IONTAOBHAS TAIGHDE BRADAN na h-EIREANN
IONCORPORTHA

(THE SALMON RESEARCH TRUST OF IRELAND INCORPORATED)

Sponsored by Arthur Guinness Son & Co. Ltd. and
the Minister for Fisheries

ANNUAL REPORT
No. XXV

ADMINISTRATION OFFICE

PLEASE DO NOT REMOVE

REPORT FOR THE YEAR ENDED 31st DECEMBER, 1980.

REPORT FOR THE YEAR ENDED 31st DECEMBER, 1980.

The Report is set out in the following sections:-

Appreciation of Arthur E. J. Went.

SECTION A : GENERAL

1. Committee of Management.
2. Consultative Committee.
3. Handover of Burrishoole Fishery.
4. Personnel.
5. Installations.
6. Meteorological data.
7. Visits and communications.

SECTION B : SALMONID REARING

1. Grilse ova hatched in 1978.
2. Grilse ova hatched in 1979.
3. Grilse ova hatched in 1980.

4a. Grilse ova laid down in 1980.
4b. Sea trout ova laid down in 1979.
4c. Sea trout ova laid down in 1980.

5. Investigations of mortalities and therapeutic treatments: February to December 1980.
   a) Salmon parr and smolts.
   b) Hatchery fry (salmon and sea trout).
   c) Yearling salmon parr (excluding smolts) and sea trout.
6. Vaccination of 2+ salmon smolts against **Aeromonas salmonicida** by intra-peritoneal injection.
7. Vaccination of 1+ salmon parr against **Aermonas salmonicida** by simple immersion (Dip) and hyperosmotic infiltration (H.I.).
8. "Demand feeding" of salmon parr.
9. Thyroid feeding experiment.

SECTION C : CENSUS WORK ON FISH MOVEMENTS

1. WILD SALMON

   (i) Upstream movements.
      (a) Timing and numbers.
      (b) Net-marked grilse.
      (c) Spawning escapement.
      (d) Survival from brood year ova to smolts and grilse.

(ii) Downstream movements.
  (a) Smolts: timing and numbers.
  (b) Survival of salmon smolts.
  (c) Tagging of wild smolts.
  (d) Salmon kelts.
  (e) Ulcerative Dermal Necrosis.

2. REARED SALMON

(i) Upstream movements.
(ii) Smolt releases.

3. SEA TROUT

(i) Upstream movements.
  (a) Timing and numbers.
  (b) Net-marked fish.
  (c) Spawning escapement.
(ii) Downstream movements.
  (a) Sea trout smolts.
  (b) Autumn-migrating trout.
  (c) Tagging of autumn-migrating trout.
  (d) Sea trout kelts.
(iii) Sea trout scales.
  (a) Sea trout smolts.
  (b) Rod caught adult sea trout.

SECTION D : FISHERY REPORT

1. Exploitation rates by rod-fishing.
2. Fishery results.
3. Eels.
  (i) Silver eels.
  (ii) Elvers.

The Annual Report was prepared as follows:-

DJP : Section A, 1-7, B8, C1 & 2, and General Editor.
TFC : Section B4a & b, C3.
JOK : Section B1-4a, 5-7.
CPM : Section D & B9.

Arthur E. J. Went

The Trust records with deep regret, the sudden death of its Chairman, Dr. Arthur J. Went, on December 6, 1980.

He was born in London in 1910 and having graduated with an Honours Degree in Zoology from Imperial College, joined the Department of Agriculture, Fisheries Branch in Dublin in 1936, succeeding Mr. G. P. Farran as Scientific Advisor and Inspector of Fisheries in 1946. He acted in this capacity until his retirement in 1975.

Although **Salmo salar** was considered by most of his colleagues as his first love, he was interested in all species of fish and in particular, the occurrence of rare fishes around the coast, submitting lists of these to the Irish Naturalists Journal at regular intervals. With his co-author Dr. Michael Kennedy he produced his third edition (since in collaboration) of the List of Irish Fishes in 1976. He was a founder member of the Irish Specimen Fish Committee which published annual lists of specimen and record weights of fish taken by anglers in Irish waters. He had a keen interest in the history of fisheries in relation to fishing methods and ownerships. He had numerous publications on this subject and at the time of his death, had five histories in the course of preparation.

Internationally, he was recognised as an eminent authority on fisheries. He played a leading role in the development of the International Council for the Exploration of the Sea, having held office in various committees form 1952 through to 1969. From 1966 to 1969 he was President of the Council, the highest office attainable. He was a member of the International Advisory Group of the Atlantic Salmon Trust and of its counterpart in North America, the International Atlantic Salmon Foundation.

The Salmon Research Trust of Ireland was the brain child of Arthur Went and Sir Richard Levinge, assisted by the generosity of Charles Roberts, who offered the Burrishoole Fishery for experimental work. Sir Richard, who is a keen angler, persuaded his company, Arthur Guinness, Son & Co. Ltd., to contribute financially to salmon research in Ireland. Arthur Went secured the agreement of the then Minister for Lands (with responsibility for Fisheries) to contribute towards the running costs of the Salmon Research Trust, which was founded in 1955. From its inception until his death, Dr. Went was closely associated with the Trust, acting as Director of Research (1955-75) followed by his election as Chairman and Honorary Consultant (1975-80). At the time of his death, he had begun work on an historical record of the Burrishoole Fishery.

One could well adapt the poignant conclusion of An t-Oileanach and apply it as a fitting epitaph for Arthur Went — "Ni bheidh a leitheid aris ann" — (We shall not see his like again).

E.T.

SECTION A : GENERAL

1. COMMITTEE OF MANAGEMENT

It is with deep regret that the Committee records the sudden death of its Chairman, Dr. A. E. J. Went, on December 6, 1980. An appreciation of Dr. Went's service to the Trust will be found at the beginning of this report.

Major C. W. Roberts retired as an Elective Member of the Committee with effect from April 30, 1980. He had been associated with the Trust since its inception in 1955 and was elected to the Committee in 1956. The early installations of the Trust (two rearing ponds and a laboratory building) were built under his supervision at Treanlaur as were the later installations (rearing ponds, hatchery and traps) at Furnace.

Major Roberts administered the Burrishoole Fishery, owned by the Roberts family until its purchase by Arthur Guinness, Son & Co. Ltd. in 1965 and thereafter continued to manage the fishery on behalf of the new owners until his retirement. He was an unceasing advocate of sound conservationist principles in his management of the fishery, and in his service to Bangor Board of Conservators (1955-1980) and the Council of Boards of Conservators (1955-1980), of which he was elected Chairman in 1964. He was appointed to the Inland Fisheries Commission from 1970-1975.

The Committee, and in particular the officers of the Trust owe him a deep debt of gratitude for the hard work and advice so generously given during his twenty-five years association with the Trust.

2. CONSULTATIVE COMMITTEE

The decision was taken in 1979 to establish a Consultative Committee composed of persons living in the Newport area, who could be expected to take an interest in and advise the Trust on its research programme. The first meeting was held on June 16 and the Committee comprised:-

Dr. A. E. J. Went, Chairman
Mr. J. Diffley (Secretary, Glenisland Co-operative Society)
Mr. E. Kilroy (Independent netsman)
Mr. M. McGuire (Secretary, Newport Anglers Club)
Mr. F. Mumford-Smith (Newport House Hotel)
Mr. P. Quinn (Secretary, Clew Bay Oyster Co-operative Society)
Mr. J. Sweeney (Chairman, Bangor Board of Conservators)

Senator T. K. Whitaker, Miss E. Twomey, Dr. D. J. Piggins and Mr. R. G. Mallet attended the meeting, representing the Trust. Topics for discussion ranged over the proposed research programme, rod fishing lettings, commercial salmon fishing, protection and conservation of salmonid fish stocks and the effects of drought conditions during April and May.

3. HANDOVER OF BURRISHOOLE FISHERY

The fishery was handed-over as an outright gift by its owners, Guinness Ireland Ltd. to the Trust on April 9, 1980, with effect from January 1, 1980. The opportunity is taken to place on record the Trust's deep appreciation of this generous gesture on the part of Guinness Ireland Ltd.

The hand-over ceremony took place in Newport in the presence of the Minister for Fisheries and Forestry, Mr. Patrick J. Power, T.D., when the Chairman of the Trust, Dr. Went, received the title deeds of the Fishery from the Deputy Managing Director of Guinness Ireland, Mr. Frank W. Peard. The Trust considers that the gift will allow of more efficient integration of the research programme on salmonid husbandry and census work with the practical aspects of administering a commercial rod-fishery.

4. PERSONNEL

Dr. T. F. Cross was appointed Assistant to the Director with effect from January 1, 1980. Mr. C. P. R. Mills, M.Sc. and Mr. J. O'Kelly, B.Sc. were appointed as Biologists, as from January 1 and February 1, respectively.

Following the handing-over by Guinness Ireland Ltd. of Burrishoole Fishery to the Trust, the three permanent employees of the fishery (Messrs P. J. Bryce, J. Collins and T. Keane) were appointed to the permanent staff of the Trust. Mr. J. Collins retired with effect from March 31, on reaching the age of 65, after 22 years service.

The manning of the Salmon Leap trap during summer and autumn floods was maintained with the help of two pairs of Temporary Scientific Assistants (Messrs D. Quigley, M. Gormley, K. Meyler and G. Singleton), during the period July 1 to December 20.

A number of candidates were interviewed for the newly-created post of Administrative Assistant and following the early resignation of the first appointee, the post was offered to Mrs. Lesley Mills, B.Sc., who accepted with effect from May 12.

5. INSTALLATIONS

The second elver trap (on the left bank of the Mill Race) was completed in May, in time for part of the elver run but it proved impossible to obtain the artificial grass climbing substrate. Teased out corlene rope fibre was used but proved unsuccessful.

The installations in the hatchery were changed during October from 22 asbestos-cement flumes to 8 x 1.5m diam. plastic tanks. The flumes were inefficient, in that artificial feeders could not be provided for that number of individual flumes. In consquence, the fry had to be restricted to hand-feeding during working hours instead of throughout the daylight hours in May and June. A disadvantage of the 8

tanks is that there is a proporationately greater risk of losses due to water supply failure or disease.

The Old Laboratory at Treanlaur was converted into a dwelling-house, having 2 bedrooms, bathroom, sitting room and kitchen, with solid fuel central heating.

Two 8m diam. rearing ponds, an outdoor hatchery and three stock ponds still exist at Treanlaur, where these facilities were used for research and commercial purposes during 1980.

Solid fuel central heating was also installed in the Salmon Leap bungalow, as well as one of the Trust's telephones.

The false floor of the Salmon Leap upstream trap was renovated and both trap floors were fitted with 2.5cm white plastic mesh, to enable trapped fish to be more easily discerned.

6. METEOROLOGICAL DATA

Despite a drought during April and May, 1980 proved to be the wettest year since records began at Furnace, in 1960. The total of 1972.1mm (70.6") was some 338mm more than the average for the ten years 1970-1979, or 123% of normal.

