

IONTAOBHAS TAIGHDE BRADAN na h-EIREANN

IONCORPORTHÁ

(The Salmon Research Trust of Ireland Incorporated)

Sponsored by Arthur Guinness & Sons P.L.C.  
and the Minister for Fisheries & Forestry.

ANNUAL REPORT

No. XXIX

Report for the year ended 31st December, 1984

IN MEMORIAM

SIR RICHARD LEVINGE

Sir Richard Levinge, Bart., M.B.E., who died on December 27, 1984 at the age of 73, was a founder member of the Committee of Management of the Trust. Indeed, the idea of making funds available from Guinness for salmon research in Ireland arose out of discussions between Sir Richard and the late Sir Hugh Beaver, in 1954.

Sir Richard was an enthusiastic and very knowledgeable member of the Committee of Management from 1955 to 1972. He was then elected Chairman of the Trust and served in that capacity for 5 years, until he moved from Dublin to London, within the Guinness group of companies. He then resigned from the Committee with effect from December 31, 1977.

He was a skilful and experienced angler and had an acute appreciation of the biological and technical problems of salmon research, making many valuable contributions to the planning of our research programme.

After his retirement from the Trust, he continued with his work as President of the Salmon and Trout Association and Chairman of the Atlantic Salmon Trust in the United Kingdom, where his scientific and business expertise proved of immense value.

We mourn his passing, as a good friend and colleague, who, more than most men, aided and promoted the aims and objects of the Salmon Research Trust of Ireland.

Mr. Frank Mumford-Smith

The Committee notes, with deep regret, the sudden death of Mr. Frank Mumford-Smith (Newport House Hotel) in August. He had been a member of the Consultative Committee since its inception and had always taken a keen personal interest in the results of the Trust's research, particularly as they applied to stock levels and rod fishing.

COMMITTEE OF MANAGEMENT

Dr. T. K. Whitaker

(Chairman)

W. M. Hutton

Dr. I. R. Moore

(as Nominees of the Chairman of Arthur Guinness & Sons, P.L.C.)

J. Power

Miss Eileen Twomey

(as Nominees of the Minister for Fisheries and Forestry)

Prof. Maire Mulcahy

M. Phelan

(Elective members)

CONSULTATIVE COMMITTEE

J. Diffley

M. Kennedy

E. Kilroy

M. Maguire

F. Mumford-Smith (deceased August, 1984)

P. Quinn

P. Sweeney

Beltra Co-operative Society.

N, W, Regional Fisheries Board  
Estuary Netsman

Newport Anglers' Club

Newport House Hotel

Clew Bay Oyster Co-operative Society

Commercial Fishing and Chandlery

STAFF

D. J. Piggins, Ph.D., B.Sc.

C.P.R. Mills, M.Sc., B.Sc.

D. T. Quigley, B.Sc.

G. Rogan, Dip. Aq.

Mrs. L. A. Mills, B.Sc.

Director

Biologist

Junior Biologist/Research Officer

Temporary Laboratory Assistant

Administrative Assistant

A. Nixon	Field Assistant (Foreman)
T. Lavelle	Field Assistant
P. J. Bryce	Field Assistant
T. Keane	Field Assistant
R. G. Mallet, F.C.A., F.C.I.S.	Secretary
D. F. Murphy, D.B.E.	Consultant Engineer

Registered Office: St. James's Gate, Dublin 8.

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SALMON RESEARCH TRUST SMOLT REARING UNIT

STAFF

D. Baird, B.Sc.	Fishmaster
Miss D. Cotter, M.Sc., B.Sc.	Research Officer
M. Davitt	Driver/Technician

Address: Furnace, Newport, Co. Mayo

Telephone (098) 41112

REPORT FOR THE YEAR ENDING 31ST DECEMBER, 1984

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GLOSSARY

The Annual Report was prepared as follows:-

DJP: Section A, 1-5 & 7, Section C, 1(i), (ii)a,b,c,f, C 2, C 3(iv), C 4, abridged Report and general editing.

CPRM: Section C 1(ii)d, C 4, Section D.

DTQ: Section A 6, Section B 1-8, Section C 1(ii)e, C 3(i), (ii), (iii).

DB: Section B 9.

RAM: Section E.

Lesley Mills and Gerard Rogan helped in the preparation of data.

## SECTION A: GENERAL

### 1. Committee of Management

The composition of the Committee of Management (Chairman: Dr. T. K. Whitaker) remained unchanged during 1984.

### 2. Consultative Committee

The Committee met on June 29 and subjects discussed included:- value of grilse derived from artificially reared smolts to the offshore netting industry; declining freshwater escapements of both grilse and sea trout- review of poor 1984 season, to date; oyster development programme in Clew Bay; impact of Greenland and Faroes Fisheries on Irish salmon stocks; inadequacy of resources for protection measures.

The Committee of Management notes with deep regret, the sudden death of Mr. Frank Mumford-Smith (Newport House Hotel) in August, who had been a member of the Consultative Committee since its inception.

### 3. Personnel

The post of Assistant Director remained unfilled but following the handing over to the Trust of the smolt rearing unit of Curraun Fisheries Ltd., with effect from July 1, the permanent staff of the Trust was increased by two graduate biologists and one technician/driver.

In all, six students were employed as Temporary Scientific Assistants for 22 working weeks over the summer period (Geraldine O'Donnell, Margaret Gallagher, Gearoid Henry, Hubert Henry, Francis Waldron and David O'Malley). In addition, four French students (Catherine Agostini, Isabel Haberstock, Eric Lechevallier, Claire Duhazé) were accommodated on short (unpaid) study visits.

Facilities were provided for three zoology students from University College, Cork, to complete their Final Year Projects.

Two Polish students (Gregor Kaminski and Artur Lebiezinski) arrived in early December, to collect material for an M.Sc. project.

From April, laboratory and field facilities have been provided for Dr. R. A. Macdonald, during the tenure of a research contract from the Dept. of Fisheries and Forestry, Wildlife Division. Dr. Macdonald is working on the impact of cormorant feeding on juvenile salmonids.

The Director returned to full-time duties with effect from June 1.

#### 4. Installations

The harbour at Furnace was provided with concrete steps on the north wall and the western wall was underpinned with stone and concrete where erosion had occurred at the water-line.

#### 5. Meteorological Data

Rainfall for 1984 was close to the average for the past 12 years (see Table 1) but the summer months were characterised by low rainfall amounts and consequently, low water levels during the period May 1 to August 31 (see Fig. 1). Only two minor floods occurred during these summer months and for much of the time, water levels were inadequate for upstream migration of fish. Water temperatures did not reach the extremes ( $23^{\circ}\text{C}$ ) experienced in 1983 but ranged from  $17.5 - 19.5^{\circ}\text{C}$  during the period July 22 - August 27. The rapid increase in water temperature experienced in April ( $10^{\circ}\text{C}$  by April 28) facilitated the early feeding of fry in the hatchery.

Table 1. Monthly rainfall totals (mm) and annual totals (mm) for 1973-84.

January	:	295.5	1973	:	1468.7	:	57.8"
February	:	135.2	74	:	1573.2	:	61.9
March	:	73.8	75	:	1299.6	:	51.2
April	:	70.5	76	:	1266.7	:	49.8
May	:	31.3	77	:	1579.7	:	62.2
June	:	77.6	78	:	1592.2	:	62.7
July	:	44.3	79	:	1653.3	:	65.1
August	:	76.3	80	:	1792.1	:	70.6
September	:	163.0	81	:	1646.8	:	64.8
October	:	248.1	82	:	1609.6	:	63.4
November	:	162.7	83	:	1495.9	:	58.9
December	:	178.3	84	:	1556.6	:	61.3
Total	:	1556.6 (61.3")	Average	:	1544.5	:	60.6

#### 6. pH of Rainfall and Mill Race Water

The pH of the rainfall and the Mill Race water supply have been monitored on a regular basis since November 1982. The mean pH of the rainfall (6.48) and Mill Race (6.71) during 1984 was similar to that recorded in 1983. The monitoring programme, so far, indicates that there is no immediate acidification problem in the Burrishoole system. Details of pH measurements for 1984 are shown below (Table 2):-



Table 2

Month	Rainfall			Mill Race		
	Max	Min	Mean	Max	Min	Mean
January	7.10	6.40	6.75	7.35	6.75	7.02
February	7.12	6.80	7.01	7.30	6.82	7.05
March	7.30	6.90	7.16	7.40	6.90	7.15
April	7.20	7.10	7.14	7.30	6.79	7.09
May	6.90	6.40	6.62	7.35	6.45	6.85
June	7.00	6.30	6.52	6.85	6.35	6.63
July	6.45	6.35	6.40	7.15	6.20	6.62
August	6.80	5.00	5.83	6.60	5.50	6.12
September	7.20	5.50	6.10	7.10	5.70	6.43
October	6.80	6.00	6.33	7.00	5.95	6.59
November	6.35	5.69	6.06	6.90	6.45	6.62
December	6.15	5.65	5.87	6.75	6.00	6.38
			<u>6.48</u>			<u>6.71</u>

7. Visits and Communications

Miss Twomey and the Director attended a Workshop on "Stock Enhancement" sponsored by the Atlantic Salmon Trust at University of Surrey, Guildford, in April. Miss Twomey presented a paper entitled "Evaluation of promoting natural propagation versus restocking", based on results from the Trust's research programme.

Mr. Mills presented a resumé of the results of research in 1983/84 to a meeting of the Irish Freshwater Research Group held in Galway in April.

The Director attended the "Salmonid Smoltification Workshop" held at the University of Stirling in July and the meetings of the Anacat

Committee of the International Council for the Exploration of the Sea held in Copenhagen in October.

The Director and Mr. Mills were invited to present papers at a Sea Trout Workshop, organised by Dr. Graeme Harris (Welsh Water Authority) and sponsored by the Atlantic Salmon Trust.

The Director was present at two meetings of the Scientific Advisory Panel of the Atlantic Salmon Trust, held in conjunction with the above Workshops.

#### Publications

Cross, T.F.\*, C.P.R. Mills and D.T. Quigley. Tagging studies on the migratory behaviour of wild and reared sea trout (S. trutta) in western Ireland. Salmonid Smoltification Workshop, Univ. of Stirling.

Cross, T.F.\* An intensive electrophoretic survey of brown trout and sea trout in Western Ireland.  
Sea Trout Workshop, WWA/Atlantic Salmon Trust.

Mills, C.P.R., D.T. Quigley and T.F. Cross\*. Rearing and ranching of sea trout in the Burrishoole river system.  
Sea Trout Workshop, WWA/Atlantic Salmon Trust.

Mills, C.P.R. The results of a questionnaire on sea trout (Salmo trutta,L) rearing techniques in Europe.  
ICES CM 1984 M2. pp11.

Piggins, D.J. and C.P.R. Mills. 1985. Comparative aspects of the biology of wild and reared Atlantic salmon smolts.  
Aquaculture 1985 (in press).

Piggins, D.J. Sea trout in the Burrishoole system.  
Sea Trout Workshop, WWA/Atlantic Salmon Trust.

\* Cross, T.F: Present address - Zoology Dept., University College, Lee Maltings, Prospect Row, Cork.

## SECTION B: SALMONID REARING

### 1. FISH REARED FROM GRILSE OVA

Two groups of fish were reared in 1984:-

Table 3. Grilse ova hatched in 1983

Original stock of eyed ova (1983)	:	59,990
No. of 0+ parr (December 1983)	:	36,746 (61.3% survival)
No. of 1+ smolts released (1984)	:	24,219 (65.9% of population)
No. of 1+ parr (December 1984)	:	9,939

In December 1983, the large grade 0+ parr averaged 13.7 cm in length and 32.2 g in weight. When released as 1+ smolts in May 1984, these fish had grown to an average length of 15.7 cm and weighed 43.5 g.

