

Not to be quoted without permission of the author

Fisheries Research Services Report No 14/91

RIVER SPEY JUVENILE SURVEY - 1990

by

R Laughton

July 1991

The Scottish Office Agriculture and Fisheries Department
Marine Laboratory
PO Box 101
Victoria Road
Aberdeen

RIVER SPEY JUVENILE SURVEY - 1990

R Laughton*

SOAFD Marine Laboratory
Aberdeen

INTRODUCTION

Radio tracking studies carried out during 1988 and 1989 showed that the spring running component of the River Spey stock progress to the upper reaches of the catchment (Laughton, 1989, 1991, in prep.). Research on the Cally Burn, a small tributary of the Spey, suggests that the behaviour of the spring salmon progeny is different to that of the grilse progeny raised under similar conditions (Morgan and Poulson, 1991, in prep.). In general the smolts and pre-smolts of spring fish origin migrate earlier than those of grilse. The grilse progeny also show higher numbers of mature male parr.

The implications from these findings are important in the future management of the River Spey stocks. If any attempt to increase the numbers of spring salmon returning to the river is to be made through stocking then it is evident that both the correct progeny must be used and that appropriate areas of the river chosen for the stocking.

During 1990 research activities were extended to examine the distribution and population densities of salmon and trout throughout the catchment. Particular attention was paid to the upper tributaries which are important in the production of the early running spring salmon.

During 1990 approximately half of the Spey catchment was surveyed, the remainder will be completed during 1991. This report contains a summary of the results obtained during 1990.

MATERIALS AND METHODS

An electro-fishing survey was carried out at various locations throughout the Spey catchment using techniques similar to those described by Gardiner (1989). In general, sites for electro-fishing were pre-selected at random; in practice, however, vehicle access often limited the areas which were available to survey. Where obstructions such as waterfalls, dams or weirs were present, sites above and below the barrier were selected.

*Employed by Spey District Salmon Fishery Board

The equipment used during the study consisted of a small portable Honda EM500 generator coupled with a transformer and control box to supply smoothed DC current. A battery operated back-pack system was also used to examine some of the inaccessible areas or when the generator system was under repair.

Each survey site encompassed an area of approximately 100 sq metres and contained a variety of habitats such as pools and riffles. The boundaries of each site were marked using ropes and the area between was fished either three times to allow density calculations (Zippin, 1958), or only once to determine the species present.

The fish caught were placed in a solution of anaesthetic (MS222 1:10,000 Sandoz), identified, their fork length measured, weighed, and a proportion scale sampled for age determination.

The physical characteristics of each site such as substrate type, depth, width, presence of overhanging banks and trees and the surrounding land use were all recorded. A water sample was collected at many sites for pH, alkalinity and conductivity determination. The presence of any effluent discharges and obstructions such as waterfalls and dams was also recorded.

Where possible the population densities were calculated for each age class of salmon and trout present. The densities were calculated using the Zippin (1958) method. 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. Where the Zippin (1958) method could not be applied the total catch divided by the area fished provided a minimum estimate. With the exception of site Fe1, densities are not given for areas which were fished only once.

RESULTS

Figure 1 shows the positions of the tributary sites on the River Spey which were electro-fished during 1990. For simplicity the lower and middle burn sites are not shown. 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.

A total of 64 sites was examined during 1990. Of these, 38 were fished three times to allow the population density to be calculated, the remainder were fished only once to determine the species present.

Distribution of Fish Species

The distribution of fish species in the sites examined is presented in Table 1.

The results presented in Table 1(a) to (d), indicate that seven fish species were found, these include salmon (*Salmo salar*), trout (*Salmo trutta*), eels (*Anguilla anguilla*), brook lamprey (*Lampetra planeri*), minnow (*Phoxinus phoxinus*), three-spined stickleback (*Gasterosteus aculeatus*) and pike (*Esox lucius*).

Salmon and trout were the most widely distributed species and were found at 52 (81%) and 63 (98%) of the 64 sites respectively. Eels were also widely distributed, appearing at 34 (53%) of the sites, lampreys were present at nine (14%), minnows at seven (11%) and sticklebacks and pike at one (2%) each.

Salmon, trout and eels were found throughout the system, while the minnows, sticklebacks and pike were all found at sites upstream from Grantown. However, Morrison (1989), records minnows and sticklebacks in the Fiddich. Other species which are present in the Spey are the Arctic charr (*Salvelinus alpinus*) and rainbow trout (*Oncorhynchus mykiss*). Neither was found during this survey.

Salmon Densities by Age Class

Tables 2 to 12 show the age class densities for salmon and give schematic diagrams of the sites on each tributary. Figure 2(a) gives a summary of the densities of salmon in the 38 sites which were fished three times.

In many sites the figure given for fry is for salmon and trout combined. During the early season ie May and June it was difficult to distinguish the species. It is worth noting, however, that very high densities of 0+ were recorded at some sites. For example, F2, F3, F4 and F5 on the Fiddich; A2, A5 on the Avon; N1 and N2 on the Nethy all recorded combined densities greater than 1.00 m⁻². The high densities at these sites indicate a good spawning stock; however, there is likely to be some loss through density dependent mortality as the year progresses.

Where 0+ salmon densities were determined the range was 0.009 to 0.88 m⁻², with quarter densities at 0.14 m⁻², 0.29 m⁻² and 0.44 m⁻². The range of densities for 1+ salmon was 0.006 to 1.18 m⁻², with quarter densities at 0.18 m⁻², 0.36 m⁻², and 0.55 m⁻². The range recorded for 2+ parr was 0.01 to 0.68 m⁻², with quarter densities at 0.05 m⁻², 0.10 m⁻² and 0.20 m⁻².

The highest densities of salmon fry were found at A1 and MB11, while the sites with the highest density of 1+ salmon were F4, A2, N2, and N4. Site N2 also showed the highest density of 2+ salmon. Salmon age 3+ were also found at sites Fe1(b), Fe2, T1 and T3, in the upper areas of the catchment.

Trout Densities by Age Class

Tables 2 to 12 also show the age class densities for trout. Figure 2(b) gives a summary of the densities of trout in the 38 sites which were fished three times.

The range of densities for 0+ trout was 0.006 to 1.26 m⁻², with quarter densities at 0.08 m⁻², 0.13 m⁻² and 0.65 m⁻². The range of densities for 1+ trout was 0.009 to 0.41 m⁻², with quarter densities at 0.03 m⁻², 0.08 m⁻², and 0.18 m⁻². The range recorded for 2+ trout was 0.009 to 0.38 m⁻², with quarter densities at 0.01 m⁻², 0.04 m⁻² and 0.08 m⁻².

The highest densities of 0+ trout were found at A1, MB11, LB1 and LB2, while the highest density of 1+ trout was found at Dr3. The highest density of 2+ trout was within the same catchment at Dr2. A total of 15 sites produced trout of age 3+, the densities were all <0.10 m⁻², the highest being recorded at MB6; three 4+ trout were caught at one location, T3 (density 0.02 m⁻²), while one was caught at Dr2. It is also worth noting that some of the sites which were fished once only produced high densities of trout, in particular A6 on the Conglass Burn and F7 on the Allawaken Burn, River Fiddich.

In general most of the salmon and trout caught were of age 0+, 1+ or 2+. The range of densities for the 0+ fish was similar, while the older trout age classes showed a more restricted range than the equivalent age classes of salmon (Fig. 2). Salmon older than 2+ were rare and were limited to the upper catchment. However, older age classes of trout were observed at a number of locations.

Sites with Low Salmon or Trout Densities

While it is encouraging to have recorded many sites within the catchment with high densities of salmon, it is perhaps the ones with low densities which are of most interest. Several sites showed low levels of particular age classes but were stronger in others; for example, Dr2 shows lower 0+ densities than the 1+ and 2+ year classes.

Some sites were low in all age classes and/or had year classes missing. Where possible some of these sites were revisited during November to determine the presence of either salmon or trout redds. These data are included where relevant.

Site D2 on the Duthil Burn, below the falls, had low densities of all salmon age classes; however, trout fry densities were high.

The Fe1(a) and (b) sites, on the main stem Feshie, had no 0+ salmon present and low densities of 1+ and 2+ fish. The area was examined for redds on 16 November but none were found. The River Feshie in this area is wide, fast flowing with light coloured, clean substrate making the presence of redds difficult to determine. The results may indicate that the area is not

favoured for spawning, and those juvenile salmon which were present may have moved in from upstream. Alternatively, any eggs present from 1989 redds may have been washed away by the extensive flooding experienced by the Feshie during early 1990.

The River Tromie sites T1 and T3 were low in all age classes. At site T2 the densities of 0+ and 2+ salmon were in the second quarter; however, 1+ salmon were missing. The low densities observed at T1 may have resulted from the area being bulldozed during the summer 1990 to protect nearby fields against flooding. Sites T2 and T3 are upstream from the An t-Seilich Hydro Dam. The dam has a fish ladder and it is evident from the results presented here that salmon can ascend successfully.

The River Tromie from Loch an Duin to Loch Bhrodainn was examined for redds on 8 November. Three salmon redds were observed approximately 1.5 km downstream from Lochain Duin mouth, two being close together while the third was further downstream. One adult salmon, (length approximately 50 cm, possible male), was observed, although not on or near any of the redds. Within the sample site T2, one brown trout redd was located, with a pair of trout in attendance. Several small redds were located at the outflow of Loch an Duin, these being either charr or trout redds. The Allt Gharbh Ghaig was examined from its confluence with the Tromie to approximately 1 km upstream from site T3. No positive salmon redds were observed; however, three small trout redds were located with a pair of trout present at one (approximate lengths 20-30 cm).

Two middle burn sites MB6 and MB8 had only 2+ salmon present. In the case of the Gynack site (MB8) access to salmon may be limited by a waterfall further downstream. The Dunachton Burn (MB6) has no obvious barriers; however the site contained a deep pool (40-50 cm) surrounded by overhanging tree roots which favoured trout.

Low densities were observed in the Mashie (M1). No obstructions to access were observed, although water abstraction from the Mashie to Loch Laggan does take place. This constricts the flow regime and may affect adult salmon migrations into the tributary.

At site SD1, above Spey Dam, 0+ densities were in the second quarter, but 1+ were very low. The main stem Spey from Allt a'Chaorainn to the Allt Yairick, including the lower reaches of both of these tributaries, was examined for redds on 7 November. No salmon or trout redds were located.

Sites with an Absence of Salmon

In total 12 sites contained no salmon, these being F6, F7, D3, D5, N3, N7, Fe6, Fe7, MB1, MB4, MB5 and MB13. In most cases the absence of salmon was related to the presence of an impassable obstruction, usually a waterfall, or on one occasion a small dam at site F6. The exceptions were at sites F7, N7 and MB1. At sites F7 and N7 the stream was narrow, slow moving, with

deep overhangs and few riffle areas, these conditions favouring trout rather than salmon. Site MB1 contained many riffle areas interspersed with shallow pools and looked suitable for salmon. It is not known if there is an obstruction to salmon entry further downstream.

