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Report for the year ended 31st December 2001

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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 2001

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SUMMARY

1. The Salmon Research Agency of Ireland merged with the national Marine Institute on the 1st July 1999 forming the nucleus for the new Salmon Management Services Division. This report provides a continuation of the data records for the Burrishoole facilities.
2. The total rainfall recorded in Furnace was 1298.7 mm in 2001 – a relatively dry year with low rainfall in the first five months.
3. The total release of microtagged salmon smolts of Burrishoole reared origin into L. Furnace amounted to 24,500. Smolts were released as four groups, averaging 67g in weight. A further 47,700 smolts were released as five '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 1.4 million salmon ova to Germany for the *Rhine 2000* Programme.
5. A total of 368 wild grilse were recorded moving upstream through the permanent traps during the season. The number of spring fish recorded in the upstream traps was 6. The total run of wild grilse, including the Lough Furnace rod catch, was 369.
6. A total of 6,466 wild salmon smolts were recorded in the downstream trap in 2001. The return to freshwater of the Burrishoole reared grilse recorded was 2.0%. The wild grilse return, at 605%, was lower than that recorded in 2000 (8.1%).
7. The ova to smolt survival at 0.52 – 0.59, was similar to that recorded in 2000.
8. A total of 89 wild sea trout and a further 54 non-silvered trout migrated upstream through the traps in 2001. Of the sea trout, 54 were adults and 44 (49%) were finnock. The 2001 smolt run amounted to 530 smolts – the lowest run on record.
9. The percentage of smolts returning as finnock in the same year has historically ranged from 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 2001 was at 8.5%.
10. Silver eel trapping was continued in 2001. The run timing was different to the previous two years with 51% trapped in October. The total run amounted to 3875, a substantial increase from 2631 recorded in 2000.
11. A total of 60 salmon were caught in the Burrishoole Fishery in 2001. The catch consisted of 17 wild fish and 43 reared salmon. Of the 17 wild fish caught, 16 were returned alive to the water and 1 was killed. There was a minimum of 48 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 and 1.0% and 0.3% in 2000. 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.

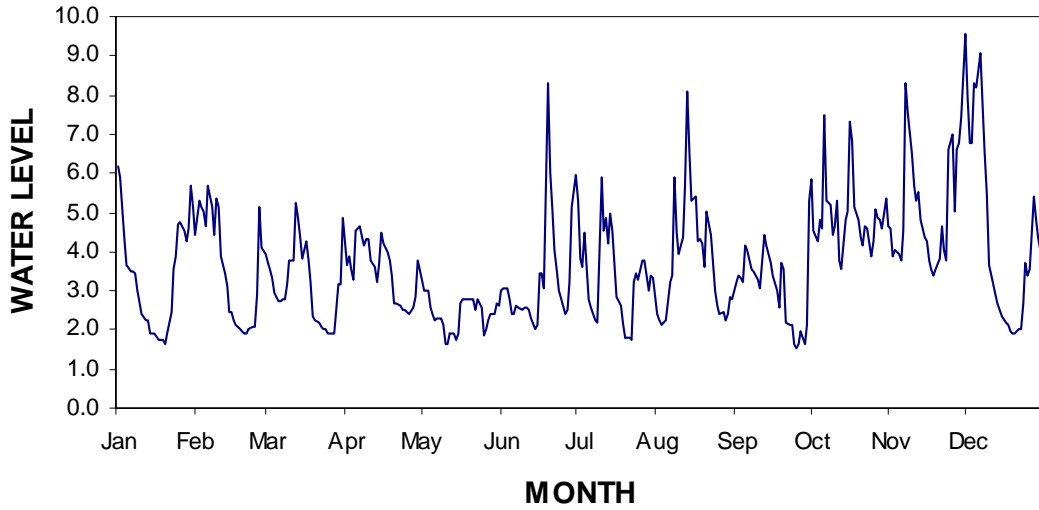
1. INTRODUCTION

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 Salmon Management Services Division 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.

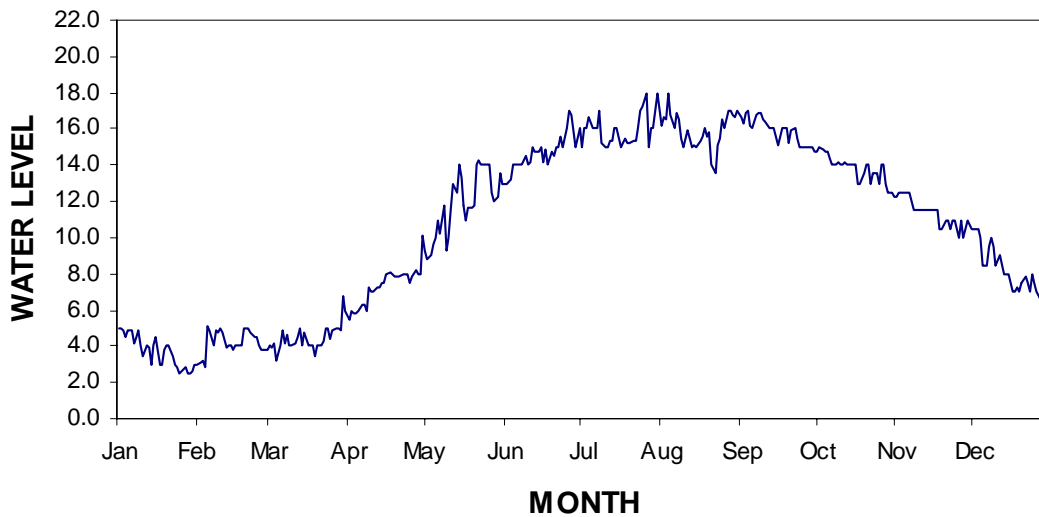
This report represents a continuation of the Annual Reports published by the Salmon Research Agency of Ireland. The data presented creates a unique record of fish rearing and wild fish census data for the past 31 years. This data is an essential component in the local, regional and national management 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.



