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EDWARD FAHY

SEA-TROUT AND THEIR FISHERIES FROM THE DUBLIN FISHERY DISTRICT.

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Sea-trout and their fisheries from the Dublin Fishery District

by

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ABSTRACT

Age, length and weight data from 440 sea-run trout are described together with data from 339 parr from a small trout stream. Pre-migratory length at age was not influenced by calcium content of nursery streams. Relatively faster growth of certain year classes in particular years was observed. Mean smolt age (2.1 years) was low. Sea run fish averaged at 0.86 sea-winters, contrasting with longer lived sea-trout on the Welsh coast but early maturation was observed in both. The regression coefficient for percentage previous spawners on mean individual weight in the Irish/Celtic Seas was lower than for fish from the Atlantic.

The four principal fishing centres are each supplied with sea-trout by two to four small to medium sized rivers. A proportion of the catch is likely to originate in non licensed mullet gear. The annual catch declined from a peak of four tonnes in the 1950s to stabilise at 1.5 tonnes since the 1960s. The decline coincided with an increase in the ratio of draft to drift nets.

INTRODUCTION

The gentle topography of the east coast of Ireland is drained either by very large rivers or by small, short streams. Medium sized catchments are unusual, unlike the hilly western seaboard whose drainage density is higher and where a majority of low order catchments provide suitable freshwater conditions for sea-trout production. Sea-trout are considerably less abundant along the east coast and to date there has been only one assessment of a sea-trout stock from this coastline, that of the River Mattock, by Went (1956); the paucity of published material may be a reflection on the scarcity of the fish. The Dublin Fishery District is situated centrally along the east coast and its catch is well documented, the greater part of it being taken by commercial rather than sporting means (Anon, 1927-1978). The objective of this paper is to give an account of the sea-trout and their fisheries in the Dublin District.

