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WELSH WATER AUTHORITY/ATLANTIC SALMON TRUST LIMITED

SEA TROUT WORKSHOP

24th-26th OCTOBER, 1984

SEA TROUT WORKSHOP : Plas Menai : 24-26/10/1984

List of Participants

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W J Ayton	- Welsh Water Authority, Brecon
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Dr T Cross	- University College, Cork
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Sea Trout Workshop 24-26 October 1984

Electrophoretic Studies of Brown Trout - Sea Trout Inter-relationships

A. Ferguson, Zoology Department, The Queen's University of Belfast

SUMMARY

All present day natural brown trout (non-anadromous) and sea trout populations in Britain and Ireland must have arisen from a common ancestor, the anadromous trout which entered freshwater after the end of the last Ice Age ie within the past 10,000 years. Why do certain trout become freshwater resident and does this have a genetic basis? Electrophoretic studies have demonstrated that there have been two post-glacial colonisations by distinct races ("ancestral" and "modern") of trout. Considerable genetic heterogeneity was found among brown and sea trout populations examined from 40 discrete water systems in western Britain and Ireland but there was no clear cut genetic distinction between the two types. Similarly there were no distinct geographical groupings of sea trout. In some cases more heterogeneity was present within river systems (ie among tributaries) than between systems. In one river which was examined in detail the non-migratory trout were predominantly males while the migratory ones were mainly females with both types forming a single panmictic population. In another river system genetically distinct (ie. reproductively isolated) migratory and non-migratory populations were present even in the absence of a physical barrier. Genetic analysis of rivers with non-migratory populations, as a result of impassable falls, suggest that there is genetic basis for stream residency. Further evidence for genetic control of migratory behaviour is provided by the genetically distinct sea trout, gillaroo, sonaghen and ferox populations of Lough Melvin. The genetic distinctness of adjacent river systems argues for accurate homing of sea trout with low reproductive straying even though straying without breeding or with unsuccessful breeding may be present. Electrophoresis is of limited value in the detection of genetic differences which may have evolved in less than 10,000 years and future studies should take advantage of recent advances in gene technology which allow direct examination of mitochondrial and nuclear DNA.

AN INTENSIVE ELECTROPHORETIC SURVEY OF BROWN TROUT AND SEA TROUT (*Salmo trutta* L.) IN WESTERN IRELAND.

by T.F. Cross, Department of Zoology, University College, Cork, Ireland.

Starch gel electrophoresis coupled with specific enzyme staining was used to study trout (*Salmo trutta* L.) from the Burrishoole and Newport systems which enter the sea 1Km apart in the north east of Clew Bay, Co. Mayo in the west of Ireland. Four samples of trout were taken from the Burrishoole system. Two of these, taken in 1982, were resident brown trout from above waterfalls impassable to upstream-migrating trout, on the Cottage river and at the Fairy Glen. The third sample of non-migratory brown trout came from Lough Feeagh, a large freshwater lake in the lower part of the system. These trout cohabit with migratory sea trout. They were chosen to be at least three years old in the summer of collection and adjudged to be non-migratory by scale analysis. Most sea trout smolts in the Burrishoole system are 2+ or 3+ years old so it was very unlikely that older fish would subsequently smoltify. Sea trouts smolts were collected during the spring from downstream traps on the two streams connecting L. Feeagh to the brackish L. Furnace. The latter two samples consisted of fish collected in 1981 and 1982. A sample of rod-caught adult sea trout was obtained from the Newport river in 1982.

More than 30 loci were screened electrophoretically of which 11 were variable ($_{S}$AAT-1, $_{S}$AAT-3, α-GPDH-2, $_{S}$IDH-1, LDH-5, $_{S}$MDH-2, $_{S}$MDH-3, SDH-1, PGI-3, SDH-1, PGI-3, CK-1, $_{m}$ME-2) and used in sample comparison.

Highly significant differences at a number of loci occurred between the samples from the Cottage river and Fairy Glen and all of the other samples. Such differences have probably accumulated over a long period of isolation and may have been magnified by genetic drift associated with small population

sizes.

A much smaller but significant difference occurred at one locus between the combined 1981 and 1982 sea trout smolt samples from the Burrishoole system (which did not themselves differ) and the sea trout sample from the Newport river. This implies fairly exact homing fidelity by the sea trout of these adjacent systems. Genetic differences between sea trout populations of adjacent rivers in the Co. Antrim have been recently reported (Fleming, C. and A. Ferguson, Ir. Fish Invest. Ser. B. - in press).

