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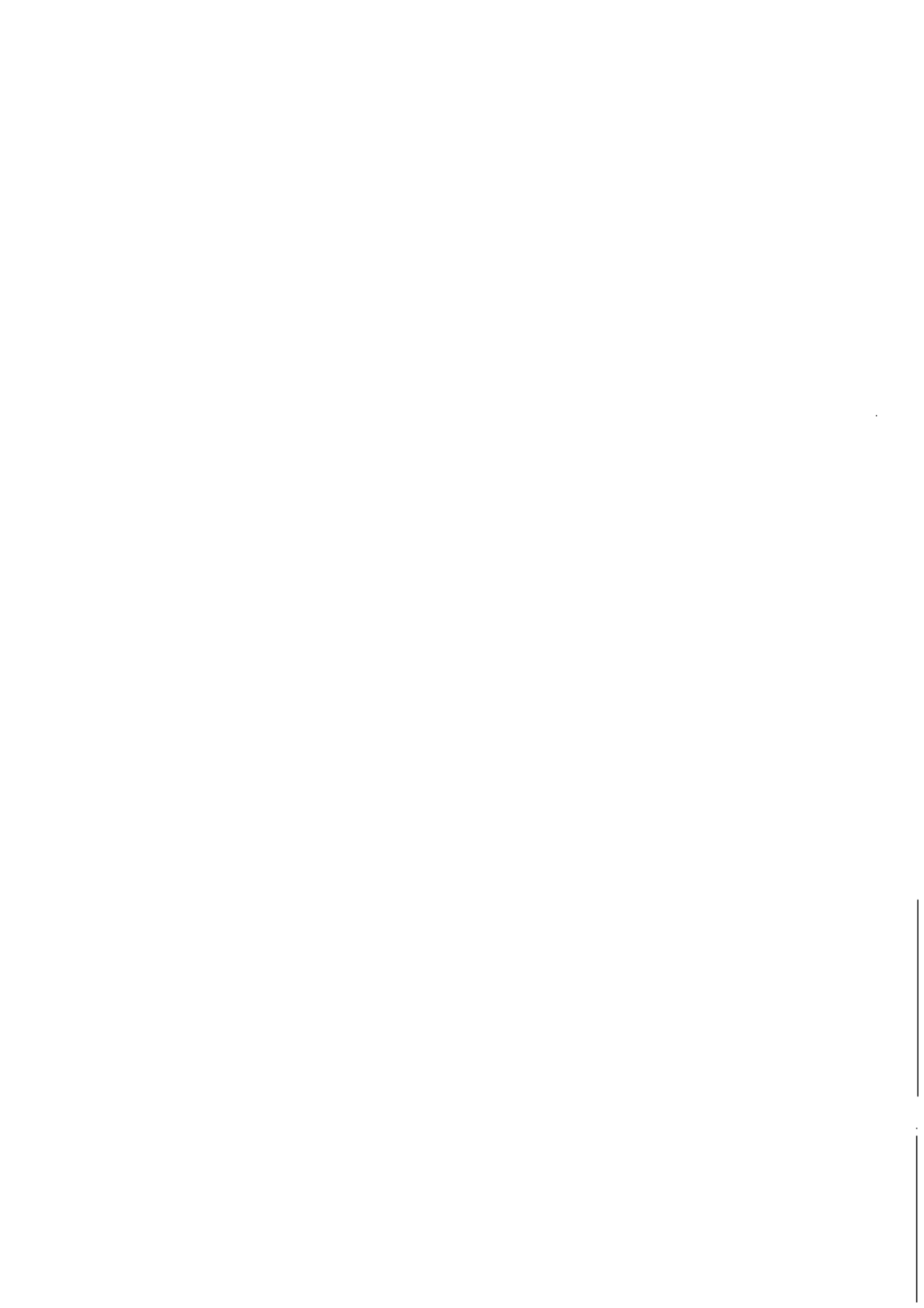
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RIVER SPEY JUVENILE SURVEY 1991

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INTRODUCTION

A survey of the distribution and population densities of juvenile salmon and trout in the river Spey was implemented in 1990. The 1990 survey results are presented in Laughton (1991). During 1991 a further 53 sites were examined throughout the catchment. This short report presents data on the distribution and population densities of salmon and trout at the sites examined on the Spey during 1991. Where 1990 sites were revisited data from both years are presented and compared.

MATERIALS AND METHODS

The electro-fishing techniques used during the survey are described by Gardiner (1989) and for the Spey in particular by Laughton (1991).

Each site was fished three times to allow density calculations (Zippin, 1958), or only once to determine the species present. Where possible the population densities were calculated for each age class of salmon and trout present. Where the Zippin method could not be applied the total catch divided by the area fished provided a minimum estimate (me). Quarter density divisions for each age class were determined in the following way, if for example, a total of 28 sites were examined the seven sites with the highest densities were assigned to the first quarter, the next seven to the second quarter and so on.

The survey sites are referred to by their respective tributary; Fiddich = F, Avon = A, Dulnain = D, Nethy = N, Druie = Dr, Feshie = Fe, Tromie = T, Calder = C, Truim = Tr, Mashie = M. The smaller burns which enter the Spey downstream from Grantown are referred to as lower burns, LB, those entering between Grantown and Laggan are referred to as middle burns, MB, while the sites above Spey Dam are referred to as SD.

RESULTS

Figure 1 shows the location of the 1991 tributary sites on the Spey. For simplicity the lower and middle burn sites are not shown.

The number of sites electro-fished throughout the year are summarised in Table 1. The results from the depletion experiment, three sites on the Truim and Raitts Burn respectively, will be reported elsewhere by Armstrong *et al.* (in prep), however, some density figures and species distributions from these sites are included.

DISTRIBUTION OF FISH SPECIES

Table 2 shows the fish species recorded at each of the survey sites. Salmon and trout were the most widely distributed species and were found at 42 (79%) and 51 (96%) of the sites respectively. At two sites (4%), LB3a and A9, only fry were caught. These were too small to identify accurately and no larger fish were caught to confirm whether it was salmon or trout which were present. Eels were caught at 23 (43%) of the sites, lampreys were present at five (9%), minnows at five (9%), sticklebacks at one (2%) and pike at one (2%).

The salmon, trout, eel and lamprey were found throughout the system while the other species were only found upstream from Grantown. However, Morrison (1989) found minnows and sticklebacks further downstream in the Fiddich. Two other species are also present in the Spey, Arctic charr and rainbow trout, neither were found during this survey.

SALMON AND TROUT AGE CLASS DENSITIES

Tables 3 to 14 show the age class densities for salmon and trout and give schematic diagrams of each site location. The 1990 sites are also shown and the results for these sites are presented in Laughton (1991). The range of age class densities for salmon and trout are shown on Figure 2.

During the early season, ie May and June, it was difficult to distinguish the salmon and trout fry at sites A13, N4 and Tr1, so no figure is given. It is worth noting, however, that high combined densities of 0+ were recorded at the three sites.

Sites D1 and F3 showed the highest salmon 0+ densities, 4.16 m and 3.15 m respectively. Quarter densities for 0+ salmon were at 0.17 m², 1.01 m² and 1.38 m². The maximum 1+ salmon density, 0.63 m², was found at A12, with quarter densities at 0.07 m², 0.15 m², and 0.17 m². The maximum 2+ salmon parr density, 0.46 m², was found at Fe2, with quarter densities at 0.01 m², 0.09 m² and 0.12 m². Salmon age 3+ were also found within the catchment, at sites, A9, Fe2, Fe10, and C1. These were generally in the upper reaches of the river.

Sites F3 and A2 showed the highest 0+ trout densities, 1.22 m² and 0.86 m² respectively, these sites also showed high levels of 0+ salmon. Densities of 0+ were also high in the Raitts Burn (MB7). Quarter densities for trout fry were determined at 0.02 m², 0.25 m² and 0.31 m².

The range for 1+ and 2+ trout was more limited than that of the equivalent salmon age class, (Fig. 2). The maximum densities for 1+ trout was 0.42 m⁻² and for 2+ trout 0.19 m⁻², both recorded at A10. Quarter densities for these age classes were not determined. Older trout age 3+ and 4 were also found but were generally limited to one or two fish per site.

In general most of the salmon and trout caught were of age 0+, 1+ or 2+. The range of densities for 0+ salmon and trout was similar, while the older trout age classes showed a more restricted range than the equivalent age classes of salmon. Salmon older than 2+ were rare and similar to 1990 were limited to sites in the upper catchment.

AREAS WITH LOW SALMON DENSITY

Many areas of the Spey can be considered to have reasonable levels of juvenile salmon. However, as in 1990, some areas were found to have very low levels. These were above Spey Dam and Tromie Dam.

Salmon were recorded at the two main stem sites (SD4, SD5) and surprisingly above the screens in the Markie (SD6). However, in each case only one or two juvenile salmon were found. Numbers of juvenile trout at these sites were also low.

Spey Dam is fitted with a salmon ladder to enable adults to ascend. At site SD5 it is likely that a lack of suitable habitat may be more important than adult access. The substrate at site SD5 was predominantly composed of pebbles which may be suitable for spawning but offers no cover for older fish. The same argument cannot be used for SD4 which contained a range of substrate types from pebble to large boulders. However, with very little spawning taking place above SD4 there may be a lack of juveniles to occupy the available habitat in SD4. Further examination of the river immediately above Spey Dam reservoir will take place in 1992.

Only one site above Tromie Dam (T2) was examined during 1991. The density of salmon and trout at this site was low. However, the density of juveniles at Dailraich (T4) below the Dam were also low. More sites need to be examined on the Tromie, particularly above the Dam, before any firm conclusions can be drawn.

COMPARISON OF FISH DENSITIES AT SITES FISHED IN 1990 AND 1991

Nine 1990 sites (F3, A2, D1, N4, Dr2, Fe2, T2, Tr1, MB7a) were refished during 1991. The 1+ and 2+ salmon and trout densities for each site are given in Table 15. No comparison for salmon and trout fry was possible since they were too small to identify at many of the sites fished earlier in the year.

It is evident from Table 3 that wide variations in juvenile densities at the same site can occur. Some of this variation may occur from visiting the sites at different times of the year. To reduce the effect of this variable sites which were visited within one month of each other in 1990 and 1991 are presented in Figure 15.

The sites with high densities of 1+ salmon parr in 1990 also showed high densities during 1991. However, the 1991 density of 1+ salmon was lower than in 1990 at all sites. A similar trend is evident for 2+ salmon with most sites showing lower densities than in 1990. The exception was at Fe2 which showed a large increase in the numbers of 2+ salmon. The density of 1+ trout were either equal or showed an increase from the previous year, while no clear trend was evident for 2+ trout.

COMPARISON OF FISH DENSITIES AT SITES FISHED IN JUNE AND OCTOBER 1991

Changes in population densities throughout 1991 at four sites (A2, N4, Fe2, Tr1) are shown in Figure 4. Again no comparison for salmon and trout fry was possible since they were too small to identify during the June visits.

With the exception was Fe2, where the 1+ salmon densities remained the same, all the sites showed lower densities of 1+ salmon during the October visit. The densities of 2+ salmon parr at three sites were also lower in October than June, however, a small increase in 2+ salmon was noted at N4. No clear trend was evident for 1+ or 2+ trout.

1+ SALMON GROWTH

Shackley and Donaghy (1992) indicate that salmon parr in the River Dee tributaries show different growth rates depending on the altitude and water on the Spey the mean length of 1+ salmon parr was calculated at five sites (F3, A2, A13, N4, Fe2) during June and October 1991. The preliminary results are presented in Figures 5 and 6.

It is evident from Figures 5 and 6 that differences in growth rates exist between tributaries within the catchment. The 1+ parr found in the higher altitude tributaries, such as the Loin (alt 450 m), were smaller, mean length 79.1 mm in October, than those in the lower altitude rivers such as the Fiddich (alt 190 m), mean length 97.5 mm.

The three sites on the Dorback (N4), Livet (A2) and A Ruadh (Fe2) were all at similar altitudes approximately 200 m. However, 1+ salmon in the Ruadh were shorter in length, 76.3 mm in October, than those from the Dorback and Livet, 89.4 mm and 89.9 mm respectively.

The underlying geology and soil composition can affect the water chemistry of a stream. The acidity (pH), alkalinity and conductivity can be measured to provide an indication of a stream's chemical richness.

