·0±(16·8)
Wexford	2·2	2·1	—	2·1	1·0	0·2	0·4	1·8	3·4	7·8± (8·2)
Waterford	0·2	2·1	—	2·1	7·2	—	2·7	0·8	10·7	13·1±(12·1)
Lismore	1·3	1·4	—	1·4	1·9	0·7	0·2	0·8	3·6	6·4± (7·0)
Cork	0·1	5·4	—	5·4	7·7	2·5	0·1	2·9	13·2	18·6±(14·7)
Kerry	0·2	0·2	—	0·2	0·3	—	—	0·2	0·5	0·8± (1·2)
Limerick	1·4	1·5	—	1·4	0·5	0·3	0·6	0·2	1·6	4·5± (6·3)
Galway/Connemara/ Ballinakill	2·2	1·8	—	1·8	1·6	0·1	0·5	—	2·3	6·3± (8·4)
Bangor/Ballina	1·5	2·9	—	2·9	0·4	—	0·1	0·3	0·8	5·1± (4·0)
Sligo/Ballyshannon	1·9	2·0	—	2·0	1·2	0·2	0·1	0·4	2·0	5·8± (5·0)
Letterkenny	2·8	1·3	0·1	1·4	2·9	0·8	0·7	0·9	5·3	9·5±(13·1)
Drogheda/Dundalk	3·4	3·4	—	3·4	3·7	—	6·2	1·7	12·2	18·8±(13·2)
All Districts	2·5 ±(0·6)	3·9 ±(0·7)	0·3 ±(0·2)	4·2 ±(0·8)	6·6 ±(1·6)	1·8 ±(0·7)	2·5 ±(0·9)	2·2 ±(0·5)	13·4 ±(2·3)	20·0 ±(3·6)

*We do not show itemised breakdowns of non-local overhead expenditure as the amounts spent non-locally on these items were very small.

Note: 1. Due to rounding errors the figures in each cell do not necessarily add to the row totals shown.
2. The figures in brackets are the confidence intervals about the estimates at the 95 per cent level of significance.

Estimated Total Expenditure by all Irish Anglers in 1970

In Table 21 is shown the estimated total expenditure of all Irish salmon anglers classified by the districts where the expenditure was incurred. The total for all anglers in all districts was about £326,000 of which roughly 60 per cent was spent by anglers in their local fishery districts. The confidence interval about the figure for total expenditure at the 95 per cent level was ±£34,000. The expenditure of Dublin anglers (£96,300) exceeded that of anglers from all other areas. Limerick anglers, whose licences numbered 1,339 in 1970, spent about £49,400 and the next largest outlays were by anglers from Waterford (£31,600) and Cork (£27,500). Thus, in descending order, the largest amount of expenditure was incurred by anglers from: Dublin, Limerick, Waterford and Cork, all of which districts are more urbanised than the western fishery districts.

When we look at the column totals of Table 21, which give the expenditures in the different districts, we see that Limerick was the district where the highest total expenditure (£48,400) was incurred, and it was followed by Galway/Connemara/Ballinakill (£40,700) and Bangor/Ballina (£40,500). The lowest total expenditure occurred in Wexford where £8,500 was spent. A striking feature of Table 21 is the extent to which expenditure by Dublin anglers (and, to a lesser extent anglers from Cork, Waterford and Drogheda/Dundalk) is spread over several districts, while expenditure by anglers from other districts tends to be spent mainly in their local areas.

The figures (underlined) in the diagonal cells of Table 21 show the expenditure in a district by anglers resident in that district. By subtracting these figures from the corresponding column total we obtain the expenditure in each district by non-local anglers, the latter representing the districts' "export earnings" from sales to Irish anglers. The figures for local, and non-local expenditure together with the expenditure of the out-of-state visiting salmon anglers in the different districts are summarised in Table 22. This Table shows that a total of £164,000 was spent in Kerry by all anglers. Of this amount £9,300 was spent by anglers resident in Kerry. Of the remainder £21,000 was spent in Kerry by Irish anglers from outside Kerry and £134,000 by out-of-state visiting anglers. The total non-local expenditure on salmon and sea-trout angling in Kerry in 1970 was therefore £155,000. The corresponding figures for other districts were Galway/Connemara/Ballinakill £150,000 and Bangor/Ballina £103,000. The lowest figure, £15,500 was for Drogheda/Dundalk.

Estimated Total Expenditure by All Irish and Visiting Anglers in 1970

The total figure for all expenditure (including travel to Republic) by Irish and out-of-state salmon and sea-trout anglers amounted to £923,000 of which

Table 20: *Average Expenditure per Angler in 1970 in Local and Non-Local Districts, Classified by Item of Expenditure and District of Residence of Angler*

District of Residence	*Expenditure in Local Districts*				*Expenditure in Non-Local Districts*				*Expenditure in All Districts*				*Total Expenditure per Rod/Day*
	Overheads	*Travel*	*Non-Travel*	*All Items (a)*	*Overheads*	*Travel*	*Non-Travel*	*All Items (b)*	*Overheads*	*Travel*	*Non-Travel*	*All Items (a+b)*	
						£							
Dublin	13·8	1·9	5·8	21·5	9·8	18·7	68·4	97·0	23·6	20·6	74·2	118·4±(21·5)	6·9
Wexford	14·6	2·0	1·5	18 1	2·2	2·1	3·4	7·8	16·9	4·1	4·9	25·9± (9·1)	0·5
Waterford	14·4	5·5	2·4	22·3	0·2	2·1	10·7	13·1	14·7	7·6	13·1	35·3±(11·9)	0·7
Lismore	11·0	7·9	25·8	44·7	1·3	1·4	3·6	6·4	12·3	9·4	29·4	51·1±(27·6)	1·1
Cork	14·6	5·9	9·7	30·2	0·1	5·4	13·2	18·6	14·7	11·3	22·9	48·9±(16·3)	1·1
Kerry	13·6	4·9	3·5	22·0	0·2	0·2	0·5	0·8	13·8	5·0	3·9	22·8± (7·1)	0·4
Limerick	24·2	4·6	3·6	32·4	1·4	1·4	1·6	4·5	25·7	6·0	5·2	36·9±(11·8)	0·8
Galway/Connemara/ Ballinakill	14·5	13·5	13·4	41·3	2·2	1·8	2·3	6·3	16·7	15·3	15 6	47·5±(15·4)	1·4
Bangor/Ballina	36·1	7·4	11·7	55·2	1·5	2·9	0·8	5·1	37·5	10·3	12·6	60·3±(25·8)	1·6
Sligo/Ballyshannon	27·8	6·8	4·5	39·2	1·9	2·0	2·0	5·8	29·7	8·7	6·6	45·0±(15·1)	1·1
Letterkenny	36·3	6·1	1·4	43·7	2·8	1·4	5·3	9·5	39·1	7·4	6·8	53·2±(26·4)	1·1
Drogheda/Dundalk	11·5	5·2	3·2	19·8	3·4	3·4	12·2	18·8	14·8	8·6	15·3	38·7±(14·9)	1·1
All Districts	19·3 ±(2·7)	5·4 ±(0·9)	5·7 ±(0·6)	30·5 ±(3·7)	2·5 ±(0·6)	4·2 ±(0·8)	13·4 ±(2·3)	20·0 ±(3·6)	21·8 ±(2·8)	9·6 ±(1·2)	19·1 ±(3·3)	50·5 ±(5·2)	1·2

Notes: 1. Due to rounding errors the figures in each cell do not necessarily add to the row totals shown.
2. The figures in brackets are the confidence intervals about the estimates at 95 per cent level of significance.

Table 21: *Estimated Total Expenditure of all Irish Salmon Anglers on All Items Classified by District of Residence of Angler and District Where Expenditure Incurred**

District of Residence	*District of Expenditure*														*Travel Expenditure in Non-Local Districts†*	*All Expenditure*
	Dublin	*Wexford*	*Waterford*	*Lismore*	*Cork*	*Kerry*	*Limerick*	*Galway/ Connemara/ Ballinakill*	*Bangor/ Ballina*	*Sligo / Ballyshannon*	*Letterkenny*	*Dundalk/ Drogheda*	*Unknown*	*Total*		
								£								
Dublin	17,500	1,800	2,900	1,400	1,700	9,700	3,400	18,000	17,200	1,300	1,700	4,000	600	81,100	15,200	96,300±(17,500)
Wexford		4,700	100				200	300	400			200	400	6,000	600	6,600±(2,400)
Waterford		200	19,800		4,000	600		4,500	200		400			29,700	1,900	31,600±(10,700)
Lismore	100			10,900	200		100	800						12,200	400	12,600±(6,800)
Cork			100	300	16,800	6,200			800	300				24,400	3,100	27,500±(9,300)
Kerry	100					9,300		200						9,600	100	9,700±(3,100)
Limerick	1,200		900				43,400		1,300	600			100	47,500	1,900	49,400±(15,800)
Galway/Connemara/ Ballinakill	200							14,100	1,400					15,700	600	16,300±(5,600)
Bangor/Ballina	400							100	16,000			100		16,700	800	17,005±(7,500)
Sligo/Ballyshannon			100				300	200	200	12,000	390			13,500	600	14 100±(4,800)
Letterkenny							900	1,000	2,200		22,200			26,300	800	27,100±(13,400)
Dundalk/Drogheda	800	1,800				100	100	1,600	800	1,700	200	9,000		16,000	11,500	17,500±(6,400)
All Districts	20,300 ±(7,600)	8,500 ±(3,400)	23,800 ±(4,900)	12,600 ±(6,800)	22,600 ±(7,100)	25,900 ±(8,700)	48.400 ±(14,100)	40,700 ±(9,300)	40,500 ±(10,300)	16,100 ±(5,000)	24,800 ±(10,700)	13,300 ±(3,100)	1,200 ±(1,300)	298,700 ±(31,200)	27,500 ±(7,800)	326,000 ±(33,800)

*The figures in brackets are the confidence intervals about the estimates at the 95 per cent level of significance.
†Travel expenditure in non-local districts has not been allocated to different districts in this table as such allocation is of necessity rather arbitrary.

Irish anglers spent £196,000 in their local areas, £131,000 was spent by Irish anglers in non-local areas, and the balance of £597,000 by out-of-state anglers in all areas.

If, however, we take into account the multiplier effect of the expenditure by the out-of-state (foreign) anglers* as given in a previous paper[1], we estimate that the total income generated in the state in 1970 by salmon angling was about £1·16 million (i.e. £830,000 by out-of-state anglers and £326,000 by home anglers). Since regional multipliers are not available, we cannot distribute this amount between the different districts with any degree of accuracy but it is estimated in a very rough manner that about two-thirds of this amount was generated in the western districts of Kerry, Galway/Connemara/Ballinakill, Bangor/Ballina, Sligo/Ballyshannon and Letterkenny.

*See Appendix B for discussion of this point.

[1]O'Connor, R, and Whelan, B. J., *op. cit.*, p. 42. The value of the multiplier used was 1·6.

Table 22: *Estimated Total Expenditure of all Local and Non-Local Irish Anglers, and of Out-of-State Visiting Anglers, in the Different Fishery Districts* (1970)

District of Expenditure	*Expenditure by*			*All Non-Locals*	*All Expenditure*
	Local Irish Anglers (*a*)	*Non-Local Irish Anglers*† (*b*)	*Out-of-State Visiting Anglers* (*c*)	(*b*)+(*c*) (*d*)	(*a*)+(*b*)+(*c*) (*e*)
			£000		
Dublin	17·5	3·6	19·7	23·3	40·8
Wexford	4·7	4·8	14·4	19·2	23·9
Waterford	19·8	5·1	17·8	22·9	42·7
Lismore	10·9	2·1	27·5	29·6	40·5
Cork	16·8	7·4	19·9	27·3	44·1
Kerry	9·3	21·0	133·8	154·8	164·1
Limerick	43·4	6·3	14·5	20·8	64·2
Galway/Connemara/ Ballinakill	14·1	33·7	116·7	150·4	164·5
Bangor/Ballina	16·0	31·0	71·5	102·5	118·5
Sligo/Ballyshannon	12·0	5·2	20·0	25·2	37·2
Letterkenny	22·2	3·3	67·6	70·9	93·1
Drogheda/Dundalk	9·0	5·5	10·0	15·5	24·5
Unknown	—	1·5	—	1·5	1·5
All Districts	195·7	130·5	533·4	663·9	859·6
*Cost of Travel to Republic***	—	—	63·6	63·6	63·6
Total	195·7	130·5	597·0	727·5	923·2

**Excluding payments to non-Irish travel firms.

†The figures in column (*b*) include expenditure on travel in non-local districts. We have distributed this item in proportion to the distribution of all other non-local expenditure.