In contrast no differences were observed either between years or morphological types between the sea trout and non-migratory brown trout from L. Feeagh on the Burrishoole system. This suggests that interbreeding occurs between the two types and that migratory habit, at least on this system, is not related to reproductive isolation.

"PAEDOGENESIS IN SEA TROUT : SOME THEORIES"

G S Harris, Welsh Water Authority

SUMMARY

The predominance of females in populations of both adult and smolt sea trout is reviewed and discussed in relation to the predominance of precociously mature, non-migrant males in populations of 'trout'in certain areas.

Comparisons are made with salmon and brown trout and the significance of paedogenic of dwarf 'resident' males is considered in the context of reproductive strategies and evolution.

Theories of 'displacement', 'polymorphism' and 'integrity' in explaining the sea trout/brown trout inter-relationship are discussed and a new theory suggesting that sea trout and brown trout may be compound species is introduced.

Movements of sea trout in the central and southern North Sea

E C E Potter and D J Solomon MAFF, Fisheries Laboratory, Lowestoft

SUMMARY

This paper examines the results of a series of experiments carried out by the Ministry of Agriculture, Fisheries and Food in the 1950's. Each year between 1951 and 1956 sea trout smolts and kelts were trapped on the fish pass at Warkworth on the River Coquet, Northumberland and tagged before being released. Some recaptures were made within a few weeks of tagging on the East Anglian coast and others in the same and subsequent years along the Dutch, Belgian and Danish coasts. Numbers of tagged fish were also caught by trawlers working well away from the coast in the middle of the North Sea. Fish on their homeward migration were taken in large numbers in the north east coast fishery particularly around the mouth of the River Coquet.

Parallel smolt tagging experiments carried out on the River Tweed by the Department of Agriculture and Fisheries for Scotland suggest very similar migration patterns for the sea trout stocks from the two rivers.

Two follow-up experiments were carried out to learn more about the sea trout in the southern part of the North Sea. In 1955 and 1956 a small reward was paid for details of sea trout or salmon caught outside the territorial waters in the North Sea. The response was unexpectedly large with 106 fish being reported, of which all but one were sea trout. In 1955 sea trout were tagged from the commercial nets on the East Anglian coast. In addition to the recaptures in the same fishery, tags were returned from the north east coast and from the Rivers Tweed, Aln, Coquet, Esk and Ouse (Sussex). This last recapture may indicate an overlap in the feeding ranges of sea trout from south and east coast rivers.

SEA TROUT OFF THE NORTH EAST COAST OF ENGLAND

BY

A S CHAMPION

In Northumberland and Durham large sea trout abound along the coast and run the majority of rivers from May to December. For some reason the local race has been dignified with the soubriquet "bull trout" and is thought by many anglers to be different specifically from the "sea trout". There appear to be no valid grounds for this belief but amongst many anglers they are not popular because they do not take readly.

In 1867, William Dunbar reported to the Duke of Northumberland that "The bull trout have got the ascendancy in the Coquet - in fact the sole control - and they are vermin equally as voracious as pike, and where they predominate they will allow no other fish to live" and advocated an extension of the netting season to 1 November.

This year one local netsman returned a catch of 5,700 lbs of sea trout. He probably averaged £1/lb over the season so vermin can be valuable. Many of these fish were probably destined for the River Tweed but the total run in the River Coquet has averaged over 10,000 per year for the last 25 years with a rod catch of only 250 so perhaps Dunbar had a point even though these fish averaged in the region of 2 kilos.

The total net catch of sea trout in Northumbrian Water's area has varied between 19,000 (37 tons) and 46,000 (84 tons) during the last 19 years. As in the other rivers of the region in the River Coquetthe majority of fish run after the netting season and do not experience any significant fishing effort. It seems entirely conceiveable that the exploitation rate could be doubledwithout endangering local stocks as a renewable resource. It also seems possible that local rivers would then support greater numbers of juvenile salmon but who will buy upwards of 40 tons of half ripe sea trout?

