Serial no. 177

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Document No. 7

ANNUAL MEETING - JUNE 1954

EXPERIMENTAL STUDIES ON CONVERSION FACTORS FOR COD, HADDOCK, POLLOCK, AND WHITE HAKE.

Carried out on board the Spanish Vessel "Vendaval" in the waters southeast and south of Newfoundland, March 1953.

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Forwarded by Direccion General de Pesca Maritima, Madrid*.

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One of the special tasks which we carried out during the biological cruise in the waters off Newfoundland on board the Spanish trawler "Vendaval" in March 1953 was the calculation of Conversion Factors.

The knowledge of the weight of the fish as it comes from the sea is of special interest for the international fisheries statistics. However, on board the fishing vessels the fish caught are never weighed just when caught, and it is not known with any accuracy how many tons of fish are put into the hold daily. Only approximately out from a more general experience can the captain calculate the daily yield of the fisheries.

The only effective control of the yield of the fishery are the weighings carried out when the fish are landed in port. However, from the moment when the fish are caught more or less alive right from the sea, and until they are landed in port, they have been subjected to:

a) heading, eviscerating, cleaning
b) salting.

Through these operations the fish lose greatly in weight.

The only exact figure which we have for weight, dates from the moment of landing in port. In order to know the weight of the fish just when caught, it is necessary to multiply this figure by a factor previously calculated, using the following equation:

$p \times X = P$

p = weight of fish when landed
X = Conversion Factor
P = weight of fish, fresh round, coming from the sea.

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* This paper originally formed part of the Spanish Research Report for the year 1953. However, as other special reports on Conversion Factors have been distributed as separate documents for the Annual Meeting 1954, it is considered to be most to the purpose to use the same procedure for this paper.

Executive Secretary.

To solve this equation we have carried out the following operations and calculations:

From each of the species exploited by the Spanish fishing vessels (cod, haddock, pollock, and white hake) we have selected several specimens of various sizes, subjecting them to the following weighings:

a) individual weight of the whole fish as it comes from the sea, just captured; this weighing is carried out on board.

b) Weight of the same specimen after heading, eviscerating, and cleaning; weighing carried out on board.

c) Weight of the same specimen after being salted at the moment when it is landed in port; the weighing carried out in the fishing plant.

Each fish was clearly marked with a metal tag furnished with a number. All the weighings, those on board as well as those in the fishing plant, were made by means of the same steelyard.

Details of these weighings and of the resulting percentages of losses are given by individuals in the tables 1-4 for each of the four species. From the figures available it has been possible to carry out the calculations necessary for the determination of:

A) % of loss of weight through heading, eviscerating and cleaning.

B) % of weight of fish as ready for salting.

C) Conversion Factor I, the factor by which the weight of the fish as ready for salting (without head and entrails) shall be multiplied in order to calculate its total weight as round fresh fish.

D) % of loss of weight through salting and storage in the hold.

E) % in weight of total loss of fish from the moment when it comes from the sea and until landing in port.

F) % of weight of salted fish landed in port.

G) Conversion Factor II (the Conversion Factor proper). This is the factor by which shall be multiplied the weight of the fish landed in port in order to calculate the total weight of the fresh round fish just when captured. As appears from table 5 this factor varies from species to species, and also within the same species, according to individual size. For the cod, a species in which the sizes vary within a considerable range, we have calculated the percentage of losses and the conversion factor by sizes, see table 5.

The specimens of larger size as a rule have a stomach filled with food. In some cases 200 cubic cm. or more of stomach content was found. At the moment when the weighing took place the sexual glands were in a state very far advanced, near to the spawning. On the contrary the younger individuals of the smaller sizes as a rule did not have stomachs filled to that degree, and their sexual glands were not yet fully developed. These facts explain why the losses found are bigger in the larger than in the smaller cod.

We have to make some final remarks which are necessary for a true evaluation of the figures here calculated. The weighings were carried out on board in the middle of March 1953 when the "Vendaval" was starting its fishing campaign of that year. The fishes subjected to this study were salted and deposited in the bottom of the hold. The weighings of the salted fish took place when landed in the first days of August of the same year. This means that these fishes had passed five months in salt and being deposited in the bottom of the hold.

