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Rhanbarth Cymru
National Rivers Authority
Welsh Region

DEE STOCK ASSESSMENT PROGRAMME

ANNUAL REPORT 1993

Welsh Region
Technical Fisheries
Report No. 6

I.C. Davidson
R.J. Cove
N.J. Milner

March 1995

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March 1995

SUMMARY

1. This fourth annual report of the Dee Stock Assessment Programme (DSAP) presents results for Jan-Dec 1993 - the second full year of the programme. DSAP has continued to be successful in meeting its objectives, with improvements in many areas including: (i) increased numbers of salmon and sea trout tagged and recaptured - producing more precise run estimates; (ii) logbook circulation (464) and returns (total 53%) maintained at a high level - demonstrating sustained support for DSAP among anglers; (iii) the largest catch of microtagged salmon to date at Chester Weir (38) and over 33,000 1+ parr/smolts stocked from the Maerdy hatchery, and (iv) encouraging results from a pilot wild smolt microtagging exercise on the main Dee.

2. 1264 salmon and 889 sea trout were tagged in 1993, with 176 salmon recaptured by anglers, and 59 sea trout recovered at Chester Weir. The resulting annual run estimate for salmon of 9700 indicated an increase of 111% on 1992 - mainly arising from a marked (152%) rise in the numbers of 1SW fish, with only 3SW fish declining (88 fish in 1992 to only 51 in 1993). For sea trout, annual run estimates applied to the previous season (1992) with populations of 0+ and >0+SW fish of 2537 (95%CL 1359-4531) and 1767 (95%CL 1328-2347), respectively, representing reductions of 51% and 31% on 1991. In contrast, the overall trap catch rate for sea trout in 1993 (0.259 fish per hour) was up by 33% on 1992 and largely resulted from a 244% increase in the catch rate for 0+SW fish.

3. Rod and net catches for salmon were among the largest of the decade, each at around 1000 fish, with annual catch rates for logbook anglers (0.023 fish per hour) and trammel netsmen (1.526 fish per tide) the highest since records began in 1989 and 1991, respectively. Peak end-of-season catches on both fisheries and the high proportion of small salmon (0-3.6Kg) reflected the dominance of 1SW fish in the catch. For sea trout, net catch (42) and catch effort (0.022 fish per tide) declined on the previous season, with the latter the lowest recorded. In contrast, the declared rod catch from licence returns (103) and logbook catch-effort (0.034 fish per hour) improved markedly on 1992, with the proportion of the catch in the smallest (0-0.5kg) weight category the highest of the decade (66%). While the latter appeared to reflect an increased contribution of 0+SW fish to the rod catch, fish of this size were absent from net returns because of gear selectivity.

4. The overall rod exploitation rate for salmon of 15% (95%CL 13-17%) was similar to 1992 (17%), as were spatial and temporal recapture patterns, and possibly reflected above average monthly flows which were a feature of both seasons and contrasted with the dry year of 1991. Angling exploitation rates on 1SW salmon also conformed to this pattern with rates in 1992 (16%) and 1993 (13%) much higher than in 1991 (6%). While 1SW salmon experienced the lowest exploitation rates (except for previous spawners), rates for 3SW salmon were the highest recorded in both 1992 (27%) and 1993 (27%).

5. Electrofishing surveys indicated no change in juvenile salmon or trout abundance at Dee tributary sites between 1992 and 1993, although a significant ($p=0.041$) increase in numbers of 0+ salmon was apparent for main river sites.

6. DSAP has contributed directly to developments in local and regional fisheries management, most notably in the successful introduction of Spring salmon byelaws on the Dee, and, more recently, in the derivation of salmon egg deposition estimates as part of a regional Net Limitation Order (NLO) review. For the latter, estimates below a 'spawning target' of 390 eggs 100m^2 indicated a need for increased spawning escapement and provided a rationale for regulating the net (and rod) fisheries.

Key words: Salmon, sea trout, River Dee, stock assessment, trapping, mark-recapture, fishery performance, microtagging, juvenile monitoring

CONTENTS

CONTENTS

1. INTRODUCTION

This fourth annual report of the Dee Stock Assessment Programme (DSAP) presents results for January-December 1993 - the second full year of the programme. The report describes and assesses progress of DSAP against its objectives which remain unchanged from those published previously (NRA, 1994a).

The components of the programme are essentially the same as last year, but 1993 was the final year of the radio-tracking programme - the results of which will be reported elsewhere. One new development has been the start of a wild smolt trapping and microtagging programme on the main Dee, the details of which are described in Section 2.5.

2. RESULTS - ADULT SALMON

2.1 Run composition and timing

2.1.1 Trap catch

1723 salmon were captured at Chester Weir in 4993 hours of fishing. Catch rates (catches per hour) for individual sea age groups are shown in Table 1 and Fig 1 for the period 1991-93. As in previous years, these are based on daily estimates of sea age composition from scale readings (Section 2.1.2.1) and, where appropriate, fish size information.

1993 was the third year of trapping and only the second year when the trap was operational throughout the year. In 1991 trapping commenced in late May, although the trap was structurally less efficient prior to July of that year. As a consequence, comparison of trap catch rates for sea age groups which enter the Dee at Chester prior to July is restricted to the two years 1992-93, this includes all multi-sea winter salmon (Fig 1). However, for 1 sea-winter (1SW) salmon the majority of the run arrives after June, so it is reasonable to compare post-June catch rates over the three years.

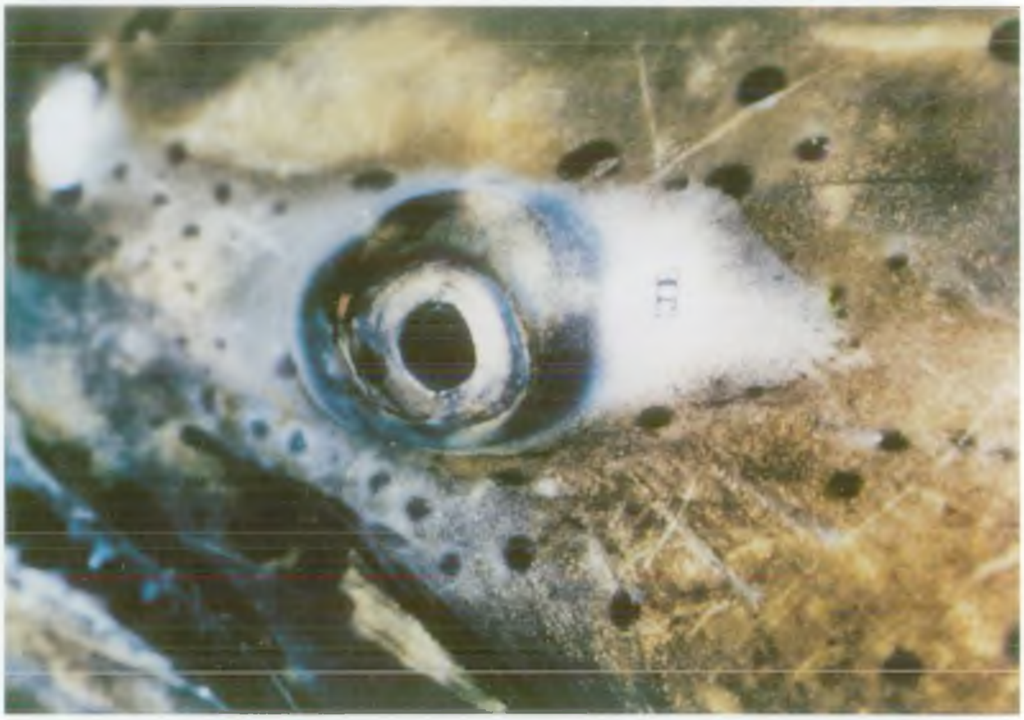
The post-June catch rate for 1SW salmon in 1993 of 0.549 fish per hour was markedly higher than in either of the previous two years (0.384 and 0.357). However, for multi-sea-winter fish, annual catch rates were very similar in 1992 and 1993 with identical catch rates recorded for 2SW salmon (0.077) and near identical rates for 3SW fish (0.004 and 0.005) and previous spawners (PS) (0.005 and 0.007) (Table 1).

Run timing for each of the sea age groups appeared remarkably consistent between years (Fig 1). 3SW fish were again virtually confined to the 'Spring' months (Jan-May), and although 2SW salmon and previous spawners also contributed to the early run, both these sea age groups continued to enter the river in numbers throughout the remainder of the year.

2.1.2 Age composition

2.1.2.1 Sea age

Scales were taken from 1406 salmon at Chester Weir (82% of the total catch) of which 1402 had a readable sea age (Table 2). The age composition was similar to 1992, with 1 and 2SW fish comprising the majority (70% and 26%, respectively), and the remainder made up of similar proportions of 3SW salmon and previous spawners (4%).



Adult sea trout with VI tag immediately behind the left eye. (Photo courtesy of Northwest Marine Technology).

Front Cover: Commercial draft netting in the Dee estuary at Connahs Quay.

Microtagging juvenile salmon at the Maerdy hatchery.

2.1.2.2 Smolt age

Scales from 1179 salmon had readable river centres of which 37% appeared to have emigrated as one year old smolts and 62% as two year olds (Table 3). Smolt age composition was very similar to the previous year (35% one year olds and 64% two year olds), as was the overall mean smolt age (1.64 in 1993 compared to 1.66 in 1992). No significant differences ($p>0.05$) were apparent in the mean smolt ages of post-June entrants over the three years 1991-93, except for 1SW salmon where the mean smolt age in 1991 (1.52 years) was significantly less than in either 1992 or 1993 (both 1.64 years) ($p=0.0001$).

2.1.3 Sex composition

Sex was assigned to 1297 out of 1403 fish examined of which 58% were considered female and 42% male (Table 4). The corresponding F/M ratio of 1.38 was slightly higher than that recorded in 1992 (1.25), with more marked differences within sea age groups, most notably among previous spawners where the F/M ratio increased from 4.20 in 1992 to 33.00 in 1993.

2.1.4 Weight composition

504 salmon were weighed at Chester Weir in 1993 - around 30% of the trap catch (Table 5). No multi-seawinter fish were weighed prior to July to avoid handling stress on Spring entrants. Comparison of mean weights in post-June entrants indicated no significant differences ($p>0.05$) among sea age groups (1SW and 2SW fish and previous spawners) over the three year period 1991-93.

2.2 Run size

2.2.1 Tagging

1264 salmon were Floy tagged at Chester Weir in 1993 within the angling season (up to 14th Oct), including 36 radio-tagged fish (Table 6). This represented over 73% of the trap catch in any one month within this period.

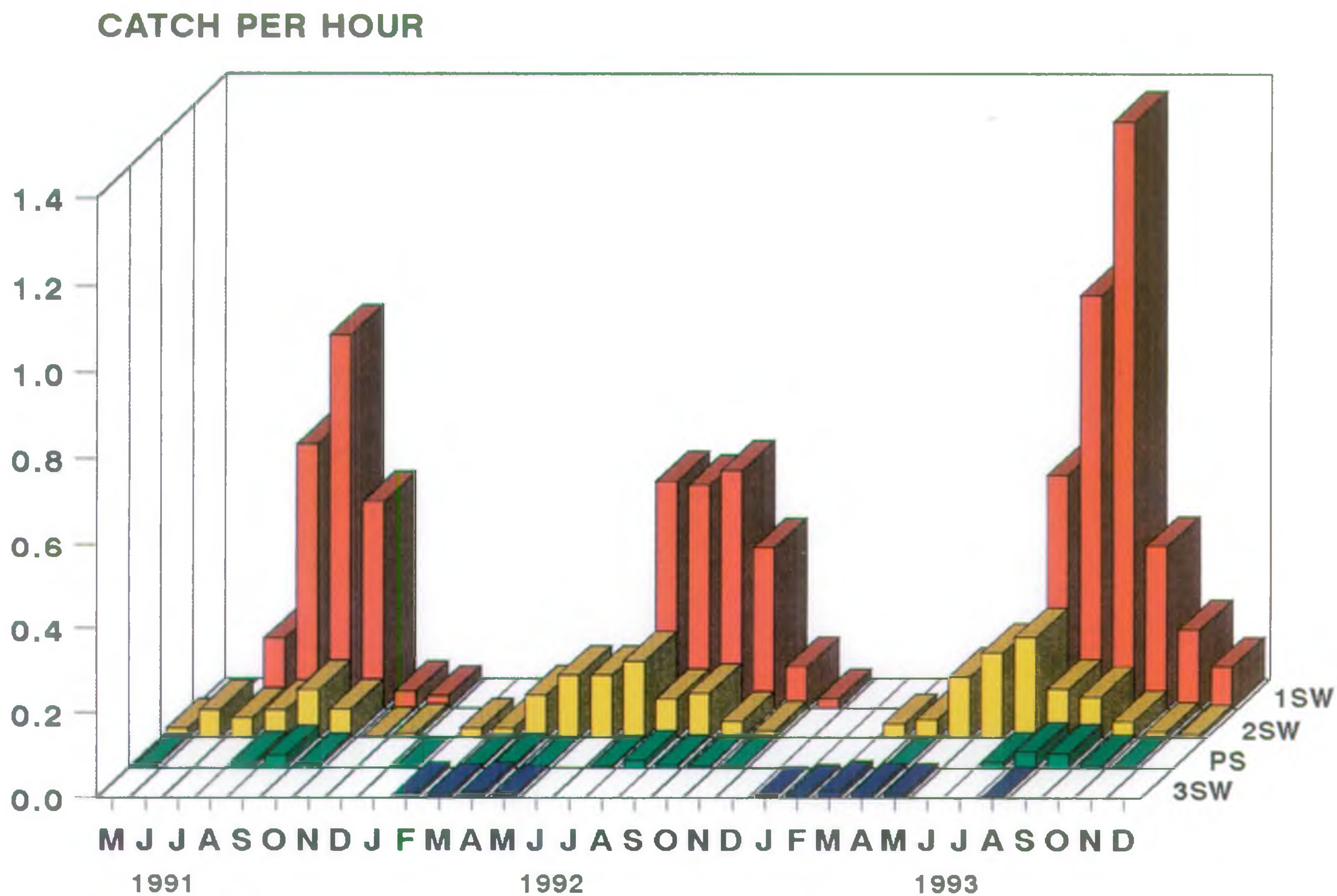
2.2.2 Recaptures and straying

Of salmon tagged in 1993, 174 were recaptured by Dee anglers inseason, including 61 fish reported by anglers who made a logbook return. As in previous years, only a small number of salmon were recaptured downstream of the trap including 4 fish taken by Dee estuary nets and 1 fish recovered by an angler fishing on another river - the Ribble in North West Region (Table 7).