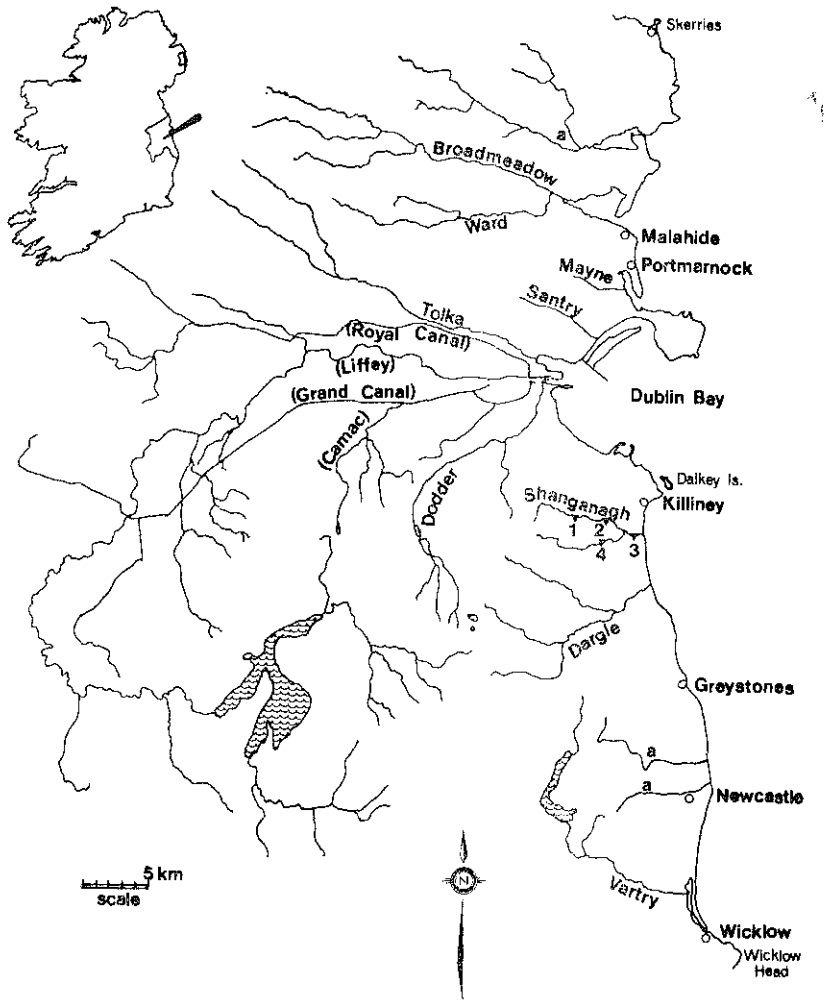

Fig. 1. Map of the Dublin Fishery District naming likely sea-trout producing rivers. (a = unnamed on 1: 126,720 O.S. map), other waters in parentheses. Netting centres mentioned in the text identified. Shanganagh stations indicated 1-4.

The area

The Dublin Fishery District provided most of the material treated here. The District extends from Skerries, north of Dublin city, to Wicklow Head in the south. Within it a number of small rivers and streams have the physical attributes of sea-trout producing waters (Fahy, 1977). To these (shown in Fig. 1) might be added the River Camac which is seriously polluted. The River Liffey in whose estuary sea trout feed and are commercially harvested is not recorded as having regular runs.

Details of the calcium content of waters in the Dublin District are included in reports by Flanagan (1974) and Flanagan and Toner (1972). Rivers flowing over limestone north of the Liffey have a higher calcium content than streams running off the acidic intrusive rocks in the southern part of the region. Unpublished data collected by An Foras Forbartha indicate that calcium contributes most to the figure for total hardness and this varies within the region by two orders of magnitude, the rivers north of Dublin City containing approximately twice as much calcium carbonate in solution as those in the southern part of the District.

The Shanganagh River. A small stream system in south Co. Dublin, the Shanganagh, was monitored in the course of its recovery from a series of pollution incidents in 1976 and 1977 and observations were made on its juvenile trout population; these are presented to illustrate the population structure and growth rate of trout in freshwater within the District. Sea-trout are fished commercially in the vicinity of the Shanganagh mouth and sea run fish were captured in the course of population assessments in the river.

The Shanganagh is a small stream which rises at 400 m in the Dublin Mountains and flows over bedrock consisting of intrusive igneous rocks for more than 8 km before entering the sea.

The uppermost of four sampling sites (1) was not occupied by fish at any time during the survey, having borne the brunt of the earlier pollution. A second site (2) (downstream) which was recovering from contamination contained only 0+ trout during the later part of the survey but the lowest (3) which was situated within 1 km of the sea had not been adversely affected by pollution and it was from this that the samples described here were taken. The fourth site (4) was on a second, southern branch of the river which had not been subject to pollution of any kind.

The experimental section (3) from which trout dealt with here are described was 70-80 m long, 4.6 m wide (average) and 20-80 cm deep (normal flow), had some loose gravel and plentiful rocks of sufficiently large size to support *Fontinalis* moss. The experimental stretch was shaded by overhanging vegetation. The water chemistry of the Shanganagh whose lowest reaches have a total hardness (as p.p.m. $CaCO_3$) of 160-180 p.p.m. belongs to the group of rivers relatively low in calcium in the Dublin area.

The Vartry River. Sea-trout from this river supply a number of draft and drift nets in the vicinity of Wicklow town. Its estuary is approximately 2 km. long. Adult and post-smolt sea-trout captured by draft nets on beaches adjoining the estuary are described in some detail to illustrate the growth and population structure of the Wicklow fish.

COMMERCIAL FISHERIES WITHIN THE DUBLIN DISTRICT

Statistics of sea-trout disposed of through wholesale outlets and collected by the Dublin Board of Fishery Conservators over a period of 30 years and by the Department responsible for Fisheries from 1927-'47 (recorded in alternate years) are shown as a five year moving average in Fig. 2. Since 1958 there has been a downward trend in commercial catches from a peak of 4 to 1.5 tonnes per annum in recent years.