A S CHAMPION
Chief Fisheries Officer

9 October 1984

CODE W/X ASCD3 ASCRPTSTNECE

OBSERVATION ON UPSTREAM MOVEMENTS OF ADULT SEA TROUT BY RADIO TRACKING

David Solomon (MAFF Fisheries Lab, Lowestoft) and Hugh Sambrook (SWW, Bodmin)

SUMMARY

Between 1979 and 1984 over 100 sea trout have been tagged with miniature radio transmitting tags near the tidal limit on the River Fowey, Cornwall. Their movements have been tracked as part of a study of the effects of a major regulating reservoir, currently being filled. The movements of the fish are followed by active tracking with hand-held aerials and portable receivers, and by a range of automatic recording equipment. Particular attention has been paid to identifying the exact time at which each step of the upstream journey commenced, and the environmental conditions obtaining at the time.

Most upstream movement takes place at night, commencing shortly after nightfall and ceasing at, or shortly after, dawn. River flow appears relatively unimportant, except that greater distances appear to be covered each night in higher flows, presumably because passage is easier. When river flows and turbidity are elevated following heavy rain, migration also takes place by day. Upstream movement each night generally ceases after 10-14 days, and is resumed in response to increased flows, and, probably, developing sexual maturity.

Large adults (1-4 kg) tracked during May generally penetrate well into the system within 7-10 days, covering the majority of their total upstream migration to the spawning grounds within this time. Smaller fish (school peal or whitling) tracked in July moved less rapidly but nevertheless penetrate much of the accessible river system within that time period.

HOMING SPECIFICATION AMONG SEA TROUT OF THE RIVER FOWEY SYSTEM

Hugh Sambrook (S.W.W Bodmin)

SUMMARY

Research on the River Fowey, in particular the St. Neat River, has shown that sea trout exhibit very little straying behaviour, not only returning to their natal river, but homing to precise areas within the natal river catchment.

Brief summary of the main points:

A. St Neat River

1. Batch markings of juvenile trout, as downstream migrants, at Colliford have resulted in the recapture of adult sea trout at Colliford in subsequent years.

   Return rates of 0.3-3.5% were recorded among three age categories of juvenile trout.

2. Sea trout smolts marked at Colliford have been recaptured as adults returning to Colliford. Recapture rates for smolts marked during 1979 ranged from 5.8-15.1%.

3. Hault sea trout tagged at Colliford have been recaptured at Colliford in successive years. The recapture rate for adults tagged in 1978 was 25.7%.

4. Adult sea trout trapped at Colliford have been fitted with radio tags and displaced back to the main River Fowey. These fish were tracked and monitored returning to the St Neat River.

5. During 1981 and 1982 all sea trout trapped at Colliford were tagged and displaced to the head reaches of the River Fowey, ie upstream of the St Neat River confluence. A proportion of these fish were recaptured at Colliford in subsequent years.

B. River Fowey Catchment

1. Since 1978, the overall recapture rates of adult sea trout tagged at Colliford, Two Waters' Foot and Restormel were 15.1%, 11.8% and 11.9% respectively. The majority of recaptures were reported within the River Fowey catchment. In total only six tagged fish were reported caught outside the Fowey estuary. Five fish were taken by coastal nets, while one fish was caught in a local river system.

2. Sea trout tagged in a recognised lie/pool one year have been recaptured in the same location, after a successful sea migration, at the same time the following year.

3. During 1980 and 1981 two traps were operated on a temporary basis at the confluence of the St Neat River and the River Fowey (Two Waters' Foot). On several occasions groups of sea trout migrated past the junction and were trapped. The majority of Colliford tagged/marked fish were recorded to split away from the shoal and migrate up the St Neat River. Those fish that were recorded to remain in the main river were subsequently recaptured at Colliford later in the same year.

4. Work undertaken in the head waters of the River Fowey, during late November and December, resulted in the recapture of only main river tagged fish from Two Waters' Foot and Restormel. No Colliford or St Neat River tagged sea trout were recorded.

H Sambrook
15.10.84

Movements of Sea Trout from the River Axe

E C E Potter (MAFF, Fisheries Laboratory, Lowestoft)

SUMMARY

Between 1960 and 1976 the Ministry of Agriculture, Fisheries and Food operated a counting fence at the limit of tidal influence on the River Axe in Devon. This consisted of a system of movable Wolf grids to capture all downstream migrants and a trap compound with an inscale entrance to catch the fish moving upstream. Although the main aim of the experiment was to investigate salmon population dynamics, sea trout smolts and adults were also tagged for a few years in the early 1960's. Unfortunately the sea trout studies could only be conducted under fairly severe constraints from local fishing interests, and a number of operational difficulties were experienced with the trap, particularly in the early years.

