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Redbook

The Effect of Storage on the Length and Weight of Herring

by R. D. Humphreys
Fisheries Research Board of Canada, St. Andrews, N.B.

Herring, divided into two groups of 100 fish each, were used to determine the effect of storage on length and weight.

The fish were measured to the nearest millimetre from tip of the snout to the end of the longest lobe of the caudal fin and weighed on a Mettler electronic balance to the nearest tenth of a gram. Measurements were recorded at weekly intervals for the first four weeks of storage and then once a month for a total period of six months. One group was stored in a 5% solution of formalin in a sealed, metal container. The other was stored on racks, uncovered, in a cold storage vault at approximately 0°F (-17.7°C).

Initially, the fish ranged in size from 94 to 260 mm for the formalinized group and from 94 to 287 mm for the refrigerated sample. The fish were arranged in 10 mm length categories and 10 weight categories. Average lengths and weights were then calculated for each category on each date the fish were measured. The number of fish in each category was determined by the size composition of the sample and no attempt was made to pick out equal numbers of fish of each size.

After a period of storage of 183 days (six months), loss in length ranged from 1.0% to 3.2% of the original for the refrigerated herring and from 0.5% to 2.2% for the formalinized lot (Tables 1 and 2).

Loss of weight in stored herring was much more pronounced. Refrigerated herring lost from 11.7% to 59.3% of their original weights over the 183-day period, the smaller fish undergoing the largest percent loss (Table 3). The rates at which loss in weight was incurred are presented in Fig. 1 for the refrigerated sample.

For the first two weeks of storage, some of the formalinized fish gained rather than lost weight, due to the absorption of preservative (Table 4). Thereafter, a loss was generally recorded for all individuals, but it was difficult to control the amount of moisture adhering to the surface of the fish. Therefore, the weight change for individual fish between dates of weighing could not be determined with any degree of accuracy. At the end of 183 days, the average loss in weight ranged between 4.2% and 7.8% of the initial body weight.

Table 1. Cumulative percent loss in length of refrigerated herring

Initial Length Interval (mm)	No. of Fish	Days of Storage								
		7	14	21	28	63	91	124	154	183
90- 99	1	0.0	0.0	1.1	1.1	1.1	2.1	2.1	2.1	2.1
100-109	8	0.9	0.9	0.9	0.9	1.9	1.9	2.8	2.8	2.8
110-119	8	0.9	0.9	1.8	1.8	1.8	1.8	1.8	2.7	2.7
150-159	2	0.6	0.6	1.3	1.9	1.9	1.9	2.6	3.2	3.2
160-169	7	0.0	0.0	0.6	0.6	0.6	1.2	1.2	1.8	1.8
170-179	17	0.0	0.0	0.6	0.6	1.1	1.1	1.1	1.7	1.7
180-189	31	0.5	0.5	1.1	1.1	1.6	1.6	1.6	2.2	2.2
190-199	10	0.0	0.5	0.5	1.0	1.0	1.6	1.6	2.1	2.1
200-209	6	0.5	0.5	0.5	1.0	1.0	1.5	1.5	2.0	2.0
210-219	1	0.0	0.5	0.5	0.5	0.5	0.9	1.9	1.9	1.9
250-259	1	0.4	0.8	0.8	0.8	0.8	1.9	1.9	1.9	2.1
260-269	3	0.0	0.4	0.4	0.4	0.4	0.8	1.1	1.1	1.1
270-279	4	0.0	0.0	0.4	0.4	0.7	0.7	0.7	1.1	1.1
280-289	1	0.0	0.0	0.3	0.7	0.7	0.7	1.0	1.0	1.0