Analysis of the data for four recent years (1975-'78) indicates that the percentage contribution of the four main offshore fishing centres to the total catch in that period was:

Malahide/Portmarnock	...	16.6
Dublin Bay	...	30.7
Killiney/Greystones	...	20.7
Newcastle/Wicklow	...	32.0

Commercial methods of fishing are draft (seine) net and drift net. The mesh size of draft nets is approximately 14-15 cm in the round. Draft nets are used in all fishing centres except Dublin Bay. Drift nets are used in the four offshore fisheries. According to a byelaw Number 59 dated 15 October, 1874, the use of nets with a mesh of 17.8 cm in the round is permitted between Dalkey Island and Wicklow Head for the capture of sea-trout. North of Dalkey Island multifilament drift nets with a mesh size of 18 cm in the round are used for the capture of sea-trout.

The mean weight of fish from both kinds of gear is shown in Table 1. The smaller meshed enclosing draft nets take fish whose mean weight of 0.90 kg is less than those from drift net catches, 1.26 kg.

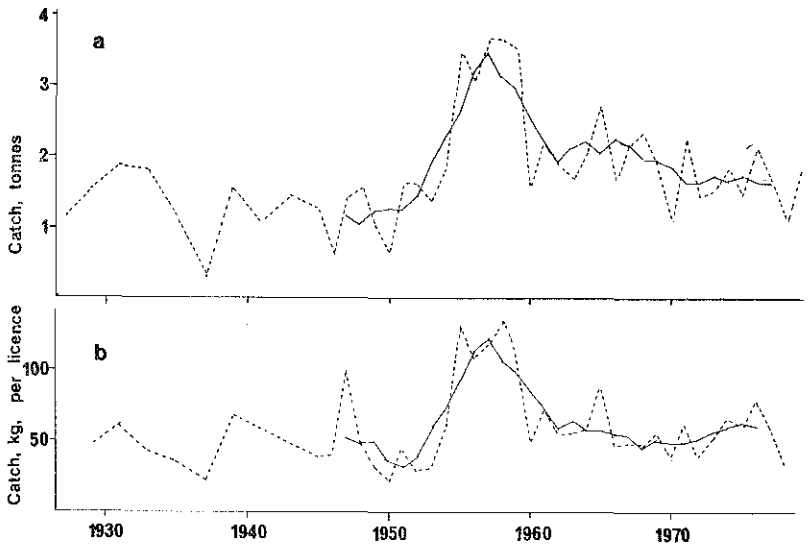

Fig. 2. Commercial catches of sea-trout in the Dublin District a, total catch in tonnes; b, catch (kg) per net licence (draft and drift) issued. Annual catch (broken line); five year moving average (continuous line).

The proportion of the catch going to each type of engine is shown in Table 2 from which it can be seen that draft nets are more important earlier in the year, their contribution to the catch declining as the summer progresses and rising again in the autumn. The total catch in the four years is almost evenly divided between the two methods of capture. It is probable that a large proportion of the sea-trout catch is taken by monofilament "mullet gear" which is used by some of the fishermen in the same locality. Its mesh size is 18.4 cm in the round.

For the years 1975 to 1978 during which a detailed study of the commercial catch figures for the Dublin District was made the weight of sea-trout taken by draft net per licence issued varied between 22 and 112 kg. Per drift net the range was between 38 and 52 kg. Over this period an average of 59 kg of sea-trout was captured per draft net licence per year and 44 kg per drift net. On the basis of these average yields draft and drift nets are assumed to be roughly equivalent and the total number of licences issued annually for both is used to obtain the catch per effort data expressed in Fig. 2.

THE SEA-TROUT

Materials and methods

Aspects of the growth and population structure of a trout population in south county Dublin are described from juvenile material examined in the course of a rehabilitation project on a small stream, the Shanganagh, in south County Dublin in 1979. Three assessments of its population were carried out between January 1979 and February 1980. On each occasion the river was electrofished at each of four sites (which were stop-netted beforehand). The fish were measured and a scale sample removed from each.

In 1978 some 125 sea-trout taken by various methods in the Celtic and Irish Seas were examined at retail outlets in Dublin. The collection included a few large sea-trout from salmon drift nets off the south coast. All of these fish were traced back to their place of capture. A small part of the collection originated in the Malahide/Portmarnock fishery and back calculations on these scales are used to estimate the length of smolts migrating off the limestone.

