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MANUSCRIPT REPORT SERIES

No. 1202

TITLE

Estimating count per pound of scallop meats by volumetric
measurement ✓

AUTHORSHIP

J. F. Caddy

and

C. Radley-Walters

Establishment

Biological Station
St. Andrews, N. B.

Dated September 1972

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INTRODUCTION

Unless there is some easy and foolproof method of estimating meat counts at sea, there is considerable justification on the part of the skippers for claiming that they had no precise knowledge of the exact meat count in their catch. Obviously, fishermen could be advised as to the shell size of scallop which gives on average a given number of meats per lb, but there is some variation in meat weight for a given shell size across the bank. Preferably the skippers should have access to the same device that is used by fishery officers ashore in examining the catch. Since weighing 1 lb of meats at sea is impractical, a volume measure has some obvious advantages. Scallop meats have a specific gravity (sp. g.) just heavier than water and year-round studies on inshore scallops revealed no evidence that sp.g. changes at the time of capture on a seasonal basis. There is still the possibility that meats left on ice for 2 weeks will take up enough water to reduce their sp.g. and increase their volume. This increase would reduce the apparent count on the wharf below that measured at the time of fishing and might provide an acceptable safety margin acting in favour of the fisherman.

This report describes a simple volumetric device which can be used to estimate meat counts rapidly and easily, and reports on its accuracy and method of use. It is suggested that this device be issued to each of the offshore vessels with instructions for its use, and the suggestion that counts be made of the catch while filling the 40 lb cloth bags, thus ensuring that their contents do not exceed the prescribed count.

METHODS

Specific gravity determination

Meat specific gravity was determined by suspending samples of 3 to 5 freshly cut scallop meats by a cotton thread from a balance arm, and weighing them both in air and when suspended in fresh water. (Negligible water uptake occurred during the 10-20 sec spent weighing the meats in fresh water.) Nine duplicate samples were weighed. The specific gravity of the meats was then obtained by:

$$\text{Sp.g.} = \frac{A}{A-B} \quad \text{where } A = \text{weight in air} \\ B = \text{weight in water}$$

The mean sp.g. for all freshly shucked meat samples was 1.064.

Design and construction of the sampling device

One pound of water has a volume of 454 ml, so that 1 pound of scallop meats (assuming perfect packing) would have a volume of $\frac{454}{1.06}$ ml = 428 ml. Initial tests with fresh scallop meats indicated that this was a good approximation to the volume of 1 lb of meats.

The sampler (Fig. 1) consists of a cylinder of 1/8 inch (3 mm) thick perspex, 9 inches (23 cm) high with an internal diameter of 6.9 cm (external diameter of 3"). A graduation at 11.5 cm from the base, corresponds to a volume of 428 ml, and weight of 454 g (= 1 lb) of scallop meats. The cylinder is mounted on a 10 cm square perspex base, which is perforated by twenty 3 mm holes inside the cylinder.* A perspex disc, 6.8 cm in diameter slides easily inside the cylinder, and is kept horizontal by 2 vanes of perspex glued on the upper surface. Four weights were placed on the disc to bring its weight up to 1 1/2 lb (681 gm): it having been established during the early trials that scallop meats were effectively incompressible when subject to more than 1 lb compression.

(N.B. In the final version of the sampler, for ease of cleaning and use, the lid should be constructed of solid perspex with embedded shot weights, and a length of nylon monofilament should attach it to the base of the cylinder to prevent loss.)

Use of the sampling cylinder

Scallop meats were poured into the sampler until the upper surface of the meats was just below the graduation. The lid was then dropped onto the meats, and the position of its lower edge checked in reference to the 428 ml mark scratched on the cylinder. The lid was removed and individual meats added until the bottom of the lid came up to the mark when in place. The number of meats in the sample were counted as they were poured out of the cylinder. (N.B. The practice of counting the meats into the cylinder should be strongly discouraged, as it is likely to lead to an upward bias in the meat sizes selected.)

With a little practice, it became possible to pour in the correct amount of meats the first time, with little

* See 1st page of discussion

need for subsequent correction; the whole process taking no more than 30 seconds.

At-sea testing of the sampling cylinder

Scallops were fished at intervals during an 8-day trip to Georges Bank on the "E. E. Prince", and the meats shucked out and washed for about one minute in sea water, duplicating normal commercial practice. Two 428 ml samples of drained meats in approximately the same size range, were measured out, one sample being placed in a plastic bag and frozen at -20°C ; the other placed into a cotton bag, such as is used commercially, and covered with chipped ice in a 2 x 1 x 1 ft insulated container, stored on deck at ambient temperatures of about $10-15^{\circ}\text{C}$. Forty duplicate samples were taken in this way at intervals throughout the trip (Table 1). Chipped ice in the container was topped up each day, and melted water in the bottom of the container poured off.