Tributaries draining chemically richer rocks such as limestones will have a higher alkalinity and conductivity than those draining harder wearing rocks such as schists and granites.

Table 16 shows the results from water samples collected from each tributary close to where the 1+ salmon were caught. No sample was obtained from the Livet, however, results from the Tervie, a tributary of the Livet which drains a similar area, are shown.

The pH, alkalinity and conductivity were high in the Fiddich with the Allt Ruadh samples the lowest. This indicates that the Fiddich is draining richer substrate than the Allt Ruadh. Samples from the two Avon sites also show high conductivity and alkalinity, while the Nethy results are between the two extremes.

DISCUSSION

The results of the 1991 survey are similar to those found during 1990, Laughton (1991). Salmon and trout are widely distributed throughout the catchment. Where juvenile salmon are absent the main reasons are, restrictions to adult access by a dam, weir or screen, (T5, SD7, F8, LB6b); by a natural obstacle such as a waterfall, (D10, SD8); or a combination of these factors (LB4) or through unsuitable habitat, (MB10b).

The population densities of both species varied throughout the catchment. The highest densities of salmon were found in the lower tributaries such as the Fiddich, Avon (particularly the Livet and Loin) and Dulnain. Salmon densities in the upper tributaries such as the Feshie, Tromie and Truim were lower.

Where older salmon parr densities were high, trout densities were generally low. A similar pattern was described on the River Tweed by Gardiner (1989). This may reflect the different habitat usage by the two species, older age classes of trout preferring deeper slow flowing areas while salmon prefer the faster flowing riffle areas, Jones (1975), Kennedy and Strange (1982), Heggenes and Saltveit (1990).

It is worth noting that some sites had high densities of trout (A11, D9, D11) and, similar to salmon, these tended to be in the lower reaches of the catchment. Small populations of resident trout were also found above waterfalls and dams which denied access to adult salmon and sea trout (LB4, D10, T5, SD7, SD8). In general these sites were fished only once to determine the species present, however, the indications were that these trout populations were at low density.

Where population densities were compared in June and in September 1991 at the same site, lower densities were found later in the year. This observation could result from a variety of factors including, density dependent mortality, emigration from the study area and predation among others.

There are also some indications of differences in growth rates throughout the catchment. The 1+ salmon from higher altitudes and from granitic catchments showed slower rates of growth. These findings may be related to the chemical and biological quality of the stream.

Much of the upper Spey catchment drains schist type rocks (Maizels, 1988) and water samples from this area indicate low conductivity levels. In contrast the waters of the Fiddich and the lower Avon are more influenced by limestone and so show much higher conductivities. Egglislaw and Shackley (1985) indicate that salmon production and growth rates are higher in streams draining sandstone and limestone than those draining harder wearing schists and granites. While Shackley and Donaghy (1992) suggest that variations in juvenile growth rates and population density determined for the River Dee are related to altitude which influences river temperature, and water chemistry. These preliminary results from the Spey concur with their findings.

It is important to return to a number of sites each year within a survey to gain information on annual variations in populations densities. From the data presented in Figure 3 there is an apparent decline in the density of salmon parr at the five 1990 sites which were re-examined in 1991. It should be stressed that the results obtained from these sites may not reflect trends in the catchment as a whole.

It is unclear if these results indicate poor recruitment from the previous two spawning seasons or whether it is simply natural variation. Wide variations in juvenile population densities from year to year have been noted in other studies, Egglislaw and Shackley (1977), Bergheim and Hesthagen (1990).

Indeed this highlights some of the problems in interpreting survey data. A number of factors affect the population density of salmon and trout including habitat availability, predation levels, mortality, population movement, water temperature, flow rates etc. These factors vary both annually and seasonally and have differing effects on the results of any survey. To allow a comparison between subsequent years and minimise the effects of these factors the selected site should be visited within the same month in each year. To determine the effects of these other factors further more specific research is necessary.

One of these factors, juvenile salmon and trout movements and recolonisation of depleted areas of stream, was addressed throughout 1991 and continued in 1992 as part of a joint project with SOAFD. These results will be reported elsewhere by Armstrong *et al.* but should provide useful information on the movements within streams and may help in interpreting juvenile survey results.

The results of the 1991 survey combined with those presented in Laughton (1991) indicate that much of the catchment is well stocked with juvenile salmon and trout. These are encouraging for the future when salmon catches on the river have generally declined. However, some areas

such as above Spey Dam and Tromie Dam in particular appear to have very low densities, these are worthy of closer examination and perhaps some limited re-stocking.

In order to examine as much of the catchment as possible the number of 1990 sites which were revisited was limited. Revisits will be increased in future years. However, the current electro-fishing technique is quite time consuming and limits the amount of sites which can be examined, currently around 40-50 sites to be examined per year depending on weather conditions.

There is a need to reassess the technique by perhaps reducing the number of fishings from three to two or to opt for a catch per unit effort method. Substrate type is also measured quite accurately again this could be re-assessed. Methods of improving the electro-fishing techniques and allowing more sites per year to be visited will be further examined.

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TABLE 1

Summary of the sites electro-fished in 1991

New Sites	32
Revisited from 1991	9
Visited in June/October 1991	6
Examined as part of depletion experiment	6
Total number of sites examined in 1991	53

TABLE 2

Distribution of fish species 1991

No	River	Site	Date	Type of fish present			
				Salmon	Trout	Eel	Others
F2	Fiddich	Balvenie Ford	23 05 91	+	+	+	-
F3*	Fiddich	Auchendoun	23 05 91	+	+	+	-
F8	Dullan	Bridge	23 05 91	-	+	-	La
A7	Avon	1 m up Dalestie	29 08 91	+	+	+	-
A8	Avon	Ponymans Hut	22 08 91	+	+	-	-
A9	Avon	Faindouran	01 08 91	?	?	-	-
A2*	Livet	Whitefolds	05 05 91	+	+	+	-
A10	Chabel Burn	Bailcorach	15 10 91	+	+	-	-
A11	A Bailhachan	Bailechnoil	29 08 91	-	+	+	-
A12	Duilg Burn	Above Ford	02 08 91	+	+	+	-
A13*	Burn of Loin	Above Ford	13 06 91	+	+	-	-
LB3a	Mulben Burn	Delfur	21 05 91	+	+	+	-
LB3b	Mulben Burn	Mulben	21 05 91	?	+	-	Lo
LB4	Rothas Burn	Chapel Lay Br	23 10 91	-	+	-	-
LB5	Dalvey Burn	Tulchan	05 06 91	+	+	-	-
LB6a	Cromdale Burn	Below Dist	22 05 91	+	+	+	-
LB6b	Cromdale Burn	Above Dist	22 06 91	-	+	+	-
D1*	Dulnain	Duthil Church	13 08 91	+	+	+	-
D8	Dulnain	Eil	11 09 91	+	+	+	-
D9	Dulnain	Suspension Br	30 09 91	+	+	-	-
D10	A Slochd Mhuic	Insharn	21 08 91	+	+	+	La
D11	A Fionnaich	Kinrara Br	11 09 91	-	+	-	-
D12	Feithlinn	Bothy	30 08 91	+	+	-	-
N4*	Dorback	Drum	04 08 91	+	+	+	-
N6	A Mor (Nethy)	Nethybridge	03 08 91	+	+	+	La
Dr2*	Allt Mor	Chute	16 08 91	+	+	+	-
Dr6	Am Beanaidh	Cairngorm Br	12 09 91	+	+	+	-
Dr7	Am Beanaidh	Above 2nd Ford	28 08 91	+	+	-	-
Dr8	Beanaidh Bheag	Above Ford	28 08 91	+	+	-	-
Fe8	Feshie	Garbhloch Mouth	10 09 91	+	+	-	-
Fe9	Feshie	2nd Ford	10 09 91	+	+	-	-
Fe10	Feshie	Black Bothy	08 09 91	+	+	-	-
Fe2*	Allt Ruadh	Bridge	06 06 91	+	+	-	-
T4	Tromie	Dailraich	11 06 91	+	+	-	-
T2*	Tromie	Lochan Duin	22 10 91	+	+	-	-
T6	A Bhran	Above Dam	22 10 91	-	+	-	-
C1	Calder	Cottages	23 08 91	+	+	+	-
C2	Calder	Cluny Bothy	25 06 91	+	+	-	-
Tr1*	Truim	Crubenmore	12 06 91	+	+	-	St
MB14	Millon (King)	Wades Br	01 10 91	+	+	+	-
MB15	A Laxaidh	Strons	14 08 91	+	+	+	-
MB10b	A Dobhrain	Auchmore	12 10 91	-	+	+	La, Pi
SD4	Spey	Garva Br	08 08 91	+	+	-	Mi
SD5	Spey	Shesgan	25 10 91	+	-	-	-
SD6	Markie	Above Screen	14 08 91	+	+	-	-
SD7	A Crunachdain	Laggan Inlake	26 08 91	-	+	-	Mi
SD8	Feith Telegain	Garvamore	08 08 91	-	+	-	-

TABLE 2 (continued)

Removal experiment sites 1991

No	River	Site	Date	Type of fish present			
				Salmon	Trout	Eel	Others
Tr4	A Colra Fhar	Balsporran (UC)	06 09 91	+	+	-	-
Tr2	Truim	Balsporran	09 08 91	+	+	+	-
Tr3	Truim	Balsporran (LC)	09 09 91	+	+	-	-
MB7a*	Riatta Burn	A9 (UC)	04 09 91	+	+	+	Mi
MB7b	Riatta Burn	Railway	07 08 91	+	+	+	Mi
MB7c	Riatta Burn	Lower (LC)	08 10 91	+	+	-	Mi

Notes

- * Site first examined in 1990
- ? Fry not identified as salmon or trout
- La Lamprey
- Mi Minnow
- Pi Pike
- St Stickleback
- LC Lower control for removal experiment
- UC Upper control for removal experiment

TABLE 8

River Fiddich

No	Site/Trib	Date	Population Density (m ⁻³) (95% conf limit)						
			Salmo			Trent			
			0+	1+	2+	0+	1+	2+	3+
F3	Auchendoun	03 10 91	3.15 (0.30)	0.21 (0.03)	0.35 (0.00)	1.22 (0.14)	0.08	0.03	0.01

Others

F2 Halvenie 23 05 91 Fry only
 F8 Bridge/Dullan 23 05 91 Trent only

Notes

1. F2 and F8 were fished only once.
2. The weir between F5 and F8 on the Dullan was dismantled in 1991 to allow salmon access.
3. 1990 data for F1 to F7 available in Loughton (1991).