River Fiddich - Growth Rates

It is evident from Table 2 that the densities of salmon and trout in the River Fiddich are high, generally in the upper quarter. It is also evident that 2+ salmon and trout are rare in the lower sites, F1, F2 and F5. These sites are downstream from the input of distillery cooling water while sites F3 and F4 are above any input.

The mean lengths of 1+ and 2+ salmon and trout are presented in Table 13. It is clear from Table 13 that the juveniles at sites F3 and F4 are smaller than those at the three sites further downstream.

The growth rates of juvenile populations in the River Fiddich have been studied by Morrison, (1989). He concluded that the growth rates of fish downstream from the input of distillery cooling water are greater than for fish of the equivalent age class further upstream. The results presented here concur with his findings.

CONCLUSIONS

The general indications are that many of the areas examined during the study have good stocks of salmon. The sites on the Fiddich, lower Avon, lower Dulnain, Druie and Truim were all well stocked. Year classes 0+, 1+ and 2+ were found at most sites where salmon were present, while 3+ were found at some. Two sites on the Feshie recorded good densities as did one of the middle burns the An t-Eileach.

The Rivers Tromie and Mashie showed much lower densities than those further downstream. It should be noted that these sites, with the exception of T1, are at the extremes of salmon migration and may not be representative of the stream as a whole. The area above Spey Dam also had low densities of 1+ parr.

The Tromie sites (T2 and T3) and the Spey Dam sites are upstream from dams. This may affect the upstream migrations of spawning adults. However, more sites from below the dams need to be studied to give a comparison.

Trout were found at all except one site during the survey. At many sites 0+ trout densities were similar to those of the salmon. However, at sites where older salmon parr densities were high, trout densities were generally low. This is in agreement with the findings of Gardiner (1989) on the Tweed. This may simply reflect the different habitat usage by the two species, trout

preferring areas of cover under banks, near larger boulders etc, while salmon prefer the faster flowing riffle areas. There was a general indication that more trout than salmon were found in the lower and middle burns. However, further work is needed to determine the densities present, since many of these burns were fished only once.

FUTURE WORK

When using any kind of electro-fishing apparatus it is important to know its efficiency. The system used here will be tested during 1991 by stocking an area with a known number of parr and then electro-fishing the area. The efficiency of the equipment can then be calculated and applied to the results from the survey sites.

During 1990, sites on most of the main tributaries were visited, but there is still much of the catchment to be examined. Work will continue in 1991 to examine areas such as the upper reaches of the Rivers Avon, Dulnain and Feshie, the middle reaches of the Tromie and Truim, and the River Calder.

There is also a need to examine the changes in year class densities throughout the season. In 1991 several sites will be visited during late May and again in September to compare the changes in densities.

The primary purpose of this survey is to locate areas of low salmon density or where they are absent. The density of juvenile salmon in a stream is limited by several factors including the availability of suitable habitat, the surrounding environmental conditions and the access to spawning adults. Future work must try and address why fish densities in certain areas of the catchment are low and whether they can be successfully enhanced. One possible method of doing this is by collecting fry soon after they emerge and transplant them above an obstacle to an area of lower density. The density of the introduced stock could then be determined. If they survive at the new higher density then the area may be suitable for stocking.

The results presented here are simply species distributions and some density calculations. During the survey, details of substrate types, water depths, water chemistry, overhangs and surrounding land use were all collected. The relationship between the calculated densities and these parameters has still to be determined.

ACKNOWLEDGEMENTS

The author gratefully acknowledges the help and assistance given by the following people and organisations, in particular Hamish Marshall who helped with the electro-fishing throughout the year and whose knowledge of upper Speyside was invaluable, Robert Clerk and the Spey District Fishery

Board who provided the funding for the research, Ross Gardiner and Ian MacLaren from the Freshwater Fisheries Laboratory, Pitlochry, who gave advice on equipment, sampling techniques and data analysis, Hugh Blakeney and Andrew Norval of Strathspey Estates who provided accommodation throughout the year.

Finally a special thanks should be extended to the many proprietors, gamekeepers and farmers who allowed access to tributary sites within their estates.

REFERENCES

- Gardiner, W.R. 1989.** Tweed juvenile salmon and trout stocks. In: *Tweed Towards 2000: Symposium on the Future Management of the Tweed Fisheries*, (Mills, D., ed.), 105-114pp.
- Laughton, R. 1989.** The movements of adult salmon within the River Spey. *Scottish Fisheries Research Report*, 41, 19pp.
- Laughton, R. 1991.** The movements of adult Atlantic salmon (*Salmo salar*, L.) in the River Spey as determined by radio telemetry during 1988 and 1989. *Scottish Fisheries Research Report*, 50, (in prep.).
- Morgan, R.I.G. and Poulson, W. 1991.** Freshwater development of Atlantic salmon (*Salmo salar*, L.) progeny derived from adults of different sea ages. Unpublished Report.
- Morrison, B. 1989.** The growth of juvenile Atlantic salmon (*Salmo salar*, L.) and Brown trout (*Salmo trutta*, L.) in a Scottish river system subject to cooling water discharge. *Journal of Fish Biology*, 35, 539-556pp.
- Zippin, C. 1958.** The removal method of population estimation. *Journal of Wildlife Management*, 22, 82-90pp.

TABLE 1

The distribution of species

River Fiddich

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
F1	18 06 90	Craigellachie	Yes	Yes	Eels Lampreys
F2	20 06 90	Balvenie Ford	Yes	Yes	Eels
F3	21 06 90	Auchendoun	Yes	Yes	Eels
F4	27 06 90	Glenfiddich Lodge	Yes	Yes	-
F5	26 06 90	Pittyvaich/Dullan	Yes	Yes	Eels
F6	26 09 90	Pitglassie/Corrie Burn	-	Yes	-
F7	26 09 90	Allawaken Burn	-	Yes	-

River Avon

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
A1	28 09 90	Old Mill/Tervie	Yes	Yes	-
A2	22 05 90	Whitefolds/Livet	Yes	Yes	Eels
A3	11 06 90	Inverlochy/Lochy	Yes	Yes	Eels
A4	11 06 90	Above Falls/Burn of Brown	Yes	Yes	-
A5	08 06 90	Glenmulliach/Conglass Burn	Yes	Yes	Eels
A6	30 08 90	Iron Mine/Conglass Burn	Yes	Yes	-

Lower Spey Burns

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
LB1	20 08 90	Port Farm Bridge/Allt an Fhittich	Yes	Yes	Eels
LB2	20 08 90	Congash Farm/Congash Burn	Yes	Yes	Eels Lampreys

River Dulnain

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
D1	04 06 90	Duthil Church	Yes	-	Eels
D2	12 09 90	Below Falls of Ess/Duthil Burn	Yes	Yes	-
D3	12 09 90	Above Falls of Ess/Duthil Burn	-	Yes	-
D4	04 06 90	Allt Lorgy	Yes	Yes	Eels
D5	21 08 90	Below Falls/Badden Burn	Yes	Yes	Eels Lampreys
D6	21 08 90	Above Falls/Badden Burn	-	Yes	-
D7	21 08 90	Allt an-t Sluggan Dhuibh	Yes	Yes	Eels

TABLE 1 (continued)

River Nethy

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
N1	31 05 90	Nethybridge	Yes	Yes	Eels Lampreys
N2	06 06 90	Inchtomach	Yes	Yes	-
N3	28 05 90	Bynack Stable	-	Yes	-
N4	24 05 90	Drum/Dorback Burn	Yes	Yes	Eels
N5	24 07 90	B970 Bridge/Allt Mor	Yes	Yes	Eels
N6	24 07 90	Straanruie/Duack Burn	Yes	Yes	Eels
N7	24 07 90	Lynamer Farm/Duack Burn	-	Yes	Eels

River Drurie

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
Dr1	15 06 90	Island/Luineag	Yes	Yes	Eels Lampreys
Dr2	02 08 90	Chute/Allt Mor	Yes	Yes	-
Dr3	25 06 90	Coire na Ciste Burn	Yes	Yes	-
Dr4	05 09 90	First Ford/Am Beanaidh	Yes	Yes	Eels
Dr5	19 07 90	Loch Einich Mouth/Am Beanaidh	Yes	Yes	Eels

River Feshie

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
Fe1a	13 06 90	Calliach No 1	Yes	-	-
Fe1b	13 06 90	Calliach No 2	Yes	-	-
Fe2	31 07 90	Bridge/Allt Ruadh	Yes	Yes	-
Fe3	20 07 90	Allt Garbhlach	Yes	Yes	-
Fe4	26 07 90	Allt Fearnagan	Yes	Yes	-
Fe5	27 09 90	Baileguish/Allt Chomhraig	Yes	Yes	-
Fe6	26 07 90	Allt Mor	-	Yes	-
Fe7	26 07 90	Feith Mor	-	Yes	-

River Tromie

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
T1	29 08 90	Invertromie Farm	Yes	Yes	Eels
T2	22 08 90	Loch an Duin (Above Hydro Dam)	Yes	Yes	-
T3	23 08 90	Allt Gharbh Ghaig (Above Hydro Dam)	Yes	Yes	-

TABLE 1 (continued)

River Truim

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
Tr1	14 05 90	Crubenmore	Yes	Yes	Eels
Tr2	13 09 90	Balsporran	Yes	Yes	-

Middle Spey Burns

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
MB1	31 07 90	An Sluggan	-	Yes	Minnows
MB2	27 07 90	Allt na Criche	Yes	Yes	Eels
MB3	27 07 90	Boring Mill/Milton Burn	Yes	Yes	Eels
MB4	27 07 90	Loch an Eilein Road/ Milton Burn	-	Yes	Eels
MB5	04 09 90	New A9/Loch Alvie Burn	?	Yes	Eels
MB6	15 08 90	Lodge/Dunachton Burn	Yes	Yes	Eels
MB7	15 08 90	Old A9/Raitts Burn	Yes	Yes	Lampreys Eels Minnows
MB8	04 09 90	Golf Course/Gynack Burn	Yes	Yes	-
MB9	03 09 90	Keepers House/Gynack Burn	-	Yes	-
MB10	17 08 90	Bridge/Ruthven Burn	Yes	Yes	Eels Lampreys Minnows Sticklebacks
MB11	17 08 90	Cluny Mains/Allt Dobhrain	Yes	Yes	Eels Minnows Pike
MB12	14 08 90	Cluny Castle/An t-Eileach	Yes	Yes	Eels Minnows
MB13	13 08 90	Below Falls/Breakachy Burn	Yes	Yes	Eels Minnows
MB14	17 05 90	Above Falls/Breakachy Burn	-	Yes	-

River Mashie

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
M1	14 08 90	A86 Bridge	Yes	Yes	Eels Minnows

Spey Dam

No	Date	Site/tributary	Type of fish present		
			Salmon	Trout	Others
SD1	18 09 90	a'Chaorainn/Spey	Yes	Yes	-
SD2	25 07 90	Lower/Allt a'Chaorainn	Yes	Yes	-
SD3	25 07 90	Bridge/Allt Yairick	Yes	Yes	-

Note - One possible salmon parr caught at site MB5.