The figure of £1·16 million is a measure of the GNP generated by salmon angling in Ireland in 1970. It is felt that the amenity or recreational value of salmon angling would be considerably in excess of this figure, since, as was shown above, many Irish anglers spend little on their sport and would probably pay considerably more if they had to. However, given the limitations of data and the relative infancy of some of the theoretical tools available, (see Appendix B), it was not possible to arrive at a more accurate and inclusive estimate of amenity value.

THE DETERMINANTS OF ANGLERS' CATCH AND THE NUMBERS OF ANGLERS

In this section we describe the results of some investigations which we have carried out by means of regression analysis into the factors which influence anglers' catch and the numbers of anglers in the years 1955–1970.

In general, these results are not as satisfactory as we would have wished—the multiple correlations are rather low and some of the variables are not significant. These unsatisfactory results probably stem from three causes: (i) the complexity of the biological factors which determine fish stocks (ii) deficiencies in the data used, particularly the catch data and (iii) the impossibility of taking account of the incidence of poaching. This latter omission may be of considerable importance since we have been reliably informed that poaching has greatly increased in recent years, due to improvements in transport and the availability of deep freeze facilities. In earlier times poachers found great difficulty in disposing quickly of their very perishable catch, but nowadays deep freeze facilities allow fish to be stored for long periods, often along with legitimate catch, so that fishery protection staff find them impossible to trace. If poaching has indeed increased to the extent suggested, a whole new dimension has been introduced which Fisheries Branch will need to investigate thoroughly and which will require special measures to combat.

Anglers' Catch

In regression analysis the variable whose fluctuations we are trying to explain is termed the "dependent". The dependent variable in the present case is anglers' catch which is shown in two forms by the solid lines in Figures 1·1 and 1.2. Figure 1.1 shows the total catch by anglers in the years 1955–71 and Figure 1.2 shows average catch per angler in the same period. The most striking feature of these diagrams is the persistent decline in catch per angler in recent years.

Those factors which we assume to be the causes of fluctuations in the dependent variable are termed "independent" or "explanatory" variables. In this instance, it was assumed that the basic explanatory variables were the number of anglers and the stock of fish. The number of anglers was therefore incorporated in the equations in two ways: (1) by using catch per angler as a dependent variable, and (2) by including the total number of anglers as an independent variable in the regressions of total catch by all anglers. Ideally, account should also be taken of any variations in average number of days fished per angler. However, since data on this were not available, the assumption was made that the average number of days fished per angler remained constant over the period

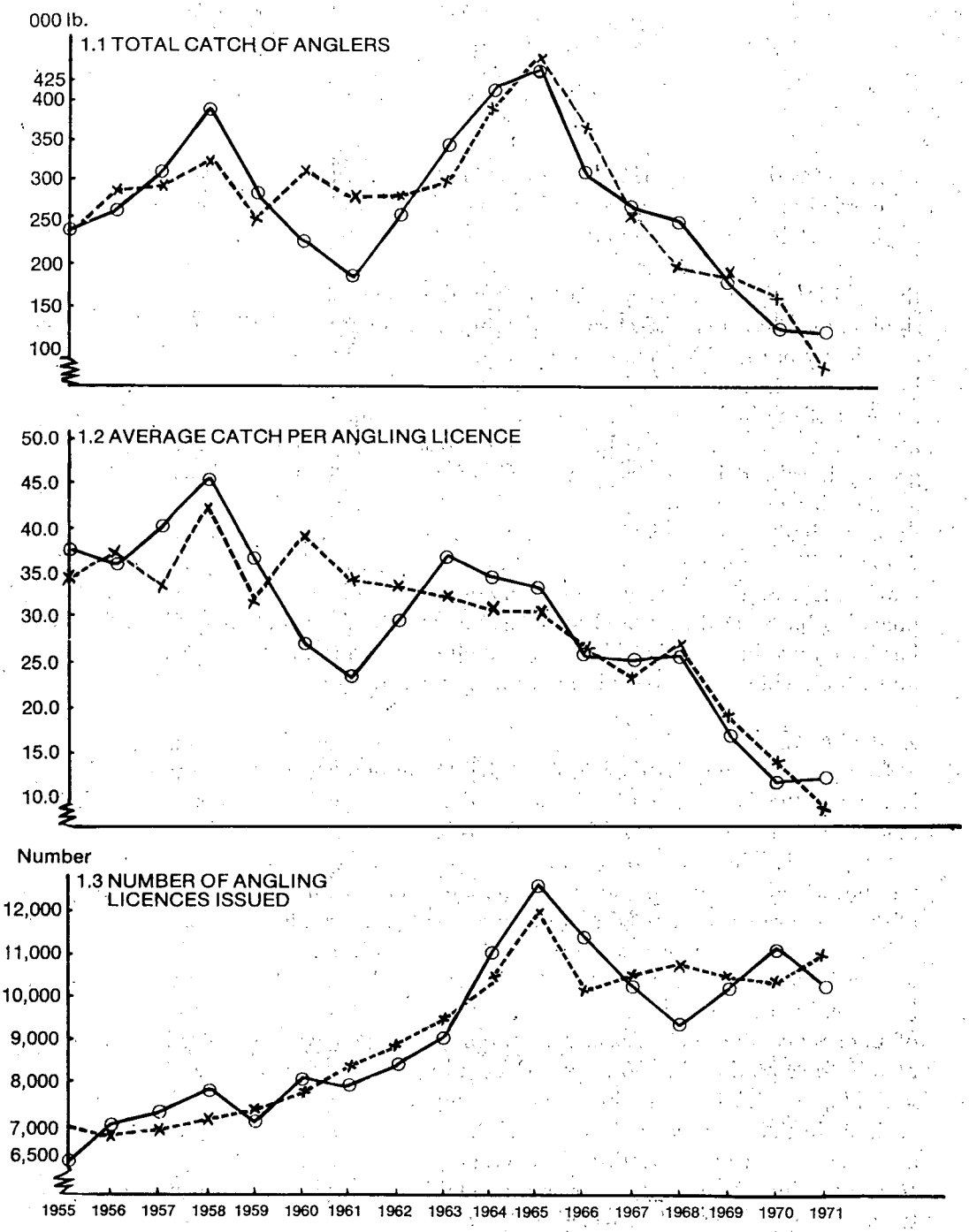


Fig. 1: Time Series of Total Anglers' Catch, Average Catch per Angling Licence and Number of Angling Licences Issued.
Actual _____
Fitted .....

in question. This assumption seems unlikely to introduce serious bias into our estimated equations. Our measure of the numbers of anglers in any year was the total number of rod and line licences issued in that year (excluding Foyle Area extensions), as published in the annual Sea and Inland Fisheries reports of the Department of Agriculture and Fisheries.

In view of the salmon's life cycle, as described above (pp.2–4), stocks of salmon in the fresh-water parts of Irish rivers and lakes in any year are likely to be mainly determined by: numbers of fish spawning four years previously; catch by Greenland nets one year previously; catch by drift and draft nets in the current year; presence or absence of disease; and water and weather conditions in the year concerned. Numbers of fish spawning four years previously were measured by catch per angler four years previously, on the assumption that catch per angler in any year is a good indicator of stocks and hence of the numbers of fish spawning. This assumption is based on the view that angling is a relatively inefficient method of catching fish and for that reason variations in the number of anglers do not significantly affect the proportion of the total stock which survives to spawn in a given year. Irish net and angling catch data were obtained from the Sea and Inland Fisheries Reports. Data on the catch in Greenland were obtained from an ICNAF research document [2]. Account of the effect of the salmon disease was taken by means of a dummy variable equalling zero in 1955–65 and 1 in 1966–70. The most important aspect of weather from an angling point of view was considered to be rainfall in the months May to August in each year, as shown in the Statistical Abstract of Ireland issued by the Central Statistics Office.

By hypothesis we would expect a positive relationship between anglers' catch and numbers of fish spawning four years previously, the absence of disease, and rainfall in the summer months. High rainfall is expected to benefit angling since high water levels should lead to an increased escapement of fish into the fresh-water sectors of the rivers and hence to better angling. If netting significantly reduces the runs of fish available to anglers, then a negative relationship would be expected between catch by the various types of net and anglers' catch.

A number of equations incorporating these variables were tried. In none of these could any significant relationship be found between anglers' catch and the variable which represented numbers of fish spawning four years previously, or that which represented Greenland netting. The absence of a significant relationship for these variables is not really surprising. In the case of numbers spawning, the statistical proxy which was used (catch per angler four years previously) is far from being a perfect indicator of *successful* spawning, since floods, droughts, pollution, etc. can considerably upset the relationship between the numbers of salmon in a river in one year and the numbers returning four years later. As

regards Greenland netting, we have no assurance that the series used contains a significant proportion of Irish salmon but as it is the only series available we felt it should be included in the analysis. As explained below, it also proved very difficult to separate the effects of salmon disease from those of the increase in drift nets.

The best regression equation of total catch was as follows:
[t-values are given in parentheses. At t-value of 2·2 is significant at the 95 per cent level and an F-value of 3·29 is significant at the same level for (3, 15) d.f. A Durbin-Watson (DW) statistic above 1·46 indicates the absence of a significant positive residual auto-correlation for an equation containing 3 variables.]

$$\text{(i)}\quad C_t = -83{\cdot}108 + 0{\cdot}028\,A_t - 0{\cdot}136\,Di_t + 0{\cdot}100\,Da_t + 0{\cdot}311\,R_t$$
$$(0{\cdot}81)\quad (2{\cdot}25)\quad (2{\cdot}98)\quad (1{\cdot}76)\quad (1{\cdot}35)$$
$$\bar{R}^2 = 0{\cdot}546 \quad \text{F-value} = 5{\cdot}52 \quad DW = 1{\cdot}37$$

where C_t = catch (in 000 lb.) by anglers in year t
A_t = the number of anglers i.e. the number of rod and line licences issued in year t.
Di_t = the catch by drift nets in year t (000 lb.)
Da_t = the catch by draft nets in year t (000 lb.)
R_t = rainfall in millimetres in the months May to August

The best regression of catch per angler was:

$$\text{(ii)}\quad \bar{C}_t = 21{\cdot}927 - 0{\cdot}013\,Di_t + 0{\cdot}008\,Da_t + 0{\cdot}033\,R_t$$
$$(2{\cdot}27)\quad (3{\cdot}49)\quad (1{\cdot}40)\quad (1{\cdot}39)$$
$$\bar{R}^2 = 0{\cdot}579 \quad \text{F-value} = 7{\cdot}89 \quad DW = 1{\cdot}29$$

where $\bar{C}_t$ = anglers' catch (lb.) per angling licence issued in year t and the other symbols have the meanings assigned to them earlier. Figs. 1.1 and 1.2 show actual total catch and catch per angler, together with the respective "fitted" figures i.e. those estimated from equations (i) and (ii).

The implications of both these equations are broadly similar. As expected, total catch by anglers is related positively to rainfall and the number of anglers. It is also positively, though insignificantly, related to draft net catch, suggesting that when there is a good run of fish both anglers and draft netsmen benefit. There is a significant negative relationship between anglers' catch and catch by drift nets, which lends some substance to the belief that increasing drift net catches have been one of the factors responsible for the decline in anglers' catches. A practically identical picture emerges from equation (ii).

