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SPAWNING TROUT IN EASTERN CONNEMARA.

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Spawning Trout in Eastern Connemara

by

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ABSTRACT

Concentrations totalling 299 trout from nine spawning sites in eastern Connemara in 1981 were examined to elucidate the spawning biology of these stocks. Sea trout made up the majority. Brown liveried fish predominated among migratory males (75%) but were few among females (2.5%). Males were of younger sea and river age than females and the ratio of females to males was lowest among the younger age categories. Scars and marks were evenly distributed between the sexes and 51% of females showed signs of being spent.

Spawning Connemara sea trout were similar to spawning Cumberagh, Co. Kerry, sea trout in a number of respects as for example their length at age but the spawning behaviour of fish in the two places differed considerably: the density of spawning fish was greater in the Cumberagh than in Connemara where immature trout occurred in the vicinity of the redds. The ratio of females to males was lower in Connemara than in the Cumberagh and males appeared to be more heavily marked in Connemara. The relevance of these observations to some known genetic characteristics of the stocks is briefly discussed.

INTRODUCTION

The majority of investigations of sea trout biology have been undertaken on catches made by anglers and netmen and studies of spawning fish are few. Elsewhere in Europe there are several (Alm, 1950; Paterson, 1973; Campbell, 1977 and Jensen, 1968). An investigation of spawning sea trout in the Cumberagh system in Co. Kerry in 1980 (Fahy, 1982 b) was the first of its kind in Ireland. The following year the exercise was repeated on several of the fisheries producing sea trout in eastern Connemara, Co. Galway. A substantially similar procedure to that followed in the Cumberagh system was adopted and the outcome is evaluated by reference to the Cumberagh work. Supplementary information on sex ratios among the Connemara stocks in other years is considered in this interpretation.

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MATERIALS AND METHODS

Known spawning places for trout were kept under surveillance from early October 1981 and fished when spawning activity was reckoned to be most intense (between 20 November and 6 December). All sites were bordered by bog or acidic grassland (Fig. 1). Some were stop netted and electrofished (sites I and V) as in the Cummeragh system; at others an enclosing net of 7m in length was staked across the stream and fish were driven down into it (Sites II, III and IV). All fish were returned to the water alive after examination. At site V all trout were examined after removal by electrofishing but at all other places fish of less than 20cm fork length were ignored. Each fish was measured (fork length to the nearest mm) and scales were collected. Livery was described as "brown trout" or "sea trout". The position of scars and injuries on the left side of the body was noted as were signs that a hen fish was partially or wholly spent.

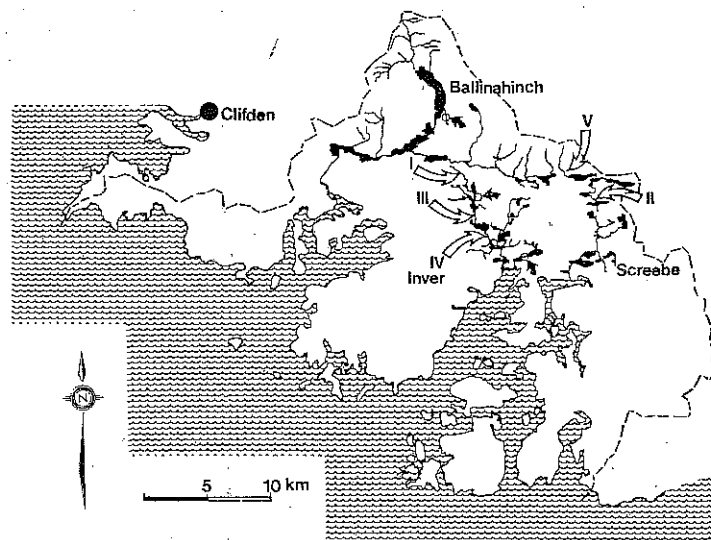


FIGURE 1. Collection sites for spawning trout on three river systems in Connemara. Roman numerals indicate the principal stations and other collection points are indicated by black arrows. The broken line demarcates the boundary of the Connemara Fishery District.

RESULTS

In the course of the survey 299 trout were examined. Of these 87 were less than 20cm fork length. The following types were identified:

Parr:

These occurred at all sites but were retained only at site V. A proportion of the larger members of the age groups were precocious males with running milt (Table 1).