MILL RACE WATER LEVEL, 2001



MILL RACE WATER TEMPERATURE, 2001



2. Meteorological Data

Daily meteorological data were collected during 2001 at the Met Station in Furnace. The monthly rainfall figures for 1998, 1999, 2000 and 2001 are given in Table 1, along with the annual totals for 1977 to 2001. Months of high rainfall in 2001 were June, July and August in the summer and October, November and December with low rainfall in the first five months of the year and in September. The total rainfall was 1298.7 mm in 2001.

Table 1. Monthly rainfall totals (mm) for the Furnace Station in 1998, 1999, 2000 and 2001 and the annual totals for 1977 to 2001.

Month	1998	1999	2000	2001	Year	Total
January	165.6	232.7	133.2	93.4	1977	1579.7
February	132.9	169.1	223.6	90.8	1978	1592.2
March	126.0	112.8	123.2	94.0	1979	1653.3
April	97.0	148.0	115.9	97.8	1980	1792.1
May	66.5	83.3	80.2	51.3	1981	1646.8
June	151.2	75.2	87.4	110.2	1982	1609.6
July	145.2	93.3	56.6	100.9	1983	1495.9
August	238.4	145.0	182.9	169.0	1984	1556.6
September	96.0	195.6	150.0	62.3	1985	1584.1
October	231.8	113.7	299.8	154.5	1986	1886.9
November	181.6	213.3	211.7	170.0	1987	1373.6
December	198.7	367.1	168.7	104.5	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

Water levels in 2001 largely reflected the monthly rainfall with high flows from June to August and October to December. Levels were lower through the early months of the year with low flows in May, parts of June and September. Water temperatures fell to a minimum of 2.5°C in January. The temperature remained fairly steady through February and March before rising in April through a series of peaks to a maximum of 19°C in late July. It began dropping steadily for the rest of the year from the end of July.

3. PUBLICATIONS

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- Fagan *et al.* (2001). A biochemical study of mucus lysozyme, proteins and plasma thyroxine of Atlantic salmon during smoltification. Paper presented at the 6th International Workshop on Salmonid Smoltification in September 2001.
- McGinnity, P. (2001). Overgrazing and afforestation effects on river catchments. In: *Catchment Management - Proceedings of the 31st Annual Study Course of The Institute of Fisheries of Fisheries Management* (ed. C. Moriarty), Trinity College, Dublin. p73.
- Poole, W.R., Byrne, C.J., Dillane, M.G., Whelan, K. & Gargan, P.G. (in press). The Irish sea trout enhancement programme: a review of the broodstock and ova production programmes. *Fisheries Management & Ecology* (in press).
- Poole, W.R., Nolan, D.T., Wevers, T., Cotter, D. & Tully, O. (in press). An ecophysiological comparison of wild and hatchery-raised Atlantic salmon (*Salmo salar* L.) smolts from the Burrishoole System, Western Ireland. *Aquaculture* (in press)
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- Whelan, K.F. (2001). The Burrishoole – a pioneer in catchment management. In: *Catchment Management - Proceedings of the 31st Annual Study Course of The Institute of Fisheries of Fisheries Management* (ed. C. Moriarty), Trinity College, Dublin. 49-50.

Whelan, K.F and Mullen, M. (2001). Aquaculture in Ireland – Framework, technical assessment, potential impacts and future strategy. In: *Reports of the Special Liaison Meetings to Review Measures taken by NASCO Parties to Minimise Impacts of Salmon Aquaculture on Wild Salmon Stocks*. NASCO CNL(01)69. Edinburgh. 143pp.

Posters at the 6th International Workshop on Salmonid Smoltification in September 2001.

‘A Biochemical comparison of diploid and triploid Atlantic salmon during smoltification’. M. Gogarty, N. O’Byrne-Ring, R. Ryan, D. Cotter, K. Whelan and U. MacEvilley.

‘Electrophoretic analyses of Atlantic salmon skin mucus proteins during smoltification’ (1999 – 2001). P. Kennedy, D. Cotter, R. Ryan, R. Eibrand, B. Wu and U. MacEvilley.

‘A computerised proteomics system for protein pattern analysis of salmon skin mucus’. R. Eibrand, P. Kennedy, D. Cotter, R. Ryan, U. MacEvilley and B. Wu.

4. SALMONID REARING

4.1 Salmon Stocks 2000

4.1.1 Ranching

The total release of microtagged smolts of ranched Burrishoole grilse origin was 24,500. Smolts were released as four groups, averaging 67g in weight.

A further 47,700 smolts were released as five ‘experimental’ groups. The groups were part of a contract 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 averaging 68g in weight, were differentially microtagged and branded.

4.1.2 Aquaculture

An estimated 28,200 vaccinated salmon smolts, averaging 56g, were successfully transferred to a commercial sea farm on 9th April 2001. The smolts, of Icelandic origin, were used in a field trial to test the efficacy and safety of vaccination with Norvax Mono PD vaccine.

4.2 Salmon Stocks 2001

Burrishoole grilse stock, commercial 2SW Scottish stock and 'experimental' stocks were hatched in 2001. Experimental groups consisted of crosses between line bred grilse and multi-sea winter Shannon stocks from Parteen hatchery. The return behaviour of these groups will be compared, in a joint programme with NUIG.

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 October and November. Photoperiod was manipulated in a group of upper mode Scottish

salmon parr to produce 41,300 S 1/2 smolts (mean weight 75g), which were transferred to a commercial salmon farm in December 2001.