Sea-trout from the Wicklow fishery are described from scales and fork length and weight data gathered in Wicklow in 1977 and 1978. The collections were taken in the Wicklow draft net fishery between 20 May and 30 June, 1977 and 18 May and 20 July 1978 by Mr. Charles Byrne of Wicklow town. When catches were small all fish were examined; when larger (*c* 20 kg) a sample representative of the size range was surveyed. By these means it is estimated that some 20% of Mr. Charles Byrne's draft net catch was examined in the two years.

Terminology and treatment of results are as in Fahy (1979 b).

Results

Age frequencies of trout in the Shanganagh River are shown in Table 3. The mean age declined from 1.34 years in January and February to 0.38 years in October as 0+ fish increased in numbers and 2+ fish decreased. Mean fork lengths back-calculated from the scales of 2+ fish in these samples (Table 4) were 6.54 cm at 1 year and 14.01 cm at 2 years, the calculation being made on material gathered in the January/February samples.

Data from the Wicklow fishery show that smolt migration takes place at lengths ranging from 10.5 to 24.8 cm (Table 5). Significant ($P < 0.05$) variation in growth rate between years in freshwater were observed in the Wicklow samples where, for example, the mean length at one year for the 2 year smolt class was 6.42 cm in 1974 and 7.42 cm in 1975 (Table 6). Mean smolt age in the two years of collection of the Wicklow fish was 2.13 in 1977 and 2.14 in 1978. The overall incidence of B type smolts was 49.5% (Table 7) and 2 year smolts showed a mean increment of 26% as a result of B type growth (Table 5).

The mean length of 77 specimens of 2 years smolt fish at the end of the first post migration winter was 30.14 cm $\pm$ 0.51 and of 20 specimens of these fish at the end of the second sea winter 38.80 $\pm$ 1.19. Lengths, weights and sea ages of fish belonging to the general Irish and Celtic Sea collection are set out in Fig. 3. The majority of specimens weighed between 200 and 1,500 g and had spent one winter at sea. The average value of the Condition factor (K)—calculated according to the methods of Nall (1930)—for the general Irish Sea collection was 1.07.

The age composition of the three Irish Sea collections is set out in Table 8. Only the Wicklow fish were considered suitable for quantitative assessment, the general Irish Sea collection being drawn from too wide an area and its means of capture diverse. The 108 sets of scales deciphered were distributed among 20 age categories.

There were 120 fish in the 1977 Wicklow collection, distributed among 10 age categories, a diversity index value (α) of 2.5 (Williams, 1947); the 1978 sample contained 15 age categories distributed among 212 fish, an α value of 3.4.

Mean age at first maturation, at 0.42 "sea" years, was higher than expected and the proportion of the stock which reached first maturation in the year of their first run to sea, averaging *c* 15% was also high.

DISCUSSION

Fishing effort and the stocks

Although accommodation for the freshwater phase of sea-trout is not plentiful along the east coast the marine environment favours rapid growth. Fodder fishes, notably sand eels, *Ammodytes* spp., and sprats *Sprattus sprattus,* are abundant (Molloy, 1967; Waind, 1971) and these species are known to be favoured by migratory trout (O'Donoghue and Boyd, 1934).

The Dublin District is unusual in Ireland because the commercial sea-trout catch outweighs and outnumbers the anglers' contribution. The location of the four fishing centres off the Dublin coast (Fig. 1) suggests that each is supplied with sea-trout smolts by two to four small to medium sized rivers. Over the past five years some 20 salmon net licences, distributed among the four fishing centres, have been issued annually, and a small number of non-licensed mullet nets are in use in the vicinity. The meshing mechanism of the mullet gear has been described (Fahy, 1979 a); mullet resemble sea-trout in shape and the lengths and weights of mullet captured by mullet gear approximate to those of sea-trout of the .1+ age group (Fig. 3). Table 1 suggests that drift nets usually select fish of this age grouping, post-smolt being captured in the region by draft net.