Some caution is called for in interpreting these equations. Firstly, the level of variance explained, as measured by $\bar{R}^2$, is rather low. Secondly, the outbreak

of salmon disease coincided roughly with the expansion in the catches by drift nets, and it is therefore very difficult to disentangle the separate effects of these factors. However, we tried various formulations of the relationship, some including a dummy variable for disease, but concluded that the above equations seemed to be the best of those tested. It thus seems reasonable to draw the following conclusions. Firstly, heavy drift netting is likely to have a deleterious effect on salmon stocks and the curtailment of these licences as suggested by the Inland Fisheries Commission may therefore be an appropriate move at the present time. Secondly, the positive relationship between anglers' catch and rainfall may reflect the fact that wet weather favours angling in the sense that fish are more willing to take in high water than in drought conditions. However, it seems more likely to mean that fish get trapped in the estuaries in dry weather since they cannot ascend the rivers, and are thus taken in large numbers by the netsmen. This could seriously affect stocks in a dry year and therefore the idea of a variable rather than a fixed weekly close period is worthy of consideration. Thirdly, the equations suggest, though not conclusively, that draft net catches and anglers' catches both tend to be positively correlated with the run of fish, rather than negatively with each other. In other words, draft net catches do not appear to have had a significant negative effect on anglers' catches.

Numbers of Salmon Anglers

The number of salmon angling licences issued since 1955 is shown in Table A.1 and by the solid line in Figure 1.3. The total number of licences rose fairly steadily to a peak of 12,378 in 1965, and then declined to a trough of 9,676 in 1968, after which they rose to 11,210 in 1970, but fell to 10,857 in 1971.

It was thought useful to attempt to identify the factors which cause these fluctuations, in order to project future demand for salmon angling. We tried to determine these factors by regressing the total number of angling licences issued on the variables most likely to explain a person's propensity to take out a salmon licence. These variables were assumed to be (a) taste for salmon or sea-trout angling (b) the likelihood of successful fishing (c) capacity to pay for salmon fishing and (d) the number of licences taken out in the previous year.* We discuss each of these in turn:—

(a) *Tastes:* In some of the equations, tastes were assumed constant while in others an attempt was made to allow for changes in tastes by including a trend variable whose sign would indicate whether tastes were shifting away from salmon angling or towards it. Also, it was thought that many of the tourists who come to Ireland have a greater "taste" for salmon fishing than the Irish

*The political situation in Northern Ireland is also likely to have had some effect on licence numbers. However it has not been included explicitly in our analysis as its effect is no doubt measured by other variables particularly the variable for number of visitors.

population as a whole since 42 per cent of all 1970 salmon-angling licences were issued to people from outside the Republic. Hence, the total number of tourists visiting Ireland each year was included as an explanatory variable in some equations. The figures for the number of tourists were obtained from March (in earlier years) and June (in more recent years) issues of the Irish Statistical Bulletin. (ISB).

(b) *Likelihood of success:* An angler's perceived likelihood of success (i.e. how confident he feels before taking out a licence that he will catch some salmon or sea trout) is likely to be related to (i) catch in previous years, by both himself and others; (ii) catch in the current year by others, and (iii) the known prevalence of salmon disease. The statistical proxies used in the regressions for these variables were catch in lb. per angling licence of both salmon and sea trout for both current and previous year, and a dummy variable for salmon disease, equalling 1 for the years 1966–1970 and zero prior to 1966.

(c) *Capacity to pay for salmon fishing:* Real Irish Personal Disposable Income per head in each year from 1955 to 1970 was included as a variable on the assumption that capacity to pay for salmon fishing was related to income. This variable *per se* would not of course be expected to influence foreign anglers but since economic conditions in Ireland are closely related to those in Britain, any measure of the prosperity of Irish anglers would probably be applicable to British and perhaps to other visiting anglers also.

(d) *Number of licences taken out in the previous year:* In practical forecasting the outcome in any year is usually assumed to be the best estimate of the likely outcome in the year following and for that reason forecasters usually take as their base the outcome in the current year and make decisions as to how this level will change in the next year on the basis of some other criteria such as changes in prices, tastes, GNP, etc. In this analysis the number of licences in year t-1 was tried out as an explanatory variable in a number of the equations.

A number of regressions was run, in both linear and logarithmic form, using various combinations of the above variables.

No significant relationship could be discovered between number of anglers and catch in either current or previous years and equations in which the catch variable was included all turned out to be insignificant. However, the dummy variable for salmon disease turned out to be significant in all cases, indicating that likelihood of success does have some effect on the number of licences taken out in any year. Real Disposable Income per person was found to be significant in some of the equations but not in others. Unfortunately, the income variable proved to be highly correlated with the number of tourists, so that it was not

possible to use these two variables in the same equation. On its own, or in combination with variables other than income, the number of tourists was usually significant. Number of licences issued in the previous year was significant in most of the equations.

The regressions given below proved the most satisfactory of those fitted.

(v) $A_t = 5976{\cdot}531 + 0{\cdot}272V_t - 1983{\cdot}260S_t + 164{\cdot}811T_t$
$\quad\quad (13{\cdot}33) \quad (3{\cdot}09) \quad\quad (2{\cdot}99) \quad\quad (1{\cdot}58)$
$\quad\quad \bar{R}^2 = 0{\cdot}834 \quad$ F-value $= 26{\cdot}07 \quad$ DW $= 1{\cdot}65$

where A_t = number of angling licences issued in year t (see Table A.1)
V_t = total number of visitors to Ireland (in thousands) in year t (see March and June issues of ISB)
S_t = dummy variable for the effect of Salmon Disease = 0 for 1955–1965
= 1 for 1966–1970
T_t = a time trend = 1 in 1955 and 16 in 1970

(vi) $A_t = -2935{\cdot}156 + 28{\cdot}628I_t - 1803{\cdot}165S_t + 0{\cdot}762A_{t-1}$
$\quad\quad (1{\cdot}70) \quad (3{\cdot}05) \quad (2{\cdot}97) \quad (4{\cdot}84)$
$\quad\quad \bar{R}^2 = 0{\cdot}849 \quad$ F-value $= 27{\cdot}15 \quad$ DW $= 2{\cdot}05$

(vii) $A_t = -79345{\cdot}063 + 5113{\cdot}914 \log (I_t) + 6807{\cdot}785 \log (A_{t-1}) - 1431{\cdot}337S_t$
$\quad\quad (5{\cdot}90) \quad\quad (2{\cdot}21) \quad\quad (3{\cdot}87) \quad\quad (2{\cdot}25)$
$\quad\quad \bar{R}^2 = 0{\cdot}813 \quad$ F-value $= 21{\cdot}30 \quad$ DW $= 1{\cdot}82$

where log is the natural logarithm and I_t = Real Irish Disposable Income per person in year t and the other symbols are the same as those listed above.

All the above equations suggest a generally upward trend in the demand for salmon angling, since all the explanatory variables, with the exception of S_t, are likely to increase in future years. The salmon disease is now on the wane and will hopefully disappear shortly. Our equations suggest that its disappearance will, other things being equal, lead to an increase of about 1,400 to 2,000 in the number of angling licences issued per annum. However, it should be noted that the disease variable S_t is probably picking up the effects of reduced angling catches due not only to salmon disease but also to other factors such as increased netting, poaching, etc. so that the elimination of salmon disease alone may not lead to the full increase suggested above. S_t however may also be influenced by the effects of the Northern Ireland troubles which have been increasing since 1969 as the salmon disease has waned. The positive sign of the variable I_t suggests that salmon angling has a positive income elasticity of demand, i.e. that, other things being equal, an increase of £1 in real disposable income per person will lead to about 29 new angling licences being issued.

Projections of Numbers of Salmon Angling Licences

The equations may be used to predict the number of licences which are likely to be issued in any year, provided we can estimate the values of the explanatory variables for that year. For instance, we know the values of all the explanatory variables for 1971, and we can, therefore, estimate the value of A_t for that year. In 1971 the number of visitors to Ireland, as published in the June ISB, was 9,417,000. Thus, $V_t = 9{,}417$. Let us assume that salmon disease is still affecting anglers' assessments of their likelihood of success, hence $S_t = 1$. The time trend, T_t, equals 17 in 1971. Hence, from equation (v)

$$A_{1971} = 5976{\cdot}5 + 0{\cdot}272\ (9417) - 1983\ (1) + 164{\cdot}8\ (17)$$
$$= 9357.$$

In 1971, $I_t = 276{\cdot}0$. Hence the 1971 prediction from equation (vi) is

$$A_{1971} = -2935{\cdot}2 + 28{\cdot}63\ (276{\cdot}0) + -1803\ (1) + 0{\cdot}762\ (11{,}210)$$
$$= 11{,}706.$$

Equation (vii) gives a projection of $A_{1971} = 11{,}442$

The actual figure for 1971 is 10,857 which lies above the first estimate but below the others.

In order to predict for a future year for which the actual values of the explanatory variables are not known, the values of these variables must first be estimated. One can derive such estimates either by accepting a forecast made by some other body, or by forecasting the independent variables oneself. For instance, if it is desired to project the total number of anglers in 1975 using equation (v), it might be possible to use a projection of visitors made by some body (such as Bord Fáilte) to estimate V_{1975}. This estimate, together with the appropriate value of the time trend, and an assumed value for the disease variable S_{1975}, could then be inserted in equation (v) to produce the required projection. However, equations (vi) and (vii) seem preferable for the purpose of such predictions, since visitors constitute only 42 per cent of all licence holders, and equation (v) contains no term except the time trend to reflect the behaviour of Irish anglers.

Linear equations such as equation (vi) may, however, give unrealistically high predictions when used to project over a long period, because they imply a constant proportionate increase in the dependent for each increase in the independents, and therefore fail to take account of any diminution in the rate of increase of demand. Hence, the projections derived from the logarithmic equation (vii) are probably better since this formulation implies a certain levelling off of demand over time.

A projection of the number of anglers in 1975, using equation (vii) was derived as follows. Since no generally accepted projections of I_t exist, it was

decided to project I_t by means of a simple time trend.* It was assumed that the salmon disease continued to affect the number of licences issued up to 1973 but not afterwards (i.e. S=1 for 1972 and 1973 and 0 afterwards). The lagged dependent variable was estimated in a recursive fashion, i.e. its value was projected for each year and this projection was used as an independent variable to project the following year's figure. Thus, A_{1972} was estimated from equation (vii) by

$$A_{1972} = -79345{\cdot}063 + 5113{\cdot}914 \log (280{\cdot}2) + 6807{\cdot}785 \log (10{,}857) - 1431{\cdot}337 \quad (1)$$
$$= 11{,}310$$

A_{1973} was then estimated from equation (vii) using the estimated value for A_{1972} as the value for A_{t-1}, and I_{1973} was projected by the time trend as the value for I_t. In this way a projection of $A_{1975} = 14{,}645$ licences was obtained.

It should be noted that forecasts of this kind are prone to many types of error: the estimated relationship on which they are based is liable to considerable margins of error; new variables may become important; trends in the explanatory variables may change or even become reversed; and in some cases resources may become fully utilised, or demand satiated, so that total demand begins to level off even more rapidly than is implied by equation (vii). In spite of these difficulties, however, we believe that the forecasts justify the conclusion that demand for salmon angling will increase considerably in the years ahead, provided the likelihood of success is not further diminished, i.e. that no further outbreaks of disease take place and stocks are not unduly depleted by netting, pollution or poaching.

Projections of Expenditure

In conclusion, it may be of interest to make a rough estimate of the likely total expenditure on salmon angling in 1975 at 1970 prices. To do this we make the following assumptions: (a) that real expenditure per angler remains at the 1970 level (b) that the proportion of Irish as opposed to visiting anglers in the total remains at its 1970 level of about 58 per cent (c) that the present trends in the number of angling licences continue, and that the likelihood of successful fishing is not diminished by further outbreaks of disease, by pollution or by excessive netting. Given present trends in income and leisure, it seems likely

*The time trend in I_t (i.e. regression of I_t on T) was:

$$I_t = \underset{(44{\cdot}18)}{140{\cdot}756} + \underset{(25{\cdot}09)}{7{\cdot}74}T. \quad \bar{R}^2 = 0{\cdot}979$$

where $T_t = 1$ in 1955 and 17 in 1971 and 2 in 1975.

that expenditure per angler will increase in real terms in the years ahead, so that assumption (a) will make our projection for 1975 a minimum figure.

Assumption (b) implies that the forecast total of 14,645 anglers will be made up of 8,494 Irish and 6,151 visiting anglers. At an average expenditure per licence of about £50 for Irish anglers and £116 for visitors this gives a total expenditure on salmon angling in the State in 1975 of £1·14 million at 1970 prices. The comparable figure for 1970 was £860,000. (See Table 22 above).

