

ROINN NA MARA

**SALMON TAGGING IN THE WEST OF IRELAND
1986 TO 1988**

by

Tom McDermott

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Fisheries Research Centre,
Ross House, Galway.

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The analysis of more than twenty-six thousand micro-tag recoveries has led to important discoveries for the management of Irish salmon stocks. This Leaflet gives details of the tagging over half a million young salmon and of the results of recovering 4,000 tags from 1986 to 1988. The most important conclusions are:

Careful control of place and time of release of hatchery-reared smolts has a dramatic effect on their survival. In the Corrib system, transportation of smolts from Cong to Galway resulted in a substantial improvement in yield, with a tenfold increase on one occasion. This means that up to ten times as many salmon can be produced at no increase in the cost of rearing them.

The returning adult salmon produced from smolts which were released at Galway tended to stay for a long time below the Galway weir and therefore made a major contribution to the rod fishery.

Marine survival fluctuated yearly for hatchery and wild smolts released. For hatchery smolts those released later survived best. In contrast wild smolts which migrated in May had a lower survival than those which left in April. Marked differences in homing accuracy, timing and speed of migration were noted between wild and hatchery smolts within the Corrib system.

Drift net fisheries depend mainly on the salmon which originate from rivers nearby. There is a distinct division between the catches north and south of Galway Bay: those to the south come mostly from the rivers Shannon and Corrib, those to the north from Connemara rivers.

The drift net fishery continues to rely heavily on a self sustaining population of wild salmon despite improved hatchery performance and increasing catch of cage farm escapees.

Hatchery smolts transferred to different rivers learned to recognise the new river within a remarkably short time. Two weeks were sufficient to achieve a degree of homing success approaching that of fish returning to their own rivers. This discovery is of major significance in the development of salmon ranching.

INTRODUCTION

Coded wire tagging

The tagging of salmon in Ireland was first recorded during the Great Famine (1847-1850) and developed during the succeeding century and a quarter. In 1979 the coded wire tagging system was introduced to Ireland by John Browne at the Fisheries Research Centre. For the first time large numbers of wild and hatchery-reared juvenile salmon could be tagged quickly, reliably and at a reasonable cost. By 1988 1.7 million hatchery reared and 62,000 wild smolts had been tagged. Over 26,000 of these have since been recovered as adult salmon on their return to Irish waters.

Analysis of the recaptures reveals the changing pattern of salmon migration and the impact of the various catching methods. By using batch marks for smolts, released at different times and places on particular rivers, it is possible to determine the best possible arrangements for release. This aspect of the work has already led to spectacular improvements, doubling the survival of hatchery-reared salmon in many cases. Wild smolts tagged from the Corrib, Munster Blackwater and Bush provide a yardstick to assess the performance of hatchery-reared fish and other artificial measures used to increase stocks.

Tagging involves the implantation of a microscopic binary coded wire tag into the nose of a juvenile salmon. The tag is 1 mm long and its diameter is similar in size to the dot on the letter "i". Each tag bears a code number which can be deciphered under a microscope. They are supplied on a wire spool comprising 10,000 identically coded tags. During the tagging operation the adipose fin of the salmon is removed to assist later identification and recovery.

As the salmon return to Irish waters, after maturing at sea, researchers examine catches for tags. Fin clipped salmon are passed through a detector which "bleeps" when a tag is located. A core containing the tag is removed from the fish and placed in a container, with a sample of scales and details of the specimen's length, weight, date and place of capture. This is then sealed and set aside for processing. Any information forwarded by fishermen in relation to seal damage, location of stocks exploited, direction of migration at sea, etc is noted to give a comprehensive account of the fishery at the end of the season.

Tagging locations and numbers released

Details of the 593,641 smolts tagged from 1985 to 1987 are given in Table 1. The rivers and tagging locations are shown in Figure 1. The majority of tagged hatchery-reared smolts were released downstream of the rearing stations. Wild smolts were tagged as they migrated from the rivers.

Some smolts from Carrigadrohid, Cong and the Salmon Research Trust (SRT) were released in distant rivers to determine the time needed to establish homing ability, migration patterns and the straying rates of these fish. In 1985 tagged smolts from SRT and Carrigadrohid were placed in sea cages to determine the number and behaviour of escapees.

All tagged salmon are finclipped. In addition, all smolts released from Parteen hatchery on the River Shannon are fin-clipped whether they have been tagged or not. Therefore a fin-clipped salmon with no tag can be recognised as of Shannon origin.

Tag recovery

The recovery programme involved daily inspection of sea-caught landings at selected locations in June and July. In addition river-caught fish were monitored throughout the open season and brood-stock were examined in December.

Analysis of the recoveries is based firstly on three large regions: Cork/Kerry, Clare/Galway and Mayo/Donegal (Fig. 1). The Clare/Galway region is subdivided into southern and northern areas, the division between the two being at Mace Head. (Fig.2). In 1988 a new sampling location was established at Carrigaholt in the Shannon Estuary.

Salmon from drift net catches were examined at coastal landing places and processing premises. On the spot samples were examined from draft net catches in Killary Harbour and on the Inagh river, from river salmon at trap fisheries on the Corrib and Screebe and from rod fisheries on Corrib, Screebe and Erriff.

RESULTS

The recovery rate from stocks tagged and released north and south of Mace Head reveal that two distinct fisheries exist in close proximity on the Clare and Galway coasts (Fig 1). Details of tagging and recaptures are given in Table 1.