Stocks remaining in December 2001 were 25,800 Burrishoole grilse, 27,800 commercial 2SW and 55,000 'experimental' ranch stocks.

4.3 Salmon Stocks 2002 (Grilse ova laid down in 2001)

Broodstock were stripped in December and early January. An estimated 695,000 green ova were produced by 183 hens. The average fecundity value was 3,800 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 Cong, Delphi and Parteen hatcheries, the MI SMSD co-ordinated the sale of 1.4 million ova to Germany for the Rhine programme. SMDS exported 624,000 ova and retained 40,000 ova of Burrishoole grilse origin.

4.4 Rainbow Trout 2001

An estimated 7000 rainbow trout (Sea Stream stock) were stocked into Ballinlough Fishery, from August to October. 1500 trout were retained in December 2001 for stocking the Fishery from February to June 2002.

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 SMSD 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 368 wild grilse were recorded moving upstream through the permanent traps during the season (Table 2). The run commenced in June and was completed in December. The main upstream migration was recorded in the Salmon Leap trap with 287 wild grilse and 81 in the Mill Race trap.

The number of spring fish recorded at 6 was similar to the previous year.

The retained rod catch of wild grilse on Lough Furnace was 1 fish. Therefore, the total wild grilse return to the system, including the Furnace rod catch and the upstream trap count, was 369.

The run commenced in June and wild fish were recorded in the traps in all of the subsequent months (Table 3). High water levels were recorded during June and over 60% of the total upstream migration occurred during this period.

The run of 368 grilse to the traps was the lowest recorded in recent years (Table 4).

Table 2. Monthly wild grilse totals for the Salmon Leap and Mill Race traps.

	Mill Race	Salmon Leap	Total
May	0	0	0
June	63	158	221
July	7	69	76
August	1	40	41
September	1	2	3
October	5	14	19
November	2	2	4
December	2	2	4
Total	81	287	368

Table 3. Monthly proportions (%) of wild grilse run 1997 –'01.

	1997	1998	1999	2000	2001
May	1.0	0.0	1.2	1.8	0
June	11.9	30.7	26.3	31.5	60.1
July	32.0	44.6	44.6	4.9	20.7
August	21.1	8.7	16.9	45.1	11.1
September	23.0	4.4	9.6	11.6	0.8
October	9.0	10.9	1.2	3.5	5.2
November	2.1	0.8	0.2	0.0	1.1
December	0.0	0.0	0.0	0.4	1.1

Table 4. Wild salmon and grilse totals in upstream traps 1970-2001

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

5.2 Net marked fish in upstream traps

Net marks were observed on both wild and reared grilse between June and October (Table 5). Of the total returns to the slut trap 19.1% wild grilse and 13.8% reared grilse were recorded with net marks.

Table 5. Percentage Occurrence of Net Marks on Wild and Reared Grilse

	Wild Grilse	Reared Grilse
May	0.0	0.0
June	14.8	21.7
July	31.3	22.7
August	20.5	15.1
September	0.0	3.8
October	7.2	2.6
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.

The maximum spawning escapement in 2001 decreased from 567 fish in 2000 to 370 in 2001. (Table 6). The reared component of the spawning stock (21) was 5.7%, which is a decrease from 7.0% recorded the previous year. The reared component was minimised by culling a proportion of the run during the summer months.

All experimental reared fish identified by freeze brand marks in the upstream traps were culled and not allowed to migrate further upstream.

When estimated mortalities, displacements downstream and removals for broodstock are taken into account (Table 7) the actual spawning stock of wild grilse was 337 and 6 spring salmon. Only 21 ranched fish released upstream remained available to spawn after displacements downstream and mortalities. All displacements of ranched fish downstream are removed fro broodstock.

Table 6. Spawning escapement 1970 - 2000

	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	370	349	21

Table 7. Spawning stock of salmon and grilse

	Wild grilse(1SW) & previously spawned grilse	Wild Salmon (2SW)	Ranched fish released upstream
Counted in trap	368	6	83
Rod Feeagh*	--	--	--
Culled	--	--	0
Broodstock	7	--	0
Estimated morts.	18	--	2
Displacement	6	--	60
Spawning stock	337	6	21

* No angling on L. Feeagh during 2001.

5.4 Survival of Ova to Grilse

The relevant brood year for the 2001 grilse was 1997 with ova hatch in 1998 and smolt migration in 2000 (Table 8). 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 8. Survival ova to grilse

Spawning escapement in 1997	494
No. of females	247 - 272
Ova deposition	988,000 – 1,119,200
No. of smolts in traps 2000	5791
No. of smolts released	5689
Survival ova to smolt	0.59 - 0.52
No. returning grilse 2001	369
Survival smolt to grilse	6.5%
<i>Survival to grilse per grilse female</i>	<i>1.5 – 14</i>

5.5 Ova to Smolt Survival

The survival of ova to smolt range of 0.52 to 0.59 was similar to that recorded the previous year (Table 9).

The survival of smolt to grilse decreased from 8.1% to 6.5%. The survival to grilse per grilse female was below the value required to sustain the population of four years earlier.

5.6 Wild Salmon Smolts

A total of 6466 wild salmon smolts were recorded in the downstream traps during 2001 (Table 10). The run commenced on the 6th April in the Salmon Leap trap. The main peak occurred on May 13th when a total of 919 (14.2%) wild smolts were recorded (Figure 1). Table 11 gives the smolt numbers for previous years and also gives the totals released to sea.

Table 9. 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

Table 10. Numbers of wild salmon smolts counted in 2001.