When allowance is made for angling visits by out-of-state anglers, for the revenue accruing to Irish tourist firms from these anglers and for the multiplier effects of the out-of-state anglers' expenditure (assuming the multiplier remains unchanged at 1·6), the projection of total income generated by salmon angling in 1975 is £1·51 million (at 1970 prices). The comparable figure in 1970 was £1·16 million.

It should be emphasised that the exact level of these projections is liable to quite wide margins of error, but we believe that they are of the right order of magnitude. If this belief is correct, then it is clear that Irish salmon angling will be an asset of increasing value in the years ahead provided its quality is not impaired by excessive depletion of stocks.

SUMMARY

THIS paper contains the results of a survey of native Irish salmon and sea-trout anglers in 1970 which was carried out by ESRI in 1971. It forms part of a project entitled "An Economic Evaluation of Irish Salmon and Sea-Trout Fishing" which is being sponsored by the Department of Agriculture and Fisheries. Other sections of the project deal with visiting foreign anglers (see [1]), with commercial fishermen and with operators of salmon and sea-trout fisheries.

Method of Evaluation

We were concerned to evaluate Irish salmon and sea-trout angling from two points of view: (1) the contribution made by this angling to the incomes of various regions of the State and (2) the satisfaction derived by Irish anglers from the use of angling facilities. A variety of theoretical and practical circumstances made it necessary for us to use the gross expenditure method for both these purposes, despite the drawbacks of this method which are outlined in Appendix B. The application of the gross expenditure method involved obtaining data on expenditure and other items from a sample of Irish anglers and using these to estimate totals for various regions and for the State as a whole.

The Survey

Having conducted a pilot study in December 1969 with encouraging results, we picked a sample of 611 anglers from the licences issued in 1970 of whom 586 (96 per cent) responded. The sample was designed to maximise the precision of our estimate of total expenditure and for this purpose we employed variable sample fractions in the different fishery districts.

RESULTS OF SURVEY

Characteristics of Anglers: Compared to the Irish population as a whole, Irish salmon anglers were found to be concentrated in the middle-age groups, although their age structure was broadly similar to that of visiting salmon anglers. Only one-tenth of Irish salmon anglers have agricultural occupations, one quarter have professional or managerial occupations and somewhat less than half are manual employees. Only a tiny fraction of the sample reported incomes in excess of £5,000 and nearly half stated that they had incomes of less

than £1,000. Half of all Irish salmon anglers are members of angling clubs and about one-tenth are members of syndicates.

Angling Activity: In 1973, Irish salmon anglers fished an estimated total of 254,000 days in local waters and 15,000 days in other waters, or an average of 39 days locally and 2 days non-locally. The great bulk of non-local fishing was done by Dubliners, and three quarters of all Irish anglers did not travel outside their local district at all. The average number of rod/days per non-local trip was 1·4. Most of these trips were made for the sole purpose of fishing, and the anglers making them were usually accompanied by two or three other fishermen.

During these salmon-fishing trips, Irish anglers and their dependants spent in all 31,400 bednights away from home, mainly in the Western districts. Two-thirds of these bednights were spent by Dublin anglers. Seventy per cent of all bednights were spent in the July-September period. A quarter of all bednights were spent in hotels and a further quarter with relatives and friends.

Irish anglers paid an average rental of 16 pence per day fished, though the average per district varied from 56 pence per day in Lismore to 4 pence in Kerry. Private and hotel waters tend to be more expensive than club or other waters. In all, about £45,000 was spent by Irish anglers on fishery rental.

In most districts, private waters yielded better catches of salmon and sea-trout than did other types of water. The districts with highest catch figures per rod/day for salmon were Bangor/Ballina and Galway/Connemara/Ballinakill, and for sea-trout were Galway/Connemara/Ballinakill, Bangor/Ballina, and Dundalk/Drogheda.

The average Irish angler caught 40 lb. of salmon, of which he sold 23 lb., valued at about £9. The average proportion of the total catch sold varied considerably. Anglers resident in certain districts such as Kerry and Lismore sold over four-fifths of their catch, while anglers from Galway/Connemara/Ballinakill sold only 12 per cent. About one-seventh of all anglers received more for their sales than they spent on angling, but about two-thirds had catch sales worth less than one-tenth of their total costs. The catch of salmon by Irish anglers was estimated at 261,000 (±48,000) lb. valued at £103,000, while the total catch of sea trout was estimated at 104,000 lb., valued at £25,000. Our survey estimates of total catch were found to differ considerably from the official figures and it is felt that the latter are understated.

Opinions

The opinions expressed by Irish anglers strongly suggest that the quality of salmon angling has seriously declined. According to the anglers, this decline is due largely to salmon disease, excessive netting and pollution, although the

effects of drainage schemes were very frequently mentioned in the districts of Bangor/Ballina and Dundalk/Drogheda. Two-fifths of Irish anglers would prefer public or state ownership of angling waters: a quarter co-operative ownership, and a fifth private ownership. Higher income groups and younger age groups were more inclined to prefer public ownership, while the idea of co-operative ownership received some support in all groups.

Expenditure of Anglers

Total expenditure per angler averaged about £50, about £31 of which was spent locally and the remainder non-locally. Of the local expenditure an average of about £19 was spent on overhead items such as boats, boat-houses, tackle and lures and about £5 on travel. Accommodation/meals; hire of boats, boatmen and gillies were the most important items on which non-local expenditure was incurred. The average expenditure of Dubliners at £118 was significantly higher than that of anglers from other districts. Dubliners spent about £20 locally and about £97 non-locally.

The total expenditure by all Irish anglers in 1970 was estimated at £326,000 (±33,800). Dublin-based anglers spent £96,000 and this latter amount was spread widely throughout the fishery districts. Anglers from other districts spent much smaller amounts and most of their expenditure was confined to their local districts. The districts in which the largest amount of expenditure was incurred were Limerick (£48,000), Galway/Connemara/Ballinakill (£40,700) and Bangor/Ballina (£40,599). The two latter districts received most of their expenditure from non-local sources, unlike the Limerick district where £43,000 of the £48,000 was incurred by local anglers.

It is estimated that in 1970 Irish anglers spent £195,700 in their local areas and £130,500 non-locally. Visiting (foreign) anglers spent £727,500, giving a figure of £923,000 for the total expenditure of all salmon anglers in the Republic in that year. Allowing for the multiplier effect of the visiting anglers' expenditure, the total GNP generated by salmon angling activity amounted to £1·16 million (£830,000 by visiting anglers and £326,000 by Irish anglers). It is felt that the amenity or recreational value of salmon angling would be considerably in excess of this figure, since, as was shown above, many Irish anglers spend little on their sport and would probably pay considerably more if they had to. However, given the limitations of data and the relative infancy of some of the theoretical tools available, (see Appendix B), it was not possible to arrive at a more accurate and inclusive estimate of amenity value.

DETERMINANTS OF CATCH

An analysis of the trends in anglers' catch and the numbers of anglers showed that both total catch and catch per angler have been falling in recent years

while numbers of anglers have, generally speaking, been increasing. Regression analysis was applied in an attempt to explain these trends. Although the results were not completely satisfactory, it seems clear that the onset of salmon disease and the increase in drift netting are the main factors responsible for the fall in average catch. Irish incomes and the number of tourists seemed to be the main determinants of the number of anglers. Provided an angler's likelihood of successful fishing is not unduly diminished, it seems likely that the number of anglers will increase in the years ahead. A tentative projection of total expenditure by salmon anglers in the State in 1975 is £1·26 million (at 1970 prices), compared with a total expenditure of £860,000 in 1970. If the multiplier effects of visiting anglers' expenditure are taken into account, total income generated by salmon angling in 1975 is projected at £1·51 million (at 1970 prices) compared with £1·16 million in 1970.

APPENDICES

APPENDIX A

Table A1: *Licences Issued and Catch Returns*§ 1955–1970

Year	Licences Issued		Catch												
			Salmon							Sea Trout					
			Commercial				Anglers		Total Salmon	Commercial				Anglers		Total Sea Trout
	Commercial	Rod and Line	Drift Net lb.	Draft Net lb.	Other lb.	Total lb.	Weight lb.	Number of fish	lb.	Drift Net lb.	Draft Net lb.	Other lb.	Total lb.	Weight lb.	Number of fish	lb.
									('000)							
1955	1,244	6,604	234·6	606·4	173·8	1,014·8	246·5	28·6	1,261·4	1·4	27·5	2·0	30·9	42·3	46·6	73·2
1956	1,229	7,495	250·7	720·8	207·8	1,279·0	264·2	35·8	1,443·2	1·2	33·6	2·1	36·9	56·2	57·7	93·2
1957	1,246	7,785	298·4	1,003·4	188·3	1,490·1	309·5	39·6	1,799·5	3·6	37·4	3·0	41·0	56·6	56·5	100·5
1958	1,146	8,294	286·1	772·4	220·0	1,278·5	375·4	49·7	1,654·0	1·4	23·6	1·1	26·1	40·3	38·3*	66·4
1959	1,230	7,567	352·5	865·8	146·2	1,364·5	259·9	31·6*	1,624·4	5·6	24·5	6·1	36·2	41·5	45·4*	77·7
1960	1,195	8,477	263·5	701·2	169·2	1,133·9	230·4	27·2	1,364·3	1·3	16·2	1·1	18·6	43·4	45·1	61·9
1961	1,121	8,322	218·2	741·3	192·7	1,152·2	193·4	25·3	1,345·6	1·2	23·0	1·8	26·0	64·1	64·9	90·1
1962	1,180	8,780	606·8	1,622·6	376·8	2,606·2	257·6	34·3	2,836·9	1·4	23·4	2·5	27·3	63·0	59·9	90·4
1963	1,289	9,435	687·2	1,395·9	412·0	2,495·1	341·5	40·3	2,836·6	0·8	21·9	4·1	26·8	64·8	65·7	91·7
1964	1,523	11,353	761·6	1,496 0	365·0	2,622·6	390·1	52·5	3,012·7	1·2	29·7	2·9	33·6	71·9	74·6	105·7
1965	1,435	12,378	795·0	1,250·2	407·8	2,453·0	416·3	54·9	2,869·3	4·6	25·0	0·3	29·9	83·7	83·0	113·6
1966	1,492	11,621	744·0	961·4	319·4	2,024·8	301·6	35·7	2,326·4	2·0	20·2	0·9	23·1	63·3	64·8	66·4
1967	1,531	10,502	1,015·7	1,071·3	366·0	2,453·0	267·8	35·3	2,720·8	8·5	51·3	1·1	60·9	68·1	70·0	129·0
1668	1,451	9,676	1,040·4	1,059·0	351·2	2,450·6	251·4	33·7	2,702·0	8·1	45·9	1·0	55·0	69·6	70·2	127·3
1969	1,608	10,506	1,678·5	1,206·8	336·3	3,221·6	182·2	23·8	3,403·8	7·9	46·8	1·0	55·7	71·6	72·0	127·3
1970	1,769	11,210	1,730·9	1,261·0	381·7	3,373·6	136·8	17·9	3,520·4	5·1	40·3	0·9	46·3	40·4	60·6	86·7

Sources: Sea and Inland Fisheries Reports, 1955-1969; Unpublished figures for 1970 were supplied by Fisheries Division, of Department of Agriculture and Fisheries.

*Estimates by authors.

§Due to rounding errors the figures in each row do not necessarily add to the totals shown.

