Newport Research Facility

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NO. 48

Report for the year ended 31st December 2002

This report follows in sequence from the Annual Reports of the Salmon Research Agency of Ireland Incorporated and The Salmon Research Trust of Ireland Incorporated

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Marine Institute – Newport Research Facility

Report for the year ending 31st December 2002

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SUMMARY

1. The Salmon Research Agency of Ireland merged with the national Marine Institute on the 1st July 1999 into Aquaculture & Catchment Management Services. This report provides a continuation of the data records for the Burrishoole facilities.

2. The total rainfall recorded in Furnace was 1715.9 mm in 2002 – a relatively 'normal' year with low rainfall in March, July and September.

3. The total release of microtagged salmon smolts of Burrishoole reared origin into L. Furnace amounted to 24,700. Smolts were released as four groups, averaging 67g in weight. A further 53,200 smolts were released as eight 'experimental' groups. The groups were part of a contract study with NUIG

4. In association with Cong, Delphi and Parteen hatcheries the SRA/MI co-ordinated the sale of 750,000 salmon ova to Germany for the Rhine Rehabilitation Programme.

5. A total of 648 wild grilse were recorded moving upstream through the permanent traps during the season. The number of spring fish recorded in the upstream traps was 2. The total run of wild grilse, including the Lough Furnace rod catch, was 649.

6. A total of 8,627 wild salmon smolts were recorded in the downstream trap in 2002. The return to freshwater of the Burrishoole reared grilse recorded was 2.3%. The wild grilse return, at 10.2%, was higher than that recorded in 2001 (6.5%).

7. The ova to smolt survival at 0.58 – 0.60, was similar to that recorded in 2001.

8. A total of 115 wild sea trout and a further 68 non-silvered trout migrated upstream through the traps in 2002. Of the sea trout, 35 were adults and 80 (70%) were finnock. The 2002 smolt run amounted to 1272 smolts – a substantial increase on the 530 recorded in 2001.

9. The percentage of smolts returning as finnock in the same year has historically ranged form 11.4% to 32.4%. In 1989 it collapsed to a minimum of 1.5%. There has been a saw-tooth pattern of finnock return in the 1990's between 4 & 10%, rising to 16.7% in 1999 – the highest return rate since 1986. Finnock return in 2002 was at 6.4%.

10. Silver eel trapping was continued in 2002. The run timing was different to the previous two years with 51% trapped in October. The total run amounted to 2863.

11. A total of 22 salmon were caught in the Burrishoole Fishery in 2002. The catch consisted of 12 wild fish and 10 reared salmon. Of the 12 wild fish caught, 11 were returned alive to the water and 1 was killed. There was a minimum of 12 sea trout caught on Lough Furnace and returned alive. The exploitation rate on wild salmon decreased from 24% in 1995 to 8.6% in 1996, when catch and release was encouraged. In 1997, when catch and release was mandatory, exploitation fell to 4.6%. Exploitation decreased further to 2.1% in 1998, 1.1% in 1999, 1.0% in 2000, 0.3% in 2001 and 0.15% in 2002. The % angling success has ranged from 29.7% in 1996 to 7.6% in 1999 and it was 12.1% in 2000. The % angling success fell to 4.5% in 2001, partly as a result of the poor return rate of wild grilse and partly due to a reduction of the angling season to two months. This fell again to 1.8% in 2002.

1. INTRODUCTION

The Salmon Research Agency merged with the national Marine Institute on the 1st July 1999. The staff of the Agency were absorbed into the new Aquaculture & Catchment Management Services Group of the Institute and the research facilities at Furnace have undergone a programme of upgrading and improvement. The core monitoring work of the Agency will continue but its unique experimental facilities, both in relation to aquaculture and wild fisheries, will be fully utilised within the context of the Institutes published Research, Technology, Development and Innovation Strategy. The merger has resulted in an increased national role for the work of the Agency and a consolidation of the trap and laboratory facilities at Newport.

This report represents a continuation of the Annual Reports published by the Salmon Research Agency of Ireland. The data presented creates a unique record of fish rearing and wild fish census data for the past 32 years. This data is an essential component in the local, regional and national management of salmon, sea trout and eel and is becoming ever more valuable in the light of increasing pressures on natural stocks, such as exploitation, habitat degradation and global climate change scenarios. The trapping facilities in Newport, along with the reared and ranched stocks held in Burrishoole, are also essential for the evaluation of novel enhancement techniques, alternative stocks and ranching and evaluation of interactions between farmed, ranched and wild strains.

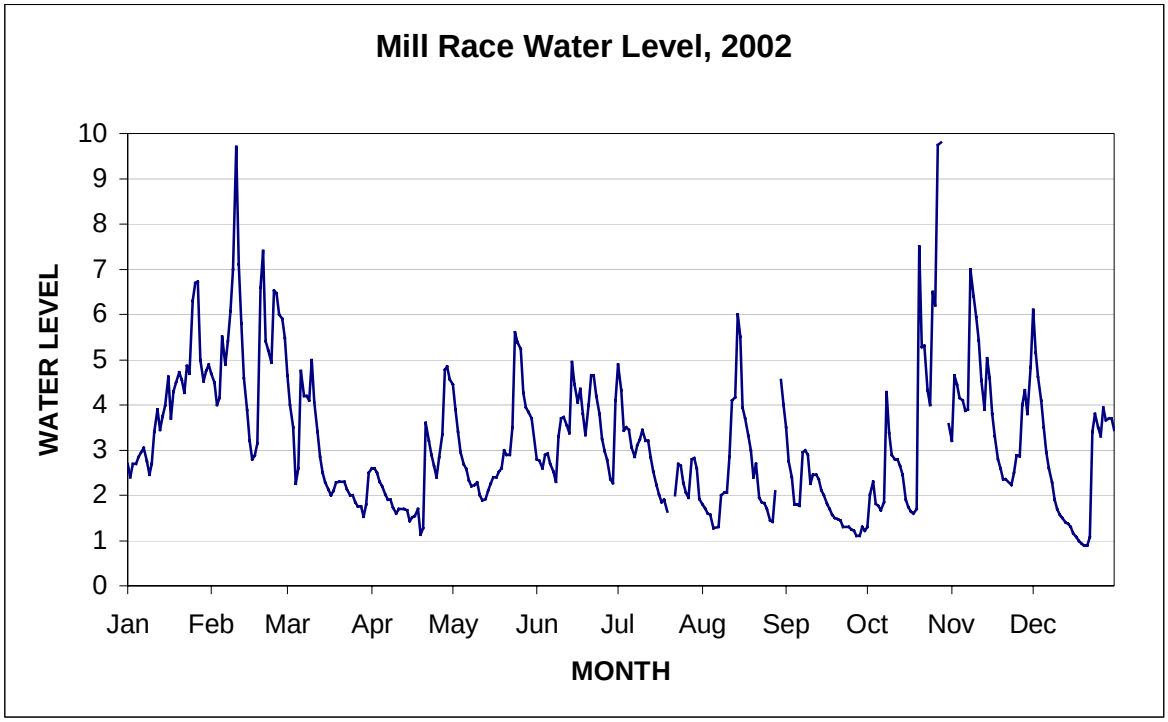

Figure 1. Water levels recorded in the Mill Race at midnight.

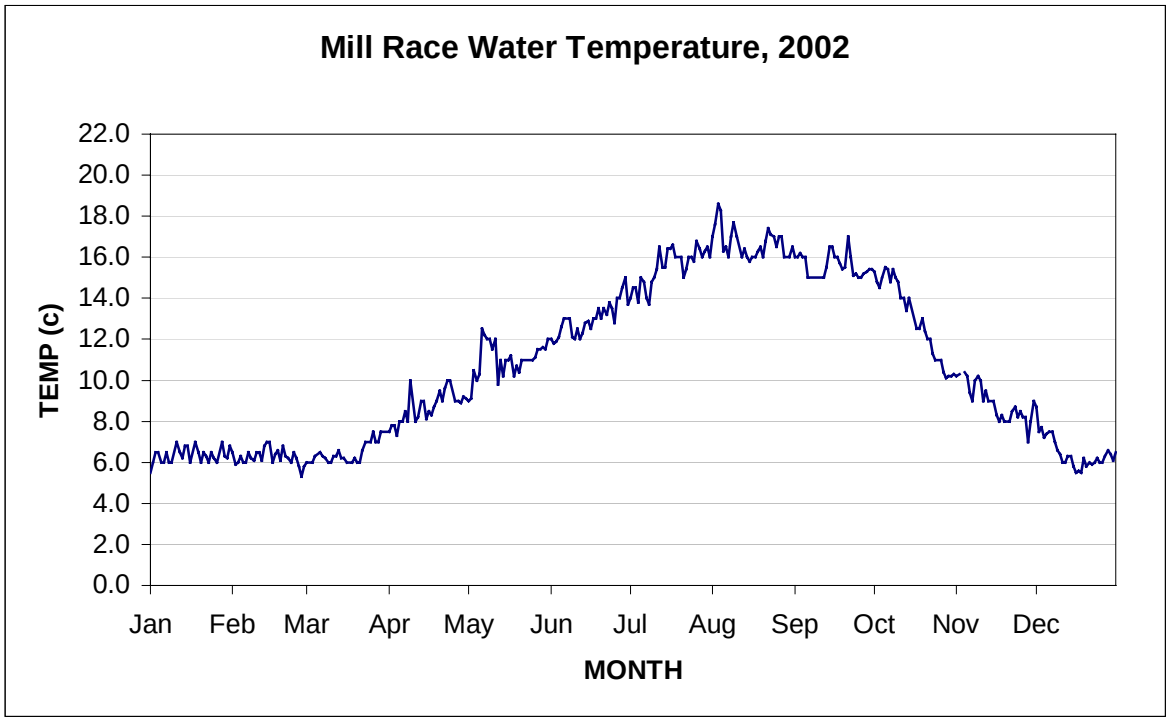

Figure 2. Water temperatures recorded in the Mill Race at midnight.