MONTH	SLDT	MRDT	TOTAL
March	0	0	0
April	546	26	572
May	3076	1902	4978
June	773	119	892
July	11	1	12
August	8	0	8
September	8	0	3
October	1	0	1
TOTAL	4418	2048	6466

Table 11. Annual numbers of wild salmon smolt recorded in downstream traps

1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
3794	6926	5429	5971	5998	6148	6331	9588	7197	5791	6466
					5854*	5960*	8937*	7118*	5689*	6387*

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

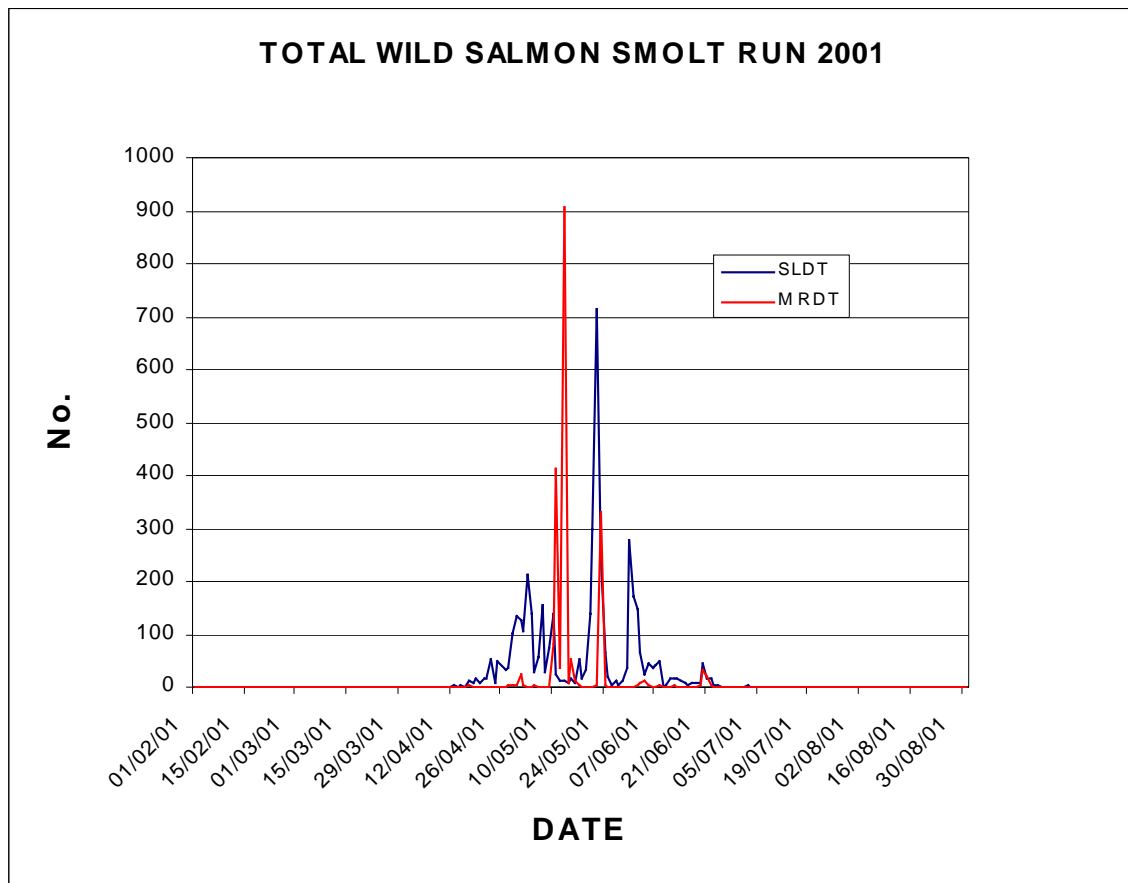


Figure 1. Timing of the 2001 Wild Salmon Smolt Run in Salmon Leap & Mill Race Traps

5.7 Wild Salmon Kelts

The wild kelt run commenced in December 2000 and the peak of the run occurred during April 2001 (Table 12). As in recent years the kelts recorded in the downstream traps were in very good condition (Table 13). The percentage survival from the spawning stock was 72.5%.

Table 12. Numbers of wild salmon kelts counted in 2001.

	SLDT	MRDT	TOTAL
Dec '00	9	0	9
January '01	16	1	17
February	32	1	33
March	144	3	147
April	148	3	151
May	25	0	25
Total	374	8	382

Table 13. Comparison of kelt 'condition' in 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	*

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

The following summaries the exploitation by nets and the survival rates to the coasts and to the river

Exploitation by nets if NCFM is included	89.4%
Survival to the coast	10.5%
Survival to the river	2.0%

6.2 Return rate of reared and wild grilse

A total of 834 reared salmon were recorded in freshwater during 2001. The total included 791 fish recorded in the upstream traps and 43 fish on rod and line. A total of 778 fish were cored and microtags were recovered from 741 fish (Table 15). Of the fish identified by microtag 64% (474) were identified as Burrishoole grilse released in 2000 as part of the Burrishoole ranching programme. This represents a minimum return rate of 1.9% to freshwater. In recent years microtagged smolts for specific projects have been released in addition to Burrishoole smolts for the on-going ranching programme. Therefore, fish recovered without microtags cannot be assumed to be of Burrishoole origin.

The maximum return rate for the Burrishoole ranch groups to freshwater is therefore calculated by applying the percentage of Burrishoole ranched fish in the overall return to freshwater as determined by microtags to the number of fish recorded without a microtag. In 2001 64% of the total microtags identified were from the ranching programme. Therefore 24 fish (64%) of the 37 fish recorded without microtags were assumed to be from the Burrishoole ranch strain. The maximum number of Burrishoole fish recorded in freshwater during 2001 was 498 fish, which is equal to a 2.0% return rate. The 2001 return rate represents a decrease from 2.9% the previous year. There was also a corresponding decrease in the survival of wild fish to freshwater, which decreased from 8.1% to 6.5% for the same period.