TABLE 2

Population densities 1990

River Fiddich

No	Site/tributary	Date	Population density (m ⁻³) (95% conf limit)						
			Salmon			Trout			
			0+ **	1+	2+	0+	1+	2+	
F1	Craigellachie	18 06 90	1.97 (0.12)	0.18 (me)				0.08 (me)	
F2	Balvenie	20 06 90	4.78 (0.30)	0.27 (0.08)				0.02	
F3	Auchendoun	21 06 90	4.41 (2.83)	1.18 (0.14)	0.68 (0.22)			0.19 (me)	
F4	Fiddich Lodge	27 06 90	2.70 (0.12)	0.54 (0.03)	0.29 (0.03)			0.14 (0.05)	0.03
F5	Pittyvaich/River Dullan	26 06 90	2.36 (0.03)	0.46				0.13	0.06

Others

F6 Pitglassie/Corrie Burn 26 09 90 Trout only

F7 Burn of Allawaken 26 09 90 Trout only

me Minimum estimate, a progressive reduction in catches was not obtained.
 ** Trout and salmon fry combined at all sites.

Notes

1. Corrie Burn (F6) and the Burn of Allawaken (F7) were only fished once to determine species present, no salmon present in either.
2. Sampling conditions changed at Craigellachie due to sewage discharge commencing during second fishing. Similar problem at Fiddich Lodge, heavy rain produced a rise in water levels during second and third fishings.

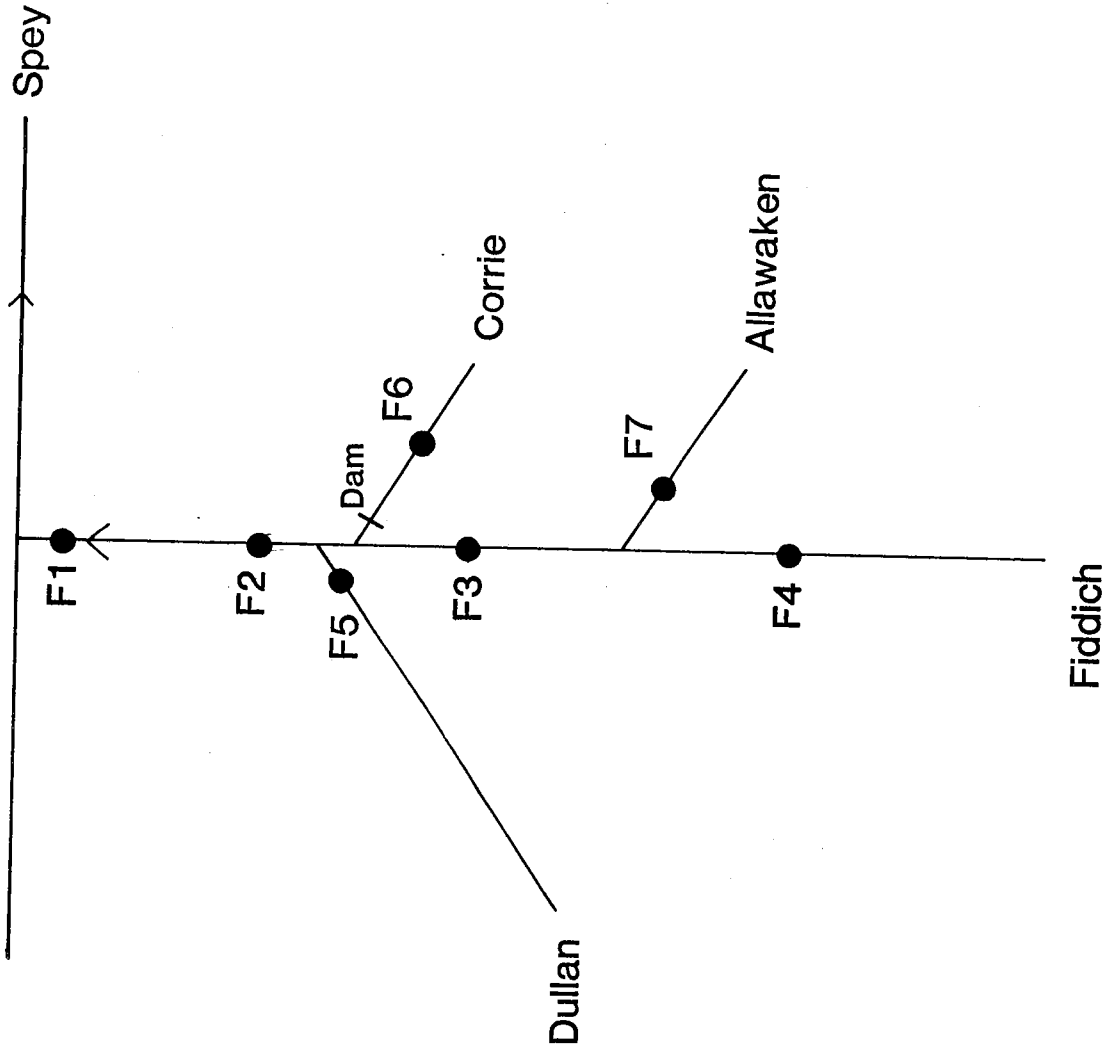
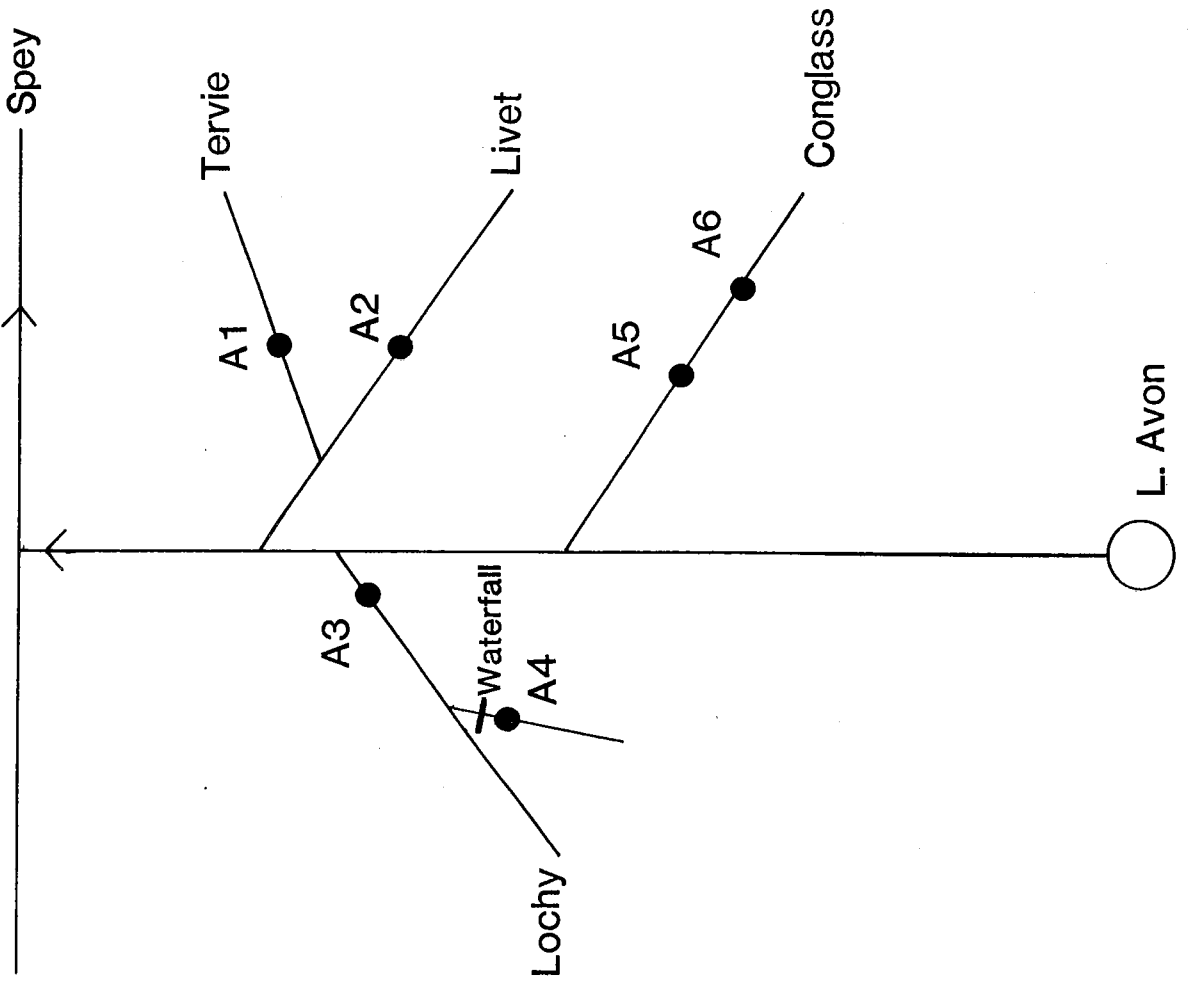


TABLE 3

Population densities 1990

River Avon



No	Site/tributary	Date	Population density (m ⁻²) (95% conf limit)									
			Salmon			Trout						
			0+	1+	2+	0+	1+	2+	3+			
A1	Old Mill/River Tervie	28 09 90	0.55 (0.10)	0.36 (0.05)	0.10 (0.03)	1.15 (0.10)	0.08 (0.04)	0.02				
A2	Whitefolds/River Livet	22 05 90	3.17 (**)	0.89	0.34		0.02	0.01				
A3	Inverloch/River Lochy	11 06 90	1.25 (**)	0.40 (0.11)	0.20 (0.03)		0.01	-				0.01
A5	Glennulliasch/River Conglass	08 06 90	3.03 (**)	0.11 (me)	0.05 (0.01)		0.19 (0.12)	0.09 (me)				