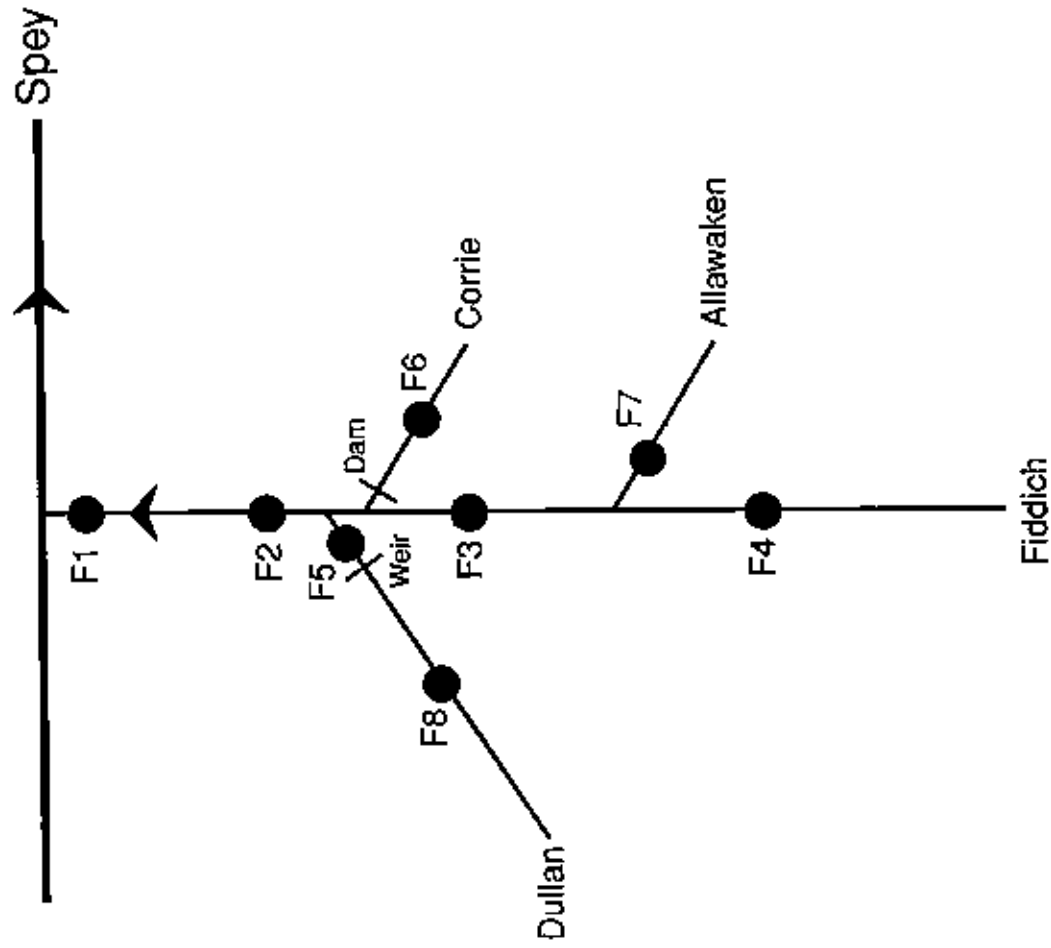


TABLE 4

River Avon

No	Site/Trb	Date	Population Density (m ⁻²) (95% conf limit)									
			Salmon					Trout				
			0+	1+	2+	3+	0+	1+	2+	3+		
A2	W/Inchida/ Livet	02 10 91	3.41 (0.37)	0.62 (0.06)	0.06		0.88 (0.07)	0.01				
A3	Dakess/Avna	28 05 91	0.93 (0.24)	0.05 (0.03)	0.02		0.02					
A4	Shallow Ford/ Avon	22 08 91	0.69 (0.74)	0.07	0.01	0.01	0.02	0.01	0.01	0.01	0.008	
A10	Air Shilshach	29 06 91	-	-	-	-	0.16	0.48	0.19	0.02		
A12	Above Ford/ Builg Burn	02 08 91	0.43 (0.15)	0.34 (0.04)	0.08		0.46 (0.04)	0.13	0.06			
A12	Above Ford/ Loin	13 08 91	**	0.43 (0.10)	0.13			0.11 (0.01)	0.09			

** Salmon and trout fry density not determined.

Others

A9 Faindourain 01 08 91 Fry only
A10 Ballcorach/Chabet Burn 15 10 91 Salmon and trout present

Notes

1. The fry at Faindourain were too small to identify, only six were caught giving density of 0.02 m⁻².
2. A10 fished only once to determine species.
3. 1990 data for A1 to A7 available in Laughton (1991).

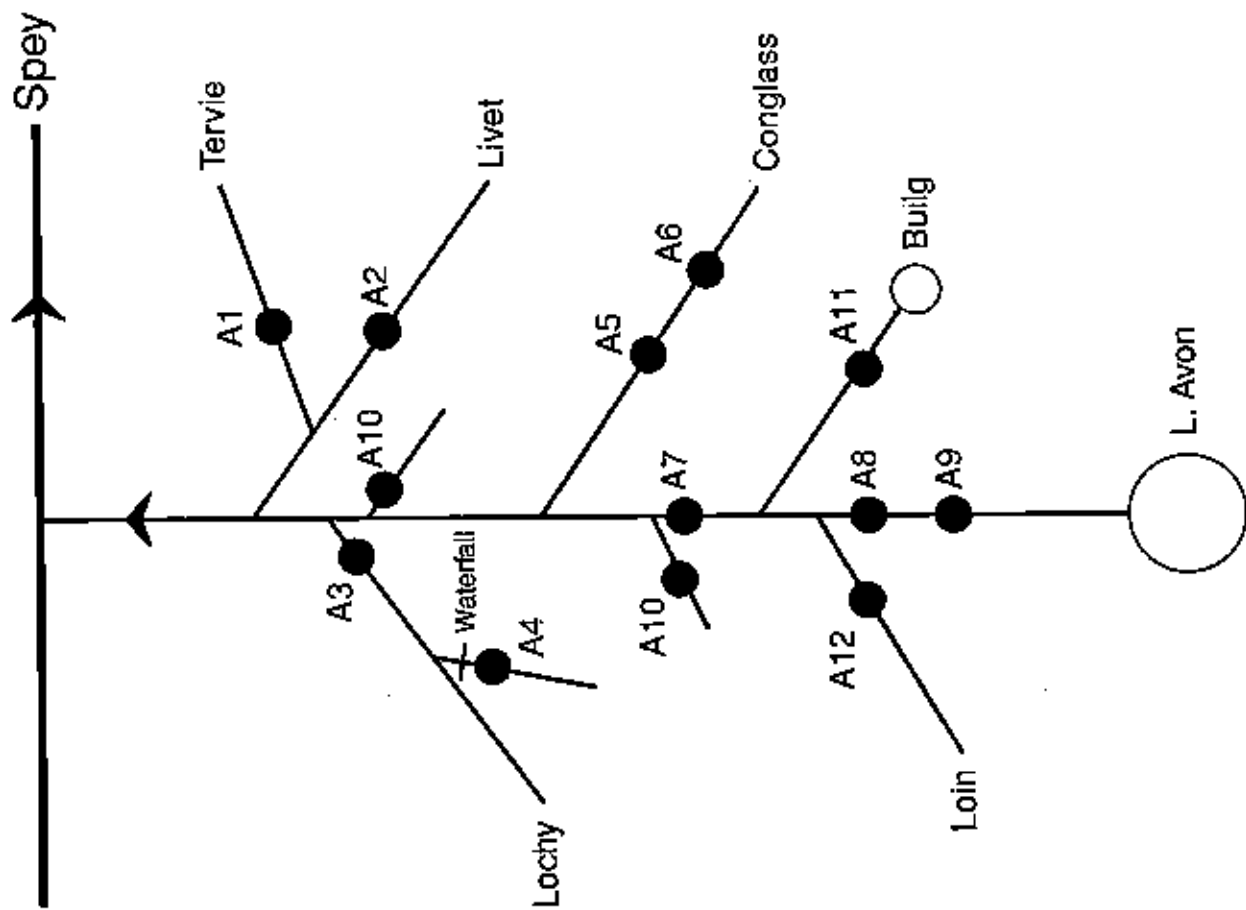


TABLE 6

Lower burns

LB3a	Delfur/Mulben Burn	21 05 91	Salmon and trout
LB3b	Mulben/Mulben Burn	21 05 91	Unidentified fry
LB4	Chapel Ley/Rothes Burn	23 10 91	Trout only
LB5	Tulchan/Dalvey Burn	05 06 91	Salmon and trout
LB6a	Below Distillery/Cromdale Burn	22 05 91	Salmon and trout
LB6b	Below Distillery/Cromdale Burn	22 05 91	Trout only

Notes

1. LB3 to LB6 were fished only once to determine species present.
2. Fry were too small to identify at LB3b
3. Waterfall prevents access to salmon below LB4.
4. Weir and waterfall prevents access to salmon and sea trout on LB4.
5. Distillery water intake between LB6a and LB6b prevents salmon and sea trout access.
6. 1990 data for LB1 and LB2 available in Laughton (1991).

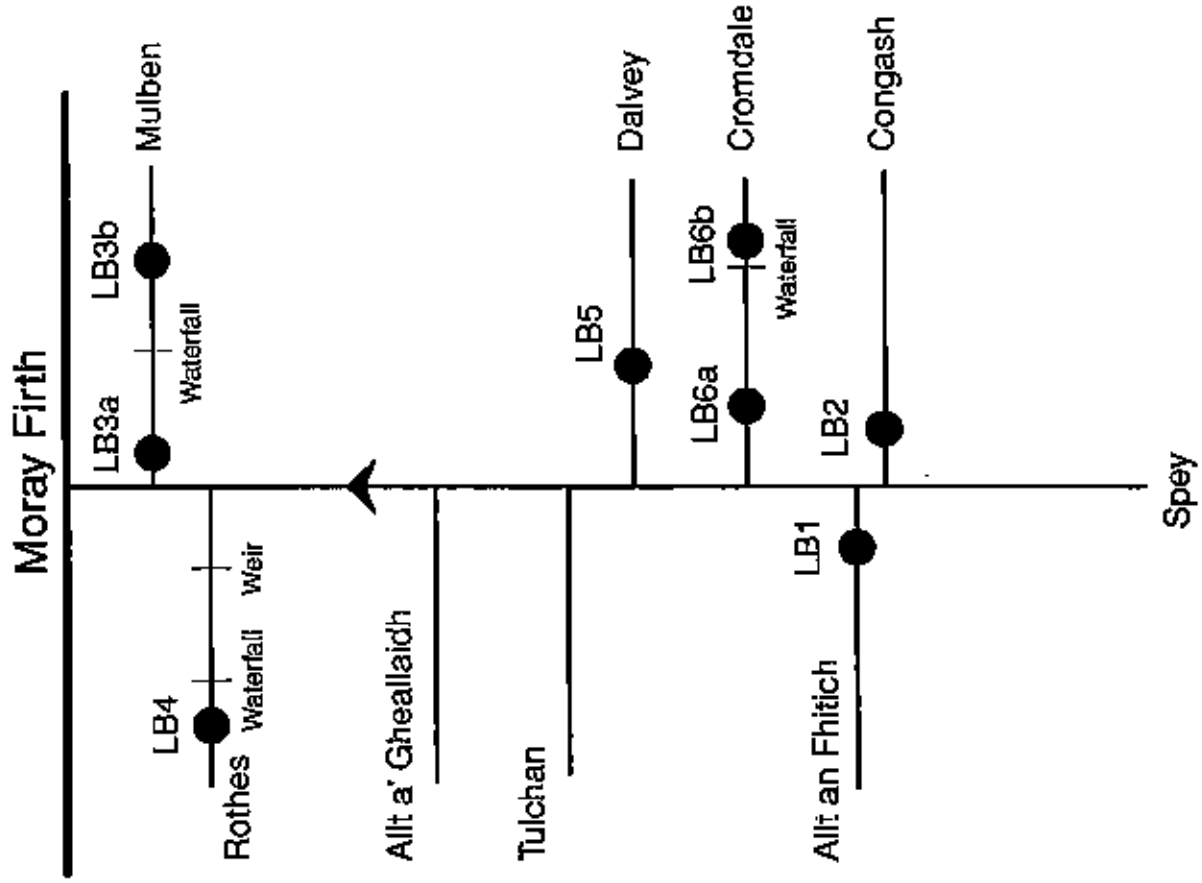


TABLE 6

River Dulnain

No	Site/Type	Date	Population Density (m ⁻²) (95% conf limit)					
			Salmon			Trout		
			0+	1+	2+	0+	1+	2+
D1	Duthill	12 08 91	4.16 (0.18)	0.11	0.028	6.18 (0.02)		
D7	E11	11 08 91	1.89 (0.27)	0.17 (0.04)	-	0.08	0.02	
D8	Separation bridge	30 08 91	1.05 (0.08)	-	0.06	0.18	0.04	
D9	A Slochd	21 08 91	0.85 (0.24)	0.05	0.02	1.03 (0.18)	-	0.12
D11	Bathymetry	30 08 91	0.23	0.10		1.91 (0.24)	0.08	0.03