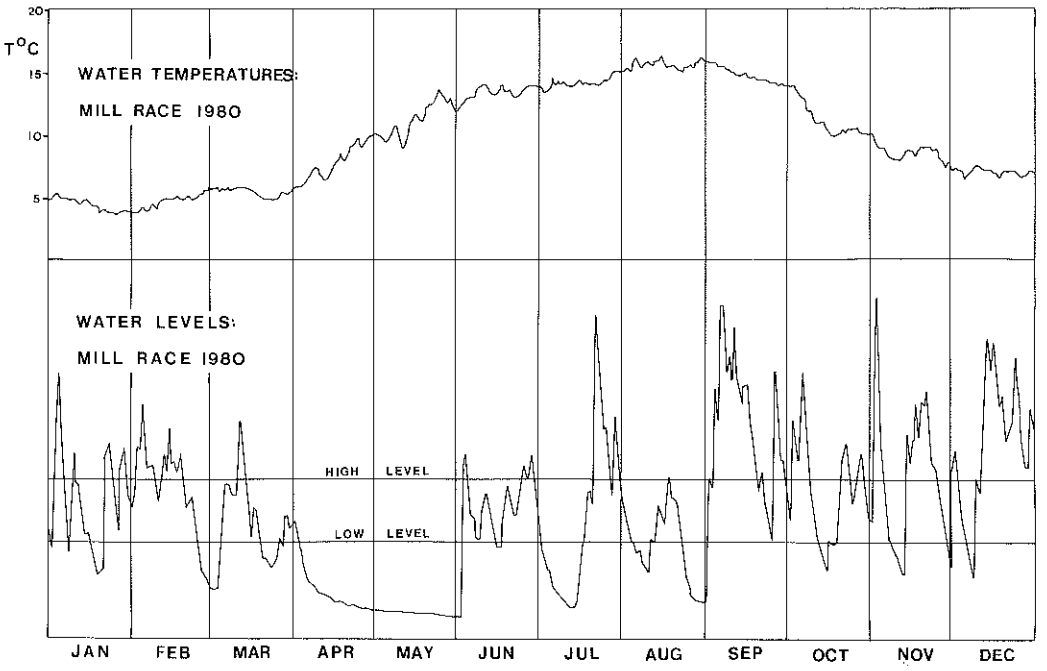
Only 42.7mm of rain were recorded during April and May but this was counterbalanced by almost 300mm in December (See Table 1.). The highest daily rainfall was 52.6mm on November 1. There was a prolonged period of low water during April and May as well as two brief periods during July and August. Three very high floods were recorded during the year, in July, September and November respectively, but each was of short duration. (See Fig. I).

Water temperatures were normal over the winter, with a minimum of 4°C during late January and early February. The water warmed up quickly in the spring and had reached 10°C by late April, almost a month earlier than in 1979. The summer water temperature was cooler than normal, as a result of the cool, wet weather, with daily maxima not exceeding 17°C and an average of 15°C for only 41 days during late July, August and early September. (See Fig. I). This probably contributed to the low incidence of furunculosis noted among the reared juveniles during 1980.

Table 1. Monthly rainfall totals (mm and ins.) for 1980 and annual totals for 1970-80.

January	:	133.6	1970	:	1655.6 : (65.2")
February	:	115.8	1971	:	1174.3 : (46.2")
March	:	129.2	1972	:	1275.4 : (50.2")
April	:	17.5	1973	:	1468.7 : (57.8")
May	:	25.2	1974	:	1573.2 : (61.9")
June	:	168.9	1975	:	1299.6 : (51.2")
July	:	154.7	1976	:	1266.7 : (49.8")
August	:	115.2	1977	:	1579.7 : (62.2")
September	:	260.2	1978	:	1592.2 : (62.7")
October	:	185.9	1979	:	1653.3 : (65.1")
November	:	193.0	1980	:	1792.1 : (70.6")
December	:	292.2			
Total: 1792.1mm (70.6")			Average: 1484.6mm (58.5")		

FIG. 1



7. VISITS AND COMMUNICATIONS

The Director attended a symposium organised by the European Inland Fisheries Advisory Commission at Stavanger, Norway in May, on the subject of "New Developments in the Utilisation of Heated Effluents and of Recirculation Systems for Intensive Aquaculture." This was followed by a study tour of aquaculture installions, including those of the Institute for Marine Research, Bergen and the Fish Breeding Experimental Station, Sundalsøra.

He also attended a Special Meeting on Diseases of Commerially Important Marine Fish and Shellfish, followed by the Statutory Meeting of the International Council for the Exploration of the Sea, held in Copenhagen during late September/early October.

Dr. Went and Dr. Cross attended the meeting of the Salmon and Trout Association held in Oxford during March. At this time, Dr. Cross also visited personnel in Wales and Scotland who were conducting research on sea trout.

Dr. Cross and Mr. O'Kelly attended the Irish Geneticists meeting held in Galway during April, where both presented papers. Mr. O'Kelly made a study tour of research centres in Scotland specialising in fish immunology during October.

Mr. Mills attended a symposium on freshwater cage culture organised by the Institute of Fisheries Management at Reading, during March. He also represented the laboratory at the annual meeting of the Irish Freshwater Research Group held at University College, Dublin in May.

The Director engaged in 6 days consultancy work for the Welsh Water Authority during August and the laboratory continues to be represented on the Salmonid Working Group organised by the National Board for Science and Technology.

SECTION B : SALMONID REARING

1. GRILSE OVA HATCHED IN 1978

Table 2. Survival during freshwater life.

Original stock of ova			78,243
Stock remaining on 31 December, 1978			49,667
No. of 1+ smolts produced in 1979			25,965
(3536 released, 22,429 to Curraun Fisheries Ltd.)			
No. of 1+ parr, estimated, remaining 31 September 1979			8,944
Losses in January, 1980	20		
February	25		
March	30		
April	1260		
Total losses	1335		
Biological samples	137	=	1,462
No. of 2+ smolts produced in May 1980			7,768

As : 2095 V brand, adipose fin clip, microtagged
(includes 81 "giant smolts" double V brand)
2101 V brand, adipose fin clip, untagged
(includes 19 "giant smolts")
1446 T brand, adipose fin clip (maintained at Treanlaur)
(includes 27 "giant smolts")
2126 2+ unbranded, adipose fin clip, vaccinated by intraperitoneal injection against **Aeromonas salmonicida**
69 2+ parr were adipose fin clipped and released at branding.

The figures for smolts released are based on actual counts, while the figure for stock remaining on 31 December 1979 is based on subtracting the cumulative mortality from the estimated stock at December 31, 1978.

The microtagged smolts formed part of a programme initiated by the Department of Fisheries, to test the efficacy of this type of marking, compared with conventional fin-clipping and freeze branding. Returning V-branded grilse in 1981 will be examined by means of a special detector for the presence of this microtag in the nasal cartilage. Market samples will be taken by the Department of Fisheries.

The 1446 fish which were maintained at Treanlaur were intended to form part of a morpholine-imprinting experiment. Due to late delivery of the morpholine, this work had to be deferred until 1981.

Difficulties were experienced in obtaining liquid nitrogen as required, in 1980, with the result that some fish were branded when they were fully transformed smolts, causing severe stress and consequent mortality, at this delicate stage.

A sample of 200 V-branded microtagged 2+ smolts had an average fork length of 16.0cm and an average weight of 54.9g at branding, (February 15, 1980) giving a

condition factor of 1.34. When the fish were checked for microtag loss (April 10, 1980), the average fork length of 100 fish was 16.3cm and the average weight 55.8g giving a coefficient of condition of 1.28.

No data is available for lengths and weights of the remainder of the two year old smolt releases, but they may be assumed to conform with the samples cited above. All the 2+ smolts were given a prophylactic treatment with oxytetracycline in their diet whilst being held in the release ponds, which were flushed out on April 28, 1980. No overt outbreak of furunculosis occurred in the smolts awaiting release, although **Aeromonas salmonicida** was isolated from some of the fish which died in the release ponds, reflecting the presence of latent furunculosis.

The returns expected from the unbranded, intraperitoneally vaccinated fish (due to disease outbreak in rearing pond before release) and those from the T-branded fish (due to disease outbreak at Treanlaur) are expected to be lower than would have been the case had they remained healthy. The latter two groups of fish were transported to the Front Weir (see Frontispiece map) and released into the brackish water of Burrishoole River on April 28, 1980. (Note that mortalities from disease among 2+ smolts and other fish are discussed more fully in Section B5).

2. GRILSE OVA HATCHED IN 1979

Table 3. Survival during freshwater life.

Original stock of ova		244,316
Ova transferred to Burrishoole Fishery		116,442
Ova transferred to Curraun Fisheries		31,232
Stock retained for on-rearing		96,642
Stock remaining December 31, 1979		51,274
Losses in January	420	
February	309	
March	580	
April	1206	
May	2006	
June	520	
July	161	
August	51	
September	57	
October	47	
November	29	
December	114	
Total losses	5500	
No. of 1+ smolts released in May 1980		2,958

As : 2,258 "S" branded, adipose fin clip, microtagged
516 unbranded, adipose fin clip
21 unbranded "giant parr", adipose fin clipped and released in August and September.
163 unbranded, adipose fin clip, thyroid-fed parr, survivors of sea-water challenge experiment at Bellacragher Bay.

Loss in sea-water challenge experiment	1,570
1+ parr sold in 1980	21,716
As : 1,466 to Curraun Fisheries Ltd. (as "silver parr")	
10,050 to Ardbear Sea Farms Ltd.	
10,200 to Dept. of Fisheries and planted in the Glenamoy River, June 1980	

1,060 1+ parr were supplied to Mr. Sean Nixon, Western Regional Board of Conservators, Cashel, Connemara in return for sea trout eggs supplied earlier.

Approximately 6,000 1+ parr were held at Treanlaur and from this batch a number considerably in excess of 4,000 were placed in tributaries of Lough Beltra to the order of the Glenisland Cooperative Society. The apparent loss here was due mainly to the fact that these fish had to be transferred to an old rectangular pond whilst a batch of 2+ smolts was branded and a large number of the small yearling fish were not recovered.

The total disposal of 1+ parr was therefore at least 26,776 although the exact number transferred to tributaries of Lough Beltra was not counted, in order not to impose undue stress on the fish. Stock of yearling fish (presumptive 2+ smolts) remaining on December 31 was:

Treanlaur rearing ponds (incl. 1,430 microtagged)	4,010
Hyperosmotic and dip-vaccination experiment	5,965
Remaining microtagged fish	2,084
Total	12,059

The S brand one year old smolts released in May 1980 had a mean fork length of 12.7cm on February 13, 1980; by April 10, the mean length had increased to 13.5cm, with a mean weight of 26.5g and a coefficient of condition of 1.08.

The 516 unbranded 1+ smolts were removed from the parr population in early June during grading and counting operations. They were fin clipped and released directly into Lough Feeagh.

The 21 "giant parr" released in August and September were removed from the 1+ population. These fish would have become 2+ "giant smolts" which have been found to have poor survival to adults. The growth and food conversion of the remaining yearling parr benefits from their being graded out of the population. They were not included in the 1+ smolt figures.