Brown Trout:

Scale reading showed that only four of the brown liveried fish of greater than 20cm had no sea growth. These ranged from 3+ to 5+ years.

Sea Trout:

Of 212 fish of fork length exceeding 20cm and including resident trout, a further 162 individuals were fully aged (Table 2). Replacement scales which could not be confidently read were collected from 46 trout. All showed signs of spawning (running eggs or milt or a spent appearance). They varied considerably in appearance but brown liveried fish predominated among the males. At least 74% clearly displayed this external appearance. The majority of the remainder were extremely dark and could not be decisively placed with either brown or silver liveried fish. Among the females, brown livery was rare (2.5%).

Age composition of the sea trout

Scale readings of the 158 sea trout (Table 2) showed that the majority were of two parr years. Two sea winter fish were marginally more abundant than one sea winter. Overall mean smolt age was 2.28 winters. Mean age at first maturation varied with smolt age as follows:

Smolt age	Sea age at first maturation	N
2 years	2.08 winters	114
3 years	1.91 winters	44

Male sea trout were of younger river and sea age than females:

Sex	River age	Sea Age	N
Males	2.24	1.67 winters	115
Females	2.36	2.65 winters	43

Length at age data are presented in Table 3. Mean lengths ranged from 31.8cm after one summer of sea growth to 68.2cm after six summers. The majority of specimens were two or three summer fish with mean lengths from 38 to 48cm. No significant differences in sea growth were shown between fish of two year and three year smolt age. For brown (resident) trout fork length varied with age as follows:

Age (winters)	Fork length
1	7.2cm
2	18.6
3	27.0
4	28.1
5	30.7

Sex and spawning

The ratio of females to males at the five sites yielding most fish is set out in Table 4. Males predominated and the ratio ranged from 0.55 to 0.12. The ratio of females to males varied with age as follows:

	Sea Age (Winters)					
	0	1	2	3	4	5
Ratio	0.02	0.32	0.29	0.92	0.50	2.00
N	12	50	67	52	6	3

Spent fish

The proportion of females (N = 45) showing signs of being partially or completely spent was 51%.

Marks, injuries and scars

Scars and marks were fairly evenly distributed between the sexes in the Connemara sea trout (Fig 2). On 65 females examined, 11 scars were recorded, an incidence of 0.17 per fish. On 163 males 26 marks were noted, an incidence of 0.16 per fish. The majority of marks occurred on the posterior part of the body, behind the dorsal fin.

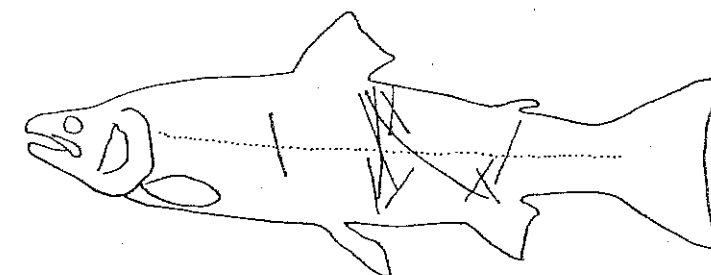
Occurrence of spawning sea trout

The various well known trout spawning places which were fished in the course of the survey are shown in Fig. 1. Details of the most densely populated are set out in Table 4. They ranged in length from 45 to 200m. At all other sites the lengths were within this range but at these the density of fish was less than 1 per 10m³ or 1 fish per 25m².

DISCUSSION

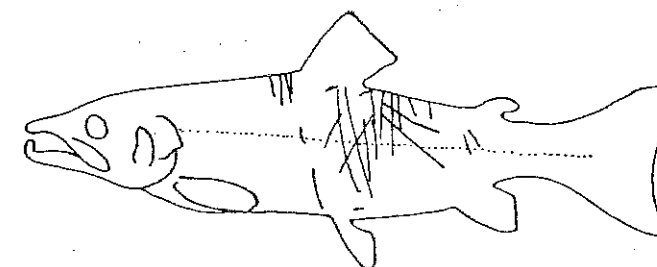
The general biology of an Irish spawning sea trout stock has been described (Fahy, 1982 b) and the Connemara fish are discussed in this context and with particular reference to the Cumberagh trout. In a number of important characteristics, sea trout in the two groups (Cumberagh and

Connemara) are very similar. Brown (resident) trout form a small proportion of the stocks. The age range in the two groups is the same as is the proportion of fish displaying silver livery to brown livery. Mean smolt age and the variation in age at first maturation with smolt age are of the same order and both the river and sea ages of males are less than those of females in the Cumberagh system and Connemara. Differential mortality between the sexes varied with age in the two populations, males predominating among the younger fish and females among the older.