2 Meteorological/Environmental Data

2.1 Mill Race Data

Daily meteorological data were collected during 2002 at the Met Station in Furnace. The monthly rainfall figures for 1999, 2000, 2001 and 2002 are given in Table 1, along with the annual totals for 1977 to 2002. Months of relatively high rainfall in 2002 were February, April, May, June, October and November with low rainfall in March, July and September. The total rainfall was 1715.9 mm in 2002.

Table 1. Monthly rainfall totals (mm) for the Furnace Station in 1999, 2000, 2001 and 2002 and the annual totals for 1977 to 2002.

Month	1999	2000	2001	2002	Year	Total
January	232.7	133.2	93.4	163.8	1977	1579.7
February	169.1	223.6	90.8	261.2	1978	1592.2
March	112.8	123.2	94.0	97.4	1979	1653.3
April	148.0	115.9	97.8	111.5	1980	1792.1
May	83.3	80.2	51.3	118.9	1981	1646.8
June	75.2	87.4	110.2	152.0	1982	1609.6
July	93.3	56.6	100.9	78.5	1983	1495.9
August	145.0	182.9	169.0	115.8	1984	1556.6
September	195.6	150.0	62.3	38.6	1985	1584.1
October	113.7	299.8	154.5	203.9	1986	1886.9
November	213.3	211.7	170.0	230.3	1987	1373.6
December	367.1	168.7	104.5	144.0	1988	1715.2
					1989	1583.9
					1990	1805.9
					1991	1549.6
					1992	1771.1
					1993	1473.4
					1994	1757.1
					1995	1382.5
					1996	1286.6
					1997	1351.6
					1998	1830.9
					1999	1949.1
					2000	1833.2
					2001	1298.7
					2002	1715.9

Water levels (Fig. 1) in 2002 largely reflected the monthly rainfall with high flows particularly in January, February, October and November. Levels remained high through much of May, June and July and there was a large flood in August. Levels were low in March/April, late July, September and December. Water temperatures (Fig. 2) fell to a minimum of only 5.5^0C in late February and hovered between 6 and 7^0C for January to the end of March.. There was a steady increase in temperature from late March to a maximum of 18.6^0C in late July. It

began dropping steadily for the rest of the year from the end of July back to a minimum of 5.5^{0}C in late December.

2.2 Catchment Programme

In recent years, the combined effect of extreme weather events, and changes in land-use, have had a significant effect on the erosion rates recorded in many upland areas. The Marine Institute installed a network of automatic monitoring stations to quantify the impact of these factors on the transport of suspended sediment from the Burrishoole catchment. These automatic monitoring systems, funded under EU LIFE programmes, include a lake station (AWQMS - installed under EU LIFE 93), which has various meteorological instruments included with a suite of underwater temperature and water chemistry sensors, and three river stations (ARMS - installed under EU LIFE 98) which are equipped with sensors for measuring water temperature, water level, pH, conductivity, dissolved oxygen and suspended sediment concentration. The automatic monitoring stations are also equipped with a telemetry system for relaying the high-resolution data back to the laboratory. Figure 3 gives an example of the relationship between water level and suspended solids during one flood event in the Rough R.

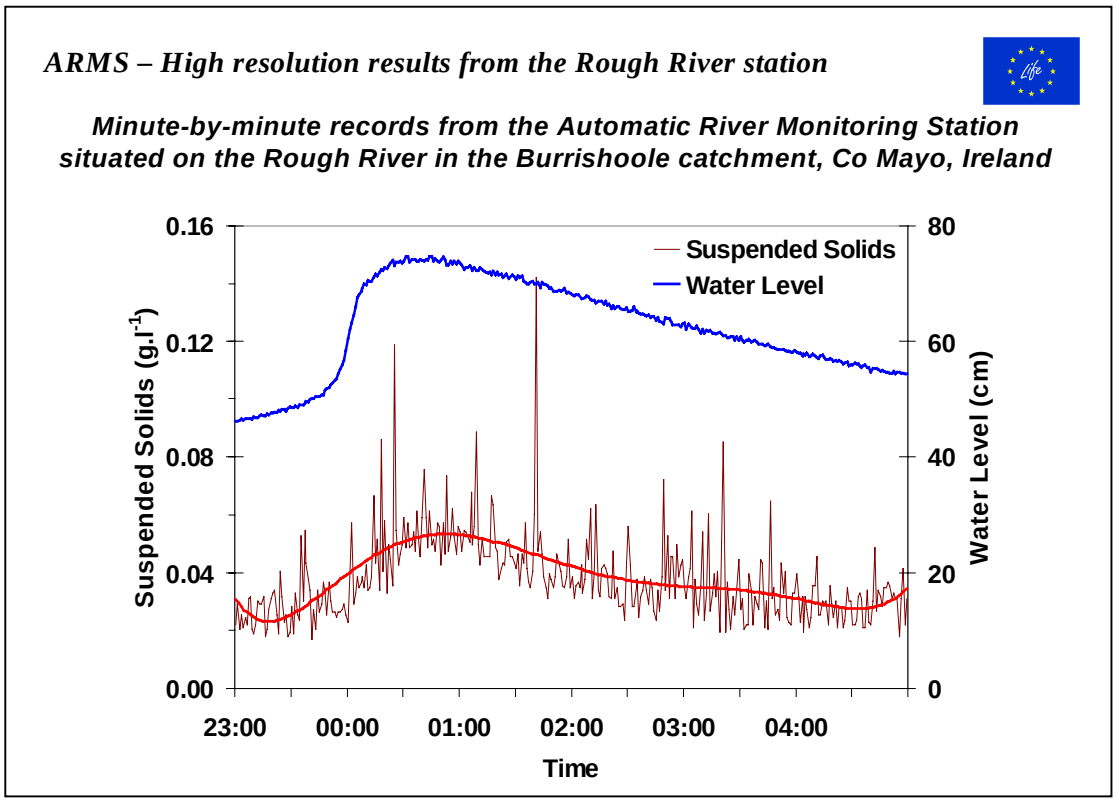

Figure 3. High-resolution data for one flood event in the Rough River.

In addition, the Marine Institute has deployed additional core-funded instrumentation in the catchment, including a series of data-logging rain gauges (Fig. 4), to build up a detailed profile of precipitation in a mountainous catchment. Table 2 presents summary rainfall data for 12 rain gauges situated in the Burrishoole catchment. Figure 5 shows the annual total rainfall for the 12 stations and also includes the two rain gauge devices in the Met Station,

labelled Furnace and Furnace chart. Even allowing for days when the gauges were not operable (days not sampled – Table 2) this clearly demonstrates considerable variation in recorded rainfall between locations within relatively short geographic distances.

Figure 4. Map of the Burrishoole catchment showing locations of rain gauges.

Also deployed in the catchment are a series of water level recorders to measure stream-flow, and a number of SIGMA water samplers, which collect a discrete water sample for later laboratory analysis. Finally a series of sediment samplers were positioned at five sites and two depths in Lough Feeagh.

An important feature of the monitoring network is the simultaneous acquisition of data from the river, lake and climate instruments. The results demonstrate that the movement of sediment in the streams is strongly influenced by antecedent rainfall patterns. The data acquired from Lough Feeagh suggests that erosional events in the catchment also have a significant effect on the spatial distribution of suspended sediment in the lake. The horizontal dispersion of suspended sediment in lakes is commonly viewed as an internal process governed by the mixing effect of the wind, heavier, inorganic particles settle out of suspension quickly. Adult trout and salmon can tolerate very high concentrations of suspended sediment but there is some evidence to suggest that they may delay their upstream movements if a sudden increase in the concentration of particles in suspension is experienced.

Table 2. Summary rainfall data for 12 rain gauge stations in Burrishoole.