The Corrib, Screebe, Erriff, Inagh and Fergus tag returns are dealt with separately. Comparison of Corrib wild and hatchery experimental groups, returning as grilse to the river in 1986, revealed that distinct behavioural differences existed between wild and hatchery groups (page 7). To determine whether these differences existed in the drift net fishery, a national comparison of the relative level of exploitation was undertaken (page 9). The performance of groups tagged, wild and hatchery, is investigated in detail under the headings of the terminal fisheries (pages 7 to 13). Results of experimental release of Cong-reared smolts from the Erriff are given on page 11. Details of recoveries in drift nets north and south of the Clare/Galway region are given on page 13.

Clare/Galway 1986

The data presented in Table 2 indicate that notable differences exist in stock composition between the two areas. In the southern area in 1986 over 3% of the fish examined were tagged, in comparison to over 9% in the northern. Only 45% of the finclipped fish observed in the southern samples had tags compared to 84% for the northern. These figures indicate the preponderance of Shannon stocks off the Clare Coast, as all smolts with finclips but without tags were released from this river. The Shannon hatchery, at Parteen, contributes most of the hatchery reared stocks to the drift net fishery in the region. This is estimated to be 4% of the catch.

The monthly data in Table 2 reveal a decrease in the presence of tagged stocks, towards the latter part of the season, especially in relation to southern catches. For example in the last week of July a sample of 824 salmon yielded only 3 tags (0.4%). The study of tag codes in this period suggested an absence of local stocks and the presence of stocks from distant rivers.

The overall recovery in the southern area of stocks from the northern was 35% and from northern stocks in the northern area 62%.

Recovery rates of stocks from separate rivers are shown in Table 2. There is an obvious gradation from the Burrishoole stock, and its dominance in the northern area, to the Shannon stock and its commanding presence in the southern catches. These figures support the observation that stocks are exploited most close to their natal rivers. In both fisheries the majority of tags were recovered in June (61% and 63%).

Timing, homing accuracy and migration speed of river stocks, through interceptory fisheries, may vary and so affect escapement.

For example the Corrib stock, both wild and hatchery, suffered little exploitation by the immediate offshore fishery, as stocks migrated early in the season.

Differences in average size of returning grilse were observed during the tag recovery operation. These ranged from 2.8kg for Corrib wild stocks, to 3.1kg for Shannon hatchery stocks. Screebe also produced a large grilse at 3.1kg, against 2.8kg for the Corrib hatchery groups. Returning adults from the early running group of wild smolts were larger than those which migrated later, 2.8kg compared to 2.6kg respectively. Selection of stock, size of smolts at release, time of entry and return from feeding at sea, and gear selectivity, for size are some factors which may combine to produce these differences.

To compare the relative exploitation of river stocks, the ratio of sample size to total catch is used to estimate the contribution of each river to the fishery. It was calculated that 1,075 or 0.5% of 215,155 tagged hatchery smolts released in 1985 were subsequently caught in the Clare/Galway drift net fishery. The Screebe river had the highest exploitation (2.3%) followed by the Burrishoole (1.7%) and Shannon (0.8%).

In the Clare/Galway drift net fishery 12 tags from 2-seawinter fish were recovered: 4 were from wild Corrib fish, 3 each from the Boyne and Burrishoole, and 2 from Screebe.

From the 21,565 smolts tagged for cage farming only 1 of the 8 recoveries were from the Clare/Galway drift net fishery. One tagged fish had grown considerably to 5.2kg while another had migrated to Greenland before being intercepted. The rate of escapement was 0.04%.

Clare/Galway 1987

There was a 40% decrease in the number of salmon examined in 1987 compared to 1986 and a similar drop in the number of finclipped fish observed and the number of tags recovered (Table 1). The decline was confined to the southern area, where good prawn fishing on the Porcupine Bank and poor salmon fishing combined to reduce catches.

In comparison the northern area performed well. In Table 2 the 1987 data are presented in the same format as 1986.

In 1986 fishing commenced early and finished late in the season, in 1987 it was confined to mid June. Weather conditions throughout 1986 were wet and windy, in comparison June 1987 experienced calm sunny conditions turning to unsettled broken weather for July.

In the southern area over 4.3% of the fish examined were tagged; for the northern this figure was 5.1%. Only 55% of the finclipped fish observed had tags, in southern samples, compared to 83% in northern. The recovery rates for selected rivers (Table 4) as in 1986 demonstrated the gradation in the exploitation of stocks from Burrishoole in the northern, to Shannon in the southern area.

The overall recovery rate of stocks from north of Mace Head, exploited in the southern area, was 44% and from northern stocks in the northern area 95%. The figures in Table 2, show a decrease in exploitation of tagged hatchery stocks from 1986 (0.50%) to 1987 (0.38%). The greatest exploitation of a single stock, in the Clare/Galway region was 1.8% for the Erriff. This was followed by the Corrib (1.3%) and Burrishoole (0.9%). The Screebe stock released performed poorly.

The rate of return for Burrishoole fell due to the stocking of Mowi salmon, non-native smolts derived from Fanad farmed fish transferred to Newport as fingerlings in 1985. Mowi and Burrishoole smolts were released under similar conditions. Burrishoole fish returned to the Irish coast at a rate of 13 native to one Mowi.

The pattern of recoveries shown in 1987 again indicates that the greatest exploitation of river stocks occurs close to the river of origin. The tag recoveries also suggest that the migration path chosen by separate river stocks will affect their relative availability to successive interceptory fisheries.

The largest grilse recovered were of Shannon origin at 3.4 kg, followed by the Corrib and Burrishoole at 2.8 kg with Erriff slightly smaller at 2.7 kg. The early appearance of northern stocks in Cork/Kerry observed in 1986 did not occur in 1987.

In the Clare/Galway drift net fishery 8 tags from 2-seawinter fish were recovered: 4 were from Burrishoole, 3 from Bundorragha, and 1 from the Gowla River.