Table 2. Cumulative percent loss in length of herring stored in formalin

Initial Length Interval (mm)	No. of Fish	Days of Storage								
		7	14	21	28	63	91	124	154	183
90- 99	1	0.0	0.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1
100-109	9	0.5	0.1	1.0	.4	.9	1.6	1.2	1.0	0.5
110-119	8	1.4	.2	.2	1.0	.9	1.8	1.1	1.7	.5
120-129	1	2.4	.8	3.2	2.4	1.6	1.6	1.6	1.6	1.6
160-169	8	.8	.5	.8	1.3	1.5	1.2	1.7	1.7	1.2
170-179	18	.6	.2	1.0	1.1	1.4	1.2	1.5	1.9	1.8
180-189	33	.7	.3	1.1	1.1	1.3	1.6	1.7	1.7	1.6
190-199	15	.6	.8	.7	.9	1.3	1.3	2.2	1.5	1.1
200-209	5	1.0	.4	1.3	1.1	1.4	1.6	1.8	2.1	2.2
210-219	1	1.4	1.4	1.9	1.0	1.4	1.4	1.9	2.4	1.9
260-269	1	0.0	0.0	.8	.8	.8	1.5	1.5	1.2	1.9

Table 3. Cumulative percent loss in weight of refrigerated herring

Initial Weight Interval (gm)	No. of Fish	Days of Storage								
		7 %	14 %	21 %	28 %	63 %	91 %	124 %	154 %	183 %
0.0- 9.9	3	12.1	20.9	24.2	27.5	39.6	47.3	51.6	56.0	59.3
10.0- 19.9	14	9.1	15.7	19.8	22.3	33.1	38.0	43.0	46.3	49.6
30.0- 39.9	12	6.3	9.5	11.1	12.2	16.8	19.6	22.0	23.9	25.3
40.0- 49.9	25	5.4	8.0	9.8	11.1	14.3	16.5	18.0	19.5	20.6
50.0- 59.9	27	5.4	8.2	9.5	10.3	13.2	14.9	16.4	17.5	18.5
60.0- 69.9	7	4.5	6.9	8.2	9.2	11.2	13.3	14.3	15.3	15.9
70.0- 79.9	2	4.7	6.5	8.4	9.2	11.1	12.6	13.4	14.2	14.6
80.0- 89.9	1	5.1	7.9	8.9	9.6	12.0	13.2	14.3	15.2	15.8
140.0-149.9	1	4.2	5.5	6.9	7.6	9.8	11.3	12.9	14.2	15.3
150.0-159.9	1	4.4	6.2	7.0	7.5	9.5	10.9	12.2	13.1	14.0
160.0-169.9	4	4.6	6.2	6.8	7.2	8.6	9.7	10.6	11.3	11.8
170.0-179.9	1	4.6	6.2	6.7	7.2	8.5	9.7	10.8	11.6	12.1
190.0-199.9	1	5.4	6.7	7.4	7.9	9.1	10.2	11.0	11.7	12.1
210.0-219.9	1	3.6	5.0	5.5	6.1	8.0	9.2	10.2	10.7	11.7