The remaining small grade 1+ parr averaged 9.8 cm and 12.1 g when measured at the end of May. At the end of December 1984, these potential 2 years old smolts averaged 15.4 cm and 46.9 g.

Table 4. Grilse ova hatched in 1984

Original stock of eyed ova (1984)	:	50,000
No. of 0+ parr (December 1984)	:	35,777 (71.6% survival)

At the end of December 1984, the large grade 0+ parr averaged 13.5 cm and weighed 28.7 g; the small grade averaged 7.8 cm and 5.9 g.

Although growth rates were not quite as good as those recorded in 1983 (see above), survival to the end of the first year improved by almost 10%.

### 2. GRILSE OVA LAID DOWN IN 1984

Collection of broodstock commenced on October 9. All fish were transported from the Salmon Leap or Mill Race traps to the broodstock

holding facilities at Furnace. Although two fish died after jumping out of the holding pond, no fish were lost as a result of fungal infection or UDN.

Only 18 females and 36 males were available for stripping. Fish were anaesthetised before stripping and a sample was weighed and measured. In 1984, the condition factor of the female broodstock averaged 0.98, compared with 1.00 in 1983, 1.03 in 1982 and 1.05 in 1981.

Stripping commenced on November 20 and was completed by January 7, 1985; over three-quarters of the females were stripped during December. All kelts were tested with the microtag detector and then released directly into L. Furnace.

Using volumetric estimates, there were 57,023 ova at the fertilised egg stage; this figure will be checked by actual counts at the eyed egg stage.

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

No. of females	:	18
Vol. of ova produced	:	10.17 litres
No. of ova produced	:	57,023
No. of ova per female	:	3,168
No. of ova per litre	:	5,607
Av. weight of female fish	:	2.45 kg
No. of ova per kg weight	:	1,293

The average number of ova produced per female and per kg of body weight showed a decrease on that recorded in 1983.

### 3. FISH REARED FROM TWO-SEA-WINTER FISH OVA

One group of fish was reared in 1984:-

Table 6. Two-sea-winter fish ova hatched in 1982

Original stock of eyed ova (1982)	:	20,000
No. of 0+ parr (December 1982)	:	11,747 (58.7%)
No. of 1+ smolts released (1983)	:	3,228 (27.5% of population)
No. of 1+ parr (December 1983)	:	7,813
No. of 2+ smolts released (1984)	:	7,613

In December 1983, the remaining 7813 1+ parr averaged 16.5 cm and 57.1 g. When released as 2+ smolts at the end of April 1984, these fish had grown to 18.9 cm and 79.2 g.

No two-sea-winter fish ova were laid down in 1984.

### 4. FISH REARED FROM SEA TROUT OVA

Table 7. Sea trout ova hatched in 1982

	Burrishoole	Connemara
Original stock of eyed ova (1982)	9,005	21,150
No. of 0+ fish (December 1982)	992 (11%)	4,554 (21.5%)
No. of 1+'smolts' released (1983)	42	1,259
No. of 1+ fish (December 1983)	61	2,735
No. of 2+ smolts released (1984)	61	2,700

At the end of December 1983, the remaining 1+ fish were held as two separate groups: one in a cage in brackish water L. Furnace and the second in a pond supplied with fresh water from L. Feeagh. In November 1983, the cage group averaged 21.9 cm and 135.8 g; the pond group averaged 21.8 cm and 128.8 g.

In early April 1984, both groups of 2+ fish were released, the cage group from a release pond into L. Furnace and the pond group, after 2 months "imprinting period" in a pond at Treanlaur (Cottage River - see end page map), was released into L. Feeagh.

Table 8. Sea trout ova hatched in 1983 (Burrishoole stock)

Original stock of eyed ova (1983)	:	23,813
No. of 0+ fish (December 1983)	:	35 (0.15% survival)
No. of 1+ fish (December 1984)	:	19

A major mortality took place at the mid-alevin stage in 1983 and only 0.08% survived to the end of their second year.

Table 9. Sea trout ova hatched in 1984

	Burrishoole	Waterville	Welsh
Original stock of eyed ova (1984) :	5,360	9,708	18,081
No. of 0+ fish (December 1984) :	2,559	8,094	12,841
% survival :	47.7	83.4	71.0

The survival rates of eggs derived from Burrishoole and Connemara sea trout stocks have been very low in recent years (see Ann. Rep. XXV-XXVIII). In an attempt to overcome this problem, it was decided to utilise additional stocks (Waterville and Welsh) and to investigate different rearing techniques.

#### BURRISHOOLE STOCK

In early December 1983, a group of early-stripped fertilised ova (2516) was laid down in a flume at the Treanlaur hatchery. Very few losses were recorded at hatching or first feeding and on May 4, the fry were tranfered to a 2 m pond at the Furnace hatchery. The survival rate from the eyed egg stage to the end of June 1984 was estimated to be 93.5%.

A second group (2844) of Burrishoole fertilised ova was laid down in a 1.5 m hatchery tank at Furnace in late December 1983. Minimal losses were recorded at hatching and first feeding but an outbreak of myxobacterial gill disease during May, resulted in the loss of 60% of this group. The survival rate from the eyed egg stage to the end of June was estimated at 32.7%.

On July 3, both groups were mixed and transferred to a 6 m pond. Despite recurrent outbreaks of furunculosis, growth and survival (42.7%) to the end of 1984 were satisfactory.

The results of these rearing experiments could indicate that late stripping may be one cause of early mortality; the relative survival rates of fry reared in either flumes (at two different hatcheries) or tanks, were similar.

#### WATERVILLE STOCK

In late December 1983, a consignment of 9708 eyed ova was received from the S.W. Regional Fisheries Board. The eggs were placed in a flume at Furnace. Very few losses occurred at hatching and first feeding. Growth and survival to the end of the year was very satisfactory. (See Table 9 and 10).

#### WELSH STOCK

A total of 18,081 eyed ova was received from the Welsh Water Authority in mid-January 1984. 5160 ova were laid down in a flume at Treanlaur and the remainder was held in flumes at Furnace. Very few losses occurred at hatching or first feeding. Both groups were mixed in June and placed in circular ponds at Furnace. Although survival to the end of December was estimated at 71.0%, growth has been relatively slow.

This is probably due to higher stocking densities involved with this stock. The Welsh broodstock were tested for viral and bacterial diseases at stripping, in November, 1983.

Table 10. Comparison of growth rates of Burrishoole, Waterville and Welsh sea trout stock.

	Burrishoole		Waterville		Welsh	
	Length	Weight	Length	Weight	Length	Weight
August 84	8.0	5.9	7.3	5.1	6.3	3.5
September	9.3	10.2	8.7	8.4	8.0	6.3
October	11.0	17.2	9.8	12.1	8.7	8.4
November	11.9	21.4	10.7	16.4	10.3	15.7
December	N/A	N/A	N/A	N/A	N/A	N/A

5. BROWN TROUT OVA HATCHED IN 1983

Table 11.

Original stock of eyed ova	:	2087
No. of 0+ fish (December 1983)	:	301 (14.4% survival)
No. of 1+ fish (December 1984)	:	118 (5.7% survival)

Heavy mortalities occurred at the mid-alevin stage in 1983.

The remaining 1+ fish are being maintained as potential broodstock.

6. RAINBOW TROUT STOCKED 1984

2446 1+ fish were stocked into Ballinlough in March.

These fish averaged 21.1 cm and 123.3 g. A further 200 1+ fish escaped from the broodstock pond at Furnace during a high flood and most of these fish passed downstream into L. Furnace.

7. DETAILS OF SMOLT RELEASES IN 1984

Table 12.

GROUP:	A	B	C	D	E	F
Parentage	2SW	G	G	G	ST	ST
Age	2+	1+	1+	1+	2+	2+
Date released	26/3	4/5	3/5	7/5	7/4	9/4
Site of release	Release pond	Estuary	L. Furnace	Release pond	L. Feeagh	Release pond
No. released	7613	7135	8909 <del>1309</del>	8175	1570	1191
Av. length(cm)	18.9	16.2	14.8	16.0	24.4	26.4
Av. weight(g)	79.2	48.2	36.4	45.9	177.4	220.0
Av. C.F.	1.17	1.13	1.12	1.12	1.22	1.20
Microtag code	24746	24742	14704 14705	24742 24755	-	-
% microtag loss	0.17	0.3	14.7	9.3	-	-
External mark	Panjet R anal	Panjet R pelvic	Panjet caudal peduncle	Panjet R pectoral	Carlin tag (red)	Carlin tag (yellow)
% loss of external mark	3.8	9.0	1.8	6.7	1.5	0
% precocious males	20.0	-	-	-	-	-

Totals of smolts released:

2+SW : 7,613  
 1+G : 24,219 31,832  
 2+ST : 2,761

<sup>1985</sup>  
 3 2SW in Greenland  
 A x 24755 in tanks

GI+ R. Pelvic Estuary Release 4/5/1984

Code No.	No. tagged	No. Released	Micro. Loss
24742	6527	6456	0-0.5
24755	461	461	0
-	227	227	-
	<u>7215</u>	<u>7144</u>	<u>0-0.5</u>

GI+ R. Pectoral Release Pond 7/5/1984

Code No.	No. tagged	No. Released	Micro. Loss
24742	2503	2499	1.0
24755	5696	5677	10.0-17.0
	<u>8199</u>	<u>8176</u>	

GI+ Caudal L. Furnace 3/5/1984

Code No.	No. tagged	No. Released	Micro. Loss
I4704	7860	7836	6.5-17.3
I4705	1073	1073	-
	<u>8933</u>	<u>8909</u>	

SF2+ R. Anal Release Pond 26/4/1984

Code No.	No. tagged	No. Released	Micro. Loss
24746	7748	7615	-

Total No. Tagged:	GI+(24742)	9030	Released:	8955 (+227) untag
	GI+(24755)	6175		6138
	GI+(I4704)	7860		7836
	GI+(I4705)	1073		1073
	SF2+(24746)	7748		7615

## 8. INVESTIGATIONS OF MORTALITIES AND THERAPEUTIC TREATMENTS

### (i) Salmon

#### a) 1+ and 2+ smolts released in 1984

In contrast to 1983, furunculosis was detected among the 1+ and 2+ smolt populations between January and May. It is estimated that about 1.5% of the 1+ smolt population and 2.6% of the 2+ smolt population was lost as a direct result of the disease. In addition, small losses occurred due to Saprolegnia infections of both pectoral and caudal areas. The majority of the infected fish were 2+ sexually precocious males.

The strain of Aeromonas salmonicida isolated in 1984 was sensitive to "Flumiquil" and this antibiotic proved successful in controlling outbreaks of furunculosis in juvenile salmon. Saprolegnia infections were treated with regular flushes of Malachite Green, combined with culling of infected fish.

#### b) 1+ parr

No serious mortalities were experienced with the 1+ parr population during 1984. Recurrent low-level infections with furunculosis accounted for a mortality of 2.6% of the population for the year.

#### c) 0+ Fry

Relatively few mortalities occurred among the 0+ salmon either at hatching or at first feeding. The majority of losses occurred in May and June due to myxobacterial gill disease and bacterial necrosis of the caudal peduncle.

Losses for the remainder of the year were at a low level and the overall survival rate to the end of December was 71.6%.

The incidence of myxobacterial infections was brought under control by reducing pond densities and increasing flow rate, combined with regular bath treatments with "Furanace" at 1 ppm.

Table 13. Summary of main disease problems affecting juvenile salmon during 1984.