ANNUAL RAINFALL VALUES FOR THE YEAR 2002

Station	Total (mm)	Mean (mm)	Max (mm)	No. dry days	No. wet days	No. days not sampled
Altahoney	2058	6.8	58.8	79	224	62
Buckogh	1216.4	4.4	40.2	81	194	90
Gaulaun	2028.2	5.6	41.8	61	301	3
Glenamoo 1	1519.8	5	66	53	198	114
Glenamoo 2	1145.6	5.4	42.6	48	166	151
Glenamoo 3	1883.8	5.6	60.4	70	264	31
Maumaratta	1148	3.8	39.8	85	196	84
Rough 1	1581	5.7	51.2	53	222	90
Rough 2	986	4	41	60	185	120
Rough 3	2228.8	6.1	53.6	79	286	0
Salmon Leap	1317.4	3.6	31	86	279	0
Mill Race	1419.7	3.9	35.4	84	281	0

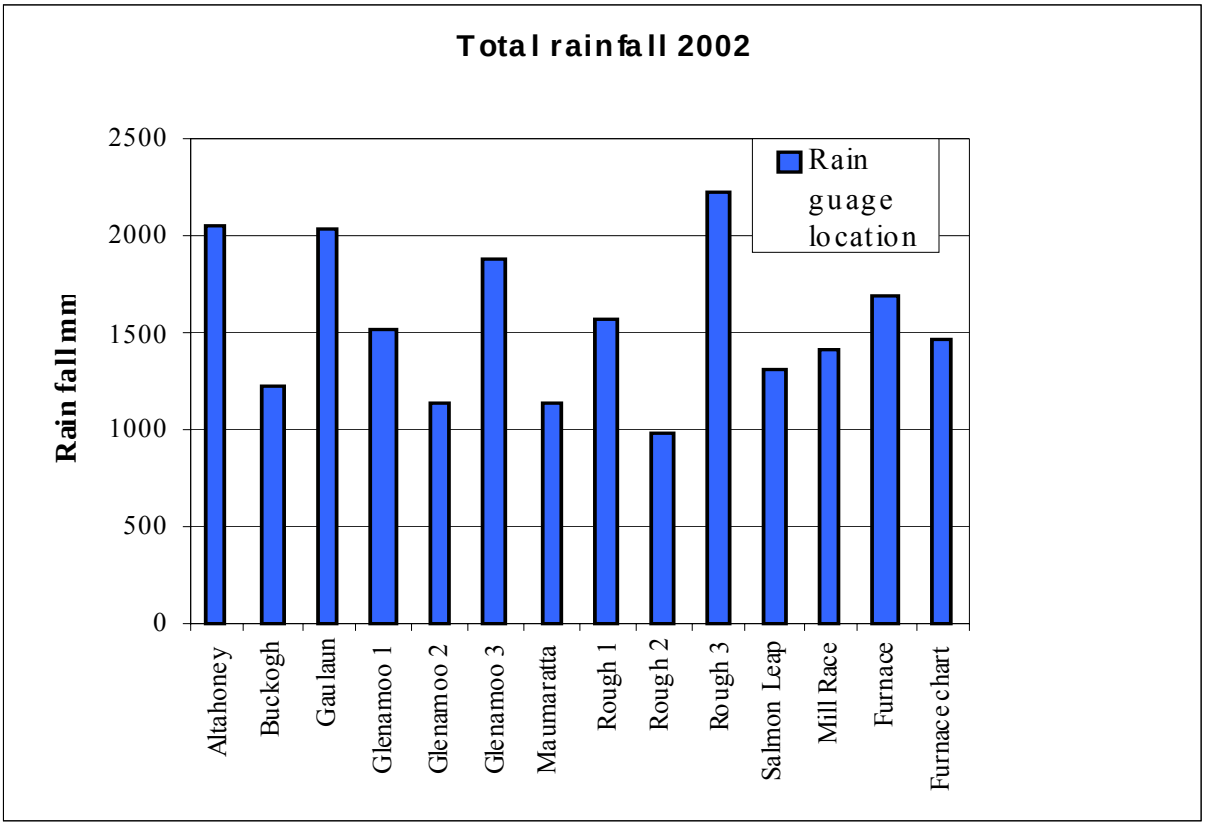

Figure 5. Rainfall totals for 12 rain gauge sites and for the existing met station gauges.

3 PUBLICATIONS

Papers

Allott, N., McGinnity, P. & O'Hea, B. (2002). Factors influencing the downstream transport of sediment in the Lough Feeagh catchment, Burrishoole, Co. Mayo, Ireland. *Paper presented to the final LIFE 98 meeting, Seville, Spain, November 2002.* 20pp.

Byrne, C.J., Holland, C.V.,. Poole, R & Kennedy, C. R. (2002). Comparison of the macroparasite communities of wild and stocked brown trout (*Salmo trutta* L.) in the west of Ireland. *Parasitology* **124**; 435-445.

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McCarney, P., Copley, L., Kennedy, S., Nulty, C. & Jackson, D. (2002). National survey of sea-lice (*Lepeophtheirus salmonis* KrØyer and *Caligus elongatus* Nordmann) on fish farms in Ireland – 2001. Marine Institute, Fisheries Leaflet **181**; 28pp.

McGinnity, P., Ferguson, A., Baker, N., Cotter, D., Cross, T., Cooke, D., Hynes, R., O'Hea, B., O'Maoileidigh, N., Prodőhl, P. and Rogan, G. (2002). A two-generation experiment comparing fitness and life history traits of native, ranched, non-native, farmed and hybrid Atlantic salmon under natural conditions. In: Mills, D. (ed.) Proceedings of the 6th International Atlantic Salmon Symposium 'Salmon at the Edge', Edinburgh, UK, July 2002; 138-143.

Poole, R. (2002). Monitoring of eel recruitment in the Republic of Ireland. In: W. Dekker (ed.) *Monitoring of glass eel recruitment*. Netherlands Institute of Fisheries Research, Ijmuiden, Netherlands, EU Report *C007/02-WD*, 256pp.

Poole, W.R., Byrne, C.J., Dillane, M.G., Whelan, K. & Gargan, P.G. (2002). The Irish sea trout enhancement programme: a review of the broodstock and ova production programmes. *Fisheries Management & Ecology* **9**; 315-328.

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Posters

'Electrophoretic analysis of Atlantic salmon (*Salmo salar)* skin mucus proteins during smoltification (1999-2001). P.Kennedy, D.Cotter, R.Ryan, R.Eibrand, B.Wu and U.MacEvilly. Marine Institute Conference, Dublin 2002

A Computerised Proteomics System for Protein Pattern Analysis of 1D SDS-PAGE Gels of Atlantic salmon (*Salmo salar*) Skin Mucus. R. Eibrand, P. Kennedy, D.Cotter, R. Ryan, U. MacEvilly, B. Wu. Marine Institute Conference, Dublin 2002

4 SALMONID REARING

4.1 Salmon Stocks 2001

4.1.1 Ranching

The total release of microtagged smolts of ranched Burrishoole grilse origin was 24,700. Smolts were released as four groups on 1st May 2002, averaging 65g in weight. In an on-going research project, initiated in 2001, the lice prevention treatment 'SLICE' was fed as a prophylactic to a group of salmon smolts prior to release, to increase the smolt's resistance to lice infestation in the first weeks at sea. This project aims to address concerns that sea lice infestations on wild salmon may be a source of mortality in the first few weeks at sea. The return rates of grilse in 2002 and 2003 will provide valuable data on the effects of sea lice infestations on migrating salmon smolts from the Burrishoole system.

A further 53,200 smolts were released as eight 'experimental' groups on 30th April 2002, averaging 66g in weight. The groups were part of a study with NUIG 'Enhancing MSW return phenotypes in Atlantic salmon: a test of hypothesis regarding a threshold effect', using line bred multi-sea winter and grilse stocks of Shannon origin. Groups were differentially microtagged and branded.

4.1.2 Aquaculture

An estimated 27,500 vaccinated salmon smolts of Scottish origin, averaging 90g, were successfully transferred to a commercial sea farm on 25th March 2002.

4.2 Salmon Stocks 2002

Burrishoole grilse stock, Shannon stocks and commercial 2SW Scottish stock were hatched in 2002. A new ranching study was initiated using line bred Shannon stock bred from precocious and from adult males. This study, with NUIG, aims to explore if the offspring of precocious male parr return as grilse rather than as MSW salmon more often than is expected in the offspring of normal adults.

Growth and survival was satisfactory throughout the year. Grading was carried out from July to September and all commercial pre-smolts were vaccinated (Norvax Compact 4) during November. ISAV was detected in farmed rainbow trout in Clew Bay during the summer and it was considered prudent to monitor ranched adult salmon returns to the Burrishoole system. All broodstock were screened for the presence of ISAV and proved negative.

Stocks remaining in December 2002 were 28,400 Burrishoole grilse, 58,300 commercial 2SW and 45,500 Shannon.

4.3 Salmon Stocks 2003 (Grilse ova laid down in 2002)

Broodstock were stripped during December and an estimated 457,000 green ova were produced by 101 hens. The average fecundity value was 4,500 per female. Broodstock condition was good throughout the holding period. Fish were tested by the Marine Institute Fish Health Unit in December and subsequently salmon ova were certified disease free. Ova quality and survival was good.

In association with Delphi and Parteen hatcheries, Marine Institute ACMS co-ordinated the sale of 750,000 ova to Germany for the Rhine programme, of which 382,000 ova were of Burrishoole origin; 42,000 Burrishoole ova were retained in the hatchery.

4.4 Rainbow Trout 2002

An estimated 7,200 rainbow trout (Seven Springs NI) were stocked into Ballinlough Fishery, from August to October. 1000 trout were retained in December 2002 for stocking the Fishery from February to June 2003.

4.5 EU Triploid Programme

The programme (AIR CT94 2216) 'Minimising the interaction of cultured and wild fish: a comprehensive evaluation of the use of sterile, triploid, Atlantic salmon' aimed to evaluate the comparative biology of diploid and triploid Atlantic salmon in terms of their performance in fresh and sea water culture, behaviour on release, product quality, potential for somatic growth, exercise physiology and disease resistance. The Marine Institute ACMS (formerly the SRAI) was contracted by the National University of Ireland, Galway, to assess the comparative performance of diploid and triploid salmon as cultured stocks and the environmental impact of triploid salmon through tagging and release studies.