During 2000 a group of Burrishoole smolts were released into the Burrishoole estuary and a control group released into Lough Furnace during early May. There was a similar return rate to freshwater for both groups, 2.1% as calculated directly from microtag recoveries. A third group, which was released, into Lough Furnace at the end of April had a lower return rate of 1.6%.

6.3 Recapture of Reared 2SW Fish

A total of 10 2 SW reared Burrishoole stock were identified by microtag during 2001. Fish from each of the release groups in 1999 were represented.

Table 15. Details of microtags recovered in freshwater at Burrishoole during 2001

Microtags	Tag Code	Year of Release	Release group
5	184727	1999	Ranch
2	194715	1999	Ranch
3	14701	1999	Ranch
1	184738	1999	Ranch
2	174749	1999	Experimental
4	194709	1999	Experimental
5	184750	1999	Experimental
23	184748	1999	Experimental
30	194722	1999	Experimental
13	194724	1999	Experimental
146	14771	2000	Ranch
164	14769	2000	Ranch
164	14770	2000	Ranch
23	174723	2000	Experimental
8	174754	2000	Experimental
1	174733	2000	Experimental
18	184763	2000	Experimental
11	174763	2000	Experimental
4	34741	2000	Experimental
11	184725	2000	Experimental
2	194753	2000	Experimental
17	184726	2000	Experimental
52	194739	2000	Experimental
45	14768	2000	Experimental

6.4 Smolt releases 2001

A total of 24,592 reared smolts of Burrishoole origin consisting of four microtag groups were released during 2001 (Table 16). 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 16. Burrishoole smolts released in 2001.

Release Date	3/5/01	3/5/00	3/5/00	3/5/01
Release Site	Furnace	Estuary	Furnace	Furnace
No. Released	4298	4226	10352	5716
<i>Weight (g)</i>	63.9	71.8	63.4	67.4
<i>Length (cm)</i>	17.7	18.4	17.7	18.0
<i>Condition Factor</i>	1.1	1.2	1.1	1.2
Microtag Code	204709	204708	204713	204701

7 Wild Sea Trout

The sea trout research and monitoring programmes were continued in 2001.

7.1 Upstream Movements: Timing and Numbers.

A total of 89 wild silvered sea trout and a further 54 non-silvered trout migrated upstream through the traps in 2001. Of the silvered trout, 54 were adults and 44 (49%) were finnock. The numbers are compared with other years in Table 17. Of the total run of migratory trout (143), 37.8% were non-silvered. For the purposes of this report, the non-silvered trout are not included with the sea trout. Table 17 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.

The timing of the sea trout run in 2001 and in previous years, expressed in monthly percentages, is given in Table 18. The highest proportion of sea trout, both finnock and adults, moved upstream in July. No sea trout moved upstream in September, probably due to low water levels.

Table 17. 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	

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

Table 18. Timing of the Burrishoole sea trout run (in monthly percentages).

	1970-'79	1980-'84	1985-'89	1990-'94	1995-'99	2000	2001
May	-	0.2	0.5	0.1	3.1	0.9	2.3
June	13.1	24.6	9.4	8.4	8.6	7.2	23.6
July	54.4	44.9	62.2	55.0	42.4	9.0	30.3
August	15.8	10.3	18.4	16.5	19.3	72.9	16.9
September	7.6	14.8	3.7	8.5	9.8	7.2	0.0
October	6.4	3.5	4.1	7.9	12.2	1.8	24.7
November	2.4	1.5	1.5	2.9	4.3	0.0	2.2
December	0.3	0.2	0.2	0.7	0.7	0.0	0.0

7.2 Spawning Escapement

With the continuation of the catch and release bye-law into the 1999 fishing season, no sea trout were reported killed by anglers on L. Feeagh in 1999. Using the upstream fish counts through the traps, the total maximum spawning escapement of migratory trout to the L. Feeagh catchment was 143, of which 54 were non-silvered sea trout. This was the lowest overall spawning escapement ever recorded.

Table 19. Annual spawning escapement of sea trout into freshwater.

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

7.3 Reared Adults

This was the eighth year that a return of sea trout occurred derived from the sea trout rearing programme. A total return of 2 tagged or marked trout was recorded in the upstream traps in 2001, the lowest return of the programme. These were broken down into 1 adult sea trout and one unsilvered trout.

7.4 Downstream Movements, Sea Trout Smolts

The 2001 smolt run amounted to 530 smolts, of which 516 were released to the wild (Table 20). This was the lowest smolt run recorded since 1970 (Table 21). The smolt run in 2001 was more spread out over time with at least five smaller peaks influenced by increases in water level or temperature in the case of the peak on 22 May. (Fig. 2).

Table 20. Monthly numbers of Burrishoole sea trout smolts recorded through the traps.