Clare/Galway 1988

North of Mace Head the catch remained at the same level as in 1987 but southern catches increased slightly. Fishing conditions were poor in June due to calm sunny weather but improved in July. The inshore fishery increased its share of the catch despite a switch to more profitable lobster fishing in July. Larger boats turned to prawn fishing on the Porcupine Bank for most of the season.

In 1988 data from a new sampling location at Carrigaholt Co. Clare was included to examine the composition of the Shannon Estuary catch. The 1988 Clare/Galway catch was higher than that of 1987 (Table 1).

From the data presented in Table 2 it appears that a separate fishery exists within the Shannon Estuary. Though the percentage of tags recovered from Shannon Estuary and Clare/Galway catches is similar a marked difference exists between the two in relation to the number of hatchery-reared salmon in the catch. Over 10% of the Estuary catch was finclipped compared to an average 4% in Clare/Galway. Only 34% of the Estuary finclipped fish had tags compared to 86% in Clare/Galway indicating the strong presence of Shannon stocks in the estuary. Recoveries from the Parteen hatchery constitute a minimum of 9% of the catch in the Estuary but only 1% in Clare/Galway.

The monthly data in Table 2 show a marked decrease in the presence of tagged stocks, late in the season in southern catches but little change in the northern area. Fishing commenced early with a constant catch in June and July north of Mace Head. In the south the July catch fell as in 1987. At Carrigaholt inshore fishermen operating in the Shannon estuary reported good fishing for June but with the break in weather in July catches fell. Few salmon entered the market after mid July.

The overall recovery in the southern area of stocks from the northern was 21% and from northern stocks in the northern area 57%. The recovery in the Estuary area of stocks from the northern was 9%. The recovery rates of stocks from selected rivers are shown in Table 4 demonstrated the gradation in the exploitation of stocks from Burrishoole in the north to Fergus and Shannon stocks in the Estuary.

Shannon stocks again produced the largest grilse at 3.2 kg followed by Screebe 3.1 kg and Lee 3.0 kg. The Corrib hatchery grilse, 2.5 kg, were smaller than their wild counterpart. Tagging three groups of wild smolts at different times during the run indicated

that the timing of the smolt migration influenced the size attained by adults caught by drift net. Smolts tagged on 29 April, 5 May and 14 May produced grilse of the following weights: 3.0, 2.8 and 2.7 kg. Early running smolts thus may be producing the largest grilse.

The relative exploitation of tagged hatchery stocks in the Clare/Galway drift net catch was 0.24% and in the Shannon Estuary 0.36%. The Screebe river had the highest exploitation (2.11%) with equal shares taken in June and July. The Corrib wild smolts (1.31%) were exploited to a greater extent in June (1.21%). In comparison to the wild the Corrib hatchery smolts performed poorly (0.12%).

Stocks exploited in the Shannon Estuary were Fergus (2.32%), Inagh (2.02%) and Shannon (1.20%). The accurate homing ability of Corrib wild salmon was evident as only 0.07% were exploited in the Shannon Estuary catch.

Six multi sea-winter tags recovered in Shannon Estuary and Clare/Galway catches were from the rivers Erriff, Burrishoole and Shannon.

Corrib 1986 - Riverine fishery

The relative performance of wild and hatchery salmon was evaluated in an experiment based on tagging 63,800 hatchery reared smolts of indigenous stock and 4,714 wild Corrib smolts in 1985. The hatchery smolts were divided into two groups. The first (53,700) was released in Cong, at the head of the system. The second (10,100) was transferred 35km downstream from Cong to Galway, placed in a holding cage and released on the same date as the Cong group. The wild smolts were tagged as they migrated out of the system in Galway and represented an estimated 4% of the total wild run.

The sampling sites for adult returns included the Galway trap and rod fisheries, at the mouth of the river and the Cong rod and hatchery returns at the head of Lough Corrib. The number of tags recovered is given in Table 3. The majority of tags recovered within the system in 1986 were from these groups. The appearance of Corrib wild and hatchery reared stocks in the 1986 drift net fishery is included to give a comprehensive account of the 1985 tagging experiment.

In the river, a total of 2909 salmon were examined and 892 tags recovered. In the Galway catches, 1,745 grilse yielded 474 tags from the 1985 Corrib releases. At Cong 551 grilse gave 255 tags. From the Corrib catches sampled, 1% of the hatchery group tagged in 1985 was recovered in 1986 and 2% of the wild group. In the Galway trap catch the return rate of the transferred group was higher (1.9%) than for the wild group (1.6%).

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The recovery rates of hatchery and wild tagged stocks from the Corrib river show that marked differences exist between groups. Altering the release location of the hatchery reared smolts resulted in a considerable increase in survival, allied to a change in migratory behaviour. Tag recovery for the transferred group was (3.9%) compared to (0.4%) for the group released at Cong - a tenfold increase in survival as a result of transportation.

The ratio of recaptures of per 10,000 smolts released at Galway to 10,000 released at Cong were:

Galway trap	18:1
Galway rods	40:1
Cong rods	1:1
Cong broodstock	3:1

Speed of ascent and homing instinct in fresh water appear to have been impaired within the transfer group, resulting in heavier exploitation downstream. Few of the transfer group reached the headwaters at Cong in June and July. Broodstock returns taken in December, nevertheless, provided a greater return to the hatchery than the upstream release group. Increased straying within the system and the observed increase in exploitation downstream may have combined to reduce returns of the transfer group.

Time of return to the Corrib also varied for wild and hatchery fish. The wild stocks were the first to enter the river, in mid May, followed by the downstream group, a week later and the upstream group, a fortnight later. The wild and hatchery upstream groups ascended the river in the normal way. The downstream group passed the traps in the tidal section then delayed less than 500 metres upstream, at the location of release within the rod fishery.