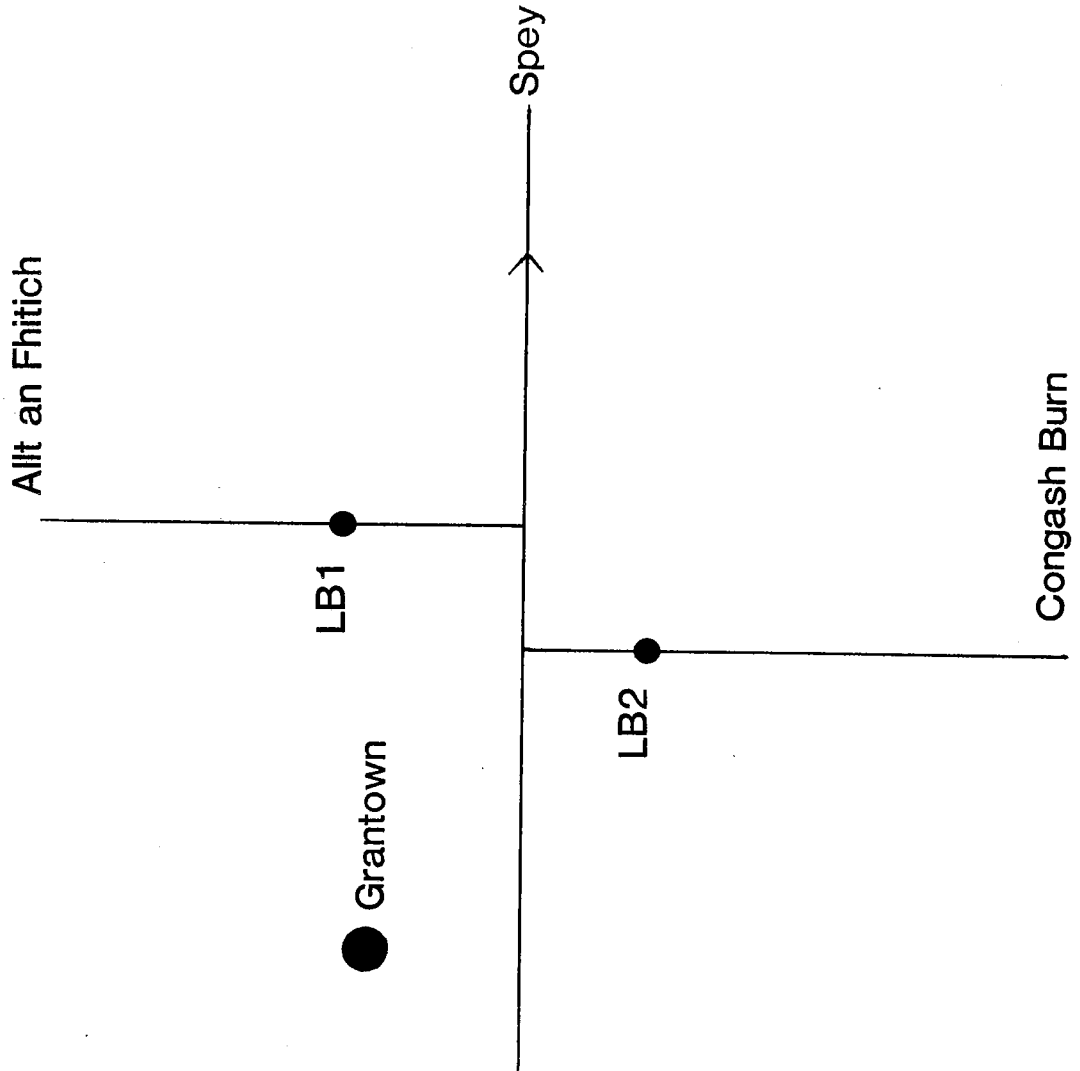
Others

- A4 Above Falls/Burn of Brown 11 06 90 Salmon and trout present
- A6 Iron Mine/River Conglass 30 08 90 Low density of salmon, high density of trout
- me Minimum estimate, a progressive reduction in catches was not obtained.
 ** Salmon and trout fry combined.
- Notes
1. Burn of Brown (A4) fished only once to determine if salmon could ascend the Falls.
 2. Iron Mine (A6) fished only once to determine species present, trout present in high densities 0+ 1.00 m, 1+/2+/3+ 0.78 m, salmon 1+ 0.05 m, note these densities are only estimates.

TABLE 4

Population densities 1990

Lower Spey Burns



No	Site/tributary	Date	Population density (m ⁻²) (95% conf limit)					
			Salmon			Trout		
			0+	1+	2+	0+	1+	2+
LB1	Allt an Fhithich	20 08 90	0.32 (0.06)	0.20 (0.08)	0.28 (0.11)	0.76 (0.12)	0.07 (0.02)	0.02 -
LB2	Congash Farm/Allt Coire Odhair	20 08 90	0.15 (0.01)	0.11 (0.05)	0.07 -	0.65 (0.07)	0.20 (0.06)	0.08 -

TABLE 5

Population densities 1990

River Dulnain

No	Site/tributary	Date	Population density (m ⁻²) (95% conf limit)									
			Salmon			Trout						
			0+	1+	2+	0+	1+	2+	3+			
D1	Duthil Church	04 06 90	0.97** (0.39)	0.56 (0.04)	0.12 (0.09)	-	-	-	-	-	-	-
D2	Below Falls/Duthil Burn	12 09 90	0.08 (0.01)	0.11 (0.004)	0.05 (0.01)	1.26 (0.13)	0.17 (0.09)	0.01	-	-	-	-
D3	Above Falls/Duthil Burn	12 09 90	-	-	-	0.16 (0.02)	0.23 (0.01)	0.03	-	-	-	0.01
D6	Dalrachney/Batten Burn	21 08 90	0.36 (0.01)	0.03 *	-	0.42 (0.03)	0.04 *	-	-	-	-	-

Others

D4 Allt Lorgy 04 06 90 Salmon and trout present

D5 A9 Site/Batten Burn 21 08 90 Trout only

D7 Allt an t-Sluggan Dhuibh 21 08 90 Salmon and trout present

* Age classes not determined.

** Salmon and trout fry combined.

Notes

1. Sites D4, D5 and D7 were fished only once to determine species present.
2. Salmon absent above waterfalls on the Duthil and Batten Burns.

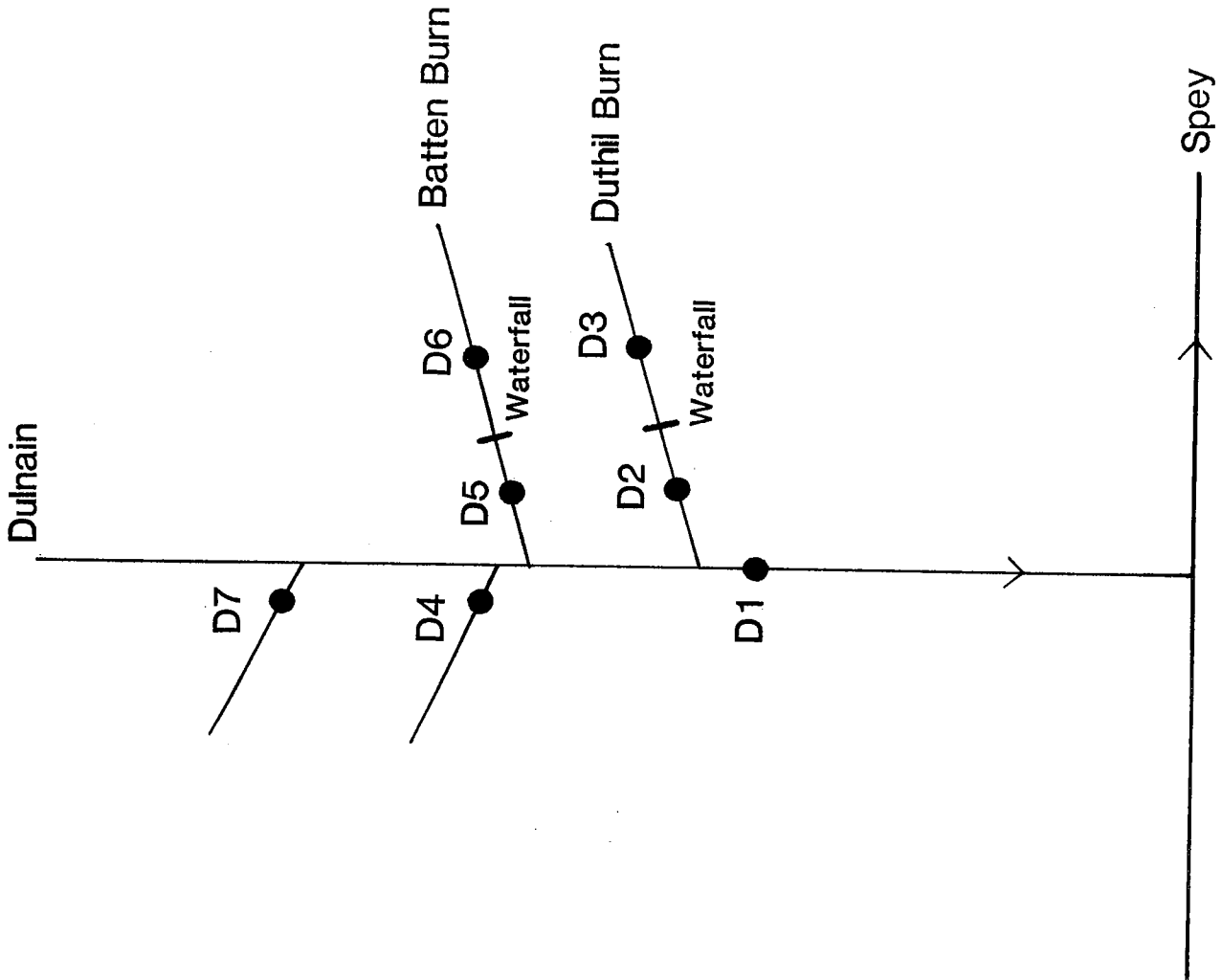


TABLE 6

Population densities 1990

River Nethy

No	Site/tributary	Date	Population density (m ⁻³) (95% conf limit)									
			Salmon			Trout						
			0+	1+	2+	0+	1+	2+	3+			
N1	Nethybridge	31 05 90	2.00 **	0.18 (0.02)	0.02	-	0.01	-	0.01	0.01	-	0.02
N2	Inchtomach	06 06 90	2.00 **	1.01 (0.26)	0.31 (0.11)	-	0.19 (0.04)	0.06 (0.02)	-	-	-	0.02
N3	Bynack Stable	28 05 90	-	-	-	0.16 (0.06)	0.08 (0.01)	0.15 (0.01)	0.01	0.01	-	0.05 (0.01)
N4	Drum/Dorback Burn	24 05 90	0.96 **	1.00 (0.29)	0.12 (0.001)	-	0.03	-	0.01	-	-	-

Others

- N5 Bridge/Allt Mor 24 07 90 Salmon and trout present
- N6 Siraanruie/Duack Burn 24 07 90 Salmon and trout present
- N7 Lynamer/Duack Burn 24 07 90 Trout only

** Salmon and trout fry combined.

Notes

1. Sites N5, N6 and N7 were fished only once to determine species present.
2. Waterfall downstream from Bynack Stable; however, only small approximately 1-1.5 m but may be enough to prevent access to salmon.