Table A2: *Estimated Total Days Fished by All Irish Anglers in Different Types of Water in the Different Districts*

Fishery District	*Type of Water*					*Total*
	Private	*Club*	*Hotel*	*Free*	*Public Body and Other*	
(*a*) *Local waters*			*Number of Days*			
Dublin	442	3,735	—	229	615	5,021
Wexford	3,945	473	—	8,315	—	12,733
Waterford	3,467	19,223	—	16,216	5,833	44,739
Lismore	7,289	666	—	3,055	—	11,010
Cork	4,713	11,838	—	6,952	173	23,676
Kerry	2,374	8,787	1,501	10,766	27	23,455
Limerick	4,580	11,170	2,467	27,203	14,130	59,550
Galway/Connemara/Ballinakill	1,138	3,630	1,344	3,767	1,687	11,566
Bangor/Ballina	1,765	7,187	405	1,427	398	11,182
Sligo/Ballyshannon	3,549	2,698	547	5,396	495	12,705
Letterkenny	3,527	493	—	11,917	8,419	24,356
Dundalk/Drogheda	3,002	9,601	—	1,596	—	14,199
All Districts	42,749	90,449	8,154	110,252	31,811	254,192
Per Cent	(15·1)	(31·9)	(2·9)	(38·9)	(11·2)	(100)
(*b*) *Non-local waters*						
Dublin	—	—	—	—	—	—
Wexford	838	—	—	239	—	1,077
Waterford	776	274	10	76	76	1,212
Lismore	67	20	—	341	—	428
Cork	—	185	5	—	—	190
Kerry	291	244	76	1,096	—	1,707
Limerick	401	334	—	51	323	1,109
Galway/Connemara/Ballinakill	2,066	86	264	464	67	2,947
Bangor/Ballina	2,079	259	142	108	101	2,689
Sligo/Ballyshannon	216	393	—	278	200	1,087
Letterkenny	21	435	—	333	84	872
Dundalk/Drogheda	437	1,180	—	326	—	1,943
All Districts	7,192	3,410	497	3,312	851	15,261
Per Cent	(44·5)	(22·9)	(3·2)	(23·4)	(6·0)	(100)

— means that the number of days spent fishing in that type of water in that district by anglers in the sample was zero.

Table A3: *Estimated Total Fishing Rental Paid in Different Types of Water in the Different Fishery Districts*

Fishery District	*Type of Water*				*Total*
	Private	*Club*	*Hotel*	*Public Body and Other*	
			£		
(*a*) *In local waters*					
Dublin	15	620	—	31	666
Wexford	66	123	—	—	189
Waterford	1,163	8,499	—	—	9,662
Lismore	6,202	92	—	—	6,294
Cork	1,344	2,016	—	—	3,360
Kerry	1,529	28	—	14	1,571
Limerick	1,516	1,729	1,163	—	4,408
Galway/Connemara/ Ballinakill	609	403	197	—	1,209
Bangor/Ballina	107	803	7	73	990
Sligo/Ballyshannon	114	1,807	81	—	2,002
Letterkenny	204	117	—	248	569
Dundalk/Drogheda	811	203	—	—	1,014
All Districts	13,680	16,440	1,448	366	31,934
(*b*) *In non-local waters*					
Dublin	—	—	—	—	—
Wexford	2,079	212	—	—	2,291
Waterford	331	46	—	—	377
Lismore	102	—	—	—	102
Cork	5	—	—	—	5
Kerry	107	158	—	—	265
Limerick	41	598	669	766	2,074
Galway/Connemara/ Ballinakill	4,062	31	381	31	4,505
Bangor/Ballina	1,847	311	31	—	2,189
Sligo/Ballyshannon	117	46	11	—	174
Letterkenny	177	—	—	—	177
Dundalk/Drogheda	813	200	—	—	1,013
All Districts	9,681	1,602	1,092	797	13,172

Table A4: *Disposal of Total Catch of Salmon and Sea Trout by all Irish Anglers, Classified by District of Residence*

District of Residence	*Total Catch of Salmon*						*Total Catch of Sea Trout*		*Total Value of Combined Catch of Salmon and Sea Trout*
	Quantity			*Value*			*Quantity*	*Value*	
	Consumed	*Sold*	*Total*	*Consumed*	*Sold*	*Total*			
	lb.			£			*lb.*	£	£
Dublin	12,704	3,688	16,392	6,754	2,032	8,785	11,138	2,672	11,457
Wexford	3,544	10,640	14,184	1,123	3,782	4,905	8,910	2,138	7,043
Waterford	16,004	15,907	31,911	6,904	7,108	14,012	7,898	1,896	15,908
Lismore	2,113	8,973	11,086	678	3,347	4,025	2,493	598	4,623
Cork	8,521	8,986	17,507	3,436	3,847	7,283	13,609	3,265	10,458
Kerry	3,868	21,566	25,434	1,363	9,281	10,644	9,033	2,168	12,812
Limerick	9,185	39,759	48,944	2,789	4,274	17,254	7,118	1,708	18,962
Galway/Connemara/ Ballinakill	7,429	989	8,418	2,680	374	3,054	7,878	1,891	4,945
Bangor/Ballina	9,040	12,467	21,516	3,439	5,043	8,482	7,366	1,768	10,250
Sligo/Ballyshannon	4,791	5,256	10,047	1,991	2,762	4,752	4,708	1,130	5,883
Letterkenny	24,233	13,185	37,418	7,832	4,262	12,094	8,752	2,100	14,194
Drogheda/Dundalk	10,222	7,815	18,037	5,021	3,137	8,158	14,313	3,434	11,592
All Districts	111,663	149,231	260,894	44,202	59,248	103,450	103,916	24,767	128,217

Table A5: *Estimated Total Weight of Salmon taken by All Irish Anglers in Different Types of Water in Different Fishery Districts*

Fishery District	*Type of Water*					*Total*
	Private	*Club*	*Hotel*	*Free*	*Public Body and Other*	
(a) In local waters			(*lb.*)			
Dublin	488	2,140	—	695	36	3,359
Wexford	3,432	139	—	10,254	—	13,825
Waterford	1,524	11,165	502	3,528	4,528	21,247
Lismore	10,099			911	—	11,010
Cork	2,240	8,723	—	4,559	—	15,522
Kerry	6,209	9,757	1,570	3,955	3,943	25,434
Limerick	1,903	3,066	282	27,098	13,388	45,737
Galway/Connemara/Ballinakill	1,080	3,052	2,227	1,372	—	7,731
Bangor/Ballina	4,487	14,932	100	199	1,440	21,158
Sligo/Ballyshannon	3,501	3,096	649	2,363	300	9,909
Letterkenny	6,546	2,105	—	11,118	12,874	32,643
Dundalk/Drogheda	10,324	5,523	—	456	758	17,061
All Districts	51,833	63,698	5,330	66,508	37,267	224,636
(b) In non-local waters						
Dublin	—	—	—	—	—	—
Wexford	4,908					4,908
Waterford	499	199	—	583	—	1,281
Lismore	254	—	—	214	—	468
Cork	57	153	92			302
Kerry	956	87	72	1,951	—	3,066
Limerick	87	—	—	21	872	980
Galway/Connemara/Ballinakill	12,603	204	254	215	112	13,388
Bangor/Ballina	6,145	468	450	56	72	7,191
Sligo/Ballyshannon	392	—	—	347	—	739
Letterkenny	57	66	—	892	—	1,015
Dundalk/Drogheda	1,986	616	—	318	—	2,920
All Districts	27,944	1,793	868	4,597	1,056	36,258

Table A6: *Estimated Total Weight of Sea Trout Taken by all Irish Anglers in Different Types of Water in Different Districts*

Fishery District	*Type of Water*					*Total*
	Private	*Club*	*Hotel*	*Free*	*Public Body and Other*	
			(*lb.*)			
(*a*) *In local waters*						
Dublin	329	300	—	26	—	655
Wexford	2,250	49		6,480		8,779
Waterford	1,504				4,290	5,794
Lismore	904	498		703		2,105
Cork	1,721	4,774		4,142		10,637
Kerry	355	2,156	1,351	5,144		9,006
Limerick	3,524	247	881	1,691		6,343
Galway/Connemara/Ballinakill	3,572	1,158	2,149		754	7,633
Bangor/Ballina	1,560	1,732	929	399	2,567	7,187
Sligo/Ballyshannon	284	1,863		49	2,220	4,416
Letterkenny	1,060	581		2,178	840	4,659
Dundalk/Drogheda	4,661	7,739		494		12,894
All Districts	21,724	21,097	5,310	21,306	10,671	80,108
(*b*) *In non-local waters*						
Dublin	—	—	—	—	—	
Wexford	122	117				239
Waterford	26	91				117
Lismore	504	—	—	—	—	504
Cork		31	5			36
Kerry	542	127		4,037		4,706
Limerick	102	348		59	26	1,535
Galway/Connemara/Ballinakill	6,334	950	1,854	2,009	447	11,594
Bangor/Ballina	3,285	143	31	455	110	4,024
Sligo/Ballyshannon	155			41		196
Letterkenny		281		77	8	366
Dundalk/Drogheda	144	448		179		771
All Districts	11.214	2,536	1,890	6,857	591	23,088

Table A7: *Estimated Total Weight of Salmon Taken by All Irish Anglers in the Different Fishery Districts, Classified by District of Residence of Anglers*

Fishery District in which caught	*District of Residence of Angler*												*Total*
	Dublin	*Wexford*	*Waterford*	*Lismore*	*Cork*	*Kerry*	*Limerick*	*Galway/ Connemara/ Ballinakill*	*Bangor/ Ballina*	*Sligo/ Ballyshannon*	*Letterkenny*	*Dundalk/ Drogheda*	
								(*lb.*)					
Dublin	3,358												3,359±(2,332)
Wexford	2,359	13,825									2,555		18,733±(15,735)
Waterford	1,037		21,247		244								22,528±(7,992)
Lismore	254			11,010	214								11,478±(5,573)
Cork	188	114			15,522								15,824±(4,548)
Kerry	1,336			76	1,527	25,434						127	28,500±(9,978)
Limerick	899						45,737			81			46,717±(29,976)
Galway/Connemara/ Ballinakill	1,824		10,664					7,731	252		116	532	21,119±(20,694)
Bangor/Ballina	3,521						2,679	687	21,158		305		28,349±(8,912)
Sligo/Ballyshannon	391									9,909	348		10,648±(4,717)
Letterkenny	112						529				32,643	317	33,601±(15,053)
Dundalk/Drogheda	1,118	245								57	1,451	17,061	20,038±(16,847)
All Districts	16,392	14,184	31,911	11,086	17,507	25,434	48,944	8,418	21,516	10,047	37,418	18,037	260,894±(48,355)

*The figures in brackets are the confidence intervals about the estimates at the 95 per cent level of significance.

Table A8: *Estimated Total Weight of Sea Trout Taken by all Irish Anglers in the Different Fishery Districts, Classified by District of Residence of Angler*

Fishery District in which caught	*District of Residence of Angler*												*Total*
	Dublin	*Wexford*	*Waterford*	*Lismore*	*Cork*	*Kerry*	*Limerick*	*Galway/ Connemara/ Ballinakill*	*Bangor/ Ballina*	*Sligo/ Ballyshannon*	*Letterkenny*	*Drogheda/ Dundalk*	
							(*lb.*)						
Dublin	655												655
Wexford	239	8,779											9,018
Waterford	117		5,794										5,911
Lismore	127			2,105	377								2,609
Cork	36	58			10,637								10,731
Kerry	1,824		220		2,555	9,006					87		13,712
Limerick	259			276			6,343						6,878
Galway/Connemara/Ballinakill	4,878		1,603	92		27		7,633	179		3,338	1,419	19,169
Bangor/Ballina	2,119		40		40		775	225	7,187	284	581		11,211
Sligo/Ballyshannon	112									4,416	44		4,612
Letterkenny	117		241							5	4,659		5,025
Drogheda/Dundalk	655	73									43	12,894	13,665
All Districts	11,138	8,910	7,898	2,473	13,609	9,033	7,118	7,858	7,366	4,708	8,752	14,313	103,196

Table A9: *Percentage Distribution of Expenditure by Irish Anglers from Different Districts of Residence on Certain Items of Expenditure*

Fishery District of Residence	*Expenditure in Local Districts*			*Total (Local) (a)*	*Expenditure in non-Local Districts*			*Total (non-local) (b)*	*Total (all expenditure) (a+b)*
	Travel	*Non-Travel*	*Overheads*		*Travel*	*Non-Travel*	*Overheads*		
						per cent			
Dublin	1·6	4·9	11·7	18·2	15·8	57·8	8·3	81·9	100
Wexford	7·7	5·6	56·5	69·8	8·2	13·1	8·5	30·1	100
Waterford	15·5	6·7	40·8	63·0	6·0	30·3	0·7	37·0	100
Lismore	15·5	50·5	21·4	87·5	2·8	7·1	2·6	12·4	100
Cork	12·1	19·9	29·8	61·8	11·0	27·0	0·3	38·1	100
Kerry	21·7	15·3	59·7	96·6	0·7	2·0	0·7	3·4	100
Limerick	12·3	9·8	65·7	87·8	3·9	4·4	3·8	12·2	100
Galway/Connemara/ Ballinakill	28·3	28·1	30·5	87·0	3·7	4·7	4·7	13·1	100
Bangor/Ballina	12·3	19·4	59·9	91·5	4·7	1·3	2·4	8·5	100
Sligo/Ballyshannon	15·0	10·1	61·8	87·1	4·3	4·5	4·1	12·9	100
Letterkenny	11·4	2·6	68·2	82·1	2·8	10·1	5·2	17·9	100
Drogheda/Dundalk	13·4	8·3	29·7	51·2	8·8	31·5	8·8	48·5	100
All Districts	10·7	11·3	38·2	60·4	8·3	26·5	5·0	39·6	100

APPENDIX B

Economic Evaluation of Recreational Facilities—Methodological Problems

THE problem of making an economic evaluation of a recreational resource such as angling waters is an extremely difficult one, because the use of such resources does not usually involve the conventional market mechanism. Much recent research has focused upon the problem of measuring the benefits of such receation, and a variety of techniques have been developed which assign a monetary value to the benefits. Before going on to discuss these techniques, however, it should be stated that the specific technique to be used depends on the point of view from which the facility is being considered, and the time period involved.

