Conon Spring Salmon Tracking Project

Project carried out by Keith Williams

Acknowledgments

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Introduction

Prior to the initiation of the installation of hydroelectric schemes in the 1950's, the Conon system was famed for producing numbers of early-running salmon (for statistical purposes salmon captured prior to the end of April have been classified as 'spring' salmon in Scotland). This component of the stock was exploited by both rod and line and net fisheries. The Orrin tributary in particular was deemed to be an important area of habitat for such fish and supported a net fishery immediately below Orrin falls. While the number of salmon returning to their natal rivers has declined globally, the early running component of the stock would appear to have suffered disproportionately. The decline of such stocks appears particularly marked in those rivers harnessed and regulated for the supply of electricity. Various explanations for the overall decline in salmon abundance have been suggested, including increased marine mortality and changes in habitat.

A number of initiatives have been implemented on the Conon system in recent years in an attempt to boost this fragile and economically important resource. In particular, anglers have donated salmon caught in the early months of the season so that they may be retained for broodstock. Once stripped of eggs and milt, the salmon have been retained for reconditioning. This process involves feeding salmon in a freshwater environment enabling an individual salmon to potentially contribute to the programme for several years in succession. The progeny of these salmon have been stocked in several areas within the Conon catchment – particularly tributaries of the Blackwater and Meig. The reconditioning of such fish can assume increased significance given that research has suggested that the propensity of salmon to enter rivers in the early months of the year has a strong genetic component. Thus those salmon that are the offspring of early running salmon are themselves more likely to return in the early months of the year. Adults are expected to return to the Conon as a result of this programme from the 2004 season onwards. As such, this study represents an opportunity to assess aspects of the status of early-running salmon before the effects of enhancement programmes become evident.

Radio telemetry has been utilised in a number of studies in order to answer specific questions relating to salmon behaviour. Within the Conon system, for example, such methods have been utilised in order to test the efficacy of fish passage facilities. The aims of this study were:

- To ascertain if the early running salmon on the Conon favour specific areas within the catchment for spawning purposes. If certain tributaries were favoured, for example, this may have important implications for management i.e. stocking practices and protection of key areas of habitat.
- To ascertain if early running salmon caught and released can successfully survive to the spawning period.

Methods

Twenty salmon captured by anglers were donated by anglers during April and May 2003. Whilst salmon were captured prior to 23rd April by anglers, unfortunately these were not donated to the project. Thus information regarding the very earliest component of the Conon stock is lacking. Fish were anaesthetised, scale samples taken and measurements recorded. A radio tag (Sal3, HS Electronics, Norwich) was gently inserted into the stomach of the salmon via a perspex tube. A T-bar anchor Floy tag was also inserted into the dorsal region to aid visual identification in the event of re-capture. Salmon were subsequently allowed to recover prior to release.

Salmon were tracked using a combination of active tracking using hand-held receivers and MAFF-type automatic listening stations (ALSTNs). The latter were positioned at Torr Achilty Dam, Meig Dam and Luichart Dam. Each individual salmon was identified via a unique tag combination of frequency and pulse rate.

Salmon Movements

During the tracking period (April-December 2003) a wide variety of behaviour was observed. In the initial period after release many of the salmon tagged remained in the immediate vicinity of capture site or dropped downstream, although some continued upstream migration almost immediately after release. Such a reaction to tagging by salmon in freshwater has been observed in previous studies, although salmon tagged in estuary or marine environments appear to more readily continue their migration with long-distance initial penetration into rivers often being displayed. (Webb, 1989,1990). Periods of movement in upstream and downstream directions were often interspersed by long periods of quiescence. The latter was especially evident during the period of hot weather in the summer months (July and August). Deep pools on the mainstem of the Conon, particularly the Rock Pool on the Lower Brahan beat, Moy on Middle Bran and Clachuile on Upper Fairburn were favoured by a number of fish during this period. Such behaviour has been observed in a number of other tracking studies, for example on the Rivers Spey, Tay and Dee (Laughton, 1989; Webb 1989,1990; Laughton & Smith, 1992). Movements increased with the onset of the spawning period, with some individuals displaying large movements in both upstream and downstream directions.