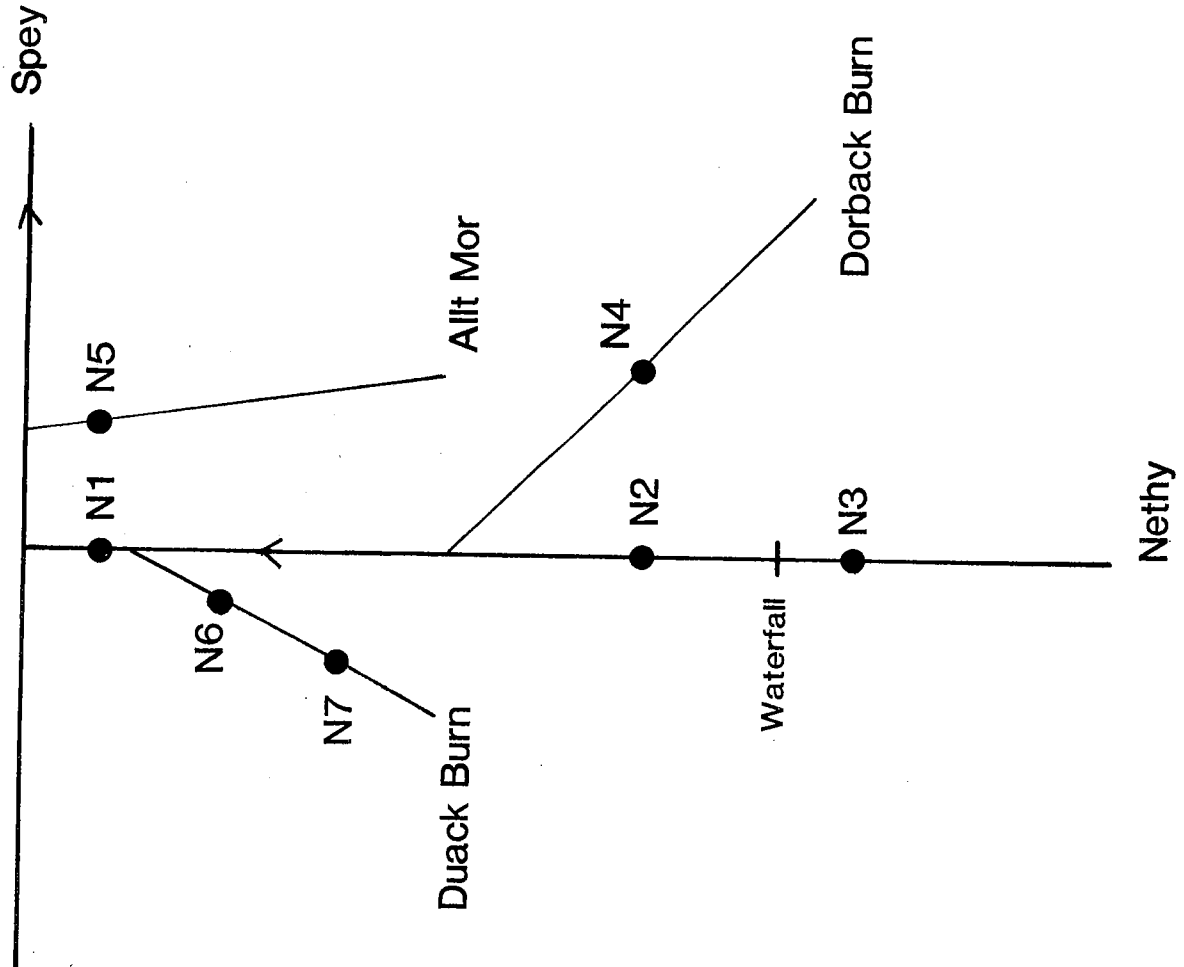
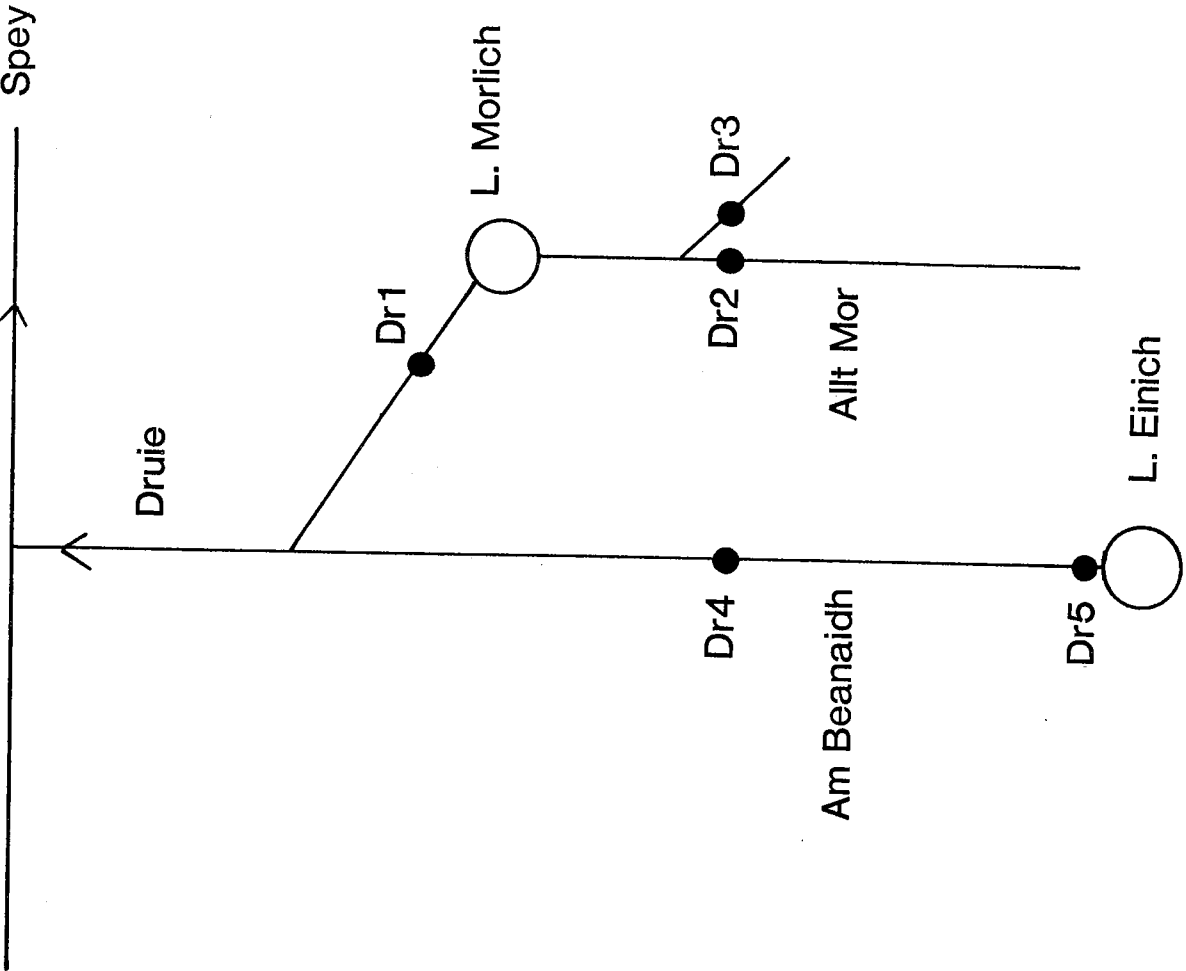


TABLE 7

Population densities 1990



River Druie

No	Site/tributary	Date	Population density (m ⁻³) (95% conf limit)							
			Salmon			Trout				
			0+	1+	2+	0+	1+	2+	3+	
Dr1	Island/River Luineag	15 06 90	2.94 **	0.28 (0.07)	0.06 (0.01)	-	0.01	-	0.01	-
Dr2	Chute/Allt Mor	02 08 90	0.22 (0.02)	0.49 (0.08)	0.26 (0.04)	0.08	0.18 (0.02)	0.22 (0.15)	0.02	-
Dr3	Coire na Ciste Burn	26 06 90	0.18 **	0.01	0.02	-	0.41 (0.14)	0.06	0.02	-
Dr4	First Ford/Am Beanaidh	05 09 90	0.40 (0.05)	0.25 (0.14)	0.11 (0.01)	0.08 (0.09)	0.05 (0.02)	0.04 (0.01)	0.03	-

Others

Dr5 Loch Einich/Am Beanaidh 19 07 90 Salmon and trout present

** Salmon and trout fry combined.

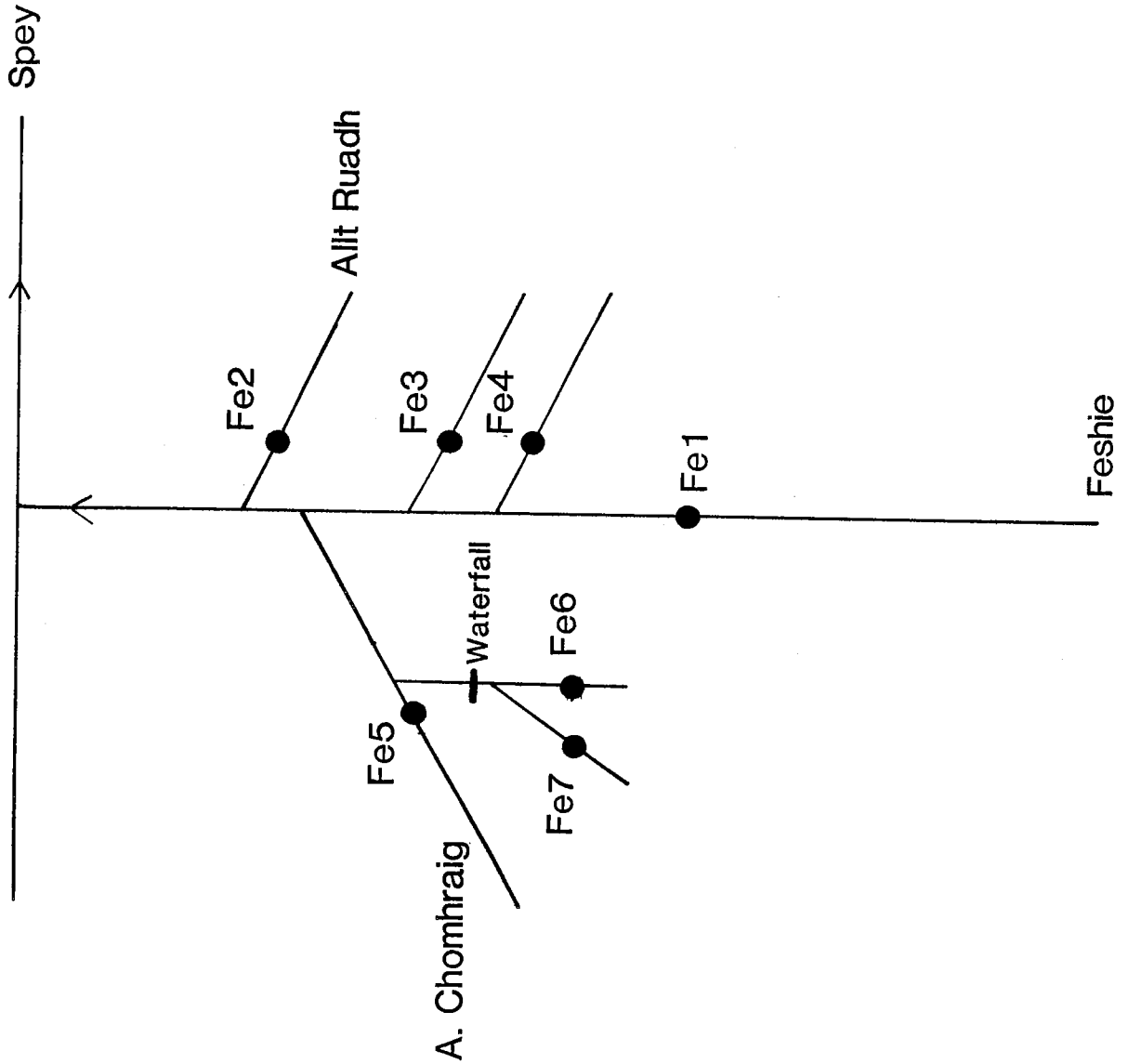
Notes

1. Loch Einich fry were too small to determine the species, salmon parr present but in low densities. Site fished only once to determine species.
2. One 3+ salmon parr caught at the First Ford site (Dr4).
3. One 4+ trout caught at Chute/Allt Mor (Dr2).

