Serial No. 280

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Document No.13

ANNUAL MEETING - JUNE 1955

Norwegian Experiments on Conversion Factors for West Greenland Cod

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A preliminary experiment on determining the conversion factor for West Greenland cod on board Norwegian vessels was undertaken in the summer of 1953. In the same year similar experiments were made by France, Portugal and Spain. The results arrived at by the different countries were, however, greatly at variance with each other, and it was deemed advisable that the different fishing nations continue the investigation. New experiments for assessment of the conversion factor were therefore undertaken by Norway in 1954.

On the Norwegian vessels in West Greenland waters the cod is generally handled in the following way:

The cod is caught by means of long-lines which are set either along the bottom in varying depth, or pelagicly as floating-lines. The lines are allowed to fish for 2-4 hrs. whereupon they are hauled with powerdriven gurdy. As soon as the fish comes in over the rail, its throat is cut and the fish allowed to bleed. After a quarter or half an hour the fish is dressed. This process includes removal of head, intestines and liver. After dressing, the fish is immediately split during which process the foremost half of the backbone is removed. The split cod is washed in running sea water and brought to the hold where it is salted in tiers.

The Norwegian vessels pursue the fishery off West Greenland from May till October. During this season the fish consist of spent and immature individuals. The roe and milt thus weighs comparatively little. The size and weight of the liver generally increases from early in the season till late in the season. Variations in liver content occur from one year to another.

The procedure used in determining the conversion factor was the same in 1953 and 1954. In both years about 100 specimens of varying size were sampled. To each fish was fastened a numbered tag for identification. Some tags were however lost before the fish was unloaded in Norway. In the following, we have only considered those individuals which could be followed all the way through the different processes.

The conversion factor was determined thus:

When the fish came over the rail, the single individuals were measured to the nearest centimetre and weighed in round condition. After removal of head and entrails, the fish was weighed again. A numbered tag was fixed in the neck or near the earbone of the fish. Thereupon the cod was split and salted in the hold. After 14-15 days the fish was unloaded or restacked and the opportunity was taken to weigh and measure the fish again. The length of the salted fish is the distance from the tip of the tail to a straight line between the foremost edge of the earbones.

During the experiment the split cod has as far as possible been salted in the middle of the tiers so that it should receive a pressure comparable to the mean for the whole saltfish catch. In 1953 the salted fish was transferred after 15 days to a transport vessel taking 2,000 tons salted fish. In 1954 the salted cod was taken home on an ordinary fishing vessel of 150-200 tons after the

fish had been restacked after 16 days in salt. During the restacking the experimental fish by a mistake was placed in the upper part of the tiers. The control weighing, however, show that this does not seem to have had much influence on the final results.

In 1953 we have complete data for 84 individuals. In table I are listed the mean weight of the fish in round condition, in dressed condition before removal of the dorsal bone, the weight after salting in 15 days and finally the weight of the salted fish after 1½ month in salt. The mean weight of the cod is given in 5 cm. groups, from 52-57 cm. up to 102-107 cm.

In 1953 the fish was not weighed upon unloading in Norway, but according to information given by the receivers, the fish weight for the whole load was reduced by 7.5% in the period between the transfer of the saltfish from the fishing vessels to the transport ship and delivery in Norway. In table I, column "salted 1.5 months" this reduction of 7.5% has been taken into consideration.

In table II the data for 104 fish handled during the experiment in 1954 are summarized. In the following the experiments in both years will be discussed.

Round fresh weight

In both 1953 and 1954 the fish used in these experiments were caught on pelagic long-lines in the Holsteinsborg Deep. In 1953 the sample was taken on July 29-30. In 1954 the sample was taken on July 9th. In 1953 the sample contained somewhat larger fish than in 1954. The mean sizes were respectively 75.48 and 74.66 cm. The experimental fish were slightly larger than the cod in the commercial catches which in 1953 had a mean size of 72.58 cm., in 1954 73.21 cm.

In 1953 the weight of the fish varied between 1.83 and 10.74 kg. (mean wt. - 4.04 kg.). In 1954 the fish weight varied between 1.44 and 6.66 kg. (mean wt. - 3.67 kg.).