Others

D10 Kinnara Bridge/Allt Fionnach 11 09 91 Trout only

Notes

1. D10 fished only once, adult access prevented by waterfall.
2. 1990 data for D1 to D7 available in Laughton (1991).

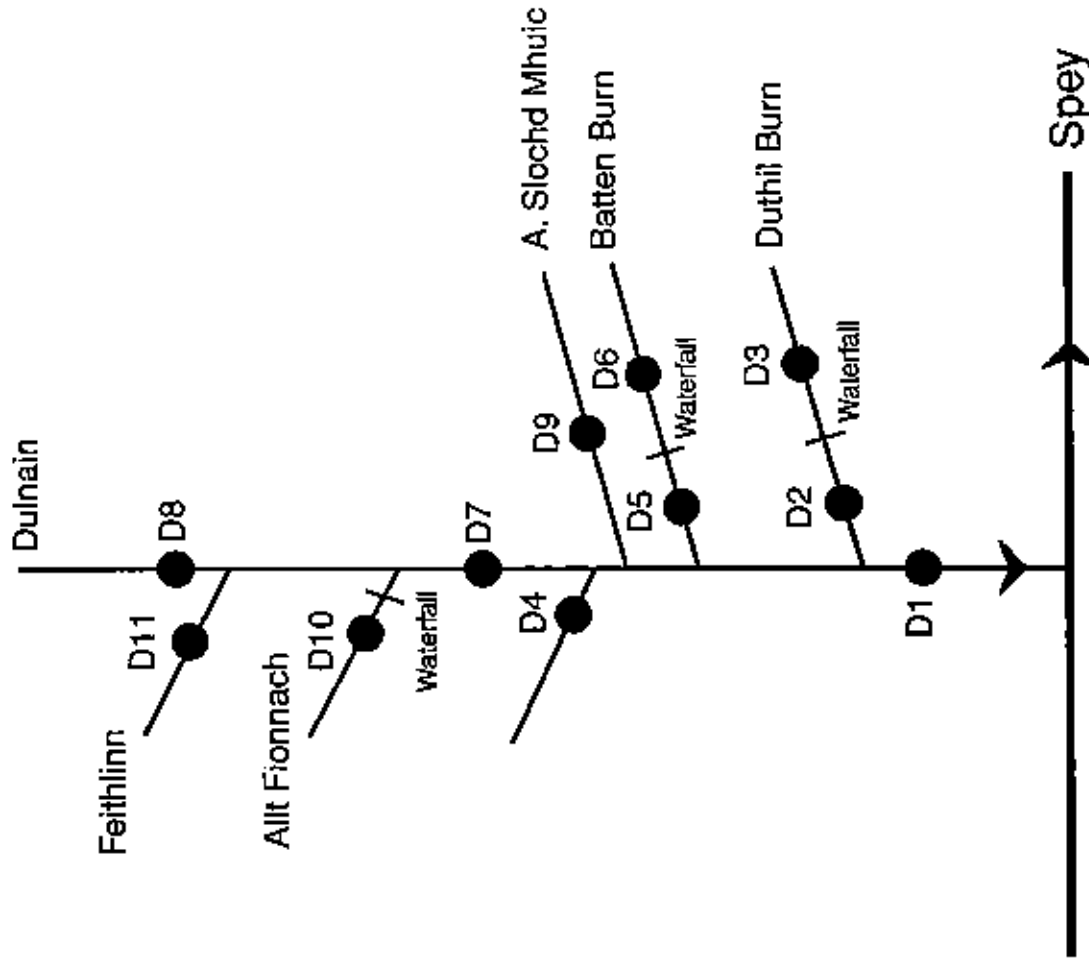


TABLE 7

River Nethy

No	Site/Date	Date	Population Density (no. / 100 m ² of bank)						
			Salmon			Trout			
			0+	1+	2+	0+	1+	2+	
N4	Drum/Dorback	04 06 91	**	0.99 (0.01)	0.23			0.14 (0.04)	0.006
N4	Drum/Dorback	04 10 91	1.22 (0.06)	0.17 (0.03)	0.29	0.12			
N5	Bridge/Aik Moor	03 08 91	1.84 (0.30)	0.13	0.02			0.23 (0.06)	

** Salmon and trout fly density not determined.

Notes

1. 1990 data for N1 to N5 available in Laughton (1991).

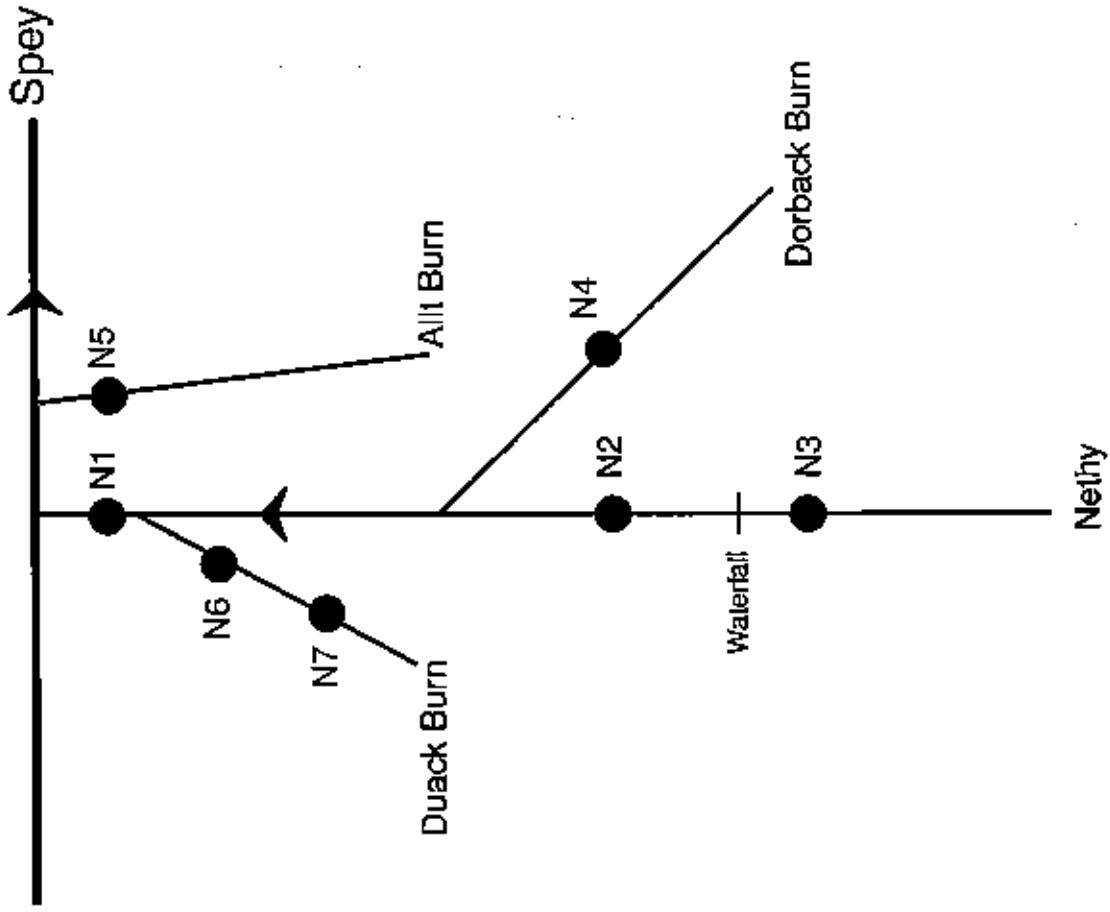


TABLE 8

River Druie

No	Site/Trib	Date	Population Density (ac ²) (95% conf limit)						
			Salmon			Trout			
			0+	1+	2+	3+	4+	5+	6+
Dr2	Chava/Allt Mor	16 08 91	0.00	0.18 (0.02)	0.28 (0.02)	0.31 (0.04)	0.08		
Dr6	C'agorm, BsrAm Beanaidh	13 08 91	0.46 (0.07)	0.18	-	0.05	0.08		
Dr7	Zid Feidhig Beanaidh	28 08 91	0.18	0.15 (0.04)	0.03	0.06	0.02	0.06	
Dr8	Beanaidh Bheag	28 08 91	0.58 (0.04)	0.09 (0.02)	0.11	0.28	0.03	0.06	

Salmon and trout density not determined.
 Minimum estimate a progressive reduction in catch was not achieved.

Notes

- 1990 data for Dr1 to Dr8 available in Laughton (1991).

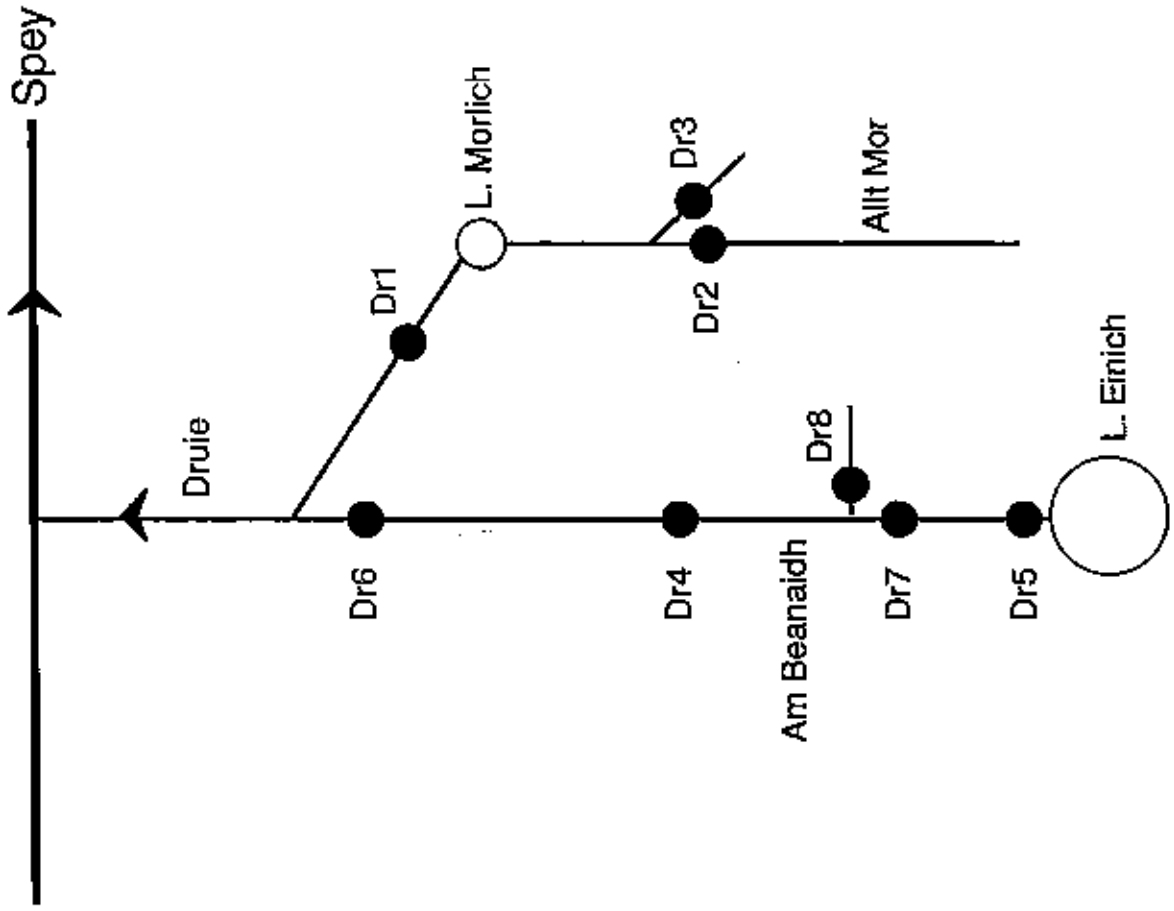


TABLE 9

River Feshie

No	Site/Trib	Date	Polychlorinated Biphenyls (PCBs) (ppb)											
			Salmon						Trent					
			B ₁	B ₂	B ₃	B ₄	1 ₁	1 ₂	2 ₁	2 ₂	3 ₁	3 ₂	4 ₁	4 ₂
Fe8	Garbhloch Muirh	10 09 91	0.31 (0.08)	0.09 (0.02)	0.06	0.12 (0.03)	0.07	-	0.01	0.01	-	-	0.01	0.01
Fe9	2nd Ford	10 09 91	0.54 (0.08)	0.02	0.12	0.08	-	-	-	-	-	-	-	-
Fe10	Black Lochy	08 08 91	0.34 (0.03)	-	0.01	0.02	0.04	-	-	-	-	-	-	-
Fe2	Bridges/ A. Ruadh	06 06 91	0.70	0.30	0.45 (0.14)	0.09	0.06	0.31	0.07	0.01	-	-	-	-
Fe2	Bridges/ A. Ruadh	16 10 91	0.15 (0.04)	0.20	0.11	0.09	0.08	0.03	0.03	-	-	-	-	-

me Minimum estimate only a progressive reduction in catch was not achieved.

Notes

1. 1990 data for Fe1 to Fe7 available in Laughton (1991).

