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NET-WEIGHT DETERMINATION FOR FROZEN GLAZED FISH

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ABSTRACT

A procedure is recommended for determining the net weight of frozen glazed fish (large-size units such as halibut fletches and whole dressed fish). The accuracy and applicability of the procedure are discussed.

INTRODUCTION

Requests for a recommended method to determine the net weight of frozen glazed fish such as salmon and halibut steaks, halibut fletches (the entire fillet or its cross-cut chunks), and whole dressed fish have been received periodically by the U. S. Bureau of Commercial Fisheries Seattle Technological Laboratory. Since the publication of the article, "Accuracy of Net-Weight Determination for Frozen Glazed Halibut Steaks" (Patashnik 1962), the question of the applicability of the halibut-steak method to large-size units such as halibut fletches and whole dressed fish has arisen.

In the marketing of frozen glazed halibut and salmon, the need for a referee procedure to establish net weight (in the absence of an official procedure) is becoming increasingly apparent. Since it is not economically practical to apply a precisely controlled level of percentage glaze, we find considerable variation in percentage glaze on individual fish. In 1957, for example, the percentage glaze on individual halibut fletches, observed as part of an industry survey, varied from a low of 2.5 to a high of 14.9 percent. We might expect even more extreme variation in the percentage glaze of whole dressed fish because of the possibility of filling or not filling voids in the belly cavity. Thus, since net weights are usually designated for fish after glazing (based on weighing the glazed fish), they can only be regarded as an estimate of the true net weight. Therefore, to arrive at a fair designation of weight for a given lot of frozen glazed fish, we must adequately sample the entire lot and establish an average percentage glaze for the lot, the latter being established by employing the interim procedure presented below. The net weight of the lot can be calculated on the basis of this average percentage glaze.1/

The purpose of this article is (1) to recommend an interim procedure for determining the net weight and percentage glaze of frozen glazed fish--including halibut fletches and whole dressed fish; (2) to present typical data on the accuracy of the procedure; and (3) to discuss briefly various aspects of the procedure.

RECOMMENDED INTERIM PROCEDURE

The recommended procedure outlined on page 2 for the determination of net weight and percentage glaze is based on the official method given in the current U. S. Standards for Grades of Frozen Halibut Steaks (March 1959). The procedure is as follows:

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1/ U. S. Department of the Interior Bureau of Commercial Fisheries trained inspectors are available on a nominal fee basis, as a service to processors and buyers of frozen glazed fishery products, to apply and interpret officially this procedure, and thus assure fair dealing to contractual parties.

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1. Weigh the fish with the glaze intact, to determine the gross weight (C in formula I).

2. Thaw the glaze from the fish as follows:

   a. Rapidly remove all excessive ice layers or pockets of ice with running tap water or a nozzle-type spray. Where the belly walls of dressed fish are frozen together, continue thawing until the ice pockets in the belly cavity are completely removed. (The use of 50° to 60° F. tap water is usually satisfactory. For the rapid removal of deeply recessed ice pockets, however, the use of about 100° to 110° F. water is preferable.)

   b. Adequately thaw the remaining outer surfaces of the frozen fish by means of water spray or water immersion to prevent the freezing of water thereon during step 4 below. Continue thawing until no residual ice glaze can be visually observed or can be sensed by finger touch. (Usually 2 to 5 minutes of thawing with 50° to 60° F. tap water are adequate, but additional time may be needed for larger fish. Neither the exact thawing time used nor the slight overthawing of the fish surface are critical factors in this determination. However, when the relatively heavy halibut fletches are being thawed, it is important to limit the thawing to a very thin surface layer to avoid significant errors during the handling in steps 3 and 4 below.)

3. Place the deglazed fish in an inclined position for about 1 minute to permit most of the excess surface water to drain away freely.

Demonstrating the use of a nozzle-type spray for reaching inaccessible ice pockets.

4. Gently wipe off all remaining excess water from the slightly thawed surfaces of the fish with a water-saturated paper towel, periodically squeezing out the excess water from the towel. Gently wipe the entire surface at least once but not more than twice. If the fish starts to ice up before step 4 can be completed, repeat step 2 as required. (Use of the water-saturated towel avoids the blotting action of a dry towel. The proper and adequate removal of the surface water as directed in step 4 is the critical part of the procedure.)

5. Weigh the deglazed fish to determine the apparent net weight (D in formula I).

6. Calculate the percentage glaze as:

$$\frac{C - D}{D} \times 100 = \text{percentage glaze} \quad \text{(Formula I)}$$

7. The net weight is represented as the difference between the gross weight with glaze on and the apparent net weight with glaze removed by this procedure.