	Salmon Leap	Mill Race	Total	%
January	0	0	0	0.0
February	3	0	3	0.6
March	7	1	8	1.5
April	192	5	197	37.2
May	240	8	248	46.8
June	47	20	67	12.6
July	6	1	7	1.3
Total	495	35	530	
Number Released Downstream			516	

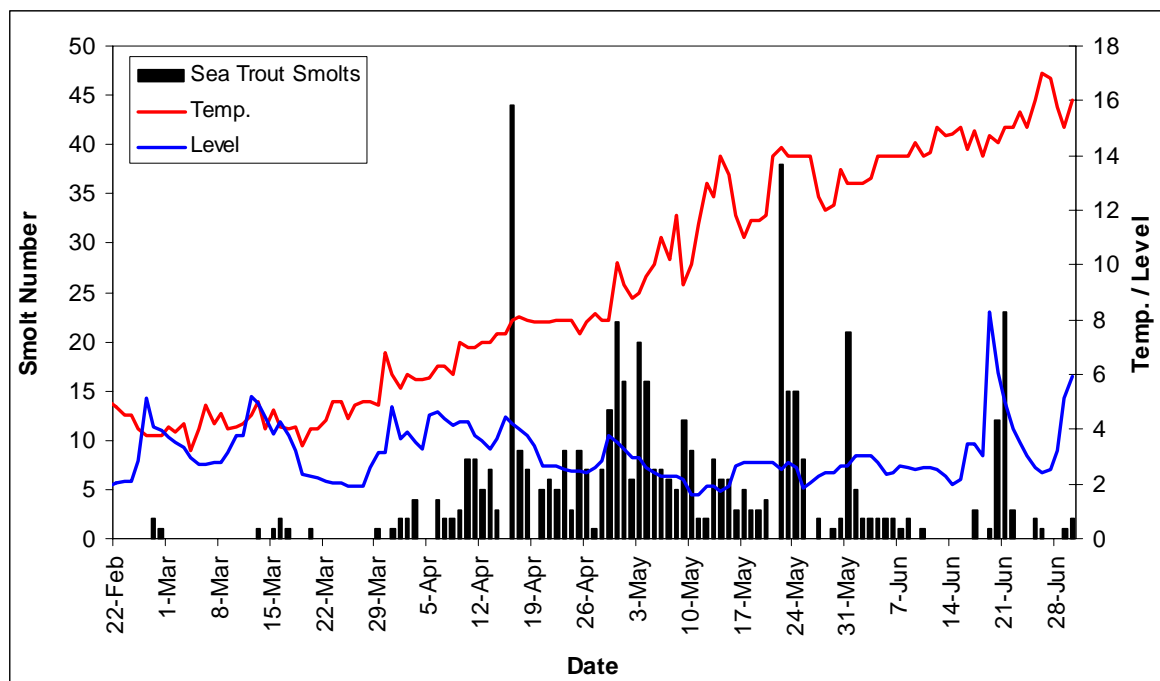


Fig. 2. Timing of the 2001 wild sea trout smolt migration with daily water level and temperature.

Table 21. Annual sea trout smolt numbers in Burrishoole for 1970 to 2001.

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

LENGTH

The length distribution for the 2001 wild sea trout smolts is given in Figure 3. The wild smolts had an average length of 21.9 cm and ranged from 15 cm to 28.2 cm in length with a modal length of 22 cm.

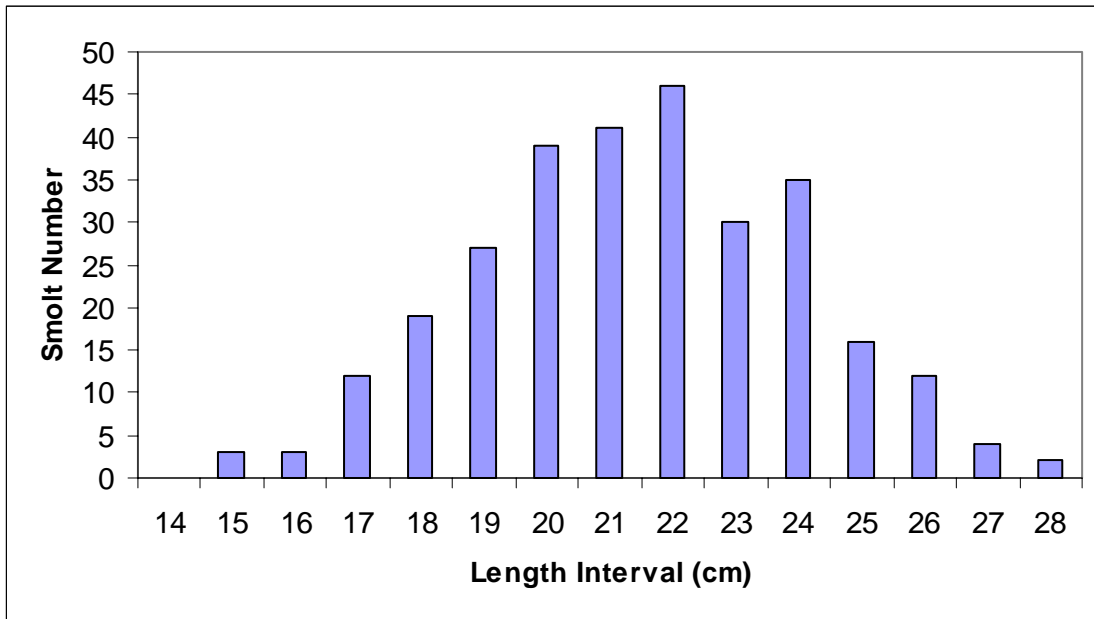


Fig. 3. Length distribution for smolts in the Burrishoole system, 2001 (n=289).

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. A total of 1907 trout entered the traps between July and December 2001 and January 2002 (Table 22). The percentage of 0+ trout that migrated in 2001 was 56.4% (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 22. Numbers of migrating autumn juvenile trout, to the end of January 2002.

Month	0+	1+
July	0	0
August	19	28
September	27	17
October	616	479
November	234	166
December	134	88
January 2001	49	50
Total	1079	828
Overall Total		1907

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	56.4

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.

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

* estimated

7.7 Marine Survival

WILD

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. 4). 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. 5).

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.

