EFFECT OF FORMALIN ON THE LENGTH AND WEIGHT OF *GALAXIAS VULGARIS* (PISCES: SALMONIFORMES: GALAXIIDAE)

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ABSTRACT

The effect of 10% formalin on the length and weight of *Galaxias vulgaris* was examined at intervals over a period of 245 days. The greatest changes occurred during the first 24 hours, length decreasing to 95.15% of the live length, whereas weight increased to 106.98% of the live weight. Length continued to decrease at a much slower rate throughout the experiment. However, after the initial sharp increase, weight slowly decreased towards the initial live value.

INTRODUCTION

Body dimensions of fish are affected by storage in various preservatives. The type of preservative (usually either formalin or alcohol), its strength, and the length of time spent in the preservative have all been shown to have an effect on body dimensions. Also, fish of different species and conspecifics of different size may be differentially affected by the same preservative (Parker 1963, Stobo 1972). Therefore, in order to obtain meaningful values of length and weight, and thereby condition, from preserved fish it is necessary to formulate correction factors which take into account the effects of the preservative. This short paper describes an experiment to determine correction factors for the effect of 10% formalin on the length and weight of *Galaxias vulgaris*, a New Zealand stream-dwelling fish.

MATERIALS AND METHODS

Twenty fish were used in the experiment. All were obtained by electric fishing in the Glentui River, a tributary of the Ashley River, in Canterbury, New Zealand. Before handling, fish were anaesthetized with benzocaine, some properties of which are described by McErlean and Kennedy (1968). A saturated solution of benzocaine in absolute alcohol was added to the aquarium containing the fish until anaesthesia was complete. Anaesthesia was indicated by total loss of motor coordination and equilibrium.

Total length, i.e. the length from the tip of the snout to the distal end of the central rays of the emarginate caudal fin, was measured to the nearest 0.1 mm using a measuring board with a vernier scale designed by Woods (1968). Fish were weighed in water on a Mettler H15 balance. Weights were recorded to the nearest 0.001 g. As indicated by Parker (1963), the degree of removal of surface liquid is the most obvious source of error in obtaining true weights of fish. In the present investigation,

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all weights were measured after each fish had been rolled over on damp towelling and lightly blotted with a damp towel. To test the consistency of this method, a fish which had been preserved for 12 days was weighed ten times over a period of one hour after surface liquid had been removed in the manner described above (Table 1). Between each weighing the fish was returned to the preservative (10% freshwater formalin).

TABLE 1. RESULTS OF 10 WEIGHINGS OF A PRESERVED FISH AFTER USING A STANDARD METHOD OF REMOVAL OF SURFACE LIQUID

Trial	Weight (g)
1	7.010
2	7.024
3	7.011
4	7.003
5	7.019
6	7.009
7	7.021
8	7.024
9	7.014
10	7.013
mean $\pm$ 95% confidence limits	7.015 $\pm$ 0.007

The small range of the confidence limits of the mean weight for the ten trials indicates that reproducible results may be obtained using the method.

After the initial measurement of length and weight of anaesthetized live fish, each fish was placed in a separate container of 10% freshwater formalin. Each fish was completely immersed in the preservative. Lengths of anaesthetized live fish ranged from 55.1 to 100.6 mm (mean = 73.2 mm), whereas weights ranged from 1.164 to 8.122 g (mean = 3.442 g). The length and weight of each fish were then recorded at intervals over a period of 245 days. After each set of readings, fish were returned to their own container.

RESULTS AND DISCUSSION

Mean relative lengths and weights of fish on each measuring day, together with the corresponding correction factors required to obtain live lengths and weights, are shown in Tables 2 and 3.

The greatest changes occurred in the first 24 hours, length decreasing and weight increasing. Length continued to decrease thereafter at a much slower rate, but, after the initial sharp increase, weight slowly decreased towards the initial live value. This sequence probably reflects chemical changes brought about by the formalin, which affect the osmotic strengths of fluids within the body and within the cells. Parker (1963) found a similar sequence of events in formalin-preserved salmonid fry, fingerlings and smolts, the greatest changes occurring in the first one or two days of preservation. The same sequence of

TABLE 2. THE EFFECT OF 10% FRESHWATER FORMALIN ON THE LENGTH OF *G. VULGARIS*. SAMPLE SIZE = 20. LIVE LENGTH = PRESERVED LENGTH x CORRECTION FACTOR

Days in formalin	Mean % of live length	95% confidence limits of mean	Correction factor
0	100		
0.5	95.61	± 0.66	1.046
1	95.15	± 0.69	1.051
2	94.98	± 0.67	1.053
4	94.89	± 0.70	1.054
6	94.82	± 0.73	1.055
8	94.82	± 0.73	1.055
12	94.79	± 0.77	1.055
20	94.68	± 0.69	1.056
30	94.42	± 0.67	1.059
60	94.23	± 0.64	1.061
90	94.31	± 0.74	1.060
120	94.28	± 0.81	1.061
245	94.08	± 0.74	1.063

TABLE 3. THE EFFECT OF 10% FRESHWATER FORMALIN ON THE WEIGHT OF *G. VULGARIS*. SAMPLE SIZE = 20. LIVE WEIGHT = PRESERVED WEIGHT x CORRECTION FACTOR

Days in formalin	Mean % of live weight	95% confidence limits of mean	Correction factor
0	100		
0.5	105.05	± 1.04	0.952
1	106.98	± 0.86	0.935
2	106.81	± 1.10	0.936
4	106.14	± 0.83	0.942
6	105.68	± 0.87	0.946
8	105.73	± 0.96	0.946
12	105.42	± 1.14	0.949
20	105.06	± 0.99	0.952
30	104.50	± 1.07	0.957
60	103.80	± 1.05	0.963
90	103.82	± 1.00	0.963
120	103.13	± 1.10	0.970
245	102.78	± 0.98	0.973

events was also observed by Stobo (1972) in formalin-preserved yellow perch, *Perca flavescens*. In the latter study the time required to reach the maximum preserved weight was much longer than that required in either the present study or in Parker's study, with weight increasing for up to 60 days before decreasing to the initial live value. Stobo suggested that the heavy scalation of the perch, a spiny-rayed fish, slowed the osmotic processes involved in the weight changes. Compared with yellow perch, salmonid fry, fingerlings and smolts have smaller, thinner scales, whereas galaxiids are scale-less.

Both Parker and Stobo found that relative magnitudes and rates of change were related to the size of specimens within a sample. In the present study no size-related trends were

evident. However, this may merely reflect the small size of the sample (n = 20).

It is evident from the results presented here that any condition factors calculated from the lengths and weights of formalin-preserved fish will be inaccurate unless a correction for the effect of the preservative is applied.

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