Month	Hatchery fry	O+ fish*	1+ fish	2+ fish
Jan			<u>A. salmonicida</u>	<u>A. salmonicida</u>
Feb			"	<u>Saprolegnia</u>
Mar			"	<u>Saprolegnia</u>
Apr			"	<u>A. salmonicida</u>
May	Myxobacterial gill disease		"	
Jun	Bacterial necrosis of caudal area		"	
Jul	-		"	
Aug		Tail rot Eye loss	"	
Sep		Tail rot Eye loss	"	
Oct		-	"	
Nov		-	"	
Dec		-	"	

\* Hatchery fry moved to outdoor ponds in late July.

(ii) Sea trout.

a) 2+ sea trout smolts released in 1984

Very few losses occurred among the 2+ sea trout smolt population prior to their release in April.

b) 1+ sea trout

Only 35 fish belonging to this group (Burrishoole stock hatched in 1983) survived to their first winter (see Ann. Rep. XXVIII). At the end of 1984, only 19 1+ sea trout remained, the remainder having succumbed to furunculosis.

c) 0+ sea trout

Three different stocks of sea trout were reared to the 0+ fry stage during 1984 viz. Burrishoole, Waterville and Welsh. Very few losses occurred at hatching and first feeding. However, an outbreak of Myxobacterial gill disease amongst the Burrishoole stock in May resulted in the loss of about 60% of these early feeding fry. Successive treatments with "Furanace" were ineffective. A reduction in stocking density together with increased water flow, brought the mortalities down to a low level.

Recurrent outbreaks of furunculosis were experienced in all three stocks during July. The strain of Aeromonas salmonicida isolated was sensitive to "Flumiquil" but the sea trout were more refractive to treatment with this antibiotic than the salmon. This phenomenon was also observed with 1+ sea trout reared in 1983 (see Ann. Rep. XXVIII).

Losses for the remainder of the year were low. The overall survival rates for Burrishoole (47.7%), Waterville (83.4%) and Welsh (71.0%) stocks was the best achieved in recent years.

9. SMOLT UNIT (as from July 1, 1984).

Table 14. Opening and closing stocks of fish for the six months to December 31, 1984

Year class	Salmon 1983 2+ smolt production	Salmon 1984 1+ smolt production	Salmon 1984 Contract rearing	Rainbow 1984 Fingerling production
Stage	1+ parr	0+ parr	0+ parr	0+ fingerling
Eyed ova	-	368,000	144,000	-
Fry, 30/6/84	50,900	304,500	117,000	35,300
Sales	-	7,800	103,600	34,200 (Oct)
Mortalities	2,600(5.1%)	106,600(29.0%)	40,400(28%)	650
Parr, 31/12/84	48,300	253,600	-	450

The mortalities in the S'83 1+ parr were due to a furunculosis outbreak in July which was successfully treated with Aquilinic Powder at a daily dose of 20 mg/kg active ingredient (oxalinic acid) for 10 days.

The S'84 0+ fry underwent successful start-feeding in the 3.6m fibreglass tanks. The low level mortalities were all incurred during first feeding, due to the usual gill parasites - Costia and Trichodina. These were treated with salt (included pumped brackish water from L. Furnace), 1% for 30 minutes, as required.

Survival from eyed egg to December 31, 1984 was 72.6% with an overall potential smoltification rate of 78.5% and cumulative FCR of 1.86.

The S'84 hatch consisted of three strains of salmon which gave varying results as shown by Table 15. Length frequency histograms for the upper modes are shown in Figure 2 .

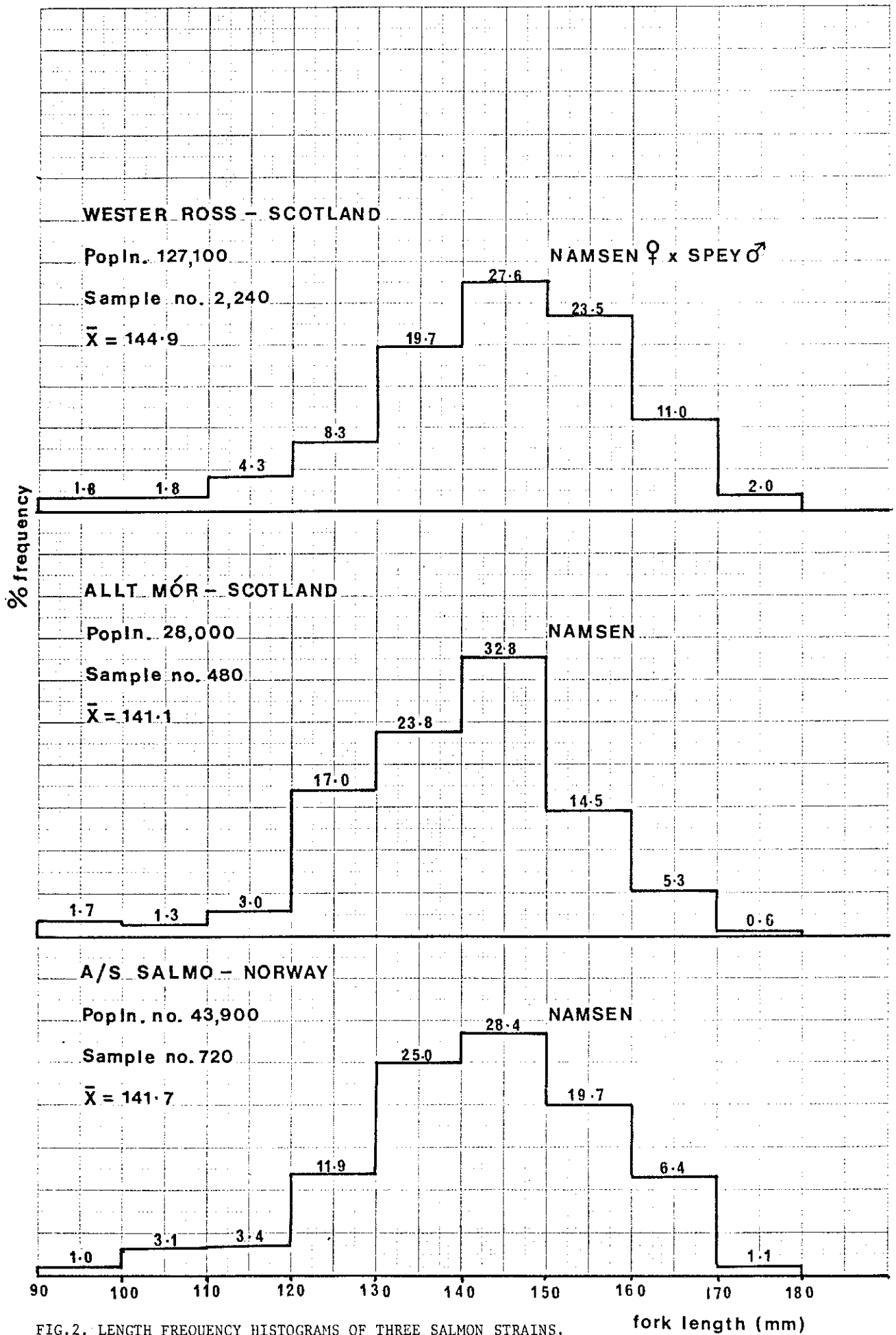


FIG.2. LENGTH FREQUENCY HISTOGRAMS OF THREE SALMON STRAINS.

Table 15. Strain comparisons of 1984 hatch, December 31, 1984.

Hatchery:	Wester Ross	Alt Moir	A/S salmo
Strain:	Namsen/Spey	Namsen	Namsen
Survival%	66.5	74.3	83.3
% Upper mode	90.8	68.4	84.5
% potential yield smolts at end '84	60.4	50.8	70.4
$\bar{X}$ Weight g *	36.6	32.7	32.25
$\bar{X}$ Length cm *	14.50	14.11	14.17
C.F. *	1.20	1.16	1.13

\* These figures refer to the upper mode of the population only (potential S1 smolts), excluding the lower mode which will not make S1 smolts. Approximately 50,000 lower mode parr will be available for sale or rearing to 2+ smolts.

## SECTION C: CENSUS WORK ON FISH MOVEMENTS

### 1. WILD SALMON

#### (i) Upstream movements

##### a) Timing and numbers

Only 11 two-sea-winter fish (2SW) were counted through the traps in 1984, from April to September, with the majority (8) in June during the first small flood since mid-April (see Fig. 1). A further spring fish (77.4cm : 4.9kg) was found dead in the Mill Race on June 15. This total is the smallest since 1979. Five year averages and individual annual numbers since 1980 are given in Table 17.

The first grilse were seen in June but only just over 200 fish ran through the traps during June and July. August comprised a period of low water and no grilse moved upstream but under these conditions in other years, fish have been able to enter and accumulate in Lough Furnace, as in 1983. However, when water levels rose in September, only a further 65 grilse ran upstream during the remainder of the year, giving an annual total of 270, the lowest recorded since full records began in 1970.

A feature of the 1984 upstream run was the poor utilisation of the Mill Race passage (by salmon and sea trout) perhaps as a result of known hunting and predation by otters. Only about one-quarter of the grilse used this route to Lough Feeagh in 1984.

The timing of the grilse, expressed as monthly percentages of the total run is shown in Table 16 below, with preceding 5-year averages for comparison:-

Table 16. Monthly proportions of the grilse run.

	1970-74	1975-79	1980-84	1984
May	-	1.0	-	-
June	5.8	15.6	24.1	36.7
July	18.9	17.7	29.9	39.2
August	26.8	24.1	15.1	-
September	25.5	26.2	21.9	18.9
October	17.6	13.7	6.6	4.4
November	4.8	1.4	1.8	0.4
December	0.6	0.3	0.6	0.4

Note that no grilse were counted upstream during August in either 1983 or 1984.

b) Net-marked fish

Net-marks were largely confined to fish migrating upstream in June and July, only 3 marks being noted in September. 25% of the grilse was marked in June, followed by 13% in July; no grilse was seen in the traps in August and of the 50 noted in September, only 3 were marked. This confirms early-season reports of good grilse catches off Mayo in June by the drift-nets, followed by poor catches later in the season. Note that net-marks are not easily visible in fish which are not removed from the traps so that the above figures are probably under-estimates.

c) Spawning escapement

No ova or fry of salmon were planted out in the nursery streams in 1984, in order not to affect the ova to wild smolt production rate.

The total upstream escapement is shown in Table 17 below and includes 2SW and previously-spawned grilse. There were 9 of the

latter category included in the grilse total of 279. Five-year averages are given for 1970-74, 75-79 and 80-84, as well as individual values for the past five years:-

Table 17 . Comparative escapements of wild salmon and grilse.

Year	Mill Race		Salmon Leap		Total	
	Salmon	Grilse	Salmon	Grilse	Salmon	Grilse
1970-74	7	630	7	515	14	1145
1975-79	9	278	27	425	36	703
1980-84	13	186	22	263	39	449
1980	28	278	21	359	49	637
1981	21	177	43	149	64	326
1982	6	200	15	245	21	445
1983	3	207	26	353	29	560
1984	6	68	5	211	11	279
1985	14	195	11	309	25	504 + 10 p56

The total for upstream-migrating grilse is the lowest ever recorded and appears to be the result of unknown factors affecting survival in the sea, of what was a moderate smolt run (9,383) in 1983.

Whilst coastal drift-nets continued to take the major proportion of the run, the overall survival of grilse reaching the coast was undoubtedly very poor, in 1984.

The spawning stocks of salmon and grilse are calculated as shown in Table 18 , with the usual reduction of 5% for natural mortalities, disease, poaching etc.

Table 18 . Spawning stocks of salmon and grilse

	Wild grilse (1SW) and previously spawned grilse	Wild salmon (2SW)	Reared fish
Counted through traps	279	11	81
Rod caught, L. Feeagh	31	-	3
Hatchery use	-	-	49
Estimated mortalities	14	0	4(+2 found dead)
Escapements	234 ✓	11	23
Maximum spawning stock	<del>268</del>		

Comparison with spawning escapements of previous years and the three 5-year averages are given in Table 19 .