Differences were noted in the return rate between two sub-groups of wild smolts which represented the mid and late portion of the run. Wild smolts entering the marine in May did not do as well as those running to sea in April. A closer study to quantify this was undertaken in 1988 (Table 3).

There were 161 2-seawinter returns to the Corrib river and a wild salmon tagged in 1983. The 2-seawinter tags are from an 1984 experiment involving wild smolts and Cong hatchery released and transported smolts. The hatchery smolts transported downstream to a canal were largely exploited in Galway whereas the hatchery release group passed quickly through the lower portion of the river and were taken in Cong. One hatchery fish had grown to 10kg in two years.

Of the 892 tags recovered in the Corrib, only 5 did not belong to the system. These fish were of Lee origin transferred as eggs to the Ballyshannon hatchery for stocking the Erne river. The transfer of stocks, from one system to another, appears to increase straying. This is supported by another experiment, where parr of Corrib stock, reared in Cong hatchery were transferred in November 1984 to the Gowla river. Seven of these were recovered in the Corrib in 1986.

Corrib 1986 - drift net fishery

The recovery rates of tags in the drift net fishery for the three experimental groups in 1986 showed similar proportions for upstream to downstream releases as observed for those returning to the river:

Upstream	0.08%
Downstream	0.81%
Galway wild	1.08%

In Table 4 the recovery rates of tags from the three Corrib groups together with hatchery fish from Burrishoole, Screebe and Shannon are shown. The wild stocks exhibit a stronger migratory bias to the south which may be linked to their earlier return to Irish waters. The Burrishoole and Shannon stocks also appear in the Cork/Kerry catch, suggesting a certain southern bias in their migration early in the season. The Screebe stock was heavily exploited by the Clare/Galway fishery, as the timing of the run to the river coincided with the peak of drift net fishing in the area.

Corrib 1987

Few grilse tags were recovered in the river in 1987 as only one group of Cong-reared smolts was released in 1986. The transferred smolts were not placed in a cage as in 1985 but were put directly into a canal. Due to flooding no Corrib wild smolts were tagged. The same sampling sites were used in 1987 as 1986. The number of fish examined and tags recovered are given in Table 3.

There were 2,334 salmon examined and 191 tags recovered from the river in 1987. The Galway trap catch showed a slight increase on 1986 with more grilse and fewer multi sea-winter. Tags were recovered from 25% of the multi sea-winter fish and 4.5% of the grilse. The former included two recoveries from 1983 releases and four from 1984.

The Galway rod fishery gave recovery rates of 32% and 9% for multi sea-winter and grilse respectively. The downstream release again favoured the rod rather than the trap fishery. The recovery rate of the multiseawinter groups to the river were : transferred group 0.3%; Cong 0.04% and the wild 0.4%. Distribution within the system for each group was similar to the 1986 grilse.

The overall recovery rate for the transported group was only 1.0% compared with 3.9% for 1986. Allowing for reduced sea survival in 1987 the release of hatchery smolts to a downstream holding facility does appear to increase survival especially in flood conditions. The slight increase in catch at the trap fishery may be explained by the fact that the number of unfishable days due to high water levels dropped from 17 in 1986 to 4 in 1987. The average weight of grilse entering the traps increased from 2.3kg in April to 2.7kg in July.

Corrib 1988

The relative performance of wild and hatchery-reared salmon was assessed within the system in 1988 with the release of 8,771 wild and 12,791 hatchery smolts in 1987. The wild smolts were tagged in three groups between 23 April and 14 May (Table 3) as they migrated downstream above tidal waters at Galway and represented an estimated 9% of the total wild run.

The hatchery smolts were divided into two groups, one released into a cage placed above the weir and the second into a canal which re-enters the river below the traps, further downstream. The smolts were transferred on 7 May and released on the 15 May 1987.

The sampling sites were the same as in 1986 but an angling boycott on the Corrib meant no angling data were available from above the Galway fishery. Two Cong tags were collected from 17 salmon during a May truce. The number of tags recovered are given in Table 3.

From the Corrib catches sampled 3.2% of the wild smolts were recovered compared to 0.4% hatchery. The recovery rates of the individual groups of wild smolts highlights falling survival with time of entry to the marine environment. Early smolts tagged returned to the traps larger than late running smolts. There were only slight variations in time of return between the groups though the late group appeared in May to a lesser extent than the two earlier. Tags recovered from a developing angling fishery below the traps were all from the hatchery transferred groups.

The trap recovery rates for wild smolts tagged were: early 3.5% ; mid 2.9% and late 2.1%. The average weights for the three groups were : 2.97, 2.75 and 2.66 kg respectively. The largest grilse return was 5.0 kg caught on 9 June. The recovery rate for the cage group was 0.2% and canal 0.3%. One Burrishoole stray was taken. Of the trap catch of 3,265 grilse 9% were tagged.

The multiseawinter catch of 459 salmon produced 15 tags. These were from the 1986 hatchery canal release group. One tag was recovered from the release of 2,348 Cong parr on 14 May.

The hatchery transferred groups returned initially to the location of release but rod returns were lower as a result of poor survival.

The critical factor of marine arrival time as identified with the wild smolts suggests that the late release date of the transferred groups in 1987 may have reduced survival.

Two multiseawinter tags were collected from a rod catch of 69 salmon. One was a 1985 cage release fish and the other a 1986 canal release.

Screebe 1986 to 1988

The Screebe river has a catchment area (55 square km) similar to that of many small salmonid streams in the region. In 1986 a trap in the lower portion of the system was operated to monitor escapement of hatchery and wild stocks upstream. This resulted in the recovery of 362 tagged grilse from a run of 818 salmon. The wild were the first to enter the trap in June and July. The hatchery-reared migrated upstream later in July and August.