Large numbers of tagged sea trout were recaptured on their return to the River Axe. However, whereas the salmon showed little straying into other rivers, numbers of tagged sea trout were recaptured in rivers from North Cornwall to the Solent. Most returning sea trout were seen for the first time as whitling three to four months after they had left the river while smaller numbers returned as maiden fish after one year at sea and only a very few after two years.

The paper considers possible relationships between smolt size, time of downstream migration and growth and survival in the sea. In addition the distribution of recaptures outside the River Axe is examined along with factors influencing the time of return of the fish to the trap. Finally some differences in the behaviour of different size or age classes of sea trout are discussed.

THE USE OF RESISTIVITY FISH COUNTERS TO MONITOR UPSTREAM MOVEMENT OF SEA TROUT

D. Cragg-Hine, North West Water Authority.

The use of counters operating on the resistivity principle for the monitoring of runs of sea trout is subject to a number of problems in addition to those associated with the counting of salmon. Because the primary purpose of most counters is to count salmon, the electrode spacing and sensitivity thresholds are normally set so as to record only fish above a pre-determined size, chosen to separate salmon from sea trout. If sea trout are to be counted the counter sensitivity has to be increased and the size threshold lowered. However, there are limits to the extent to which this can be done without introducing operational problems.

In the N.W.W.A. area it has been found practicable to set a lower size threshold corresponding to a fish of approximately 2lb (0.9 Kg) in weight. Most fish below the threshold will not be counted, thus the recorded counts are inevitably an underestimate of the total run. Where salmon are also present, it is necessary to set a second higher threshold to distinguish salmon from sea trout. Because of the overlap in the size distributionsof salmon and sea trout in most rivers, this second threshold has to be a compromise figure, and there is always the possibility that there will be more sea trout above the threshold size than salmon below it, or vice versa, thus resulting in additional errors in estimating sea trout numbers. Differences in the timing of runs of salmon and sea trout can be a further source of error.

Despite these problems, counters can be used to provide useful information on topics such as the flows at which upstream movement of sea trout takes place, and the counters installed in recent years in North West England have been designed to separate fish into "small" (less than 4 lb) and "large" (greater than 4 lb) categories. The former are assumed to be sea trout and the latter salmon.

Data from four such N.W.W.A. sites have been examined to date, and attempts have been made to relate fish movement to river flow, incident light and water temperature. Initial conclusions are that upstream migration of sea trout bears very little relation to flow, and that these fish will move upstream under most flow conditions. Increase in flow may at time stimulate upstream movement,

Continued/...

but there is no dependence on higher flows as appears to be the case with salmon. To give an example, at a site on the lower reaches of the River Kent, 80% of the movement of fish less than 4 lb in weight observed during the summer and early autumn of 1982 was recorded at flows less than 40% of the average daily flow (ADF) and most movement was observed in the 20 - 30% ADF range. Generally, low flow migration took place during the hours of darkness, whereas at higher flows most fish movement occurred during the daylight hours. No clear cut relationships have been observed between fish movement and water temperature.

D.C-H.

October 1984.

Sea trout movements in the estuary and lower reaches of the Afon Glaslyn with special reference to the effects of tidal sluices

N.J. Milner

ABSTRACT

Sea trout movements were studied in the Afon Glaslyn to describe their reactions to tidal sluices and to provide information on their behaviour in the estuary and lower freshwater reaches of the river. Twenty one fish were tracked during 1981 and 1982 using acoutic transmitters with fixed and mobile hydrophones.

Seventeen fish eventually moved through the tidal sluices after remaining in the estuary or at sea for periods of 2½hr to 24 days. Sea trout movement patterns differed between the upper harbour area and the lower estuary. In the latter, movements were usually directed by tidal flow, reversal in flow direction causing reversal in direction of movement. Position holding was only recorded in the harbour area within which certain locations, including a commercial netting pool, were preferentially used. Holding was more frequent on ebb (52% of time) than on flood flow (36%).
Characteristics of the major holding areas in the upper harbour were deep water with the presence of a cold, saline, slow moving bottom layer. Movement from these areas ~~This~~ seemed to be stimulated by the mixing of fresh/brackish river water with this layer 1½ - 4½hr after the tidal sluices opened.