Dressed fish

In 1953 the average weight reduction by removal of entrails and head was 36.8%, in 1954 35.4% (see tables). The % reduction in weight from fresh round fish to dressed state is about the same in all sizes of cod. This is reflected by the conversion factors for dressed to round fresh weight which are listed in the lower part of the tables. The mean factor in 1953 was 1.58 and in 1954 1.55. In the individual size groups, the conversion factor varies between 1.46 and 1.68. The average reduction in weight from round fresh to dressed fish for both years is 36.2% with a corresponding mean conversion factor of 1.57.

Salted fish

The reduction in weight from round to salted fish, and likewise from dressed to salted fish, shows some difference in the two years. In 1953 the reduction in weight from round fresh to salted weight after 15 days is 65.4% or conversion factor of 2.89. In 1954 the weight reduction in the same space of time is 67.5% with a corresponding conversion factor of 3.06. The explanation of this difference in the two years is probably that the fish in 1953 was more lightly salted and that it was exposed to less pressure during the first two weeks. That this has been the case is also indicated by the reduction in weight in the period following the first two weeks.

As mentioned above, the fish weight in 1953 was reduced by 7.5% during the interval between weighing in Greenland and delivery in Norway. In table I this figure for reduction has been used to calculate the saltfish weight after 1½ months in the different sizes of cod. The total reduction from fresh round to fully salted fish in 1953 thereby amounts to 68% which corresponds to conversion factor of 3.13.

In 1954 the weight of each single fish was recorded in Norway after two months in salt. The mean reduction in weight during the 1½ months between the last weighing in Greenland and delivery in Norway was found to be only 2.5% or 5% less than in 1953. The mean reduction from round fresh to fully salted fish was in 1954 calculated to 68.2% with a corresponding conversion factor of 3.14. Thus in both years the total loss of weight from round fresh to fully salted fish delivered in Norwegian port is almost identical.

In table III the material for the two years is treated as one sample. The mean conversion factors from the fish in the different size groups is given in the lower right hand part of the table.

The combined samples also show that the percentage reduction of weight from round fresh to dressed fish is about the same in the different size groups. For conversion to round fresh from dressed fish the mean factor is 1.57.

For conversion of fully salted to fresh round fish the mean factor is 3.14. However, the table also shows that the correct conversion factor to be used in practice depends upon the size of the fish in the catches. In the ICNAF Meeting Document No.3 for the 1954 Annual Meeting, it is stated in connection with the Portuguese investigations that the conversion factor does not vary with the individual size of the fish. A similar report from Spain states that the factor shows an increase with increasing size of the fish. Our results can only confirm Spain's statement. The larger the fish, the more the weight is reduced by salting and the higher the conversion factor to be used. In e.g. the 53-57 cm. group, the weight is reduced by 59%, while in the 93-97 cm. group the reduction is 71%. The intermediate size groups show a gradual increase in reduction of weight. This gives for the whole catch a conversion factor which can vary from 2.46 to 3.49, all depending upon the size of fish chosen as representative for the catch. The mean factor for the fish investigated in both years in the case of Norway is 3.14.

The fact that the conversion factor changes with the size of the fish possibly also explains why the study of catches of other countries containing perhaps trawl-caught fish, or fish of another size composition, can show widely different conversion factors. In the investigation undertaken by Portugal the conversion factor for salted to fresh round fish for Greenland cod was found to be 2.62. France found in 1953 a conversion factor of 2.46. This last factor refers to trawl-caught cod. The mean size of the cod is not stated in the French report, but the conversion factor found indicates that the fish may have been rather small. Our samples show a similar conversion factor (2.46) for cod with a mean size of 55 cm.

The Norwegian investigation in regard to the conversion factor in 1953 was checked by similar investigation in 1954, and it would seem that the factors arrived at are relatively correct. However, should the total catch be correctly assessed from the saltfish landed, proper consideration must be given to the mean size of the fish in the commercial catches in the different years.

- THE END -

Table 1.