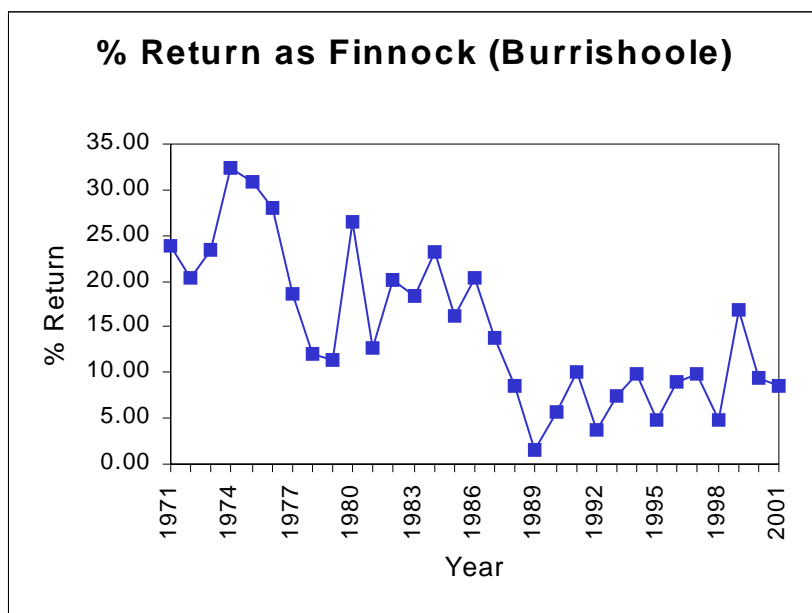


Fig. 4. Annual percentage return of smolts returning as finnock to the Burrishoole system.

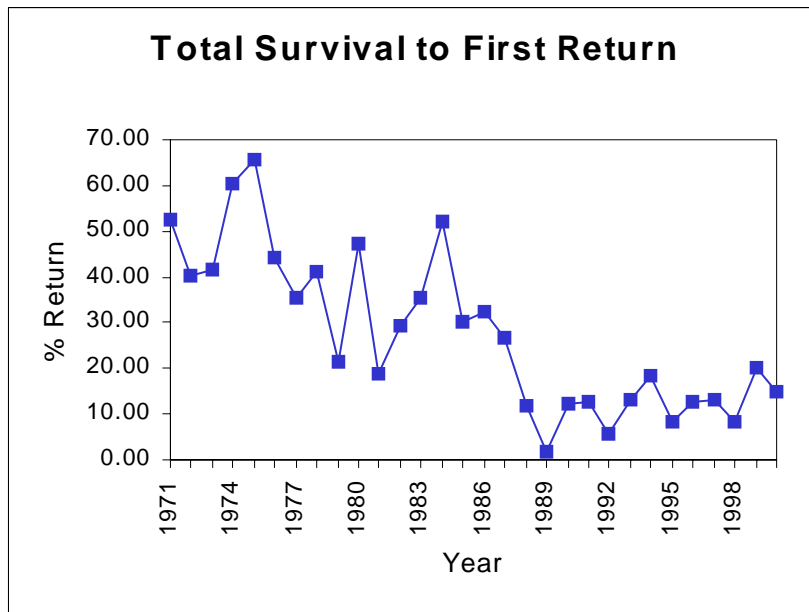


Fig. 5. Annual marine survival of smolts to first return (as finnock and 1+ sea trout) to the Burrishoole system.

7.8 Sea Trout Kelts

The timing and numbers of downstream migrating sea trout kelt are given in Table 26. These are divided in large and small (<32 cm) fish roughly separating in finnock and older fish. A total of 70 kelts, 19 large and 51 small, were counted downstream.

Table 26. Timing and numbers of sea trout kelts for the 2000/2001 season.

Month	Large	Small	Total
October	0	2	2
November	1	7	8
December	1	5	6
January	1	8	9
February	4	3	7
March	3	2	5
April	4	20	24
May	5	4	9
Total	19	51	70

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 15. 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 overwinter 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%	" *

* 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 2001. The run timing was different to that in 2000 with 51% of the migration in October (Table 28). The total run amounted to 3875. As in other years, the highest proportion of the total catch (85%) was made in the Salmon Leap trap.

Table 28. Timing and numbers of the 2001 silver eel run.

	Salmon Leap	Mill Race	Total	%
June	6	0	6	0.2
July	25	2	27	0.7
August	155	82	237	6.1
September	183	62	245	6.3
October	1911	282	2193	56.6
November	973	127	1100	28.4
December	28	15	43	1.1
January 2002	23	2	25	0.6
Total	3303	572	3875	

Sampling of individual eels (n=850) gave an average length of 48.9 cm (range: 24.4 – 95.6 cm) and an estimated weight of 238 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. 6). 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 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. 6).

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

* Incomplete due to flood damage

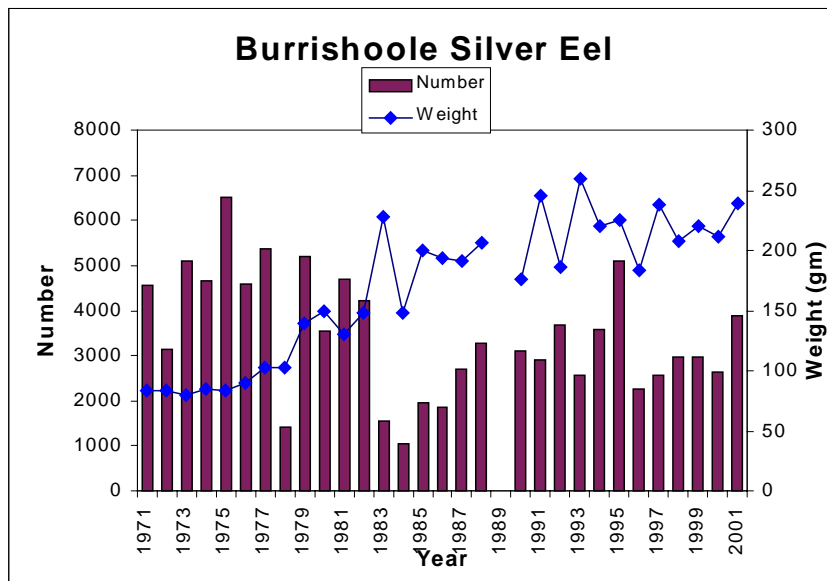


Fig. 6. Annual number and mean weight of silver eels trapped in the downstream traps.