Table 19 . Comparative spawning stocks.

Year	Maximum escapement	Reared fish component (% of total in parentheses)
1970-74	1126	140 (12.4%)
1975-79	725	42 (5.8%)
1980-84	474	44 (9.3%)
1980	650	22
1981	440	85
1982	446	54
1983	563	30
1984	<del>268</del>	23
1985	735	263 (36%)

The spawning escapement of 273 (including reared fish unavailable for hatchery purposes) represents only 24% of the average for the years 1970-74.

d) Survival from broodyear ova to smolts and grilse

The relevant 'majority' broodyear for the 1984 grilse was 1980, when the ova hatched in 1981 and over 90% of the smolts migrated in 1983.

Only 22 reared fish were incorporated into the 1980 spawning escapement of 650 and these reared fish are presumed to have spawned normally, in the absence of any evidence to the contrary. All relevant calculations are based on the data parameters set out in Ann. Rep. XIX 1974, thus obtaining an estimation for ova deposition in the winter of 1980/81. The relevant maiden grilse total in 1984 was 295 (trap count 279, minus 9 previous spawners, plus 25 Furnace rod-caught).

Table 20 . Survival from ova to grilse.

Spawning escapement in 1980	650
No. of females	325-357
Ova deposition	1,300,000-1,469,000
No. of smolts produced in 1983	9383
Survival: ova to smolt	0.72-0.64
No. of returning grilse in 1984	295
Survival: smolt to grilse	3.1%
Survival to grilse per grilse female	0.91-0.83*

\* A value of 2.0 is required for a self-sustaining population.

Beginning with 1970, there is data now for eleven brood-years on relevant survival rates. These are shown in Table 21 as the two five-year averages and the comparable annual value for 1980:-

Table 21 . Comparative survival rates

Brood year class	% survival rates:	Survival rates to grilse
	ova to smolt	per grilse female
1970-74	0.48-0.62	1.42-1.75
1975-79	0.63-0.72	1.50-1.69
1980 <del>74</del>	0.64-0.72	0.83-0.91

The overall situation is that freshwater production from ova to smolt appears to be stable , in terms of survival rates, but smaller numbers of ova result in proportionately smaller smolt runs.

At inter-generation survival values of less than 1 spawner to 2 offspring, a population cannot be termed self-sustaining and values in the 1984 range of 0.83-0.91 are little short of catastrophic. No species can withstand a prolonged exposure to exploitation and natural mortality at these levels.

(ii) Downstream movements

a) Smolts: Timing and numbers

The smolt run began at both traps on April 18, coinciding with a rise in the lake water temperature to 7°C and the onset of the first flood since March 25. The peak of the run was seen at the Mill Race trap during the second week of May (water temperature: 12°C) but water levels were too low for migration to occur at the Salmon Leap. Almost 90% of the run was counted through the Mill Race trap and the overall smolt total was 7270. This was very close to the predicted value, based on survival rates from spawning escapements over the past ten years. This level of smolt production might be expected to produce approximately 360 grilse in 1985 (range 225-625), using the average survival rate for the past five years and the range of survivals experienced in those five years.

b) Survival of salmon smolts

Table 22 gives the three 5-year-averages since 1970 and the individual annual values since 1980 for survival from trap-counted smolts to maiden grilse and 2SW fish in the two years following smolt descent. The rod catch of wild grilse from L. Furnace is included in the grilse total.

Table 22. Salmon smolt survival rates to adult.

	Trap count	Furnace rod catch	2SW fish	Total	Relevant smolt total	% survival
1970-74	1146	120	31	1297	13,183	9.8
1975-79	700	62	35	797	11,397	7.3
1980-84	439	28	31*	498	9,314	5.2
1980	637	10	64	711	8,276	8.6
1981	305	17	21	343	11,208	3.1
1982	438	41	29	508	9,434	5.4
1983	545	47	11	603	10,381	5.7
1984	270 504	26	<sup>25</sup> N/A 08	296**	<sup>9388</sup> <del>7270</del> 7270	3.1 ✓ 3.4 with SF 7.4

\* Average based on 4 years returns; awaits 1985 returns.

\*\* Survival to grilse only; 2SW fish not due until 1985.

The smolt survival rate to 1984 grilse equalled the previous low of 1981, when the relevant smolts were delayed by drought. In 1983/84 however, smolts were able to leave normally, via the Mill Race and some factor affecting survival in the sea must be responsible for the poor returns.

c) Tagging of wild salmon smolts.

No salmon smolts were tagged in 1984, partly in consequence of the reduced smolt numbers and also in order not to affect the smolt sampling programme. If and when wild salmon smolt tagging is resumed

in the future, it will be reported in section C (ii).

d) Sampling of salmon smolts

To determine the age structure, mean length and weight of the wild salmon smolt population, 5 samples of approximately 60 smolts were collected between May 6 and May 26. The expected total number of smolts was estimated and the samples were taken at 5 regular intervals during the run. The fish were anaesthetised, measured to the nearest mm, weighed to the nearest g and a small sample of scales removed from the shoulder; after recovery, they were released.

Age categories were determined by scale reading viz. 1A, 1B, 2A, 2B, 3A and 3B (the figures indicate lifespan in years; the letters indicate growth type). A-type smolt scales show no growth after the end of their final winter in freshwater whereas B-type smolt scales exhibit more widely spaced circuli outside the final winter band of circuli, denoting spring growth before migration. In Table 23, these age categories have been reduced to 3 year classes, with the percentage age composition, average length, weight and condition factor given for each sample.

Table 23. Percentage age composition and sizes of wild salmon smolts.

Sample	N	% smolt age composition			Av. Length (cm)	Av. Weight (g)	C.F.
		1	2	3			
1	50	0	100	0	13.9	24.7	0.92
2	48	0	100	0	13.4	22.9	0.95
3	51	2.0	94.1	3.9	14.2	27.6	0.96
4	49	6.1	93.9	0	14.0	27.5	1.00
5	50	0	100	0	15.0	31.5	0.93 (estimated)
6	49	2.0	96.0	2.0	15.8	37.0	0.93
Mean	49.5	1.7	97.3	1.0	14.4	28.5	

As in previous years, the average length and weight of the 5 samples fluctuated. The average size of the last two samples was larger than previously recorded. The mean condition factor of the smolts was lower than that recorded in previous samples. The average length and weight of the total 1984 sample was slightly higher than that recorded in 1977, 1981-83.

Table 24 .

Year	Sample No.	Av. Length (cm)	Av. Weight (g)
1977	180	14.1	27.0
1981	272	13.8	26.4
1982	301	14.0	27.2
1983	297	13.8	26.6
1984	298	14.4	28.5

The trend for an increased proportion of 2 years old smolts was maintained in 1984, with a corresponding decrease in 1 and 3 years old smolts.

Table 25 .

Year	% age composition		
	1	2	3
1977	9.0	84.7	6.3
1981	3.7	90.8	5.5
1982	3.0	92.4	4.6
1983	3.6	93.2	3.2
1984	1.7	97.3	1.0

Again in 1984, there was no significant difference between the mean weight of 2A and 2B type smolts at migration and, as before, the proportion of smolts exhibiting A type growth tended to decrease as the run progressed, whilst the proportion exhibiting B type

in the future ... weight of both 1 and 3 years old smolts  
 ... samples though the sample size

Age weight (in g) of different age categories  
1984 compared with those recorded in 1977, 1981, 1982 and 1983.

Year	Age Categories					
	A	1B	2A	2B	3A	3B
1977	-	24.6	28.6	27.3	32.0	37.0
1981	-	24.0	27.9	26.2	27.9	29.8
1982	19.6	20.3	28.5	26.6	27.8	29.1
1983	-	18.3	26.8	27.0	32.6	37.5
1984	-	25.6	27.2	28.7	41.3	51.7

Sampling of the salmon smolt run over a period of 5 years has shown that the age composition and growth characteristics of the smolt run have been very consistent. It has therefore been decided to suspend sampling for a period of several years before renewing checks on this aspect of salmon smolt biology.

e) Salmon kelts

Table 27. Timing of Salmon Kelt Run

December 1983	13	
January 1984	57	
February	7	
March	107	
April	144	
May	<u>1</u>	
Total	329	incl. 13 finclipped = 316 wild kelts

The majority of the kelt run migrated downstream in March (32.5%) and April (43.8%) at the Salmon Leap. Almost all the kelts marked by UDN/fungal infections were noted in January; 82% of the run was clean and well-mended, as in 1982. Survival of the spawning escapement increased to 58.4%. It has been a common feature of salmon kelt runs over the years since 1960 that downstream migration virtually ceases during February, irrespective of water levels and that the later and major portion of the run is composed, almost entirely, of female fish.

Table 28. Comparison of annual kelt runs.

	A	B	C	D	E
1975-79	75	18	14.0	30.0	8.1
1980-84	82	18	6.7	48.7	9.7
1983	82	18	7.0	50.0	13.5
1984	82	15	7.6	58.4	5.0
1985	94	26	3.0	56.0	7.7%

A : % healthy kelts in kelt run

B : % males in kelt population

C : % lightly marked with fungus

D : % survival of spawning escapement

E : % recaptures of previously spawned grilse in first year.

Note the encouraging trend towards better survival to the kelt stage from the spawning escapement.

Of the 242 wild kelts tagged (90% at the Salmon Leap), 12 recaptures were made (5.0%), including 2 in the Irish drift-net fishery and one tag which was found on the shore near Burtonport, Co. Donegal. The survival rate from kelt to second spawner was less than

one-half that recorded in 1983, in common with poor survival rates from smolt to maiden grilse of both wild and reared fish.

Two twice-spawned kelts were recorded in the Salmon Leap downstream trap in March 1984. Both of these fish escaped upstream during 1983 without having been recorded, due probably to the tag being obscured by algal growths. Another twice-spawned kelt which escaped downstream in 1984 without having been recorded, was recaptured in a drift-net off Aranmore Island, Co. Donegal in July.

Details are as follows:-

1. Tag no. L317, tagged March 17, 1983. Recaptured March 25, 1984  
Growth increment: 3.0 cm.
2. Tag no. L373, tagged March 18, 1983. Recaptured March 25, 1984  
Growth increment: 9.5 cm.
3. Tag no. L495, tagged March 26, 1983. Recaptured September 18, 1983. Growth increment: 11.5 cm. Recaptured July 14, 1984.  
Additional growth increment: 4.5 cm.

Growth at sea from tagged kelt stage to return to freshwater averaged 6.7 cm (range 4.5 - 8.0 cm) in length, over an average period of 117 days (range 84 - 193 days).

No long absence (over 12 months) previously spawned fish were detected in 1984.

#### f) Ulcerative Dermal Necrosis/Fungal Infections

##### Downstream 1984

The incidence of UDN/fungal infections among the downstream migrating kelts during the 1983/84 spawning season was lower than that recorded in 1982/83. In December, January and February, the relevant proportions were:-

35% clean, 30% lightly marked and 35% heavily infected. However, during the major part of the run, in March and April, only three diseased kelts were observed.

#### Upstream migrants 1984

There were no cases of UDN/fungal infections observed in the upstream migrants during 1984. However, three fish were infected with papilloma (wart-like condition of the skin).

## 2. REARED SALMON

### (i) Upstream movements.

#### a) Recaptures of maiden reared grilse.

In common with the wild grilse, there was a very poor survival of reared smolts released in 1983 to the grilse stage in 1984. Of 14,914 smolts released, only 79 were recaptured (0.53%), only about one-third of the average value for the past eight years. This value of 0.53% may be compared with 3.1% for wild smolts, which survived almost six times better. No immediate cause for this poor survival is apparent although it has been noted in the past that environmental factors in the sea which adversely affect the survival of wild smolts, have an even more pronounced effect on reared smolts.