In the Clare/Galway drift net fishery, the exploitation of tagged Screebe stock was 2.3%. Rod and trap returns, within the river, revealed that a further 0.7% were caught by anglers and 3.6% escaped upstream. Total tag returns for the 1985 release exceeded 7%.

Due to storm damage the smolts tagged for release in May 1986 escaped the previous November. Only 5 tags were recovered in the 1987 offshore fishery, a recovery rate of 0.07%. The angling catch of 28 salmon produced one further tag, giving a total recovery rate of 0.08%. Unfortunately the upstream trap at Screebe was not used for tag screening so that no information on escapement to the river was available. Even allowing for a decrease in sea survival between seasons, the accidental escape in November clearly showed the improvement in survival resulting from late spring releases.

The recovery rate of Screebe hatchery stock to the rod fishery in 1988 was similar to that achieved in 1986. There were 39 tags in a rod catch of 114 salmon with the bulk of these recovered in July instead of August as in 1986. From the catch data it appears that the hatchery fish are available to the rod fishery later than the wild.

The migration pattern of Screebe stock in 1986 was markedly different to that of 1988. In 1986 Screebe salmon were exploited to the south of the river to a greater extent than in 1988 (Table 4). The recovery rate for the offshore fishery in 1988 was 2.5%. Total tag returns excluding escapement was 3.2%.

Erriff 1986 to 1988

In 1984 a group of tagged hatchery smolts were placed in a self release pond above the tidal waters on 3 April. By 11 April all 7,293 smolts had entered the river. The smolts were derived from Lee eggs ongrown at Mullingar hatchery. In 1985 5% of the 151 fish examined from the Killary draft nets had tags. Only 2% of the 495 fish caught by the Erriff rod fishery were tagged. In 1986, a further 0.7% of 573 rod caught fish had tags but none were found in the 109 caught by draft net. The rate of return (2.4%) achieved from ranching non-indigenous stock augured well for the 1987 ranching study involving the use of Erriff wild fish as broodstock.

The experiment began in November 1984, when ova derived from Erriff wild fish were transferred to Cong hatchery, for ongrowing to smolt. In May 1986, these fish were transferred back to the Erriff and released at the mouth of the river (Table 1). As in the case of the non-indigenous hatchery group, the fish were placed in a

concrete pond, situated above intertidal water and allowed to migrate out at will. In 1987 the drift, draft and rod fishery catches were examined for tags.

The 1986 Erriff group suffered heavy exploitation in the 1987 offshore and terminal fisheries, reflecting good post smolt survival. In the Killary draft nets 8% of the 263 fish examined had tags. Of these, 17 had come from the Erriff, and 2 from the Burrishoole river. In the rod fishery 5.8% of the 639 fish caught were tagged. All were from the 1986 Erriff release.

The results indicate that the draft net fishery largely depends on Erriff grilse stocks. The hatchery-reared salmon entered the draft net fishery later than the wild with the majority of tagged fish appearing in the second week of July. Exploitation of the hatchery stock increased at the net stations located close to the river mouth.

The hatchery stock homed initially to the location of release in the river during June and July, but moved further upstream late in the season. In June/July 82% of the hatchery fish caught by rod were taken on the lower beats compared to only 53% in August/September. One stray was recorded at Cong. Given the retention period for imprinting the smolts in 1984 and 1986, the homing accuracy is surprising. The relatively high rate of return may be attributed to good sea survival.

The exploitation in the Clare/Galway drift net fishery was 1.9%; in the draft nets 0.2% and 0.4% were rod caught. A further 7 hatchery salmon were recovered from the 1987 broodstock. Total tag returns for this group was 4%.

Of the 12 tags recovered in 1988 from the 1986 release group, 4 were caught in the Clare/Galway drift nets as grilse. A further 7 tags were recovered as two-seawinter fish from the Erriff rod fishery. The 1988 rod catch consisted of 805 grilse and 70 multi-seawinter. One stray appeared in the Bundorragha rod catch of 143 salmon: 22 of these were multi-seawinter.

Inagh 1988

In 1987 two groups of hatchery-reared smolts were introduced to the Inagh river (Fig.1). The first group, of 1,350 smolts, was derived from the transfer of 60,000 eyed ova from the Lee to Mullingar hatchery. The second, consisting of 2,653 smolts, was derived from the transfer of 200,000 Cong eyed ova. Both groups were ongrown separately and stocked into the Inagh river on 15 April 1987 as one year old smolts.

Total tag returns in 1988 indicated a higher exploitation of Cong stock (2.3%) than Lee (1.7%). Both groups were of similar size 2.9kg. From the examination of 44 draft net caught salmon in the Inagh river 7 tags were recovered, 6 were Cong and 1 Lee.

DISCUSSION

The drift net fishery in the west of Ireland is largely dependent on grilse stocks from west coast rivers. Few multi sea-winter salmon were recovered in 1986, 1987 or 1988. Southern or northern bias in migration about the coast continually alters the level of exploitation suffered by any one river stock. Survival of hatchery fish is still considerably lower than that of wild.

Timing, homing accuracy and speed of migration through interceptory fisheries are critical factors governing stock survival. An increase in grilse size, from week to week, was noted in drift net catches. Examination of returns indicated that the difference in size of groups tagged in separate rivers may result from timing of return to the Irish coast and period of feeding at sea. Stock selection, husbandry practices, size, health and condition of smolts at release are other factors which may be implicated.