Dams and impoundments are known to impinge on the ability of salmon to migrate through river systems. However, the effects of such features on migratory fish is site specific and comparisons between studies should be treated with caution. A number of salmon were located in the vicinity of fish passes at the major dams on the system, either by ALSTNs or by tracking with hand-held receivers which did not subsequently successfully achieve passage (10, 14,15,16,17,20). This includes fish 10 and 17 that

had successfully completed passage at Torr Achilty but did not achieve passage through Luichart and Meig Dam respectively. However, such fish may not have intended to spawn above the dams, as previous studies have identified that many salmon temporarily migrate to areas upstream of their final spawning locations.

Studies on large river systems that have multiple stock components have suggested a relationship between time of river entry and subsequent spawning location (Laughton & Smith, 1992). Specifically, those fish entering rivers in the earliest months of the years tend to be destined for the upper reaches of their respective catchments. In this study, a marginally significant statistical relationship between date of capture and subsequent entry to tributaries or Upper Conon was evident (logistic regression: Z= -1.82, P=0.069). However, there was no significant correlation between date of capture and observed maximum upstream distance travelled (r=-0.307, P=0.247). Such analysis should be treated with caution, though, due to the relatively short period over which the fish were captured. The addition of information regarding the movements of both earlier and later running fish would facilitate more considered analysis with regard to entry to the river system and subsequent spawning location.

Overall, of the twenty tagged fish thirteen were located during November and December. In addition fish 3 was believed to have been killed by a predator, with the tag lying in shallow water. Two others (4 and 5) were last located during September and October in the upper reaches of the catchment and were not subsequently located by either ALSTNs or manual tracking. The Meig was visited in order to establish if these fish had gained access to this part of the catchment via the diversion tunnel linking Meig and Luichart but neither was located and is likely that both fish spawned in the Bran system. The utilisation of this part of the system by early entrants may have important significance given that this habit has only been available to salmon relatively recently and that juveniles of known spring origin have never been stocked on the Bran. Eight fish were believed to have spawned on the mainstem of the Conon, although the possibility of forays by some of these fish into the Orrin and Blackwater between tracking periods cannot be ruled out. While some of these eight fish had been located in the region of Torr Achilty Dam at times during the summer, others would appear to have made no concerted attempt to penetrate the upper catchment.

Most of the fish displayed a long period of quiescence during the summer months prior to increased movement during October and November. Individual salmon remained in areas below their capture sites for extended periods – including the spawning period. Two salmon were known to have entered the Blackwater, one of which was retrieved from the trap at Loch na Croic and one believed to have perished below Rogie Falls. The latter had been tagged below Torr Achilty. A single fish (2) was located in the River Orrin during the spawning period, after spending much of the summer in the vicinity of the confluence of the Orrin and Conon. No fish were detected in the Meig, although fish 17 spent considerable time immediately below Meig Dam. Salmon 6 and 8 were 'lost' shortly after capture and 18 was not located after 24th September. Weak signals believed to be from fish 13 were detected on occasions from Loch na Croic. Table 1 gives details of salmon used in the project, including a brief précis of the fate of each individual. For the purposes of this table, mainstem Conon refers to the section of the main river between Torr Achilty Dam and Conon Bridge. Full tracking records are listed in Appendix 1.