Movements of sea trout through the harbour and into the river were temporarily impeded by vacillation below a road bridge and the open tidal sluices. Both offered constrictions in the form of cills and side walls.

Fish tracking whilst seine netting was in progress demonstrated that this activity was less efficient than commonly thought. Of 18 hauls made whilst

fish were in the netting pool a tagged fish was caught on only one occasion, although fish were usually disturbed by the netting.

In the lower freshwater reaches of the river sea trout spent long periods (3-79 days, mean 47 days) holding up near the confluences of tributaries known to be important spawning areas. This effectively limited their availability to the rod fishery upstream.

ERRIFF SEA-TROUT: POST-SMOLT MATURATION AND CONTRIBUTION TO EGG DEPOSITION

Provisional Abstract

Post-mortem analyses were carried out on sea-trout caught on rod and line in the Erriff Fishery (Erriff River and Tawnyard Lough) during the 1983 and 1984 angling seasons. Routine fishery statistics were collected. Sex was determined by internal examination. Maturation status was determined after consideration of gonado-somatic ratios and capture date. The occurrence of unshed eggs in the abdominal cavity of one-sea-winter females was considered more reliable than scale examination in assessing the proportion of these fish which first spawned as post-smolts.

The contribution of each sea age group to egg deposition was determined after consideration of sex ratios, percentage maturation of females, mean fecundity and percentage composition of catch.

Martin O'Farrell

Central Fisheries Board.

Rearing and ranching of sea trout (Salmo trutta L.) in the Burrishoole River system.

By C.P.R. Mills, D.T. Quigley and T.F. Cross.

Sea trout have been reared by the Salmon Research Trust of Ireland during eleven seasons between 1962 and 1983. The survival rate to 1 year old parr averaged only 10.2% between 1962 and 1983 but 77% of the ova hatched in 1984 had survived after 6 months.
A preliminary comparison of the performance of sea trout reared in a freshwater pond and floating net cage showed a higher growth rate for fish in the cage but higher survival of fish in the pond. Factors affecting growth and survival of sea trout from egg to smolt are discussed, with reference to results obtained elsewhere.

Percentage recaptures of ranched sea trout varies from 0 to 7%. These are minimum rates based on tagged fish and higher recapture rates would have been recorded if tag loss rates had not been high (up to 71%). Low return rates for 1 year old "smolts" may indicate that these fish had not developed true migratory behaviour or survived poorly in the sea. A considerable percentage of 2+ smolts (51.8% in 1984) were also found not to have migrated to sea.

The behaviour of ranched sea trout on their return to freshwater and their value as a means of stock enhancement is discussed.

MOVEMENT PATTERNS OF MIGRATORY TROUT IN THE LOWER GLASLYN ESTUARY

ABSTRACT

The seasonal distribution of sea-trout rod catches on the Afon Glaslyn is unusual in that a high proportion (≃ 30%) of the annual catch is taken in the estuary during April/May, compared with ≃ 1% for other Gwynedd rivers. A sampling and tagging programme was carried out to describe the composition and movements of migratory trout populations in the tidal section.

Dfferences in movement patterns, temporal abundance and morphometric characteristics enabled the sub-division of the population into 3 groups : smolts/partially silvered parr, estuarine trout and sea-trout/sea-trout kelts.

The majority of the smolts were captured during May/June, with smaller numbers being present in March/April and October. Those caught in June were smaller and of a younger age group than those caught in April/May. Many juveniles delayed their migration and remained temporarily in the tidal reaches. This delay was particularly marked in the later migrants, many of which remained until the following spring before migrating to sea. Residence in the brackish zone was accompanied by a change in body colouration, enabling distinction from other types of trout. Relatively few estuarine trout were captured showing evidence of having spent more than one year in the estuary.

R. Brassington.
Fisheries Conservation Resources Officer.

3/9/84.

The Trout of the Findhu Glen Burn (Tayside)

Summary

The Findhu Glen Burn is a mildly alkaline, torrential tributary of the River Earn, 5 - 7 metres wide and 70 km from the Tay Estuary. Salmon are present in the lower reaches up to a waterfall which is passed by migratory trout, the latter being able to penetrate a further 6 km to falls at 350 metres elevation, above which there are brown trout.