Conversion Factors, West Greenland Cod 1953

84 ind. weighed and measured

Length of live fish cm.	53-57	58-62	63-67	68-72	73-77	78-82	83-87	88-92	93-97	98-102	103-107	Averages
No. of ind.	1	8	7	12	20	22	8	4	-	-	2	75.48 cm.
Av. weight of live fish kg.	1.83	2.16	2.65	3.14	3.77	4.45	5.28	6.72	-	-	10.74	4.04
" " " dressed, headless "	1.21	1.44	1.68	2.01	2.38	2.79	3.31	4.16	-	-	6.74	2.55
" " " salted 15 days "	0.79	0.86	0.98	1.07	1.30	1.52	1.81	2.25	-	-	3.61	1.40
" " " salted 1½ month "	0.73	0.79	0.91	0.99	1.20	1.40	1.68	2.08	-	-	3.34	1.29
" length of salted fish cm.	45.0	47.0	50.71	53.33	58.50	62.73	64.37	68.75	-	-	82.50	58.63
Conversion factors:												
A. from dressed to live weight	1.51	1.50	1.58	1.56	1.58	1.59	1.60	1.62	-	-	1.59	1.58
B. " salted 1½ month to live weight	2.51	2.73	2.91	3.17	3.14	3.18	3.14	3.23	-	-	3.22	3.13
C. " " " " " dressed weight	1.66	1.82	1.85	2.03	1.98	1.99	1.97	2.00	-	-	2.02	1.98
D. " " length to live length	1.22	1.26	1.28	1.31	1.28	1.28	1.32	1.31	-	-	1.27	1.29

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Table 2.

Conversion Factors, West Greenland Cod, 1954

104 ind. weighed and measured

Length of live fish cm.		53-57	58-62	63-67	68-72	73-77	78-82	83-87	88-92	93-97	Average
No. of ind.		2	5	17	17	16	26	15	3	3	74.66 cm.
Av. weight of live fish	kg.	1.34	1.87	2.45	2.92	3.69	4.04	5.23	5.31	6.66	3.67
" " " dressed, headless	"	0.80	1.28	1.66	1.93	2.34	2.59	3.29	3.49	4.22	2.37
" " " salted 16 days	"	0.57	0.70	0.89	1.00	1.17	1.31	1.63	1.73	1.98	1.20
" " " salted 2 months	"	0.55	0.69	0.87	0.97	1.13	1.28	1.57	1.69	1.91	1.17
Length of salted fish	cm	42.50	44.00	51.18	52.94	56.25	60.96	65.33	68.33	71.67	57.21
Conversion factors:											
A. from dressed to live weight		1.68	1.46	1.48	1.51	1.58	1.56	1.59	1.52	1.58	1.55
B. " salted 2 months to live weight		2.44	2.71	2.82	3.01	3.27	3.16	3.33	3.14	3.49	3.14
C. " " " " " dressed weight		1.45	1.86	1.91	1.99	2.07	2.02	2.10	2.07	2.21	2.03
D. " " length to live length		1.29	1.36	1.27	1.32	1.33	1.31	1.30	1.32	1.33	1.31

Table 3.

Conversion Factors, West Greenland Cod 1953-1954

188 ind. weighed and measured

Length of live fish cm.	53-57	58-62	63-67	68-72	73-77	78-82	83-87	88-92	93-97	98-102	103-107	Averages
No. of ind.	3	13	24	29	36	48	23	7	3	-	2	75.29 cm
Av. weight of live fish kg.	1.50	2.05	2.51	3.01	3.73	4.23	5.25	6.12	6.66	-	10.74	3.84
" " " dressed, headless "	0.93	1.38	1.67	1.97	2.36	2.68	3.30	3.87	4.22	-	6.74	2.45
" " " salted 15-16 days "	0.64	0.80	0.92	1.03	1.24	1.40	1.69	2.02	1.98	-	3.61	1.29
" " " salted 1½-2 mos. "	0.61	0.75	0.88	0.98	1.17	1.33	1.61	1.91	1.91	-	3.34	1.22
" length of salted fish cm.	43.33	46.15	51.04	53.10	57.05	61.77	64.75	65.86	71.67	-	82.50	57.74
Conversion factors:												
A. from dressed to live weight	1.61	1.49	1.50	1.53	1.58	1.58	1.59	1.58	1.58	-	1.59	1.57
B. " salted 1½-2 mos. to live weight	2.46	2.73	2.85	3.07	3.19	3.18	3.26	3.20	3.49	-	3.22	3.14
C. " " " " to dressed weight	1.52	1.84	1.90	2.01	2.02	2.02	2.05	2.03	2.21	-	2.02	2.07
D. " " length to live length	1.27	1.30	1.27	1.32	1.31	1.30	1.31	1.37	1.33	-	1.27	1.30