Only 3 pre-spawning mortalities were reported in 1993 compared to 10 in 1992. Most of the latter were fish tagged in the Spring (Jan-May) period, a pattern not repeated in Floy tagged fish in 1993, or indeed in radio-tagged fish where behaviour could be closely monitored. It remains unclear as to whether the Spring fish mortalities in 1992 were related to tagging, particularly as mortalities among untagged individuals were also reported. In any event, trapping and tagging procedures were modified in 1993 to reduce any potential handling stress (see for example Section 2.1.4).

SALMON TRAP CATCH RATE BY SEA AGE GROUP; CHESTER WEIR, 1991-93

FIG. 1



SW = SEA WINTER

PS = PREVIOUS SPAWNER

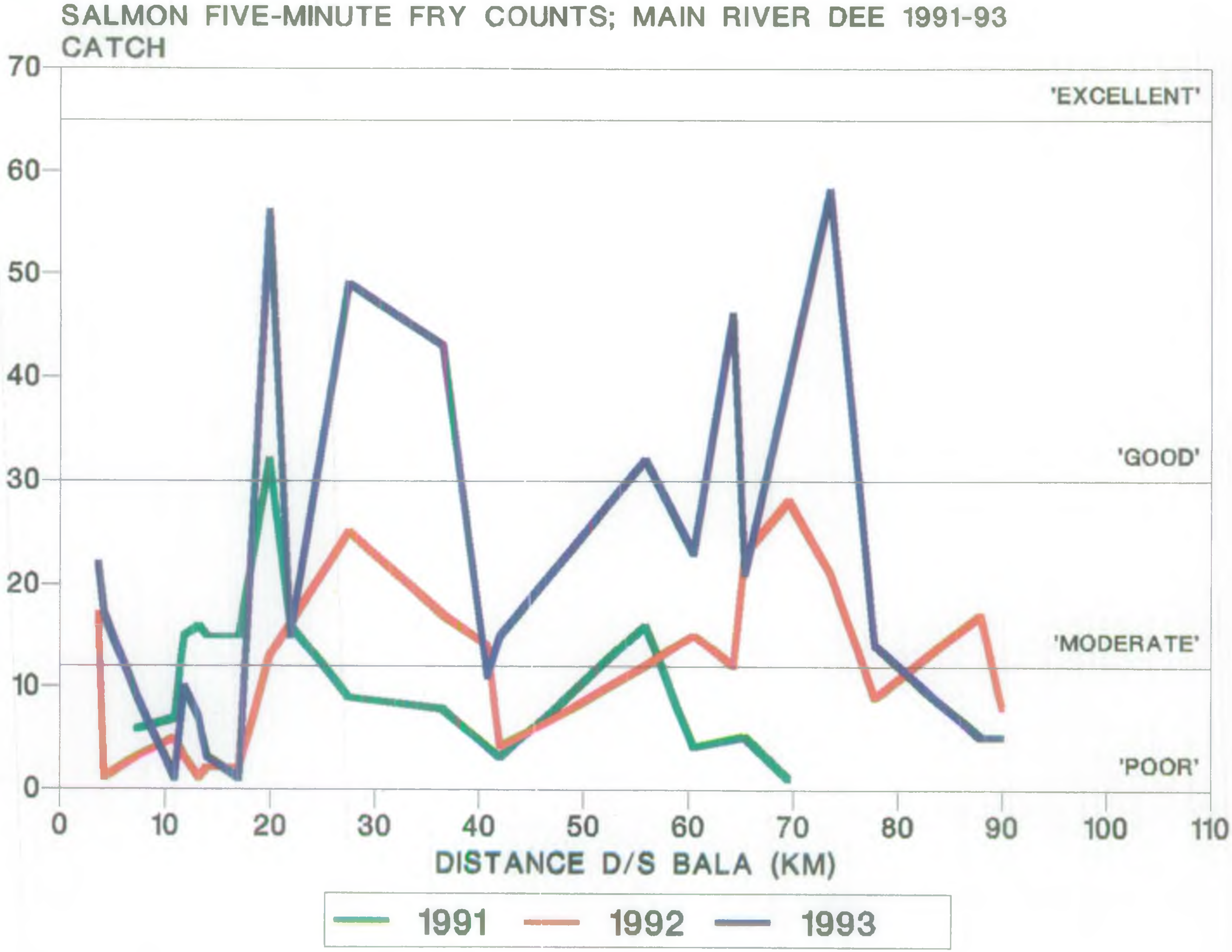

SALMON FIVE-MINUTE FRY COUNTS; MAIN RIVER DEE 1991-93
CATCH
'EXCELLENT'
'GOOD'
'MODERATE'
'POOR'
0
10
20
30
40
50
60
70
0
10
20
30
40
50
60
70
80
90
100
110
DISTANCE D/S BALA (KM)
1991
1992
1993

FIG. 8

Table 37

SEA TROUT WEIGHT COMPOSITION; ROD FISHERY 1983-93

YEAR	% COMPOSITION IN WEIGHT CATEGORY (Kg)			TOTAL WT (Kg)	n	MEAN WT (Kg)
	0-0.5	0.5-1.8	>1.8			
83	23.6	68.2	8.3	113.4	157	0.72
84	19.0	73.0	7.9	49.4	63	0.78
85	14.8	76.6	8.6	104.8	128	0.82
86	21.2	64.6	14.1	123.8	99	1.25
87	23.0	68.1	8.8	98.4	113	0.87
88	6.2	87.0	6.8	137.9	146	0.94
89	16.7	79.2	4.2	59.4	72	0.83
90	17.9	78.6	3.6	68.5	84	0.82
91	20.6	70.6	8.8	33.6	34	0.99
92	1.5	98.5	0.0	37.6	67	0.56
93	66.0	28.2	5.8	72.6	103	0.70
1983-92	16.5	76.0	7.5	826.9	963	0.86[i]

n = No. of fish with known weight.

i Weighted 10-year mean

Table 38

SEA TROUT CATCH PER HOUR (CHr-1); ANGLERS LOGBOOK, 1989-93

	YEAR					MEAN (1989-92)
	1989	1990	1991	1992	1993	
CHr-1	0.056	0.069	0.009	0.027	0.034	0.040

Table 39

SEA TROUT CATCH PER HOUR; ANGLERS LOGBOOK, 1993

RIVER SECTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	UKN	ALL
1	–	–	0.000	–	–	–	0.000	–	–	–	–	0.000
2	–	–	–	0.000	0.095	0.000	0.039	0.035	0.000	–	–	0.033
3	–	–	0.000	–	0.051	0.024	0.000	0.040	0.065	0.000	–	0.028
4	–	–	–	0.000	–	0.167	0.333	0.200	0.000	0.000	–	0.088
5	–	–	–	–	–	–	–	–	–	–	–	–
6	–	–	–	–	–	–	–	–	–	–	–	–
7	–	–	–	–	–	–	–	–	–	–	–	–
8	–	–	–	–	–	–	–	–	–	–	–	–
UKN	–	–	–	–	–	0.000	–	–	–	–	–	0.000
ALL	–	–	0.000	0.000	0.067	0.031	0.031	0.047	0.041	0.000	–	0.034

UKN = UNKNOWN

Wild smolt trapping at Manley Hall using a floating fyke net and holding box suspended below the right bank weir

Trout Parr electrofished as part of the juvenile monitoring programme (lower fish shows signs of smoltification).

5. SEASON REVIEW

5.1 Salmon

The 1993 season proved a notable one for salmon - recording a marked increase in annual run size with an estimated 9700 fish compared to 4600 in 1992, and producing rod and net catches among the highest of the decade, each at around 1000 fish or more. Corresponding catch rates for logbook anglers (0.023 fish per hour) and trammel netsmen (1.526 fish per tide) were also the highest recorded. Most of the increase in run size resulted from a dramatic (152%) rise in the 1SW (grilse) component, although lesser increases were apparent in the numbers of 2SW salmon (24%) and previous spawners (108%). Only the run of 3SW salmon appeared to have declined - from 88 fish in 1992 to only 51 in 1993 - reinforcing the need to protect this highly vulnerable 'Spring' component of the stock. Run timing was similar to 1992 with most of the annual run (89%) entering the river within the rod fishing season.

Evidence of improved salmon catches in 1993 was not confined to the Dee, with several Welsh rivers reporting a similar upward trend, particular among smaller fish. The strong grilse run on the Dee was reflected in the size distribution of rod caught fish, with the proportion of the catch in the lowest 0-3.6kg weight band the highest of the decade at 50%, and the overall mean weight the lowest (3.8kg). Similarly, the end-of-season period was again the most prolific on both rod and net fisheries - an established pattern on the Dee and most other Welsh rivers where runs are now dominated by the later running grilse. Despite this, the capture of at least one very large Dee salmon of 33lb was reported in June by an angler fishing in the Corwen area - a fish which was tagged a month earlier at Chester Weir.

The overall rod exploitation rate of 15% in 1993 was similar to that of the previous season (17%), as were spatial and temporal recapture patterns - possibly reflecting the above average monthly flows which were a feature of both years and contrasted the dry season of 1991. Angling exploitation rates on 1SW salmon also conformed to this pattern with rates in 1992 (16%) and 1993 (13%) higher than in 1991 (6%). While 1SW salmon experienced the lowest exploitation rates (except for previous spawners), rates for 3SW salmon were the highest recorded in both 1992 (27%) and 1993 (27%).

Electrofishing surveys indicated no change in the abundance of juvenile salmon at Dee tributary sites, although on the main river there was evidence of a marked improvement in the numbers of fry (ie. fish which hatched in 1993). The increased salmon run size in 1993 should give rise to greater numbers of fish escaping to spawn (see Section 7), but it remains to be seen whether improved fry populations will result in the summer of 1994, or be detected by the monitoring programme.

One important legislative change on the Dee 1993 was the introduction of amended sea fishery byelaws designed to reduce illegal exploitation of migratory salmonids. These byelaws apply to the operation of trammel and trawl nets which are permitted to fish for sea fish in the lower estuary from the 1st September to 31st January. The amendments mean that fishing is no longer allowed at all states of the tide but is restricted to the high water period, a change which should considerably reduce the illegal by-catch of salmon (and sea trout) and greatly aid policing of the lower estuary.

5.2 Sea trout

Mark-recapture estimates for sea trout in 1992 indicated that runs of both 0+SW fish (2537) and >0+SW fish (1767) had declined on 1991, by 51% and 36%, respectively. In contrast, trap catch rates in 1993 increased on the previous season for a number of sea age groups, but especially for 0+SW fish (whitling) where the annual catch rate improved by 224%. The marked rise in the latter was not reflected in the net catch which declined by 32% on 1992, although gear selectivity would exclude a large proportion of 0+SW fish because of their small size (Section 3.4.1.2). On the rod fishery however, the logbook catch-rate increased by 26% on 1992, and the proportion of small (0-0.5kg) sea trout in the declared catch (66%) was the greatest this decade - probably reflecting a rise in the contribution of whitling to the total catch. Similar improvements in sea trout rod catches were reported on other Welsh rivers.

The introduction of VI tagging in sea trout has meant that anglers can no longer be relied upon as a source of recapture for this type of tag which would be easily overlooked because of its small size; hence, no rod exploitation estimates are given for 1993. Fishing effort for this species remains at a low level (only 2% of that recorded for salmon) and the declared rod catch is still relatively small (a 10-year average of only 109 fish).

6. PROGRAMME REVIEW

Results from 1993 demonstrate improvement or continued success in many of the the key areas of DSAP. For example, more salmon (1264) and sea trout (889) were tagged at Chester Weir than in 1992 - despite a reduction in fishing effort of over 500 hours; similarly, larger numbers of fish were recaptured (176 and 59) than in any previous year. Consequently, the precision of 0+SW and >0+SW sea trout run estimates improved (95% confidence limits within +/- 78% and +/- 33% of the estimate, respectively) and estimates for salmon were maintained at a statistically acceptable level (95%CL within +/- 30% of the estimate).

Large numbers of logbooks were circulated (464 books) and 'total' and 'complete' return rates (53% and 39%, respectively) remained high, resulting in recovery of 181 usable logbooks and demonstrating sustained and wide ranging support for DSAP among anglers. More microtagged salmon were recovered at Chester Weir than before (38 confirmed tagged) and 33,433 1+ parr/smolts were microtagged and released from the Maerdy hatchery. In addition the first wild smolts (538) were microtagged on the Dee during a pilot trapping exercise at Manley Hall. Over 100 sites were electrofished as part of the juvenile monitoring programme, including the repeat sampling of 85 five-minute fry sites covering the main river as well as tributaries.

Many of the parameters measured by DSAP require several years of monitoring before even single complete values can be obtained. This is true, for example, of year class strength where up to 6 years of annual run estimates are needed to describe the fate of just one generation of salmon or sea trout. Similarly, evaluating the return rate of a single stocking of microtagged fish can require 4 or 5 years of screening at Chester Weir. Moreover, year class estimates from several generations, or return rates from several batches of stocked fish, are necessary before we can begin to understand the factors which affect these parameters and use this knowledge to manage stocks more effectively. For example, monitoring for a minimum period of perhaps 15 years is likely to be needed before we can expect to define an adult-to-adult stock-recruitment curve for the river or estimate optimum egg deposition rates and spawning escapement.

Realisation of many of the outputs and management benefits of DSAP will depend on a long term commitment to the programme, although this does not preclude significant short term progress. For example, a number of the outputs from DSAP have already contributed directly to developments in local and regional fisheries management, the most significant concerning the introduction of Spring salmon byelaws on the Dee and other rivers (Section 2.4.4) and, more recently, involvement in the Regional Net Limitation Order (NLO) review.

