

# FISHERIES

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SPAWNING TROUT *SALMO TRUTTA* L. POPULATIONS  
IN THE CUMMERAGH SYSTEM, CO. KERRY.  
EDWARD FAHY

An Roinn Iascaigh agus Foraoiseachta  
Department of Fisheries and Forestry

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## Spawning trout *Salmo trutta* L. populations in the Cummeragh System, Co. Kerry

by

EDWARD FAHY

Fisheries Research Centre, Department of Fisheries and Forestry,  
Abbotstown, Castleknock, Co. Dublin, Ireland.

### ABSTRACT

Concentrations totalling more than 300 spawning trout from five sites at three parts of the Cummeragh system were examined in 1980. The majority of the fish were sea trout but some brown trout and precocious males occurred at every site. Of the various physical characteristics of the sites, numbers of fish displayed the most consistent relationship with the volume of water in the pools where they occurred. Trout ranged from 22cm to 68cm fork length and maiden fish of two sea summers comprised the majority. Brown trout matured at a smaller size and younger age than sea trout. Males matured before females and older smolts before younger. Females outnumbered males in the entire collections although there were differences in this and other characteristics of the fish from one site to another, a result it is thought of the timing of sampling. The majority of male sea trout had a brown livery and more female than male trout displayed scars on the body behind the dorsal fin.

### INTRODUCTION

The vast majority of studies on sea trout in Britain and Ireland have been based on samples collected by anglers and netmen. For a multiple spawning, migratory salmonid these approaches are not ideal although when several such exercises are carried out consecutively on the same stock they generally concur on important features of its biology (Fahy, 1978). Descriptions of spawning sea trout populations are very few and none have been undertaken to date in Ireland. Elsewhere in Europe there are several (Alm, 1950, Paterson, 1973, Campbell, 1977 and Jensen, 1968). Descriptions of the anglers' catch on Lough Currane, the lake on which the majority of Cummeragh sea trout are captured, are available, the latest by Fahy (1980) dealing with the catch in the mid 1970s. Fahy (unpublished) has also sampled the anglers' catch in 1980. This paper describes a sample of spawning trout from tributaries supplying the Currane fishery.



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**METHODS**

Concentrations of trout were located in three tributaries of the Cumberagh system in early November, 1980. Site I consisted of three pools (1-3) and Sites II and III of one pool each. The locations are shown in Figure 1 and their physical characteristics are summarised in Table 1. Surrounding vegetation consisted of rough grassland and the bank type varied from permanent, rising to about 1m above the water surface, to eroding for 50% of the pool margin. Bank vegetation, overhanging slightly, consisted of gorse *Ulex europaeus* L, willows *Salix* spp, and in one place royal fern *Osmunda regalis* L. Sand and gravel of various grades up to 30cm longest axis were plentiful in and immediately above and below the pools.

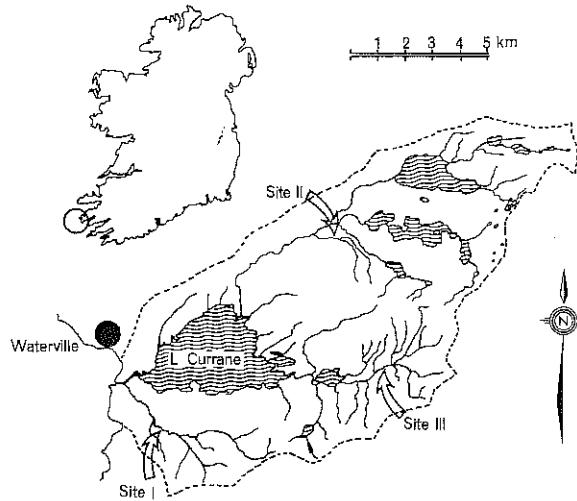


FIGURE 1. Map of the Cumberagh system showing the three locations at which spawning trout populations were examined

The fish were collected by electro-fishing. Stop nets were secured across riffles upstream and downstream of the pools. At site I (1) all trout were removed and examined; at all others fish of less than 15cm were left in the pools. After a brief examination trout were returned to the water downstream of the lower stop net. Scales were removed for ageing and the following characteristics of each fish were observed:

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Fork length

Sex

Livery (i.e. whether the external appearance was that of a brown or sea trout)

Whether the fish showed signs of having spawned

If and where individuals were marked (on the left side) with a fresh injury or an old scar.

