

**Note on the Smolt to Grilse Stage of the Salmon, with
Exhibition of a Marked Fish recaptured. By W. L.
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(MS. received July 13, 1906. Read July 13, 1906.)

In tracing the various stages of the salmon's growth, precise information has been difficult as to the length of time occupied between the first descent to the sea as a smolt and the first return to the river as a grilse. The difficulty of attaching to so small a fish as a salmon-smolt a suitable mark for subsequent identification has, in the main, been responsible for this lack. The average smolt is $5\frac{1}{2}$ to 6 inches long (14-15 cm.), and weighs from 1 to 2 ounces. In the next stage with which we are familiar the fish may weigh 3 to even 10 lbs. It is clear, therefore, that any mark attached to the smolt must not only be sufficiently small and light for a fish only a few inches long to carry without inconvenience and injury, but must be adaptable to the rapid and great increase of growth which takes place in the sea.

In the past a method of marking has been repeatedly resorted to which, though having the merit of simplicity, is not really reliable; I refer to the method of fin-cutting, especially and commonly the cutting or the removal of the adipose fin. The famous Stormontfield experiments, reported upon by Buist in 1867, and repeated in other localities by other observers since that date, were conducted, so far as the study of migratory movements went, almost exclusively by fin-cutting. These experiments have been chiefly responsible for the belief that the smolt which enters the sea in greatest numbers in the spring, returns to fresh water as a grilse in two or three months, *i.e.* during the immediately succeeding summer. The Duke of Bedford's experiments in Devonshire were conducted by fin-cutting, and are held to show a different conclusion. Only three cases are, I think, on record in which the smolts have been marked by the attachment of a foreign substance, and recapture effected. These cases come from the

Tweed (*Tweed Salmon Reports*, 1868). The marking was done in 1854, 1855, and 1857, and in each case the recapture of the fish as a grilse was fully a year after the date of marking.

In the spring of 1904 I commenced experiments in smolt-marking at the Cunninghaugh Ponds, near Fochabers, the property of the Duke of Richmond and Gordon. The method first used was the attachment of a small silver disc to the operculum by means of a split pin passed through the operculum from beneath; but so many of the marks were torn out, by the yielding of the delicate bones of the gill cover, within a few weeks, that the method was abandoned. I next used, on the Tay, a simple piece of silver wire, which I passed through the skin of the back close to the adipose fin, and formed into a loop by twisting the ends together. The method seemed fairly satisfactory, but the wire used was rather heavy, and interfered somewhat with the balance of the little fishes as they swam away. Next year (1905) the Tay Salmon Fisheries Company, under Mr P. D. Malloch's supervision, took up the marking of smolts, and a wire was employed of lighter weight—so thin that it could be easily cut with scissors. The wire was passed through the dorsal fin close to the anterior border and a short distance above the base of the fin rays, and was formed into a loop or loose ring and the ends snipped off. Mr M'Nicol had charge of the operations, and succeeded in marking 6500 smolts in the spring of 1905. No recaptures were made in 1905.

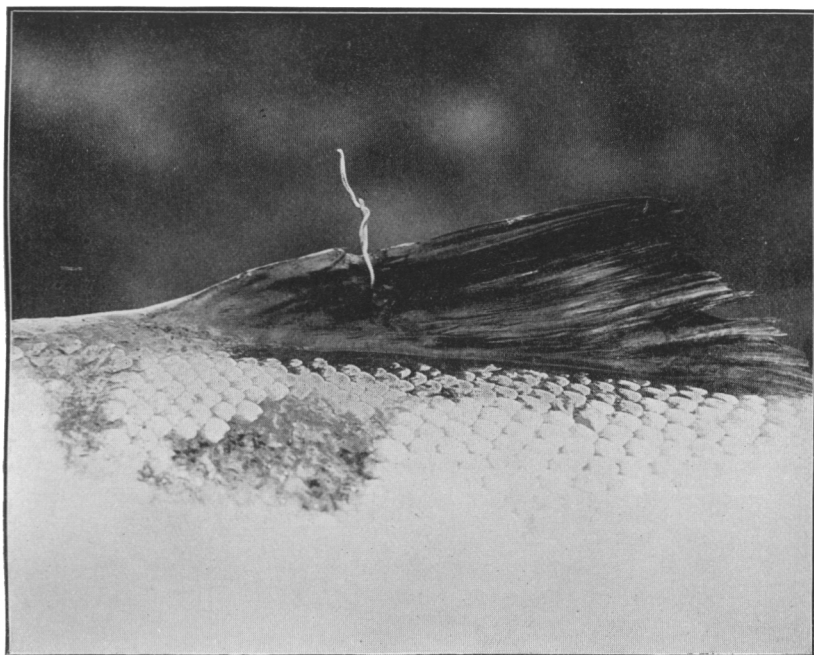
This summer (1906) a considerable number of those smolts have been recaptured as grilse. In each case the recapture has been made in the Tay estuary, where the marking was originally conducted. The particulars of the first five are as follow :—

1st June 1906,	grilse weighing	2 lb. 15 oz.
26th	„ „	4 „ 8 „
28th	„ „	4 „ 12 „
3rd July	„ „	3 „ 4 „
4th	„ „	5 „ 8 „

The specimen exhibited is the second on the list, caught on 26th June, and weighing 4 lb. 8 oz. It is a male fish with rudimentary testes, and measures to the fork of the caudal fin 24 inches

(61 cm.); the greatest depth is 4 inches (10·2 cm.), and the depth of the caudal peduncle $1\frac{1}{2}$ inches (3·7 cm.).

These recaptures, then, confirm the belief that the smolt does not return as a grilse the same year as it descends, but rather after a year or fully a year has elapsed. The development shown on the scales of grilse, as well as the capture of the Galway



Dorsal fin of grilse, caught 1st June 1906, marked as a smolt in May 1905.
(Photograph by P. D. Malloch, Perth.)

specimen which I exhibited to the Society about a year and a half ago, all give evidence that the first normal return of a smolt to fresh water takes place when the fish, as a grilse, is three to three and a half years old, and after it has been fully a year in the sea. From other observations it seems certain that all grilse do not, however, enter fresh water, but that many fish pass the grilse stage in the sea and return for the first time to fresh water as small spring salmon, four years of age.

With regard to the other wired grilse which have been taken during the fishing season of 1906, I may add that their weights ranged to a maximum of 9 lb., and that when further time has elapsed in which the possible return of those fish may be noted, additional particulars will be published.

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