For the latter, outputs from DSAP played a major role in the derivation of salmon egg deposition estimates for the Dee and other NLO affected rivers (NRA, 1994b). These estimates were compared to a minimum target egg density of 390 $100m^{-2}$ based on data from the River Bush, Northern Ireland, with estimates below target level indicating a need for increased spawning escapement and providing a rationale for regulating the net (and rod) fisheries. The target egg density value applies to 'usable' salmonid rearing habitat, which on the Dee comprises an estimated 4.4 million m^2 of river or 69% of the total wetted area. At target level, this is equivalent to 17 million eggs, requiring an estimated spawning population of 4900 salmon. For the NLO review, estimates of the size and composition of the spawning population were derived from average rod catches over the period 1983-91 and required information on angling exploitation, size and sex composition, outseason run, etc. In cases where river specific values were not available for these parameters, values from the Dee were frequently utilised instead (where these were considered appropriate).

For the Dee, average salmon egg deposition over the period 1983-91 was estimated at 10.5 million eggs per annum, leaving a shortfall of 6.6 million eggs or the equivalent of 1900 spawners. In an attempt to increase spawning escapement and address the shortfall in egg deposition, proposals have been made to halve the number of net licences and restrict their area of operation (NRA 1994b). Salmon mark-recapture estimates for 1992 and 1993 indicate annual runs of 4600 and 9700 fish, respectively. Assuming inseason rod exploitation rates in these years of 17% and 15% (Section 2.4.3), and 7% mortality in the pre-spawning period (NRA, 1994b), then around 3200 and 7000 salmon would have escaped to spawn. Although the latter exceeds the target, this does not preclude the need to reduce netting activity as it remains to be seen whether the improvement in run size in 1993 will be maintained in the longer term.

7. DEVELOPMENTS

7.1 Technical

VI tagging of sea trout was undertaken for the first time in 1993 and proved as rapid a process as Floy tagging with no apparent adverse effects. All VI tagged fish received an adipose fin hole punch as a second mark which will be used to estimate tag retention rates from trap recaptures in 1994.

Increases in the numbers of fish tagged and recaptured have resulted in considerable improvements in the precision of run estimates for both 0+SW and >0+SW sea trout. However, for the former sea age group, 95% confidence limits still exceed the limit of +/30% of the estimate considered the minimum appropriate for stock assessment purposes. To bring estimate precision within this limit, at least a five-fold increase in the number of recaptures would be needed. This represents an increase from 8 trap recaptures in 1993 to 40 or more in subsequent years, and would in turn require a similar rise in the numbers of 0+SW fish tagged. The 8 recaptures (R) in 1993 resulted from 147 0+SW fish tagged (M) in the previous year; based on the same ratio R:M, around 750 0+SW fish would need to be tagged to achieve the target of 40 recaptures. Infact, the estimated total trap catch of 0+SW sea trout in 1993 was 599, so even if all these fish had been tagged, the target could not have been achieved.

The present bar spacing on the trap grid at Chester Weir (30 mm) permits fish below 350mm (mainly 0+SW sea trout) to escape capture (although smaller specimens are retained). Reducing the bar spacing on the upstream trap grid, eg. by the introduction of small mesh plastic netting, should reduce sampling bias for 0+SW fish (Solomon in prep.) and greatly increase the catch of this sea age group. The tagging rate of 0+SW sea trout would need to be improved to coincide with an increased catch, although it remains to be seen whether a provisional tagging target of 750 fish could be attained. The number of fish tagged at Chester Weir on any one occasion is limited by the preferred length of the trapping session and the tagging rate. While improvements in the latter are possible, the former rarely exceeds 2.5 hours in order to limit stress to the fish associated with confinement.

The pilot wild smolt microtagging exercise at Manley Hall indicated the potential of the sampling technique employed. Greater sampling effort will be exercised in 1994 in an attempt to increase numbers tagged. Wild smolt microtagging is viewed as an important development within DSAP, providing a means of obtaining estimates of marine survival and exploitation which are directly applicable to the wild fishery (both key objectives of the programme) and which will also serve as a valuable comparison with the same parameters derived for hatchery reared fish.

7.2 Capital assets

No further progress has been made with the reinstatement of the Manley Hall resistivity fish counter due to lack of funding.

8. EVENTS AND REPORTING

8.1 Trap visits/DSAP presentations

Several individuals and various angling clubs and fishery concerns visited the Chester Weir trap in 1993, in addition talks and presentations on DSAP were also given on a number of occasions. Some of these are highlighted below. The year proved a particularly memorable one for angler Paul Williams of Wrexham who won the Grand Award of $2,500 in the NASCO (North Atlantic Salmon Conservation Organisation) prize draw for a salmon he caught on the Dee in 1992. This annual event is designed to encourage fishermen throughout the North American, North-East Atlantic and West Greenland Regions to return external tags from Atlantic salmon. The Grand Award was open to all tag returnees from these regions, but in addition four more Dee anglers won cash prizes totalling $800 in the North-East Atlantic Commission Area draw. The prizes were presented in July by NASCO Secretary, Dr. Malcom Windsor, at a special event which included a visit to the Chester trap.

Date	Organisation
21.4.93	Dee Fisheries Association - presentation
14.7.93	Dee and Clwyd Informal Fisheries Group - trap visit
29.7.93	NASCO Tag Return Incentive Scheme - award presentation/trap visit
12/13.9.93	Regional Fisheries Advisory Committee - presentation/trap visit
14.9.93	IFM Annual Conference, Cardiff - poster presentation
16.11.93	Wirral Game Angling Club - presentation

8.2 Reports/publications

Although no reports or publications were produced featuring the results of DSAP, the programme contributed to a number of studies in the year. These included R&D projects reviewing the biology of sea trout in England and Wales (R&D Project 443) and investigating sea trout genetics (R&D Fellowship F5). In addition, a paper was given at the ICES Workshop on 'Salmon Spawning Stock Targets in the North-East Atlantic' which drew heavily on the results of DSAP (workshop held at Bushmills, N. Ireland, 7-9 December 1993) and formed the basis of the approach used for the NLO review (NRA 1994b).

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Table 1

SALMON CATCH RATE (CATCH PER HOUR) AT CHESTER WEIR, 1991-93

YEAR	CATCH PER HOUR												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
1991	—	—	—	—	0.031	0.066	0.213	0.704	1.019	0.568	0.043	0.039	0.386
1992	0.002	0.035	0.039	0.123	0.157	0.155	0.723	0.639	0.675	0.427	0.119	0.022	0.246
1993	0.002	0.007	0.050	0.057	0.154	0.218	0.804	1.124	1.493	0.435	0.206	0.107	0.345
SEA AGE													
0SW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1SW	0.000	0.000	0.000	0.000	0.000	0.017	0.552	0.969	1.361	0.387	0.186	0.098	0.256
2SW	0.000	0.000	0.034	0.044	0.144	0.201	0.238	0.115	0.098	0.041	0.015	0.009	0.077
3SW	0.002	0.007	0.016	0.011	0.011	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.005
PS	0.000	0.000	0.000	0.002	0.000	0.000	0.014	0.037	0.034	0.008	0.004	0.000	0.007

SW = SEA WINTER
PS = PREVIOUS SPAWNER

Table 2

SALMON SEA AGE COMPOSITION; CHESTER WEIR, 1993

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
TOTAL CATCH	1	3	25	26	72	90	338	421	443	161	107	36	1723
SCALE SAMPLE(%)	1 (100.0)	3 (100.0)	25 (100.0)	21 (80.8)	69 (95.8)	87 (96.7)	298 (88.2)	345 (81.9)	332 (74.9)	124 (77.0)	74 (69.2)	27 (75.0)	1406 (81.6)
SEA AGE (%)													
0SW(%)													
1SW(%)						6 (6.9)	197 (66.6)	287 (83.2)	297 (89.5)	108 (87.1)	63 (87.5)	24 (88.9)	982 (70.0)
2SW(%)			17 (68.0)	16 (76.2)	64 (92.8)	81 (93.1)	93 (31.4)	43 (12.5)	27 (8.1)	13 (10.5)	7 (9.7)	3 (11.1)	364 (26.0)
3SW(%)	1 (100.0)	3 (100.0)	8 (32.0)	4 (19.0)	5 (7.2)			1 (0.3)					22 (1.6)
PS(%)				1 (4.8)			6 (2.0)	14 (4.1)	8 (2.4)	3 (2.4)	2 (2.8)		34 (2.4)
ALL(%)	1 (100.0)	3 (100.0)	25 (100.0)	21 (100.0)	69 (100.0)	87 (100.0)	296 (100.0)	345 (100.0)	332 (100.0)	124 (100.0)	72 (100.0)	27 (100.0)	1402 (100.0)
UR							2				2		4

SW = SEA WINTER
PS = PREVIOUS SPAWNER
UR = UNREADABLE

Table 3
SALMON SMOLT AGE COMPOSITION; CHESTER WEIR, 1993

	SEA AGE						
	0SW	1SW	2SW	3SW	PS	UR	ALL
SCALE SAMPLE	0	982	364	22	34	4	1406
SMOLT AGE (%)							
1 (%)		312 (37.5)	117 (39.3)	5 (26.3)	2 (6.7)	0 (–)	436 (37.0)
2 (%)		509 (61.2)	177 (59.4)	14 (73.7)	28 (93.3)	0 (–)	728 (61.7)
3 (%)		11 (1.3)	4 (1.3)				15 (1.3)
4 (%)							
ALL (%)	0 (–)	832 (100.0)	298 (100.0)	19 (100.0)	30 (100.0)	0 (–)	1179 (100.0)
UR		150	66	3	4	4	227
MEAN SMOLT AGE	–	1.64	1.62	1.74	1.93	–	1.64

SW = SEA WINTER
PS = PREVIOUS SPAWNER
UR = UNREADABLE

Table 4
SALMON SEX COMPOSITION; CHESTER WEIR, 1993

SEA AGE	FEMALE		MALE		F/M RATIO	UNKNOWN
	n	%	n	%		n
0SW	0	–	0	–	–	0
1SW	485	52.8	433	47.2	1.12	58
2SW	218	69.0	98	31.0	2.22	43
3SW	10	58.8	7	41.2	1.43	4
PS	33	97.1	1	2.9	33.00	1
UR	7	58.3	5	41.7	1.40	1
TOTAL	753	58.1	544	41.9	1.38	106

SW = SEA WINTER
PS = PREVIOUS SPAWNER
UR = UNREADABLE

Table 5

SALMON WEIGHT COMPOSITION; CHESTER WEIR, 1993

SEA AGE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
1SW n	0	0	0	0	0	3	118	121	104	48	27	13	434
MEAN WT (Kg)	–	–	–	–	–	2.05	2.48	3.01	3.50	3.59	2.99	3.55	3.06
2SW n	0	0	0	0	0	0	5	23	10	10	5	2	55
MEAN WT (Kg)	–	–	–	–	–	–	5.64	6.61	6.76	7.04	7.08	5.76	6.64
3SW n	0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN WT (Kg)	–	–	–	–	–	–	–	–	–	–	–	–	–
PS n	0	0	0	0	0	0	1	3	6	1	1	0	12
MEAN WT (Kg)	–	–	–	–	–	–	4.35	4.33	5.25	6.00	5.78	–	5.05
UR n	0	0	0	0	0	0	2	0	0	0	1	0	3
MEAN WT (Kg)	–	–	–	–	–	–	3.11	–	–	–	1.68	–	2.63
ALL n	0	0	0	0	0	3	126	147	120	59	34	15	504
MEAN WT (Kg)	–	–	–	–	–	2.05	2.63	3.60	3.86	4.22	3.63	3.85	3.49

SW = SEA WINTER
PS = PREVIOUS SPAWNER
UR = UNREADABLE

Table 6

NUMBERS OF SALMON TAGGED AT CHESTER WEIR, 1993

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT (1-14)	OCT (15-31)	NOV	DEC	ALL
TOTAL CATCH	1	3	25	26	72	90	338	421	443	112	49	107	36	1723
NO. FLOY TAGGED	0	3	25	19	65	68	298	336	329	85	0[i]	0	0	1228
NO. RADIO TAGGED	0	0	0	0	3	15	2	7	3	6	4	6	1	47[ii]
TOTAL TAGGED	0	3	25	19	68	83	300	343	332	91	4	6	1	1275
% TAGGED	0.0	100.0	100.0	73.1	94.4	92.2	88.8	81.5	74.9	81.3	8.2	5.6	2.8	74.0

i Excludes 4 fish tagged for publicity purposes
ii Excludes 29 fish relocated to the estuary

Table 7

FATE OF SALMON FLOY AND RADIO TAGGED AT CHESTER WEIR, 1993

FISH TAGGED IN-SEASON 1993		
A) TOTAL TAGGED	1264	
B) FISH RECOVERED D/S CHESTER WEIR		
NET	4	
FOUND DEAD		
(PRE-SPAWNING)	1	
(POST-SPAWNING)	1	
C) OTHER RIVERS		
(IN-SEASON) [i]	1	RIVER RIBBLE
(OUT-SEASON)	0	
D) FISH RECOVERED AT CHESTER WEIR	20	
E) FISH RECOVERED U/S CHESTER WEIR		
ROD (IN-SEASON)	174	
ROD (OUT-SEASON)	3	
FOUND DEAD		
(PRE-SPAWNING)	2	
(POST-SPAWNING) [ii]	5	
FISH TAGGED PRIOR TO 1993		
F) RETURNING FISH FLOY TAGGED IN 1992		
ROD	1	
NET	4	
CHESTER TRAP	5	
G) RETURNING FISH FLOY TAGGED IN 1991		
ROD	1	
NET	0	
CHESTER TRAP	1	

i Rod recaptures unless otherwise stated.

ii Fish found dead after 30th November are assumed to be post-spawning mortalities

2.2.3 Run estimates within the angling season

Modified Petersen (Chapman, 1951) and Schaefer (1951) estimates for the inseason period were 7157 (95% confidence limits: 5546-9226) and 8610, respectively. These estimates were derived solely from the recaptures of logbook anglers and assume a tag reporting rate of 100% (because of the voluntary nature of the logbook scheme and effort required to complete each return) and a Floy tag retention rate of 94%. The latter was based on recaptures at Pont Barcer broodstock trap where only 1 out of 16 fish had lost its tag (established from the presence of an adipose fin punch used as a second mark). The mean time to recapture for tagged fish recovered from this source was 100 days (range 77-138 days).

Numbers of monthly entrants of each sea age group in 1993 are detailed in Table 8 based on the Schaefer estimate and age composition data at Chester Weir. The age composition data used in this instance have been modified to represent the entire trap catch and so differ slightly from those shown in Table 2. Run estimates for 1991 and 1992 have also been reworked to incorporate the 1993 tag retention estimates, and hence are slightly smaller than those reported earlier (NRA, 1994a).