Statistics showing total landings and data indicating the catch per effort (Fig. 2) suggest that in recent years the fisheries of the Dublin District have performed well in spite of a disimprovement in freshwater conditions. The Broadmeadow and Ward systems were arterially drained in 1961-'64 and Flanagan and Toner (1972) and Flanagan (1974) described these rivers together with the Tolka, Dodder and Dargle as being of impaired water quality. Only the Vartry, among the medium sized rivers of the Dublin District which they examined, was found not to be significantly polluted. This may explain the relatively large contribution of the Newcastle/Wicklow fishery (32%) to the total catch in recent years.

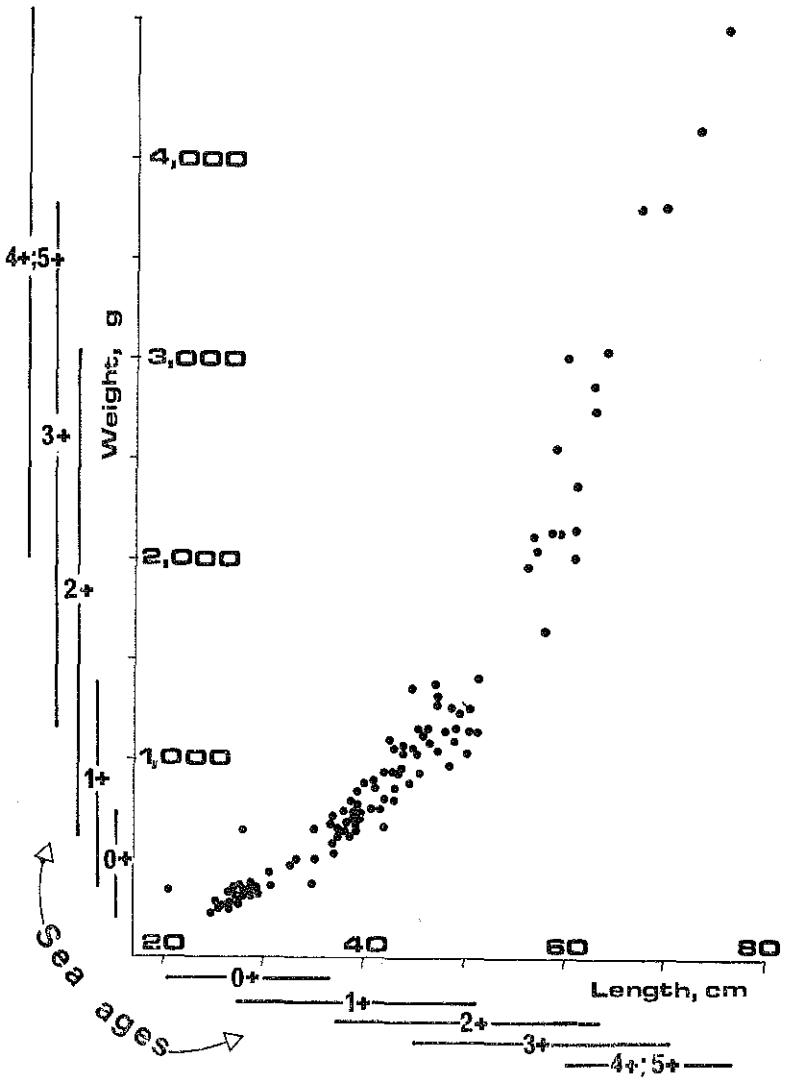

Fig. 3. Length, weight and sea age of migratory trout in a general collection from the Irish Sea; various methods of capture.

Catch per effort figures (Fig. 2) reflect the total commercial landings. Higher annual yields during the 1950s may be due to the greater use of drift nets during that decade: the ratio of draft:drift increased from 1.7 to 1.4 in the 1930s and 1940s to 2.4 in the 1950s and it has declined through 2.0 in the 1960s to 1.5 in the 1970s (to 1978).