We wish to stress these details which we consider to be of importance, as the loss in weight is larger the longer time the fish stay in the hold and the farther below in the hold they have been placed. In this way the main loss in weight should in reality be a little smaller than that found from these experiments, and consequently the conversion factor should also be slightly lower than that calculated from the experiments.

The Conversion Factors (II) found for the waters south and southeast of Newfoundland and for the month of March 1953 by the Spanish experiments are the following:

Cod:	Large	3.90
	Medium	3.48
	Small	3.20
Haddock:		3.10
Pollock:		2.64
White Hake:		3.90

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TABLE 1 - COD

Length cm.	Weight in kgs.			% Losses of weight		
	round, fresh (1)	eviscerated (2)	salted, landed (3)	through heading and eviscerating	through salting	TOTAL
130	18.000	8.000	3.950	55.56	50.63	78.06
130	23.500	12.800	6.500	45.54	49.22	72.35
124	21.700	10.300	5.450	52.54	47.09	74.89
110	13.600	6.800	3.200	50.00	53.00	76.48
104	10.500	6.000	3.200	43.00	46.67	69.53
98	8.900	4.300	2.150	51.70	50.00	75.86
96	11.000	5.400	2.650	51.00	51.00	76.00
95	10.600	5.700	2.800	46.23	50.88	73.59
94	9.400	4.950	2.400	47.35	51.52	74.47
94	8.200	4.700	2.400	42.70	49.00	70.74
93	7.800	4.300	2.100	45.00	51.17	73.08
92	8.000	4.400	2.300	45.00	47.73	71.25
91	6.700	3.700	1.950	45.00	47.30	70.90
91	6.500	3.300	1.700	49.24	48.49	73.85
91	8.100	4.300	2.250	47.00	47.68	72.23
89	6.500	3.900	2.000	40.00	48.72	69.24
88	7.400	4.150	2.000	44.00	51.81	73.00
87	7.200	3.950	1.950	45.14	50.64	73.00
87	7.200	3.950	1.950	45.14	50.64	73.00
85	6.100	3.700	1.950	40.00	47.30	68.04
85	6.700	3.600	1.850	46.27	48.62	72.39
83	4.600	2.900	1.500	37.00	48.28	67.40
83	5.000	2.450	1.300	51.00	46.94	74.00
88	4.700	2.450	1.200	44.00	51.03	74.47

TABLE 1 (continued)

Length cm.	Weight in kgs.			% Losses of weight		
	round, fresh (1)	eviscerated (2)	salted, landed (3)	through heading and eviscerating	through salting	TOTAL
82	5.700	3.200	1.600	43.86	50.00	72.00
82	5.300	2.950	1.450	44.34	50.85	72.65
81	5.000	3.150	1.640	37.00	48.00	67.20
80	4.500	2.700	1.300	40.00	51.86	71.12
80	4.300	2.550	1.300	40.70	49.00	70.00
77	3.800	2.200	1.300	42.11	41.00	65.79
77	4.000	2.300	1.150	42.50	50.00	71.25
76	4.100	2.650	1.400	35.37	47.17	65.86
75	3.400	1.900	1.050	44.12	44.74	69.00
73	3.700	2.100	1.050	43.25	50.00	71.63
72	3.200	2.000	1.000	37.50	50.00	68.75
70	2.900	1.800	0.900	38.00	50.00	69.00
66	2.400	1.450	0.720	39.60	50.35	70.00
62	2.300	1.350	0.720	41.31	46.67	68.70
56	1.500	1.000	0.550	33.34	45.00	63.34
55	1.600	0.900	0.450	44.00	50.00	71.88
53	1.800	0.800	0.450	46.67	43.75	75.00
52	1.200	0.550	0.370	54.00	32.73	69.17
52	1.200	0.650	0.370	45.84	43.08	69.17
50	1.100	0.600	0.250	45.46	58.34	77.28
48	1.100	0.600	0.300	45.46	50.00	72.73
48	0.900	0.500	0.320	45.45	36.00	64.45
47	1.000	0.550	0.350	45.00	36.37	65.00
47	0.850	0.500	0.270	41.18	46.00	68.24
46	0.800	0.450	0.250	43.75	44.45	68.75