TABLE 8

Population densities 1990

River Feshie



No	Site/tributary	Date	Population density (m ⁻³) (95% conf limit)										
			Salmon			Trout							
			0+	1+	2+	3+	0+	1+	2+	3+			
Fe1a	Calliach 1	13 06 90	-	0.06 (me)	0.04 (me)	0.01	-	-	-	-	-	-	-
Fe1b	Calliach 2	13 06 90	-	0.07 (me)	0.03 (me)	0.01 (me)	-	-	-	-	-	-	-
Fe2	Bridge/Allt Ruadh	31 07 90	0.44 (0.23)	0.40 (0.04)	0.15 (0.01)	0.03 (0.01)	0.09 (0.10)	0.16 (0.03)	0.02	-	-	-	-
Fe5	Bailegush/Allt Chomhraig	27 09 90	0.44 (0.11)	0.17 (0.04)	0.10 (0.01)	-	0.04	0.03	-	-	-	-	0.01

Others

Fe3 Allt Gharbhliach	20 07 90	Salmon and trout present
Fe4 Achleum/Allt Fhearnagan	26 07 90	Salmon and trout present
Fe6 Allt Mor	26 07 90	Trout only
Fe7 Feith Mhor	26 07 90	Trout only

me Minimum estimate calculated from only one fishing.

Notes

1. Most burns ie Allt Mor etc fished only once to determine species.
2. Allt Mor (Fe6) and Feith Mhor (Fe7) are upstream from impassible waterfall, no salmon were found.
3. The mouth of the Allt Gharbhliach is elevated and may be difficult for salmon to ascend during periods of low flow.

TABLE 9

Population densities 1990

River Tromie

No	Site/tributary	Date	Population density (m ⁻³) (95% conf limit)										
			Salmon			Trout							
			0+	1+	2+	3+	0+	1+	2+	3+			
T1	Invertromie	29 08 90	0.11 (0.11)	0.006	0.02	0.02	0.006	-	-	-	-	-	-
T2	Loch an Duin	22 08 90	0.27 (0.06)	-	0.10 (0.01)	-	0.02	0.01	-	-	-	0.03	-
T3	Allt Gharbh Ghaig	23 08 90	0.05	0.008	-	0.02	0.08	0.02	0.02	0.06	0.02	-	-

me Minimum estimate, a reduction in catches was not achieved.

Notes

1. Loch an Duin (T2) and Allt Gharbh Ghaig (T3) upstream from Tromie dam.
2. Loch an Duin site (T2) furthest upstream point of River Tromie.
3. Invertromie site area had been bulldozed fairly recently, probably 1990.
4. Three 4+ trout caught at the Allt Gharbh Ghaig site, density 0.02 sq m.

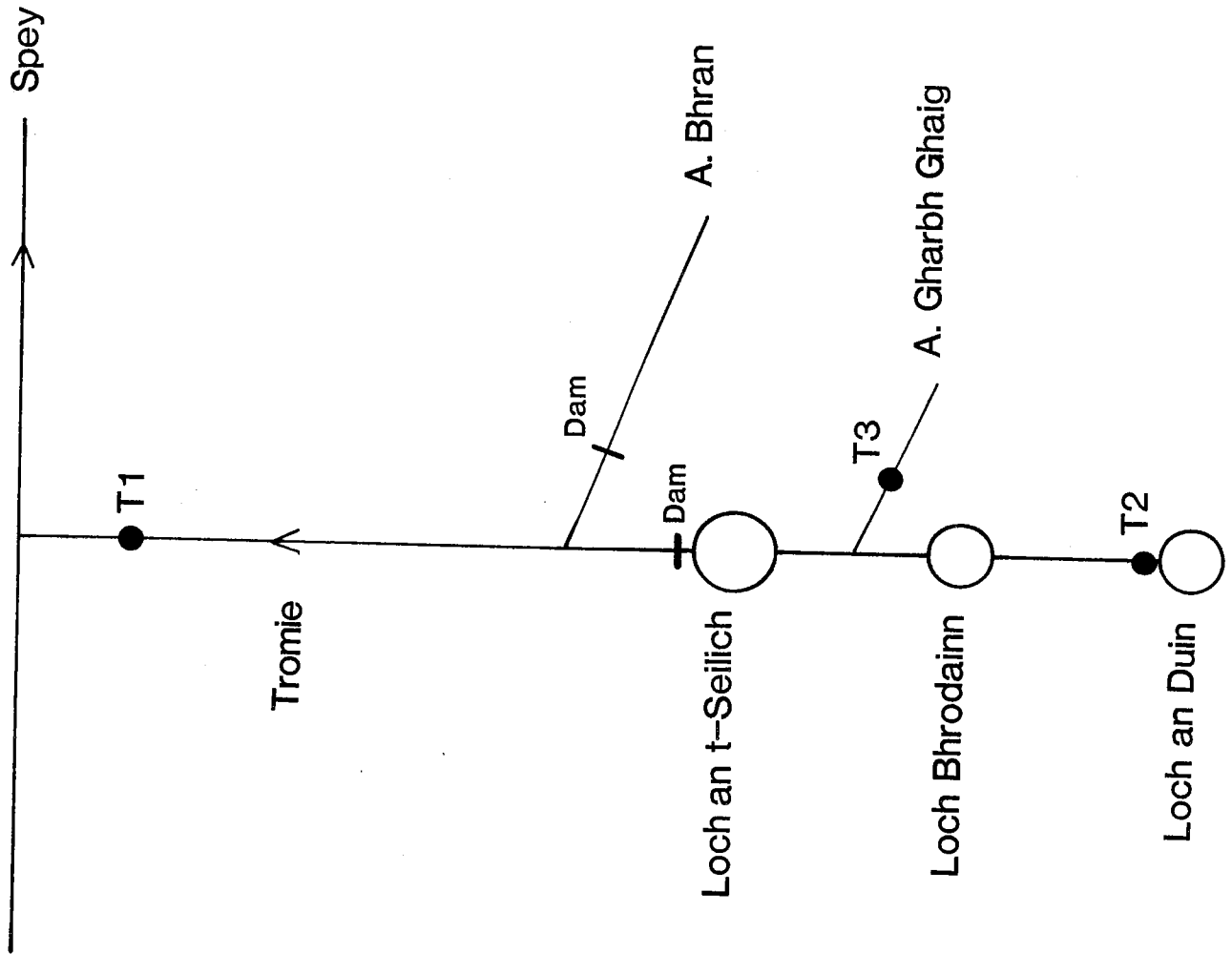


TABLE 10

Population densities 1990

River Truim

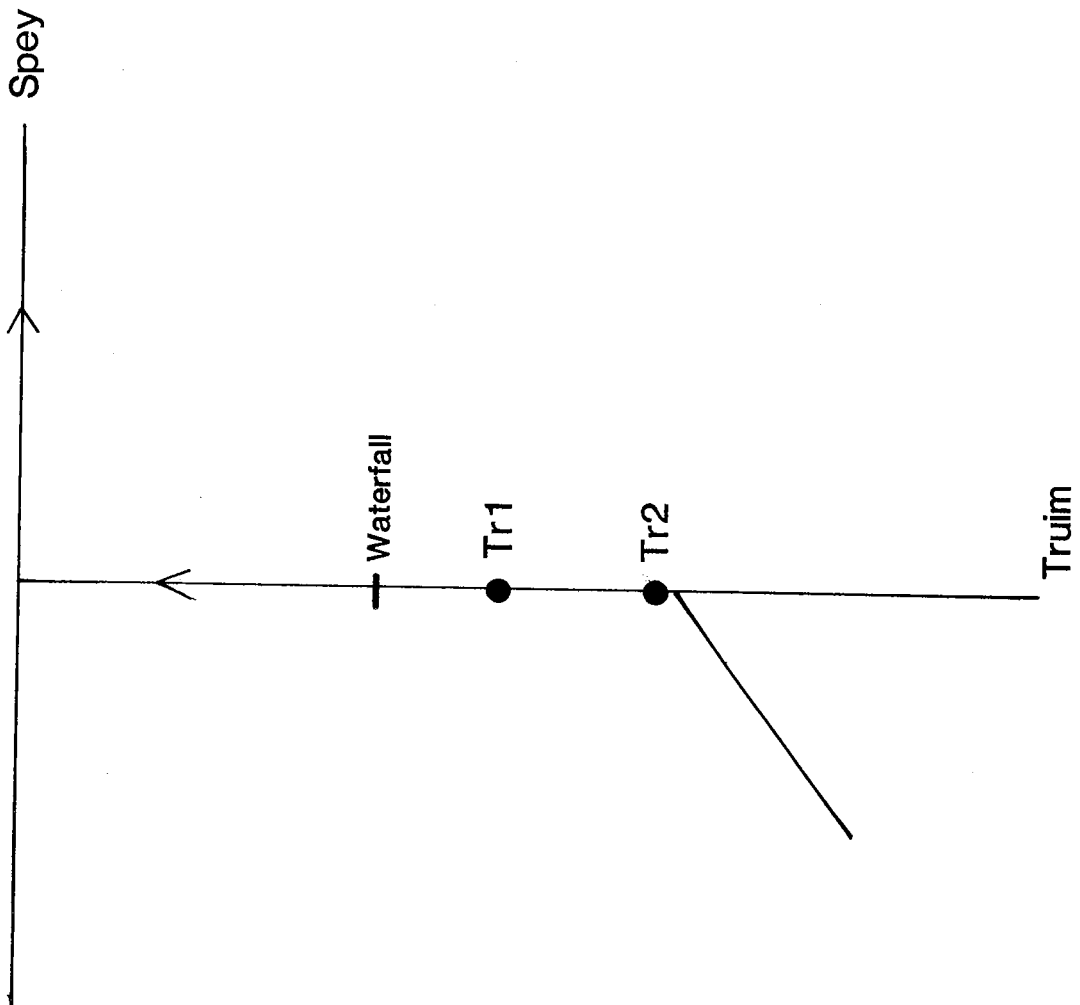
No	Site/tributary	Date	Population density (m ⁻³) (95% conf limit)							
			Salmon			Trout				
			0+	1+	2+	0+	1+	2+	3+	
Tr1	Crubenmore*	15 05 90	0.04 **	0.55	0.15		0.01			
Tr2	Balsporran	13 09 90	0.29 (0.18)	0.16 (0.02)	0.12 (0.02)				0.01	0.01

* Estimate from two catches.

** Salmon and trout fry combined.

Notes

1. Both sites above Falls of Truim.
2. Some evidence of erosion/bed movement during the winter.
3. Site Tr1 was visited during early May which is before fry emergence. This accounts for the low 0+ density.