ACCURACY OF PROCEDURE

EXPERIMENTAL: To test the accuracy of the procedure, we prepared glaze-free frozen halibut fletches, dressed halibut, and pink salmon of true net weight, T (formula II, p. 3), and glazed them. (The true net weight initially established was assumed to remain the same for all tests.) The glaze was then removed by the recommended procedure, and the fish were reweighed to give the apparent net weight, D. The difference in weight, D - T, was considered

to be the error in the method. The percentage error in the determination of true net weight was calculated as follows:

$$\frac{D - T}{T} \times 100 = \text{percentage error} \qquad \text{(Formula II)}$$

RESULTS: The following three series of tests--series A, B, and C--show the accuracy obtained in using the recommended procedure:

Series A: In the first series of tests, a single, dressed pink salmon (6 pounds, 3 ounces) was put through 11 cycles of glazing and deglazing over a 3-day period, being returned to -20° F. after each glazing and deglazing. The results (table 1) show that the error in net weight was not greater than 1.0 percent. No obvious differences in the accuracy of the method was noted whether the dressed salmon was deglazed by water spray or by water immersion. Neither the amount of glaze applied nor the length of time the fish was immersed in water noticeably affected the accuracy of the procedure, provided that the time was sufficient to remove the glaze.

Table 1 - Error in the Determination of True Net Weight for a Dressed Pink Salmon (6 pounds, 3 ounces) Subjected to 11 Cycles of Glazing and Deglazing

Test Cycle	Deglazing Time	Amount of Glaze Applied	Deglazing Error for:	
			Water Spray	Water Immersion
Number	Minutes	Percent	Percent	Percent
1	2-4	8.2	+0.2	
2	2-4	4.8	+0.1	
3	2-4	9.0	+0.2	
4	2-4	12.2	+0.2	
5	2-4	6.2	+0.2	
6	2-4	3.8	+0.0	
7	2	3.5		1/+1.0
8	5	4.6		+0.4
9	10	3.0		+0.5
10	30	3.7		+0.3
11	60	6.0		+0.4

1/The 2-minute thawing time was inadequate, as some ice glaze still remained in the visceral cavity.

Series B: In the second series of tests, a dressed halibut (21 pounds, 9.8 ounces) was put through eight cycles of glazing and deglazing as above. The results (table 2) showed that the percentage error in true net weight was within 1.0 percent for both deglazing by water spray or by water immersion for all time-intervals employed.

Table 2 - Error in the Determination of True Net Weight for a Dressed Halibut (21 pounds, 9.8 ounces) Subjected to 8 Cycles of Glazing and Deglazing

Test Cycle	Deglazing Time	Amount of Glaze Applied	Deglazing Error for:	
			Water Spray	Water Immersion
Number	Minutes	Percent	Percent	Percent
1	8	2.6	+0.5	
2	5	1.9	+0.3	
3	5	2.6	+0.3	
4	5	3.2	-0.2	
5	5	3.1		-0.1
6	10	3.8		-0.1
7	30	3.4		0.0
8	60	3.1		+0.3

Series C: In the third series of tests, three halibut fletches (3 pounds, 1.7 ounces; 7 pounds, 1.8 ounces; and 11 pounds, 0.3 ounces) were put through nine cycles of glazing and deglazing in a manner similar to series A. The results (table 3) were within 1.0 percent of true net weight. However, more variability was noted on duplicate tests of fletches that were excessively thawed; these are among the 60-minute water-immersion tests in the table.

When the fletches were deglazed for 10 minutes or more, they began to present a

Table 3 - Error in the Determination of True Net Weight of Three Halibut Fletches Subjected to 9 Cycles of Glazing and Deglazing

Type of Deglaze	Test Cycle	Deglazing Time	Amount of Glaze On:	Error in Net Weight for:	Amount of Glaze On:	Error in Net Weight for:	Amount of Glaze On:	Error in Net Weight for:
			Fletch #1 (3.1 lbs.)		Fletch #2 (7.1 lbs.)		Fletch #3 (11.0 lbs.)	
	No.	Minutes	Percent	Percent	Percent	Percent	Percent	Percent
Water Spray	1	1/1.5-2.5	4.3	-0.4	3.5	+0.1	2.5	+0.2
	2	1/1.5-2.5	3.0	-0.1	3.5	+0.1	2.9	+0.1
	3	1/1.5-2.5	3.6	-0.4	3.3	+0.1	3.5	-0.1
	4	1/1.5-2.5	3.4	-0.1	4.1	+0.1	3.9	+0.1
Water Immersion	5	5	4.0	-0.4	4.0	+0.2	3.6	-0.1
	6	10	4.8	-0.5	4.4	+0.2	3.4	-0.1
	7	10	4.0	-0.7	5.7	-0.2	4.4	-0.2
	8	60	2.6	+0.6	4.2	+0.5	4.7	-0.8
	9	60	3.6	-0.4	4.7	-0.1	4.4	-0.3

1/For adequate delgazing, fletch #1 required 1½ minutes, fletch #2 about 2 minutes, and fletch #3 about 2½ minutes.

problem because of overthawing. Owing to the relatively greater weight of the fletches, it was difficult to wipe off the excess surface moisture gently without squeezing out water from the readily compressible, thawed outer shell.