TABLE 1 (concluded)

Length cm.	Weight in kgs.			% Losses of weight		
	round, fresh (1)	eviscerated (2)	salted, landed (3)	through heading and eviscerating	through salting	TOTAL
46	0.800	0.500	0.300	37.50	40.00	62.45
46	0.900	0.500	0.300	44.45	40.00	66.67
46	0.900	0.500	0.300	44.45	40.00	66.67
44	0.800	0.400	0.250	50.00	37.50	68.75
44	0.800	0.500	0.270	37.50	46.00	66.25
44	0.800	0.400	0.270	50.00	32.45	66.25
43	0.700	0.400	0.270	43.00	32.45	61.43
43	0.600	0.400	0.220	33.34	45.00	63.34
43	0.700	0.450	0.250	35.70	44.45	64.29
43	0.600	0.400	0.250	33.34	37.50	58.34
42	0.650	0.450	0.220	30.77	51.12	66.16
42	0.600	0.390	0.220	35.00	43.59	63.34
42	0.550	0.400	0.170	28.00	57.50	69.09
41	0.600	0.350	0.220	41.67	37.15	63.34
41	0.680	0.400	0.220	41.18	45.00	67.65
41	0.500	0.300	0.200	40.00	33.34	60.00
40	0.500	0.300	0.170	40.00	43.34	66.00
40	0.500	0.350	0.170	30.00	51.43	66.00
37	0.450	0.300	0.160	33.34	46.67	64.45
37	0.450	0.290	0.170	35.56	41.38	62.23
	308.630	167.380	85.810	2,932.87	3,196.14	4,778.42

TABLE 2 - HADDOCK

Length cm.	Weight in kgs.			% Losses of weight		
	round, fresh (1)	eviscerated (2)	salted, landed (3)	through heading and eviscerating	through salting	TOTAL
61	2.200	1.350	0.750	38.64	44.45	65.90
61	2.100	1.300	0.600	38.10	53.85	71.43
59	2.100	1.300	0.700	38.10	46.16	66.67
59	1.850	1.150	0.560	38.00	51.31	69.74
59	1.850	1.050	0.600	43.30	47.62	67.57
57	1.750	1.050	0.540	40.00	48.57	69.15
57	1.450	0.950	0.450	34.49	52.64	68.97
56	1.550	0.950	0.540	38.71	43.16	65.17
55	1.450	0.950	0.450	34.49	52.64	68.97
55	1.500	0.950	0.500	36.67	47.37	66.67
55	1.600	1.000	0.470	37.50	53.00	70.63
55	1.400	0.850	0.410	39.29	51.77	70.72
55	1.450	0.950	0.500	34.49	47.37	65.52
54	1.350	0.850	0.430	37.04	49.42	68.15
53	1.400	0.850	0.400	39.29	52.92	71.43
52	1.200	0.750	0.360	37.50	52.00	70.00
52	1.250	0.750	0.380	40.00	50.00	70.00
52	1.150	0.750	0.370	34.79	50.67	67.83
52	1.100	0.650	0.370	40.90	43.08	66.37
51	1.100	0.750	0.370	31.82	50.67	66.37
50	1.150	0.750	0.360	40.00	52.00	68.70
50	1.200	0.750	0.370	37.50	50.67	70.00
50	1.050	0.700	0.380	33.34	45.70	63.81
49	1.050	0.600	0.390	42.86	43.34	67.62

TABLE 2 (concluded)