9 FISHERY REPORT - CATCH DATA

9.1 Numbers and Average weight of Rod Catch

A total of 60 salmon were caught in the Burrishoole Fishery in 2001. The catch consisted of 43 reared fish and 17 wild fish of which 16 were released and 1 killed.

The average weight of reared fish was 2.4kg (n=43), the heaviest reared fish, 6.8kg, was from an experimental group. No lengths or weights are available for wild fish.

The total trout rod catch was 48 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 2001, as Lough Feeagh remained closed as a conservation measure. Due to the low return rate of wild fish to the trapping facilities in early summer it was decided to cease angling at the end of July as a further conservation measure (Table 30; Fig. 7). The rod effort decreased from 704 rod days in 2000 to 403 in 2001.

Table 30. Wild and reared salmon rod catch and rod effort (hours) for the 2001 season.

	SALMON CATCH		EFFORT/ HRS.
	WILD	REARED	
JUNE	7	17	1626
JULY	10	26	1600
AUGUST	0	0	0
SEPTEMBER	0	0	0
Total	17	43	3226

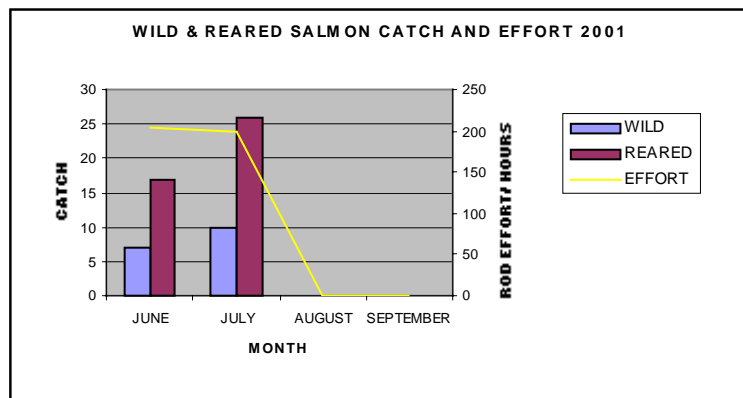


Fig. 7. Wild and reared salmon rod catch and rod effort (hours) for the 2001 season.

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.

Voluntary catch and release was introduced in 1995 and the exploitation rate for wild fish in that year was 24%. With the introduction of mandatory catch and release exploitation rates fell to 4.6% in 1997, 2.1% in 1998 1.1 in 1999 and 1.0% in 2000. There was a further decrease in 2001 to 0.3%. This lower exploitation rate in 2001 was also a consequence of the cessation of angling at the end of July. The exploitation rate on reared fish also showed a significant decrease, decreasing from 10.3% the previous year.

Table 31. Rod Fishing Exploitation Rates (1990-2001)

	1990 -94	1995	1996	1997	1998	1999	2000	2001
WILD SALMON								
Lough Feeagh								
"Available" fish by end of fishing season	400	235*	167	*	*	*	*	*
Total rod catch	35	30	11					
Rod catch retained		29	8					
Angling success % ¹	-	12.8	6.6					
Exploitation rate % ²	8.8	12.3	4.8					
WILD SALMON								
Loughs Feeagh & Furnace								
Total stock of wild fish	449		475	406	544	520	524	580
+ 10% addition for								
L. Furnace population	494		523	447	598	572	576	638
Total catch of wild fish	70		141	119	125	80	40	70
Rod catch retained			114	35	25	11	6	6
Max. angling success %			29.7	29.3	23.0	15.4	7.6	12.1
Min. exploitation rate	14.2		21.8	7.8	4.2	1.9	1.0	0.9
Max. exploitation rate	15.6		24.0	8.6	4.6	2.1	1.1	1.0
REARED SALMON								
	1990 -94	1995	1996	1997	1998	1999	2000	2001
Lough Feeagh								
"Available" fish by end of fishing season	606	49	150*	*	*	*	*	*
Rod catch	25	3	1					
Exploitation rate %	4.1	6.1	0.7					
Loughs Feeagh & Furnace								
Total stock	858	889	1032	848	1682	395	1257	834
Total rod catch	108	185	176	93	560	35	129	43
Exploitation rate %	12.6	20.8	17.1	11.0	33.3	8.9	10.3	5.2
WILD SEA TROUT								
Lough Feeagh								
"Available" fish by end of fishing season	196	108	82*	*	*	*	*	*
Rod catch	31	6	5					
Exploitation rate %	15.8	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. The decrease in the rod catch of wild fish in 2001 was partially a result of a poorer return rate of wild fish and a reduction of the angling season to two months. This resulted in a reduction in angling success from 12.1% to 4.5% this was the lowest angling success rate since catch and release was introduced.

Although the CPUE value for salmon decreased from 0.3 in 2000 to 0.15 2001 (Table 32) it was higher than in 1999 at 0.09 which like 2001 was also a year of poor marine survival.

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	-----	-----	-----	-----