2.2.4 Run estimates outwith the angling season

An outseason run of 1147 salmon in 1993 (Table 8) was estimated from the proportion of the total trap catch recovered in this period, and was derived using the same approach as that described in the last annual report (NRA, 1994a). This gave a total run estimate at Chester Weir of 9757, more than double that of 1992 (4643). Most of this increase resulted from an improved grilse (1SW) run of 7836, up by 152% on the 1992 estimate of 3114. Lesser increases of 24% (1337 to 1654) and 108% (104 to 216) were apparent for 2SW salmon and previous spawners, respectively, although the run of 3SW salmon declined by 42% from 88 to only 51 fish.

2.3 Year class strength

Year class composition based on the combined annual run estimates of 1992 and 1993 is shown in Table 9. Possible smolt age (1-3 years), sea age (1-3 SW) combinations on the Dee mean that a single year class of fish may return as adults from two to six years after hatching. On this basis, continued monitoring up to 1996 will allow the first complete estimate of year class strength to be obtained for salmon hatched in 1990, and estimates of year class strength for fish emerging prior to 1990 will remain incomplete.

2.4 Fishery performance

2.4.1 Net fishery

2.4.1.1 Catch and catch-effort

The combined draft and trammel catch for salmon in 1993 was 1156, an increase of 41% on the previous season (818) and the second largest catch of the decade (Table 10). The corresponding catch rate for both gears of 0.617 fish per tide was the second highest since records began (cf. 0.509 in 1991 and 0.790 in 1992), and in the case of the trammel nets only, the highest recorded at 1.526 (Table 11). Twenty-one draft nets operated in 1993 - an increase on 1991 (20) and 1992 (13), although the same number of trammel nets (4) were active throughout. Fishing effort (as tides fished) was the highest recorded to date for both gears (drafts 1584 and trammels 291 tides fished).

Table 8

ESTIMATED SALMON RUN AT CHESTER WEIR, 1991-93

YEAR	MARK RECAPTURE ESTIMATE											TRAP ESTIMATE				TOTAL RUN
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT (1-14)	IN-SEASON RUN	OCT (14-31)	NOV	DEC	OUT-SEASON RUN	
[i] 1991	–	–	–	–	–	435	395	1360	1512	650	4352	–	–	–	–	–
[ii] 1992	–	–	165	275	281	130	973	987	1481	–	4292	129	194	28	351	4643
[ii] 1993	–	–	48	46	234	281	1774	2594	3633	–	8610	292	640	215	1147	9757
SEA AGE																
1SW	–	–	0	0	0	22	1218	2237	3299	–	6776	264	594	202	1060	7836
2SW	–	–	28	35	218	259	525	265	255	–	1585	22	34	13	69	1654
3SW	–	–	20	9	16	0	0	6	0	–	51	0	0	0	0	51
PS	–	–	0	2	0	0	31	86	79	–	198	6	12	0	18	216

SW = SEA WINTER
PS = PREVIOUS SPAWNER
i Part-Season trapping programme commenced 20th May 1991.
ii Combined Jan-Mar and Sep-Oct estimates due to low number of Jan, Feb and Oct recaptures.
Note: Estimates may be adjusted in later years as additional data become available.

Table 9

YEAR CLASS COMPOSITION OF SALMON RUN AT CHESTER WEIR, 1992-93

SEA AGE	YEAR CLASS						ALL
	1987	1988	1989	1990	1991	1992	
0SW							0
1SW		24	2053	5935	2939		10951
2SW	17	875	1449	649			2990
3SW	71	55	13				139
ALL	88	954	3515	6584	2939	0	14080
PS	–	–	–	–	–	–	320

SW = SEA WINTER
PS = PREVIOUS SPAWNER
Note: Estimates may be adjusted in later years as additional data become available.

Table 10
ANNUAL SALMON CATCH; NET AND ROD FISHERIES, 1983-93

METHOD	YEAR 83	84	85	86	87	88	89	90	91	92	93	10 YR MEAN (1983-92)
NETS[i]	1025	915	705	1056	874	920	1212	844	856	818	1156	922.5
RODS[ii]	520	273	576	739	633	1019	273	427	376	164	455	500.0
BOTH	1545	1188	1281	1795	1507	1939	1485	1271	1232	982	1611	1422.5

i Combined Draft and Trammel net catch shown.

ii National rod licence in 1992 and 1993 – no reminder issued to licence holders – actual catch grossly underestimated

Note: Catch statistics may differ slightly from those published regionally because of local editing of returns considered invalid.

Table 11
MONTHLY SALMON NET CATCH AND CATCH-EFFORT, 1993

METHOD	MAR	APR	MAY	JUN	JUL	AUG	ALL
DRAFTS:							
TOTAL CATCH	5	0	5	53	291	358	712
TIDES FISHED	123	122	181	307	425	426	1584
CATCH PER TIDE	0.041	0.000	0.028	0.173	0.685	0.840	0.449
TRAMMELS:							
TOTAL CATCH	0	0	0	10	168	266	444
TIDES FISHED	0	0	19	71	98	103	291
CATCH PER TIDE	–	–	0.000	0.141	1.714	2.583	1.526
BOTH:							
TOTAL CATCH	5	0	5	63	459	624	1156
TIDES FISHED	123	122	200	378	523	529	1875
CATCH PER TIDE	0.041	0.000	0.025	0.167	0.878	1.180	0.617

Note: Catch statistics may differ slightly from those published regionally because of local editing of returns considered invalid.

2.4.1.2 Weight composition

Monthly catches for 1993 are classified into five weight categories in Table 12 and compared to catches from the last decade in Table 13. Weight composition was almost identical to 1992 with the majority of fish (70%) in the lowest 0-3.6Kg band. The overall mean weight of the catch increased by 0.16Kg on 1992, from 3.32Kg to 3.48Kg, although the latter remained below the 10-year mean (3.65kg).

2.4.2 Rod fishery

2.4.2.1 Catch - Licence return

The declared catch for 1993 of 455 salmon (Table 10) was again a gross underestimate of actual catch, resulting from the introduction of the single national rod licence in 1992 and absence of a reminder system. For example, catch statistics from individual fishery owners compiled by bailiffs indicated a salmon rod catch of around 900 fish. Comparison with the declared catch for 1992 (164) - when the same licence structure applied, suggested an increase in catch of 177% (Table 10).

2.4.2.2 Weight composition

Salmon weights from the licence return are classified into the same categories used on the net fishery; composition data are given by month for 1992 in Table 14 and annually over the last decade in Table 15. Weight distribution among the five categories was similar to 1992, although the percentage of the catch in the lowest (0-3.6kg) band was the highest of the decade (49.9%) and the overall mean weight (3.84kg) the lowest of the decade.

2.4.2.3 Catch-effort - Logbook return

464 logbooks were circulated in 1993, a slight increase on the previous year (456) and the largest seasonal total to date (Table 16). A high 'complete' and 'total' return rate was maintained at 39% and 53%, respectively, producing 181 usable logbooks and indicating sustained support for the programme. The overall salmon catch rate of 0.023 fish per hour was the highest recorded and exceeded the previous (1992) maximum by 35%, extending the general trend of increasing catch rate evident since the scheme began in 1989 (Table 17). As in previous years, September and October proved the most productive months with catch rates of 0.044 and 0.041 fish per hour, and Angling Section 2 (Erbistock Weir to Newbridge) the most prolific (0.028 fish per hour) (Table 18).

2.4.3 Exploitation rates

The angling exploitation rate for all tagged salmon in 1993 was 15% (95% confidence limits 13-17%) (Table 19). This estimate includes an adjustment for tag loss described earlier (Section 2.2.3); similarly, the same adjustment has been applied retrospectively to exploitation estimates for 1991 and 1992. However, no adjustments for angler reporting rates have been incorporated pending definitive estimates of the latter based on the in-river fates of radio-tagged fish.

Patterns of exploitation on monthly entrants were consistent with those observed in previous years (Fig 2), with early entrants experiencing the highest rates - up to a maximum for April fish in 1993 of 34% (95%CL 15-74%) compared to a minimum rate of 5% (95%CL 2-12%)

in October entrants. In keeping with these temporal trends and with observations in 1992, early running 3SW salmon were the most heavily exploited sea age group (27%; 95%CL 11-63%) and late running 1SW fish the least exploited (13%; 95%CL 11-16%) (excluding previous spawners) (Table 20 and Fig 3).

2.4.4 Recapture distribution and timing

The spatial distribution of angling recaptures was similar to the previous season, with 89% of fish taken in the main Dee downstream of the Alwen confluence (Angling Sections 1-4) (Table 21). Over all angling sections, the mean recapture time for June-October tagged salmon in 1993 of 27.5 days was not significantly different ($p>0.05$) from that in 1991 (25.2 days) or 1992 (30.8 days), although the range of recapture times in 1993 (1-104 days) appeared more in keeping with the previous season (2-126 days) than 1991 (3-51 days) (Fig 4). Recapture times within angling sections were also statistically similar between years ($p>0.05$), except in Section 6 ($p=0.022$) where sample sizes were small (<=3 fish in any one year).

Mean recapture times tended to be greatest in those angling sections most distant from Chester Weir (Fig 4). The greater similarity between recapture times in 1992 and 1993, particularly at the upper end of the ranges, may have related to the flow conditions experienced in both years (Fig 5) and their possible effect on fish behaviour and angling success. For example, monthly mean flows in 1993 were above average throughout most of the summer, with the mean flow for the 1st June-14th October period (23.3 cumecs) almost identical to that in 1992 (22.3 cumecs) and in marked contrast to the dry year of 1991 (14.9 cumecs).

Observations on the recapture times of tagged fish (along with estimates of their exploitation), provide a means of assessing the likely benefits of angling byelaws to protect Spring salmon which are set to come into force in 1995. The new byelaws will mean a later start to the season (3rd March instead of 27th January) and allow fly fishing only before the 1st June - reducing the permissible period for the most popular and effective methods of spinning (previously allowed from the beginning of the season) and bait fishing (which commenced on the 15th April). New byelaws will also operate on the net fishery where the season will start on the 1st May instead of the 1st March.

Both sets of byelaws are specifically directed at protecting salmon entering the river from January to May, including virtually all 3SW fish - the component under greatest threat because of the low numbers presently running the river (an average of only 70 fish for 1992-93). The angling byelaws will prove successful if fish which would otherwise have been caught by bait or spinner escape capture by the fly in the period when they appear most vulnerable to capture (20-40 days after entry), and are not exploited heavily later on. Recaptures of Spring salmon in 1992 and 1993 indicate that this will be the case (Fig 6), although once the byelaws come into force, continued tagging on the Dee will allow their effect to be fully assessed.

Table 12

SALMON WEIGHT COMPOSITION; NET FISHERY, 1993 (DRAFT AND TRAMMEL CATCH COMBINED)

	MAR	APR	MAY	JUN	JUL	AUG	NO DATE	ALL
NO WEIGHT	0	0	0	0	0	0	0	0
0–3.6Kg	3	0	4	34	316	453	0	810
3.6–6.4Kg	1	0	1	25	125	138	0	290
6.4-10.0Kg	1	0	0	4	18	33	0	56
10.0–12.7Kg	0	0	0	0	0	0	0	0
>12.7Kg	0	0	0	0	0	0	0	0
TOTAL WT (Kg)	23.1	–	16.3	244.0	1576.7	2166.8	–	4027.1
MEAN WT (Kg)	4.63	–	3.27	3.86	3.45	3.49	–	3.48

Note: Catch statistics may differ slightly from those published regionally because of local editing of returns considered invalid.

Table 13

SALMON WEIGHT COMPOSITION; NET FISHERY 1983–93 (DRAFT AND TRAMMEL CATCH COMBINED)

YEAR	% COMPOSITION IN WEIGHT CATEGORY (Kg)					TOTAL WT (Kg)	n	MEAN WT (Kg)
	0-3.6	3.6-6.4	6.4-10.0	10.0-12.7	>12.7			
83	–	–	–	–	–	3609.3	1025	3.52
84	–	–	–	–	–	2973.3	915	3.25
85	–	–	–	–	–	2403.6	697	3.45
86	–	–	–	–	–	3905.0	1056	3.70
87	–	–	–	–	–	3320.8	874	3.80
88	–	–	–	–	–	3329.0	920	3.62
89	–	–	–	–	–	4776.9	1212	3.94
90	–	–	–	–	–	3578.9	844	4.24
91	65.5	31.2	3.3	0.0	0.0	2990.1	855	3.50
92	71.3	25.3	3.2	0.1	0.1	2714.3	818	3.32
93	70.1	25.1	4.8	0.0	0.0	4027.1	1156	3.48
1983-92	68.3	28.3	3.2	0.1	0.1	33601.3	9216	3.65[i]

n = No. of fish with known weight.

i Weighted 10-year mean

Note: Catch statistics may differ slightly from those published regionally because of local editing of returns considered invalid.