3. GRILSE OVA HATCHED IN 1980

Table 4. Survival during freshwater life.

Original stock of ova (volumetric estimate)		76,600
Losses in:		
November 1979	25	
December 1979	2,201	
Remaining stock December 31, 1979		74,374

Losses in January 1980	470	
February	2,960	
March	4,353	(+ 20,000 sold)
April	1,716	
May	4,915	
June	1,887	
July	1,056	
August	1,302	
September	502	
October	320	
November	458	(265 due to accidental interruption in water supply)
December	85	
	20,024	

Actual stock remaining 31 December 1980 36,874
Estimated stock remaining 31 December 1980 34,388
(Difference due to volumetric estimation of ova numbers)

Survival over the first year from eyed ova (March) to end-of-year parr was 36,574 from 50,982 or 72%. These yearling salmon parr comprised:-

6,817 Large grade : Average length 126mm
10,507 Medium grade : Average length 94mm
19,250 Small grade : Average length 70mm

4A. GRILSE OVA LAID DOWN IN 1980

By contrast with 1979 when no UDN or fungus was observed among the broodstock, the 1980 season proved to be very troublesome in these respects, in the holding pens at Furnace. Grilse derived from reared smolts were transferred to the pens from the traps, commencing September 4, and by September 16, a total of 17 grilse had died, showing signs of UDN and secondary fungus infection. By September 23, a further 15 fish had died and the pens were abandoned for broodstock retention in favour of a cage moored in brackish water at the southern end of Lough Furnace.

Of 33 broodstock transferred to this cage by October 15, 20 were killed by one or more seals which harried and bit the fish through the meshes of the net. (Seals are protected species but a licence can be granted to shoot them, after damage has been proven.)

The surviving 13 broodstock grilse were removed to a disused rearing pond at Treanlaur and a further 51 fish added from captures and recaptures in the traps. A total of 33 females and 31 males were used in hatchery operations, producing an estimated 115,800 ova. This volumetric estimate at the fertilised egg stage is checked by a further count at the eyed ova stage.

Kelts were released immediately after stripping.

Table 5. Grilse fecundity values (as eyed eggs).

No. of females	:	33
Vol. of ova produced	:	24.07 litres
No. of ova produced	:	115,800
No. of ova per fish	:	3509
No. of ova per litre	:	4810
Av. wt. female fish	:	2.45kg
No. of ova per kg wt.	:	1432

4B. SEA TROUT OVA HATCHED IN 1980

The initial stocks of ova were estimated volumetrically, those from Connemara being at the eyed stage when received in January, 1980.

Very heavy mortalities of early feeding fry due to bacterial gill diseased occurred in April and May. The remaining fish were removed from the hatchery flumes into two 2 metre ponds on June 12 and from these, into two circular ponds on July 21 and 22. When measured on August 13, fork lengths averaged 63.9mm and 65.4mm for "Burrishoole" and "Connemara" sea trout respectively. A hand count on August 27 showed that the numbers of dead fry removed (probably mainly from the hatchery flumes) had been grossly underestimated. Only 2790 "Burrishoole" and 1753 "Connemara" sea trout were counted as opposed to estimates of 3342 and 3642 respectively. The "Burrishoole" sea trout had grown to an average fork length of 99mm by November 19, whereas the "Connemara" sea trout averaged 105mm on that day. Also on November 19, the adipose fins were removed from the "Connemara" fish and they were moved into the same circular pond as the "Burrishoole" sea trout. Mortalities were low until the end of the year.

Table 6. Survival during freshwater life.

		Burrishoole	Connemara
Original stock of ova		33,282	15,500
Losses in November and December 1979	:	221	—
January 1980	:	248	171
February	:	574	204
March	:	703	108
April	:	3,585	2,190
May	:	22,378	8,947
June	:	550	208
July	:	55	21
August	:	23	9
September	:	19	6
October	:	10	79
November	:	8	6
December	:	11	29
Total recorded deaths	:	28,385	11,978
Biological samples	:	1,439	15
To Curraun Fisheries Ltd.	:	200	—
Actual stock remaining December 31, 1980	:	2,717 (8%)	1,618 (10%)

4C. SEA TROUT OVA LAID DOWN IN 1980

Collection of broodstock from the traps began in mid-August. Sea trout were injected with oxytetracyline and placed in the freshwater holding pond at Furnace. By October 7, 29 fish had died of 'fungus' disease and the 4 which remained alive were transferred to the circular rearing ponds at Treanlaur. During the remainder of October and November, broodstock were transferred directly from the traps to Treanlaur. Only one further mortality occurred and the fish were stripped in November using two or three males to each female. Thirteen males were used at weekly intervals to fertilise the ova from a total of 12 females.

A further 10,400 sea trout ova were obtained from the Gowla river system in Connemara, with the kind co-operation of Mr. Sean Nixon, Western Regional Fisheries Board.

Table 7. Sea trout fecundity values.

No. of female fish	:	12
Vol. ova produced	:	1.66 litres
No. ova produced	:	10,337
No. ova per female	:	861
No. ova per litre	:	6227

5. INVESTIGATIONS OF MORTALITIES AND THERAPEUTIC TREATMENTS: FEBRUARY TO DECEMBER 1980.

a) Salmon parr and smolts.

The major cause of mortality in February and March among the 2+ salmon was fungus disease or infection. Some 2-years-old parr also exhibited deep ulcers and these fish gave cultures of **Pseudomonas flourescens** from ulcers and kidneys. One isolation of **Aeromonas salmonicida** was made from a 1+ smolt in March.

In April, the major mortalities (apart from those in the hatchery) were among the intraperitoneally vaccinated 2+ fish and the T-branded 2+ fish at Treanlaur. Mortalities among the 1+ smolts and the unvaccinated 2+ smolts at Furnace were light and were due to furunculosis and fungus infection in the release pond.

Mortalities among the vaccinated 2+ smolts were due to infection with **A. salmonicida** and **P. flourescens.** These fish were injected intraperitoneally with formalin-killed **A. salmonicida** bacterin in Freund's Complete Adjuvant on April 1, 1980. It was not feasible to change needles for individual fish when injecting large numbers. Twelve fish were culled during the injection procedure because they had ulcers similar to those described above. Three of these gave cultures of **P. flourescens.** A number of other fish with early lesions (presumably of a similar nature) were injected with the rest of the population. The vaccine preparation contained no antibiotics. These are usually included, but it was felt that ideally, an experiment to test a vaccine should not involve injection of antibiotics.

Ten days after injection, 55 fish were dead in the vaccinated pond. Twenty of these were examined, all of which were precocious males with diffuse haemorrhaging on the surface of the testes. One fish gave no culture, one gave a culture of **A. salmonicida** and eighteen gave cultures of **P. flourescens.** The antibiotic sensitivity pattern of these and all subsequent isolates of **P. flourescens** from the outbreak were the same as those obtained in February and March, indicating that the same strain of bacterium was involved.

Oxytetracycline therapy commenced on April 12 and of fourteen fish examined during the remainder of the outbreak, four gave pure cultures of **P. flourescens,** three gave mixed cultures of **P. flourescens** and **A. salmonicida** and seven gave pure cultures of **A. salmonicida.** Towards the latter half of the outbreak, the proportion of precocious males in the dying fish was found to be almost 50%. The total cumulative mortality was 869 (21.8%).

Many of the fish may have been infected systemically by **P. flourescens** as a result of the presence of the bacterium in some of the fish injected with the same needle, but this alone would not seem to account for the mortality.

In the light of subsequent experience following branding at Treanlaur, it is suspected that the outbreak was probably largely stress-mediated, in that the fish were already advanced smolts and sensitive to handling when the vaccination was carried out. The fact that a higher proportion of precocious males than females existed among the dead fish early in the outbreak lends support to this hypothesis.

The disease outbreak at Treanlaur occurred after the 2+ smolts held there since February were branded in mid-April. The mortalities were due to furunculosis and fungal infection, with a cumulative mortality of 19.2%. Both groups of 2+ fish (T-branded and vaccinated) were released on April 28, as soon as the mortalities had subsided.

b) Hatchery fry (salmon and sea trout)

Very heavy mortalities of sea trout fry due to myxobacterial gill disease occurred in the hatchery from April to June. The losses for these three months were of the order of 79.3% in the Burrishoole sea trout and 72.8% Connemara sea trout.

Salt, betacide and Chloramine T did not control the mortalities. In retrospect, it would seem that first-feeding of these fry should have commenced earlier. This, combined with the lack of an effective treatment such as "Furanace" early in the outbreak, might explain the severity and duration of the problem.

Myxobacterial gill disease also affected the salmon fry but all of these fed well throughout and the total loss from April to June was only 12.7%. It should also be noted that the salmon were derived from four generations of hatchery reared parents whereas the trout were the progeny of wild fish. A fungal problem was experienced in June among the salmon fry in the hatchery; this was severe in only one flume and was controlled by salt baths, twice a day.

c) Yearling salmon parr (excluding smolts) and sea trout.

The 1+ parr were subject to outbreaks of furunculosis during April and May.

On the basis of the percentage of the fish which gave cultures of **A. salmonicida** on bacteriological examination, 91.6% of deaths in April (1104), 85% in May (1705) and 61% in June (317) were due to furunculosis, with an overall April-June figure of 75%.

Mortalities in individual ponds where outbreaks occurred expressed as a percentage of the number of fish present at the beginning of the outbreak were 16% in two cases and 7% in a third, whilst some of the ponds escaped an outbreak entirely.

The "Connemara" sea trout suffered mortalities due to furunculosis in September and both the "Connemara" and "Burrishoole" sea trout suffered further mortalities from furunculosis in December. Neither outbreak involved serious losses.

Sea trout seem to be disturbed during rearing by human activity to a far greater extent than salmon and this may have some bearing on their resistance to disease.

The strain of **A. salmonicida** isolated during 1980 was sensitive to Oxytetracycline and Tribrissen and no problems of resistance emerged during the year.

Papilloma appeared among the 1+ salmon parr during the summer. All affected fish were placed in one of the release ponds, together with a further group of fish at a later date, all of which were moved to Treanlaur at the end of December. The remaining 2+ population was almost entirely free of papilloma which suggests that the condition may be infectious. Previous experience has shown there to be a spontaneous remission of the papillomatose condition in late winter.

6. VACCINATION OF 2+ SMOLTS AGAINST *AEROMONAS SALMONICIDA* BY INTRA-PERITONEAL INJECTION.

A typical, fresh strain of the "rough" or agglutinating form of **A. salmonicida** was used in the preparation of this vaccine. The culture was checked for purity and subcultured twice only so that it would remain as virulent as possible. The identity of the organism was confirmed by latex agglutination.

Cultures (10ml) of the organism in Brain Heart Infusion (B.H.I.) (Oxoid) were used to inoculate 1500ml flask cultures of B.H.I. All cultures were checked for purity and for absence of breakdown to the smooth non-agglutinating (and less virulent) form, before they were used in the production of the vaccine. After 48 hours incubation, the cultures were killed by adding 10ml (0.6%) formalin to each flask. The flasks were then incubated for a further thirty-six hours and all cultures were grown at 22°C in an incubator.