♀♀

N = 65



♂♂

N = 163

FIGURE 2. Distribution of injuries on the left side of spawning sea trout.

Details of length at age from the Cumberagh samples are included in Table 4. For the majority of sea age groups, length at age did not differ significantly between the two populations (Table 3) although there were some anomalies. Even in these however, the differences, although significant ($P < 0.05$) were small.

In other important respects the Cummeragh stock differed from that in Connemara. The most obvious of these was the density of the fish in the vicinity of the redds. In the Cummeragh system this varied between one fish per 0.5 — 1m³ whereas in Connemara (Table 4) it was one fish per 4 — 7m³ and this at only the most densely populated sites. Similar detailed calculations are not presented for other places at which collections were made (Fig. 1) because spawning fish were too few there, at densities of less than one fish per 10m³.

On the Cummeragh system the high densities of sea run fish engaged in spawning were accompanied by precocious parr only. Parr without running milt did not occur in these pools and that situation contrasts starkly with the composition of the parr population at site V (Table 1).

The incidence of scars and marks (Fig. 2) was fairly evenly distributed between the sexes although in the Cummeragh fish, females were twice as heavily marked as males (marks per fish were: females: 0.20; males: 0.10). The cause of marking in sea trout is not known with certainty and it is surmised that redd excavation is partly responsible. Among males, fighting for territory and for females is thought to be a contributory reason which could account for the 60% greater incidence of scarring among male Connemara sea trout. In females the incidence was 0.20 marks per fish in the Cummeragh and 0.17 marks per fish in Connemara.

In the Cummeragh system the ratio of females to males varied between 0.88 and 2.64, the higher numbers of sea run males occurring closer to the sea. The data contained in Table 4 suggests that distance above the tide did not strongly influence the relative abundance of males in Connemara. Contrasting with the position in the Cummeragh system the ratio of females to males at all sites in Connemara was lower. Supplementary information on this, collected over a number of years in the course of netting broodstock for hatchery purposes (at the same collection sites), confirms that the ratios of females to males in the Connemara region are predominantly low, rarely reaching 0.80 (Fig. 3).

The general impression is that spawning among Connemara sea trout takes place over a more protracted period than in the Cummeragh system where a brief and intensive congregation of fish is reported by local observers to be the usual pattern.

Connemara sea trout display similar catch characteristics (weight and age at capture) over a wide geographical area (Fahy, 1978) but the Cummeragh sea trout in Lough Currane are larger at capture and show various characteristics which are unique (Fahy, 1982 a) even among neighbouring fisheries. C. Fleming has identified the LDH 105 allele, a genetic marker associated with long life in trout stocks and rare in Irish sea trout, in a large proportion of Currane fish. Intensive spawning over a short period may be a mechanism for conserving this factor in the population.