Table 4. Cumulative percent change in weight of herring stored in formalin

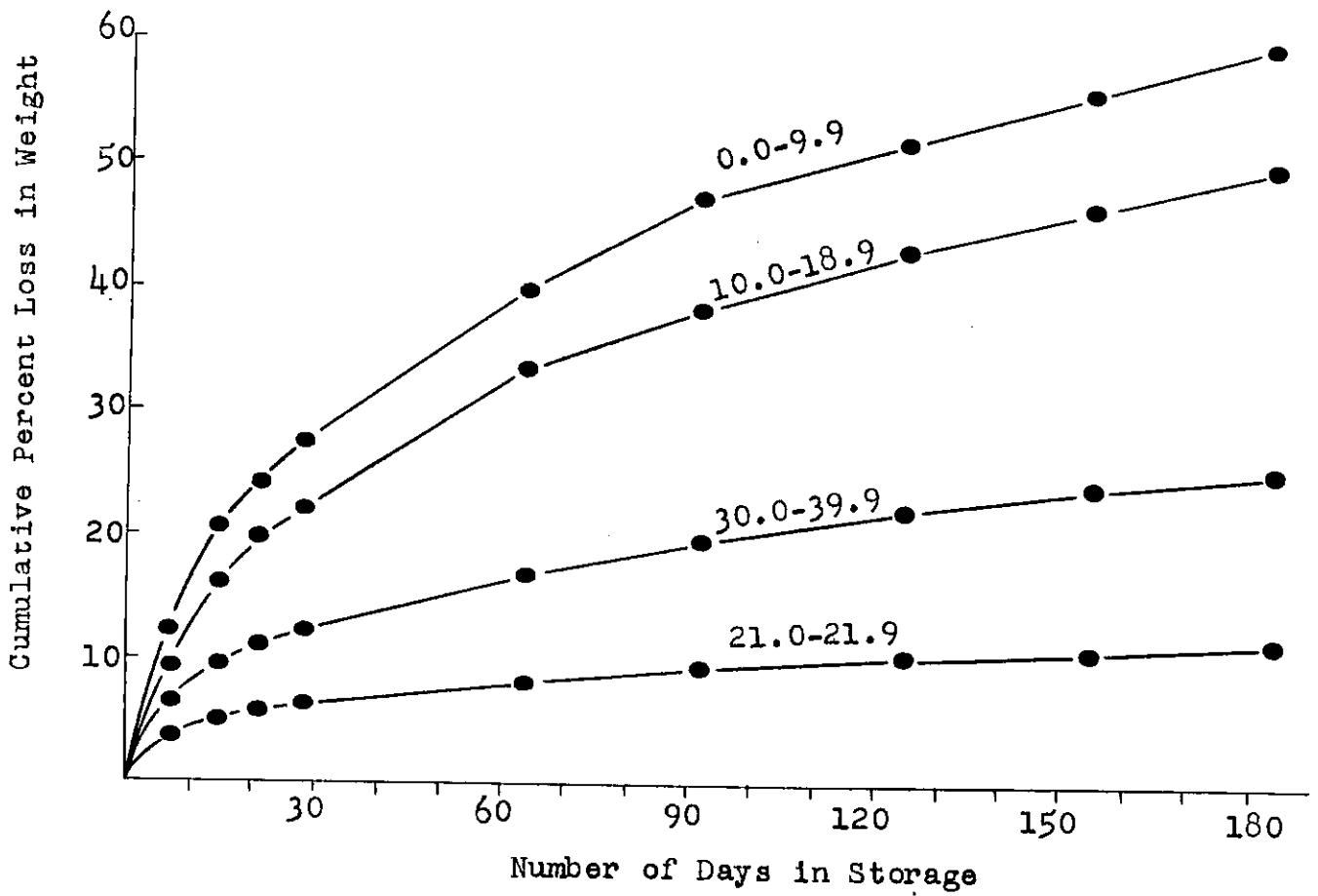| Initial Weight Interval (gm)	No. of Fish	Days of Storage								
		7 %	14 %	21 %	28 %	63 %	91 %	124 %	154 %	183 %
0.0- 9.9	6	+3.3	+2.2	0.0	0.0	-2.2	-6.6	-4.4	-3.3	-5.5
9.9- 19.9	13	+1.7	+1.7	0.0	-0.9	-3.5	-7.8	-6.1	-5.2	-7.8
30.9- 39.9	12	-1.1	-0.8	-1.9	-3.3	-4.1	-8.5	-5.8	-6.0	-7.1
40.9- 49.9	30	-1.1	-0.9	-1.8	-2.6	-3.3	-7.5	-5.1	-6.2	-7.3
50.9- 59.9	25	-1.7	-5.6	-2.8	-3.3	-7.6	-7.4	-5.6	-6.7	-6.9
60.9- 69.9	10	-0.3	-0.3	-1.1	-1.9	-2.5	-5.8	-4.1	-4.6	-5.2
70.9- 79.9	3	+0.1	-0.7	-0.8	-2.2	-2.6	-6.2	-3.5	-4.6	-4.8
130.9-139.9	1	+0.4	-0.4	-0.2	-1.7	-1.1	-4.4	-3.7	-3.4	-4.2

Fig. 1. Cumulative percent loss in weight of refrigerated herring. Initial weight intervals in grams. (Storage temperature approximately -17.7°C)