The bacterium was harvested by centrifugation, washed four times in 0.85% sterile saline to remove the formalin and resuspended in a final volume of 100ml sterile 0.85% saline giving a cell density of 10^{10}/ml.

The bacterin preparation was tested for non-viability by spreading 0.5ml on Tryptone Soya Agar (Oxoid) and inoculating 0.5 ml into 10 ml Tryptone Soya broth. The preparation was then frozen and stored at -20°C to await injection; no antibiotics were added. On the morning of the immunisation, thawed preparation was blended with an equal volume of Complete Freunds Adjuvant (Gibco) to produce an emulsion which would not disperse in water. This mixture was then re-emulsified with an equal volume of 2% Tween 80 in sterile saline (0.85%) to produce an emulsion which did not clog the valves of the self-refilling syringes.

The emulsion was injected intra-peritoneally into 3,026 2+ salmon parr using two Soccorex 1ml self-refilling syringes with 25 gauge needles, changing these when they became blunted. The fish were anaesthetised with benzocaine and fin-clipped as they were injected. 31 fish failed to recover from anaesthesia, leaving a total of 2,995 fish. A total mortality of 869 occurred between April 8 and April 28 (29%), resulting in a release of 2,126 fish, which were unbranded.

Returns of adult fish from these releases are expected in 1981 or 1982. the smolt age of unbranded fish on return as adults will be determined by scale-reading.

7. VACCINATION OF 1+ SALMON PARR AGAINST *AEROMONAS SALMONICIDA* BY SIMPLE IMMERSION (DIP) AND HYPEROSMOTIC INFILTRATION (H.I.)

The vaccines were prepared from a recent SRTI isolate of **A. salmonicida,** confirmed by latex agglutination. The inactivated culture was prepared in the same way as for the injected vaccine and was treated for 24 hours with 0.6% formalin. Samples from which the formalin was removed by centrifugation were tested for inactivation in the manner already described.

The composition of the control solutions and vaccine solutions were as follows:

Dip control		**Dip vaccine**	
Sterile uninoculated BHI	(1 vol.)	Inactivated **A. salmonicida** culture	(1 vol.)
Buffer solution	(2 vols.)	Buffer solution	(2 vols.)
Hyperosmotic control		**Hyperosmotic vaccine**	
Sterile uninoculated BHI	(1 vol.)	Inactivated **A. salmonicida** culture	(1 vol.)
Buffer solution NaCl 5.3%	(2 vols.)	Buffer solution NaCl 5.3%	(2 vols.)

The final concentration of the buffer constituents in the vaccine and control solutions was KCl 0.2g/l, Na_2HPO_4 0.2 M, KH_2PO_4 0.2 M.

On April 26, the drums containing the vaccine solutions were placed in the rearing pond to allow the temperature of the solutions to equilibrate to the ambient. The fish were exposed to the solution by placing 2.27kg of fish in a sieve-bottomed cylindrical container and immersing them in a bucket containing 7 litres of solution. Each group of fish consisting of 3 aliquots were then placed in separate ponds. On June 24, the vaccinated fish from each treatment were fin-clipped and placed in a circular pond with their respective un-clipped control fish. From then on, specific mortalities were recorded as clipped or unclipped, in these two ponds. All four groups were measured and weighed three times, between late April and mid-November, as shown in Table 8:-

Table 8. Growth of immunised and control fish.

	26/4/80		14/8/80		7/11/80	
	No.	Mean Wt.	Mean Wt.	Mean L.	Mean Wt.	Mean L.
Dip Control	1611	4.22g	23.7	11.90cm	35.59g	14.37cm
Dip vaccine	1703	3.99	20.8	11.30	38.25	14.00
H.I. control*	1529	4.45	27.9	12.61	46.62	14.82
H.I. vaccine*	1573	4.32	28.3	12.52	41.00	14.60

*H.I. = hyperosmotic infiltration

The lengths and weights of all four groups of fish on November 7 compared favourably with those for the remainder of the 2+ population (mean length 15.3cm, mean weight 45g) awaiting release as 2+ smolts in 1981.

Table 9. Cumulative mortalities 24/6/80 to 31/12/80

	No. on 26/4/80	Total mortality (24/6 to 31/12)	
Dip control	1611	62	(3.84%)
Dip vaccine	1703	84	(4.9%)
H.I. control	1529	156	(10.2%)
H.I. vaccine	1573	149	(9.4%)

Total mortality in all four groups : 451
Total % mortality in all four groups : 7%

There was little difference between the mortalities in the control and vaccinated groups. Mortality for the same period among the 1+ population as a whole expressed as a percentage of the estimated stock in April, 1980 was 8.3%.

A total of 115 fish which died in the experimental groups were examined in the laboratory. Material from the anterior kidney was streaked on Tryptone Soya agar (Oxoid), incubated at 22°C, with the following results:-

Table 10. Cause of mortalities in immunisation experiments.

	Dip control	Dip vaccine	H.I. control	H.I. vaccine	Total
A. salmonicida	Nil	Nil	Nil	Nil	Nil
No culture	6	7	24	30	67
Fungus	Nil	3	4	11	18
Tail rot	1	2	2	3	8
Other bacterial	3	7	3	5	18
Fungus/bacterial	2	1	0	1	4

No outbreak of furunculosis occurred in these fish either prior to vaccination or from the time of vaccination onward and no isolation of **A. salmonicida** was made. This was unexpected since a sample of 2+ pre-smolts at Furnace in March 1980 were found to have a latent infection rate of 15% and an occasional isolation of **A. salmonicida** would not have been unusual.

Fourteen of the "no culture" deaths which occurred in the H.I. control group and thirty such deaths in the H.I. vaccine group during July were attributable to heron predation (fish showed beak marks). When the combined Dip groups were counted in early August, the total was 122 short of the estimated stock remaining, whilst the count for the combined H.I. groups was 195 short of the expected total, so that herons may have taken a considerable number of fish.

8. "DEMAND FEEDING" OF SALMON PARR

An attempt was made to train 1+ salmon parr to use a demand feeder, involving their learning to move the end of a pendulum suspended just under the water surface in order to discharge food from a hopper overhead. This work was undertaken by Mr. M. Gormley, U.C.G.

The demand feeder was installed on July 24, being mounted on a specially designed stand in one of the release ponds, where the current of water was not as rapid as in a circular rearing pond. In addition, the feeder was installed over an area of the pond known to be favoured by the fish. Since yearling rainbow trout are said to be easily trained in the use of a demand feeder, 9 of these fish were added to the pond population of 2800 1+ salmon parr, in the hope that the trout would "lead" the salmon.

Initially, the pendulum was activated by a length of polythene thread which could be jerked at a distance of 4m from the feeder, from the place where hand-feeding normally occurred. Fish were thus fed "manually" from the demand feeder, at intervals of 1-3 hours.

For the first two days, none of the fish would approach the feeder but gradually grew accustomed to food appearing underneath it, eventually moving the pendulum themselves during feeding activity initiated manually. This activity increased markedly after a month of manual initiation of feeding but it still appeared that the fish were not initiating food discharge themselves. This was confirmed after 30 days

trial by measuring the level of food in the hopper and leaving the fish to fend for themselves for three days. Nothing occurred for the first two days but all the food was used on the third day. This was not considered conclusive evidence however and the trial had to be terminated at this point. It appears that it is difficult to train salmon parr to "use their heads," in more senses than one.

9. THYROID FEEDING EXPERIMENT

Fresh frozen pigs thyroid was incorporated into the diet of a group of small grade potential 1+ salmon smolts. 1870 fish averaging 7g at the start of the experiment were fed equal proportions of minced thyroid and dried fishmeal pellets at 4% of body weight for three weeks, commencing April 21. After this time, a sample of 175 fish were found to have an average weight of 15.1g representing an increase in body weight of over 100% in a three week period, a high growth rate compared with that normally found for hatchery fish. The majority of the fish appeared morphologically to be smolt-like, being silvery, with a blunted head and low coefficient of condition.

The fish were transported to a sea water site on May 14 and piped out into a specially constructed experimental cage. The water temperature was high for the time of year (15°C) with a salinity of 27 parts per thousand. After 24 hours sea water challenge, 53% of the fish had died, increasing after five days to 75%. After 1 month, 90% of the original stock fish had died and the survivors were fin clipped and released.

Although the thyroid feeding had obviously promoted a pseudo-parr-smolt transformation and acted as a growth stimulator, the average size of the fish on sea water challenge was only 15g. c.f. 40g in normal hatchery smolts and 25-30g in wild smolts. It would appear that the thyroid fed fish had not reached the critical size necessary to osmoregulate successfully in an hyperosmotic environment.

SECTION C : CENSUS WORK ON FISH MOVEMENT

1. WILD SALMON

(i) Upstream movements

a) Timing and numbers

No upstream movement of 2-sea-winter fish was possible during April and May, due to low water conditions (see Fig. I), but during June, 42 wild spring fish were counted upstream. A further 4 were noted in July and there was a small run of 3 summer fish in September, bringing the total of 2-sea-winter fish to 49. This improvement in the 2-sea-winter fish run was common throughout Irish rivers in 1980 and in many rivers, grilse runs too, were thought to be above normal. This was not the case for the count of wild grilse through the traps on the Burrishoole river system.

The total of 637 maiden grilse was only slighly better than that of 1977 (607) and was characterised by good numbers in the early part of the season, followed by a poor late run. Almost 70% of the entire run was recorded in June and July so that the legal netting (which ceased officially on July 25 along the northwest, west and southwest coasts) was directed against the major portion of the run. The run in August was very poor and may have been influenced by a known carry-over of illegal drift-netting in the sea. There was an improvement in September, when lengthy periods of high water conditions encouraged the upstream escapement of late-running grilse.

The poor grilse run was due, in part, to the poor smolt run in 1979, as will be evident from section (d) following, but the freshwater production rate of these smolts was normal, so that the low smolt total is attributable to the low spawning escapement in 1976.

b) Net-marked grilse

Net marks were first observed with some frequency, as from June 25. From that date, to the end of June, 56% of the upstream run was net-marked. Grilse migration slowed down in the early part of July, due to low water conditions and when it resumed on July 20, the incidence of net-marked fish for the remainder of the month was 22%. During August, the incidence increased again, to 33%, indicating that illegal netting was continuing, after the end of the legal netting season. Virtually no net-marked fish were seen after the beginning of September but occasional wild fish infected with papillomata were seen from mid-September onwards. One grilse was net-marked when seen in the Salmon Leap trap on Ocober 11.

c) Spawning escapement

No planting out of eyed ova or surplus hatchery-reared fry took place in 1980, thus maintaining the objective of allowing the wild stocks to achieve a natural survival rate, without any artificial enhancement.

In contrast to 1979, when no UDN was observed, the condition first appeared on an upstream-migrating grilse on October 5, 1980, and on a sea trout on October 24. Three further grilse were noted as affected in October, one in November and one in December, so that it must be assumed that the spawning population was affected. This is borne out by the high proportion of grilse and sea trout kelts with terminal UDN and fungus noted in the downstream traps from mid-November onwards. It is not known whether the papillomatous condition of some wild fish would predispose them to infection by UDN. The otter population attacking fish in both the Mill Race and the Salmon Leap continued their depredations in 1980. In addition, a number of salmon were noted with bad wounds, thought to result from the presence of one or more seals in Lough Furnace and from the expanding colony of common seals on the northern side of Clew Bay.