The value of a recreational facility can be looked at in two ways though these ways are not completely independent of one another.

(1) It can be considered from the point of view of its economic importance to the region or state in which it is located and its "importance" measured in terms of its present contribution to the income and employment arising in the area. This might be termed the GNP approach.

(2) Alternatively, we can consider the value of a recreation site as a measure of the satisfaction or utility it affords as an amenity to its users. In some cases, the users may spend very little money in connection with the amenity but nevertheless it may provide them with great mental and physical relaxation for which many of them would pay highly if they had to, and would object strenuously if its existence were threatened. It thus has some intangible value which can rarely be measured directly in monetary terms but has to be evaluated by some indirect means. This might be termed the amenity value approach.

We should finally point out that the time period involved is also of vital importance. In many cases, it is the future value* rather than the present value of a resource in which we are interested.

In this connection the Netherlands situation is worthy of mention. For some time, employers in that country have found it difficult (sometimes impossible) to employ workers unless outdoor recreational facilities are provided. This is particularly true in the densely populated, heavily polluted Rotterdam area. As a result, policy in that country is now strongly oriented towards the development of recreational facilities in conjunction with all urban employment

*In this context, value can be interpreted as either a GNP effect or as a measure of amenity value.

projects. Money for this is usually provided by private business and industry, but in the period 1960–69 the Netherlands Government itself budgeted some £19 million for outdoor recreation. Governments in less densely populated countries are not yet faced with such acute problems as exist in the Netherlands but those who must provide or restore outdoor recreation in urban areas find that the costs of such projects can be enormous. Hence, regardless of the results of a current evaluation exercise, potential use based on experience of similar amenities in other countries must always be considered.

The projection of future value however does not raise any issues of definition and measurement additional to those involved in the estimation of current values and we therefore do not discuss future values any further in this appendix.

METHODS OF EVALUATION

GNP Approach

Where an amenity is considered from the point of view of its economic importance to the region or state in which located, its contribution to income and employment in the region must be assessed in some way. One estimate of this contribution is the expenditure in the region of all persons from inside and outside the region who pay money specifically to enjoy this amenity. The word "specifically" is very important in this context. If outside visitors come to a district on a general holiday and happen to do some fishing while there, then only the expenditure directly incurred in fishing (i.e. licences, fees, lures, boats, etc.) can be legitimately attributed to the fishing activity. If, on the other hand, visitors come specifically to fish, then all expenditure associated with the visit (i.e. travel, accommodation, meals, souvenirs etc.) can be attributed to the fishing and should be included in the evaluation.

Spending by the recreationists generates income and employment within the area but we must not assume that the income generated is exactly equal to the expenditure. To derive the true value added (GNP) generated by the spending we should first of all deduct from total legitimate expenditure of the recreationist the amounts spent on imports from outside the region. For example, from the total expenditure by recreationists at filling stations is deducted the wholesale cost of petrol and oil which comes from outside the area. Similarly, the wholesale value of groceries from outside areas is deducted from the tourists' total grocery bill and so on. The remaining figure is then one estimate of the GNP generated by the recreational facility.

However, this is only a first round figure and may be an understatement of the true value added. It ignores the fact that spending in a region generates further

economic activity in the neighbourhood through the process known as the "multiplier effect". This effect may lead to considerable increases in value added by bringing hitherto unemployed resources into productive use.* It should be pointed out, however, that if a multiplier is to be validly used in connection with spending on recreation two basic conditions must be fulfilled. Firstly, resources in a region must be less than fully employed, for otherwise the expenditure in question will not stimulate further economic activity but will only serve to change the allocation of the given resources as between one type of activity and another. Secondly, it must be assumed that in the absence of the activity in question other expenditure, creating similar multiplier effects within the region, will not be made. Finally, we should emphasise that even when a figure for total activity generated is obtained, this cannot be assumed to represent net welfare benefits.

As far as Irish salmon angling is concerned, it is reasonable to assume that these conditions are fulfilled by the expenditure of foreign visitors. There are, undoubtedly, under-employed resources in the regions where most of the angling takes place and other opportunities for stimulating demand for these resources are extremely limited. Furthermore, if the fisheries were to become polluted or otherwise impaired, it is likely that most of the visiting anglers and their families would go elsewhere for their holidays. Hence, it seems legitimate to apply a multiplier to the total expenditure of foreign anglers who visit Ireland specifically for salmon fishing. In a previous paper [1] the authors have done this using a multiplier of 1·6 for the Irish Republic as a whole. For smaller regions, however, the multiplier effects are likely to be much less than this and in some cases (if very small regions are taken) they are likely to be less than unity.

In the case of the expenditure of local anglers the conditions for the application of a multiplier are not met. Unlike expenditure by non-Irish anglers, this expenditure is endogenous to the Irish economy. The expenditure to which a multiplier is applied must be *exogenous* to the income-determining system under consideration. Of course, expenditure by Irish anglers in areas outside their local districts are exogenous *from the point of view of the district* where the expenditure is incurred, and a multiplier could validly be applied to non-local expenditure. Although such an analysis would have been very interesting in the present context, we were not able to carry it out, since the necessary data on which to base regional multipliers are not available. We therefore accepted the first round total expenditure of the home anglers as a reasonable representation of the GNP which can be attributed to their angling activity.

Accordingly, one estimate of the value to the State of Irish salmon angling

*For the whole of Ireland it has been estimated by Bord Failte that the value added by £1 total expenditure by tourists is £1·6—£1·8 [7].

is the multiplied value of the expenditure of the visitors from outside the State plus the first round expenditure of the Irish anglers. Although this figure may accurately reflect the effects on employment and GNP of expenditure on angling, it is likely to understate the amenity value of the salmon fishing resources, for in some cases the local residents may spend very little, if anything, in connection with these resources. For this reason it is generally held that some other means of evaluating recreational sites should be used which measures more accurately the amenity value.

Amenity Value of a Resource

A recreational resource has amenity value to the extent that people pay or are willing to pay for the opportunity of using it, or to the extent that the users may demand that it be provided out of public funds to which they contribute. The objective in this case then is to measure the total willingness to pay by consumers of the recreation service as though these consumers were purchasing the service on the open market.

As Clawson and Knetch [4] say "these values may or may not register in the commerce of the nation but this does not make them any less real . . . These are the values that when appropriately measured provide the basis for calculating the economic worth of natural resources used for outdoor recreation."

The problem, of course, is to measure these values in a realistic manner because in most cases the amounts actually paid by users in connection with the recreational facility are not the same as the amounts they would be willing to pay if the resource were not available and had to be provided afresh. Indeed, in some cases a recreational resource like a scenic area or a fishing water may be completely free to the users, yet it would be untrue to say that this resource had no economic value.

We consider below the various methods commonly used for making these measurements. Before going on to this, however, we should say that, throughout this discussion of amenity value, we assume that for visitors from outside the country willingness to pay and amount paid are substantially the same (i.e. that out-of-state visitors are being charged the full economic price for the use of the resource). It seems reasonable to suggest that though a country may provide recreation for its own residents at a monetary charge less than the amount which the latter would be willing to pay, it will be reluctant to provide cheap recreation for foreign visitors. Even if it does provide cheap access to a recreational facility for all users it usually recoups the full economic cost of the facility indirectly through the visitor's expenditure in the region on accommodation, meals, transport etc. Thus for out-of-state visitors the GNP and amenity values are assumed to be similar whereas for local residents these values may be

quite different, the true amenity value being much higher than the amount actually paid.

The methods of evaluating amenity value can be grouped into two broad categories, namely (*a*) direct and (*b*) indirect methods.

Direct Method

Where this method is employed interviews are carried out to test participants' reactions to specific questions regarding willingness to pay for recreational resources and to establish demand curves on the basis of the answers received. Usually certain background information is obtained as well, such as, income, age, family structure, and distribution of expenditure during the course of the recreational visit. According to Knetch and Davis [4] "The essence of the interview method of measuring recreation benefits is that through a properly constructed interview approach one can elicit from recreationists information concerning the maximum price they would pay in order to avoid being deprived of the use of a particular area for whatever use they may wish to make of it."

Until recently, economists have been sceptical of the direct method on the grounds that it tends to be somewhat unreal. What a person says he would pay for a resource and what he would actually pay in a real situation are not necessarily the same. Another weakness is that the answers received depend crucially on the structure of the questionnaire and on the phrasing of the questions. A further difficulty is that the method does not consider such factors as probable substitute activities which could be availed of if the resource under review were not available. For these reasons the direct method has not been widely used in the past.

In recent years, however, the method seems to be returning to favour, due to a certain amount of disillusionment with some of the indirect methods which have been used and also as a result of improved methods of structuring and analysing questionnaires. Norling [6] says that the Davis Group of Resources for the Future Inc. have obtained many promising results using this method and that the attitude towards it is definitely changing. However, the newer direct techniques are still very much in the experimental stage and for the present at any rate indirect methods are more favoured.

Indirect Methods

(1) *The Gross Expenditure Method*

The total expenditure of recreationists is very often used as a measure of the amenity value of a recreational site. In this context total expenditure is used as a measure of willingness to pay. The method is based on two assumptions (*a*)

that the value of the recreation to the recreationist is approximately equal to the total expenditure associated with it, and (*b*) that the amount spent is determined by free choice over other alternatives to spend or save the same sum of money [9].

The use of gross expenditure as a measure of the amenity value of a site has been supported by some economists but not entirely by others. Crutchfield [7], has suggested that where people choose to spend money on a particular recreation activity it is possible to infer that they value the activity at least as highly as other goods and services that could have been purchased with the same amount. Clawson [8], on the other hand, speaks rather scathingly of the gross expenditure method, though all of his criticisms are not fully justified. He says that estimates of gross expenditure are very popular in many quarters because they are likely to yield large figures which at times have been suspected of exaggeration. This may be true in the cases where every conceivable item is included in the expenditure figures, but if proper definitions are adopted, and the data are collected objectively and grossed up carefully, the expenditure derived may often give a reasonably accurate estimate to the amenity value of a site.

However, Clawson raises a more fundamental point when he says that not all of the reported expenditure is new or increased expenditure. Some of it is merely credited here when otherwise it would have shown up somewhere else. For example, food bought on vacation replaces food that would otherwise have been bought at home. Although this is true, we should be hesitant to deduct anything from carefully defined total expenditure since, in many cases, the latter is a rather inadequate measure of amenity value. Total expenditure incurred by all visitors to a site (assuming this expenditure is accurately measured) is usually no more than a minimum figure for the amenity value, particularly if the majority of the users are local people who spend very little in connection with the recreation. Parks, waterways and other recreational resources situated in or near urban areas are often very heavily utilised at very low direct* cost to the consumers, but these resources presumably have a high value to the consumers. The other methods of evaluation which we describe below have been suggested as alternatives to the gross expenditure approach, but these too have their short-comings.