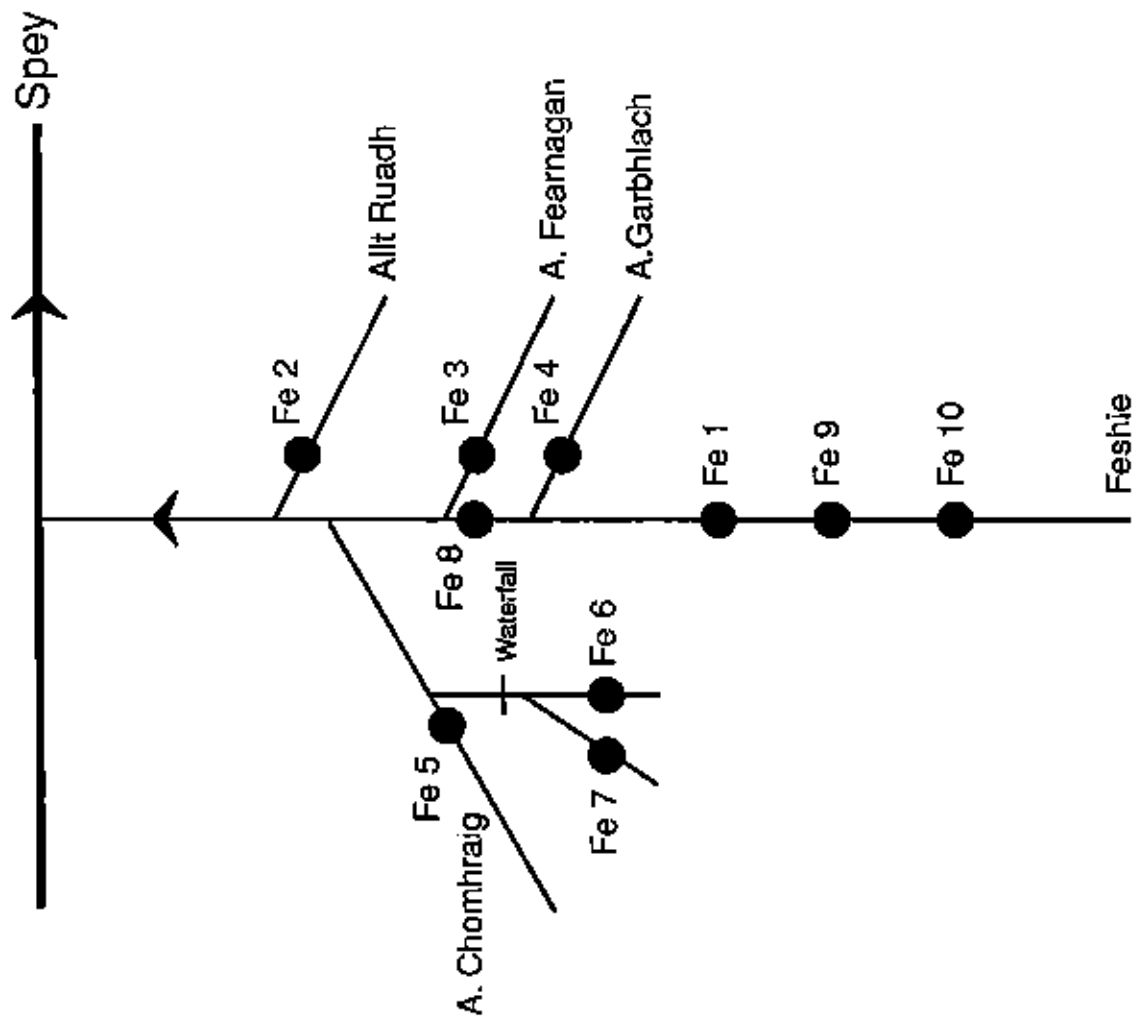


TABLE 10

River Tromie

No. Sites/Trib	Date	Population Density (m ⁻³) (95% conf limits)							
		Salmon			Trout				
		0+	1+	2+	0+	1+	2+	3+	4+
T4 Dailraich	11 08 91	0.00	0.08	0.07	0.00	0.008	0.03	0.01	
T2 Lechan Duin	22 10 91	0.00	0.03	0.04	0.06		0.01		0.01

Others

T5 Above Dam/Bhran 22 10 91 Trout only

Notes

1. No salmon or trout fry were caught at T4. The site was visited in early June which may be before complete fry emergence.
2. T5 fished only once to determine species present, dam prevents adult access.
3. 1990 data for T1 to T3 available in Laughton (1991).

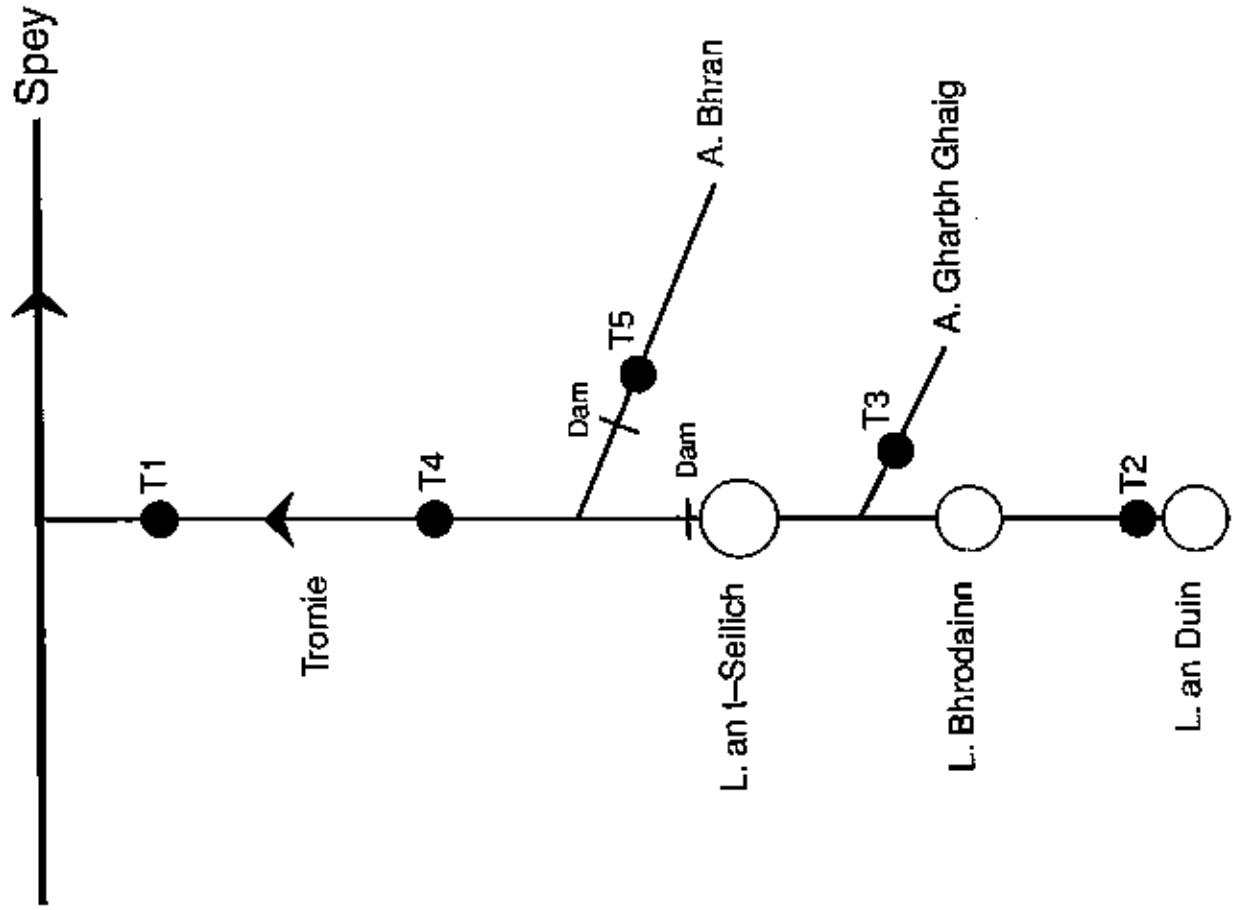


TABLE 11

River Calder

No	Site/Trib	Date	Population Density (m ²) (95% conf limit)									
			Salmon					Trout				
			0+	1+	2+	3+	0+	1+	2+	3+		
C1	Coilages	23 06 91	0.07	0.14	-	0.006	0.05	-	0.01	0.006		
C2	Cherry Body	25 06 91	0.18	0.14	0.08	-	-	0.10	0.01			

Notes

1. No Calder sites were examined during 1990.

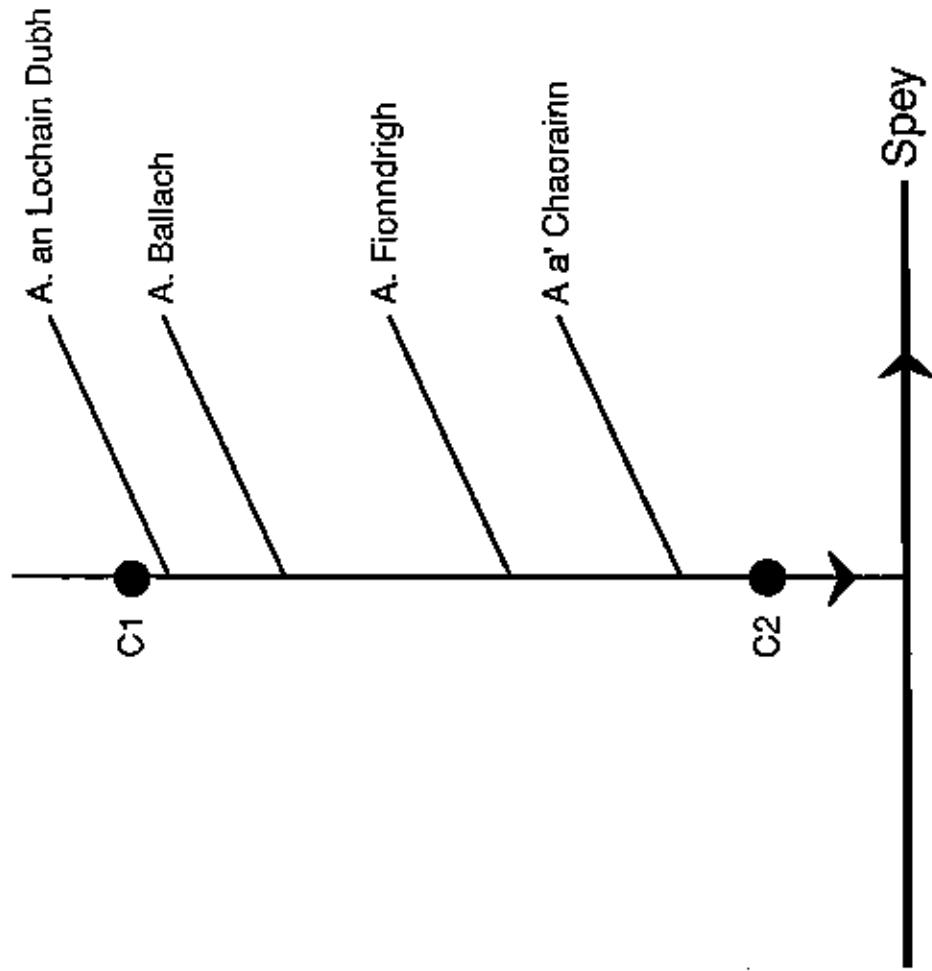


TABLE 12

River Truim

No	Site/Trib	Date	Population Density (m ⁻³) (95% conf limit)					
			Salmon			Trout		
			0+	1+	2+	0+	1+	2+
Tr1	Crubenmore	12 06 91	--	0.08	0.15	-	0.01	0.01
Tr1	Crubenmore	16 10 91	1.38 (0.03)	0.06	0.12	0.09	-	0.008
Tr2	Balsporran	09 06 91	1.02 (0.05)	0.12	0.03	0.16 (0.01)	0.008	0.008
Tr3	A Coire Fhar	06 09 91	0.70	0.14	0.10	-	-	-

-- Salmon and trout fry density not determined.

Notes

1. Tr2 and Tr3 were examined as part of a depletion experiment, initial densities are presented here. Further details will be presented by Armstrong *et al.* in due course.
2. 1990 data for Tr1 to Tr2 available in Loughton (1991).