Changing release location for hatchery smolts affects survival and altering time of release affects survival and size. Altering release conditions for hatchery reared fish can increase the level of survival and return to specific fisheries, be they offshore or river based. A factor identified which may explain low survival of smolts released at Cong was the development of gill fungal infection following release in freshwater and marked reduction in condition downstream. Wild smolts did not exhibit this.

The river based fisheries did not reflect the decrease in catch from 1986 to 1987, though certain fisheries are influenced more than others by reduced offshore fishing. If a financial alternative, such as prawn fishing as in 1987 and 1988, exists to the offshore fishery a reduction in salmon fishing may release more fish to rivers, despite poor sea survival. Early running stocks, such as the Corrib wild, avoid heavy exploitation offshore particularly if river entry conditions such as good flows are available. No evidence exists to suggest that Corrib wild stocks are depleted.

The behaviour and returns of wild and hatchery fish are of interest, as, in the light of habitat destruction and other problems for wild fish, increasing pressure exists to ranch stocks at a national level. Returns from the experiments undertaken highlight the value of the wild fish, in responding to environmental and fishing pressure change, and their continued importance as the backbone of the salmon industry in Ireland.

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Table 1. Details of tagging and release; numbers of tagged grilse recaptured in drift nets.

Year of release 1985				Recaptures 1986		
hatchery	river of release	total tagged	total released	Cork/ Kerry	Clare/ Galway	Mayo/ Donegal
Clondulane	Blackwater	136	wild	0	1	0
Carrigadrohid	Lee	20148	131586	41	6	4
SRT	Bandon	2648	2648	0	0	0
Parteen	Shannon	20682	217174	53	84	8
Galway	Corrib	4714	wild	4	27	3
Cong	Corrib	63779	87800	6	64	6
Screebe	Screebe	9922	9922	7	121	9
Cong	Gowla	10221	10221	0	15	4
Cong	Bundorragha	10209	10209	0	1	0
SRT	Burrishoole	25039	25039	38	237	86
Ballyshannon	Erne	29538	66000	7	18	7
Newport	Crana	5003	5003	3	7	2
Bushmills	Bush	17966	17966	2	22	1
Carrigadrohid	Cages	10570	0	0	0	0
SRT	Cages	10995	0	0	1	0
Total		241570	583568	161	603	131
Number examined (a)				6717	12192	4282
Number of fin clips (b)				284	1041	180
Grilse + multiseawinter recaptured (c)				162	632	136
Finclip observation rate (b/a %)				4.2	8.5	4.2
Tag recovery rate (c/a %)				2.4	5.2	3.2
Tag to finclip ratio (c/b %)				57	61	76

Year of release 1986				Recaptures 1987		
hatchery	river of release	total tagged	total released	Cork Kerry	Clare Galway	Mayo Donegal
Carrigadrohid	Lee	20927	135000	0	0	2
Parteen	Shannon	26564	121066	0	13	4
Cong	Corrib	9743	9743	0	44	7
Screebe	Screebe	7348	7348	0	4	0
Cong	Erriff	8827	8827	0	98	32
SRT	Burrishoole	29840	29840	0	179	104
Ballyshannon	Erne	32570	38787	0	3	22
Bushmills	Bush	25159	25159	0	2	9
Bushmills	Bush	1161	wild	0	0	0
Virginia	Boyne	8047	8047	0	0	2
Total		170186	383817	0	343	182
Number examined (a)				0	7267	13642
Number of fin clips (b)				0	489	300
Grilse + multiseawinter recaptured (c)				0	355	193
Finclip observation rate (b/a %)				0	6.7	2.2
Tag recovery rate (c/a %)				0	4.9	1.4
Tag to finclip rate (c/b %)				0	73	64

Year of release 1987				Recaptures 1988		
hatchery	river of release	total tagged	total released	Shannon Estuary	Clare Galway	Mayo Donegal
Carrigadrohid	Lee	18516	137000	4	5	2
Parteen	Shannon	30833	283025	168	23	4
Ennis	Fergus	3319	3319	35	2	1
Mullingar	Inagh	3922	3922	36	11	3
Cong	Kilcolgan	2348	5000	0	0	0
Cong	Corrib	13108	13108	1	8	2
Galway	Corrib	8771	wild	3	53	9
Screebe	Screebe	5999	5999	10	76	6
SRT	Burrishoole	28611	28611	18	117	5
Ballyshannon	Erne	46213	124645	4	3	5
Bushmills	Bush	17208	17208	2	0	0
Bushmills	Bush	3037	wild	0	0	0
Total		181885	621837	281	298	37
Number examined (a)				8761	8046	2574
Number of fin clips (b)				873	355	59
Grilse + multiseawinter recaptured (c)				295	307	44
Finclip observation rate (b/a %)				10.0	4.4	2.3
Tag recovery rate (c/a %)				3.4	3.8	1.7
Tag to finclip rate (c/b %)				34	86	75

Table 2. Number of recoveries per 10,000 smolts tagged

Recapture area Recapture date	1986				1987			
	Southern		Northern		Southern		Northern	
	June	July	June	July	June	July	June	July
<u>Southern releases</u>								
Lee	0	1	1	0	0	0	0	0
Shannon	28	12	1	0	4	0	0	0
Corrib	5	1	4	0	34	1	10	0
Corrib (wild)	28	2	28	0	-	-	-	-
Screebe	27	8	50	36	4	0	1	0
Total (grilse)	130	42	92	38	47	2	12	0
<u>Northern releases</u>								
Gowla	3	2	6	4	-	-	-	-
Erriff	-	-	-	-	12	3	70	25
Burrishoole	8	15	40	32	8	0	47	5
Erne	0	3	2	1	0	0	1	0
Crana	0	2	12	0	-	-	-	-
Bush	3	7	2	0	0	0	1	0
Total (grilse)	30	62	120	87	34	5	204	39
Total (grilse)	160	104	212	125	81	7	216	39
Number examined	2503	5788	2455	1446	1993	306	4376	592
Number clipped	355	262	271	153	168	12	262	47
Total recovered	161	114	226	131	92	7	217	39