In addition, there were no recaptures from a batch of 2338 smolts which were 1+ 2-sea-winter stock, which means that the recapture rate of the remaining 11,686 smolts was 0.68%. This phenomenon of poor returns from 1+ smolts derived from 2SW parents was noted in 1983 as well, when only 9 grilse returned from 2942 smolts.

None of them were seen as 2SW fish in 1984, which might have been a logical outcome following a poor grilse return. The parents of these smolts were wild (Corrib) stock and had not been selected from 5-6 generations of reared parents, as had the grilse stock. In addition, it was noted in 1983 that the 1+ smolts of grilse parentage successfully self-released themselves from the special release pond whilst the 1+2SW smolts did not. However, the 2+ smolts of 2SW parentage, released in 1983, gave better returns as grilse than those from grilse stock. This may have been an artefact of a successful mark, in that there were almost as many grilse from 2+ smolts with unrecognisable marks as those with definite brands and panjets.

The full details of all recaptures are given in Table 29 below, but to summarise, the overall recapture rates were 0.47% for 1+ smolts and 0.63% for 2+ smolts. Only one fish was unidentifiable as either 1+ or 2+ smolt derivation. This was a rod-caught fish from L. Furnace, of which the scale envelope was lost.

b) Recaptures of 2-sea winter reared fish.

Five 2-sea winter fish were recorded in 1984, 4 in the traps and one as a rod-caught fish on L. Furnace. Three were derived from 1-year-old smolts of six generations grilse parentage and two from 2+ smolts of six generations of grilse parentage. As mentioned earlier, there were no returns from 1+ smolts of 2SW parentage, which, theoretically, ought to have produced the best returns of 2SW adults.

c) Recaptures of previously-spawned grilse.

Of the three returns in this group, only one had retained its original Floy tag and the other two were detected by scale-reading. All were short-absence fish and the recapture details for the tagged fish were:

No. 00360	Tagged 5.9.83	Length 59.0 cm	Female
	Kelt 25.3.84	" 59.5 cm	"
	2nd Return 12.7.84	" 66.0 cm	"

d) Recapture totals.

The return rates of reared maiden grilse and 2-sea-winter fish in 1984 are given in Table 29 :

Table 29. Recaptures from reared smolts released in 1982 and 1983

Smolt type	Year of release	No. released	Mark	Returned as:-	
				Grilse	2SW
1+G	1982	8015	S	91	3
2+G	1982	6913	V	188	2
1+2SW	1983	3228	} PJ left pelvic PJ left pectoral	0	N/A
1+G	1983	1917		8	N/A
1+G	1983	2175		U	8
2+2SW	1983	2730	X	12	N/A
2+G	1983	2672	PJ caudal	7	N/A
2+G	1983	2192	PJ left anal	6	N/A

Table 29 does not include the 30 fish having no visible mark or the 7 fish whose mark was read incorrectly, as determined by scale-reading.

The 87 recaptures, including the 3 previous-spawners (all of which returned in July), were made in the following ways:

Salmon Leap trap	:	48 (55%)
Mill Race trap	:	33 (38%)
Furnace rods	:	6 (7%)

A slightly larger proportion of reared grilse than wild grilse used the Mill Race route to L. Feeagh, possibly resulting from their early imprinting to this water.

e) Relative survival rates.

The three 5-year average survival rates from 1966-80 are shown in Table 30, with the respective annual values from 1981-84:

Table 30. Relative survival rates of 1+ and 2+ smolts.

Year	Smolts released	Number recaptured	% overall recaptured	% 2+ smolts	% 1+ smolts
1966-70*	13,647	342	2.32	3.12	1.66
1971-75	8,809	270	2.81	3.02	1.69
1976-80	15,171	224	<del>1.47</del>	1.47	1.35
1980			1.56		
1981	10,705	221	2.06	2.29	1.46
1982	18,926	253	1.34	1.23	1.47
1983	17,870	298	1.66	2.72	0.91
1984	14,914	79	0.53	0.63	0.41

\* Mill Race Trap only.

Note that the above survival rates refer only to return to the river of origin and make no allowance for unreported reared grilse taken by coastal nets (see section on microtag recovery programme).

f) Timing of wild and reared grilse returns.

As is now the invariable rule, reared grilse were later-running into fresh water than wild grilse. Whereas 76% of the wild run had reached L. Feeagh by the end of July, only 37% of the reared grilse had been counted through the traps. Similarly, the run of wild fish from September 1 onwards was 24% c.f. 63% for the reared. This has been ascribed to the disinclination of reared fish to leave their primary homing point (the Mill Race effluent stream into L. Furnace) until sexual maturity becomes more advanced. However, it is possible that this late running reflects a distinct facet of the behaviour of reared smolts, possibly induced by a delayed onset to oceanic migration, by comparison with wild smolts.

Table 31. Timing of maiden wild and reared grilse runs.

	Wild grilse %	Reared grilse %
June	36.7	9.0
July	39.2	28.2
August	0.0	0.0
September	18.9	28.2
October	4.4	21.8
November	0.4	7.7
December	0.4	5.1

g) Summary of selective breeding programme.

The following summary, incorporates returns of 50<sup>63</sup> fish derived from reared smolts since 1966 but excludes those with doubtful or unreadable marks, as well as previously-spawned fish.

They may be divided into the following categories:-

Table 32. Selective breeding programme.

Smolt parentage	Grilse	2SW fish	Pregrilse
2SW	195(87.8%)	27(12.2%)	0
Grilse	4604(98.4%)	76(1.6%)	8
2SW x grilse	147(96.1%)	6(3.9%)	0

"Pre-grilse", which return to fresh water after less than one year in the sea, did not appear in 1984, even though 98 "giant" smolts were released in the autumn of 1983. "2SW" fish includes both small spring and small summer fish.

(ii) Size, condition factors and sex ratios of reared grilse.

Table 33.

Average length all fish	60.4 cm
Average length fish from 2+ smolts	61.5
Average length females from 2+ smolts	60.9
Average length males from 2+ smolts	62.0
Average length fish from 1+ smolts	58.6
Average length females from 1+ smolts	58.5
Average length males from 1+ smolts	58.7

Only 8 rod-caught fish were available for calculation of Condition Factor, giving a value of 1.02, although this is not a reliable estimate. Based on this however, the average weight of reared maiden grilse in 1984 was 2.248 kg or 4.95 lbs. Certainly, it was noticeable that the grilse were smaller than usual and that the smaller, thinner fish were seen early in the season, being those most likely to escape the drift nets. Grilse derived from 1+ smolts were smaller than those from 2+ smolts but had grown slightly more from their mean smolt length (14.6 cm to 58.6 cm) than those from 2+ smolts (18.8 to 61.5 cm).

The largest grilse to return in 1984 was a male measuring 73.5 cm, at a calculated weight of 4.05 kg (8 lbs 15 oz). The sex ratio among grilse from 2+ smolts was 50 females : 50 males whilst that from grilse from 1+ smolts was 53 females : 47 males.

(iii) Rod catches.

Due to the paucity of reared grilse, they formed only a small proportion of the rod catch in 1984. Of the total of 56 salmon caught, 9 (16.1%) were reared fish, including 3 out of 31 (9.7%) from L. Feeagh and 6 out of 25 (24%) from L. Furnace. All the available evidence indicates that very few fish, either wild or reared, reached L. Furnace from the sea during and after the drought in August.

(iv) Detection of microtags in adult salmon broodstock.

All reared smolts released in 1983 were microtagged, as well as having the adipose fin clipped and being given a cold-brand or panjet mark.

Broodstock numbering 49 were collected from the traps after October 1 and 46 were tested for microtags. Of these, 44 gave a positive result, which constitutes a detection rate of 96%.

(v) Net-marked reared fish.

Some 10% of the reared fish were noted as having net-marks in 1984. These comprised:-

June: 1 marked out of 7

July: 6 marked out of 22

Sept: 1 marked out of 22

The incidence of marks cannot be said to assume any special significance, in view of the very small numbers of fish involved.

(vi) Reared grilse caught in coastal nets.

All smolts destined for release in 1983 were microtagged, in order to give unequivocal results for detection of these tags in returning grilse in 1984.

Of 14,914 smolts actually released, 14,522 were estimated to have been microtagged successfully, after making due allowance for "missed" tags recorded on the machine.

The broodstock available at the end of the year were tested for the presence of microtags and gave 96% positive results. This is within the 5% tolerance limit expected for this technique.

The microtag detection programme conducted by the Fisheries Research Centre at various salmon landing-places around the Irish coast was continued in 1984.

Of the 14,522 smolts estimated to have been released with microtags, recaptures from drift-net fisheries around the Irish coast were:-

- |       |                  |                 |         |
|-------|------------------|-----------------|---------|
| (i)   | 7438 x 2+ smolts | : 60 recaptures | = 0.81% |
| (ii)  | 3228 x 1+ smolts | : 4 "           | = 0.12% |
| (iii) | 1939 x 1+ smolts | : 20 "          | = 1.03% |
| (iv)  | 1917 x 1+ smolts | : 15 "          | = 0.78% |

Group (ii) was 2SW parentage smolts and gave a similar poor recapture rate to that noted earlier, for returns to fresh water.

The overall recapture rate was  $99/14,522 = 0.68\%$ . This is a minimum figure since not all the drift-net catch could be examined, so that a "raising factor" is applied, calculated by dividing the number of salmon in the recorded catch by the number examined.

99 original

251  
78  
329

The factor in 1984 has been calculated to be 2.54,  
which increases the net-caught total to 251 fish.

Comparing this with the total of 78 maiden grilse which  
returned to fresh water, the exploitation rate by coastal  
drift-nets in 1984 was 76.3% (minimum value).

As in previous years, the majority of the recaptures  
came from Donegal and North Mayo nets but approximately  
15% were caught south of the parent river, largely off Connemara  
(Renvyle, Clifden, Rossaveal) but also as far south as Dingle  
(Co. Kerry). Two-thirds of the recaptures were made in June,  
supporting the contention that the grilse run in 1984 lacked  
the usual strong July component.

The recapture data for the years 1981-1984 inclusive  
have been re-examined in the light of raising factors now  
available for each recapture area, each year.

The exploitation rates are now:-

Table 34. Exploitation rates of drift nets on Burrishoole reared grilse.

Year	Amended value	Original estimate
1981	35.5 - 52.4%	40%
1982	79.2%	81.2%
1983	67.2%	65.5%
1984	76.3%	-

The range of values for 1981 represents the minimum to the probable rate and is due to the reported catch being considered to be considerably less than the actual catch, in the year when the salmon levy was imposed.

The data embodied in the above section was drawn from a preliminary computer print-out, kindly supplied by Mr. John Browne, Fisheries Research Centre, Dept. of Fisheries and Forestry, Dublin.

### 3. WILD SEA TROUT

#### (i) Upstream movements

##### a) Timing and numbers

The sea trout run of 1325 fish showed an apparent improvement on the 1983 figure, although extrapolation from the 1983/84 kelt run indicates probable upstream total of 1572 for 1983 (see Table 35). The finnock (0+ sea years) proportion of the run was estimated at 28.5%. The greatest number of sea trout moved upstream in July and 61.7% of the run used the Salmon Leap passage to L. Feeagh.

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

Table 35. Annual runs of sea trout

	Mill Race	Salmon Leap	Total
1970-74	1365	762	2130
1975-79	829	1775	2604
1980-84	458	780	1238
1983	505	461	966
1984	508	817	1325

These totals are known to be inaccurate, to varying degrees, especially since 1980, when the number of finnock kelts counted downstream has far exceeded the number of finnock counted upstream in the previous summer. This is due to:-

- (i) ability of small finnock to squeeze through the bars of the upstream traps, especially at the Salmon Leap, as well as the fish fence at the Mill Race.
- (ii) misclassification of finnock as sea trout, when counted upstream.
- (iii) misclassification of very large smolts as finnock kelts during their joint downstream run in April/May.