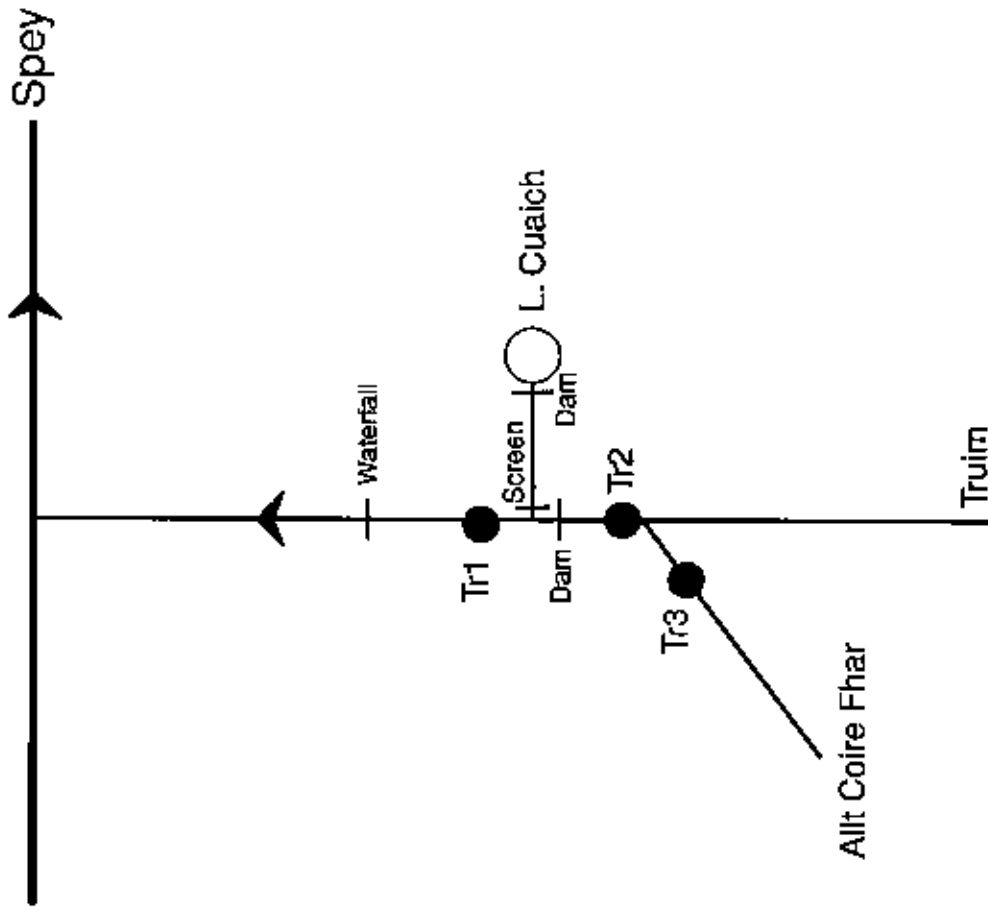


TABLE 13

Middle Spey Burns

No	Site/Trib	Date	Population Density (m ⁻²) (95% conf limit)					
			Salmon		Trout			
			0+	1+	2+	0+	1+	2+
MB7a	A9 Bridges/ Riatis Burn	04 09 91	0.29	0.20	-	0.71	0.03	-
MB7b	Railway/ Riatis Burn	07 08 91	0.06	0.05	-	0.76 (0.02)	0.007	-
MB7c	Lower Site/ Riatis Burn	13 09 91	0.20	0.01	-	0.47	-	-
MB14	Wades Bridge/ Milton Burn	01 10 90	0.02	0.02	-	0.03	-	0.04

Others

MB15 Strone/A Laraidh 14 08 91 Salmon and trout

MB10b Auchmore/A Dobhrain 12 10 91 Trout only

Notes

1. MB15 fished only once.
2. MB10b is located on a canalised drainage ditch. The site was electro-fished primarily for juvenile pike.
3. 1990 data for MB1 to MB13 is available in Leighton (1991).

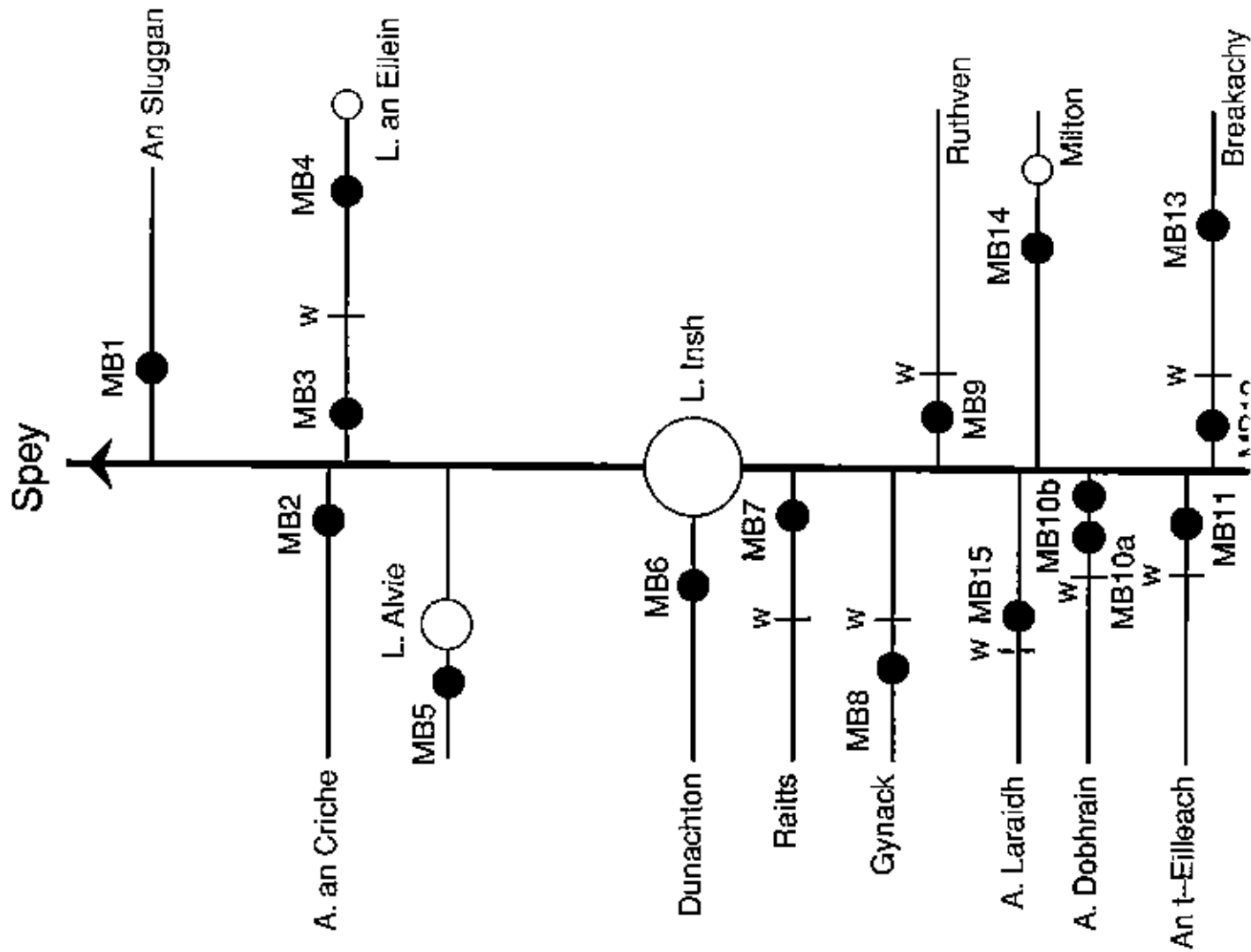


TABLE 14

Spey Dam

SD4	Garry Bridge	08 08 91	Salmon and trout
SD6	Sheagan	25 02 91	One salmon parr
SD6	Above Screen/Markie	14 08 91	Salmon and trout
SD7	Laggan Inlake/A Crunachdain	26 08 91	Trout only
SD8	Feith Talagain	08 08 91	Trout only

Notes

1. SD4 to SD8 fished only once. Very low numbers of salmon and trout present.
2. Dam/screen makes adult access difficult to SD6.
3. Screens prevent adult access to SD7.
4. Waterfall prevents adult access to SD8.
5. 1990 data for SD1 to SD3 available in Laughlin (1991).

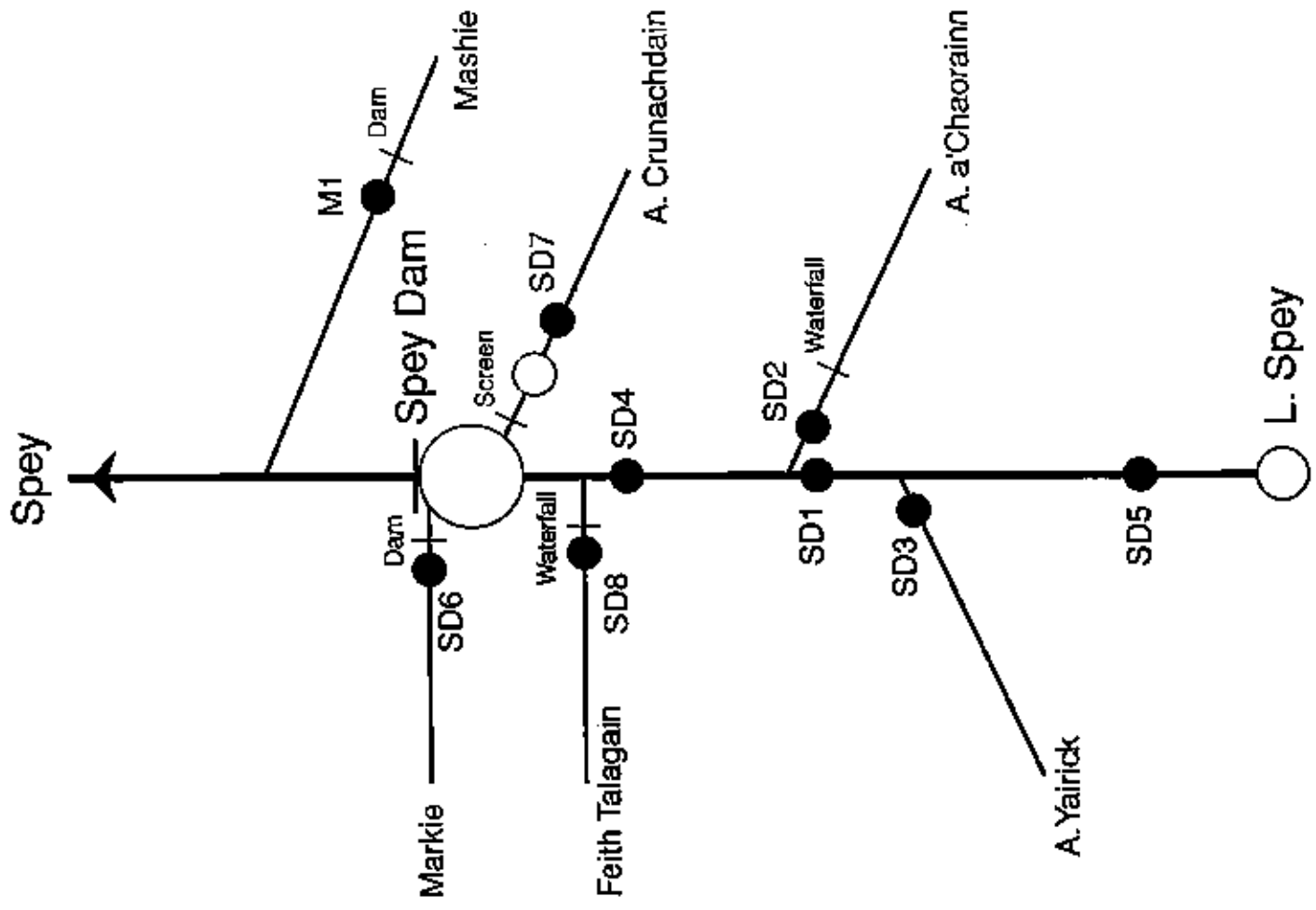


TABLE 15

Salmon and trout densities at nine sites electro-fished in 1990 and 1991

Site/River		Date	Salmon (m ⁻²)		Trout (m ⁻²)	
			1+	2+	1+	2+
F3	Fiddich	18 06 90	1.18	0.68	0.19	-
		03 10 91	0.24	0.30	0.06	0.01
A2	Livet	22 05 90	0.89	0.34	0.02	0.01
		05 06 91	0.86	0.10	0.15	0.02
D1	Dulnain	04 06 90	0.56	0.12	-	-
		13 08 91	0.11	0.008	-	-
N4	Dorback	24 05 90	1.00	0.12	0.03	0.01
		04 06 91	0.30	0.03	0.14	0.006
Dr2	Allt Mor	02 08 90	0.49	0.26	0.18	0.22
		16 08 91	0.13	0.23	0.18	0.09
Fe2	A Ruadh	31 07 90	0.40	0.15	0.16	0.02
		06 06 91	0.20	0.51	0.21	0.07
T2	Tromie	22 08 90	-	0.10	0.01	-
		22 10 91	0.03	0.04	-	0.01
Tr1	Truim	15 05 90	0.55	0.15	0.01	-
		12 06 91	0.08	0.16	0.01	0.01
MB7a	Riatts	15 09 90	0.23	-	0.009	0.009
		04 09 91	0.20	-	0.02	-