5 SALMON CENSUS PROGRAMME

5.1 Wild Salmon and Grilse

A total of 648 wild grilse were recorded moving upstream through the permanent traps during the season (Table 3). The run commenced in May and was completed in December (Table 4). As in 2001 water levels during June and July were suitable for upstream migration and as a result 85.7% of the total run was recorded by the end of July. The main upstream migration was recorded in the Salmon Leap trap with 502 wild grilse and 146 in the Mill Race trap.

The number of spring fish recorded was two.

The retained rod catch of wild grilse on Lough Furnace was one fish. Therefore, the total wild grilse return, including the Furnace rod catch and the upstream count, was 649.

Table 3. Monthly wild grilse totals for the Salmon Leap and Mill Race traps.

	Mill Race	Salmon Leap	Total
May	1	5	6
June	89	257	346
July	24	185	209
August	6	41	47
September	0	2	2
October	21	11	32
November	3	1	4
December	2	0	2
Total	146	502	648

Table 4. Monthly proportions (%) of wild grilse run 1998 to 2002.

	1998	1999	2000	2001	2002
May	0.0	1.2	1.8	0	0.9
June	30.7	26.3	31.5	60.1	53.4
July	44.6	44.6	4.9	20.7	32.3
August	8.7	16.9	45.1	11.1	7.3
September	4.4	9.6	11.6	0.8	0.3
October	10.9	1.2	3.5	5.2	4.9
November	0.8	0.2	0.0	1.1	0.6
December	0.0	0.0	0.4	1.1	0.3

Table 5. Wild salmon and grilse totals in upstream traps 1970-2002

Year	Total Salmon	Total Grilse
1970-74	14	1145
1975-79	36	703
1980-84	35	449
1985-89	22	492
1990-94	16	421
1995	15	582
1996	18	409
1997	6	538
1998	4	516
1999	16	502
2000	6	568
2001	6	368
2002	2	648

5.2 Net marked fish in upstream traps

Net marks were observed on both wild and reared grilse between June and October (Table 6). In addition it was noted that 4.7% of the total run of fish examined in the Salmon Leap trap had some degree of seal damage. This was the first year that the level of seal damage was high enough to warrant recording.

Table 6. Percentage Occurrence of Net Marks on Wild and Reared Grilse

	Wild Grilse	Reared Grilse
May	0.0	0.0
June	11.3	2.8
July	10.9	5.6
August	5.0	4.7
September	0.0	0.0
October	0.0	3.9
November	0.0	0.0
December	0.0	0.0

5.3 Wild Spawning Stock

The spawning stock represents the number of fish available for spawning. It is calculated by subtracting rod caught fish and downstream-displaced fish as well as losses due to poaching, disease and predation, which have been estimated at 5% for wild fish and 10% for reared fish (Table 7).

The maximum spawning escapement in 2002 increased from 364 in 2001 to 570 in 2002 (Table 8). The reared component of the spawning stock (8) was 1.4%, which was the lowest reared fish component yet recorded.

Table 7. Spawning stock of salmon and grilse

	Wild grilse(1SW) & previously spawned grilse	Wild Salmon (2SW)	Ranched fish released upstream
Counted in trap	648	2	88
Rod Feeagh*	--	--	--
Culled	6	--	0
Broodstock	16	--	0
Estimated morts.	30	--	1
Displacement	36	--	79
Spawning stock	**560**	**2**	**8**

* No angling on L. Feeagh during 2002.

Table 8. Spawning escapement 1970 - 2002

	Maximum spawning escapement	Wild fish component	Reared component
1970-74	1126	986	140
1975-79	725	683	42
1980-84	474	430	44
1985-89	662	428	232
1990-94	603	348	254
1995	464	376	102
1996	594	355	239
1997	494	466	28
1998	498	456	42
1999	547	485	62
2000	567	527	40
2001	364	343	21
2002	570	562	8

5.4 Survival of Ova to Grilse

The relevant brood year for the 2002 grilse was 1998 with ova hatch in 1999 and smolt migration in 2001 (Table 9). As in previous years, it has been assumed for the purpose of estimating survival that ranched grilse spawned naturally. Specific data are not available on differential survival rates of wild and ranched stocks spawned in the wild. All relevant calculations are based on parameters set out in the Ann. Rep. No. 19, 1974.

Table 9. Survival ova to grilse

Spawning escapement in 1998	498
No. of females	249 - 274
Ova deposition	996,000 – 1,127,510
No. of smolts in traps 2001	6466
No. of smolts released downstream	6387
Survival ova to smolt	0.60 - 0.58
No. returning grilse 2002	649
Survival smolt to grilse	10.2%
Survival to grilse per grilse female	***2.6 – 2.4***

5.5 Ova to Smolt Survival

The survival of ova to smolt range of 0.58 to 0.60 was similar to that recorded in recent years. The survival of smolt to grilse increased from 6.5% to 10.2%. The survival to grilse per grilse female was below the value required to sustain the population of four years earlier.

Table 10. Comparative data for the five-year averages from 1970 - 1989 and the values for the individual brood years from 1990 onwards**.**

Brood year-class	% survival rates ova to smolt	survival rates to grilse per grilse female spawner
1970-74	0.48 - 0.62	1.4 - 1.7
1975-79	0.63 - 0.73	1.5 - 1.7
1980-84	0.61 - 0.69	1.7 - 1.9
1985-89	0.44 - 0.45	1.4 - 1.5
1990	0.47 - 0.54	1.8 - 2.0
1991	0.47 - 0.53	1.8 - 2.0
1992	0.48 - 0.54	1.3 - 1.5
1993	0.39 - 0.45	1.5 - 1.6
1994	0.36 – 0.41	1.3 – 1.4
1995	0.83 – 0.93	1.9 – 2.1
1996	0.53 - 0.61	1.8 – 1.9
1997	0.52 – 0.59	1.4 – 1.5
1998	0.58 – 0.60	2.4 – 2.6

5.6 Wild Salmon Smolts

A total of 8627 wild salmon smolts were recorded in the downstream traps during 2002 and this is an increase from 6466 recorded the previous year. The main peak of the run occurred during increased water levels at the end of May and beginning of June.

Table 11. Numbers of wild salmon smolts counted in 2002.

Month	SLDT	MRDT	Total
March	2	0	2
April	2296	659	2955
May	4377	1184	5561
June	81	22	103
July	2	3	5
August	1	0	1
September	0	0	0
October	0	0	0
TOTAL	6759	1868	8627

Table 12. Annual numbers of wild salmon smolt recorded in downstream traps.

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6926	5429	5971	5998	6148 5854*	6331 5960*	9588 8937*	7197 7118*	5791 5689*	6466 6387*	8627 8423*

*Number of smolts released to sea from traps when mortalities and samples were deducted

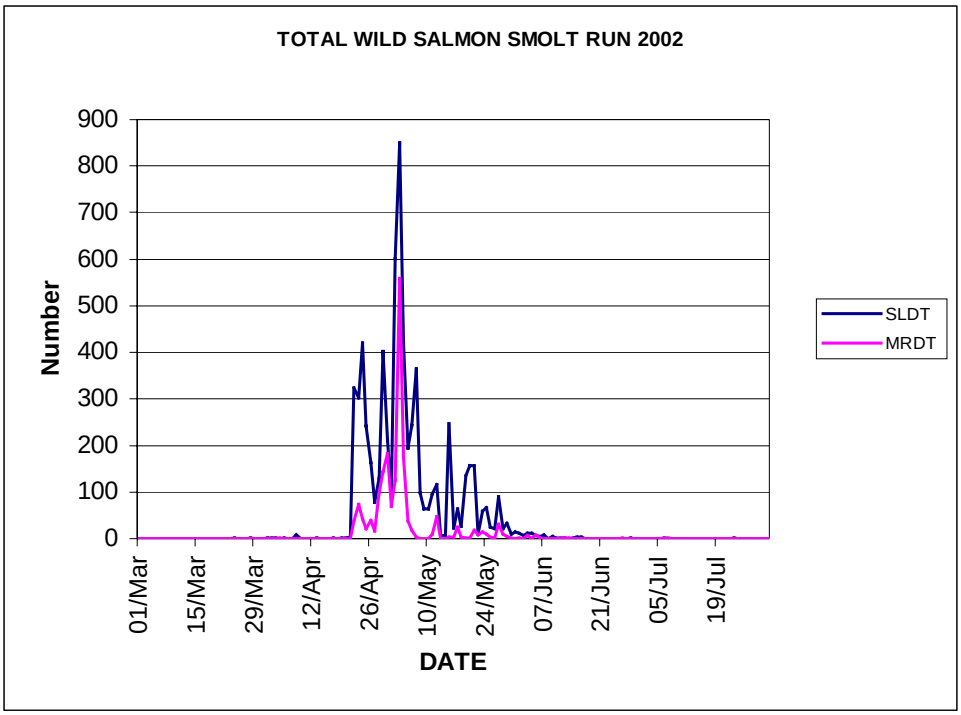

Figure 6. Timing of the 2002 wild salmon smolt run in Salmon Leap & Mill Race Traps.

5.7 Wild Salmon Kelts

The wild kelt run commenced in December 2001 and the peak of the run occurred during April 2002 (Table 13). As in recent years the kelts recorded in the downstream traps were in very good condition. However, the survival from the spawning stock decreased from 72.5% in 2001 to 49.6% in 2002.

Table 13. Numbers of wild salmon kelts counted in 2002.