Table 14
SALMON WEIGHT COMPOSITION; ROD FISHERY, 1993

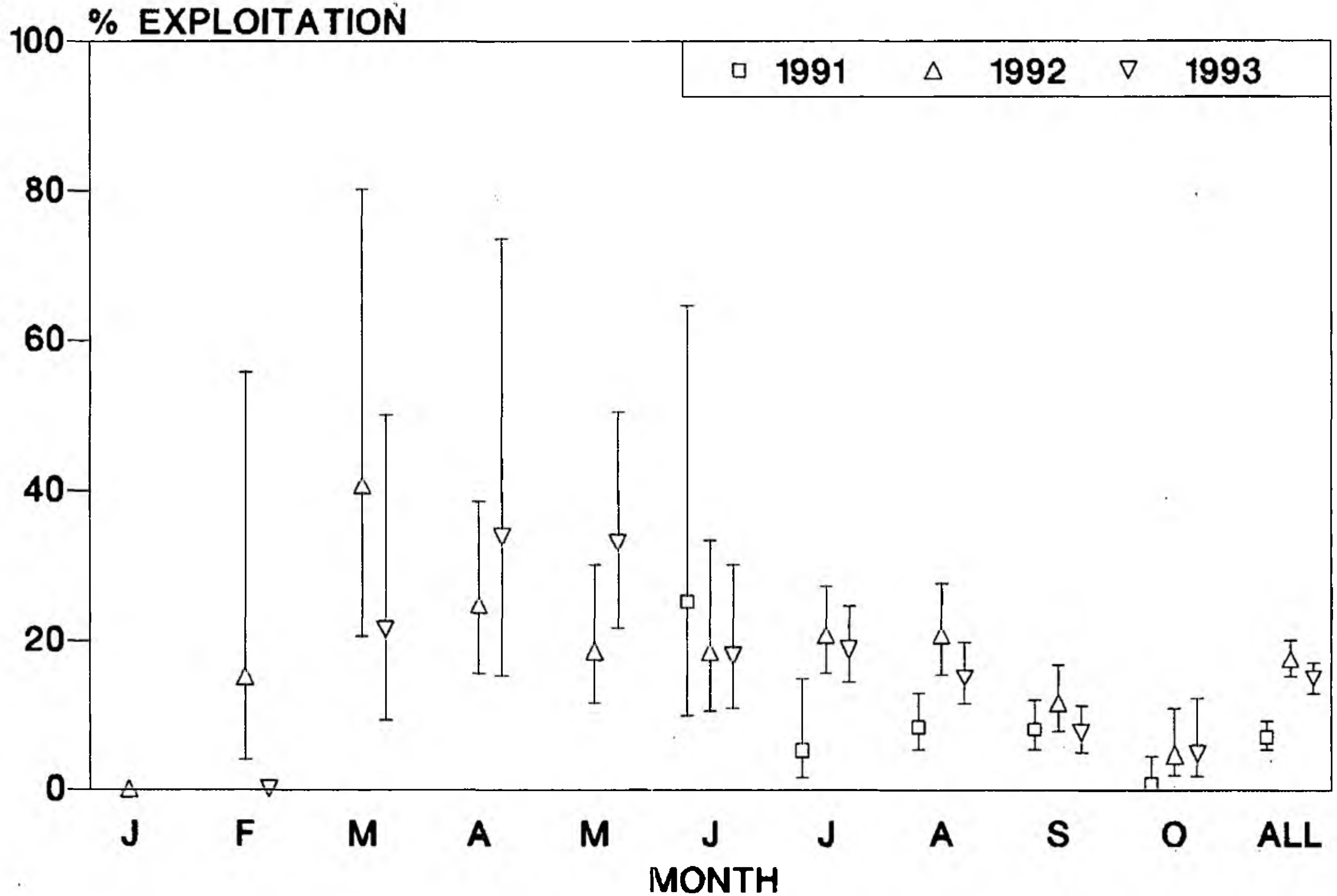
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NO DATE	ALL
NO WEIGHT	0	0	0	0	0	0	0	0	0	0	0	0
0–3.6Kg	1	1	0	0	2	5	22	50	103	43	0	227
3.6–6.4Kg	0	0	3	5	12	14	11	32	75	39	0	191
6.4-10.0Kg	0	2	0	2	2	3	1	6	10	9	0	35
10.0–12.7Kg	0	0	0	0	0	0	0	0	0	2	0	2
>12.7Kg	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL WT (Kg)	3.2	22.2	14.5	37.2	71.7	100.2	119.8	321.1	676.3	380.1	–	1746.4
MEAN WT (Kg)	3.18	7.41	4.84	5.31	4.48	4.56	3.52	3.65	3.60	4.09	–	3.84

Table 15
SALMON WEIGHT COMPOSITION; ROD FISHERY 1983-93

YEAR	% COMPOSITION IN WEIGHT CATEGORY (Kg)					TOTAL WT (Kg)	n	MEAN WT (Kg)
	0-3.6	3.6-6.4	6.4-10.0	10.0–12.7	>12.7			
83	25.4	51.2	22.4	1.0	0.0	2397.3	508	4.72
84	42.6	40.4	16.2	0.7	0.0	1152.1	272	4.24
85	45.8	38.3	15.5	0.2	0.2	1909.7	483	3.95
86	29.5	54.6	15.4	0.5	0.0	3268.2	729	4.48
87	23.8	57.1	17.6	1.4	0.0	2633.6	562	4.69
88	38.6	50.0	10.9	0.5	0.0	4215.8	1019	4.14
89	39.4	54.5	5.7	0.4	0.0	1029.2	264	3.90
90	28.2	61.4	10.2	0.0	0.2	1805.8	422	4.28
91	36.4	59.2	4.1	0.3	0.0	1449.7	363	3.99
92	42.1	48.2	9.8	0.0	0.0	652.3	164	3.98
93	49.9	42.0	7.7	0.4	0.0	1746.4	455	3.84
1983-92	34.1	51.8	13.5	0.6	0.0	20513.6	4786	4.29[i]

n = No. of fish with known weight.
i Weighted 10-year mean

SALMON ANGLING EXPLOITATION RATES FOR MONTHLY ENTRANT GROUPS, 1991-93



NOTE: 95% CONFIDENCE LIMITS SHOWN

Table 16

ANGLERS LOGBOOK RETURNS, 1989-93

	1989		1990		1991		1992		1993	
LOGBOOKS DISTRIBUTED	215		369		377		456		464	
COMPLETE RETURNS (%)	76	(35.3)	99	(26.8)	108	(28.6)	178	(39.0)	181	(39.0)
INCOMPLETE RETURNS (%)	16	(7.4)	23	(6.2)	13	(3.4)	19	(4.2)	14	(3.0)
DID NOT FISH (%)	23	(10.7)	34	(9.2)	22	(5.8)	40	(8.8)	53	(11.4)
TOTAL RETURNS (%)	115	(53.5)	156	(42.3)	143	(37.9)	237	(52.0)	248	(53.4)
TOTAL SALMON CATCH (% DECLARED CATCH)	46	(17.1)	46	(21.8)	91	(24.2)	250	(–)	322	(–)
TOTAL SEA TROUT CATCH (% DECLARED CATCH)	21	(27.6)	21	(64.3)	6	(14.6)	52	(–)	23	(–)

Table 17

SALMON CATCH PER HOUR (CHr-1); ANGLERS LOGBOOK, 1989-93

	YEAR					MEAN (1989-92)
	1989	1990	1991	1992	1993	
CHr-1	0.008	0.013	0.012	0.017	0.023	0.013

Table 18

SALMON CATCH PER HOUR BY MONTH AND RIVER SECTION; ANGLERS LOGBOOK, 1993

RIVER SECTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	UKN	ALL
1	0.000	0.000	0.005	0.002	0.015	0.019	0.028	0.017	0.044	0.051	0.000	0.019
2	0.000	0.000	0.000	0.003	0.000	0.003	0.028	0.037	0.057	0.061	0.012	0.028
3	0.000	0.000	0.000	0.000	0.005	0.003	0.010	0.021	0.033	0.032	0.083	0.021
4	–	0.000	0.000	0.000	0.004	0.017	0.000	0.032	0.045	0.035	0.000	0.025
5	–	–	0.000	0.000	0.000	0.000	0.017	0.011	0.059	0.056	–	0.019
6	–	–	–	–	–	–	–	–	–	–	–	–
7	–	–	–	–	–	0.000	0.000	0.000	0.000	0.000	–	0.000
8	–	–	–	–	–	–	–	–	–	–	–	–
UKN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.053	0.053	–	0.009
ALL	0.000	0.000	0.002	0.002	0.007	0.010	0.016	0.025	0.044	0.041	0.042	0.023

UKN = UNKNOWN

Table 19

SALMON ANGLING EXPLOITATION RATE BY MONTH TAGGED, 1991-93

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	ALL
1991	– –	– –	– –	– –	– –	25.1 (9.6-64.6)	5.0 (1.7-14.7)	8.3 (5.4-12.8)	7.9 (5.3-11.8)	0.8 (0.1-4.4)	6.9 (5.3-9.1)
1992	0.0 –	15.2 (4.0-55.7)	40.6 (20.5-80.2)	24.7 (15.8-38.6)	18.5 (11.4-30.1)	18.6 (10.4-33.4)	20.3 (15.4-26.7)	20.7 (15.1-27.1)	11.3 (7.6-16.9)	4.6 (1.9-10.7)	17.4 (15.0-20.1)
1993	– –	0.0 –	21.3 (9.0-50.0)	33.7 (15.3-73.5)	32.9 (21.5-50.4)	18.0 (10.7-30.2)	18.8 (14.4-24.6)	14.9 (11.3-19.8)	7.4 (4.9-11.1)	4.7 (1.8-12.1)	14.7 (12.7-17.0)

95% Confidence Limits shown in brackets

Table 20

SALMON ANGLING EXPLOITATION RATE BY SEA AGE GROUP, 1991-93

YEAR	SEA AGE			
	1SW	2SW	3SW	PS
1991[i]	6.2 (4.5-8.4)	12.0 (6.8-20.9)	–	5.1 (0.8-28.9)
1992	16.0 (13.2-19.4)	19.6 (15.5-24.8)	26.7 (12.2-58.3)	4.3 (0.6-24.3)
1993	13.2 (10.9-15.9)	18.6 (14.5-24.0)	26.7 (11.3-62.5)	6.7 (1.8-24.4)

95% Confidence Limits shown in brackets

i 1991 estimates for part-season (Jun-Oct) tagging programme

Note: Estimates may be adjusted in later years as additional data become available

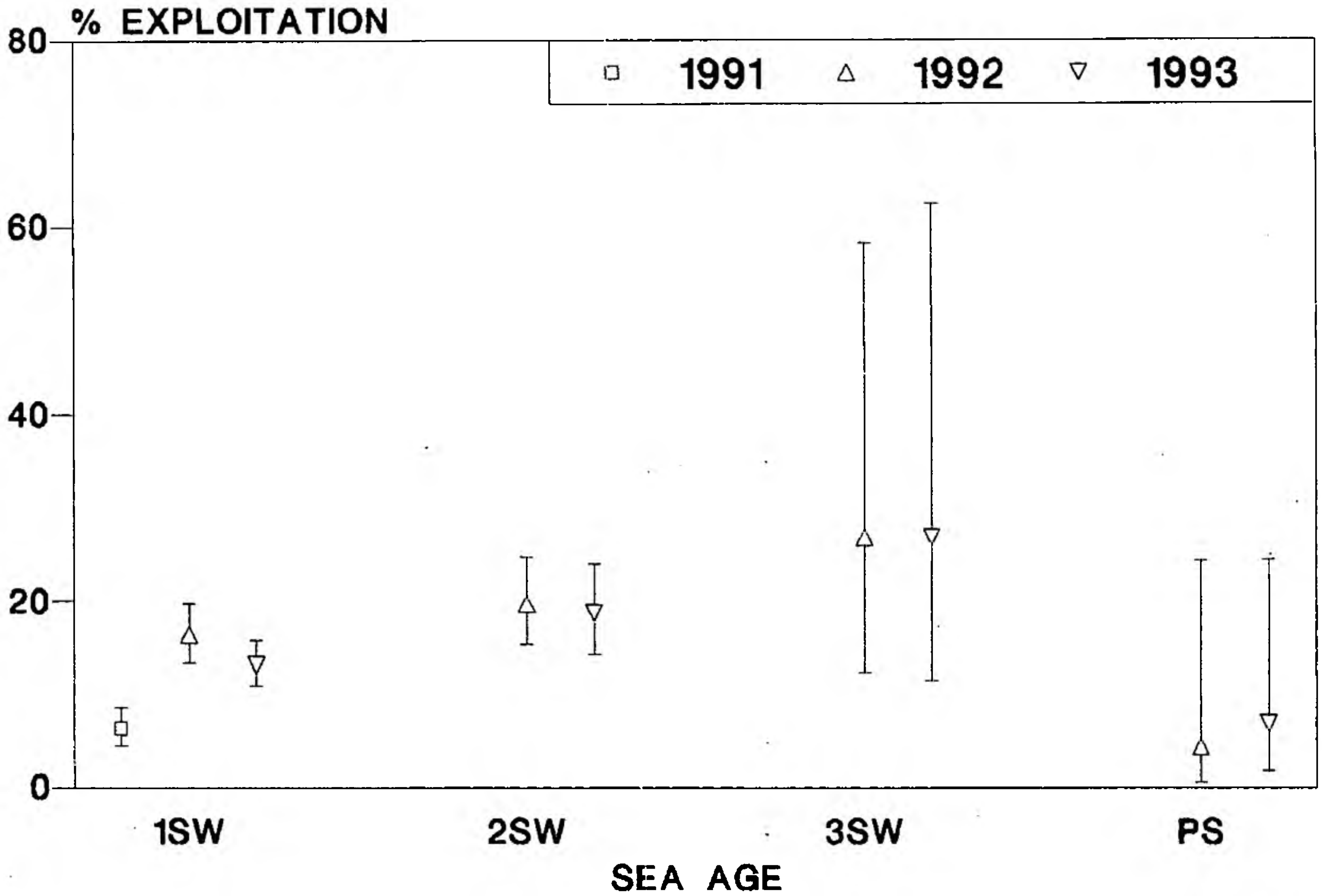
Table 21
SALMON ANGLING RECAPTURES BY RIVER SECTION, 1993

RIVER SECTION	MONTH TAGGED											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	UKN	ALL
1			4 (80.0)	2 (33.3)	10 (14.3)	2 (14.3)	9 (17.3)	9 (19.6)	9 (39.1)	3 (75.0)		48 (28.1)
2				2 (33.3)	2 (9.5)	2 (14.3)	6 (11.5)	12 (26.1)	8 (34.8)	1 (25.0)		33 (19.3)
3				1 (16.7)	1 (4.8)	4 (28.6)	15 (28.8)	7 (15.2)	2 (8.7)			30 (17.5)
4			1 (20.0)		7 (33.3)	4 (28.6)	13 (25.0)	13 (28.3)	3 (13.0)			41 (24.0)
5				1 (16.7)	1 (4.8)	1 (7.1)	7 (13.5)	3 (6.5)	1 (4.3)			14 (8.2)
6							1 (1.9)	1 (2.2)				2 (1.2)
7						1 (7.1)	1 (1.9)	1 (2.2)				3 (1.8)
8												0 (0..0)
ALL	0 (0.0)	0 (0.0)	5 (100.0)	6 (100.0)	21 (100.0)	14 (100.0)	52 (100.0)	46 (100.0)	23 (100.0)	4 (100.0)	0 (0.0)	171 (100.0)
UKN							1	2				3