**RESULTS**

The total catch for the three sites was 331 trout ranging in fork length from 22cm to 68cm. All trout examined displayed signs of spawning: i.e. running eggs or milt or evidence of being partially or wholly spent. The following types were observed:

*Precocious parr.* These occurred at all sites. At Site II(1) 29 parr-marked trout were examined. All were males and had freely running milt; 27 were 0+ with a mean fork length of 9.56cm (S.D. 1.99).

*Brown trout.* Only 10 fish with a brown trout livery yielded scales which did not display migratory growth. These ranged from 3+ to 5+ years; five were males and five females (Table 2).

*Sea trout.* A further 292 trout were thought to belong to this grouping because migratory growth was clearly visible on the scales. Of these 268 were aged (Table 2). Although they displayed much disparity in their livery (Table 3) brown liveried fish predominated among the males (81-83%) and were considerably fewer among females (4-6%).

*Age composition of the sea trout*

Of 268 sea trout which were aged the majority showed 2 river years while one sea winter (two sea summers) was the most abundant post migration category. Overall mean smolt age was 2.33 years.

Mean age at first maturation varied with smolt age as follows:

Smolt age	Age at first maturation
2	1.81
3	1.46
4	1.29

Likewise the percentage of fish of two sea summers to have spawned once was, for two smolt years, 19.0%, three years 46.6% and four years 50.0%.

The ages of males and females varied at the three sites (Table 4). Males were consistently of younger sea age and mainly of younger riverine age

also. Sea age of previously spawned fish at the three locations is given in Table 5 together with the sea age of previous spawners sampled in the anglers' catch during the summer months.

*Sex Ratios*

The ratio of females to males at the three sites is given in Table 3. Females made up the majority at two of the three sites but they were outnumbered at location 1.

Throughout the total collections the proportions of female : male varied with sea age as follows:

Sea age (winters)	0	1	2	3	4	5	6
females : males	1.3	1.6	2.6	1.6	7.0	6.0	3.0
n	42	160	38	12	7	6	3

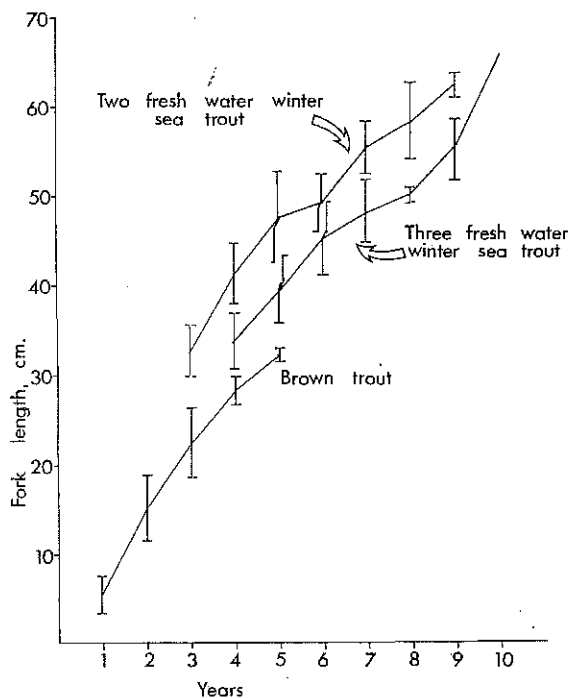


FIGURE 2. Growth curves for sea trout (of 2 and 3 smolt years) and brown trout from the Cumberagh system. Age of sea trout is expressed in summers and of brown trout in winters. Vertical bars  $\pm$  1 standard deviation.

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*Spent fish*

The numbers of female sea trout which showed signs of having spawned are shown in Table 3. The percentage varied between 11% and 33% at the three locations.

*Growth rates*

Growth curves for the two largest categories, two and three years smolts, are shown in Figure 2. Data used were the actual fork lengths and the readings are expressed in terms of post migration summers. For the brown trout back calculations were carried out and growth is expressed in winters.