Table 1 Details of tagged salmon

Fish	Tag Date	Angler	Length (cm)	Comments
1	23/04/03	R.Williams	77	Recovered from fish trap, Loch na Croic
2	24/04/03	W.Williams	77	Believed to have spawned on River Orrin
3	26/04/03	A.Hayward	75	Likely predator kill, Rogie Falls
4	03/05/03	Lord Nickson	71	Last located Achanalt Barrage 19/9/03
5	05/05/03	G.Edmonds	70	Last located Luichart listening station 11/10/03
6	07/05/03	C.Lambert	81	Not located after 14/5/03.
7	07/05/03	Mr Edgely	76	Believed to be dropping back on mainstem Conon after spawning. 28/11/03. Most of summer spent in Rock Pool
8	12/05/03	C.Walsh	74	Not located after 5/5/03
9	13/05/03	J.Whitfield	89	Little upstream movement until November Likely to have spawned around Orrin mouth
10	15/05/03	J.Whitfield	76	Last located at head of Loch Achonochie 7/1/04. having dropped back from Scatwell area of Upper Conon
11	15/05/03	B.Whitfield	78	Resident in Rock Pool most of summer. Upstream movement to Sheep in November, dropped back to tail of Wall Pool and last detected 6/12/03
12	19/05/03	Mr Jordan	81	Resident in Moy and Major pools (mainstem Conon) for the summer. Some upstream movement in November
13	19/05/03	J.Weaver	77	Last positive detection 20/5/03. Weak signal possibly detected in Loch na Croic during summer
14	19/05/03	Mr Jordan	82	Resident in Major most of summer. Moved between Rowan and Major regularly during spawning period until 5/12/03
15	19/05/03	G.Lilley	71	Resident at Clachuile for most of summer. Detected by Torr Achilty listening station on a number of occasions. Marked upstream and downstream movement in spawning period. Last detected 6/12/03
16	20/05/03	Tom	81	Located around Clachuile for most of summer. Detected by Torr Achilty listening station on a number of occasions. Dropped to Orrin mouth region at spawning period with marked upstream and downstream movement
17	20/05/03	Tom	74	Resident at the Meig Dam fish pass for two months during the summer. Dropped down to Scatwell in October and located at Torr Achilty Dam on 7/1/04
18	22/05/03	Mr Smallburn	77	Last located at Boat Pool, junction of mainstem Conon and Blackwater on 24/9/03 having been resident in that area for most of summer
19	25/05/03	Mr Prior	74	Visual confirmation of fish in Torr Achility viewing chamber 13/6/03. No further location until listening station at same location detected fish on 30/11/03
20	30/05/03	Tom	84	Detected by Torr Achilty listening station on numerous occasions. Movement took place encompassing most of mainstem Conon during spawning period

The following gives a fuller description of the migration of some individuals, highlighting the wide variety of strategies adopted.

Salmon 1

The first salmon tagged as part of the project was captured on 23rd April in the Boat Pool, close to the junction of the Conon and Blackwater. The fish showed signs of predator damage, but recovered after tagging. Little movement was detected until water levels on the Blackwater increased. On 5th May the fish was located on the Long Pool on the Blackwater, and was subsequently located just downstream of Rogie Falls on 9th May. However, the fish then dropped back to the long pool (the only major downstream movement recorded for this fish) before returning to Rogie falls by 26th May where it remained until 19th June. First detection at Loch na Croic occurred at 21st July and continued during the summer. The in-river distance between Loch na Croic and Conon Bridge (taken as the upper limits of tidal influence) is approximately 17km The fish was removed from the trap and was stripped of her eggs on 5th December.

Salmon 4

Tagged on 3rd May at the Sandbank, a short distance downstream of Torr Achilty Dam, this fish regularly alternated occupation of Sandbank and Gillianders pools. On 27th May first detection of the individual occurred at Torr Achilty ALSTN. But passage was not achieved. On 10th July the fish was found to be resident at the head of Loch Achonochie but was again detected by Torr Achilty ALSTN on17th July. By the following day, however, the fish had returned upstream to the confluence of Loch Achonochie and the Upper Conon where it was detected until 30th August. Upstream migration to Luichart Dam was completed by 12th September with the ALSTN in Luichart fish pass recording the presence of the fish on 15th September. Successful negotiation of Loch Luichart and Achanalt fish ladder was completed by 19th September as the fish was located at Achanalt Barrage (approximately 31km above Conon Bridge). The fish was not subsequently located.

Salmon 9

With a fork length of 89cm, this was the largest salmon of the sample. After tagging and release on the 13th May downstream movement from the capture site (Ferry Pool) was evidenced by location in the Wall Pool on 15th May. Tracking continued at this location until detection occurred a short distance upstream to the Rock Pool on 6th June. Only minor movements within this locale where observed throughout the summer. Indeed, three tagged fish were resident in this vicinity for considerable lengths of time. When located in the mouth of the River Orrin on 4th November, this represented the first time this salmon was known to have travelled upstream of its releases site since capture. Movements both upstream and downstream were subsequently observed with the Wires Pool representing the known upstream extent of migration (approximately 6km above Conon Bridge). The fish was mostly located in the Russian and Ferry Pools, however, during the spawning period.