Premigratory freshwater growth

Variation with river system. Kennedy and Fitzmaurice (1971) identified the calcium content of waters containing it as a major influence on the growth rate of brown trout. The northern parts of the Dublin region are floored by carboniferous limestone while rivers in the south flow off acidic intrusive igneous rocks.

Back calculations and measurements of fork length at age of two year old parr and smolts from different parts of the Dublin District are set out in Table 3. Sea-trout from the Malahide fishery are likely to have originated on the limestone. All that were examined were A type smolts. Fish from the other two collections are likely to have come off a calcium deficient substratum. The Shanganagh fish might have included potential three year smolts so that their mean length might have been greater had the collection consisted of two year smolts only. The Wicklow fish were all two year smolts, A and B types. Though not strictly comparable therefore it can be seen that the calcium content of the water has had little, if any, influence on the growth of premigratory fish.

Variation between years. The two Wicklow collections were sufficiently large to make comparison of length attained by parr in successive years possible (Table 6). Significantly different lengths ($P < 0.05$) between successive cohorts of the two and three year smolt classes occur. The first year of the two year smolt class achieved greater length in 1975 than in 1974 or 1976 but the second year in that class was more successful in 1974 and 1976 than in 1975. This pattern of growth has already been encountered elsewhere (Fahy, 1979 b, 1980). For three year smolts, the second largest class, there is no such consistent pattern of successful growth years.

Mean smolt age. The mean smolt age (MSA) of these collections was low and in keeping with generally observed values elsewhere in Ireland in recent years (Fahy, 1978 b). Overall values for the 1977 and 1978 Wicklow collections were 1.96 and 2.04 years and 2.09 for the general Irish Sea collection. These figures embrace a number of age categories and hence refer to several years. MSAs of post-smolt migrating in the years 1977 and 1978 (Wicklow collections) were 2.14 and 2.13 years respectively. The mean age of the premigratory population in the Shanganagh River was calculated (Table 3). Of more than 400 trout captured during electrofishings in 1979 none was older than 2+ years. The mean age of the juvenile population was highest in January (1.34 years) and lowest the following October (0.38 years). The ratio of 2+ to 1+ fish remained fairly constant in the September and October samples although there was a loss of 2+ fish in the spring.

B type growth. Fork lengths of A and B type smolts are set out in Table 5. The incidence of the two smolt types (A and B) is set out in Table 7. B type smolts are relatively infrequent in Wicklow where their incidence bears a close resemblance to the readings for the Currane (Waterville) system in the mid 1970s (Fahy, 1980). The amount of B type growth can influence its incidence and an important factor determining the amount is the length of estuary through which smolts must migrate.

An index of B type growth occurring in different systems can be derived using the formula: $pq/100$ where

p = average length of B increment in the two year smolt class

q = percentage of B type two year smolts.

For the Wicklow fish whose likely river of origin, the Vartry, has an estuary of intermediate length, the index of B type growth is 1.84. This value is intermediate between 2.96 for the Moy which has a long estuary (Fahy, 1978 a) and 1.48 for the Currane (Waterville) system (Fahy, 1980), a system with a short estuary.

Aspects of growth at sea

The age composition of the marine collections is given in Table 8, from which it will be seen that the general Irish Sea collection of sea-trout contains the greatest variation. The relationship between length, weight and sea age of these fish is shown in Fig. 3. The lengths of two year smolts are close to the averages for British and Irish stocks (Fahy, 1978 b) as well as close to similar measurements for two west coast stocks in which the smolts vary considerably in size (Fahy, 1979 b, 1980).

The relationship between the average weight of an individual sea run trout in a sample and the percentage previous spawners the sample contains is characteristic for sea-trout feeding in the Atlantic off the western seaboard (Fahy, 1978 b & c). The regression in Fig. 4 is calculated from the two Wicklow collections and other data referring to the Irish and Celtic Seas contained in Went 1956 (Mattock), 1962 (Argideen), Harris, 1970 (Tywi, Teify, Rheidol, Dysynni) and Nall, 1931 (Solway Rivers) and 1933 (Dovey). For comparison the regression for Atlantic feeding trout is included in Fig. 4.