*Marks: injuries and scars*

Scars and injuries were a feature of female rather than male trout. The majority were confined to the posterior part of the body. Distribution and extent of each scar is shown by a line in Figure 3.

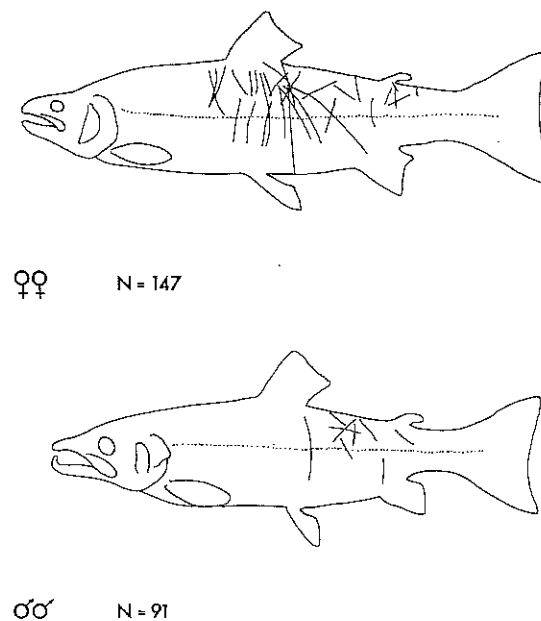


FIGURE 3. Distribution of injuries on the left side of spawning sea trout.

### DISCUSSION

Of the variables examined in the five pools containing sea trout the fish displayed a closer relationship with the volume of water than with its surface area: from 0.5 to 1.0m<sup>-3</sup> per fish; their numbers varied fivefold with the surface area of the pools, from 1.34 to 6.42m<sup>-2</sup> per fish.

In most other respects the populations were quite distinct. Mean sea and river ages varied between sites (Table 4). The sea age composition of previous spawners among the three aggregations of fish and among the anglers' catch of 1980 (Table 5) were compared by chi-square with the following values:

	Site II	Site III	Anglers' catch
Site I	1.389	38.921	17.140
Site II		51.121	15.835
Site III			126.657

Where there are 3 degrees of freedom  $\chi^2 = 7.8$  ( $P < 0.05$ ); all of the above samples except those examined at sites I and II are significantly different from one another.

In other respects too the collections from the three locations varied; sex ratios differed at all three sites (Table 3). The percentage of spent females varied threefold suggesting that the populations were at different stages of the spawning process. Alm (1950) reported that spawning fish ascend in the autumn, chiefly in November but they do not descend from the spawning streams until the following May. Paterson (1973) suggested that the difference in sex ratio which he observed between different tributaries of the same system might be attributed to the timing of reproductive behaviour. Campbell (1977) stated that in the Tweed brown trout reproduce between October and December while sea trout spawn between November and December, a long period in which variation in the composition of the spawners could take place.

Numbers of brown trout taken in association with the sea trout in the Cumberagh were small. Whereas Campbell (1977) observed that the two forms frequently occurred together so that he supposed they interbred, Paterson (1973) found that of the 244 trout he examined only 4 were brown trout. The timing of sampling may have contributed to these differences.

Sea trout making up the spawning populations (Table 2) were largely maiden fish and the largest sea age category was 2 sea summers. Campbell (1977) reported that the majority of spawners in the Tweed were 2.1+ and 3.1+ years of age. Paterson (1973) stated that 67% of his collections spawned after two summers in the sea. Alm (1950) observed the age of first spawning ascent to be 5-7 summers; 64% of the ascending fish he examined consisted of first spawners. Jensen (1968) however found that maturity was most prevalent after three summers in the sea.

Munro and Balmain (1956) remarked that there is a preponderance of

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females in salmonid spawning runs and this has generally been noted for sea trout. The overall ratio for the Cumberagh sea trout was 1.60 (Table 3) although it varied from 0.88 to 2.64. Paterson (1973) noted a ratio of 1.29, Campbell (1977), 1.14 and Alm (1950) recorded the sea trout spawning run in November to consist of 63% females and 37% males. There are several explanations for the disparity in numbers of males and females. Dahl (1910) believed that males prefer to remain in freshwater and females to go to sea. Some aspects of the Cumberagh fish could be interpreted as contributing to this tendency. Precocious males were plentiful at each concentration of spawning fish and large numbers of males reverted to brown trout livery at spawning time.

