

MARKING FISH WITH THE ELECTRIC TATTOOING NEEDLE

By C. F. Hickling, M.A.

Ministry of Agriculture and Fisheries

Most fishery biologists have heard from time to time of experiments on marking fish by tattooing identification marks on them. The present usual methods of marking fish by attaching marks externally to the gill-cover, caudal peduncle, or other part of the body, have the disadvantage that a certain number of the marks are lost, and this uncertainty bedevils all those marking experiments designed to show rates of mortality or rates of capture.

Yet the only reference in the literature known to me is a very short paper by Gandolfi-Hornyold (1929). His most successful experiment consisted in marking six silver eels on the light ventral side with Indian ink (*encre de Chine*) introduced in the oriental fashion by a bundle of needles. Five of the six fish were alive some 6 weeks later with the marks as clearly legible as when first made. But I know of no further developments of this technique.

In August 1939, I made some experiments at the Plymouth Laboratory, by the courtesy of the late Director, Dr Kemp, F.R.S., and with the help of the staff, to all of whom I would express my thanks. Some thirty-two plaice, two soles, and twenty-five rays were placed in one of the big outdoor tanks for the experiments, and were all in good condition, though they had not been fed and were certainly overcrowded.

The electric tattooing needle used was bought from a professional tattooist, who also gave me a brief lesson on his art. In principle the needle is a small vibrator run from an ordinary torch battery. The vibrator is attached to a style enclosed in a tube, and a needle is secured to the end of the style, and is adjustable, so as to vary as may be required the length of needle point which projects from the enclosing tube. In use, the tube is held like a pen, and is repeatedly dipped in the pigment, as one dips a pen in ink. The writing is done slowly, with a moderate pressure on the skin, and the needle, which vibrates at high speed, makes a series of fine punctures in the skin into which the pigment is carried. The whole device is simple and effective.

On the first day I tried various settings of the needle and various slopes of the pen on dead fish, and then tried marking two small rays and a small plaice which had that day been brought in and placed in the shallow 'Drake's Island Tank' indoors. I found the plaice easy to mark, the rays difficult.

On the next day, 5 August, the marked plaice was dead, but so were two of the unmarked controls.

I found, to my surprise, that it is much easier to mark a living plaice or sole than a dead one. This is mainly because the fish responds to the irritation of the needle by producing much mucus, which washes away the surplus ink, and makes it easy to see how much of the work has entered the deeper skin, and therefore which of the strokes need to be repeated. I used three pigments, namely, Chinese ink, which I bought as a stick and ground myself for use as needed, natural sepia from cephalopods, and Windsor and Newton's best quality vermilion, which I mixed with water to make a very strong suspension. All marks were made on the white underside of the fish: they consisted of a letter and a number, e.g. E 37.

While it was easy to mark the plaice and the sole, I had the greatest difficulty with the rays. The skin of these fish has a leathery toughness which makes penetration to any depth a matter of great difficulty. Quite early in the experiments I came to the conclusion that the method would be of no use with rays, but I persisted in giving it a good trial. Yet a spotted dogfish, which I marked with a letter for a physiologist working on the reflexes of this fish, took the mark well.

The time taken to mark a plaice was about 70 sec.; but I was working single-handed and had to hold the fish as well as to manipulate the needle. No doubt the time would be less with an assistant. The rays took much longer, for owing to the difficulties mentioned above, the strokes of the needle had to be repeated again and again to get any impression. Yet none of the fish, of any species, seemed the worse for the marking; they usually lay quietly while being marked, and, on being restored to the water, at once fled to the bottom of the tank and endeavoured to hide their embarrassment under a shower of sand, or rather, of echinoderm spicules, for this was the only cover available.

On 10 August the experiment was ended, in its first stage, by clearing all the fish out of the big tank, and examining for general condition, wounds, and for the legibility of the marks. The plaice and the sole had then had the mark for 6 days, the rays for 4 days. The fish were inspected by Dr L. H. N. Cooper, who acted as referee, and judged the fish by a fairly strict standard. Below are given the results for the plaice and the sole.

	No.	Died or dis- appeared	Condition			Legibility				Injured
			Very good	Good	Poor	Very good	Good	Moderate	Poor	
Plaice										
Marked	18	4	13	1	—	9	2	3	—	1
Controls	20	8	9	3	—	—	—	—	—	3
Soles										
Marked	1	—	1	—	—	1	—	—	—	—
Control	1	—	—	—	1	—	—	—	—	—
Rays										
Marked	12	7	4	1	—	0	3	1	1	3
Controls	17	3	6	5	3	—	—	—	—	6

Of the marked plaice, two died and two could not be found at the close of the experiments. Eight of the controls, however, died, and it will be clear that the deaths of the two marked plaice cannot with any certainty be ascribed to the operation of marking, for a much larger number of the untouched controls died. The general condition of the marked fish was also in no way inferior to that of the controls. As to the legibility of the mark, eleven were either very good, or good, and three only could be described as moderately good. In none did the referee fail correctly to read the number.

The sole took the mark very well, and was in perfect condition at the end of the experiment; the control sole was moribund.

The result with the rays was poor. Of the twelve rays marked, only five could be recognized as marked fish after 4 days. None died, though two of the controls died. Seven of the marked rays must therefore either have escaped from the tank, or have lost the mark. The latter is the most likely, for most of the rays were big specimens which could hardly hide themselves successfully in a dark corner of the tank; and, further, the referee passed over as 'controls' specimens which I knew to be marked fish, for I could still see traces of the marks.

Of the five rays recognized as marked fish, in not one was the mark classed as 'very good', three were 'good' only, and one was 'moderate', and one 'poor'. The general condition of the marked fish was at least equal to that of the controls, but wounds were very frequent, and I learnt that it is impossible to keep rays for very long in confinement in perfect condition.

Writing off the rays as a failure, there still remained the successful experiments with plaice and sole. Twelve of the marked plaice and the sole were put into the indoor tanks, where they were fed. A few days after the transfer, a ray, a plaice, and the sole died. The mark on the ray, which had been classed as 'good', was very feeble, that on the sole faint but legible, and that on the plaice very sharp and clear.

The outbreak of war caused the experiments to be ended on 26 September, when Mr G. A. Steven very kindly examined the fish for me and made a report.

After 7 weeks, the marks on the ten surviving plaice were classed by Mr Steven as follows: three fairly clear, three faint, and four extremely faint. Yet Mr Steven correctly read the writing on all but one of the fish. Four of the fish were in perfect condition, four had injuries to the tail, and two had abrasions on the underside of the head. None showed any injury around the mark.

It would seem from these experiments that tattooing has possibilities, but that the pigment injected is slowly dispersed or overlaid in the skin of the fish. It may be that branding with a hot instrument, or even scratching, will be more effective, for I would place it on record that on one of my trips on trawlers I saw caught a large halibut on which letters, apparently a man's initials, were clearly legible on the upper, coloured side. The letters were

distorted in a direction which suggested that they were carved on the skin of the fish when small, and must have been carried for a long time. The letters appeared black, and the wounds, on healing, must have become surrounded by melanophores.

REFERENCE

- GANDOLFI-HORNOLD, A., 1929. Une nouvelle méthode pour marquer des Anguilles; le tatouage. *Bull. Soc. Aquic. et Pêche*, Paris, T. xxvi, pp. 53-4.