Two year smolts at the end of their first year at sea in the Atlantic (Fahy, 1979 b, Moy) compared with similar fish in the Wicklow collections as follows:

Collection	N	Length (cm)	S.D.
Moy	110	30.64	3.01
Wicklow	77	30.14	5.18

These mean lengths are not significantly different. If the length at age of sea-trout from the Irish Sea and Atlantic are similar, then the better condition of Irish Sea migratory trout is likely to have a major influence in shaping the regressions in Fig. 4. Another possible influence is the earlier maturation of sea-trout from the Irish Sea as a result of better feeding there (Fahy, 1978 b).

Quantitative features of the marine collections. The diversity of age categories in the Wicklow collections was low, an indication that these fish are short lived (Fahy, 1978 b). Reasons for high mortality among sea-trout stocks are unknown although it is possible that human factors play a part and that netting at sea is a contributory cause. In keeping with observations made elsewhere around the Irish coast the Wicklow sea-trout do not survive long at sea; in this respect the Western margin of the Irish Sea contrasts with Wales where sea-trout are long lived and where samples have yielded higher diversity indices.

Mortality and maturation. Calculated according to the methods used by Fahy (1978 b) the coefficient of total mortality (Z) was 1.75 in 1977 and 1.72 in 1978. Mean ages at first maturation were 0.45 and 0.40 post migration years respectively. These figures do not agree well with the observed correlation between the two variables (Fahy, 1979 b) and instead suggest that the Wicklow fish mature at an earlier age than has been observed among Atlantic feeding sea-trout. Fahy (1978 b) noted that Welsh sea-trout appeared to contain a higher proportion of fish spawning in the year of their first migration to sea and the figures for the Wicklow fish are high in relation to Irish stocks generally; 9.1% spawned for the first time as post smolt in the 1977 collection and 20.8% in 1978.

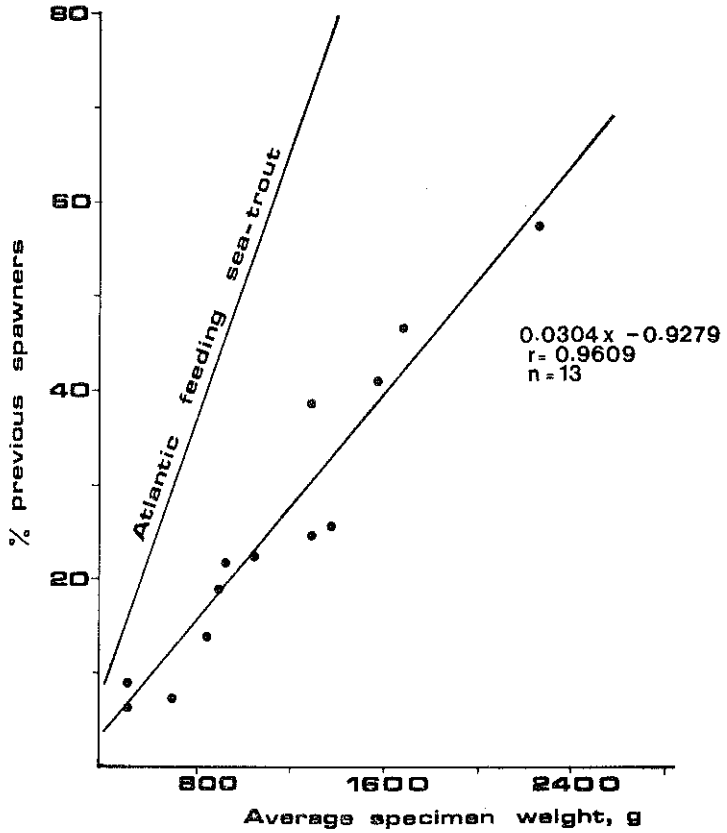

Fig. 4. Relationship between the average sample weight and percentage previous spawners in 13 sea-trout stocks from the Irish and Celtic Seas. Regression for Atlantic sea-trout (from Fahy 1978c) included for comparison.