DISCUSSION OF PROCEDURE

According to the data presented, the average net weight of frozen glazed fish can be determined within 1 percent, whether the procedure is applied to large units such as halibut fletches, dressed halibut, and dressed salmon (tables 1, 2, and 3) or to small units such as halibut steaks (Patashnik 1962). In the development and use of the procedure presented, however, some background considerations should be mentioned.

Since it has previously been demonstrated that the average net weight of small units of fish such as halibut steaks (which have a high surface-area-to-weight ratio) can be determined within 1 percent, it was reasoned that the same determination applied to such larger units of fish as fletches and dressed fish (which have a relatively low surface-area-to-weight ratio) should also give results within this level of accuracy. We would expect this conclusion to be true, provided (1) that the larger fish units could be sufficiently thawed on the surface to avoid any significant refreezing of water and (2) that there was no significant loss of natural fluids during thawing and subsequent handling. Although we found this to be true with such small units as halibut steaks even when completely thawed (Patashnik 1962), it was not invariably true with all the large units in the current study. Thus, if we substantially thawed large units of fish such as dressed salmon or halibut by immersing them in running tap water at 50° to 60° F. for 30 or 60 minutes, we obtained individual test values well within 1.0 percent (tables 1 and 2). However, we began to approach the level of 1.0-percent accuracy when the longer thawing time of 10 or 60 minutes was applied to halibut fletches (table 3). In general, we observed that the thawing of halibut fletches for 10 minutes or longer presented a problem, since it was difficult to wipe off the excess water gently (step 4 in the procedure) enough to avoid squeezing out natural fluids from the readily compressible or sponge-like thawed outer surface. This difficulty resulted from the concentration of pressure at localized surface areas where the fletches came into contact with the hands or the draining surface (during step 3 and 4), because of their relatively heavy weight. Because the skin of dressed fish prevents the squeezing out of the natural fluids, they present no such problem; thus greater flexibility in thawing time is permitted.

Although thawing times beyond 5 or 10 minutes are usually not recommended, thawing up to 60 minutes was carried out in order to estimate the effect of substantial overthawing on the accuracy of the procedure. On the basis of the data in tables 1, 2, and 3, we may conclude that a slight overthawing of the fish surface as provided in step 2 of the procedure will not introduce significant errors.

The main problem in determining the net weight of large units of glazed fish (whole dressed fish) is to achieve a complete removal of the ice pockets in the belly cavity or in other hidden recesses. This can be most speedily accomplished under step 2 of the procedure, by inserting a nozzle into the cavity and employing high-velocity water warmed to the specified 100° to 110° F. Where parts of these cavities or recesses are inaccessible for the complete wiping off of excess moisture (step 4), this omission has not been found to noticeably affect results.

In step 4 of the method, the caution was given that the critical part of the procedure was to "gently wipe off all excess water from the slightly thawed surfaces of the fish with a water-saturated paper towel." This precaution becomes especially critical when working with small units of cut fish (with no skin protection) such as halibut or salmon steaks because of the high ratio of surface area to weight. Attention to this detail is also important in working with halibut fletches (with no skin protection), especially with the smaller sizes such as fletch No. 1 reported in table 3. For optimum accuracy, it is especially important to avoid removing the below-the-surface natural fish fluids; thus it is desirable to avoid either vigorously sponging the fish surface with dry paper towels, or repeatedly sponging the surface with wet paper towels.

Other conditions being equal, the relative surface-area-to-weight ratio of the product determines the accuracy obtainable. Thus, to measure individual net weights within 1-percent accuracy on dressed halibut or salmon and on halibut fletches, the operator needs little training, provided the procedure is properly interpreted. In applying the procedure to halibut steaks, however, some prior practice or orientation of the operator is necessary to obtain the average 1-percent level of accuracy because of the relatively high surface-area-to-weight ratio.

The investigator recognizes the limited number of samples employed in this study. In his opinion, the 8 to 11 replications on a single sample (tables 1, 2, and 3) establish with reasonable certainty that the method itself introduces little variance. Several possible problem areas that might conceivably introduce sample variance in the results were considered but found to offer no serious problem (varying surface-area-to-weight ratio, percentage glaze, deeply recessed ice pockets, protective skin or no skin, length of deglazing time, temperature of the glazing water, and the effect of several cycles of freezing and thawing). Until the industry or some other interested group officially requests the development of an official procedure, a larger sampling to validate this recommended interim procedure more rigorously cannot be justified. The procedure as set forth appears to be adequate to serve existing needs.

CONCLUSION AND RECOMMENDATION

In a test of the interim procedure recommended here for determining the net weight of relatively large-size frozen glazed fish units, individual results with halibut fletches, dressed halibut, and salmon were within 1 percent of the true net weight.

It is recommended that interested groups evaluate this interim procedure as the basis of a future official standardized method for determining the net weight of frozen glazed fish.

LITERATURE CITED

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