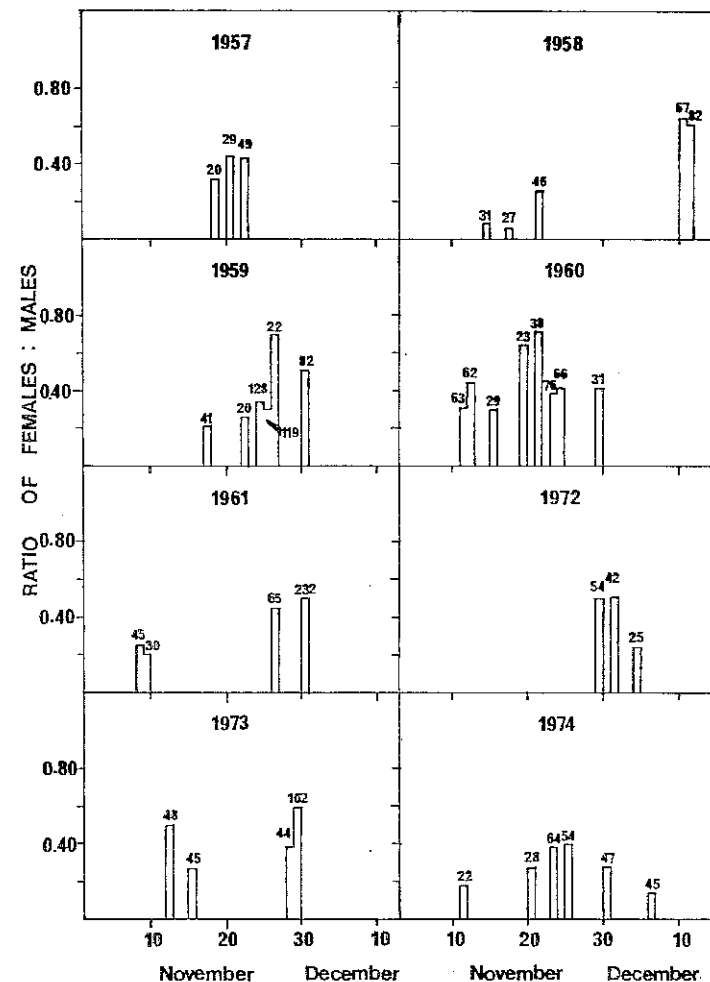


FIGURE 3. Sex ratios recorded among sea trout captured for propagation purposes at various places in Connemara. Each column represents the results of one day's fishing at a single site. Numbers above columns indicate total captures. Source: J. J. Nixon, personal record.

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Table 1. Age and fork length of trout of less than 20cm from site V.

Age Group	N	Mean Length (cm)	S.D.
Whole sample			
0+	59	7.1	2.14
1+	25	11.6	1.68
2+	3	14.2	0.64
Precocious males (with running milt)			
0+	5	9.5	1.29
1+	7	11.4	1.93
2+	2	14.1	0.78

Table 2. Age analysis of trout > 20cm fork length; all were sea trout except for four brown trout, one aged 3+, one 4+ and two 5+ years.

Sea Age	River Age				Totals
	2	3	4	5	
0	4	8	1	2	15
1	34	10			44
SM	3	3			6
2	20	6			26
1 + SM	26	9			35
2SM	4	1			5
3		1			1
2 + SM	9				9
1 + 2SM	7	4			11
3SM	1	1			2
3 + SM	1				1
1 + 3SM	3				3
2 + 2SM		1			1
1 + 4SM	1	1			2
5SM	1				1
Totals	114	45	1	2	162

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Table 3. Mean fork length (cm) at sea age (sea summers) of sea trout in the Connemara and Cumberagh collections.

	1	2	3	4	5	6	7
Two year smolts — Connemara							
N	5	37	46	19	5	2	
Mean	32.2	38.6	48.0	51.1	56.5	64.0	
S.D.	2.83	3.34	3.28	4.31	7.73	6.08	
Two year smolts — Cumberagh							
N	14	121	33	8	5	4	2
Mean	32.7	41.4	47.6	49.1	55.5	58.2	62.1
S.D.	2.72	3.39	5.09	3.33	2.89	3.88	1.27
t	0.342	4.444	0.476	1.332	0.271	1.240	
P	>0.05	<0.001	>0.05	>0.05	>0.05	>0.05	
Three year smolts — Connemara							
N	7	13	16	6	1	1	
Mean	31.8	38.8	47.8	50.4	59.5	68.2	
S.D.	1.94	3.06	5.13	1.81	0	0	
Three year smolts — Cumberagh							
N	18	27	7	3	2	2	1
Mean	33.9	39.4	45.5	48.1	50.4	55.4	66.0
S.D.	2.97	3.54	4.66	3.38	0.07	3.61	
t	2.128	0.540	1.047	1.088			
P	<0.05	>0.05	>0.05	>0.05			

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Table 4. Some characteristics of sites I—V and of concentrations of sea trout occurring there.

Site	Distance above the tide (km)	Method of fishing*	Length of site (m)	Numbers of Sea trout	m ² /Sea trout	m ³ /Sea trout	Females	
							Males	
I	3.2	E	58	29	10.0	4.0	0.38	
II	7.7	B	200	47	25.3	6.9	0.12	
III	8.7	B	160	53	14.3	4.2	0.47	
IV	8.7	B	45	16	15.7	5.2	0.25	
V	11.3	E	76	17	17.9	5.9	0.55	

* E = Electrofishing

B = Beating and Netting