TABLE 16

River Spey water samples 1990-91

Date	River	pH	Alk	Cond
21 06 90	Fiddich (Above Distilleries)	8.22	1310	154
28 09 90	Avon: Tervie	7.65	609	101
22 08 90	Avon: Loin Burn	7.55	353	57
06 06 90	Nethy	7.05	160	35
31 07 90	Allt Ruadh	6.91	75	24

FIGURE LEGENDS

- Figure 1 Map of the River Spey showing the electro-fishing sites on the main tributaries. The sites on the lower and middle burns are not shown.
- Figure 2 The range of 0+, 1+ and 2+ population densities found during 1991 for, a) Salmon and b) Trout.
- Figure 3 The population densities for 1+ and 2+ salmon and trout at six 1990 sites which were revisited in 1991.
- Figure 4 The population densities for 1+ and 2+ salmon and trout at four sites which were visited in June and October 1991.
- Figure 5 The mean length of 1+ salmon at five sites recorded in June and October 1991.
- Figure 6 The mean length of 1+ salmon at five sites of different altitude recorded in June and October 1991.

Figure 1

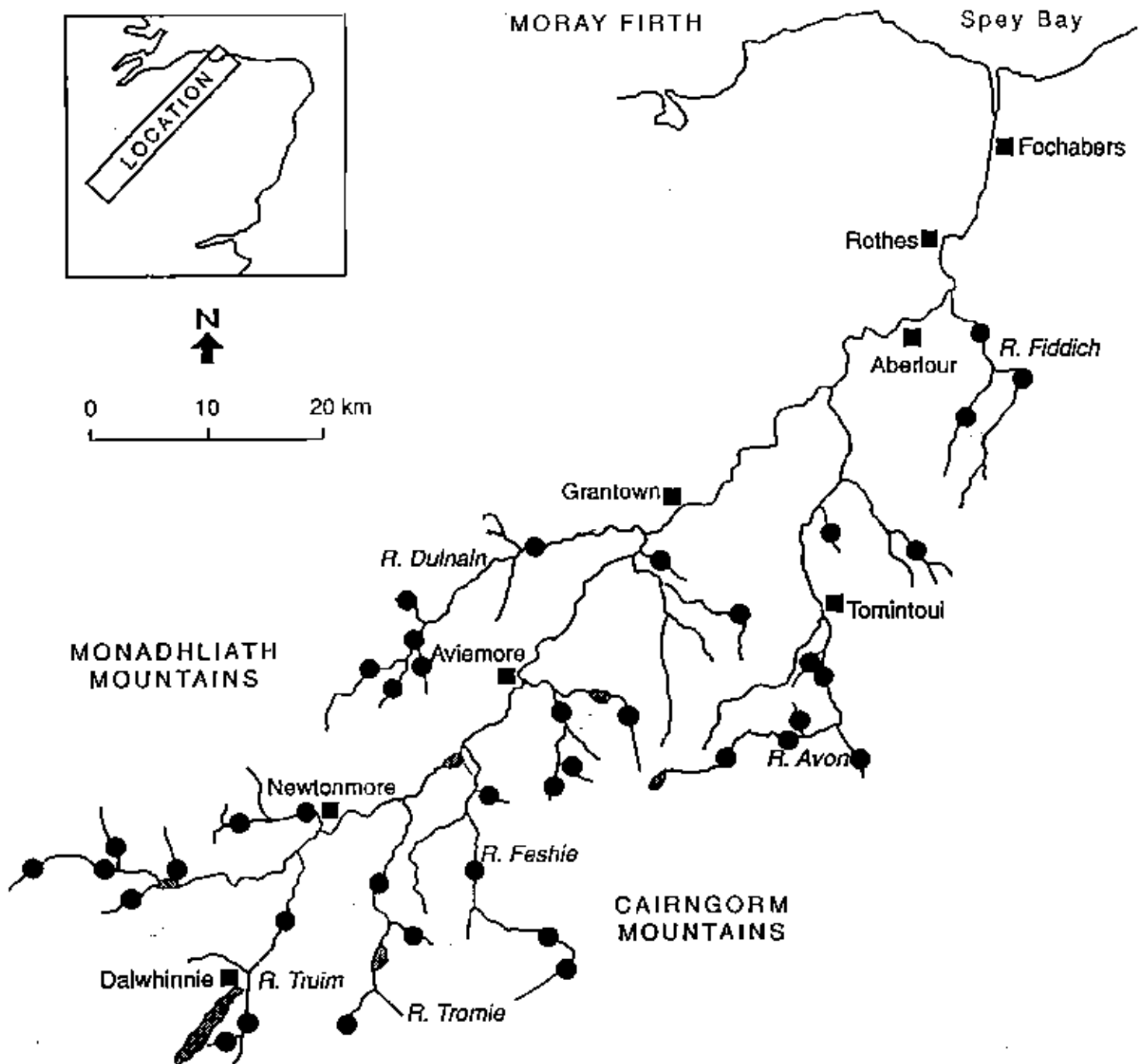


Figure 2

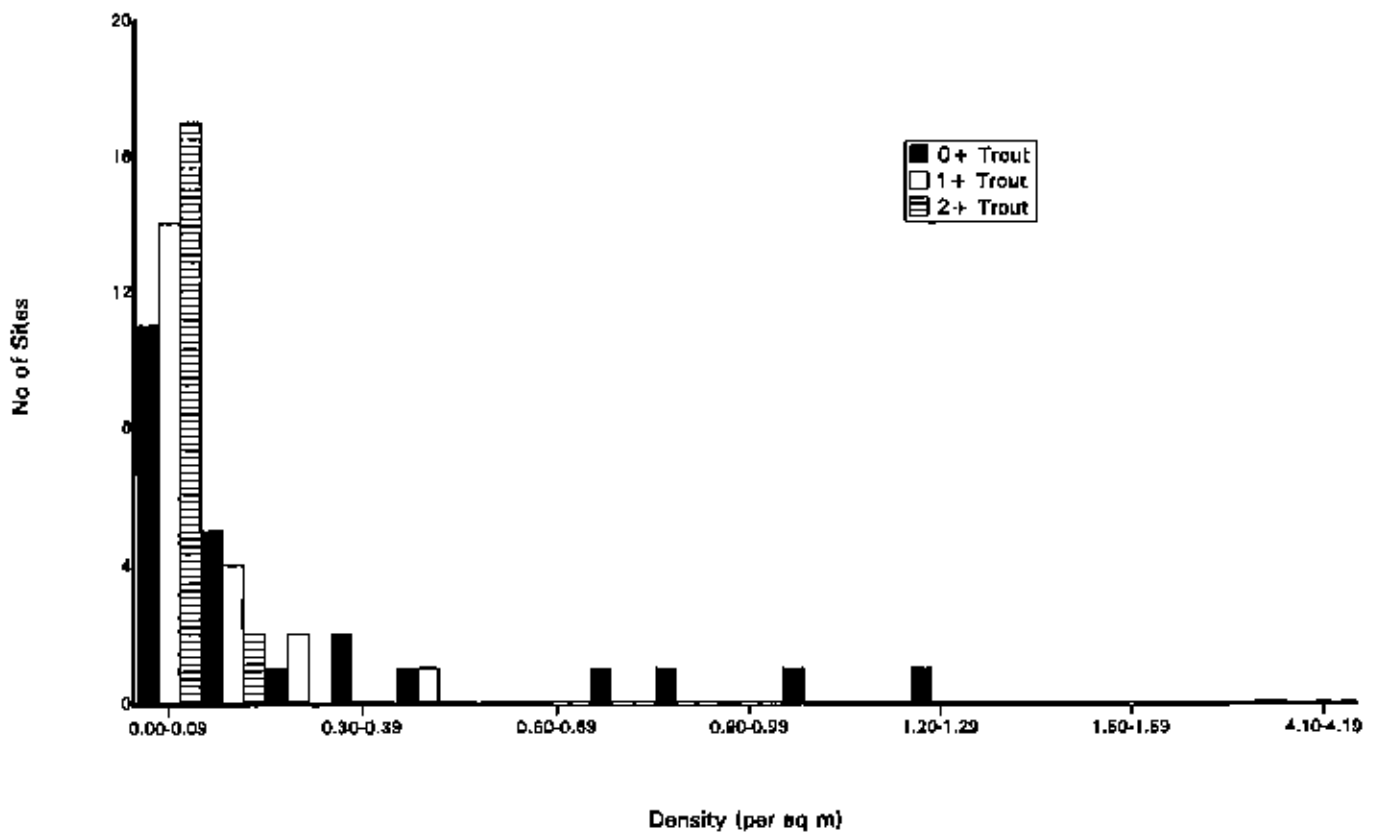
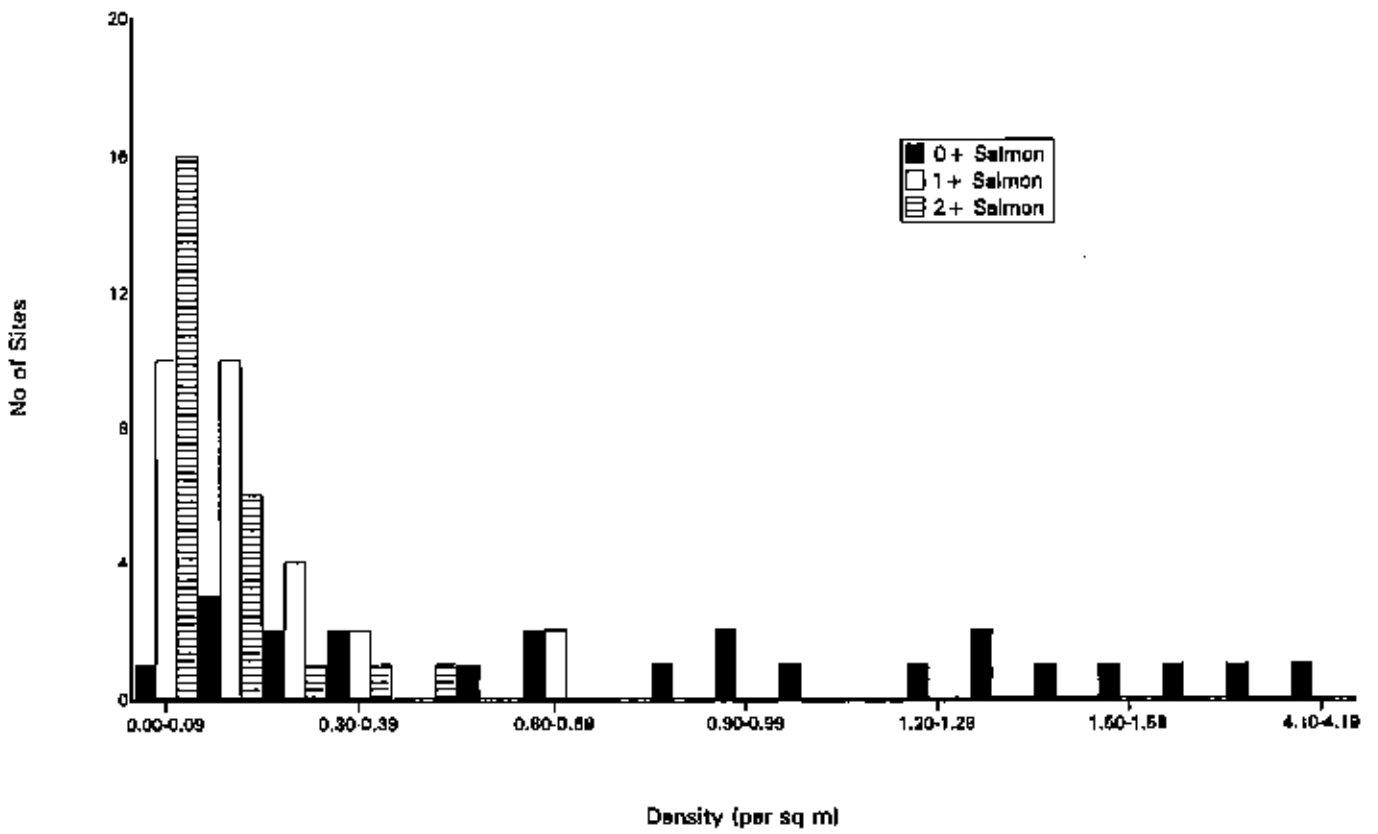