UKN = UNKNOWN
% Recaptured shown in brackets

FIG. 3

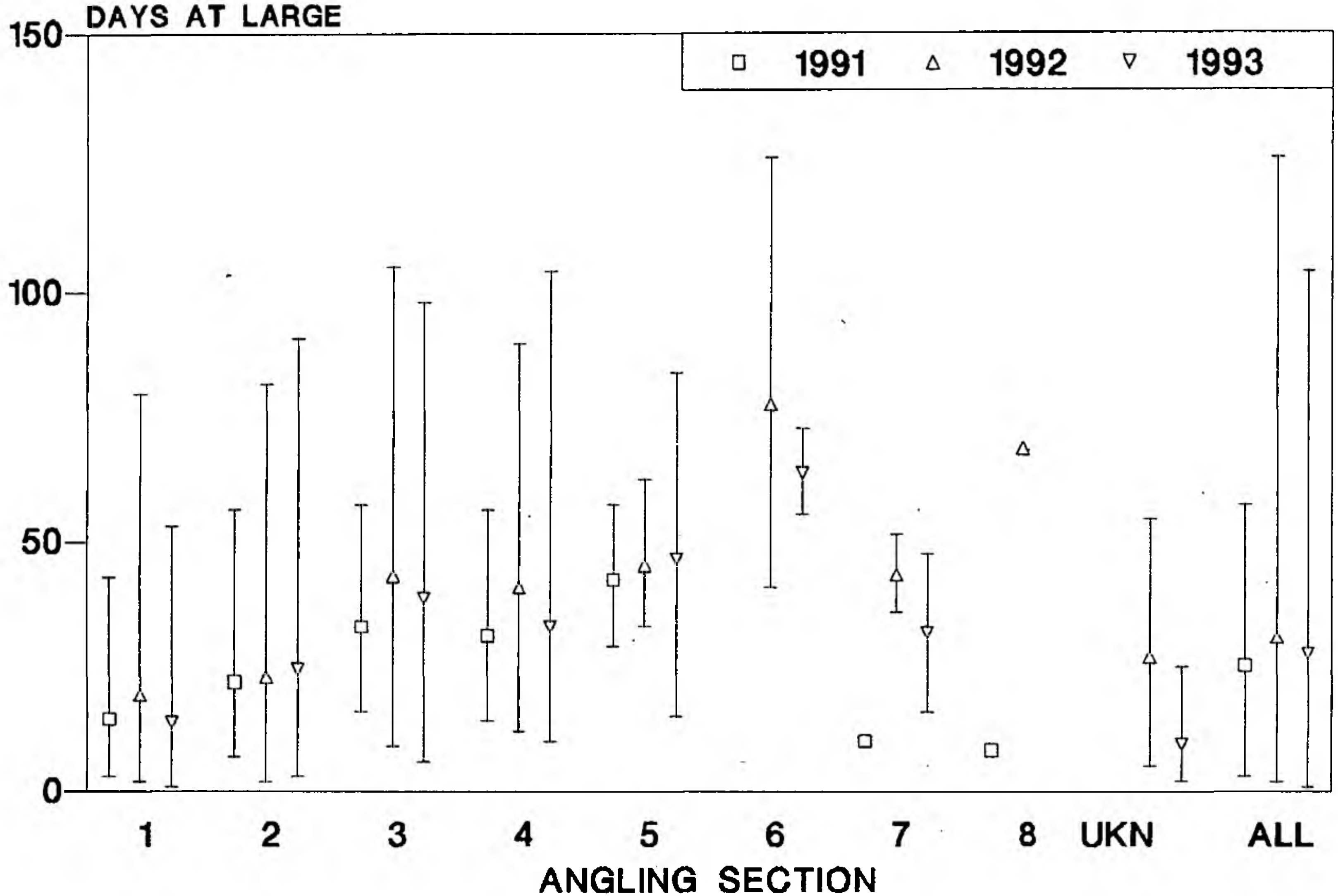
SALMON ANGLING EXPLOITATION RATES BY SEA AGE GROUP, 1991-93



NOTE: 95% CONFIDENCE LIMITS SHOWN

FIG. 4

DAYS TO AND LOCATION OF ROD RECAPTURE FOR SALMON TAGGED AT CHESTER WEIR; JUNE-OCTOBER, 1991-93



NOTE: SQUARE ROOT TRANSFOMED MEAN, MIN AND MAX RECAPTURE TIMES SHOWN

MEAN MONTHLY FLOW AT MANLEY HALL, 1991-93

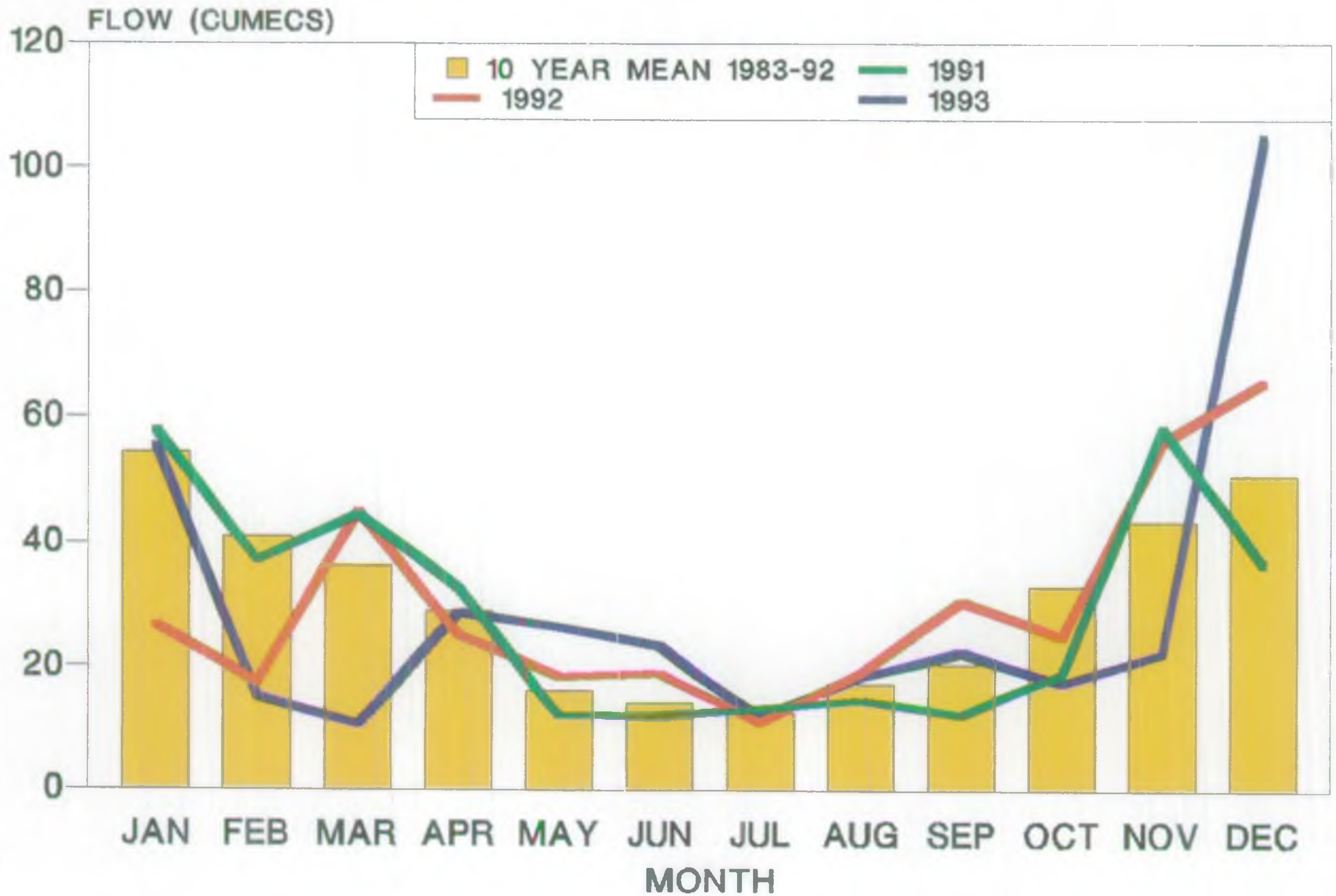
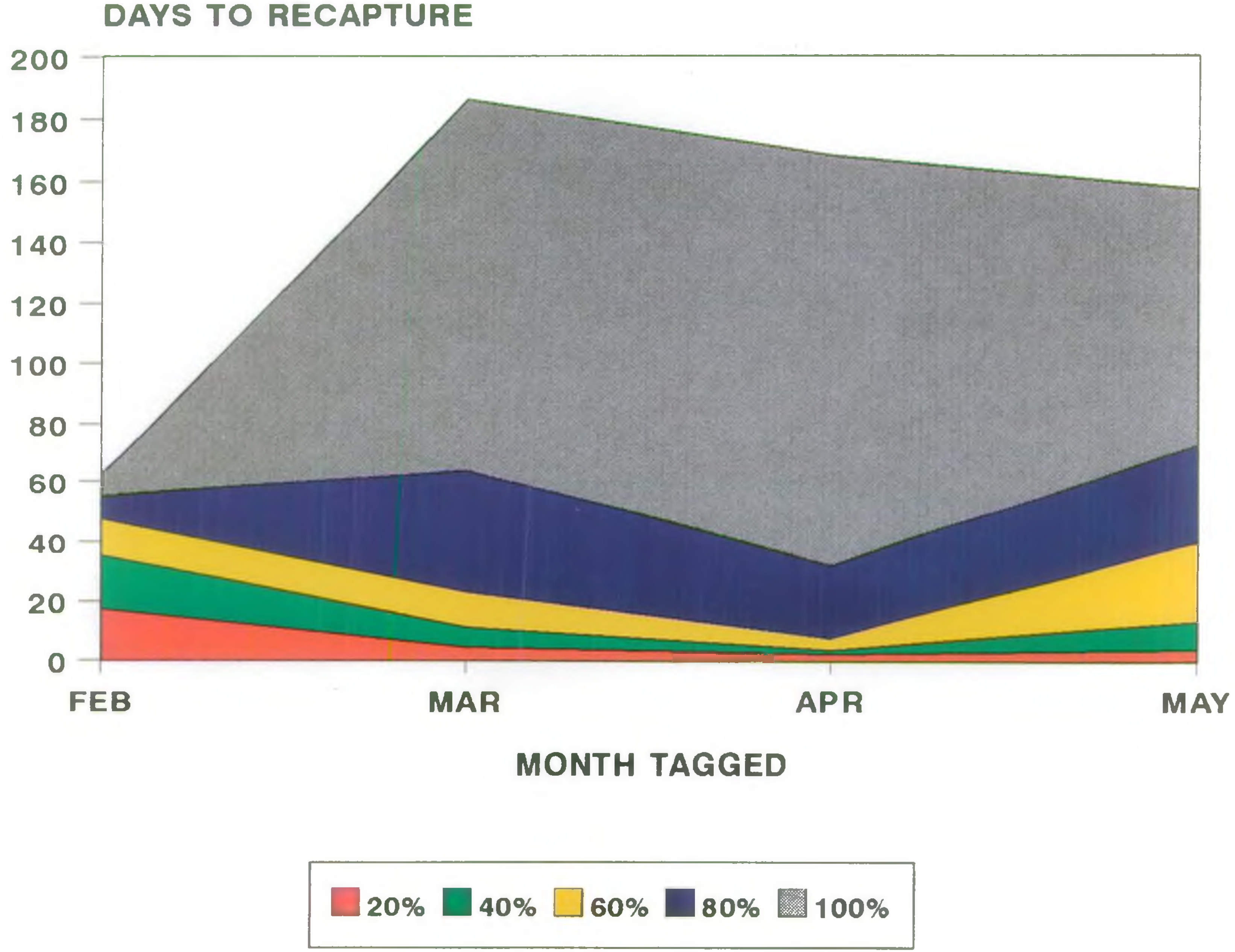


FIG. 5

DAYS TO RECAPTURE FOR SPRING (JAN-MAY) TAGGED SALMON, 1992-93 (% TOTAL RECAPTURED INDICATED)

FIG. 6



2.5 Stocking success/Microtag returns

40 adipose fin clipped salmon were recaptured at Chester Weir in 1993 of which 38 were carrying microtags - indicating a minimum tag retention rate of 95%. Of the latter, 31 (82%) entered the Dee within the angling season and were Floy tagged, and 8 were later recaptured by anglers, although microtags were recovered from only 6 of these. A further 2 microtagged salmon were recovered from the Dee net fishery and 3 from the rod fishery without prior capture at Chester Weir; in addition 11 microtagged salmon were recaptured at Pont Barcer during boodstock collection, although none of these fish were sacrificed to recover the tags. Unusual recaptures included a salmon released as an autumn fry on the Lune and recovered on the Dee at Chester Weir and later by rod at Bala. Also, a fish released as a 1+ smolt from the Dee's Maerdy hatchery and recaptured by an angler fishing the neighbouring Conwy catchment. Accumulated recaptures from all sources, including the sea fisheries, are shown in Table 22.

33,433 microtagged salmon were released from the Maerdy hatchery in 1993 as either 1+ parr or smolts (Table 22). In addition 538 wild smolts were microtagged in a 6-night pilot trapping exercise on the main Dee at Manley Hall and on the Ceiriog. At the former site a 16m wide floating fyke net was suspended immediately below the right bank weir, whereas on the Ceiriog a simple 8m wide winged fyke net was utilised. The Manley Hall device accounted for 571 salmon of which 521 were successfully tagged and 40 (7%) were hatchery released fish already microtagged. At both sites, tagging was carried out on site using mains powered equipment at Manley Hall, and a portable hand tagger on the Ceiriog.

Return rates for various batches of hatchery reared fish are shown in Table 23 - derived from microtag recaptures at Chester Weir and trap efficiency estimates (NRA, 1994a). Where trap caught fish were not recovered from the rod fishery, batch origin was determined from their combined smolt and sea ages. Return estimates are incomplete for all of the batches shown in Table 23 as fish remain to enter the Dee after 2 and/or 3 sea winters.