Sampling has been undertaken since 1980 by electrofishing and temporary trapping. Spate severity limits more intensive trapping. Marine parasites were used to confirm visual and scale reading identification of sea trout and tagging has validated age determinations.

Sea trout appear in the burn from late May and are mainly maidens aged 2.1+. Annual MSAs were 2.18 - 2.33 and MTAs 3.62 - 3.90. Previous spawners are common (20 - 40%), with individuals having up to 4 SMs. Mature finnock numbers are low ($<$8%) and they have a higher than average MSA (3.0 - 3.25). Females predominate over males, especially among the previous spawners.

Occurring with the sea trout are mature male, stream-resident and river-migrant brown trout aged mainly 2+ and 3+, but up to 7+. Only one mature female has been found in four spawning seasons. In contrast, mature females are common in the upper reaches inaccessible to the sea trout. The brown trout in the sea trout zone constitute 30 - 40% of the potential spawning stock of males, yet few female sea trout are unattended on the redds by male sea trout. Spawning commences in mid October and is completed rapidly. Tentative estimates of the annual stocks of adult sea trout have ranged from 450 - 950 fish. More than 50 recaptures have been made of fish which have returned to spawn again. Only two have been reported from outwith the Tay System, both in coastal nets, once near Montrose and the other at Amble, Northumberland.

Stocking experiments are underway to examine the response to the Findhu Glen environment of trout of different genetic strains.

A F Walker
Freshwater Fisheries Laboratory
Pitlochry

ABSTRACT : Sea Trout in the Burrishoole River system. D.J.Piggins.

Various aspects of the life-history of wild sea trout have been studied from data derived from counting the fish in two sets of up- and downstream traps on the Burrishoole River system in Co. Mayo. Smolts (migrating from February to July) are predominantly 2+ and 3+ years old, with 2+ smolts making up roughly 66% of the total. The threshold size for migration is 19-20cm, 70-90g with a Condition Factor of 0.95-0.99. Smolt production has remained relatively constant since 1970 (average number 4263) despite a decline in spawning escapements from over 3000 in 1976 to 900 in 1983. Autumn-migrating trout (1+ & 2+) also contribute to the sea trout population but tagging studies indicate a lower survival rate than from smolt to finnock (0+ sea years). As for salmon, there is no obvious relationship between numbers of juvenile migrants and returning sea trout. The data on numbers of finnock returning to fresh water is unreliable, due to:-

(a) small finnock squeezing through the fence and traps uncounted
(b) mis-classification of some finnock as sea trout in the trap counts
(c) confusing of large smolts with finnock kelts in the downstream traps in April and May.

Data exists for the timing of upstream and downstream runs, growth increments and ansence periods at sea and homing and straying of both smolts and adults as well as various aspects of sea trout behaviour in fresh water. Results from rod angling returns include annual exploitation rates and subtending factors, catch per unit effort, annual weights of rod-caught fish and age-composition of the stock. Kelt tagging ceased in 1975 but smolts and autumn-migrating trout have been tagged since 1979. Calculations of numbers of finnock, maiden sea trout and previous spawners in the upstream run each year indicate much higher survival rates from the juvenile migrant stage than those derived from recent tagging studies of juveniles.

UDN appeared among sea trout in 1971 but has had no discernible effect on stocks. Up to 7% of the kelts were affected until 1976, after which the incidence of infection fel to less than 1%.

The present decline in stocks is disquieting and can only be attributed to factors affecting marine survival. These may be part of a cyclical phenomenon of uncertain derivation or to increasing illegal exploitation off the coast.

The Atlantic Salmon Trust Sea Trout Workshop 24-26 October 1984

SEA TROUT OF THE NORTH ESK

by

W M Shearer

ABSTRACT

The sea trout population of the River North Esk was sampled by means of a stationary trap situated on Kinnaber Mill Lade which drains its water from the main river. Commencing in 1971 the number of trout taken in the trap was noted daily, and from 1976 all stages of trout caught in the trap were tagged. The peak of the sea trout smolt migration was usually in May and June, and over the period of study exhibited a tendency to occur later each season. Two year old smolts comprised the largest age class in the smolt samples with 3-year old fish being the other substantial class. Samples of smolts taken for sea determination were found to be predominantly female.