Table 11 gives the comparative escapements of wild salmon and grilse through the traps since 1970, expressed as the five-year-averages for 1970-74 and 1975-79, with the relevant annual totals for 1980. Details of earlier annual runs may be found in Ann. Rep. No. XXIV, Table 8.

Table 11. Comparative escapements of wild salmon and grilse.

	Mill Race		Salmon Leap		Total	
Year	Salmon	Grilse	Salmon	Grilse	Salmon	Grilse
1970-74	7	630	7	515	14	1145
1975-79	9	278	27	425	36	703
1980	28	278	21	359	49	637

Table 12 shows the monthly percentages of the combined total run of grilse through the traps in 1980 compared with the 5-year averages for 1970-74 and 1975-79. Figures in parentheses for 1980 are the actual monthly counts of grilse.

Table 12. Monthly proportions of the grilse run.

	1970-74	1975-79	1980
May	—	1.0	—
June	5.8	15.6	28.6 (182)
July	18.9	17.7	40.8 (260)
August	26.8	24.1	8.5 (54)
September	25.5	26.2	16.5 (105)
October	17.6	13.7	3.7 (24)
November	4.8	1.4	1.1 (7)
December	0.6	0.3	0.8 (5)

Details of the runs, rod catches in Lough Feeagh, escapements and maximum spawning stocks for wild and reared fish are given in Table 13 (a). With the observed incidence of UDN among some upstream-migrating fish in the autumn and amongst the early kelts, it was judged advisable to allow for a 5% pre-spawning mortality among wild fish from this cause. The mortality for reared fish includes the known number of deaths (55) with the addition of 5% of the escapement, making 60 deaths in all.

Table 13 (a). Spawning stock of salmon and grilse.

	Wild & previously spawned grilse	Wild Salmon	Reared Fish
Counted through traps	651	49	151
Rod catch, L. Feeagh	36	0	5
Hatchery use	0	0	64
Mortalities (UDN etc.)	33	3	60
Escapement	582	46	22
Maximum spawning stock	650		

Table 13 (b). Comparative figures for spawning of previous years.

	Maximum escapement	Reared fish component
1970	1136	236
71	609	52
72	1654	377
73	1522	27
74	708	8

75		842	47
76	(i)	736	15
77	(ii)	632	13
78	(iii)	491	62
79		926	72
80		650	22

(i) includes 11 females whose progeny was planted in 1977
(ii) includes 25 females whose progeny was planted in 1978
(iii) includes 29 females whose progeny was planted in 1979

d) Survival from brood year ova to smolts and grilse.

The wild grilse in 1980 were derived from the 1976 spawning escapement (brood year) which was 736 (maximum), including a reared fish component of 15. (See Table 13 (b) above). If it were assumed that the reared fish component failed to spawn normally, the minimum escapement would have been 721. In all these calculations (see Ann. Rep. XIX, 1974 for original data parameters), a range of 50-55% females in the escapement is assumed, as well as a range of 4000-4115 ova per female. By these means, an average and a minimum figure can be calculated for ova deposited during the 1976-77 winter (Table 14). The resulting grilse total of 647 is the trap count of upstream migrating fish (651) with the addition of wild rod-caught grilse from L. Furnace (10) and the subtraction of previously-spawned wild fish (14).

Table 14. Survival from ova to grilse.

Spawning escapement	721-736
No. of females	360-405
Ova deposited	1,440,000-1,666,575
No. of smolts produced	8276
Survival (ova to smolt)	0.57-0.50%
No. of returning grilse	647
Survival (smolts to grilse)	7.82%
Survival rate to grilse per 1000 ova	0.45-0.39
Survival to grilse per grilse female	1.80-1.60

Comparable results from the seven brood-year-classes now available are:

Table 15. Comparative survival rates.

Brood-year-class	Survival rates ova to smolts	Survival rates to grilse per 1000 ova	Survival rates to grilse per grilse female
1970	0.44-0.63%	0.36-0.52	1.48-2.06
71	0.72-0.89%	0.67-0.76	2.83-3.29
72	0.39-0.57%	0.24-0.35	0.97-1.39
73	0.47-0.54%	0.19-0.22	0.80-0.89
74	0.40-0.45%	0.24-0.28	1.00-1.11
75	0.52-0.63%	0.49-0.59	2.03-2.37
76	0.50-0.57%	0.39-0.45	1.60-1.80

Note that the survival rate from grilse female spawner in 1976 to adult grilse in 1980 has fallen below 2.0, accepted as the required level for a self-sustaining population. This indicates that commercial exploitation of the species was, once again, too high.

Survival during freshwater life from egg to smolt was normal, indicating that there has been no degradation of the freshwater environment.

(ii) Downstream movements

a) Smolts: Timing and numbers

The salmon smolt run in 1980 was totally aberrant in that very low water conditions during April and May inhibited the normal smolt run during those months, almost entirely. When the drought broke in early June, the bulk of the smolt run passed down through the traps in 6 days (June 3-8), involving some 11,000 specimens. The smolt total was 11,208, composed of 8158 at the Salmon Leap and 3050 at the Mill Race.

The salmon smolt total of 11,208 was a distinct improvement over the previous three years and more nearly approaches the 5-year-average (11,397) for the years 1975-79. It represents above average survival from ova hatched in 1978.

It seems unlikely that the delayed smolt run will affect the timing of the grilse run in 1981 since a delay of three weeks in the 1979 smolt run had no effect on the timing of the 1980 grilse run.

As in previous years, occasional specimens of fin-clipped salmon parr were noted in the downstream traps during the autumn. Scale-reading disclosed that these were 2+ fish and they are thought to have been derived from precociously mature males in the 2+ reared smolt population, which had not migrated to sea in the previous spring.

b) Survival of salmon smolts

The following values were derived from the known numbers of salmon smolts counted through the traps each year and the total stock of returning wild adults in the two succeeding years. The total stock is calculated from the count of wild maiden grilse through the traps, plus the rod-catch of wild grilse of Lough Furnace and the trap catch of two-sea-winter fish in the following year. Table 16 shows these values for the 5-year-averages of 1970-74 and 1975-79, with the individual year's values for 1980:-

Table 16. Salmon smolt survival rates.

	Trap count	Furnace rod catch	2 SW fish	Total	Relevant smolt total	% survival
Av. 1970-74	1146	120	31	1297	13,183	9.8
Av. 1975-79	700	62	35	797	11,397	7.3
1980	637	10	N/A	647*	8,276	7.8

*Survival to grilse only; spring and summer fish not due until 1981.

c) Tagging of wild smolts

No wild salmon smolts were tagged in 1980.

d) Salmon kelts

Table 17. Timing of salmon kelt run.

	Counted through traps	
December 1979	41	
January 1980	68	
February	44	
March	185	
April	2	
May	31	
June	64	
Total	435	incl. 29 fin-clipped = 406 wild kelts

A number of kelts had collected above the fish fence on the Mill Race in low water during May, where it was feared they would contract UDN/fungus or be killed by otters. The downstream trap was opened for an hour on each of four days, resulting in the capture of 31 kelts. The trap could not be left open for longer periods without risking an interruption to the rearing pond water supply.

Survival to the kelt stage was good, at 47.5% of the upstream escapement, compared with 25.8% in 1979. This was due to a low level of UDN/fungus infection, also reflected in the high proportion (30%) of males in the downstream kelt run. The proportion of healthy kelts in the total run was the highest to date, 90%. These details are embodied in Table 18.

Table 18. Comparisons of annual kelt runs.

	A	B	C	D	E
1975	72	23	16	33	7.0
76	68	14	20	23	6.7
77	78	19	15	29	7.9
78	70	31	14	41	10.9
79	86	5	6	26	8.0
80	90	30	6	48	6.9

A : % healthy kelts in kelt run.
B : % males in kelt population.
C : lightly marked with fungus.
D : % surival from escapement.
E : % recaptures in first year.

As is usual, almost 75% of the salmon kelts emigrated through the Salmon Leap trap, largely during high water periods in March.

There were 24 recaptures (6.9%) from 348 wild kelts tagged in 1979/80 comprising 14 through the traps (+ 1 with tagging thread only), 1 rod caught fish from L. Furnace and 8 from N. Mayo drift nets. One recapture was a male, this being the first previously-spawned male to be recorded for over ten years, the period when UDN/fungus infection has been prevalent.

The mean growth increment in the sea was 6.5cm over a mean absence period of 139 days. One fish spent only 51 days in the sea, growing a mere 2.0cm. Both the mean growth increment and the mean absence period were rather less than the 5-year-average for 1975-79 (7.2cm and 176 days respectively).

e) Ulcerative Dermal Necrosis

1979-80 Spawning Season.

As will be apparent from the preceeding section, UDN infection was at a very low level in the 1979-80 season. None of the hatchery broodstock contracted infection and only 16 wild fish were noted as badly affected (Condition C) and 25 lightly affected (Condition B) throughout the entire kelt run of 435 specimens. As is usual, the height of the infection was confined to the immediate post-spawning period of December and January.

1980-81

The first downstream migrating grilse affected by UDN/fungus were seen in late November but the condition was noted as early as October 24 on a sea trout in the Mill Race downstream trap. A further 8 affected sea trout were noted during November.

During December, an appreciable number (43) of grilse kelts exhibited moderate to severe infection, these constituting the bulk of the downstream run of wild fish for the month. The infection was not confined largely to males, as in previous years; over 40% of the affected fish were females. In addition, the incidence of infection among sea trout increased sharply, to 20% of the downstream migrants in December. In 1979, the relevant proportion was less than 2%.

Taken in conjunction with the early appearance of UDN/fungus infection amongst sea trout and grilse broodstock, referred to in Section B 4A, it will be apparent that there was an unwelcome resurgence of this disease condition in 1980. It cannot be attributed to any known stressful environmental factor, as the summer and autumn of 1980 was cooler and wetter than normal.

2. REARED SALMON

(i) Upstream movements

The overall recapture rate from reared smolts declined to 1.56%, this being due to a very poor return rate (0.48%) from 1+ smolts released in 1979. The 2+ smolts released at that time returned at 2.17%, almost exactly the same rate as in the previous year. The reason for the comparative failure of the 1+ smolts is not certain but seems likely to be connected with their late and rather hurried release from the rearing ponds, without sufficient "acclimatisation" and self-release from the release ponds. There was no evidence of an unduly high level of latent furunculosis among the 1+ smolts. The recapture rate from 2+ smolts has not exceeded that of 1+ smolts since 1975. (See table 19).

A notable feature of the returns in 1980 was the recording of seven 2-sea-winter fish, derived from smolts of grilse parentage (four generations) released in 1978. Brand marks were visible on 5 of the fish and it is assumed that the remaining two originated from a batch of 4758 one-year-old smolts which were not branded. Three of the 2-sea-winter fish had been 2+ smolts and the remaining four were derived from 1+ smolts.