Alm (1950) and Piggins (1968) on the other hand attributed differences in sex ratio to differential mortality between the sexes. There is evidence of this phenomenon in the Cumberagh collections where the females formed a majority of the older sea age classes.

The fork lengths of the Cumberagh sea trout varied between 30cm and 68cm. In this stock spawning would seem to commence at a relatively small size. Paterson (1973) described the average fork lengths of sea trout he examined from several tributaries of the same system to range between 52cm and 59cm. He suggested however that a minimum length of 46cm may be important in determining timing of maturity, only 2% of his fish being smaller than 45cm. In comparison with the other studies cited however the length at age of the Cumberagh sea trout appears to be small. Alm (1950) gave average lengths from the fourth summer as: 43, 51, 56, 61, 66 and 70cm. Paterson (1973) gave mean fork lengths in and after the first sea winter as 51.6, 58.1 and 71.6cm.

Spawning brown trout of the Cumberagh (Figure 2) were smaller at similar age than sea trout, a phenomenon which is usually recorded (Campbell, 1977).

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Table 1. Physical characteristics of five pools at three sites harbouring concentrations of trout and the relationship between the fish other than precocious males and some of the variables.

	(1)	Location I (2)	(3)	Location II	Location III
Distance above the tide (km)		1.93		10.46	9.66
Pool length (m)	30.4	23.0	22.8	43.0	30.0
Maximum depth (m)	0.70	0.39	0.80	1.10	1.70
Average depth (m)	0.25	0.17	0.40	0.56	0.69
Surface area (m <sup>2</sup> )	117.42	96.26	67.94	92.74	177.00
Volume of water (m <sup>3</sup> )	31.4	14.9	27.0	41.3	109.0
Numbers of trout	59	15	33	69	113
Trout /m <sup>2</sup>	1.99	6.42	2.06	1.34	1.57
Trout /m <sup>3</sup>	0.53	0.99	0.82	0.60	0.97

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Table 2. Numbers of trout (excluding precocious males) examined in the Cumberagh System in Nov. 1980. Included are 5 brown trout of 3+, 3 of 4+ and 2 of 5+ years.

Sea age	River age				Totals
	2	3	4	5	
O	14	23	3	2	42
1	102	16	2		120
SM	24	14	2		40
2	6	3			9
1+SM	20	4			24
2SM	5				5
2+SM	1	1			2
1+2SM	6	2			8
3SM	2				2
2+2SM	1				1
1+3SM	4	2			6
2+3SM		1			1
1+4SM	4				4
5SM		1			1
1+5SM	2				2
6SM		1			1
Totals	191	68	7	2	268

Table 3. Sex, spawning condition and frequency of brown livery.

Site	Females	Males	Female:Male ratio	% with brown livery		% spent females
				Females	Males	
I	50	57	0.88	6	83	24
II	46	23	2.00	4	83	33
III	82	31	2.64	6	81	11
Total	178	111	1.60	5.6	82	20

Table 4. Mean sea and river age of sea trout at three sites in the Cumberagh System.

	Males		Females	
	Mean Sea Age	Mean River Age	Mean Sea Age	Mean River Age
Site I	0.94	2.24	1.59	2.19
Site II	1.40	2.25	2.30	3.53
Site III	0.69	2.28	0.95	2.35
	0.93	2.28	1.35	2.55

Table 5. Percentage sea age composition of previous spawners at three sites in the Cumberagh System and, for comparison, the percentage sea age composition of previous spawners in the 1980 anglers' catch, (Fahy, unpublished).

Collection	Sea Age				N
	1	2	3	>4	
Site I	35.5	35.5	12.9	16.1	31
Site II	32.6	37.6	10.9	19.5	46
Site III	63.6	13.6	13.6	9.0	22
Anglers' Catch	35.5	51.6	3.2	9.7	31