A proportion of finnock (post-smolts) returned to freshwater in the year of their smolt migration and were caught in the trap from July onwards with a peak of movement occurring in the autumn. The main run of adult sea trout into the trap occurred anytime between July and October. The adult sea trout sampled were predominantly maiden spawners of age 2.1+ and 3.1+ years. Both finnock and adult sea trout samples exhibited a similar freshwater age composition to that of the smolts.

The migrations of North Esk trout were studied by tagging all the stages caught in the trap at Kinnaber Mill. The majority of recaptures were reported from the Montrose area, and evidence of a great deal of inter running between the sea trout of the North Esk and neighbouring rivers was found. Some tagged

fish undertook several journeys back and forth between sea water and fresh water as finnock. Numerous examples of tagged sea trout travelling appreciable distances (>100km) were obtained.

The net and coble catch of sea trout in the North Esk was sampled between 1977 and 1979. A comparison of the length frequency distribution of these samples with those of sea trout taken in the trap, which was assumed to be unselective, revealed that the net and coble fishery was very selective. The sea trout in the commercial catch samples were predominantly maiden one sea winter fish which had spent either two or three winters in fresh water before migrating to the sea as smolts. The freshwater age of the maiden sea trout sampled, declined as the season progressed. The ratio of males to females in the 1978 sample was 1.00 : 2.18.

The exploitation rate of sea trout reaching the furthest upstream major fishing station, Morphie Dyke, was estimated from the recapture of upstream migrating adult sea trout removed from the trap at Kinnaber Mill and released in the main river 2 km downstream of Morphie Dyke. The percentage exploitation rate at this station was found to range between 6.4% and 12.2%, and the exploitation rate for the entire net and coble fishery was at a level of approximately 30% during the period of the study.

SUMMARY

Sea feeding behaviour and its consequences for sea trout in the Irish Sea and the Atlantic.

EDWARD FAHY

Studies in the Irish Sea and the Atlantic reveal two patterns of feeding. In the relatively impoverished Atlantic sea lough feeding is mostly on Amphipods; the food web is large and complex and the meal size is relatively small. In contrast, trout in the Irish Sea are mainly piscivorous, the range of prey is narrow and the meal size is relatively large. Gut parasite burden is heavier in Irish Sea trout where the majority enter the trout via fish prey.

Greater meal size in the Irish Sea enables trout there to put on weight at a faster rate. Post-smolt from the Irish Sea are up to 80% heavier than Atlantic fish of the same fork length. Discrepancies in weight: length relationships between Irish Sea and Atlantic fish reduce at greater fork length, once the fish commence spawning. It is argued that weight: length relationships can be related to sea feeding. There are two types of weight: length relationship among British and Irish Sea trout stocks. Better conditioned stocks are mostly confined to the Irish Sea, poorly conditioned to the Atlantic. Sea feeding also has consequences for the number of eggs produced by a hen sea trout of a given fork length.

Weight: length relationships are proposed as a basis for classifying sea trout stocks.

SCALE READING AND AGE VALIDATION OF SEA TROUT

Hugh Sambrook (S.W.W Bodwin)

SUMMARY

Since 1977 a research programme has been undertaken to investigate the effects of the Colliford Reservoir Scheme on the salmonid stocks of the River Fowey, Cornwall. Over this period adult sea trout were tagged, using fly tags, and released into the River Fowey catchment. A proportion of these marked individuals were subsequently recaptured. Multiple recaptures of certain individual fish were recorded over successive years. These recaptures enabled the collection of a time series set of scales from known individuals. The scales were retained as reference standards and formed the basis on which a strict standardisation of the ageing technique was developed. The collection allowed the scale growth characteristics of individual fish to be studied in relation to known phases of their life history. The use of the reference scales was obviously important in reducing the inevitable errors associated with the interpretation of certain scale characteristics, such as spawning marks, checks, degree of erosion, etc. The establishment of these sets of scales over several years has not only aided in age validation but has allowed the development of a modified nomenclature for recording age. The main difference between the modified and classic nomenclature outlined in the literature occurs in the recording of the sea age. The description of the sea phase has been adopted to record the exact sequence of consecutive sea winters and successful spawning migrations into freshwater. This nomenclature is considered less confusing and reduces those errors associated with the subjective over-interpretation of the scales.

It must be emphasized that the development of the nomenclature and standardisation of the ageing technique has resulted from the knowledge and experience gained from a detailed study of the sea trout from a single river. The application of these reference standards to other sea trout stocks in the country has yet to be tested.

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