In addition, a further 7 of the recaptures were short-absence previously spawned grilse, 3 of which bore Floy tags attached in 1979 when the fish passed upstream, as grilse. Of the remaining 4, 2 were of branded 2+ smolt origin and 2 of 1+ smolt origin, only 1 of which was branded. Brand marks and designations were confirmed by reading the scales of all 166 returns, as there were 17 examples of "No visible brand" and a further 22 cases where the brand (if it existed) had not been noted. This was the result of errors in recording at one of the traps. Note that many of the cases of "No visible brand" were due to scarring of the shoulders of the fish by net-marks.

The recaptures of maiden grilse and 2-sea-winter fish are set out in Table 19 below:-

Table 19. Recaptures from reared smolts.

	Smolt age	Year of release	Number released	Brand	Returned as G	Returned as 2SW	% recapture
1.	1+	1978	2486	T	58	1	2.37
2.	1+	1978	4758	Nil	137	2	2.92
3.	1+	1978	878	K	34	1	4.00
4.	2+	1978	9104	S	199	3	2.22
5.	1+	1979	3536	E	17	N/A	0.48
6.	2+	1979	6221	C,X,O	135	N/A	2.17

The 2+ smolts have been grouped together in the table above, since there were 37 grilse derived from these smolts, where the brand mark was obscure or had not been noted. Accurate designations cannot be ascribed to each group of branded 2+ smolts but it may be noted that on the basis of legible brands, the group released as smolts from a cage in brackish water had the lowest proportion of returns to the traps.

This may well be due to the absence of imprinting to Lough Feeagh water, since these fish spent the final seven months of their pre-smolt life in a brackish water environment.

In the comparison of a control diet with one containing single-cell protein replacement of fishmeal, the known returns from the control diet were 2.4% compared with 1.3% for the experimental diet.

The 161 recaptures (excluding 7 previously-spawned fish) were made in the following ways:-

Mill Race trap	:	97
Salmon Leap trap	:	58
Furnace rods	:	3
Outside nets	:	3

Recaptures from outside nets were confined to those from a draft net operating in the joint estuary of Burrishoole and Newport rivers.

As noted in Section B 4A, UDN/fungus infection was severe among broodstock in a holding pond at the Mill Race during the autumn, although broodstock rainbow trout maintained just downstream of the affected grilse were themselves unaffected. Only 3 broodstock died with severe fungus infection when holding ponds at Treanlaur were used, these ponds being supplied by water from a stream which is inaccessible to migratory fish. The 3 fish which died had incipient disease at transfer.

The reared fish component of the spawning escapement in 1980 was only 17, this being the number unaccounted for as broodstock or as mortalities from UDN/fungus and seal attack. The size of returning grilse was normal in 1980, when those derived from 1+ smolts averaged 62.3cm and those from 2+ smolts, 63.5cm. Sex ratios were 50:50 and 53:47 for the two groups, respectively (females:males). The average weight for all reared grilse in 1980 was 2.75kg (6.05 lb) but those used as broodstock females were slightly smaller at 2.45kg.

Rod catches of reared grilse were poor, due mostly to the decline in salmon catches on Lough Furnace, particularly at the two salmon stands (the Mill Race and the Back Weir). In addition, over half the reared fish entered fresh water after the closure of rod-fishing season.

The timing of the runs of reared grilse compared with wild grilse are shown in Table 20:-

Table 20. Timing of wild grilse and reared grilse runs.

	Wild grilse %	Reared grilse %
June	28.6	3.6
July	40.8	24.7
August	8.5	14.5
September	16.5	44.0
October	3.7	9.0
November	1.1	4.2
December	0.8	—

Relative survival rates of reared smolts since 1966 are shown in Table 21, as the two 5-year-averages for 1966-70 and 1971-75, with individual values from 1976 onwards. Relevant individual values for the years preceeding 1976 may be found in Ann. Rep. XXIV, 1979, Table 18.

Table 21. Relative survival rates of 1+ and 2+ smolts.

Year	Smolts released	Number recaptured	% overall recaptured	% 2+ smolts	% 1+ smolts
1966-70	13647	342	2.51	3.12	1.66
1971-75	8809	270	3.06	3.02	1.69
1976	15674	253	1.61	1.62	1.60
77	15278	102	0.67	0.48	0.79
78	17922	182	1.02	0.91	1.07
79	17226	429	2.49	2.18	2.82
80	9757	152	1.56	2.17	0.48

Note that these figures refer to return to the river of origin and make no allowance for the unreported proportion of adults which is taken by coastal nets, where fin-clips and brand marks largely go unnoticed. This was confirmed by work carried out by the Dept. of Fisheries, during the month June 19 to July 19, 1980, when 12% of all grilse in the Galway and Aran Co-op. Auction premises was found to be fin-clipped (derived from reared smolts).

Excluding previous spawners, all returns since 1966 can be divided into the following categories:-

	Returned as:		
Smolt parentage	Grilse	2SW fish	Pre-grilse
2Sw	183 (87%)	27 (13%)	0
Grilse	3809 (98.4%)	63(1.6%)	6
2SW x G	147 (96.1%)	6 (3.9%)	0

N.B. "Pre-grilse" refers to fish which return to fresh water after less than one year in the sea, usually during the summer after release as smolts. "2SW fish" includes both small spring and small summer fish.

(ii) Smolt releases

A total of 10,705 reared smolts (adipose fin-clips) was released in 1980, comprising:-

1+ grilse smolts : 2258 : Brand S
1+ grilse smolts : 679 : Unbranded
2+ grilse smolts : 2095 : Brand V and micro tag
2+ grilse smolts : 2101 : Brand V
2+ grilse smolts : 1446 : Brand T
2+ grilse smolts : 2126 : Unbranded

3. SEA TROUT

(i) Upstream movements.

a) Timing and numbers.

The sea trout run at 1503 was very poor in 1980 and represented a reduction of more than 900 fish from the figure recorded in 1979. This was probably due to the very low contribution of finnock (0+ sea years) to the total run (8%). Very low water conditions during April and May resulted in 94% of the smolts migrating out to sea in early June. After that time a much smaller proportion could have grown sufficiently to return as finnock at the usual time.

The bulk of the sea trout run occurred in June and July and was thus earlier than in any year since 1970 when full trapping facilities first became available. The larger proportion of the run was through the Salmon Leap (73%) as has been the case since the rock sill was removed from the Salmon Leap in 1975.

The totals of upstream-migrating sea trout, counted through the traps from 1970 onwards, are as follows:-

Table 22. Annual runs of sea trout.

Year	Mill Race	Salmon Leap	Total
1970	885	359	1244
71	889	518	1407
72	1799	426	2225
73	1596	1248	2844
74	1658	1271	2929
75	1651	1697	3348
76	894	2408	3302
77	731	1481	2212
78	427	1303	1730
79	443	1987	2430
80	399	1104	1503

The timing of the sea trout run, expressed as monthly percentages, is shown in Table 23 together with the averages for 1970-74 and 1975-79.

Table 23. Timing of sea trout run.

	1970-74	1975-79	1980
May	—	0.1	—
June	14.3	12.0	41.5
July	50.5	58.3	40.2
August	14.1	17.5	6.8
September	8.9	6.2	7.2
October	8.4	4.3	2.7
November	3.3	1.4	1.5
December	0.5	0.2	0.1

b) Net-marked fish.

27 sea trout were noted as net-marked during June and early July, which represented an increase on 1979.

c) Spawning escapement.

Table 24. Calculation of spawning escapement.

Counted through traps	:	1503
Rod catch on L. Feeagh	:	103
Taken for hatchery use	:	55
Maximum escapement	:	1345

As with the total run, the rod catch in L. Feeagh was very poor and the maximum spawning escapement was the lowest since 1971.

Table 25. Annual spawning escapement of sea trout.

Year	1970-74	1975	1976	1977	1978	1979	1980
Maximum spawning escapement	1812	3118	3117	1898	1486	2226	1345

(ii) Downstream movements

a) Sea trout smolts

Smolts began to move downstream in March and early April but there was an almost complete stasis during the remainder of April and all of May due to extremely low water conditions. The majority of the run occurred in the first week of June, with only occasional smolts noted during the remainder of June and July. Most of the sea trout smolts left L. Feeagh via the Salmon Leap (83%). The smolt run at 2337, was the lowest since full trapping facilities became available in 1970.

Table 26. Annual sea trout smolt totals.

Year	1970-74	1975	1976	1977	1978	1979	1980
Sea trout smolt totals	4450	3587	5207	3889	3169	3656	2337

b) Autumn-migrating trout

These are 1+ and 2+ fish which cannot be positively identified as either sea-going or freshwater **Salmo trutta.** They move down through the traps in autumn, beginning in late August and ending in late December. The census of these fish numbers is incomplete, because the fine screens on the fish fence at the Mill Race had to be lifted for twelve days in September, due to high water conditions. However, observations suggest that not many fish escaped at that time since the strong current acting on the bars of the coarse screens set up a "louvre" effect and deterred small salmonid fish (but not eels) from passing through the fish fence.

Table 27. Timing of autumn migrating trout run.

	Mill Race	Salmon Leap	Totals
August	—	33	33
September	219	575	794
October	146	537	683
November	146	568	714
December	124	283	407
Totals	635	1996	2631

If it is assumed that all autumn-migrating trout contribute to the sea trout smolt run of the following year, then a figure for total recruitment can be calculated (Table 28).

Table 28. Total migrant juvenile trout production.

Year	Smolt total	Autumn juveniles (preceding year)	Total recruitment
1970	3228	N/A	3228+
1971	2961	3128	6089
1972	5465	3620	9085
1973	6071	2124	8195
1974	4527	2606	7133
1975	3587	2703	6290
1976	5207	4171	9378
1977	3889	2947	6836
1978	3167	3506	6673
1979	5656	2603	8259
1980	2337	2351	4688

It should be noted that the sea trout smolt totals in individual years have varied to much greater extent than the totals for autumn-migrating trout.

c) Tagging of autumn-migrating trout and sea trout smolts.

As mentioned in Annual Report XXIV, 353 autumn-migrating trout were tagged in 1979. One of these trout was caught by an angler in the Owenea River, Co. Donegal during June. In 1980, 448 sea trout smolts and 521 autumn-migrating trout were tagged using green plastic "Carlin" type tags attached with double thread. Two tagged smolts were recovered as fresh finnock as detailed below:-

Table 29. Recaptures from tagging of autumn-migrating trout in 1979 and sea trout smolts in 1980.

No.	Tagged	Length	Recaptured	Length
Y 4000	23/11/79	14.0 cm	6/8/80 (fresh)	23.0 cm
G 7099	4/6/80	19.8 cm	13/8/80 (fresh)	23.8 cm
G 7157	4/6/80	21.5 cm	16/9/80 (fresh)	26.2 cm

d) Sea trout kelts

The first kelts were observed in November 1979 and by March 1980 over 400 kelts had been counted. After that time, extremely low water conditions inhibited the run until early June when a further 700 kelts were counted through the traps. Only one fish had fungus infection. Table 30 gives the timing of the kelt run, the fish being divided into "large" (over 30 cm) and "small" classes, roughly delimiting finnock (0+ sea years) from older fish:-

Table 30.