On return to the laboratory, scallop meats were kept in the same container at room temperature until 14 days after the start of the trip (22 June); (14 days is the normal duration of a commercial trip). Volumes of the meat samples were measured, using a graduated version of the sampling cylinder, and samples weighed to the nearest gram and individual meats counted.

RESULTS

Accuracy of volumetric estimation of the count per pound

It is assumed that the frozen samples did not lose weight between freezing on board ship and thawing and weighing two weeks later in the laboratory. This assumption is probably correct, since no substantial amount of free water was observed on thawing the samples. The mean weight of the frozen samples on thawing was 450.1 ± 9.4 g; 3.9 g below the 1b mark, but well within one standard deviation of 454 g. The mean volume was 428 ± 3.5 ml; almost exactly the predicted volume for 1 lb of meats. The slight discrepancy between the weight and volume measure was probably caused by a slight difference in the estimate of meat density from that obtained before the cruise. The sample specific gravity of the frozen and thawed meats was $\frac{450.1}{428.5} = 1.050$. This value is slightly lower than the sp.g.

obtained from weighings of individual meats, and may result from imperfect packing of the meats (the small spaces left between individual meats observed when using the cylinder was filled up with either air or water, depending on the dryness of the meats). If an allowance is to be made for this less than perfect packing of the meats, probably the volume of the

graduated cylinder up to the calibration should be 432 ml. However, it may be concluded that the volumetric method provides a close approximation to a 1 lb sample of meats for rapid and easy use in situations where balances are not available or functional, e.g. at sea or on the deck of a vessel being unloaded.

Effect of freezing and icing on the meat count

It has already been stated that freezing the meat samples had a negligible effect on their volume after thawing. The meat count per pound estimated from the volumetric samples measured at sea were compared with the count per pound calculated after weighing the 428 ml samples. The true count per pound was obtained as follows:

$$\text{True count per lb} = \frac{\text{number of meats in the 428 ml sample}}{\text{sample weight (g)}} \times 454.$$

Observed and calculated counts were identical for most samples, as indicated by the regression equation:

$$\text{True count per lb} = 0.15 + 1.00 (\text{meat count per 428 ml}).$$

The comparison of observed and calculated counts obtained in the same way for samples held on ice yielded the following regression:

$$\text{True count per lb} = -1.15 + 0.89 (\text{meat count per 428 ml}).$$

Both regressions showed a high correlation between calculated and observed counts ($R = 0.99$), but the number of meats per lb in the iced samples were all below the counts/428 ml made at sea. No appreciable change in packing density with size was noted for either frozen or iced samples by comparing the observed and calculated meat counts.

Change in meat count following icing

A plot of the difference between count per pound before and after holding on ice (Fig. 2), is useful in predicting what effect holding in this way may have on the meat count on landing, if water absorption occurs to the same extent in the holds of commercial scallopers. The regression of the decline in the number of meats per pound after icing on the initial meat count was:

$$\text{Drop in count per lb} = -0.262 + 0.154 (\text{initial count}) (R = 0.90)$$

This suggests that under these conditions, a meat count of 40 to the pound on deck would have dropped to 34 per lb

on landing, while an (illegal) count of 47 meats per lb would pass inspection at 40 meats per lb on landing.

Although no attempt was made to follow the rate of uptake of water with time, no appreciable change in uptake was noted between the first and last samples taken, which spent 9 and 14 days respectively on ice, although further studies on this effect are needed. The average uptake of water during the 9 to 14 days on ice was 17%; the sp.g. of the meats having declined from 1.060 to 1.015 in the period.

DISCUSSION

The volumetric sampling device provides a simple and reliable method of determining average meat count under conditions when accurate weighing is impossible. To allow for imperfect packing of the meats, the cylinder calibration should be set at 432 ml.

The holes in the bottom of the cylinder became plugged by meats and were ineffective for drainage, and probably should be omitted in the next model. The 1 ml clearance between the cap and the inside of the cylinder allowed some displacement of water, and within a wide tolerance, the degree of wetness of the meats was not found to significantly affect the estimate of meat volume.

Storage conditions for the iced samples were deliberately maintained at a less than optimal level. The one lb samples of meats were kept on thawing ice, and in contact with melt water from the ice. The small volumes (1 lb) in each bag must also have facilitated water uptake, compared with the 40 lb bags used commercially. At the end of the 14th day, meat samples, although edible, had a fairly strong odor and it seems unlikely that any but substandard commercial landings would show a similar water uptake. However, the actual extent of water uptake in commercial catches should be monitored by specific gravity determinations of the landed meats. Presumably it would be possible to allow for water uptake by decreasing the volume of the cylinders issued to fishermen, but since it is unlikely that water uptake always occurs to the same extent, it is probably more satisfactory to retain the 432 ml volume, and allow the water uptake to provide a safety margin in favour of the fishermen.