Salmon 10

Captured in the same pool as fish 9 (15th May), this salmon penetrated considerably further into the catchment. After a period in a number of pools close to Torr Achilty Dam, passage into the Upper Conon was eventually achieved and by 10th July location was approximately 19km above Conon Bridge at Luichart Dam. This was the furthest upstream point known to have been reached. The fish was registered at Luichart ALSTN on a number of occassions without apparent success at achieving passage. On 25th September downstream movement to the confluence of the Upper Conon and Loch Achonochie was noted although the fish subsequently favoured the Scatwell region, particularly close to the Meig branch of the river. It would appear that downstream movement occurred post spawning and the tag could still be detected at the head of Loch Achonochie in early 2004.

Salmon 20

This salmon, the last tagged in the study, has been highlighted due the frequent movements observed in comparison with others in the study, although its capture point was only just below the extent of its maximum observed upstream migration (approximately 11km above Conon Bridge). Within one hour of release, the fish had continued upstream and was registered at Torr Achilty listening station. While the area around Clachuile was especially favoured in the summer months, movements upstream to Torr Achilty Dam were regular features. Indeed the ALSTN located at the fish pass registered this fish in June, July, August, September and October. The location of the fish at the Horse Pool and subsequent return to Clachuile, during the spawning period suggests that pronounced movements of fish between tracking periods may have occurred.

Recommendations and Future Research

The study suggests that no particular tributaries of the Conon appear to be favoured by early running fish. The Meig represents the only major tributary of the system not known to have received a tagged salmon during 2003. Thus the protection of specific areas of the upper catchment does not appear to be an imperative. Perhaps surprisingly, 8 fish are believed to have spawned on the mainstem of the Conon below Torr Achilty Dam. It is possible that this is as a result of the high temperatures evident during the summer of 2003, the presence of manmade barriers to migration present on the system or a combination thereof. However, such a finding may warrant further consideration.

From those fish tagged for the project during 2003 it would appear those tagged earliest would appear to have most success in penetrating the tributaries and upper part of the catchment. As such, it may be expedient to consider special protection measures by anglers for this component of the stock. Unfortunately, only three salmon were donated to this project prior to the beginning of May, thus comparisons between fish captured was limited by the relatively short time scale involved.

Radio telemetry is a useful tool in initial investigations regarding fish passage and location, particularly in those systems impacted by impoundments and artificial barriers. However, its use can be expensive and labour intensive. Other forms of telemetry can be utilised in order to shed further light on issues raised by this project. Passive integrated transponder (PIT) tags have been utilised on the Conon system to assess marine mortality of smolts originating from the system. Returning adults are automatically detected by aerials located at Torr Achilty Dam and Luichart Fish Ladder. The judicious placement of aerials at other key locations (e.g. Meig Dam) on the Conon system would facilitate the tracking of salmon at least to tributary level. Adult salmon angled from below Torr Achilty Dam could thus be implanted with PIT tags and allowed to complete passage to spawning locations. This would improve knowledge of how barriers to migration may differentially effect components of the stock. This system has the advantage of being more economically efficient, less labour intensive and, importantly, allows a long-term data set to be established for scientific analysis.

This study suggests that the majority of salmon released by anglers will survive until the spawning period. It is also apposite to note that salmon utilised in this project were subjected to increased handling due to tagging procedures in addition to levels associated with capture by anglers. The summer of 2003 was also notable for an extended period of drought and high water temperatures. Fish kills as a result of the latter were evident on a number of Scottish river systems. The upstream movement of the majority of fish tracked in this project during the spawning period should thus be seen as a positive for those who consider catch and release of spring salmon as a useful tool in the conservation of this component of the stock. A method of tagging salmon in the early months of the year should also be considered as this will facilitate the identification of such fish captured at Loch na Croich fish trap. The eggs and milt from such fish can then be kept separately at Contin hatchery and contribute to future enhancement programmes. The ability to obtain juveniles of known spring origin may assume greater significance given the increased difficulties of reconditioning salmon since the withdrawal of malachite green.