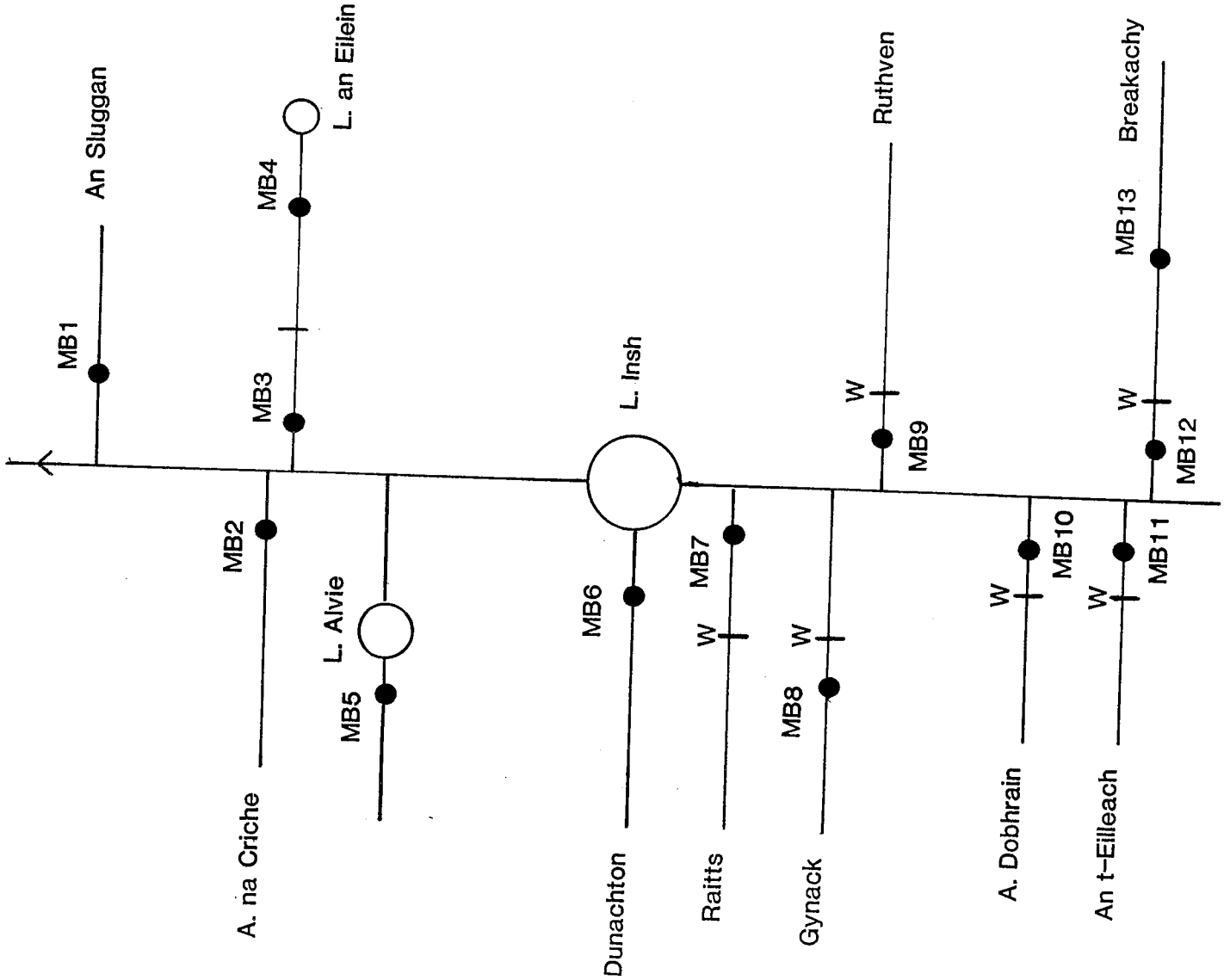


TABLE 11

Population densities 1990

Middle Spey Burns

No	Site/tributary	Date	Population density (m ⁻³) (95% conf limit)							
			Salmon			Trout				
			0+	1+	2+	0+	1+	2+	3+	
MB6	Dunachton Burn	15 08 90	-	-	0.02	0.13	-	-	0.10	0.08
MB7	A9/Raits Burn	15 09 90	0.09 (0.02)	0.23* (0.03)	-	0.09 (0.003)	0.009	0.009	0.009	-
MB8	Golf Course/Gynack Burn	04 09 90	-	-	0.02 (0.007)	-	-	0.02	0.38 (0.04)	-
MB9	Ruthven Burn	17 08 90	0.009	0.10 (0.01)	-	0.67 (0.06)	0.05 (0.005)	-	-	-
MB11	Chuny/An-t-Eilleach	14 08 90	0.88 (0.25)	0.14 (0.02)	-	0.52 (0.06)	0.02	0.02	0.07 (0.01)	-
MB13	Halfway/Breakachy Burn	17 05 90	-	-	-	0.009 **	0.11 **	0.04 **	0.06 **	-

* Age classes not separated

** Estimate from two fishings

Others

MB1	Kincardine Cottage/An Sluggan	31 07 90	Trout only
MB2	Allt na Criche	27 07 90	Salmon and trout present
MB3	Boring Mill/Milton Burn	27 07 90	Salmon and trout present
MB4	Loch an Eilean/Milton Burn	27 07 90	Trout only
MB5	A9/Allt an Fhearna (Alvie Burn)	04 09 90	Trout present, one possible salmon parr
MB10	Chuny Mains/Allt Dobhrain	17 08 90	Salmon and trout present
MB12	Cat lodge/Breakachy Burn	13 08 90	Salmon and trout present

Notes

1. Impassable water falls present on the following burns:-

Raits Burn (?), (above site), Ruthven Burn (above site), Allt Dobhrain (above site), An-t Eilleach (above site), Breakachy Burn (between sites).

2. Passable waterfall on Gynack Burn (below site).

TABLE 12

Population densities 1990

Upper Spey

No	Site/tributary	Date	Population density (m ⁻³) (95% conf limit)											
			Salmon			Trout			Trout					
			0+	1+	2+	0+	1+	2+	3+	0+	1+	2+	3+	
M1	A86 Bridge/River Mashie	14 08 90	0.07*	0.02*		0.02*			0.02*			0.03*		
SD1	a'Choarainn/River Spey	18 09 90	0.19 (0.03)**	0.01**		0.01			0.01					>0.01

Others

SD2 Allt a'Choarainn 25 07 90 Salmon and trout present
 SD3 Allt Yairick 25 07 90 Salmon and trout present

* Minimum estimate from two fishings
 ** Age classes not separated

Notes

1. Allt a'Choarainn (SD1) and Allt Yairick (SD3) fished only once to determine the species salmon and trout both present but in low densities.
2. Large impassable waterfall upstream from the lower site (SD2) on the Allt a'Choarainn.

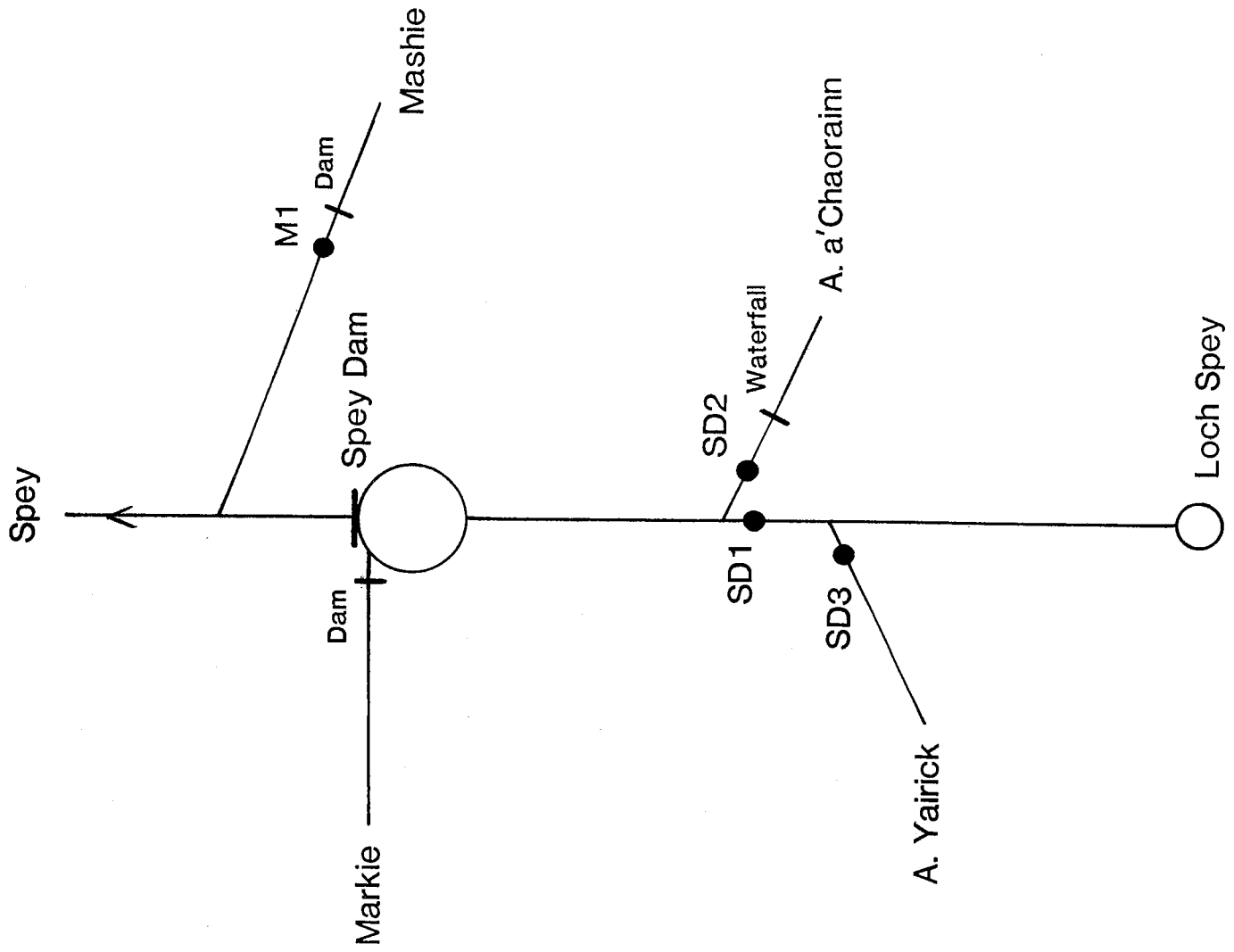


TABLE 13

Mean length of salmon and trout, 1990

River Fiddich

No	Site/tributary	Date	Mean length (mm)			
			Salmon		Trout	
			1+	2+	1+	2+
F1	Craigellachie	18 06 90	96 (9)	-	137 (16)	-
F2	Balvenie	20 06 90	96 (9)	-	120 (-)	-
F3	Pittyvaich/River Dullan	21 06 90	103 (7)	120 *	110 (13)	136 (6)
F4	Auchendoun	27 06 90	65 (7)	92 (7)	78 (13)	-
F5	Fiddich Lodge	26 06 90	65 (5)	96 (6)	77 (6)	112 (8)