By extrapolating from the known numbers of finnock kelts each year since the 1980/81 season, a revised estimate of sea trout and finnock totals upstream has been prepared:-

Table 36. Revised figures for upstream runs of sea trout since 1980

	Finnock count upstream	Finnock kelt count downstream	Probable actual run upstream	Probable actual total run
1980	120 (8% total)	414	621 (31% total)	2004 (cf 1503)
1981	279 (21.9%)	566	849 (46% total)	1896 (cf 1276)
1982	296 (26.4%)	524	801 (49% total)	1624 (cf 1119)
1983	282 (29.2%)	592	898 (56% total)	1572 (cf 966)

As mentioned later, special efforts were made in 1984 to prevent the upstream escape of uncounted finnock, thought to be the major source of error in these figures. The finnock kelt total in 1985 will indicate to what degree these precautions were successful.

The timing of the sea trout run in 1984 and previous years, expressed as monthly percentages, is shown below.

Table 37 . Timing of sea trout run

	1970-79	1980-84	1983	1984
May	-	0.2	0.2	-
June	13.1	24.6	15.2	16.2
July	54.4	44.9	35.2	64.8
August	15.8	10.3	-	1.3
September	7.6	14.8	42.6	13.0
October	6.4	3.5	4.7	3.7
November	2.4	1.5	1.9	1.0
December	0.3	0.2	0.2	-

81% of the run had migrated upstream by the end of July. However, low water conditions in August delayed the remainder of the run into September, October and November.

b) Net-marked fish

Thirty two sea trout (2.4% of the total run) were noted as net-marked in 1984. A similar proportion was net-marked in 1982 and 1983. These marks are due to illegal mackerel mesh nets and not to commercial salmon drift nets.

c) Spawning escapement

Table 38 . Calculation of spawning escapement.

Live fish counted through the traps	1325
Rod catch on L. Feeagh	52
Maximum escapement	1273

There was an overall increase in the maximum spawning escapement to the rivers flowing into L. Feeagh during 1984 as can be seen from the following table:-

Table 39. Annual spawning escapements of sea trout.

Year	1970-79	1980	1981	1982	1983	1984
Maximum escapement	2090	1345	1174	1014	925	1273
Revised estimates	-	1846	1794	1519	1531	N/A

(ii) Downstream movements.

a) Sea trout smolts.

Early smolts began to move downstream in January but only 4.1% of the run had migrated by the end of March. The main run of smolts migrated in April (44.5%), May (21%) and June (30.4%). The majority of the smolts migrated via the Salmon Leap (62.5%). The smolt run at 2383 was the lowest recorded since 1980.

Table 40. Annual sea trout smolt numbers

Year	1970-79	1980	1981	1982	1983	1984
Sea trout smolt number	4176	2337	6710	3907	4852	2383

b) Autumn-migrating trout

These are juvenile trout, which move down through the traps from September to December and cannot be identified as either freshwater

or sea-going Salmo trutta. The autumn-migrating trout run at 1384 was the lowest since complete trapping began in 1970.

Table 41. Timing and numbers of Autumn-migrating trout

	Mill Race	Salmon Leap	Total
September	-	108	108
October	149	515	664
November	79	343	422
December	80	110	<u>190</u>
			1384

Up until 1980, it could be assumed that almost all autumn-migrating trout contributed to the sea trout smolt run in the following year and a figure for total recruitment could be calculated.

However, 50% of the autumn-migrating trout in 1982 and 1983 were shown by scale reading to be 0+ years old and it is doubtful if these young fish made any contribution to sea trout production in 1983 and 1984 (Ann. Rep. XXVII, Section C3, ii). It was estimated that the proportion of 0+ fish in the 1984 migration was 55.8%.

In addition, these 0+ fish are so small that a proportion might be expected to escape through the grids of the traps and thus avoid capture. Thus, since 1980, the figures for total recruitment in Table 42 are unreliable, in that only about half the autumn trout were large enough to become smolts in the following spring. The reason for this change in age composition of autumn migrant trout is, as yet, unknown.

Table 42 . 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	5270	4171	9378
1977	3889	2947	6836
1978	3167	3506	6673
1979	5656	2603	8259
1980	2337	2351	4688
1981	6710	2631	9341
1982	3907	1730	5637
1983	4852	2218	7070
1984	2383	1574	3957

6746

7487

6139

c) Sea trout kelts

The first kelts of the 1983/84 season were recorded during November. The peak of the runs of both the larger (over 30 cm) and smaller kelts occurred in April. A fork length of 30 cm roughly delimits finnock from adult sea trout. In 1984, the proportion of sea trout kelts marked by fungus (1.0%) was lower than that recorded in 1983 (2%). This confirms the low incidence of UDN among sea trout in the Burrishoole system, where it is not thought to be a major contributory factor in the current decline in sea trout.

Table 43 . Timing and numbers of sea trout kelts

Month	Large	Small	Total	% marked
November 1983	14	9	23	0
December	21	49	70	5.7
January 1984	10	42	52	9.6
February	19	22	41	2.4
March	69	38	107	0
April	295	333	628	0
May	35	55	90	1.1
June	21	55	76	0
Totals	484	603	1087	1.0

The comparable survival rates from the maximum spawning escapement of 1983 to the kelts of 1983/84 are expressed as percentages below:

Table 44 . Annual % survival rate to kelt

Year	Large	Small
1976	79	66
1977	63	45
1978	50	66
1979	33	*107
1980	50	82
1981	44	*345
1982	53	*203
1983	63	*177
1984	74	*210

As in 1979, 1981, 1982 and 1983, the number of "small" sea trout kelts exceeded the number of finnock recorded in the upstream run.

As stated above, the main reason for the observed discrepancy in numbers is due to the fact that small finnock can squeeze through the bars at the front of the upstream traps and the Mill Race fish fence.

During 1984, fine-mesh screens were attached to the bars of the Salmon Leap upstream trap in order to stop these finnock escaping upstream unrecorded. Similarly, smolt screens were left in place on the Mill Race fish fence throughout the summer, from March to early November.

(iii) Tagging of autumn-migrating trout and sea trout smolts

Each autumn (except autumn 1983) and spring between 1979 and 1983, wild autumn-migrating trout and sea trout smolts have been tagged in the downstream traps. Recaptures in 1984 are detailed below and total percentage recaptures to December 31, 1984 are given in Table 45.

Autumn-migrating trout, 1979-81

No recaptures of any of the above groups of autumn-migrating trout were recorded in 1984.

Autumn migrating trout, 1982

One fish from this group was recaptured twice during 1984. It was originally tagged on October 28, 1982 at a length of 13.8 cm and scale reading showed that it was then 1+ years old. It was subsequently recaptured in the Salmon Leap downstream trap on April 20, 1984 ( i.e. not seen as a finnock in the upstream traps) at a length of 27.5 cm. On July 11, 1984, it was recaptured again in the Mill Race upstream trap at a length of 33.5 cm (2.0+SM+).

Sea trout smolts 1980-81

No recaptures of these fish were recorded in 1984.

Sea trout smolts 1982

Two fish from this group were recaptured in 1984, both as kelts in April. One fish, which was recaptured twice previously in 1983, was recorded again in the downstream trap at the Salmon Leap on April 14 1984 at a length of 33 cm. The second fish was recorded for the first time on April 20 1984 at a length of 40 cm, having been tagged on May 20 1982 at a length of 22.5 cm. It was misrecorded as a fresh fish in 1983.

Sea trout smolts 1983

A total of twelve fish from this group were recaptured in 1984, 11 of these for the first time. Nine were recorded as kelts (missed in the traps) and the other three as fresh-run sea trout. The mean length of the kelts was 31.3 cm and that of the fresh-run fish 36.7 cm. Note that kelts were smaller and possible "escapees".

Table 45. Details of first recaptures of tagged downstream-migrating trout up to December 31, 1984.

Year	Type	Number tagged	% recaptured	
1979	Autumn trout	353	0.8	
1980	Smolts	448	0.4	2
1980	Autumn trout	522	1.7	9
1981	Smolts	456	6.4	29
1981	Autumn trout	336	0.6	2
1982	Smolts	448	4.9	22
1982	Autumn trout	387	0.3	1
1983	Smolts	409	5.4	22

The recaptures of 1979 autumn trout exceeded those of comparable 1980 smolts, due to delay by drought in 1980 adversely affecting survival of all wild smolts.

(iv) Scales

a) Sea trout smolts, 1984

An analysis was carried out on 90 sets of scales taken from sea trout smolts caught in both the Mill Race and Salmon Leap downstream traps. As in 1983, only 2+ and 3+ smolts were distinguished but the proportions of each reverted to the levels found in 1981 and 1982 (see Table 46). In 1983, it would appear that sampling error was responsible for the decreased proportion of 2+ smolts since later analysis of finnock (0+ sea years) scales revealed the normal proportions of 68% x 2+ and 32% x 3+ smolts.

Table 46 compares the percentage age composition of smolt samples during the five years 1980-84:-

Table 46.

Age	1980	1981	1982	1983	1984
1+	-	1	-	-	-
2+	64	68	72	48	73
3+	36	30	28	52	27
4+	-	1	-	-	-

As has been found each year, there was a much higher proportion of 2+ smolts exhibiting "B" growth (pre-migration growth after final winter) than among 3+ smolts. The obvious conclusion is that

fewer younger smolts reach the threshold size for migration unless some growth occurs in the pre-migration spring.

Relative sizes were very similar to those observed in earlier years and there has been no discernible shift in population dynamics over the past five years:-

Table 47.

Smolt type	No.	Mean length(mm)	Mean weight(g)	Condition factor	Proportion in year-class
2A	11	191	69.1	1.00	16.7%
2B	55	192	70.5	1.00	83.3%
3A	14	210	92.4	1.00	58.0%
3B	10	214	98.5	1.00	42.0%

The Condition Factor (1.00) was common to all groups and is somewhat higher (i.e. fatter fish) than heretofore. Given the uniformity of growth and age composition determined for sea trout smolts over the past five years, it is proposed to discontinue annual sampling in 1985 and to resume after a period of 3-5 years. This will reduce handling stress on fish at a delicate and vital stage and the resumption of sampling will bring to light any changes that have occurred since 1984.

b) Rod-caught sea trout

In all, 152 scale samples of wild rod-caught trout were collected in 1984, of which 14 proved to be from non-migratory trout. L. Feeagh provided 44 sets of sea trout scales and L. Furnace, 94. (total 138). The total rod catch of sea trout was 290 fish.

Table 48 gives age, sample number, mean lengths and weights and hatch year of the combined sample of 138 fish:-

Table 48. Details of rod-caught sea trout.

Age	N	$\bar{X}$ length(cm)	$\bar{X}$ weight(g)	K	Hatched
2+	53	28.5	261	1.13	1982
2+SM+	20	36.0	541	1.15	1981
2.1+	25	37.5	630	1.19	1981
3+	14	29.8	275	1.04	1981
2.2SM+	1	39.0	682	1.15	1980
2.1+SM+	9	41.7	777	1.07	1980
3.SM+	5	36.3	534	1.11	1980
3.1+	4	38.3	646	1.14	1980
2.2+SM+	1	47.5	1050	0.98	1979
3.1+SM+	1	43.5	908	1.10	1979
2.1+2SM+	3	47.5	1240	1.15	1979
3.1+2SM+	1	49.0	1306	1.11	1978
3.1+3SM+	1	48.0	1050	0.95	1977

By comparison with 1983, the condition factor (K) is considerably higher, indicating that all groups of fish were fatter in 1984.