(2) *Cost Method*

One of the earliest attempts to place a value on recreation was that based on the cost of developing facilities. According to this method the value of a recreation resource is assumed to be equal to the costs of generating it or to some

*It is of course, true that the consumers are probably paying for the resource through taxation but even when this is taken into account the total cost to the consumers is still likely to be below the amenity value.

multiple of these costs. In some cases this assumption is not invalid. If it costs £100,000 to erect a swimming pool in an urban area it can be taken that the value of the recreation to be derived from the pool is worth this to the users, and one could cite numerous examples of this kind. In other cases, however, the method has several limitations. First, it does not measure consumer expenditure or willingness to pay in any useful sense. Secondly, it is of no use in evaluating the loss of recreational opportunities or the effects of alternative projects or investments and it assumes that the more spent on developing a project (e.g. a reservoir) the greater its recreational value.

(3) *Value of Catch Method*

The market value of the fish caught has been suggested as a minimum value for a sport-fishing resort. The basic assumption underlying this method is, however, misleading. The fish species in a fishing site may have no market value whatever, yet the water may be very popular with the large number of coarse fishermen who take pleasure in catching the fish, and later returning them to the water after weighing. Sometimes also the recreational value of even a high quality game fishing site may bear no relationship to the value of the fish, particularly if it forms part of a scenic area, or if it may also be used for swimming, boating etc.,

It could be argued, however, that the value of the angler's catch should be added to his total expenditure in order to arrive at a figure for the total amenity value of an angling site. It appears to us that whether or not such an adjustment is made depends on the assumptions we make about an angler's behaviour if he were deprived of the opportunity for disposing of his catch as he likes. If we assume that the angler's interest is purely in the catching of fish, and that he would fish just as frequently and expend as much money whether or not he could keep his catch, then the value of his catch is a sort of bonus, over and above the pleasure he gets from fishing. Therefore, on this assumption, the value of his catch should be *added* to his total expenditure to obtain the value of angling. If, however, we assume that before taking out his licence an angler expects a certain quantity of salmon, either to sell or to eat, and that his expenditure would be less if he could not dispose of this catch as he likes, then his expenditure *includes* an allowance for the value he places on the catch and no adjustment should be made.

The truth probably lies somewhere between these two extreme assumptions: some anglers would probably fish as much irrespective of what happened to their catch, while others might cut down on their angling. In our evaluation of salmon angling we chose to make the second, and more conservative, of the above assumptions. Thus, we do not make any adjustment for the value of catch in this instance.

(4) *Travel Cost or Consumer Preference Method*

A very popular evaluation method is the travel cost or consumer preference method suggested by Harold Hotelling of the University of North Carolina in 1947 and of which several modifications are currently in use. Hotelling's ideas are expressed in a letter to the Director of the United States National Parks Service in which among other things he said:

". . . concentric zones should be defined round each park so that the cost of travel to the park from all points in one of these zones is approximately constant. The persons entering the park in a year or a suitably chosen sample of them are to be listed according to the zone from which they come. The fact that they come means that the service of the park is at least worth that cost, and this cost can probably be estimated with fair accuracy. If we assume that the benefits are the same no matter what the distance, we have, for those living near the park, a consumers' surplus, consisting of the difference in transportation costs. The comparison of the cost of coming from a zone, with the number of people who do come from it, together with a count of the population of the zone, enables us to plot one point for each zone on a demand curve for the services of the park. By a judicious process of fitting it should be possible to get a good enough approximation of this demand curve to provide, through integration, a measure of the consumers' surplus resulting from the availability of the park. It is this consumers' surplus calculated by the above process with deduction for the cost of operating the park which measures the benefits to the public in the particular year . . . This approach through travel costs is one of several possible modes of attack on this problem. There are also others which should be examined though I think the method outlined above looks the most promising."*

(5) *The Clawson Method*

Marion Clawson† broadened the theoretical foundations of the Hotelling method and presented additional suggestions for measuring recreation values. He stated that estimation of the demand curve for a recreation area must proceed in two stages:

(*a*) One curve for the total recreation *experience,* and

(*b*) A second one for the *recreation opportunity of the site.* (Referred to as the recreation opportunity *per se*).

The total recreation experience takes the form of anticipations before the experience actually begins, the realisation of the experience, and recollections

*This extract is taken from Sewell, W. R. D. and Rostron J. [9], p 10, 11.
†Marion Clawson, *op. cit.*

afterwards. The demand curve for this total experience is a schedule showing the visitation rate per 100,000 population for different total costs per visit. It is estimated in the same way as the Hotelling demand curve except that in this case all the costs involved in reaching and staying at the site are included (i.e. food, lodging, travel, entrance fees and other miscellaneous costs). In other words the gross expenditure of the recreationists is used to estimate the whole recreation experience.

The value of the recreation opportunity *per se* is derived from the total schedule by assuming a succession of increases in entrance fees and calculating the effects these increases would have on visitations on the assumption that each increase in entrance fees reduces visitation rates. From the data on estimated numbers of visits at each level of entrance fee it is possible to construct a new demand curve which measures the relationship between the number of visits and entrance fees. Clawson claims that this approximates the true demand curve for the recreation opportunity of the site itself if it is assumed that the visit to the site was the main purpose of the trip. It shows, he says, the relationship between price per unit and number of visits, all other factors remaining unchanged, but is of course subject to the inadequacies of the data on which it is based.

The Clawson method is suitable for economic evaluation of parks, reservoirs, or lakes which have a fairly high visitation rate and which are visited by a fair proportion of people from outside the immediate locality. It is particularly easy to apply if visitors have to sign a register giving their addresses. Such a register gives immediately the numbers travelling from different zones and from this, visitation rates per 100,000 population in each zone can be readily calculated. The register also provides a frame from which samples of visitors can be drawn for interview if required.

In the analysis of survey data on Irish salmon anglers an attempt was made to utilise the Clawson method. The Dublin based anglers (of whom there were 160 in our final sample) tended to travel to fishing sites in other counties and to incur travel and related costs, as well as payment of admission fees to owners of fishery waters. However, the number of visits paid by any sub-group of these anglers to an individual location was extremely small, or where the number of visits was sufficiently large the data on costs was found to be incomplete. Disappointingly then, a Clawson-type demand curve could not be validly derived due to the small number of points on which this curve would have had to be based.

Like the gross expenditure method neither the Hotelling nor the Clawson modification is very suitable for assessing the benefits of a site near an urban area which is used substantially by local people. The costs to these people of using the site are minimal whereas the benefits derived by the users may be

enormous and could not be represented by a demand curve based on actual costs. Nor do they not have any particular merit in assessing the recreational value of a large region or of a widely scattered lake or river system. For these reasons our research has focused on the application of the gross expenditure method which despite its limitations seems to be the best method presently available for Irish conditions.

APPENDIX C

Sampling and Standard Errors

THIS Appendix contains a brief description of the sampling technique used, estimates of the gain from stratification, and a suggestion as to the size of sample which would be needed to provide reasonably precise estimates of catch in each district.

The sample was chosen using variable sampling fractions in an attempt to achieve an optimal stratification. The major variable in the survey was anglers' expenditure, and the pilot study indicated that the variance of expenditure per angler varied very considerably from one district of residence to another. An optimal sample stratification could therefore be achieved by sampling the more variable districts (strata) proportionately more intensively than the less variable districts (strata). In symbols, we wished to choose the n_h to minimise $V(\bar{y}_{st})$, where n_h is the number in the sample from stratum h and $V(\bar{y}_{st})$. the sampling variance of the mean of a stratified sample. Cochran [12] shows that

$$n_h = n \frac{N_h S_h}{\Sigma N_h S_h}$$

where n is the total sample size, N_h is number in the population in stratum h, and S_h the population standard deviation in stratum h. In our case, the data from the pilot study was used to estimate the S_h for total expenditure per angler, the N_h (=the number of anglers resident in each district) were known and n was fixed by cost considerations at about 500. Application of the above formula yielded a stratification which gave very heavy weighting to the Dublin anglers, with very few anglers to be chosen from some other districts. Since part of our objective was to make fairly good regional estimates of expenditure as well as to estimate total national expenditure, we modified our stratification system by cutting down somewhat on the numbers in Dublin and correspondingly increased those elsewhere, and we also expanded our intended sample size, n, to about 600. The resulting n_h are shown under the heading "Allocation actually used" in Table C1.

It is of interest to estimate the increase in precision achieved by this method of stratification over that which would have been achieved by means of simple random sampling (s.r.s.). Our use of variable sampling fractions necessitated some rather cumbersome re-weighting at the analysis stage, and we would like to know if the stratification which we used achieved a sufficiently large increase in precision to justify the inconvenience of re-weighting.

Cochran [12, p. 137] shows that the sampling variance, v_{ran}, of a variable, y, in a simple random sample, can be estimated by

$$v_{ran}=\frac{\mathcal{N}-n}{n\mathcal{N}}\left[\Sigma W_h s_h - \frac{\Sigma W_h s_h^2}{n_h}+\frac{\Sigma W_h^2 s_h^2}{n_h}+\Sigma W_h \bar{y}_h^2-(\Sigma W_h \bar{y}_h)^2\right]$$

where $\mathcal{N}$=the size of the total Population,

$W_h=\frac{\mathcal{N}_h}{\mathcal{N}}$=the proportion of the population in stratum h

s_h=an estimate of the stratum standard deviation of the variable

$\bar{y}_h$=an estimate of the stratum mean of the variable.

Using this formula, we found that the variance of total expenditure per angler for a simple random sample would have been 9·73. The stratified sample which we actually used had a variance of 7·10. There was thus a reduction in variance of 27 per cent ($=\frac{7\cdot10}{9\cdot73}\times100$) resulting from the use of stratification. This reduction looks fairly large when expressed in terms of the variance. However, a more relevant comparison may be between the standard error of an s.r.s. and that of a stratified sample. When measured in this way the percentage increase in precision is $\frac{\sqrt{7\cdot10}}{\sqrt{9\cdot73}}\times100=85\cdot4$ per cent, i.e. a 15 per cent reduction in the width of the confidence interval.

It is also of interest to examine the extent to which the allocation used was less than optimal.

The columns headed Optimal Allocation in Table C1 give the n_h which would have led to a minimum standard error for our estimate of overall expenditure per angler, together with an estimate of the confidence interval which this allocation would have given for each district. The divergence between the n_h actually used and the optimal n_h arises for two reasons: (1) inaccuracies in the estimates of the variance in each district from the pilot survey; (2) our decision to opt for a larger standard error for the overall average in order to ensure reasonably small standard errors for the estimates for individual districts. This latter strategy seems to have paid off fairly well. The increase in the confidence interval for the overall estimate is only 0·4 ($=\frac{\cdot4}{4\cdot8}\times100=12\%$), while the decrease in the confidence interval for certain districts is quite large. For instance, the confidence interval for Wexford would have been 15·7 under an optimal allocation, compared with the achieved confidence interval of 9·1. There was therefore a reduction of 42 per cent

Table C1: *Comparison between Allocation Actually Used and Optimum Allocation for Mean Expenditure per Angler*

	Estimated Mean Expenditure per Angler, $\bar{y}$ £	*Allocation Used*		*Optimal Allocation*	
		n_h	1·96 *S.E.*	n_h	1·96 *S.E.*
Dublin	118·4	160	21·5	179	20·3
Wexford	25·8	33	9·1	11	15·7
Waterford	35·3	45	11·9	53	11·0
Lismore	51·1	32	27·6	30	28·5
Cork	48·9	56	16·3	53	16·8
Kerry	22·8	31	7·1	13	11·0
Limerick	36·9	38	11·8	71	8·6
Galway/Connemara/ Ballinakill	47·6	37	15·4	26	18·4
Bangor/Ballina	60·3	44	25·8	39	27·4
Sligo/Ballyshannon	45·0	39	15·1	23	19·7
Letterkenny	53·2	35	26·4	59	20·3
Drogheda/Dundalk	38·7	36	14·0	29	15·6
All Districts	50·5	586	5·2	586	4·8

[(6·/15·7) × 100] for this district, while for Kerry the reduction was 35 per cent [(3·9/11·0) × 100]. Thus,on the whole,the allocation used achieved a satisfactory degree of precision in estimating overall and regional average expenditure.