Month	Large	Small	Total	"Marked"
November 1979	24	25	49	0
December	41	1	42	0
January 1980	39	9	48	0
February	49	27	76	0
March	135	79	214	1
April	12	7	19	0
May	102	30	132	0
June	410	308	718	0
Totals	812	486	1298	1 (0.1%)

The comparable survival rates from upstream run to kelts are expressed as percentages in Table 31. It can be seen that the survival in 1980 was quite normal despite the lateness of the kelt run.

Table 31. Annual % survival rates to kelts.

Year	Overall	"Large"	"Small"
1976	75	79	66
1977	57	63	45
1978	56	50	66
1979	52	33	107
1980	58	50	82

(iii) Sea trout scales

a) Sea trout smolts

Eighty sets of scales were collected during the sea trout smolt run. Two age groups were represented (Table 32).

Table 32. Numbers and percentages of two and three-years-old sea trout smolts.

	Number	%
2+	51	64
3+	29	36

Table 33 gives the mean fork lengths, weights and coefficients of condition of the two categories of sea trout smolts. The coefficient of condition is calculated from:-

$$\frac{\text{Weight (grams x 100)}}{\text{Length}^3 \text{ (cm)}}$$

Table 33.

	Length (cm)	Weight (g)	Coefficient of Condition
2+	19.6	74.8	0.99
3+	20.7	84.7	0.95

Three year old sea trout smolts were significantly larger than two-year old smolts ($t = 3.33$; $P < 0.01$). There was a higher proportion of B-type growth (spring growth visible on scales, outside the winter band) among two-year old than among three-old smolts (Table 34), as was observed in earlier work on sea trout of the Burrishoole river system (Piggins, 1961).

Table 34. Proportions of type A and B growth among sea trout smolts.

	A type	B type
2+	23.5	76.5
3+	44.8	55.2

b) Rod caught adult sea trout

Scales were also collected from 84.7% of the rod-caught sea trout during 1980. The majority of the fish not sampled were finnock so that Table 35 underestimates the finnock proportion of the rod catch.

Table 35. Numbers of maiden fish and previous spawners (with spawning marks) in the sample. Percentages are given in parentheses.

Maiden fish			Previous spawners	Total number
0+	1+	2+		
135 (36.4)	135 (36.4)	9 (2.4)	92 (24.8)	371

Direct comparison with certain aspects of a previous analysis of sea trout scales from Loughs Furnace and Feeagh (Piggins, 1961) is not possible since some of the sea trout used in the former sample were caught in a commercial net, which selected larger fish. However, other aspects may be compared. It has been noted in an earlier section that only 8% of the sea trout recorded through upstream traps in 1980 were classified as finnock. This does not appear to correlate with the data given in Table 35. However, when the catch data for the two lakes is considered separately, 43% of the Lough Furnace sample is found to consist of finnock, whereas only 10% of the Lough Feeagh sample consists of finnock.

In Table 36, the distribution of each smolt age among the various categories of sea trout within the sample and in the entire scale sample are given as percentages.

Table 36.

Smolt life (yr.)	Finnock	All maiden fish	Previous spawner	Total sample
1	—	—	1.1	0.4
2	57.8	65.2	64.1	65.0
3	39.2	33.3	33.7	33.4
4	3.0	1.4	1.1	1.4

Two-years and three-years old smolts predominated in all categories. The fact that similar proportions of each year-class of smolts were recorded in the various categories of the rod caught samples and also in the sample of smolts taken from the downstream traps implies that the proportions of smolt ages has remained relatively constant for a number of years.

There does, however, appear to be a difference in the proportions of previous spawning fish which first spawned as finnock between the results described by Piggins (1961) and those of the present survey (Table 37).

Table 37. Age proportions of previous spawners at first spawning. Percentages are given in parentheses.

	+SM	1+SM	2+SM
1956-58	39 (16)	191 (77)	18 (7)
1980	43 (47)	39 (42)	10 (11)

The divided migration and return of the various year classes making up the sample are given as percentages in Table 38.

Table 38.

Returned in 1980 as:	Hatched: 1970	1971	1972	1973	1974	1975	1976	1977	1978
Finnock	—	—	—	—	—	—	1.1	14.3	21.0
1+	—	—	—	—	—	—	10.5	25.9	—
2+	—	—	—	—	—	0.3	2.6	—	—
With SM's	0.3	—	0.3	0.8	1.3	5.9	10.0	6.2	—

The designations, number, year of hatching, mean lengths, weights and coefficients of condition of the whole sample are given in Table 39.

Table 39.

	Number	Hatched	Length (cm)	Weight (g)	Condition Coefficient of
2+	78	1978	27.3	258.2	1.27
1.1+SM+	1	1977	48.5	1191.9	1.04
2.+SM+	22		36.7	550.5	1.11
2.1+	96		36.7	601.6	1.22
3+	53		28.2	258.2	1.15
2+2SM+	2	1976	48.3	1234.3	1.09
2.1+SM+	18		43.5	868.3	1.05

2.2+	8		42.0	791.7	1.07
3+SM+	17		38.5	649.8	1.14
3.1+	39		38.0	593.0	1.08
4+	4		33.6	383.1	1.01
2.1+2SM+	4	1975	48.1	1191.8	1.07
2.2+SM+	6		45.5	1001.6	1.06
3+2SM+	2		44.3	978.9	1.13
3.1+SM+	10		43.8	851.2	1.01
3.2+	1		46.5	—	—
2.1+3SM+	2	1974	55.8	1659.9	0.95
2.2+2SM+	2		53.0	1447.1	0.97
3.2+SM+	1		50.0	1475.5	1.18
2.1+4SM+	1	1973	50.5	1702.5	1.32
3.1+3SM+	1		52.0	1475.5	1.05
4.1+2SM+	1		49.5	—	—
2.1+5SM+	1	1972	61.0	1730.9	0.76
2.2+6SM+	1	1970	61.5	3291.5	1.14

The mean lengths and weights observed for the various categories are very similar to those described in 1961. A comparison of the mean fork lengths at capture of the different age groups in the sea (Table 40) reveals little difference in marine growth between the samples collected in 1956-58 and in 1980.

Table 40. Fork lengths (cm) of sea trout smolts and of maiden fish with varying histories at sea.

	Smolts	+	1+	2+
1956-58	19.6*	27.9	36.1	40.9
1980	20.8	27.8	37.1	42.5

*Back calculated length.

Reference:
Piggins, D.J., 1961. Ann. Rep. Salm. Res. Trust, No. V, App. I.

SECTION D : FISHERY REPORT

1. EXPLOITATION RATES BY ROD FISHING

Records of the rate of exploitation (fly fishing only) for stocks of wild and reared salmon and sea trout now exist since 1970. Accurate assessments can be made for Lough Feeagh but the complication of unknown numbers of sea trout spawning in the streams flowing directly into Lough Furnace makes it impossible to attempt reliable estimates of the exploitation rate of sea trout in Lough Furnace. It should be noted that 335 sea trout were caught in Lough Furnace during 1980, most of which, it can be assumed, were destined to spawn in the Lough Furnace tributaries. (See Frontispiece for geography of Burrishoole River system).

For salmon, the maximum rates are accurate, since they assume no spawning in Lough Furnace tributaries. To arrive at the minimum rates, a tentative correction of 10% has been applied. This is a slight, deliberate over-estimation, as only one spawning stream is used to a minor extent by spawning salmon.

The bye-laws made in 1979, which not only reduced the length of the open season for commercial netting for salmon by six weeks, but also reduced the rod fishing season by the same amount, were maintained in 1980. However, it was decided during 1980 to extend both the netting and rod season by one week. Rod fishing for salmon ended therefore on September 7 instead of August 31 as in 1979 or October 12 as in previous years.

Thus, the exploitation rates from 1970-78 are not directly comparable with those for 1979 and 1980; those of the latter years could have been higher had the final six/five weeks fishing been allowed.

The exploitation rate for Lough Feeagh wild salmon (5.9%) was poorer than in previous years, as was the maximum rate for the total stock of wild salmon (7.3% c.f. 15.4%, the 10 year average for 1970-79). Initially, these reduced exploitation rates might seem to reflect the conservation effect of the new bye-laws, but in 1979 when the rod fishing season was one week shorter, better exploitation rates were obtained for total stock of wild salmon (maximum = 10.5%) and Lough Feeagh wild salmon (8.8%).

Although the exploitation rate for reared salmon on Lough Feeagh was higher than in previous years, the rate for total stock of reared fish (4.9%) reflected the very small contribution made by these fish to the Lough Furnace rod catch (2 fish).

The exploitation rate in 1980 for sea trout caught on Lough Feeagh was marginally greater than in 1979, despite there being a much smaller stock of fish present. The fishing effort for sea trout was much reduced on Lough Feeagh, especially during September and October, as most fishermen chose to fish on Lough Furnace (See section on Fishing Effort, Tables 43 and 44).

The relevant data for the five year averages of 1970-74 and 1975-79 and for the individual year 1980 are given below in Table 41.

Table 41. Exploitation rates for rod-fishing.

	1970-74	1975-79	1980
WILD SALMON			
Lough Feeagh			
"Available" fish by end of fishing season	988	644	610
Rod catch	86	51	36
Exploitation rate %	8.7	9.9	5.9
WILD SALMON			
Loughs Feeagh and Furnace			
Total stock of wild fish	1282	802	701
10% addition for L. Furnace residents	1410	882	771
Total catch of wild fish	207	113	51
Minimum exploitation rate %	11.8	12.8	6.6
Maximum exploitation rate %	13.0	14.1	7.3
REARED SALMON			
Lough Feeagh			
"Available" fish by end of fishing season	154	122	77
Rod catch	4	7	5
Exploitation rate %	2.6	5.7	6.5
REARED SALMON			
Lough Feeagh and Furnace			
Total stock	261	244	163
Total rod catch	32	28	8
Exploitation rate %	12.3	11.5	4.9
SEA TROUT			
Lough Feeagh			
"Available" fish by October 12	1983	2518	1450
Rod catch	318	210	103
Exploitation rate %	16.0	8.3	7.1

2. FISHERY RESULTS

The rod catch figures for the 1980 season (including wild and reared salmon) were as follows:

	Salmon			Sea Trout		
	No.	Total wt.	Av. wt. (lb)	No.	Total wt.	Av. wt. (lb)
Lough Feeagh	41	215	5.25	103	136	1.31
Lough Furnace	18	78	4.35	335	359	1.07
Totals	59	293	4.97	438	495	1.13

Table 42. Average weights of rod caught salmon and sea trout.

	Salmon		Sea trout	
	No.	Av. wt. (lb)	No.	Av. wt. (lb)
1970	354	N/A	1155	N/A
71	93	5.1	504	0.87
72	335	N/A	839	N/A
73	190	N/A	1045	N/A
74	214	4.1	1292	1.00
75	228	5.6	686	0.80
76	198	5.4	560	0.95
77	121	5.0	667	0.85
78	40	5.4	479	0.82
79	118	5.0	449	0.95
80	59	5.0	438	1.13

The rod catch of salmon was only half that of 1979 and, except for 1978, was the worst return recorded since 1970. The average weight of rod-caught salmon (5.0lb) was also at the lower end of the range. The poor catch on Lough Furnace was especially noticeable, particularly at the two shore stands (the Mill Race and Back Weir), which produced only 2 fish between them. Adverse climatic conditions and continual harassment by a number of seals that were present in the lough throughout the season were largely responsible for the poor return from Furnace.