Table 49 compares the mean fork length of the different age groups, from which it can be seen that the growth increments of smolt to finnock (9.1 cm) and 1983 smolt to 1984 1+ maiden (17.4 cm) were above average. This confirms the supposition of a good growing year for sea trout in the sea in 1984:-

Table 49. Fork length (cm) of smolts and maiden fish.

	Smolts	0+	Incr	1+	Incr	2+	Incr
1956-58	19.6*	27.9	8.3	36.1	N/A	46.9	N/A
1980	20.0	27.8	7.8	37.1	N/A	42.5	N/A
1981	19.8	27.0	7.2	36.3	16.3	43.2	N/A
1982	19.7	27.8	8.1	35.1	15.3	40.5	20.5
1983	20.2	29.4	9.2	37.0	17.3	44.2	24.4
1984	19.7	28.8	9.1	37.6	17.4	-	-
Mean	19.8	28.1	8.3	36.5	16.6	42.3	22.5

The proportion (as percentages) of maiden and previously spawned sea trout over the past five years are given in Table 50.

Table 50. Proportions of maiden and previously spawned sea trout.

Year	0+	1+	2+	Previous spawners	No. in sample
1980	36.4%	36.4%	2.4%	24.8%	371
1981	53.1	28.8	2.7	15.4	371
1982	58.2	29.3	1.6	10.9	249
1983	69.8	17.6	2.9	9.8	205
1984	48.6	21.0	0.0	30.4	138

There were relatively fewer finnock, slightly more 1+ maidens and many more previously-spawned fish in the 1984 rod-catch.

The increased proportion of the latter group is particularly encouraging, denoting better survival at sea.

The analysis of smolt age of the various categories of sea trout, shown in Table 51 indicates an increasing importance ascribable to 2+ smolts:-

Table 51. Analysis of smolts age, with values for 1980-83 in parentheses.

Smolt life (yrs)	Finnock	Maiden sea trout	Previous spawners	Total sample
1+	- (0.2)	- (0.2)	- (0.3)	- (0.2)
2+	79.1(56.6)	86.2(64.0)	81(73.4)	81(63.1)
3+	20.9(41.4)	13.8(35.1)	19(26.0)	19(35.6)
4+	- (1.8)	- (0.7)	- (0.3)	- (1.1)

This increased importance of 2+ smolts continues a trend first noted in 1983, although as has been found heretofore, 3+ smolts produced more finnock than older fish and were less likely to survive to become previously-spawned fish.

When the age of previous spawners at first spawning is calculated, there is no apparent trend towards any change in the relevant proportions over the past five years:-

Table 52 . % sample spawning at different ages.

	0+SM	1+SM	2+SM	3+SM
1980	47	42	11	-
1981	44	52	2	2
1982	67	18	15	-
1983	50	45	5	-
1984	62	36	2	-

There were no maiden fish which had spent 2+ years in the sea in the 1984 sample, so that the proportions (%s) hatched in the various years can be calculated as follows:-

Table 53.

Returned in 1984 as:	Hatched:					
	1977	1978	1979	1980	1981	1982
Finnock	-	-	-	-	10.1	38.4
1+ maiden	-	-	-	2.9	18.1	-
Previous spawner	0.7	0.7	3.7	10.9	14.5	-

This confirms the importance of the 2+ smolts in both the finnock and the 1+ maiden groups.

As usual, many more finnock were caught on L. Furnace but although low water conditions must have prevented finnock from running upstream to L. Feeagh, it is also possible that many non-spawning finnock stay in L. Furnace and never migrate into fresh water.

Table 54 . Proportions (%'s) of sea trout types in the rod-catches of L. Feeagh and L. Furnace for 1984.

	Finnock	Maidens	Previous spawners
L. Furnace	63.3	21.8	14.9
L. Feeagh	37.2	40.5	22.3

c) Identification of finnock kelts and large sea trout smolts

The possibility of confusing large smolts (> 25 cm) with late-running small finnock kelts in the downstream traps during the period March-May, has been cited as a contributory cause of the finnock kelt total outnumbering the upstream finnock total in the preceding summer. Whilst this inaccuracy is now thought to be due, very largely, to the non-counting of upstream finnock which squeeze through the bars of the fish fence and traps, the possible misidentification of small finnock kelts was studied in 1982 (Ann. Rep. XXVII, p46) and again in 1984.

Both sets of results indicate that the problem of misidentification is likely to be insignificant. Of 22 sets of scales taken on April 19, 1984 from fish between 21.5 and 30.5 cm in length, one smolt of 25.0 cm and one kelt of 24.0 cm were wrongly identified from external characters, when the scales were examined.

(v) Gonadal development of sea trout

Samples of rod-caught finnock and sea trout were examined to give preliminary results on:-

- a) sex determination, sex ratios and degree of maturity in finnock.
- b) fecundity determinations in female sea trout.

These observations are to be continued in forthcoming years.

#### 4. REARED SEA TROUT

##### (i) Recaptures of reared sea trout released in 1982.

In Ann. Rep. Salm. Res. Trust No. XXVII, Section C 4(ii), it was recorded that 62% of all recaptures made from tagged reared 2+ sea trout smolts released in 1982 were finnock. This calculation was based on a classification using only morphology.

Subsequently, examination of 86 sets of scales from these recaptures has shown that only 33.7% of this sample had been to sea. In 1984, 6 further recaptures were made from this group:

Table 55. Recaptures of reared sea trout released in 1982.

Recapture date	Final length (cm)	Age
1.3.84	41.4	3.0+.SM
13.3.84	39.5	2.1+.SM+
16.4.84	28.0	3.0+
1.11.84	42.5	2.2+
23.11.84	46.0	2.2+
28.11.84	40.5	3.1+

A total of 3 fish had not migrated to sea until 3 years old and the two 2SW maidens were the first recorded from reared stock in recent rearing experiments (since 1980).

There have now been 191 first time recaptures (6.7%) from the release of 2844 smolts. A total of 99 fish had not been to sea, 60 returned as finnock and 16 were recaptured as older maiden fish that had been to sea.

(ii) Recaptures of reared sea trout released in 1983.

In 1983, a total of 1301 reared 1+ sea trout "smolts" was released. Up to the end of 1983, only 3 tagged fish (0.2%) were recaptured as finnock. 5 further recaptures giving a total recapture rate of 0.6% were made from this group in 1984 (see Table 56). Two fish had been to sea returning as 1SW maidens, the others had remained in freshwater.

Table 56. Recaptures of reared sea trout released in 1983.

Recapture date	Final length (cm)	Age
22.1.84	10.0	2+
25.1.84	24.0	2+
10.2.84	19.5	2+
4.7.84	36.0	1.1+
22.11.84	40.0	1.1+

(iii) Recaptures of reared sea trout released in 1984.

In 1984, two groups of 2+ reared sea trout were released. Group A (1570 fish) were reared in a freshwater pond and were adipose finclipped and Carlin tagged (red tags, 14 x 4 mm) before release into freshwater Lough Feeagh in April. Group B (1191 fish) were put into a cage in brackish water Lough Furnace during their second year of life and after being adipose finclipped, panjetted with Alcian blue dye and Carlin tagged (yellow tags, 14 x 4 mm) released directly into Lough Furnace.

Recaptures of Group A (Feeagh release)

By June 21, 1984, 756 fish (48% of total release) from Group A had been recaptured in the downstream traps migrating out of Lough Feeagh.

Although these fish were assumed to be true migrants, a proportion of them displayed aberrant behaviour. Forty fish returned upstream after release from the downstream trap, 21 of which migrated downstream for a second time and 1 migrated upstream for a second time.

It was discovered in mid-June that some fish released for the second time from the downstream traps had not been recorded moving upstream. In consequence, additional, fine screens were added to the front of the Salmon Leap uptrap. The smolt screens on the Mill Race fish fence were retained, having been in place since the beginning of the smolt run. From the end of June any discrepancies in the movements of tagged reared sea trout were almost certainly due to human error in failing to record tagged or finclipped fish in the traps.

A total of 149 fish were subsequently recaptured from Group A, giving a recapture rate of 9.5%. Of these, 18 fish (21.1%) were identified by scale reading as having 'sea type' growth. Table 57 shows the sites of all recaptures from Group A.

Table 57.

Site	Nos. recaptures		Total	% finnock
	Before 10.10.84*	10.10-25.12.84		
L. Feeagh	23	0	23	0
Downtraps	11	79	91	1.1
L. Furnace	9	0	9	66.7
Uptraps	12	14	26	38.5
Outside	1	0	1	100.0

\* Date on which last reared sea trout was caught by rod and line.

Before October 10, recaptures from Group A were of three categories:-

- a) non-migrant fish rod-caught in L. Feeagh
- b) migrant fish rod-caught in L. Furnace
- c) fish migrating upstream into the uptraps.

After October 10, although a small number of fish were still migrating upstream, the majority of recaptures were made moving downstream.

Moreover, of the 79 fish recaptured in downtraps after October 10, only 1 was shown by scale reading to be a finnock. Thus, these 79 fish appear to represent an autumn emigration from the 815 fish that had not migrated out of L. Feeagh in the spring.

#### Recaptures of Group B (Furnace release)

A total of 71 recaptures were made from Group B giving a recapture rate of 6.0%. Scale reading showed 29 of these fish to be finnock, giving a 40.8% recapture rate as finnock.

Table 58 shows the site of recapture of all recoveries from Group B.

Table 58 .

Recapture Site	Nos recaptures		Total	% Finnock
	Before 10.10.84	10.10-19.12.84		
Outside	1	0	1	100.0
L. Furnace	22	1	23	30.4
Uptraps	14	30	44	43.2
Downtraps	0	3	3	66.6

Before October 10, most recaptures were rod-caught in L. Furnace or recovered in uptraps. After the end of the rod fishing season (October 12), the majority of first time recaptures were confined to the uptraps.

During the same period, a further 31 fish without tags (not counted as first time recaptures) were recovered in downtraps. These fish probably migrated downstream having passed their homing point, as has previously been recorded for both reared sea trout and salmon. The proportion of finnock amongst upstream migrating fish and fish migrating downstream having lost their tags was very similar (43.2% c.f. 40.7%).

There are now total recapture rates and recapture rates as finnock for 3 release groups (see Table 59 ).

Table 59.

Year	Total recapture rate (%)	Recapture rate as finnock (%)	Proportion of recaptures as finnock (%)	Sample size
1982	6.6	2.3	34.9	189
1984 (Group A)	9.5	1.2	12.1	149
1984 (Group B)	6.0	2.4	40.8	71

The recapture rate of tagged reared sea trout released as 2+ smolts was highest (9.4%) in Group A, released into freshwater Lough Feeagh in 1984. However, the recapture rate as finnock was lowest (1.2%) amongst this group. The recapture rates as finnock released directly into L. Furnace in both 1982 and 1984 were higher (2.3 - 2.4%) but these only represent approximately 30% of the total recaptures.

It can be concluded that at present, the ranching of reared sea trout results in disappointingly low returns of mainly 0+ sea years fish. Furthermore, approximately 60% of all recaptures have

been found not to have been to sea i.e. have reverted to a brown trout-like existence.

A possible cause of the diminished migratory behaviour of reared sea trout is the process of artificial rearing itself. The effect of different rearing regimes and release dates/locations on the migratory behaviour of sea trout will receive investigation.

In terms of the biomass recovered from such ranching exercises, the yield is very low. For example, a release of 1000 2+ smolts weighing on average 170g (total biomass of 170 kg) would yield, at a 10% return rate, 100 fish weighing on average 340 g (total biomass of 34 kg). This harvest of 0.2 kg/kg smolts released is obviously uneconomic in terms of recovered biomass, however, the more likely use of sea trout ranching would be to enhance sport fisheries and in this case, lower yields might be acceptable. It would be imperative however to obtain a higher proportion of migratory sea trout and preferably fish which were of larger average size, having undergone a longer sea absence.