In the case of the catch data, however, the stratification used was far from optimal. The variance of the catch by anglers from the high expenditure districts was considerably lower than that by anglers from low expenditure districts, so that the system which we used of over-sampling the high expenditure districts was the opposite of what should have been employed to get high precision figures for catch. The variance of average catch per angler was therefore *higher* in the case of our stratified random sample than it would have been for a simple random sample. Our stratified sample had a variance of 14·42, while the estimate of the simple random sampling variance was 9·74. There was thus a 48 per cent (i.e. $\frac{14{\cdot}42}{9{\cdot}74} \times 100 - 100$) increase in the variance of catch per angler as a result of the stratification which we employed. Expressed as an increase in the width of the confidence intervals this equals 21 per cent. We can now see why the confidence intervals which we showed in the text for catch were so broad.*

*We should point out, however, that despite the inefficiency (i.e. the relatively large standard errors) of the catch estimates, they are still unbiased and represent the best estimate we can make of salmon catch based on the survey data.

Table C2: *Comparison Between Allocation Actually Used and Optimum Allocation for Total Salmon Catch*

District in which taken	*Estimated Total Catch; g*	*Allocation Used*		*Optimal Allocation*	
		n_h	1·96 *S.E.*	n_h	1·96 *S.E.*
	lb.				
Dublin	16,392	160	4,023	34	8,727
Wexford	14,184	33	15,166	56	11,642
Waterford	31,911	45	20,981	88	15,003
Lismore	11,806	32	5,536	20	7,002
Cork	17,507	56	4,997	55	5,042
Kerry	25,343	31	9,523	34	9,093
Limerick	48,944	38	30,111	115	17,309
Galway/Connemara/ Ballinakill	8,418	37	3,554	14	5,778
Bangor/Ballina	7,858	44	6,937	30	8,401
Sligo/Ballyshannon	10,047	39	4,698	19	6,731
Letterkenny	37,418	35	14,915	55	11,898
Drogheda/Dundalk	18,037	36	17,135	66	12,655
All Districts	260,894	586	48,355	586	39,528

It may be of interest to those responsible for collecting data on Irish salmon catch to know how a sample should be allocated as between regions in order to achieve an estimate with a minimum standard error. Table C2 compares the sample size and confidence interval for each stratum for the allocation which we used with the corresponding data for an allocation which would optimally estimate total salmon catch. For the purposes of optimally estimating total catch, the allocation we used considerably over-sampled Dublin and under-sampled Limerick, and the discrepancies between the allocations for other strata, though smaller than those for Dublin and Limerick, were still large.

Therefore, if one's purpose were to estimate total catch, an allocation such as the optimal allocation shown in Table C2 would be advisable. However, this allocation does not depart too drastically from a stratified sample with uniform sampling fraction (i.e. a sample where the same proportion of the members of each stratum is selected). In view of the fact that quite sizeable changes in the allocations to each stratum do not seriously impair the optimality of an allocation (see Cochran [12, p. 115]) a stratified sample with uniform sampling fraction has much to recommend it, particularly its self-weighting property and its administrative convenience.

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APPENDIX D

Date of Interview..... Code No.....

SALMON AND SEA-TROUT ANGLING SURVEY
IRISH ANGLERS

Overhead Costs of Fishing

Overhead costs are defined as expenditures during the whole year on:

(*a*) Licence Fee,

(*b*) Tackle (i.e. rods, lines, reels, nets, lures and baits, etc.),

(*c*) Fishing clothes and boots,

(*d*) Purchases, repairs, upkeep and storage of boats, engines, and canvases,

(*e*) Construction, rent, repairs and upkeep of boathouses and boatyards,

(*f*) Other *overhead* costs of salmon/sea-trout angling, such as membership fee of an angling club, etc. but *excluding* "*current expenses*" on items like accommodation/meals, fishery rental, boat-hire and ghillies.

Q.1. Name the towns and villages in which you incurred expenditures on angling overheads (as defined above) in 1970. How much did you spend on each item in each of these towns and villages?

	Overheads Costs					
Names of Towns, Villages	(*a*) *Licence*	(*b*) *Tackle*	(*c*) *Fishing Clothes, Boots*	(*d*) *Boats, Engines, Canvases**	(*e*) *Boathouses Boatyards**	(*f*) *Other Overhead Costs*
	£	£	£	£	£	£

*If these items are owned or used for purposes other than salmon and sea-trout angling, charge only the appropriate portion to salmon and sea-trout angling.

Q.2. How many salmon angling licences have you taken out in 1970?

Number.....

Description of each licence	*Cost £*
1.	
2.	
3.	
4.	

Q.3. (*a*) Can you give some information on the local waters you have fished in 1970 ("local" is taken to mean fishing places within 20 miles of your residence)?

(*i*) *Information on salmon fishing*

Name and Location of of Waters Fished	*Ownership of Water See Footnote**	*Number of days fished*	*Total Fishery Rental Paid (£)*	*Approximate Weight of Salmon taken (lbs)*

(*ii*) *Information on sea-trout fishing*

Name and Location of Waters Fished	*Ownership of Water See Footnote**	*Number of days fished*	*Total Fishery Rental Paid (£)*	*Approximate Weight of Sea Trout taken (lbs)*

*Code 1, 2, 3 etc. as appropriate for the different waters as follows:

(1) Privately owned (e.g. by riparian owner or an individual other than hotel proprietor etc.); (2) Club Waters; (3) Owned by hotel proprietor, (4) Owned by a public body like the ESB etc.—state the body in question; (5) Free; (6) Other—specify clearly.

Q.3. (*b*) Please give the expenditures incurred by you on the items listed below while fishing these local waters in 1970.

Boatmen, Boat hire, Ghillies	*Accommodation and Meals Away from home*	*Other***

**Exclude expenditure on travel items.

Q.4. How much did you spend on the following travel items while fishing in your *local* waters in 1970?

Items	£	p
Petrol, oil, etc. for (*a*) Car, Motor-cycle, etc. (*b*) Boat		
Bus, and train fares		
Car Rental and taxi fares		
Other (specify)		
Total		

Information on Fishing outside Local Waters

Q.5. How many trips, during which you did some salmon or sea-trout fishing, did you make *outside* of your local waters in 1970?

Insert number in this box ☐

Q.6. If you went with a party what kind of party was it? How many were in the party? (Write the number in party opposite the kind of party).

Type of Party	*1st Trip*	*2nd Trip*	*3rd Trip*	*4th Trip*
Family Party (i.e. wife/or members of family)				
Party of Fishermen				
Other (specify)				

Q.7. Did you go specifically for salmon/sea-trout fishing purposes on each of these trips or was fishing only incidental?
(Place X opposite the appropriate answer).

Main Purpose of Trip	*1st Trip*	*2nd Trip*	*3rd Trip*	*4th Trip*
1. Trip specifically for salmon/ sea-trout fishing				
2. General family holiday				
3. Combination of (1) and (2)				
4. Other (business, etc.)				

Q.8. (i) Name the towns, villages in which you stayed and those in which you made purchases in excess of £1 in value while fishing for salmon/sea-trout *outside* your local fishing waters in 1970.
(ii) In each of these towns/villages how much did you spend on the items below? Include expenditures made by you on your own behalf and on behalf of others.

Town, Village in which Expenditure was made	*Fishery District Code No. (Leave Blank)*	*Expenditure in £'s on:*			
		Boatmen, boat hire, ghillies	*Accom-modation, meals*	*Gifts, Souvenirs*	*Other**

*Include drink, tobacco, clothes, shoes, recreation, etc. *Exclude travel expenditure and cost of fishery rental.*

Q.9. How much did you spend on the following travel items while fishing (for salmon and sea trout) *outside* your local fishing waters in 1970?

Items	£	p
Petrol, oil, etc. for (*a*) Car, Motor-Cycle, etc. (*b*) Boat		
Bus and train		
Car Rental and taxi fares		
Other (Specify)		
Total		

Information on Fishing outside local waters

Q.10. Can you give some information on your salmon and sea-trout fishing *outside* your local waters in 1970?

(*i*) *Information on salmon fishing*

Name and Location of Water Fished	*Ownership of Water See Footnote**	*Number of days fished*	*Total Fishery Rental Paid* (£)	*Approximate Weight of Salmon taken* (*lbs*)

(*ii*) *Information on sea-trout fishing*

Name and Location of Water Fished	*Ownership of Water See Footnote**	*Number of days fished*	*Total Fishery Rental Paid* (£)	*Approximate Weight of Sea-Trout taken* (*lbs*)

*Code 1, 2, 3 etc. as appropriate for the different waters as follows: (1) Privately owned (e.g. by riparian owner or an individual other than a hotel proprietor, etc.); (2) Club waters; (3) Owned by hotel proprietor; (4) Owned by a public body like the ESB or CIE etc.—state the body in question; (5) Free; (6) Other—specify clearly.

Q.11. (i) How many nights did you spend away from home while fishing *outside* your local fishing waters in 1970? (Enter figure in "Total" row).

(ii) How many of these nights did you spend in the types of accommodation listed?

(iii) Give the month(s) of the year in which you occupied these accommodation types.

Type of Accommodation	*Number of Nights*	*Month*
Hotel		
Guesthouse		
Farmhouse Accommodation		
Caravan		
Camping		
Rented house/chalet		
With relatives/friends		
Other		
Total		

Information on disposal of catch in local and non-local waters

Q.12. *Can you give me information on the disposal of your catch in* 1970.

	Disposal of catch by Weight (lbs. approx)			*Sum Received for Fish Sold*	
	Consumed or kept by self	*Given Away*	*Sold*	£	p
1. Salmon					
2. Sea-Trout					
Total					

General Information

Q.13. (i) Are you a member of

	yes	no
(*a*) Angling club	☐	☐
(*b*) Angling syndicate	☐	☐

(ii) If the answer to (i) is YES state annual subscription in £.....

Q.14. For how many years have you been doing some salmon or sea-trout fishing?

.....years?

Q.15. How often do you fish for species other than salmon or sea-trout? (Place X in the appropriate box).

Often ☐
Occasionally ☐
Seldom ☐
Never ☐

Q.16. (i) Has salmon and sea-trout fishing changed much in the waters that you have fished since you started salmon fishing?* (Place X opposite waters under the appropriate answer—Include local and non-local waters).

Name and Location	(*a*) *Declined*		(*b*) *Much the same*	(*c*) *Improved*	
	Seriously	*Moderately*		*Moderately*	*A Good Deal*
1.					
2.					
3.					
4.					
5.					

*Omit names of waters in which you have fished for only 1 year.

(ii) If the answer to (i) is either (*a*) or (*c*) for any water, give your opinion as to why the change has taken place.

Water number (as in (i) above)	*Opinion as to reason for change*
1.	
2.	
3.	
4.	
5.	

Q.17. (i) Did you find the facilities listed below to be good, fair or poor at the places where you fished in 1970? (Write "good", "fair", or "poor" in the space provided opposite the number of the water).

Water number (as given in Q.16.)	*Ownership Code (Leave Blank)*	*Facilities*				
		Accom./ eating facilities	*Ease of access, fishing boats, stages, etc.*	*Other Recreational Facilities*	*Boats, boatmen/ ghillies*	*Other Facilities*
1.						
2.						
3.						
4.						
5.						

(ii) Are there any adverse comments you would like to make on the facilities available at the centres where you fished this year?

(iii) (For persons who went fishing *outside* their local areas without their families or dependents.) Would you have taken your family or dependents with you if the facilities were better?

yes	no	possibly	not applicable*
☐	☐	☐	☐

*Do not have dependents/family etc.

Q.18. (*a*) Do you think that the rentals you were charged per day's salmon/sea-trout angling were generally

(i) excessive.....

(ii) fair .....

(*b*) If you were charged what seemed to you an excessive fee in any fishery please name the water(s) in question and give the rental charged per day's angling.

Water	*Rental/day's angling* (£)

Q.19. Do you think that the interests of sport salmon angling in your favourite fishing area would be best served by

(*a*) Private management and control of fishing waters □

(*b*) Co-operative management and control □

(*c*) State, regional or other public management and control □

Q.20. Would you be prepared to subscribe money to the formation of a fishery co-operative to take over in a legal fashion the management and control of any salmon angling waters.

YES □ NO □

For Classification Purposes

Q.21. What is your occupation?.....

Q.22. In which of the following age and income brackets do you fit? (Ring the appropriate number).

Age (years)		*Income per annum*	
Under 20	1	Less than £1,000	1
21—30	2	£1,001—£2,000	2
31—40	3	£2,001—£3,000	3
41—50	4	£3,001—£4,000	4
51—60	5	£4,001—£5,000	5
Over 60	6	More than £5,000	6

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