	SLDT	MRDT	TOTAL
Dec '01	5	0	5
January '02	9	4	13
February	34	6	40
March	34	1	35
April	70	2	72
May	5	0	5
Total	157	13	170

Table 14. 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
1985	94	26	3.0	56.0	7.7
1986	93	31	3.4	55.3	9.2
1987	68	15	10.8	22.6	9.7
1988	88	24	4.6	55.0	8.7
1989	96	11	3.7	27.0	6.6
1990	94	35	5.6	48.6	7.6
1991	98	39	3.4	82.3	9.7
1992	92	39	7.0	59.3	6.9
1993	83	5	3.2	52.7	7.4
1994	91	37	4.7	64.3	1.6
1995	74	28	18.3	59.9	2.3
1996	88.1	27	10.1	53.1	4.0
1997	93.7	33.5	6.3	58.9	*
1998	94.3	30.8	5.7	67.6	*
1999	90.6	38.5	4.5	76.0	*
2000	92.5	44.5	5.5	62.1	*
2001	97.0	38.5	2.8	72.5	*
2002	91.3	40.9	7.8	49.6	*

A = % healthy kelts in kelt run
B = % males in kelt run
C = % lightly marked
D = % survival from wild spawning escapement
E = % recapture of previously spawned grilse in first year

6 REARED SALMON CENSUS PROGRAMME

6.1 Coastal Returns

Full details of coastal returns of Burrishoole fish are available in the Marine Institute 'National Report for Ireland – The 2002 Salmon Season' report.

6.2 Return rate of reared and wild grilse

As in recent years the return of reared fish to the Burrishoole system consists of both Burrishoole native ranch fish and experimental Shannon strains.

The total adult return of reared fish to Burrishoole in 2002 was 857 fish. Microtag readings were obtained from 832 fish and of these 557 fish (67%) were identified as Burrishoole ranch grilse. This was a minimum return rate of 2.3% from a release of 24,592 smolts in 2001. As the number of Burrishoole ranch grilse identified by microtag was 67% of the total number of fish identified by microtag in 2002 the maximum return rate of Burrishoole grilse is calculated by assuming that 67% of returning adults from which tags were not retrieved (27) were also Burrishoole grilse. Therefore the maximum return of Burrishoole grilse in 2002 was 575 (2.3%). This is an increase from 2.0% recorded in 2001.

The wild grilse return also showed an increase in return rate to freshwater, increasing from 6.5% in 2001 to 10.2% in 2002.

6.3 Recapture of Reared 2SW Fish

Only two 2SW reared Burrishoole stock were identified by microtag during 2002.

Microtags recovered in freshwater at Burrishoole during 2002 were as follows:

Burrishoole grilse	557
Burrishoole 2SW	2
Experimental grilse	256
Experimental 2 SW	16
Experimental 3 SW	1
Total	**832**

6.4 Smolt Releases 2002

A total of 24,740 reared smolts of Burrishoole origin consisting of four groups were released during 2002 (Table 15). Three microtag groups were released directly into L. Furnace. A fourth group was transferred to the Burrishoole estuary for release in a repeat of the estuary release the previous year.

Table 15. Burrishoole smolts released in 2002.

Release Date	1/5/02	1/5/02	1/5/02	1/5/02
Release Site	**Estuary**	**Furnace**	**Furnace**	**Furnace**
No. Released	6141	5911	6415	6273
Weight (g)	73.7	67.7	61.1	59.5
Length (cm)	18.5	18.1	17.5	17.3
Condition Factor	1.2	1.1	1.1	1.1
Microtag Code	34703	174750 194721 24703 34704	204713 184761 34707	204701 34705 34706 184747

7 Wild Sea Trout

7.1 Upstream Movements: Timing and Numbers.

A total of 115 wild silvered sea trout and a further 68 non-silvered trout migrated upstream through the traps in 2002. Of the silvered trout, 35 were adults and 80 (70%) were finnock. The numbers are compared with other years in Table 16. Of the total run of migratory trout (183), 37.2% were non-silvered. For the purposes of this report, the non-silvered trout are not included with the sea trout. Table 16 shows clearly that the numbers of sea trout have not recovered in the Burrishoole system and have shown a ten-fold drop since the 1970s.

Table 16. Annual runs of sea trout recorded in the traps.

YEAR	MILL RACE	SALMON LEAP	TOTAL	Amended Total
1970-74	1365	762	2127	
1975-79	829	1775	2604	
1980-84	458	780	1238	1719 *
1985-89	386	590	978	
1990-94	134	72	206	
1995-99	86	91	177	
1985	479	976	1465	
1986	277	1110	1387	
1987	528	422	950	
1988	497	366	863	
1989	147	77	225	
1990	101	54	155	
1991	180	162	342	
1992	123	28	151	
1993	130	43	173	
1994	136	74	210	
1995	90	90	180	
1996	112	85	197	
1997	65	72	137	
1998	56	50	106	
1999	107	157	264	
2000	33	78	111	
2001	31	58	89	
2002	26	89	115	

* See Table 34, Ann. Rep. XXX (1985); p. 43.

The timing of the sea trout run in 2002 and in previous years, expressed in monthly percentages, is given in Table 17. The highest proportion of sea trout, both finnock and adults, moved upstream in July. Few sea trout moved upstream in September, due to low water levels.

Table 17. Timing of the Burrishoole sea trout run (in monthly percentages).

	1970-'79	'80-'84	'85-'89	'90-'94	'95-'99	2000	2001	2002
May	-	0.2	0.5	0.1	3.1	0.9	2.3	0.9
June	13.1	24.6	9.4	8.4	8.6	7.2	23.6	3.5
July	54.4	44.9	62.2	55.0	42.4	9.0	30.3	57.4
August	15.8	10.3	18.4	16.5	19.3	72.9	16.9	23.5
September	7.6	14.8	3.7	8.5	9.8	7.2	0.0	0.9
October	6.4	3.5	4.1	7.9	12.2	1.8	24.7	9.5
November	2.4	1.5	1.5	2.9	4.3	0.0	2.2	4.3
December	0.3	0.2	0.2	0.7	0.7	0.0	0.0	0.0

7.2 Spawning Escapement

With the continuation of the catch and release bye-law into the 2002 fishing season, no sea trout were reported killed by anglers on L. Feeagh in 2002. Using the upstream fish counts through the traps, the total maximum spawning escapement of migratory trout to the L. Feeagh catchment was 183, of which 68 were non-silvered sea trout.

Table 18. Annual spawning escapement of sea trout into freshwater.

	1970-'79	1980-'84	1985-'89	1990-'94	1995-'99	2000	2001	2002
Max. Escap,	2090	1146	906	231	289	174	143	183
Revised		1622						

7.3 Reared Adults

No reared sea trout were recorded in 2002.

7.4 Downstream Movements, Sea Trout Smolts

The 2002 smolt run amounted to 1272 smolts, of which 1257 were released to the wild (Table 19). The smolt run in 2002 was well spread out over time (Fig. 7). Silver smolts were migrating downstream as early as the start of January. Once the temperature started to rise 89% of the counted smolt migrated in two peaks in April and one in May, largely controlled by in creases in water level.

Table 19. Monthly numbers of Burrishoole sea trout smolts recorded through the traps.

	Salmon Leap	Mill Race	Total	%
January	25	0	25	1.9
February	56	11	67	5.3
March	35	3	38	3.0
April	727	48	775	60.9
May	329	22	351	27.6
June	14	2	16	1.3
July	0	0	0	0
Total	1186	86	1272	
Number Released Downstream			1257	

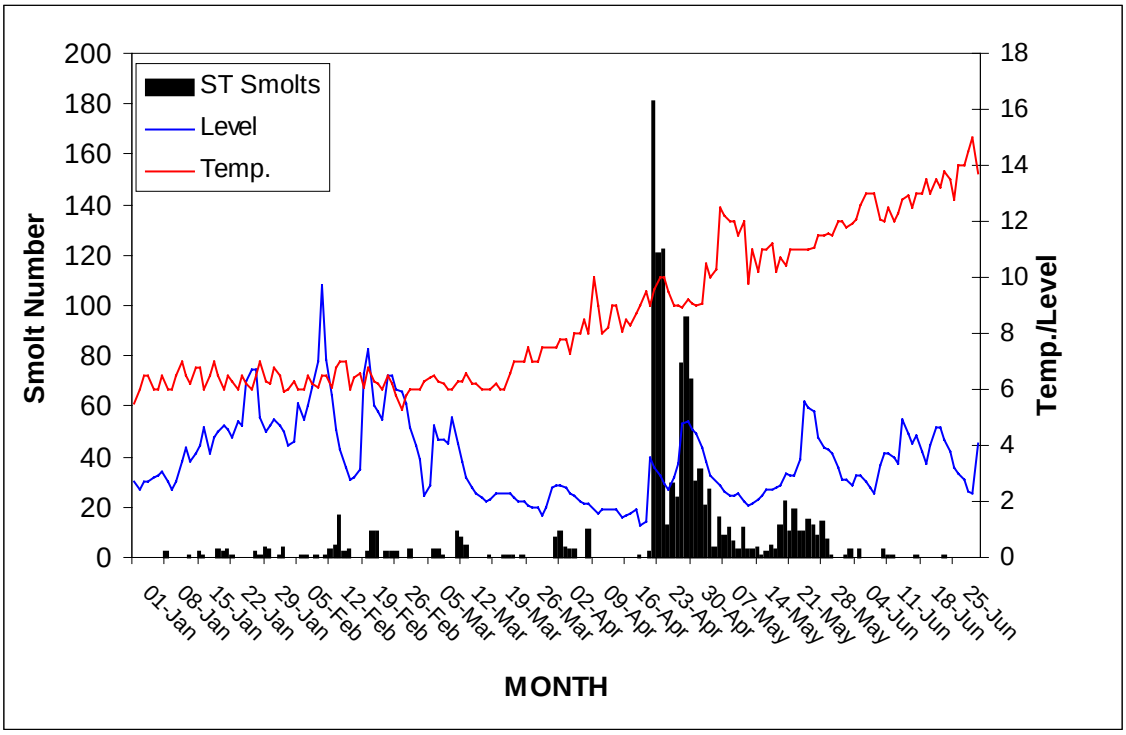

Fig. 7. Timing of the 2002 wild sea trout smolt migration with daily water level and temperature.