The sea trout catch was the worst since 1970, though the average weight was the heaviest so far recorded, at 1.1 lbs. A particularly fine fish of 7 lbs 2 oz (Irish specimen fish) was caught on Lough Feeagh in early July. The very small proportion of finnock in the Feeagh catch (10%) was probably due to the delayed smolt run.

It proved possible to quantify the fishing effort in 1980, when the angling season showed an increase in rod-lettings compared with 1979 (192 rod days let c.f. 172). This increase was probably brought about by a new policy allowing the hire of boats without boatmen. This proved very popular and provided the largest revenue to the fishery. Table 43 expresses fishing effort on Loughs Feeagh and Furnace as numbers of rod hours spent fishing and the average number of boats utilised on the fishery per day. (There were 6 boats available on Lough Furnace and 5 boats on Lough Feeagh, including Club boats).

Table 43.

	June 23-Sept. 7 (Salmon & Sea Trout)		Sept. 7-October 12 (Sea Trout only)			
	Rod hours	Boats per day	Rod hours	Boats per day	Overall boat utilization rate	Total rod hours
L. Furnace	2132	1.8	410	0.7	1.5	2542
L. Feeagh	1101	0.7	48	0.09	0.7	1149

In Table 44, the catch data is incorporated with the fishing effort to give two estimates of fishing success: catch per rod hour or numbers of hours to catch one fish.

Table 44.

	Salmon		Sea Trout			
	June 23-Sept. 7		June 23-Sept. 7		Sept. 7-October 12	
	Fish per rod hour	Hrs/fish	Fish	Hrs/fish	Fish	Hrs/fish
L. Furnace	0.008	118.4	0.12	8.2	0.18	5.5
L. Feeagh	0.04	26.9	0.09	10.7	—	*

*No fish caught.

1. It was assumed that each boat contained 2 people fishing for 8 hours unless known otherwise.
2. The fishing effort expended by Newport Anglers Club is included. It was assumed that Club fishermen fished for four hours on week days and for eight hours on Sundays.

Table 44 shows that fishing effort was concentrated on Lough Furnace but the catch of salmon per unit effort of fishing on Lough Feeagh was over four times greater than on Lough Furnace. The catch of sea trout per unit effort prior to September 7 (end of salmon fishing season) was similar on both Loughs. The catch per unit effort increased on Lough Furnace after September 7 although fishing effort was reduced. This suggests that the stock of available sea trout was not fully exploited. As in 1979, the shortened salmon fishing season dissuaded many fishermen from choosing to fish for sea trout only during September. However, the conservation effects on salmon escapement of the early closure of salmon angling can be calculated to be minimal.

Assuming that 15% of the total stock reaches freshwater, an exploitation rate by rod and line of 7.3% as in 1980, would decrease the original stock returning to Irish waters (before commercial exploitation) by 1.1%. Even if the exploitation rate by rods had increased from 7.3% to 11% as a result allowing an extra month of angling, the decrease in the primary stock would only amount to 1.65% compared with 1.1%. Thus the extra month of rod fishing for salmon depletes the original stock by 0.55% or the stock that has survived to reach fresh water by 3.7%.

An extension of the salmon rod angling season would certainly benefit the late summer tourist industry and perhaps lead to more efficient exploitation of sea trout stock whilst having little detrimental effect on the spawning escapement.

In certain systems however, salmon and sea trout might be in a state of advanced maturation by late September/early October and unfit for angling purposes. A compromise of closing both the salmon and sea trout season at the end of September might be most effective for management purposes.

3. EELS

(i) Silver Eels

The catch of silver eels in 1980 at 3550 was slightly below the five-year averages for 1971-75 and 1976-80 (see Table 46). The number of eels recorded in the Mill Race trap is an underestimate as the fine-mesh screens normally placed upstream of the main screens during the silver eel migration had to be removed during a period of very high water (September 7-19) allowing many of the eels to migrate freely downstream.

The timing of the run was similar to previous years, the greatest number of eels migrating downstream during September and October.

Table 45. Timing of silver eel run.

	Salmon Leap	Mill Race	Totals
August	132	—	132
September	925	208	1133
October	1116	295	1411
November	755	91	846
December	23	5	28
Totals	2951	599	3550

The average weight of silver eels appears to be increasing (see Table 46). In 1964, the average weight was only 70g. Over the period 1971-79 the average weight increased from approximately 80 to 126g and in 1980 a sample of 669 late running eels with a total weight of 100kg averaged 150g.

Table 46.

	Total catch	Five-year average	Average weight (g)
1971	2924		84 (estimated)
72	3144		84 (estimated)
73	5087		80 (estimated)
74	4642		85 (estimated)
75	6530	4465	84 (estimated)
76	4595		91 (estimated)
77	5362		103
78	1412		103
79	5196		126
80	3550	4023	150

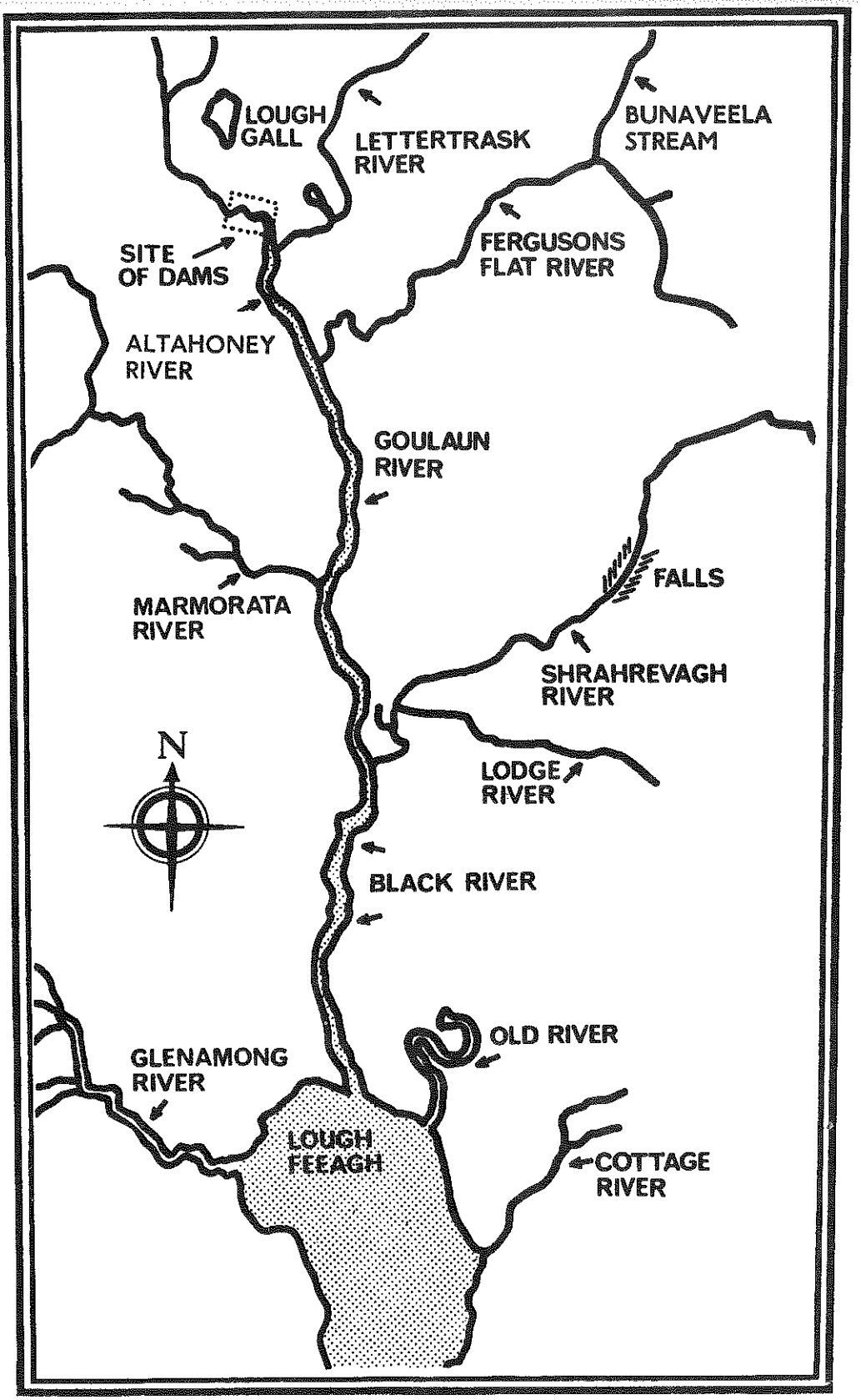
(ii) Elvers

Glass eels (non-pigmented stage) were observed on the Furnace lakeshore in February. The elver trap sited on the right bank of the Mill Race was set working on May 5, although no elvers ascended the trap until May 14. Whilst this right bank trap utilised artificial grass ("Astroturf") for the elvers to use a climbing medium, teased corlene rope had to be employed for the left bank trap. This latter proved useless to the elvers and consequently very few ascended the left bank trap. 34.5 kilos of elvers were captured in the right bank trap between May 14 and June 28. 40 kilos were also collected using hand nets from the Salmon Leap during a period of very low water (May 23-30).

Of the 74.5 kilos of elvers captured, 37 kilos were released into Lough Arrow in a restocking programme, 12 kilos were supplied to a commercial eel farm and 25.5 kilos were released. A large proportion of the elver run migrated upstream, bypassing the elver traps on the Mill Race by ascending the many underground waterways adjacent to the trap sites. The number of elvers captured at the Salmon Leap represents only a fraction of the total run.

GLOSSARY

Alevin	First free-swimming stage after hatching from the egg, having a yolk-sac which contains its food supply for the first few weeks.
Eyed ova	Eggs with embryo inside eggshell, having visible eye-pigment.
Finnock	Sea trout which return to fresh water in the same year as they left as smolts.
Fry	Free-swimming stage after yolk-sac has been used up.
Furunculosis	Bacterial disease of salmonid fish.
Glass eel	Unpigmented elver, before migration into fresh water.
Grilse	Salmon which spends only 1 winter in the sea before returning to fresh water.
Ova	Eggs.
Parr	Larger juvenile, with typical "finger-marks" on flanks.
Pruteen	I.C.I. product — single-cell protein.
Sea-trout	Migratory trout, spending 2 or more months in the sea each year after migration.
2-Sea winter fish	True salmon, termed small spring or small summer fish.
Smolt	Juvenile stage at which salmon and sea-trout migrate.
UDN	Ulcerative Dermal Necrosis — Skin condition of adult salmon, often leading to death.



Sketch map of the Burrishoole Fishery. Based on the Ordnance Survey by permission of the Government (292/2).