Table 22

MICROTAGGED SALMON; STOCKING AND RECAPTURES, 1986-93

YEAR TAGGED	NUMBER TAGGED	LIFE STAGE	ADULT RECAPTURES										TOTAL
			IN-RIVER						SEA FISHERIES				
			ROD	NET	EF	CHESTER TRAP IN-SEASON	CHESTER TRAP OUT-SEASON	PONT BARCER TRAP	FAROES	N. IRE -LAND	S. IRE -LAND	N.E. COAST	
1986	287	S1		1									1
1986	8087	1+	1	3						3	1	1	9
1987	10454	1+	1	4	1				1		2		9
1987	9426	1+	2										2
1988	23984	1+	1										1
1988	3407	S1									1		1
1989	2382	S1	3										3
1990	2448	1+/S1											
1991	2133	S1					1				1		2
1991	8672	1+	1[i]			21	5				1		27
1991	3228	S2	4[i]	3		13	6	1[i]			6		29
1992	15246	S1	7[i]	1		6	1		1		3		16
1992	24906	1+											
1993	16059	S1											
1993	17374	1+											
1993	538	WS											
TOTAL	148093	-	13	12	1	40	13	0	2	3	15	1	100

S1 = 1 YEAR OLD SMOLT
S2 = 2 YEAR OLD SMOLT
1+ = 1 YEAR OLD PARR
WS = WILD SMOLT
EF = ELECTROFISHING
i Fish originally recaptured at Chester Weir – excluded from totals

Table 23

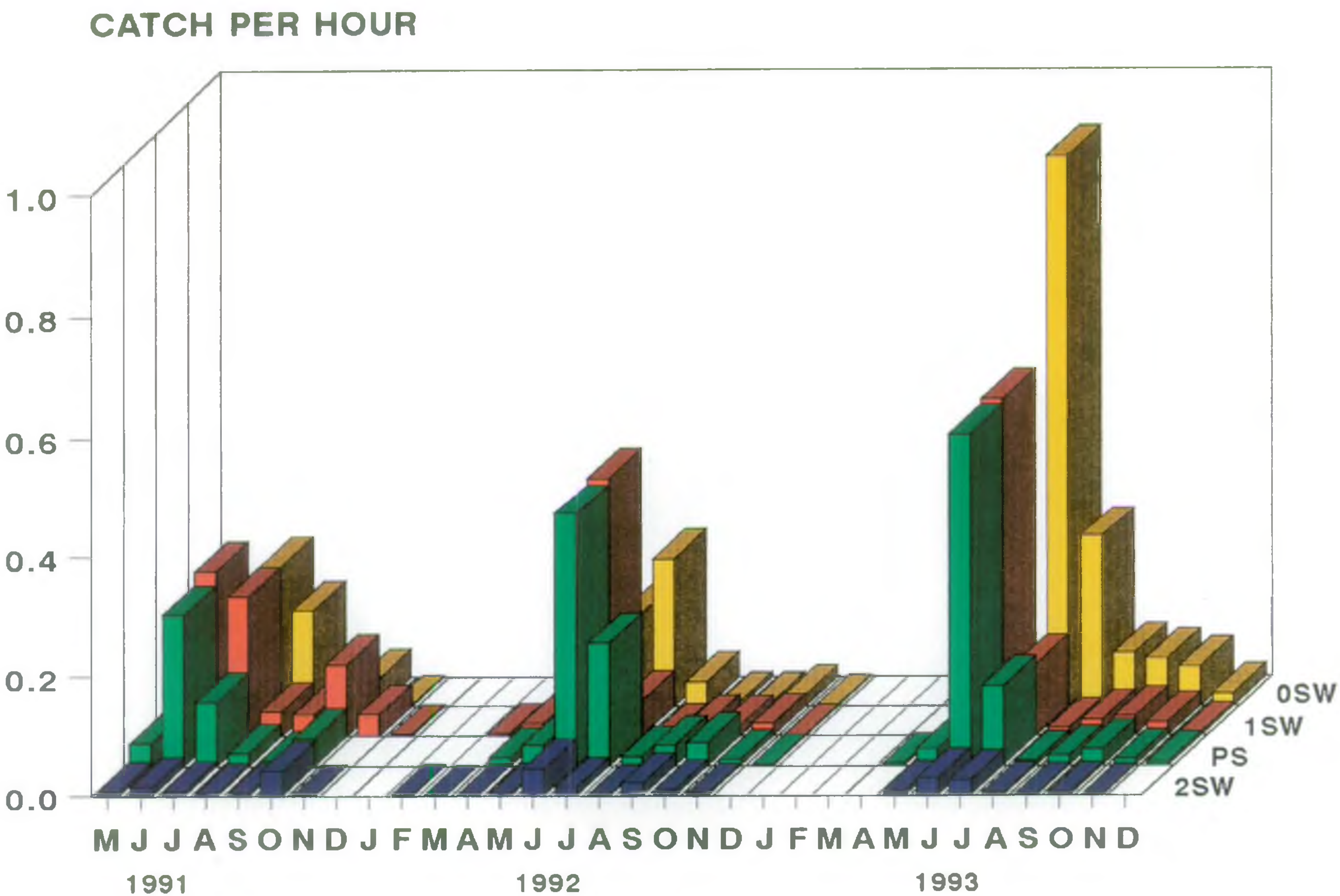
ESTIMATED RETURN RATES FOR MICROTAGGED SALMON; RIVER DEE 1991-92

STOCKING DETAILS							TRAPPING DETAILS									
BATCH NUMBER	YEAR STOCKED	MONTH	TYPE	AGE	LOCATION	NUMBER STOCKED	YEAR TRAPPED	NUMBER RECAPT'D	RIVER AGE	SEA AGE	TOTAL CATCH	TOTAL RUN	TRAP EFFCNCY	EST RETRN	% RETRN
17/11	1991	3	H,S	2+	RIVER DEE	3228	1992	15	2+	1+	886	3114	0.285	53	1.63
							1993	4	2+	2+	385	1654	0.233	17	0.53
													TOTAL	70	2.17
17/14	1991	3	H,S	1+	RIVER DEE	2133	1992	1	1+	1+	886	3114	0.285	4	0.16
													TOTAL	4	0.16
17/42, 17/43	1991	7	H,P	1+	RIVER DEE	8672	1993	26	2+	1+	1279	7836	0.163	159	1.84
													TOTAL	159	1.84
17/48, 18/11 19/59	1992	2,3	H,S	1+	ALWEN, TRYWERYN	15246	1993	7	1+	1+	1279	7836	0.163	43	0.28
													TOTAL	43	0.28

H = HATCHERY REARED FISH
P = PARR
S = SMOLTS

SEA TROUT TRAP CATCH RATE BY SEA AGE GROUP; CHESTER WEIR, 1991-93

FIG. 7



SW = SEA WINTER

PS = PREVIOUS SPAWNER

3. RESULTS - ADULT SEA TROUT

3.1 Run composition and timing

3.1.1 Trap catch

1293 sea trout were captured at Chester Weir in 1993 with trap catch rates for individual sea age groups shown in Fig 7 and Table 24 for the period 1991-93. Run timing was very similar to previous years, with June and July again experiencing the highest catch rates at 1.183 and 1.187 fish per hour, respectively (all sea age groups), and together accounting for 76% of the total catch. Annual catch rates for 0SW sea trout increased by 224% on the previous year, rising from 0.037 fish per hour in 1992 to 0.120 in 1993. Less marked increases were also apparent for 1SW fish (0.056 to 0.067) and previous spawners (0.062 to 0.066) (Table 24).

3.1.2 Age composition

3.1.2.1 Sea age

Scales were taken from 888 sea trout at Chester Weir (69% of the total catch), of which 775 had a readable sea age (Table 25). 0SW fish comprised 35% of the catch increasing from 21% in 1992, with similar proportions of 1SW fish (32%) and previous spawners (29%) making up most of the remainder. Observations indicated that fish smaller than about 350mm were able to swim between the bars of the trap, resulting in sampling bias among 0SW sea trout with the smaller members of this sea age group under-represented in the trap catch.

3.1.2.2 Smolt age

Scales from 462 sea trout had readable river centres of which most appeared to have emigrated as 2 or 3 year old smolts (88% and 11%, respectively) (Table 26). Smolt age composition was similar to 1992 (81% 2-year olds and 18% 3-year olds), as was mean smolt age (2.11 in 1993 compared to 2.17 in 1992). No significant differences were apparent in mean smolt ages for post-June entrants over the three years 1991-93, except in the case of 0SW sea trout where the mean smolt age in 1992 (2.29 years) was significantly greater than in 1991 (2.11 years) ($p=0.014$), although not significantly different from 1993 (2.15 years) ($p>0.05$).

3.1.3 Sex composition

Sex was assigned to 568 out of 891 fish of which 88% were considered female and 12% male (Table 27). The corresponding F/M sex ratio of 7.61 was greater than that recorded in 1992 (3.69) when 73% of sea trout were identified as females. An increase in the F/M ratio in 1993 was also apparent in each of the sea age groups examined.

3.1.4 Weight composition

230 sea trout were weighed at Chester Weir in 1993 - around 18% of the trap catch (Table 28). No significant differences were detected in the mean weights of post-June entrants over the period 1991-93, except for 0SW fish where mean weight progressively increased from 499g in 1991, to 518g in 1992 and 579g in 1993, with the mean weight in 1993 significantly greater than in 1991 ($p=0.007$).

Table 24

SEA TROUT CATCH RATE (CATCH PER HOUR) AT CHESTER WEIR, 1991-93

YEAR	CATCH PER HOUR												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
1991	—	—	—	—	0.086	0.600	0.586	0.229	0.076	0.255	0.043	0.004	0.238
1992	0.000	0.003	0.007	0.037	0.125	1.058	0.525	0.064	0.084	0.077	0.055	0.008	0.164
1993	0.000	0.000	0.000	0.004	0.064	1.183	1.187	0.310	0.135	0.143	0.102	0.033	0.259
SEA AGE													
0SW	0.000	0.000	0.000	0.000	0.002	0.034	0.909	0.283	0.088	0.078	0.065	0.021	0.120
1SW	0.000	0.000	0.000	0.000	0.026	0.564	0.119	0.013	0.027	0.032	0.023	0.006	0.067
2SW	0.000	0.000	0.000	0.000	0.009	0.029	0.026	0.005	0.003	0.005	0.002	0.000	0.007
3SW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PS	0.000	0.000	0.000	0.004	0.028	0.556	0.133	0.008	0.017	0.027	0.012	0.006	0.066

SW = SEA WINTER
PS = PREVIOUS SPAWNER

Table 25

SEA TROUT SEA AGE COMPOSITION; CHESTER WEIR, 1993

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
TOTAL CATCH	0	0	0	2	30	489	499	116	40	53	53	11	1293
SCALE SAMPLE(%)	0 (-)	0 (-)	0 (-)	1 (50.0)	28 (93.3)	398 (81.4)	282 (56.5)	67 (57.8)	26 (65.0)	43 (81.1)	37 (69.8)	6 (54.5)	888 (68.7)
SEA AGE (%)													
0SW(%)					1 (3.8)	12 (3.5)	162 (63.8)	51 (87.9)	10 (43.5)	16 (48.8)	18 (64.3)	3 (60.0)	273 (35.2)
1SW(%)					9 (34.6)	168 (48.4)	39 (15.4)	3 (5.2)	8 (34.8)	11 (33.3)	7 (25.0)	1 (20.0)	246 (31.7)
2SW(%)					4 (15.4)	10 (2.9)	10 (3.9)	2 (3.4)	1 (4.3)	1 (3.0)	1 (3.6)		29 (3.7)
3SW(%)													
PS(%)				1 (100.0)	12 (46.2)	157 (45.2)	43 (16.9)	2 (3.4)	4 (17.4)	5 (15.2)	2 (7.1)	1 (20.0)	227 (29.3)
ALL(%)	0 (–)	0 (–)	0 (–)	1 (100.0)	26 (100.0)	347 (100.0)	254 (100.0)	58 (100.0)	23 (100.0)	33 (100.0)	28 (100.0)	5 (100.0)	775(100.0)
UR					2	51	28	9	3	10	9	1	113

SW = SEA WINTER
PS = PREVIOUS SPAWNER
UR = UNREADABLE

Table 26

SEA TROUT SMOLT AGE COMPOSITION; CHESTER WEIR, 1993

	SEA AGE						
	0SW	1SW	2SW	3SW	PS	UR	ALL
SCALE SAMPLE	273	246	29	0	227	113	888
SMOLT AGE (%)							
1 (%)					3 (2.1)		3 (0.6)
2 (%)	147 (85.5)	125 (94.0)	13 (92.9)		122 (85.3)		407 (88.1)
3 (%)	24 (14.0)	8 (6.0)	1 (7.1)		18 (12.6)		51 (11.0)
4 (%)	1 (0.6)						1 (0.2)
ALL (%)	172 (100.0)	133 (100.0)	14 (100.0)	0 (0.0)	143 (100.0)	0 (0.0)	462 (100.0)
UR	101	113	15		84	113	426
MEAN SMOLT AGE	2.15	2.06	2.07	0.00	2.10	0.00	2.11

SW = SEA WINTER
PS = PREVIOUS SPAWNER
UR = UNREADABLE

Table 27

SEA TROUT SEX COMPOSITION; CHESTER WEIR, 1993

SEA AGE	FEMALE		MALE		F/M RATIO	UNKNOWN
	n	%	n	%		n
0SW	122	95.3	6	4.7	20.33	145
1SW	138	87.3	20	12.7	6.90	88
2SW	20	76.9	6	23.1	3.33	3
3SW	0	–	0	–	–	0
PS	156	87.6	22	12.4	7.09	49
UR	66	84.6	12	15.4	5.50	38
TOTAL	502	88.4	66	11.6	7.61	323

SW = SEA WINTER
PS = PREVIOUS SPAWNER
UR = UNREADABLE

3.2 Run size

3.2.1 Tagging

889 sea trout were VI (Visible Implant) tagged at Chester Weir in 1993 (Table 29), including 59 fish recaptured from previous years (Section 3.2.2). As mark-recapture for this species was not dependent on the rod fishery, tagging occured all year round with 69% of the annual catch tagged. No sea trout were radio-tagged.

3.2.2 Recaptures and straying

Of the 59 sea trout recaptured at Chester Trap and tagged in previous years, 53 were fish Floy tagged in 1992 and 6 were tagged in 1991 (Table 30). A further 10 fish tagged in 1992 were recaptured by the nets, including one fish recovered in the Clwyd estuary. The rods accounted for only two VI tagged sea trout, although this was to be expected given the small size and less obvious nature of the tag which was selected for screening at Chester Trap and not by the fisheries.