Table 20. Annual sea trout smolt numbers in Burrishoole for 1970 to 2002.

	1970-79	1980-84	1985-89	1990-94	1995-99	2000	2001	2002
Number	4176	4038	4119	1531	1361	769	530	1272

LENGTH

The length distribution for the 2002 wild sea trout smolts is given in Figure 8. The wild smolts had an average length of 21.3 cm and ranged from 14.2 cm to 29.2 cm in length with a modal length of 21 cm.

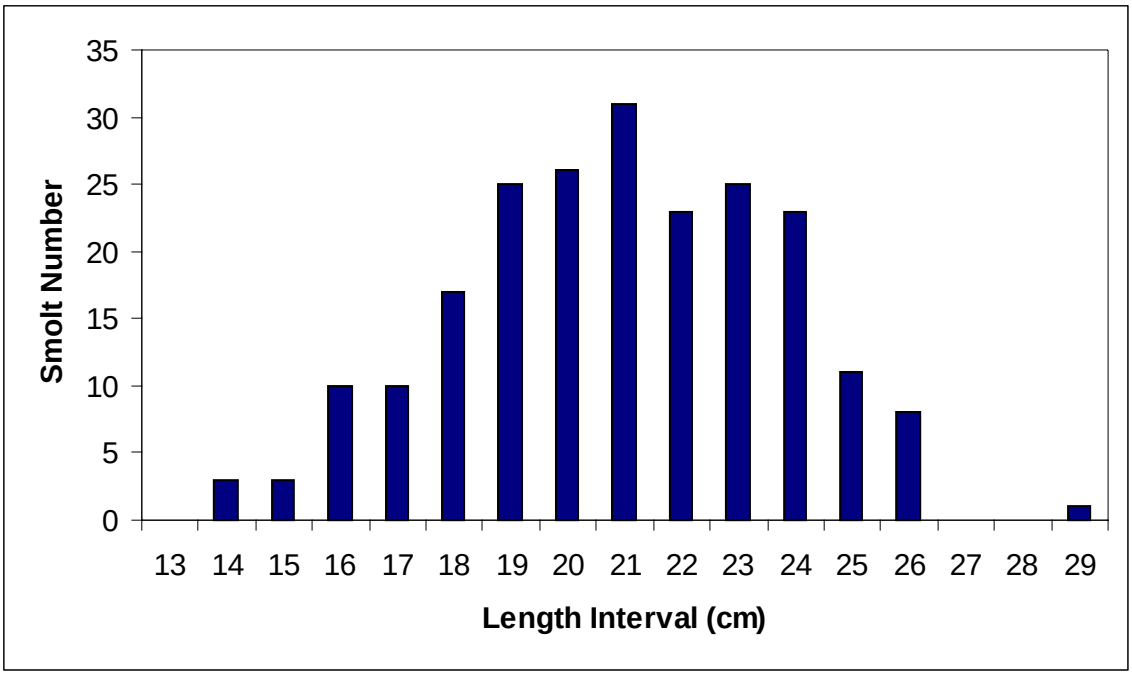

Fig. 8. Length distribution for smolts in the Burrishoole system, 2002 (n=216).

7.5 Autumn Migrating Smolts

These are juvenile trout (*Salmo trutta* L.) which generally move downstream through the traps from August to December. It is not clear whether these are true sea trout or part of the resident trout stock, should a difference exist. These runs of trout would appear to becoming more prolonged with substantial numbers of un-silvered 0+ and 1+ trout continuing to migrate downstream in the early months of the year. The table of numbers for 2001 has been repeated in this report including data from January to May 2002 and data for 2003 has also been included.

A total of 2084 trout entered the traps between July and December 2001 and up to May 2002 (Table 21). The percentage of 0+ trout that migrated over the period was 56.3% (Table 23). It is not known exactly what proportion of the 0+ trout are trapped because the downstream trap grids are not so fine as to prevent some from escaping.

Table 21. Numbers of migrating autumn juvenile trout, to the end of May 2002 (table repeated from the 2001 report).

Month	0+	1+
July	0	0
August	19	28
September	27	17
October	616	479
November	234	166
December	134	88
January 2002	49	50
February 2002	34	30
March 2002	46	29
April 2002	15	8
May 2002	0	15
Total	1174	910
Overall Total		2084

A total of 1452 trout entered the traps between July and December 2002 and up to May 2003 (Table 22). The percentage of 0+ trout that migrated over the period was 32.8% (Table 23).

Table 22. Numbers of migrating autumn juvenile trout, to the end of May 2003.

Month	0+	1+
July	2	7
August	1	20
September	21	98
October	172	215
November	128	372
December	109	137
January 2003	27	71
February 2003	6	15
March 2003	8	27
April 2003	2	7
May 2003	0	7
Total	476	976
Overall Total		1452

Table 23. Percentage of 0+ juvenile trout amongst trapped autumn migrating trout.

1982	50.0
1983	N/A
1984	55.8
1985	30.3
1986	16.1
1987	35.3
1988	60.9
1989	37.2
1990	35.2
1991	26.0
1992	38.2
1993	27.6
1994	16.8
1995	25.3
1996	34.0
1997	18.7
1998	33.5
1999	42.0
2000	47.8
2001	56.3
2002	32.8

7.6 Total Recruitment

The 0+ autumn trout will not be large enough to become sea trout smolts in the following spring. The remainder, predominantly 1+ years old, could contribute to the overall recruitment of sea-run trout the following year. The exact proportion of 1+ autumn trout that become smolts in any given year is not known.

It is only since 1982 that the proportion of 0+ trout amongst the autumn migration has been estimated. Thus the figures for total recruitment up to this time are over-estimated (Table 24).

Table 24. Estimates of total migrant trout recruitment up to 1981.

YEAR	SMOLT TOTAL	AUTUMN TROUT (preceding year)	TOTAL RECRUITMENT
1970-74	4450	2870	6746
1975-79	4314	3186	7489
1980	2337	2351	4688
1981	6710	2631	9341

From 1982, total recruitment was calculated by adding the number of sea trout smolts produced in any one year to the total of 1+ autumn trout the previous year (Table 25). The assumption is made that all the 1+ autumn trout will become sea trout smolts and that no 0+ trout from the two years previous will be recruited as smolts. The fate of 1+ unsilvered juveniles migrating downstream in January to May is unknown but it would seem unlikely that these will contribute to the 2 year old spring smolt migration.

Table 25. Estimates of total migrant trout recruitment from 1982.

YEAR	SMOLT TOTAL	AUTUMN TROUT 1+ & Older (preceding year)	TOTAL RECRUITMENT
1982	3907	1300*	5207*
1983	4852	1109	5961
1984	2383	1200*	3583*
1985	4238	611	4894
1986	3454	1472	4926
1987	3371	1726	5097
1988	4290	949	5239
1989	3179	556	3735
1990	2022	634*	2656*
1991	2137	636	2773
1992	1936	234	2170
1993	1720	183	1903
1994	1127	306	1433
1995	1821	282	2103
1996	1300	336	1636
1997	817	513	1330
1998	1608	717	2325
1999	1260	644	1904
2000	769	358	1127
2001	530	218	748
2002	1272	910	2100

* estimated

7.7 Marine Survival

An estimate of sea trout survival to first return to freshwater can be more accurately calculated by the use of trap census data rather than rod catch returns of tagged or marked fish. Small numbers of stray fish are captured in other systems and it is not known whether these fish would have returned to their natal systems to spawn. Finnock are known to wander between river systems and are therefore not as reliable for assessing survival.

The pattern of marine survival found is similar whether the number of smolts is used or the combined total recruitment of smolts and autumn 1+ trout. The percentage of smolts that return as finnock in the same year historically ranged from 11.4% to 32.4% (Fig. 9). In 1988 it fell below the previous recorded minimum to 8.5% and in 1989 to a minimum of 1.5%. There has been a saw-tooth pattern of finnock return in the 1990's rising to 16.7% in 1999 – the highest return rate since 1986.

The total survival of smolts to the first return to freshwater as finnock in the same year and one year old sea trout in the following year (always an over-estimate as a proportion of finnock re-entering freshwater in year 1 return as sea trout in year 2 (Mills et al, 1990)) also shows a drop in survival from 1987 to 1989 (Fig. 10).