1988

Recapture area Recapture date	Shannon Estuary		Southern		Northern	
	June	July	June	July	June	July
<u>Southern releases</u>						
Lee	1	1	3	0	0	0
Shannon	40	14	4	0	1	3
Fergus	84	21	3	3	0	0
Inagh	41	51	25	0	0	0
Corrib	1	0	5	0	2	0
Corrib (wild)	2	1	51	1	6	2
Screebe	13	3	42	5	43	37
Total (grilse)	181	76	104	5	37	32
<u>Northern releases</u>						
Burrishoole	4	2	9	0	16	16
Erne	0	1	0	0	0	0
Bush	1	1	0	0	0	0
Total (grilse)	13	11	26	3	45	46
Total (grilse)	194	87	130	8	82	78
Number examined	5534	3227	2366	758	2673	2249
Number clipped	632	241	164	11	89	91
Total recovered	198	97	135	11	83	78

Table 3. Corrib release and recovery. Cong hatchery smolts were transported to Galway and released from a cage or into the canal; wild smolts trapped and released at Galway.

Tagging groups	Numbers released recovered		Recoveries per 10,000 tagged			
			Cong hatchery rods		Galway rods traps	
<u>1986</u>						
Cong hatchery	53,700	226	21	7	3	12
Cong (cage)	10,100	396	72	7	122	191
Wild (26 Apr-13 May)	528	8	19	24	5	172
Wild (24 May)	4,186	92	19	19	38	76
Number of fish examined			424	127	407	1338
Number of tags recovered			192	56	139	335
<u>1987</u>						
Cong (canal)	9,743	99	4	1	27	70
Number of fish examined			98	51	283	1503
Number of tags recovered			4	1	26	68
<u>1988</u>						
Cong (canal)	5,021	18	4		8	28
Cong (canal)	7,770	27	1		10	24
Wild (23 - 29 April)	3,238	119	9		18	346
Wild (30 Apr - 5 May)	3,755	104	13		11	293
Wild (12 - 14 May)	1,778	39	0		11	208
Number of fish examined			214		374	3265
Number of tags recovered			11		24	294

Table 4. Drift netting recaptures of fish from selected stocks.

Stock	Number Number tagged recovered		Recaptures per 10,000 tagged.				
			Cork/ Kerry	Clare/ south	Galway/ north	Mayo/ Donegal	
<u>1986</u>							
Burrishoole	2,5039	1479	15	23	72	302	
Screebe	9,922	283	63	35	86	99	
Corrib	6,3800	190	12	6	4	8	
Corrib wild	4,714	81	91	30	28	23	
Shannon	2,0682	49	153	40	1	40	
<u>1987</u>							
Burrishoole	2,9840	577	6	8	52	127	
Erriff	8,827	291	26	15	95	191	
Screebe	7,348	5	0	4	1	1	
Corrib	9,743	95	6	35	10	45	
Shannon	26,564	128	11	4	0	20	
<u>1988</u>							
			Cork/ Kerry	Shannon Estuary	Clare/ south	Galway/ north	Mayo/ Donegal
Burrishoole	28,611	799	4	6	9	31	220
Screebe	5,999	151	2	17	47	80	100
Corrib	13,108	36	1	1	5	2	20
Corrib wild	8,771	113	2	3	52	8	63
Inagh	3,922	74	5	92	25	3	61
Fergus	3,319	74	15	105	6	0	60
Shannon	30,833	350	10	54	4	4	22

Figure 1.