SECTION D: FISHERY REPORT

1. CATCH DATA

(i) Numbers and average weights of rod catch.

The rod catch for the 1984 season (including wild and reared salmon and sea trout) was as follows:-

	SALMON			SEA TROUT		
	No.	Total wt(lb)	Av. wt(lb)	No.	Total wt(lb)	Av. wt(lb)
L. Feeagh	32	144.1	4.5	90	90.2	1.00
L. Furnace	25	109.3	4.4	200	157.4	0.79
	57	253.4	4.5	290	247.6	0.85

Table 60. Number and average weights of rod caught salmon and sea trout, 1970-1984.

	SALMON		SEA TROUT	
	No.	Av. Wt.(lb)	No.	Av. Wt.(lb)
1970-74	237	4.6	967	0.94
1975-79	141	4.9	568	0.87
1980	59	5.0	455	1.08
1981	42	4.4	385	0.88
1982	105	4.5	371	0.76
1983	130	5.2	250	0.80
1984	57	4.5	290	0.85

(ii) Salmon

The salmon rod catch dropped by over 50% when compared with 1983. For the third year in succession, drought conditions prevailed during July and August. However, probably due to the very low stock of fish

present in 1984, rod catches on L. Furnace were poor, in contrast with 1982 and 1983. Only 10 reared salmon were caught in 1984, 7 on Lough Furnace and 3 on Lough Feeagh, representing 17.5% of the total catch. The average weight of rod caught fish dropped in 1984 c.f. 1983 to the level recorded in both 1982 and 1981.

### (iii) Sea trout

The sea trout catch rose marginally in 1984 to 290 fish. Once again, this poor catch is a reflection of the small stock of fish available and the unfavourable weather conditions for angling (hot, dry and windless) recorded during July and August. The release of 2761 reared sea trout smolts resulted in a catch of 49 fish (1.8%).

## 2. EXPLOITATION RATES BY ROD FISHING

Only fly-fishing is permitted and records of the rate of exploitation for stocks of wild and reared salmon and sea trout now exist since 1970. Accurate assessments can be made for L. Feeagh but the complication of unknown numbers of sea trout spawning in the streams flowing directly into L. Furnace makes it impossible to attempt reliable estimates of the exploitation rate of sea trout in L. Furnace. 162 wild sea trout were caught in L. Furnace during 1983, most of which, it can be assumed, were destined to spawn in the L. Furnace tributaries (see Frontispiece for geography of the Burrischoole River system).

For salmon, the maximum rates are accurate, assuming no spawning in L. 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 stream is used to a minor extent by spawning salmon.

The 1984 rod fishing season for salmon ended on September 30, as in 1981-83. It should be noted that the exploitation rates for 1970-73 are not directly comparable with those for 1979 and 1980 when the statutory closing date was earlier.

The 1984 exploitation rates of the L. Feeagh salmon and the total stock of wild salmon were higher than normally recorded, but the 1984 exploitation rate of reared salmon in L. Furnace dropped considerably compared with 1983.

Table 61. Exploitation rates for rod fishing.

WILD SALMON	1970-74	1975-79	1980-84	1984
Lough Feeagh				
"Available" fish by end				
of fishing season	988	644	431	264
Rod catch	86	51	27	29
Exploitation rate %	8.7	7.9	6.6	11.0
WILD SALMON				
Loughs Feeagh and Furnace				
Total stock of wild fish	1282	802	496	294
10% addition for L. Furnace residents	1411	882	543	313
Total catch of wild fish	206	113	55	47
Minimum exploitation rate	14.6	12.8	10.7	15.0
Maximum exploitation rate	16.1	14.1	11.6	16.0
REARED SALMON				
Lough Feeagh				
"Available" fish by end				
of fishing season	154	122	109	48
Rod catch	4	7	5	3
Exploitation rate %	2.6	5.7	2.6	6.3

Table 61 cont.

REARED SALMON

Loughs Feeagh and Furnace

Total stock	261	257	184	87
Total rod catch	32	28	24	10
Exploitation rate %	12.3	10.9	12.7	11.5

WILD SEA TROUT

Lough Feeagh

"Available" fish by end

of fishing season	1983	2518	1193	1279
Rod catch	318	210	78	79
Exploitation rate %	16.0	8.3	6.5	6.2

3. FISHING EFFORT

(i) Boat lettings

Boat lettings in 1984 decreased slightly (8%) when compared with 1983. The drought in late July and August caused some fishermen to curtail or cancel their holiday.

Table 62. Boat lettings (number of boat days)

	Let by week	Let by day	With boatman	Without boatman	Total boat days let
1979	96	74	172	Not applicable	172
1980	73	119	76	116	192
1981	57	103	46	114	160
1982	32	155	67	120	187
1983	72	144	65	151	216
1984	54	145	75	125	199

(ii) Effort data

Table 63. Effort data

	L. Furnace:		L. Feeagh:		Overall boat utilisation rate	Total rod hours
	Rod Hours	Boats /day	Rod hours	Boats /day		
1979	1928*	0.8*	1272*	1.1*	1.9*	3476*
1980	2542	1.7	1149	0.7	2.4	3691
1981	2042	1.5	836	0.6	2.1	2878
1982	2672	1.5	1240	0.7	2.1	3912
1983	3619	2.0	955	0.5	2.6	4555
1984	2480	1.5	1304	0.9	2.4	3784

\* estimated

Fishing effort decreased on L. Furnace but increased on L. Feeagh during 1984.

(iii) Fishing success

In Table 64, the catch data is incorporated with the fishing effort to give an estimate of fishing success: number of rod days to catch one fish.

Table 64. Catch per unit effort (rod days per fish).

Year	L. Furnace		L. Feeagh	
	Salmon	Sea trout	Salmon	Sea trout
1980	14.8	0.9	3.5	1.3
1981	11.1	0.8	5.5	1.6
1982	4.1	1.4	4.2	1.5
1983	4.8	2.3	3.4	2.9
1984	12.4	1.6	5.1	1.8

The catch per unit effort (CPUE) of salmon recorded for L. Furnace was drastically reduced in 1984. This can be explained by the very low stock of salmon present in L. Furnace during most of the fishing season (see Section C 1(ii)a). The CPUE of salmon in L. Feeagh was 2.5 times greater than that recorded for L. Furnace, reflecting the fact that the majority of salmon were present in L. Feeagh during the fishing season.

CPUE of sea trout on both Loughs Furnace and Feeagh were slightly higher in 1984 c.f. 1983, possibly due to a small increase in the stock of fish available.

#### 4. EELS.

##### (i) Silver eels

The catch of 1033 silver eels in 1984 was the lowest recorded since full trapping began in 1971. The total was not a complete count since there was evidence that some eels escaped through the Salmon Leap trap in September, before repairs were effected.

In contrast with 1983, over half (62.8%) of the catch was made at the Salmon Leap trap and, as in previous years, the bulk of the run (74.7%) migrated in October.

Table 65. Timing of the silver eel run.

	Salmon Leap	Mill Race	Totals
October	486	286	772(74.7%)
November	141	87	228(22.1%)
December	22	11	33(3.2%)

Two batches of silver eels were sample-weighed before sale, with the following results:

Date	Number	Total weight	Average weight
October 31 (1984)	762	100.0 kg	131.2 g
January 5 (1985)	228	46.9 kg	205.7 g

This provides further evidence of larger eels migrating later in the season during 1984. In addition, the average weight over the entire run was 148 g in 1984, similar to that recorded in 1982 but less than that recorded in 1983 (228 g).

Table 66 . Catches of silver eels and average weights

Year	No.	Average weight (g)
1971-75	4465	84
1976-80	4023	115
1981	4702	131
1982	4234	148
1983	1548	228
1984	1033	148
<del>1985</del>	1875	

(ii) Elvers

Virtually no elvers were caught in the Mill Race traps during the spring and summer, due to unsuitable low water levels.

Moderate numbers were seen in the pools of the Salmon Leap water-course during drought conditions and some of these may have succeeded in reaching L. Feeagh, later in the year.

## SECTION E: CORMORANT PREDATION

An investigation into the impact of cormorants on the survival of salmon smolts commenced in May 1984. Preliminary work analysed the food of nestlings at two breeding colonies in Clew Bay, both within 15 km flying distance of the Salmon Research Trust.

Table 67 shows the percentage frequency of food items by number and weight in the diet of nestlings during May and June 1984.

In both colonies fresh water eels (Anguilla anguilla) and wrasse (Labridae) were the most important prey items. The differences that occurred between colonies probably reflected local differences in prey availability. For example, the Westport colony contained adult brown trout, adult sea trout and perch in the diet while these were absent in the Mulrany colony. The percentage occurrence of salmon and sea trout smolts was low in both colonies. Collectively, however, salmonid smolts (salmon and sea trout) comprised 8.0% by number and 6.5% by weight at the Mulrany colony. An analysis of the length frequency of eels obtained from the two colonies suggested that approximately 75% could be sexed as male and 25% as female.

From May 1984, weekly transects of Loughs Furnace and Feeagh have been carried out to determine the number and age of cormorants present, their activity (i.e. feeding, flying or resting) and their feeding rate. In turn, the data obtained will be used to estimate the impact of the cormorant on various prey species, in particular, salmon smolts. Numbers of cormorants present on Loughs Furnace and Feeagh increased through the summer, reaching a maximum of 16 birds in August and September. A significant proportion (> 50%) comprised juveniles born that year and colour ringing at the breeding colonies in Clew Bay showed that

these were locally bred young. Numbers declined through autumn and reached a minimum of 2 - 3 birds by late winter.

Results of time activity budgets during the summer showed that cormorants only spent an average of 13.4% of their time feeding, their main prey species being freshwater eels. An estimation of their impact on eels in Lough Feeagh during the months of July - September inclusive was carried out using the methods described above. The results show a minimum of 3200 eels consumed by cormorants and this compares with a total silver eel catch at the traps of 1,066. 6.8% of those trapped at the Research Station were found, on examination, to have wounds inflicted by cormorant beaks. Thus, the impact of cormorants on eels in Lough Feeagh appears to be high, even though the figure of 3,200 includes eels of varying ages and does not represent the actual loss of the silver eel population.

During autumn and early winter, the percentage time spent feeding increased to 36.9% of their active day, presumably in response to the shortening day length and perhaps a decline in prey availability. The diet of the cormorant during this period comprised mostly brown trout, sticklebacks and other small prey items too small to be identified.

Table 67 . The percentage frequency of prey items by number and by weight in the diet of cormorant nestlings at two breeding colonies in Clew Bay during May and June 1984.

	Colony			
	Westport		Newport	
	% by number	% by weight	% by number	% by weight
Wrasse	36.7	29.9	48.9	62.8
Eel	33.8	54.2	35.0	26.0
Brown trout (A)	6.0	5.0	0.0	0.0
Sea trout (A)	0.4	1.1	0.0	0.0
Salmon(S)	0.4	0.2	4.4	4.0
Sea trout (S)	0.8	1.3	3.6	2.5
Perch	2.4	1.2	0.0	0.0
Sea-Scorpion	10.0	4.9	2.0	2.1
Flatfish	1.6	1.2	0.7	0.5
Sprat	4.0	0.1	0.0	0.0
Stickleback	1.6	0.3	0.7	0.6
Butterfish	0.8	0.1	1.5	0.1
Shrimp	1.2	0.1	0.0	0.0
Gadoid sp.	0.4	0.4	0.7	0.8
Blenny	0.0	0.0	1.5	0.5
N =	251	18,165.7g	137	8,346.3g

A = Adult

S = Smolt