Figure 3

□ 1990
■ 1991

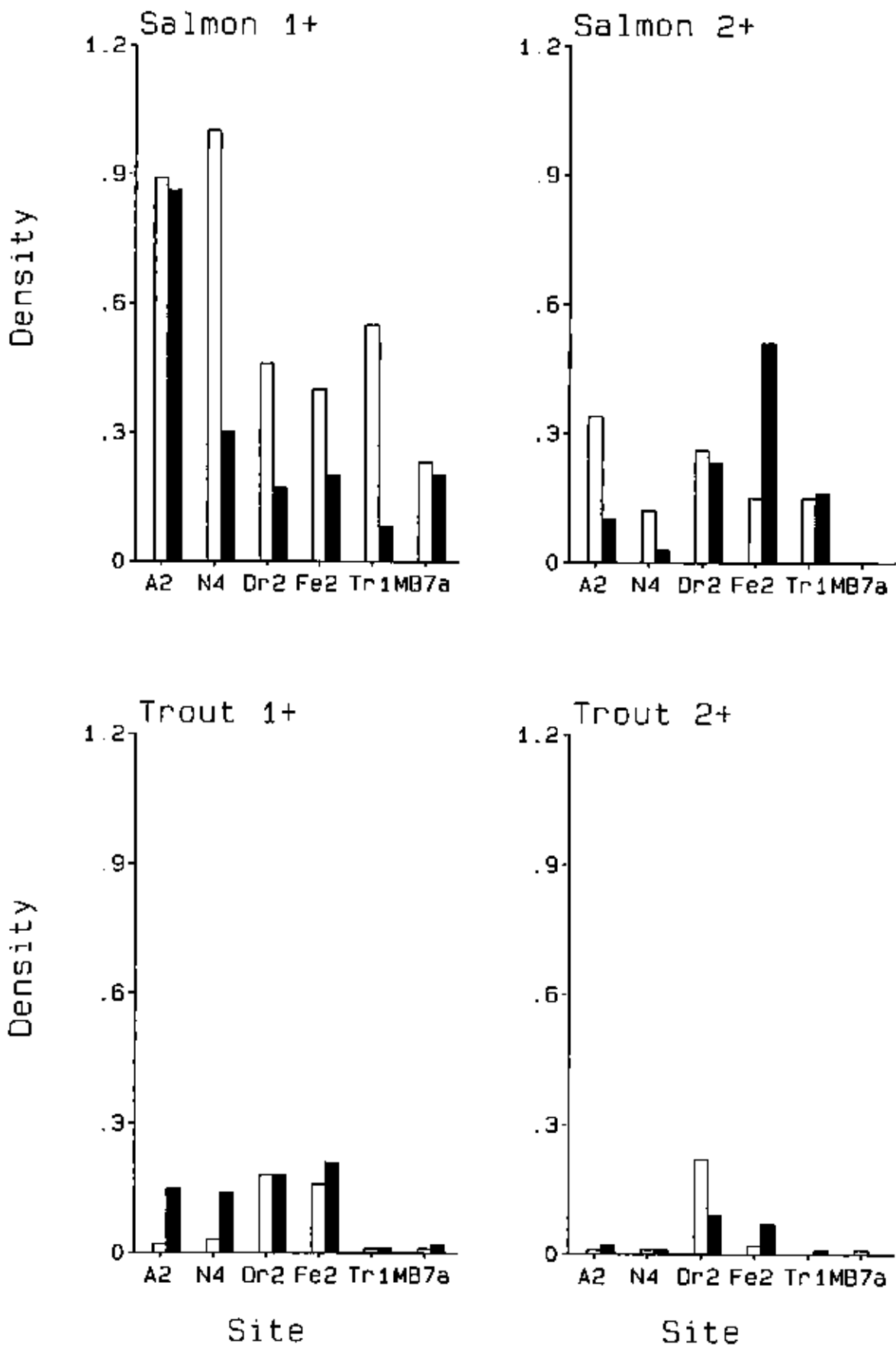


Figure 4

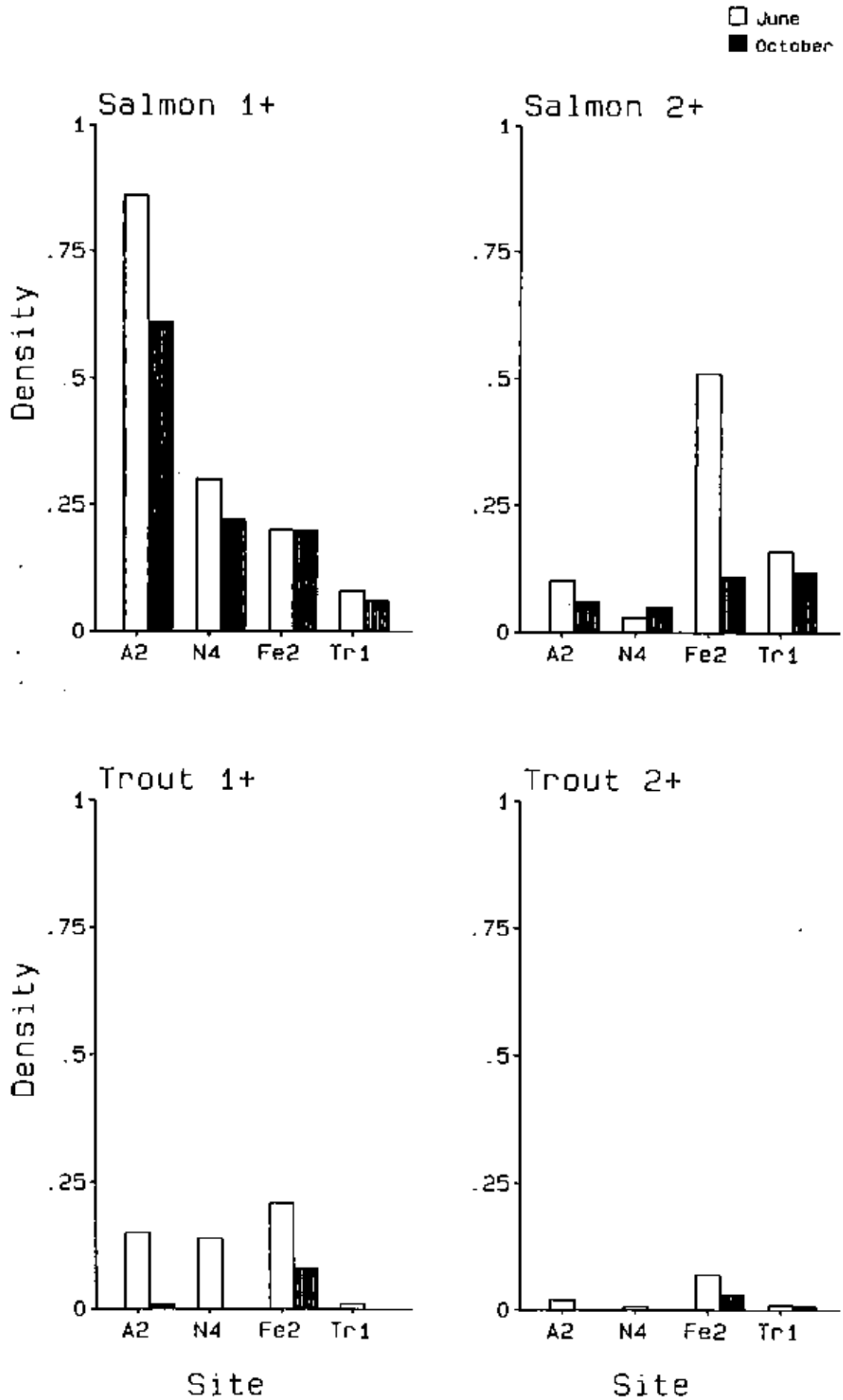


Figure 5

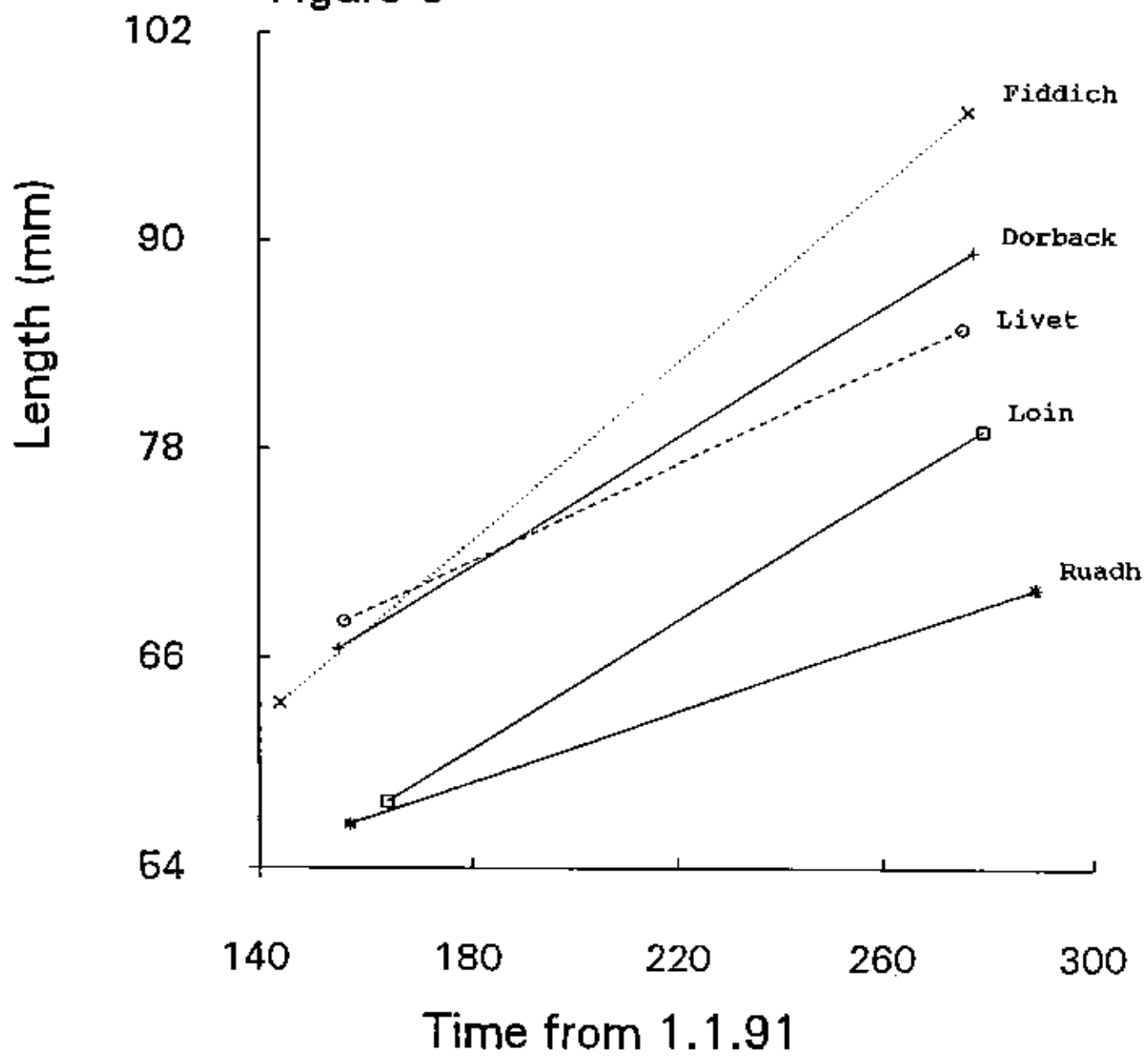


Figure 6