3.2.3 Run estimates

Modified Petersen estimates (Chapman, 1951) of 0+SW and >0+SW run size in 1992 were based on trap recaptures of 0+SM+ fish (8) and other previous spawners (45), respectively. Resulting estimates were 2537 for 0+ fish (95% confidence limits 1359-4531) and 1767 (95%CL 1328-2347) for >0+ fish, and include adjustment for a Floy tag retention rate of 96%. The latter was derived from the recapture at Chester Weir of 1 out of 24 sea trout which had lost its tag (established from the presence of an alcian blue panjet mark used as a second mark). The mean time to recapture for tagged fish carrying both marks was 362 days, with a range of 282-476 days.

The same tag retention rate was also used to adjust population estimates for sea trout in 1991 with resulting run estimates for 0+ fish and >0+ fish of 5202 (95%CL 2301-10252) and 2776 (95%CL 1725-4407). Both indicate a greater run of sea trout in 1991 than 1992, although confidence limits around the respective sets of estimates overlap.

3.3 Year class strength

Estimates of year class strength from run estimates for the period 1991-92 are shown in Table 31. Possible smolt age (1-4 years) and sea age (0-2SW) combinations for sea trout on the Dee mean that a single year class of fish may take from 1 to 6 years to complete the cycle from hatching to first spawning. Accordingly, the 1990 year class will be the first for which a full data set will be available - providing monitoring continues up to 1999.

The picture for sea trout is complicated by the fact that a proportion of 0SW do not spawn after entering freshwater, but return the following year as maiden 1SW fish. Of the 12 0+SW fish tagged in 1992 and recaptured at Chester Weir in 1993, 33% (4/12) returned as 1+SW maidens. In contrast, all (4) 0+SW sea trout tagged in 1991 and recaptured in 1992 returned as 0+SM+ fish. Furthermore, the ratio of maidens to previous spawners arising from a batch of 0+SW fish will not necessarily reflect the maturation rate at first freshwater entry, given that differential mortality is likely among spawners and non-spawners.

Estimates of year class strength will require correction to account for maturation rate in 0+SW fish. While trap recaptures indicate annual variations in this rate, estimates of post-river entry mortality for mature and immature fish will need to be assumed from the literature.

3.4 Fishery performance

3.4.1 Net fishery

3.4.1.1 Catch and catch-effort

The combined draft and trammel catch for sea trout in 1993 was 42, down by 32% on the previous season (62) and well below the 10-year mean catch of 126 (Table 32). The corresponding catch rate of 0.022 fish per tide in 1993 (Table 33) showed an even more marked decline (63%) on 1992 and was the lowest observed since data were first reported (previous minimum 0.060 fish per hour in 1992). Peak catches and catch rates for both gears occured in July giving a combined catch and catch rate of 27 and 0.052, respectively.

3.4.1.2 Weight composition

Monthly catches for 1992 are classified into three weight categories in Table 34 and are compared to catches from the last decade in Table 35. Weight composition appears similar to 1992 except for the absence of fish in the lowest (0-0.5kg) weight category. An overall mean catch weight of 1.70kg represents an increase of 0.12kg on 1992, but remains below the 10-year weighted mean (1.97kg).

Size composition data from Chester Weir suggest that the great majority of sea trout weighing 0.5 kg or less would be 0+SW fish. Estimates of net selectivity, accounting for mesh size, fish compressibility (Potter, undated) and length-girth relationships (Potter and Solomon, in prep) indicate that Dee nets would be expected to retain sea trout down to a minimum length of about 430mm. This would virtually exclude all 0+SW sea trout from capture (maximum observed length at Chester Weir 430mm, estimated weight 0.96kg) and could account for the apparent anomaly between the marked increase in catch rate for this sea age group at Chester trap and the lack of evidence for the same in the net fishery.

3.4.2 Rod fishery

3.4.2.1 Catch - Licence return

The declared rod catch for sea trout in 1993 of 103 represented an increase of 54% on the previous season (67) and was just below the 10-year average catch (109) (Table 32). However, as with salmon, changes in the licence structure after 1991 mean that catch returns from the last two seasons are likely to grossly underestimate actual catch.

3.4.2.2 Weight composition

Weight compositions by month, and annually over the last decade, are shown in Tables 36 and 37, respectively. The proportion of the catch in the lowest (0-0.5kg) weight category was the highest this decade at 66%, and in marked contrast to 1992 when less than 2% of the catch was recorded in this weight band (Table 37). Despite the greater contribution of small sea trout to the rod catch (likely to be mainly 0+SW fish), the overall mean catch weight (0.70kg) increased by 0.14kg on the previous season, but remained below the 10-year weighted average (0.86kg).

Table 28

SEA TROUT WEIGHT COMPOSITION; CHESTER WEIR, 1993

SEA AGE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ALL
0SW n	0	0	0	0	0	1	24	0	0	1	2	1	29
MEAN WT (Kg)	–	–	–	–	–	0.50	.55	–	–	1.08	0.61	0.78	0.58
1SW n	0	0	0	0	1	41	11	1	1	5	1	1	62
MEAN WT (Kg)	–	–	–	–	1.25	1.04	1.05	1.28	1.68	1.55	0.60	0.55	1.08
2SW n	0	0	0	0	3	2	5	0	0	1	1	0	12
MEAN WT (Kg)	–	–	–	–	2.55	1.79	2.15	–	–	2.33	3.35	–	2.30
PS n	0	0	0	0	3	78	12	1	3	4	2	0	103
MEAN WT (Kg)	–	–	–	–	3.53	1.64	1.66	1.93	3.29	3.29	3.48	–	1.85
UR n	0	0	0	0	0	10	5	2	0	4	2	1	24
MEAN WT (Kg)	–	–	–	–	–	1.43	0.92	0.78	–	1.16	1.04	5.56	1.36
ALL n	0	0	0	0	7	132	57	4	4	15	8	3	230
MEAN WT (Kg)	–	–	–	–	2.78	1.43	1.05	1.19	2.89	1.93	1.78	2.29	1.46

SW = SEA WINTER
PS = PREVIOUS SPAWNER
UR = UNREADABLE

Table 29

NUMBERS OF SEA TROUT TAGGED AT CHESTER WEIR, 1993

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT (1-14)	OCT (15-31)	NOV	DEC	ALL
TOTAL CATCH	0	0	0	2	30	489	499	116	40	31	22	53	11	1293
NO. VI TAGGED	0	0	0	1	28	400	281	68	26	25	18	36	6	889
NO. RADIO TAGGED	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL TAGGED	0	0	0	1	28	400	281	68	26	25	18	36	6	889
% TAGGED	–	–	–	50.0	93.3	81.8	56.3	58.6	65.0	80.6	81.8	67.9	54.5	68.8

Table 30

FATE OF SEA TROUT VI, FLOY AND RADIO TAGGED AT CHESTER WEIR, 1993

FISH VI TAGGED 1993		
A) TOTAL TAGGED	889	
B) FISH RECOVERED D/S CHESTER WEIR		
NET	0	
FOUND DEAD		
(PRE-SPAWNING)	0	
(POST-SPAWNING)	0	
C) OTHER RIVERS		
(IN-SEASON) [i]	0	
(OUT-SEASON)	0	
D) FISH RECOVERED AT CHESTER WEIR	5	
E) FISH RECOVERED U/S CHESTER WEIR		
ROD (IN-SEASON)	2	
ROD (OUT-SEASON)	0	
FOUND DEAD		
(PRE-SPAWNING)	0	
(POST-SPAWNING) [ii]	0	
FISH FLOY TAGGED PRIOR TO 1993		
F) RETURNING FISH FLOY TAGGED IN 1992		
ROD	0	
NET	10	(1 CLWYD ESTUARY)
CHESTER TRAP	53	
G) RETURNING FISH FLOY TAGGED IN 1991		
ROD	0	
NET	0	
CHESTER TRAP	6	

i Rod recaptures unless otherwise stated.

ii Fish found dead after 30th November are assumed to be post-spawning mortalities

Table 31

YEAR CLASS COMPOSITION OF SEA TROUT RUN AT CHESTER WEIR, 1991-92

SEA AGE	YEAR CLASS 1987	1988	1989	1990	1991	1992	ALL
0SW		665	4841	2233			7739
1SW	110	1142	759				2011
2SW	186	123					309
3SW							0
ALL	296	1930	5600	2233	0	0	10059
PS	–	–	–	–	–	–	2223

SW = SEA WINTER
PS = PREVIOUS SPAWNER
Note: Estimates may be adjusted in later years as additional data become available.

Table 32

ANNUAL SEA TROUT CATCH; NET AND ROD FISHERIES, 1983-93

METHOD	YEAR 83	84	85	86	87	88	89	90	91	92	93	10 YR MEAN (1983-92)
NETS[i]	133	185	107	148	155	176	108	40	142	62	42	125.6
RODS[ii]	161	92	140	155	124	146	76	84	41	67	103	108.6
BOTH	294	277	247	303	279	322	184	124	183	129	145	234.2

i Combined Draft and Trammel net catch shown.
ii National rod licence in 1992 and 1993 – no reminder issued to licence holders – actual catch grossly underestimated

Note: Catch statistics may differ slightly from those published regionally because of local editing of returns considered invalid.

Table 33

MONTHLY SEA TROUT NET CATCH AND CATCH-EFFORT, 1993

METHOD	MAR	APR	MAY	JUN	JUL	AUG	ALL
DRAFTS:							
TOTAL CATCH	0	0	0	14	24	1	39
TIDES FISHED	123	122	181	307	425	426	1584
CATCH PER TIDE	0.000	0.000	0.000	0.046	0.056	0.002	0.025
TRAMMELS:							
TOTAL CATCH	0	0	0	0	3	0	3
TIDES FISHED	0	0	19	71	98	103	291
CATCH PER TIDE	–	–	0.000	0.000	0.031	0.000	0.010
BOTH:							
TOTAL CATCH	0	0	0	14	27	1	42
TIDES FISHED	123	122	200	378	523	529	1875
CATCH PER TIDE	0.000	0.000	0.000	0.037	0.052	0.002	0.022

Note: Catch statistics may differ slightly from those published regionally because of local editing of returns considered invalid.

Table 34

SEA TROUT WEIGHT COMPOSITION; NET FISHERY, 1993 (DRAFT AND TRAMMEL CATCH COMBINED)

	MAR	APR	MAY	JUN	JUL	AUG	NO DATE	ALL
NO WEIGHT	0	0	0	0	0	0	0	0
0-0.5 Kg	0	0	0	0	0	0	0	0
0.5-1.8 Kg	0	0	0	9	22	1	0	32
>1.8 Kg	0	0	0	5	5	0	0	10
TOTAL WT (Kg)	0	0	0	26.3	44.0	0.9	–	71.2
MEAN WT (Kg)	–	–	–	1.86	1.63	0.91	–	1.70

Note: Catch statistics may differ slightly from those published regionally because of local editing of returns considered invalid.

3.4.2.3 Catch-effort - Logbook return

The overall catch rate for 1993 of 0.034 fish per hour (from an actual catch of 12 sea trout) represented an increase of 26% on the previous season and was close to the 1989-92 average of 0.040 (Table 38). Anglers reported fishing for sea trout between March and October, with activity confined to the main Dee below the Alwen confluence (Angling Sections 1-4). However, as in previous years, total fishing effort for sea trout was only a small proportion (2%) of that recorded for salmon. Fish were taken between May and September, with the August recording the highest catch rate at 0.047 fish per hour (Table 39).

4 RESULTS - JUVENILE ABUNDANCE

15 quantitative, 11 semi-quantitative and 85 five-minute fry sites were fished in 1993, including 2 quantitative sites on the Lliw and 2 on the Llafar selected as part of the rolling programme.

Mean densities of 0+ and >0+ salmon and trout at 19 Fixed sites (quantitative and semi-quantitative) fished in 1992 and 1993 were not significantly different between years ($p>0.05$). This was also true of the mean five-minute salmon fry counts in 1992 and 1993, both over all sites (geometric means 6.3 and 7.7 fry per five-minutes, respectively) and for separate tributary sections. However, on the main Dee the mean five-minute salmon fry count was significantly higher ($p=0.041$) than in the previous year (geometric mean 13.8 in 1993 compared to 7.8 in 1992), with many sites considered to have 'Good' counts for the first time (ie. 31-65 fish per five-minute fishing) (Fig 8).

Table 35

SEA TROUT WEIGHT COMPOSITION; NET FISHERY 1983–93 (DRAFT AND TRAMMEL CATCH COMBINED)

YEAR	% COMPOSITION IN WEIGHT CATEGORY (Kg)			TOTAL WT (Kg)	n	MEAN WT (Kg)
	0-0.5	0.5-1.8	>1.8			
83	–	–	–	247.7	133	1.86
84	–	–	–	419.1	185	2.27
85	–	–	–	217.7	114	1.91
86	–	–	–	209.1	89	2.35
87	–	–	–	231.8	155	1.50
88	–	–	–	380.1	176	2.16
89	–	–	–	239.0	108	2.21
90	–	–	–	81.2	40	2.03
91	0.7	68.3	31.0	246.3	142	1.73
92	9.7	67.7	22.6	98.0	62	1.58
93	0.0	76.2	23.8	71.2	42	1.70
1983-92	3.4	68.1	28.4	2370.1	1204	1.97[i]

n = No. of fish with known weight.

i Weighted 10-year mean

Note: Catch statistics may differ slightly from those published regionally because of local editing of returns considered invalid.

Table 36

SEA TROUT WEIGHT COMPOSITION; ROD FISHERY, 1993

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NO DATE	ALL
NO WEIGHT	0	0	0	0	0	0	0	0	0	0	0	0
0–0.5 Kg	0	0	0	9	0	6	20	16	16	1	0	68
0.5–1.8 Kg	0	0	0	2	3	5	4	10	5	0	0	29
>1.8 Kg	0	0	0	0	0	1	0	0	5	0	0	6
TOTAL WT (Kg)	0	0	0	5.4	1.8	9.5	10.9	16.3	28.1	0.5	0	72.6
MEAN WT (Kg)	–	–	–	0.49	0.60	0.79	0.45	0.63	1.08	0.45	–	0.70