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Table 1. Mean weight (kg) of individual sea-trout taken by draft and drift net throughout the season (1975-1978).

Month	Draft		Drift	
	weight	N	weight	N
March	0.75	12	0.91	3
April	0.97	19	0.80	11
May	0.88	23	1.21	13
June	0.95	10	1.28	20
July	0.82	10	1.41	33
August	1.05	9	1.50	13
September	0.98	2	1.76	5
October	0.78	6	1.18	2
Total	0.86	91	1.30	100

Table 2. Monthly weight of net-caught sea-trout (kg) (1975-1978) and percentage captured by draft net in the Dublin District.

Month	Total weight of catch (kg)	Percentage by draft net
March	127	87.1
April	847	82.1
May	1,070	47.3
June	560	32.2
July	2,050	48.9
August	550	31.0
September	76	36.3
October	345	50.4

Table 3. Mean age of trout in the Shanganagh River.

Period of Sampling	Age Group			Mean age (years)
	0+	1+	2+	
January/February 1979	—	159	82	1.34
September 1979	14	80	26	1.10
October 1979	37	18	5	0.38

Table 4. Back calculated fork lengths of parr from the Shanganagh River and 2 year smolts from sea-run fish.

Sample	Fork length (cm)					
	At 1 year			At 2 years		
	length	s.d.	N	length	s.d.	N
Shanganagh River, 2+ parr, 1979	6.54	1.36	34	14.01	2.12	34
Wicklow, Sea-run fish, 1977	7.35	2.02	69	17.37	3.98	69
Portmarnock/Malahide Sea-run fish, 1978	7.60	1.08	18	14.51	2.29	18

Table 5. Mean back-calculated length (cm) of smolt classes at the end of each freshwater year (both Wicklow collections).

A type smolts

Smolt age	N	First	Second	Third
1	6	10.07	—	—
2	114	7.31	17.37	—
3	22	5.64	12.11	18.85

B type smolts

Smolt age		First	Second	Third	At migration	% B type growth
1	19	8.72	—	—	14.49	66.2
2	120	6.33	14.13	—	17.81	26.0
3	9	5.14	11.72	17.81	20.02	12.4

Table 6. Back calculated length (cm) at age of Wicklow fish.

Years for which calculations made	Source of scales (year of collection)	1 year			2 years			3 years		
		L	s.d.	N	L	s.d.	N	L	s.d.	N
1976-77	2.+ (1978)	6.69	1.71	114	15.25	2.56	114			
1975-76	2.+ (1977) 2.1+ (1978)	7.42	2.23	75	17.47	4.39	75			
1974-75	2.1+ (1977) 2.2+ (1978)	6.42	1.63	42	13.72	2.52	42			
1973-74	2.2+ (1977)	6.37	1.40	3	14.10	0.22	3			
1975-77	3.+ (1978)	5.16	1.29	18	11.51	1.30	18	17.83	2.74	18
1974-76	3.+ (1977)	6.12	1.11	12	12.47	1.89	12	20.14	2.88	12

Table 7. Percentage incidence of A and B type growth in the Wicklow collections.

Smolt class	A	B	N
1	30.0	70.0	30
2	50.0	50.0	269
3	72.7	27.3	33
Totals	50.5	49.5	332

Table 8. Analysis of sea trout ages in three east coast collections.

Age groups	Wicklow 1977	Wicklow 1978	Irish Sea 1978
1. +	1	1	
2. +	47	114	16
3. +	9	18	7
1.1 +	14	10	4
2.1 +	34	29	30
3.1 +	2	3	3
1. SM +		1	
2. SM +	5	10	2
3. SM +			3
1.2 +		1	1
2.2 +	4	16	17
3.2 +			2
1.1 + SM +	1	1	1
2.1 + SM +	3	4	9
3.1 + SM +		1	
2.2 SM +		2	1
3.2 SM +			1
1.3 +			1
2.3 +			1
2.2 + SM +		1	5
2.3 SM +			1
2.3 + SM +			2
3.2 + 3SM +			1
Totals	120	212	108