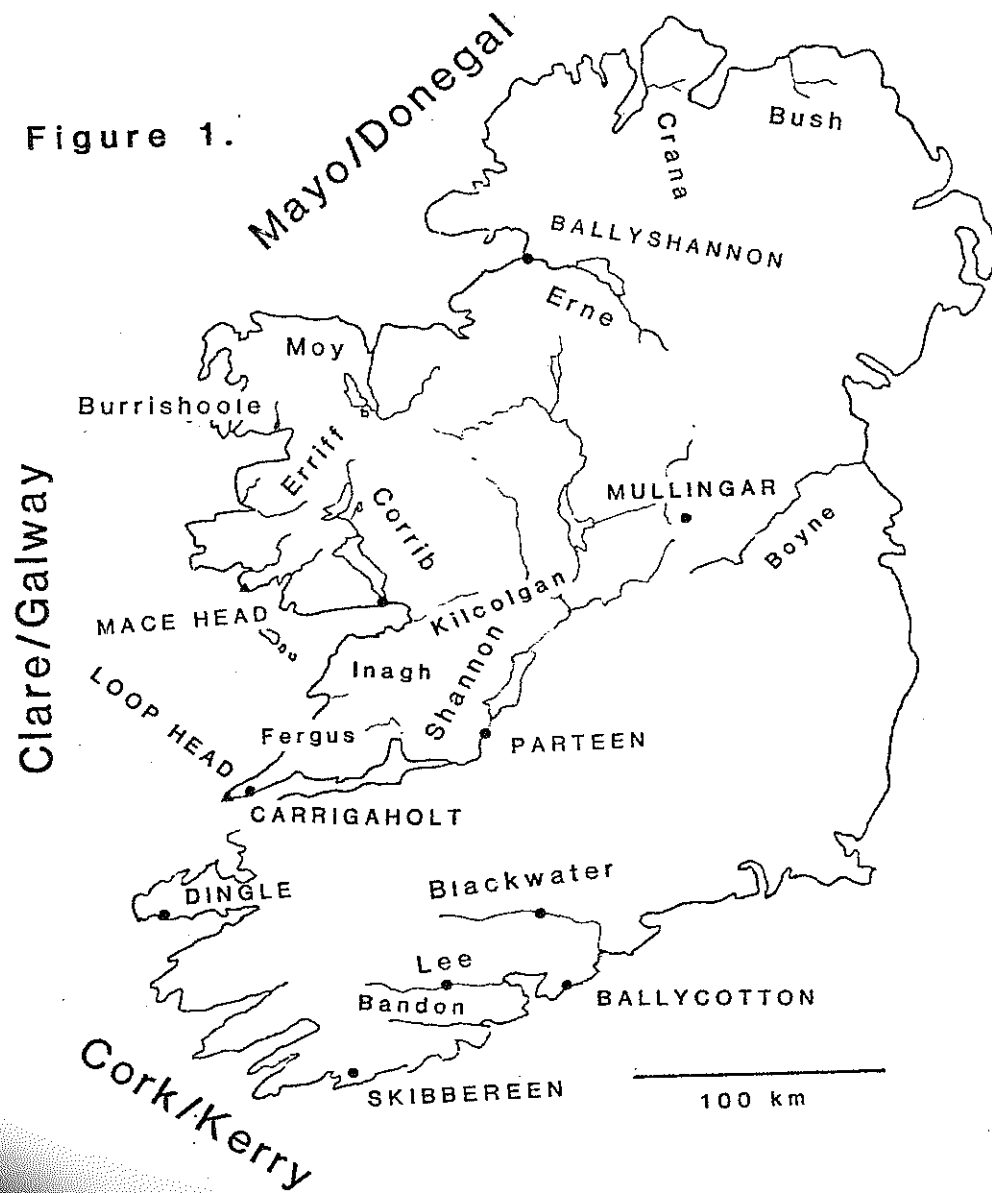
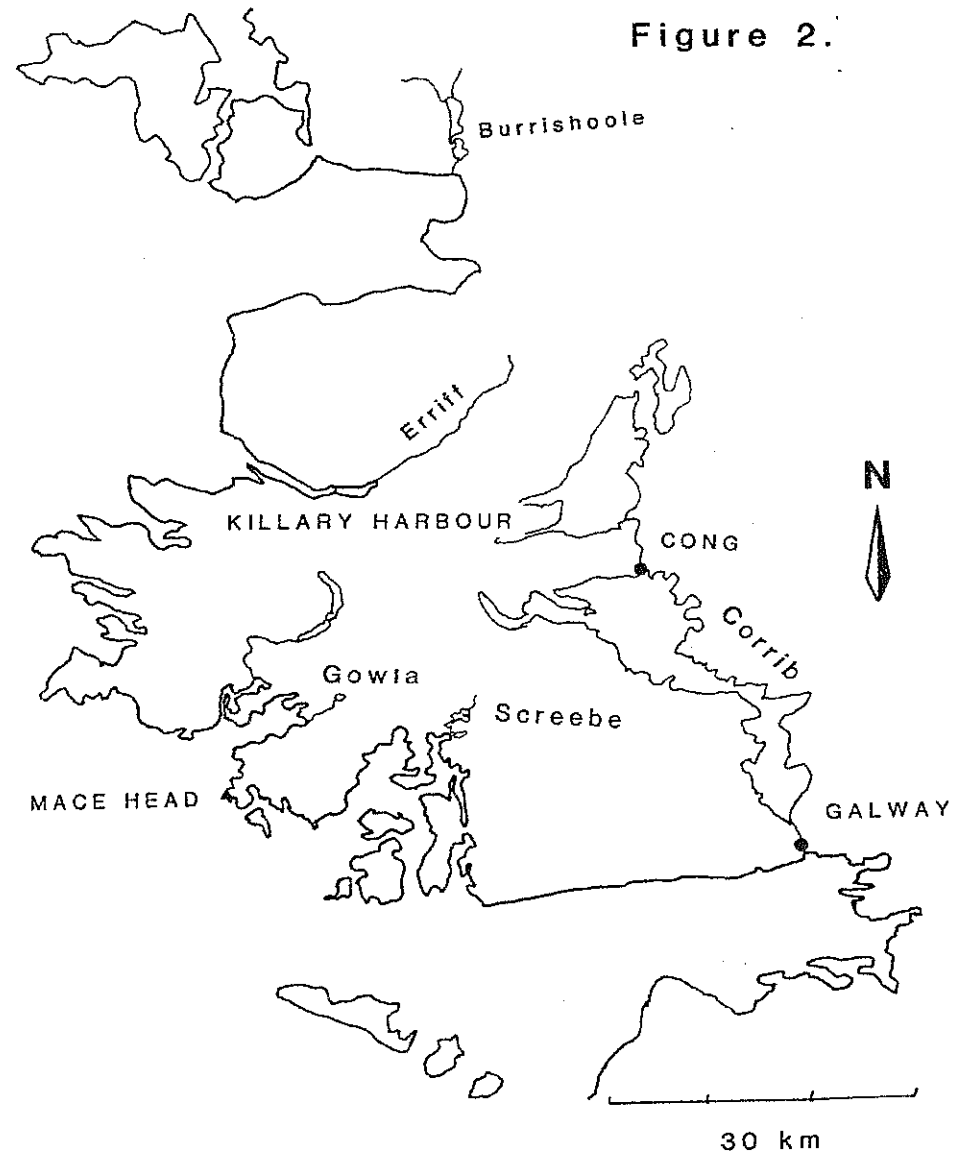


Figure 2.



Rivers, rearing stations and sampling stations.