Table 1. Changes in weight, volume and meat count of 40 pairs of 1 lb scallop meat samples after being kept on ice and frozen for periods of up to 2 weeks (measurements made ashore on the 22 June).

FROZEN MEAT SAMPLES

Sample	Date fished	Weight (g)	Thawed volume (ml)	Count/lb	
				at sea	on thawing
1	8 June	444	416	26	27
2	" "	442	423	64	65
3	" "	452	428	31	31
4	" "	447	428	78	79
5	" "	444	428	24	24
6	" "	462	435	30	29
7	" "	460	432	34	33
8	" "	452	428	28	28
9	" "	452	428	34	34
10	" "	459	428	20	20
11	" "	443	424	24	24
12	" "	444	428	18	18
13	" "	448	428	26	26
14	" "	449	428	28	28
15	9 "	454	428	30	30
16	" "	455	428	30	30
17	" "	457	435	29	29
18	" "	443	428	42	43
19	" "	453	428	36	36
20	" "	404	428	27	29
21	" "	449	428	33	33
22	" "	442	424	30	31
23	" "	454	428	35	35
24	" "	448	428	25	25
25	" "	442	424	32	33
26	" "	457	428	25	25
27	" "	440	424	39	40
28	12 "	458	435	34	34
29	" "	454	428	21	21
30	" "	453	432	20	20
31	" "	452	428	33	33
32	" "	452	428	47	47
33	" "	456	428	22	22
34	" "	459	435	75	74
35	" "	456	428	36	36
36	" "	451	428	68	68
37	" "	454	435	81	81
38	13 "	454	428	18	18
39	" "	447	428	25	25
40	" "	452	428	32	32
(small	8 "	450	432	183	183)

Mean±S.D.: 450.1±9.4g 428.5±3.5ml

Table 1 (Continued)

ICED MEAT SAMPLE

Sample	Date	Weight (g)	Volume after icing(ml)	Count/lb at sea	Count/lb on landing
1	8 June	574	565	22	17
2	" "	539	569	62	52
3	" "	567	565	20	16
4	" "	533	524	73	62
5	" "	550	539	20	16
6	" "	545	550	26	22
7	" "	506	499	28	25
8	" "	487	480	24	22
9	" "	530	517	34	29
10	" "	525	514	34	29
11	" "	543	532	29	24
12	" "	525	517	23	20
13	" "	474	465	26	25
14	" "	528	514	26	22
15	9 "	544	532	25	21
16	" "	504	491	28	25
17	" "	520	506	36	31
18	" "	535	517	37	31
19	" "	562	550	40	32
20	" "	532	524	26	22
21	" "	508	499	30	27
22	" "	500	488	23	21
23	" "	485	480	32	30
24	" "	537	532	21	18
25	" "	565	554	24	19
26	" "	524	517	27	23
27	" "	527	521	40	34
28	12 "	515	502	40	35
29	" "	533	517	36	31
30	" "	556	550	20	16
31	" "	537	532	34	29
32	" "	503	491	43	39
33	" "	553	547	17	14
34	" "	554	547	27	22
35	" "	517	506	67	58
36	" "	536	524	70	59
37	" "	545	536	70	58
38	13 "	509	502	15	13
39	" "	536	524	23	19
40	" "	507	499	26	23
(small	8 "	504	502	180	162)

Mean±S.D.:

528.5±23.0 g 520.5±24.9 ml

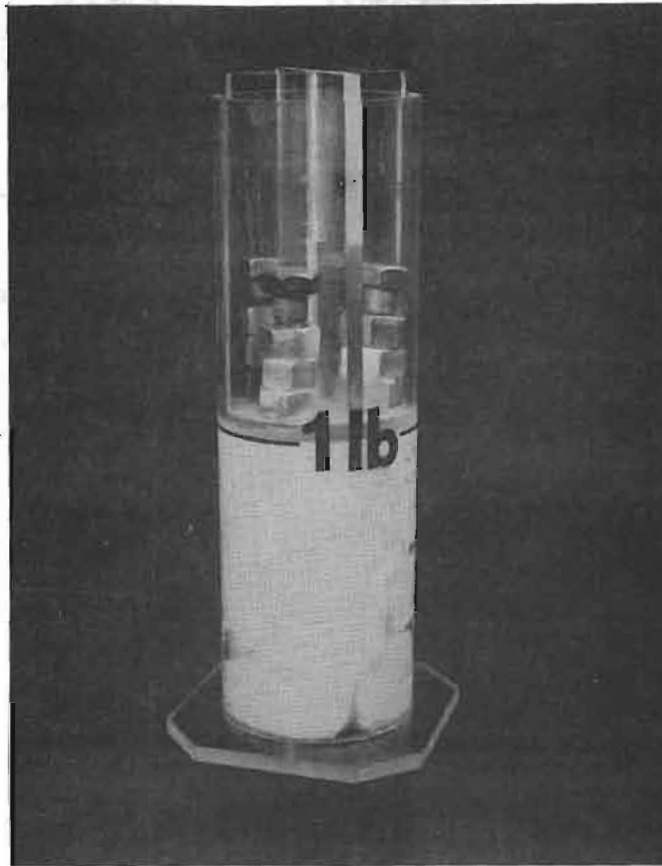


Fig. 1. Volumetric sampler containing 1 lb of scallop meats. The 1 lb graduation corresponds to a volume of 428 ml. The perspex lid and makeshift weights together weigh 1 1/2 lb (681 g).

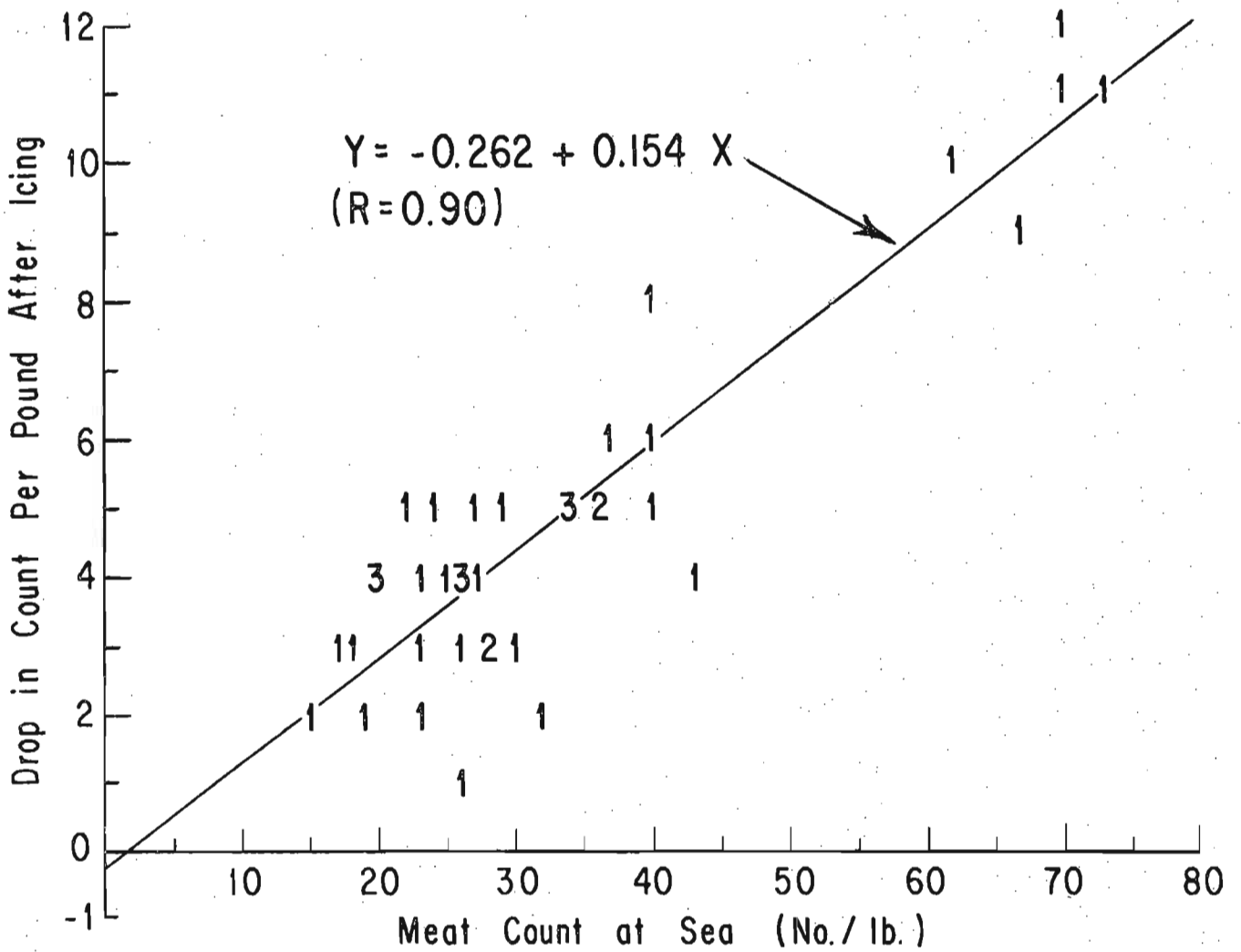


Fig. 2. Calculated regression for difference in count per pound before and after icing.