Historically, the total survival to first return ranged from 19% to 66%. This collapsed to 1.8% in 1989 but rose to 12.1% in 1990. However, little further improvement was recorded in 1991 (12.8%). Marine survival fell to the second lowest level in 1992 but returned to 13.1% for the 1993 year class of smolts. There was a further increase in 1994 to 18.2% but a drop in 1995 to 8.1%. There were marginal improvements again in 1996 (12.8%) and 1997 (13.3%), a drop to 8.3% in the 1998 year class and a marked improvement in the 1999 year class where marine survival was 20%, the highest in recorded in 12 years and within the pre-collapse historical range.

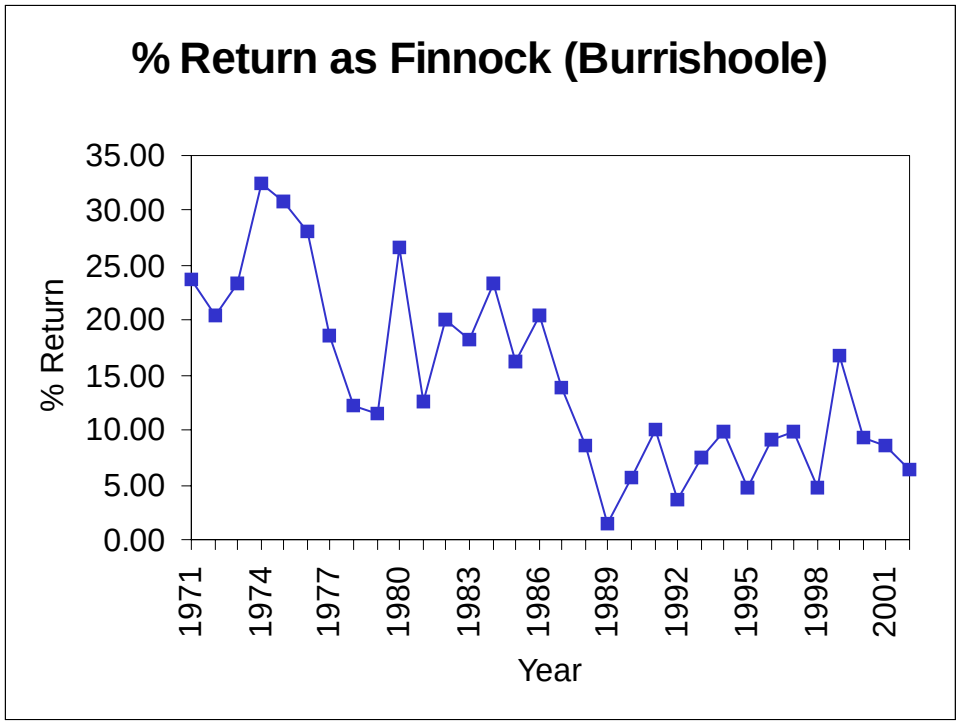

Fig. 9. Annual percentage return of smolts returning as finnock to the Burrishoole system.

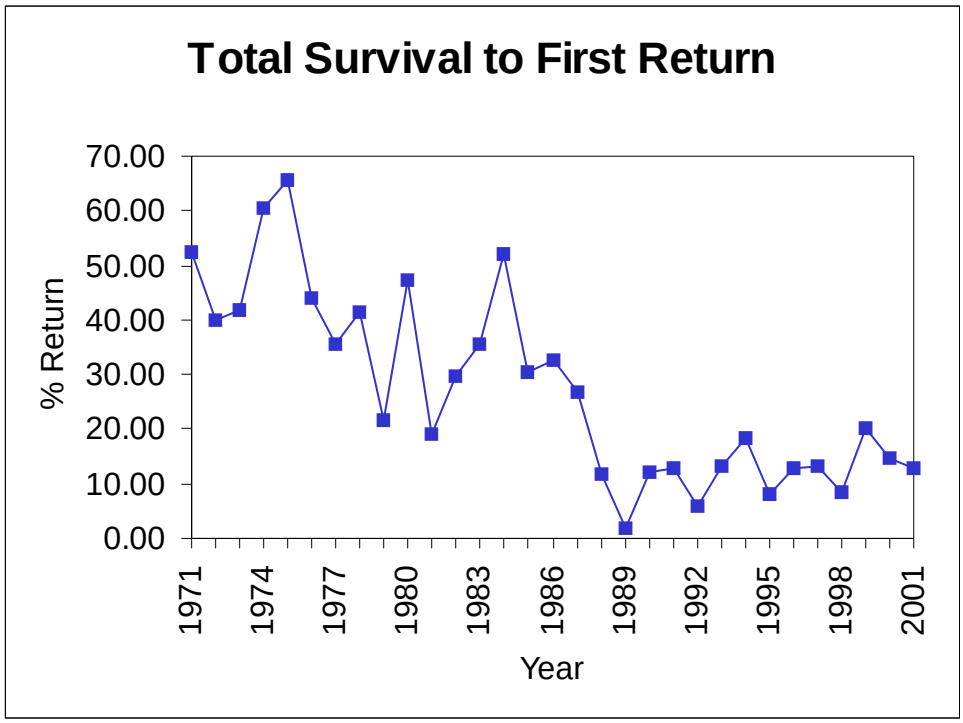

Fig. 10. Annual marine survival of smolts to first return (as finnock and 1+ sea trout) to the Burrishoole system.

7.8 Sea Trout Kelts

Table 26. Timing and numbers of sea trout kelts for the 2001/2002 season.

Month	Large	Small	Total
October	0	0	0
November	7	13	20
December	2	25	27
January	11	8	19
February	6	10	16
March	2	5	7
April	8	51	59
May	1	0	1
Total	37	112	149

The freshwater survival of kelts is given in Table 27. In some years, the number of kelts migrating downstream has exceeded the number of upstream migrants. This occurred in the early '80s when the screen allowed finnock to escape. This was rectified. More recently, the difficulty in separating small finnock and large smolts has led once again to a discrepancy as shown in Table 27. In addition to the size overlap, trout counted upstream as unsilvered

migrants may be counted downstream as silvered kelts, causing difficulties in making survival estimates.

Since 1987, only one survival rate has been given for all sizes as it has been shown that a proportion (at least 33%) of the sea trout population may over-winter in freshwater. These fish do not spawn and continue to grow. There is also the additional complication of larger smolts and reduced sea growth mentioned above. Thus the comparisons of the proportion of fish in different year classes between the upstream migrants of one year and the downstream migrants of the next are invalidated.

Table 27. Annual survival rate to sea trout kelt, as % of the upstream escapement of the previous year.

Year	Larger (> 30.0 cm)	Small (< 30.0 cm)
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*
1985	70	98
1986	66	72
1987	58.7% (combined)	
1988	65.5%	"
1989	68.7%	"
1990	79.0%	" *
1991	98.7%	" *
1992	89.5%	" *
1993	96.7%	" *
1994	104.6%	" *
1995	96.2%	" *
1996	127.7%	" *
1997	97.0%	" *
1998	140.1%	" *
1999	110.4%	" *
2000	70.1%	"
2001	82.0%	" *
2002	129.6%	" *

* Years when the number of finnock kelts counted downstream exceeded the number counted upstream during the previous season.

8 SILVER EEL CENSUS PROGRAMME

Silver eel trapping was continued in 2002. The run timing was similar to that in 2001 with 79.6% of the migration in October (Table 28). A drought in September reduced the count for that month to minimal numbers. The total run amounted to 2863. As in other years, the highest proportion of the total catch (92%) was made in the Salmon Leap trap.

Table 28. Timing and numbers of the 2002 silver eel run.

	Salmon Leap	Mill Race	Total	%
June	4	1	5	0.2
July	15	2	17	0.6
August	199	39	238	8.3
September	71	1	72	2.5
October	2113	166	2279	79.6
November	175	13	188	6.6
December	57	4	61	2.1
January 2003	2	1	3	0.1
Total	2636	227	2863	

Sampling of individual eels (n=732) gave an average length of 46.2 cm (range: 24.2 – 86.1 cm) and an estimated weight of 207 g (Table 29).

Catches of silver eel between the years 1971 (when records began) and 1982 averaged 4,400, fell to 2,200 between 1983 and 1989 and increased again to above 3,000 in the '90s (Fig. 11). There was an above average catch in 1995, possibly contributed to by the exceptionally warm summer. The catch in 2001 of 3875 eel was the second highest recorded since 1982. The average weight of the eels in the catches has been steadily increasing from 95 g in the early 1970s to 215 g in the 1990s (Fig. 11).