() Standard deviation

* Only one fish

Notes

1. Inputs from distilleries, sewage etc occurs downstream from Auchendoun.

Figure 1

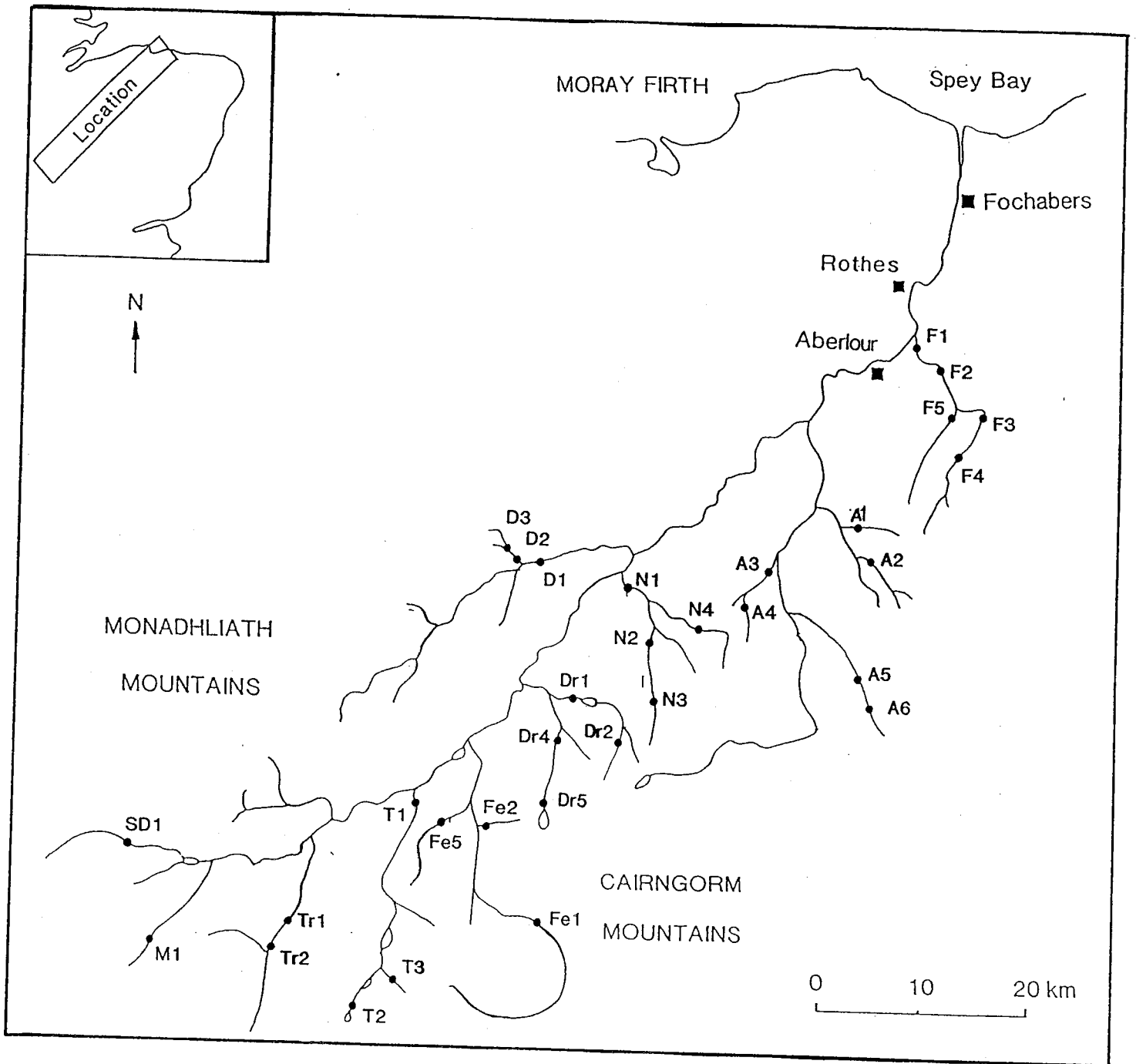


Figure 1 Map of the River Spey showing the electro-fishing sites on the main tributaries. The sites on the lower and middle burns are not shown.

Figure 2

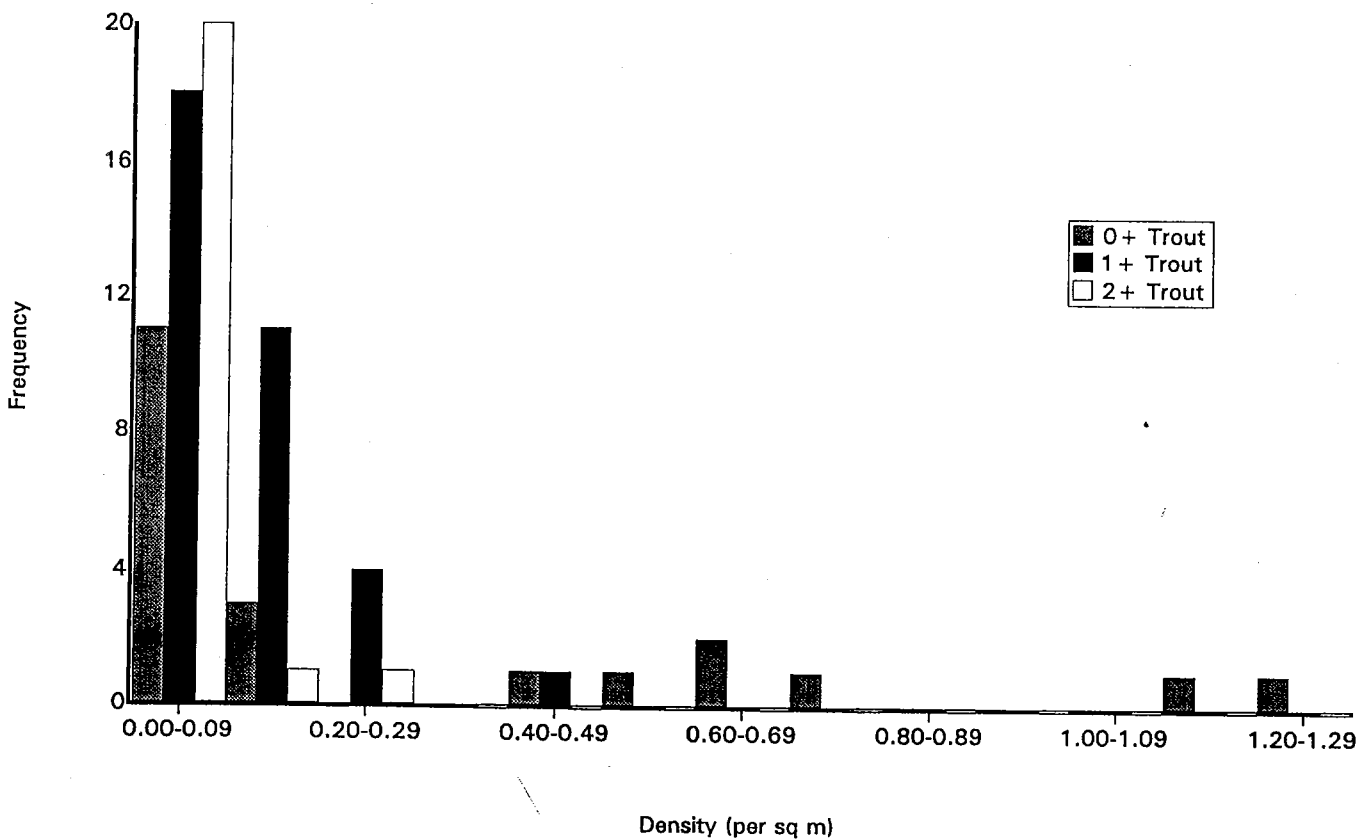
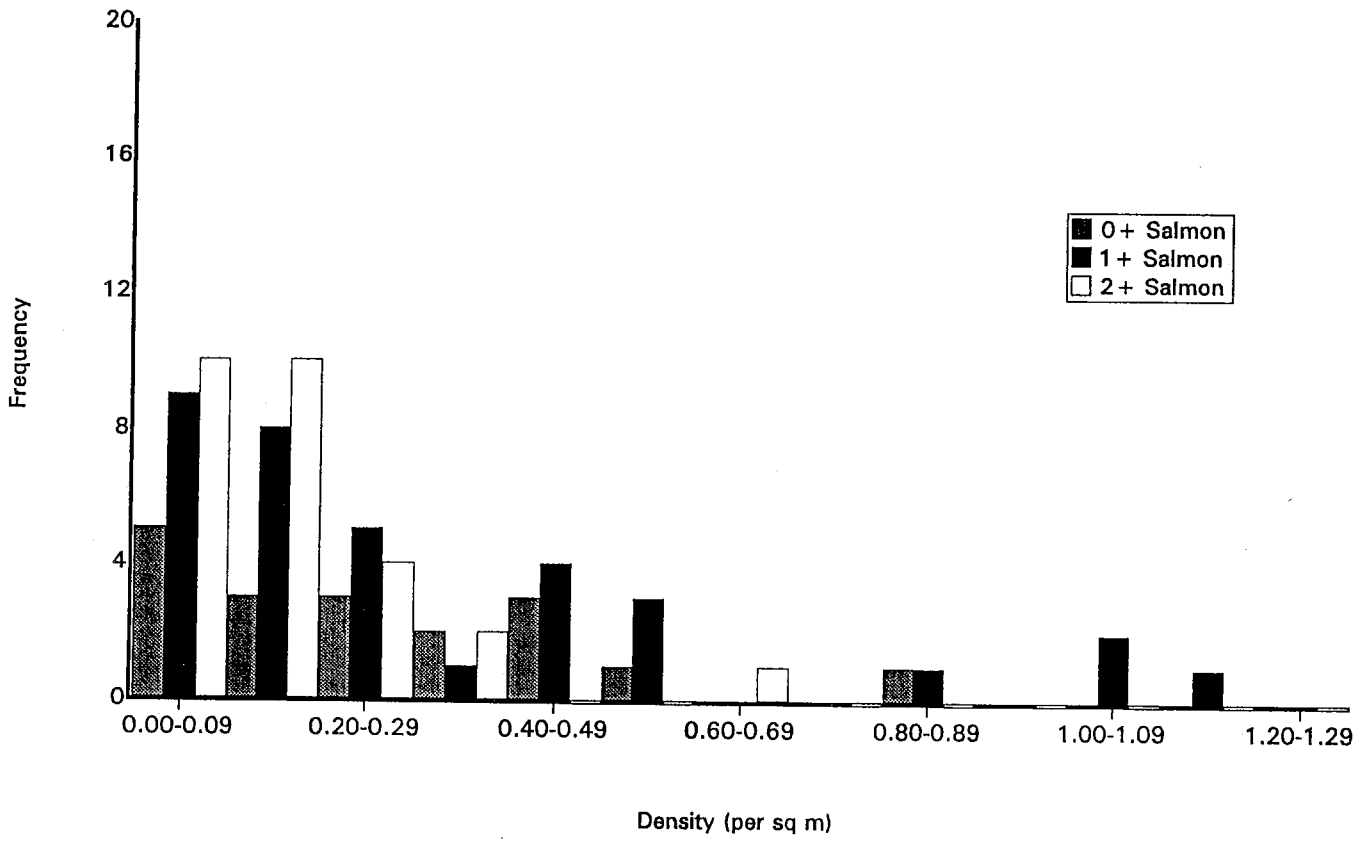


Figure 2 The range of 0+, 1+ and 2+ population densities found during 1990 for, a) salmon and b) trout.