Table 29. Comparative data for the silver eel runs since 1971

YEARS	NUMBER SAMPLED	AV. WT. (gm)
1971 - '75	4465	84
1976 - '80	4023	115
1981 - '85	2678	171
1986 - '90	11658	196
1986	1856	194
1987	2713	195
1988	3283	206
1989 *	685	254
1990	3121	176
1991	266	246
1992	523	186
1993	181	260
1994	468	220
1995	2003	225
1996	1172	184
1997	1022	238
1998	845	208
1999	577	220
2000	342	212
2001	850	238
2002	732	207

* Incomplete due to flood damage

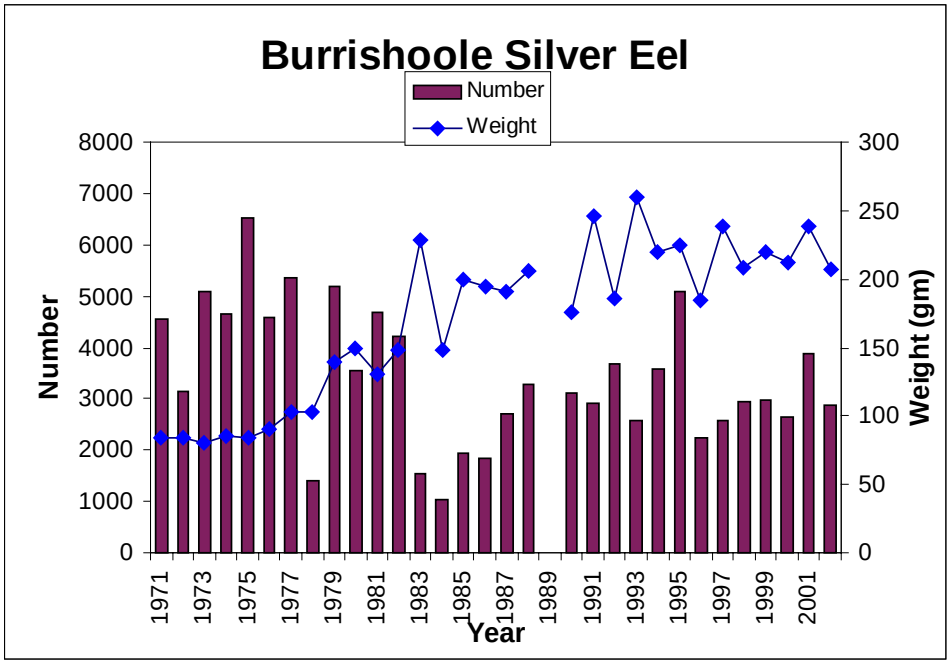

Fig. 11. Annual number and mean weight of silver eels trapped in the downstream traps.

9 FISHERY REPORT - CATCH DATA

9.1 Numbers and Average weight of Rod Catch

A total of 22 salmon were caught in the Burrishoole Fishery in 2002. The catch consisted of 10 reared fish and 12 wild fish, of which 11 were released and one killed.

The average weight of reared fish was 2.4kg (n=10) and the heaviest reared fish was 3.4kg. No lengths or weights are available for wild fish.

The total trout rod catch was 12 fish. Regulations remained in place whereby all rod caught sea trout were returned alive.

9.2 Timing of Catch and Rod Effort

Angling was again confined to Lough Furnace during 2002, as Lough Feeagh remained closed as a conservation measure. The low rod catches during 2002 were partially due to the reduced availability of fish during the angling season. Water levels were sufficiently high for much of the summer to allow fish to move into Lough Feeagh. Data from the upstream traps show that fish tended to move upstream soon after arrival from the sea. The rod effort continues to decrease in recent years decreasing from 704 rod day in 2000 to 403 in 2001 and 183 in 2002 (Table 30; Fig. 12).

Table 30. Wild and reared salmon rod catch and rod effort (hours) for the 2002 season.

	SALMON CATCH		EFFORT/ HRS.
	WILD	REARED	
May	1	1	4
June	5	4	593
July	6	5	868
August	0	0	0
September	0	0	0
Total	12	10	1462

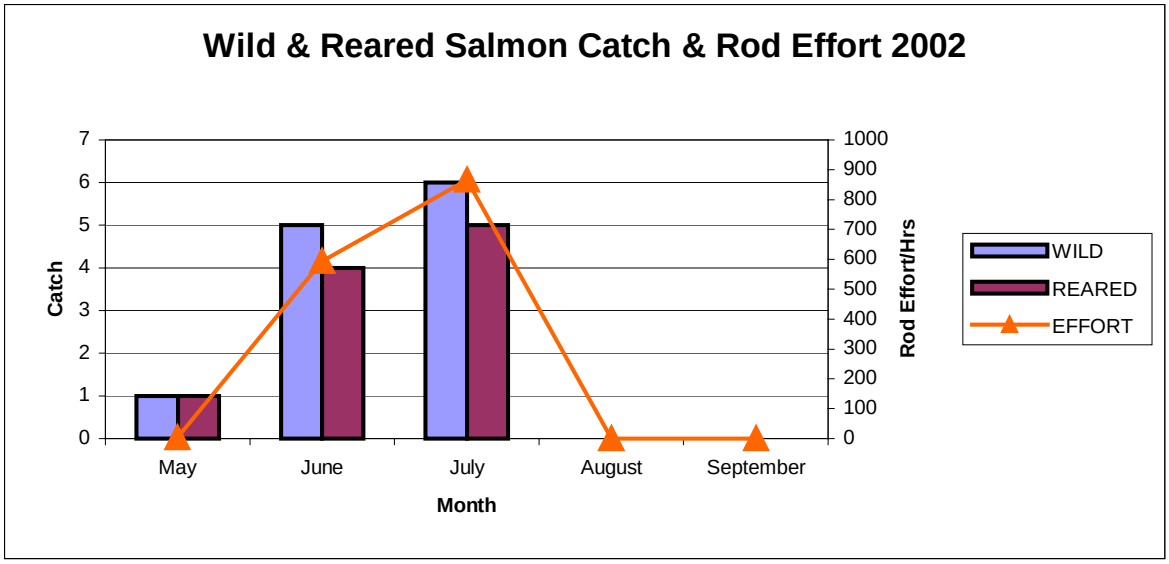

Fig. 12. Wild and reared salmon rod catch and rod effort (hours) for the 2002 season.

9.3 Exploitation Rates of Rod Fishery

Rod exploitation rates for Lough Furnace and Lough Feeagh from 1990 to 1996 are shown in Table 31. From 1997 onwards Lough Feeagh was closed to angling. Exploitation rates are only available for Lough Furnace for these years. The cessation of angling on Lough Feeagh was due to the continuing low stock level of wild fish. Anglers fishing on Lough Furnace were requested to return wild fish alive to the water. Injured wild fish were permitted to be retained, therefore the rod catch on Lough Furnace consists of a total catch which includes released fish and a retained catch which are fish that have been killed.

Table 31. Rod Fishing Exploitation Rates (1990-2002)

	1995	1996	1997	1998	1999	2000	2001	2002
WILD SALMON								
Lough Feeagh								
"Available" fish by								
end of fishing season	235	167	*	*	*	*	*	*
Total rod catch	30	11						
Rod catch retained	29	8						
Angling success %[1]	12.8	6.6						
Exploitation rate %[2]	12.3	4.8						
WILD SALMON								
Loughs Feeagh & Furnace								
Total stock of wild fish	475	406	544	520	524	580	375	651
+ 10% addition for								
L. Furnace population	523	447	598	572	576	638	413	716
Total catch of wild fish	141	119	125	80	40	70	17	12
Rod catch retained	114	35	25	11	6	6	1	1
Max. angling success %	29.7	29.3	23.0	15.4	7.6	12.1	4.5	1.8
Min. exploitation rate	21.8	7.8	4.2	1.9	1.0	0.9	0.2	0.14
Max. exploitation rate	24.0	8.6	4.6	2.1	1.1	1.0	0.3	0.15

REARED SALMON	1995	1996	1997	1998	1999	2000	2001	2002
Lough Feeagh								
"Available" fish by								
end of fishing season	49	150*	*	*	*	*	*	*
Rod catch	3	1						
Exploitation rate %	6.1	0.7						
Loughs Feeagh & Furnace								
Total stock	889	1032	848	1682	395	1257	834	860
Total rod catch	185	176	93	560	35	129	43	10
Exploitation rate %	20.8	17.1	11.0	33.3	8.9	10.3	5.2	1.2
WILD SEA TROUT								
Lough Feeagh								
"Available" fish by								
end of fishing season	108	82*	*	*	*	*	*	*
Rod catch	6	5						
Exploitation rate %	5.6	6.1						

* No Fishing on Feeagh

9.4 Angling Success

The wild catch decreased from 70 fish in 2000 to 17 fish in 2001 and showed a further decrease in 2002 when 12 wild fish were caught. The decrease in the rod catch of wild fish in 2001 was partially a result of a poorer return rate of wild fish whereas in 2002 there was a good return of wild fish. However, high water levels during the angling season resulted in fish moving upstream into Lough Feeagh rather than remaining in Lough Furnace. The angling success for salmon therefore showed a further reduction from the previous year of 4.5% to 1.8% in 2002. The CPUE value also decreased from 0.15 in 2001 to 0.12 in 2002 (Table 32).

Table 32. Catch per unit effort (CPUE) and effort per unit catch (EPUC) for the Burrishoole Fishery

YEAR	L. FURNACE				L. FEEAGH			
	SALMON		SEA TROUT		SALMON		SEA TROUT	
	CPUE	EPUC	CPUE	EPUC	CPUE	EPUC	CPUE	EPUC
'80-'84	0.13	9.92	0.85	1.35	0.23	4.47	0.63	2.10
'85-'89	0.24	4.89	0.46	5.09	0.24	4.57	0.29	70.30
'90-'95	0.20	6.10	0.17	16.80	0.20	5.40	0.10	14.0
'96	0.22	4.4	0.10	10.5	0.83	1.2	0.30	2.9
'97	0.17	6.0	0.10	9.6	-----	-----	-----	-----
'98	0.44	2.3	0.08	13.2	-----	-----	-----	-----
'99	0.09	10.8	0.05	20.8	-----	-----	-----	-----
'00	0.30	3.31	0.06	16.5	-----	-----	-----	-----
‘01	0.15	6.7	0.12	8.4	-----	-----	-----	-----
’02	0.12	8.3	0.07	15.3	-----	-----	-----	-----