Length cm.	Weight in kgs.			% Losses of weight		
	round, fresh (1)	eviscerated (2)	salted, landed (3)	through heading and eviscerating	through salting	TOTAL
48	0.950	0.600	0.350	36.85	41.67	63.16
48	0.950	0.650	0.350	31.58	46.16	63.16
45	0.750	0.450	0.250	40.00	44.45	66.67
41	0.550	0.400	0.200	27.28	50.00	63.64
41	0.550	0.350	0.200	36.37	42.86	63.64
41	0.500	0.350	0.200	30.00	42.86	60.00
41	0.550	0.360	0.200	34.65	44.45	63.64
40	0.500	0.350	0.180	30.00	48.58	64.00
40	0.500	0.320	0.150	36.00	53.13	70.00
40	0.500	0.350	0.200	30.00	42.86	60.00
39	0.450	0.300	0.150	33.34	50.00	66.67
39	0.400	0.270	0.140	32.50	48.15	65.00
39	0.450	0.300	0.150	33.34	50.00	66.67
35	0.350	0.200	0.100	42.86	50.00	71.43
33	0.350	0.200	0.100	42.86	50.00	71.43
33	0.250	0.170	0.100	32.00	41.18	60.00
	43.800	27.570	14.220	1,456.45	1,926.73	2,676.50

TABLE 3 - POLLOCK

Length cm.	Weight in kgs.			% Losses of weight		
	round, fresh (1)	eviscerated (2)	salted, landed (3)	through heading and eviscerating	through salting	TOTAL
96	6.500	4.200	2.350	35.40	44.05	63.85
94	5.500	3.700	2.050	38.73	44.60	62.73
[illegible]	6.650	4.500	[illegible]	31.37	[illegible]	61.36
87	5.250	3.550	2.000	32.39	43.67	61.91
87	4.400	3.100	[illegible]	30.00	50.00	[illegible]
86	[illegible]	3.600	[illegible]	30.77	[illegible]	[illegible]
86	[illegible]	3.250	[illegible]	32.30	[illegible]	[illegible]
85	[illegible]	4.000	2.100	33.34	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	32.65	[illegible]	65.27
[illegible]	[illegible]	2.250	[illegible]	32.95	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	35.00	[illegible]	65.00
75	[illegible]	[illegible]	[illegible]	31.58	[illegible]	[illegible]
70	[illegible]	[illegible]	[illegible]	30.31	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	30.00	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.150	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1.800	[illegible]	30.77	[illegible]	[illegible]
65	[illegible]	1.900	[illegible]	27.00	[illegible]	[illegible]
[illegible]	[illegible]	1.400	[illegible]	35.60	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	30.00	[illegible]	[illegible]
[illegible]	[illegible]	1.300	[illegible]	30.77	[illegible]	[illegible]
[illegible]	[illegible]	1.450	[illegible]	28.27	[illegible]	70.00
[illegible]	2.450	1.700	[illegible]	30.66	[illegible]	[illegible]
[illegible]	[illegible]	1.750	[illegible]	31.38	[illegible]	[illegible]

TABLE 3 (concluded)

Length cm.	Weight in kgs.			% Losses of weight		
	round, fresh (1)	eviscerated (2)	salted, landed (3)	through heading and eviscerating	through salting	TOTAL
63	2.100	1.450	0.800	31.00	44.83	61.90
63	2.450	1.700	0.870	30.66	48.83	64.49
63	2.300	1.700	0.950	27.00	44.12	58.70
63	2.250	1.600	0.900	28.89	43.75	60.00
63	2.300	1.650	0.950	28.27	42.43	58.70
62	2.300	1.700	0.950	27.00	44.12	58.70
62	2.250	1.600	0.850	28.89	46.88	62.23
62	2.050	1.450	0.850	29.27	41.38	58.54
61	2.200	1.500	0.850	31.82	43.34	61.37
60	2.150	1.500	0.850	30.24	43.34	60.47
60	1.900	1.350	0.700	28.95	48.15	63.16
60	2.250	1.600	0.850	28.89	46.88	62.23
60	1.950	1.300	0.800	33.34	38.47	59.00
59	2.000	1.350	0.950	32.50	30.00	52.50
58	2.100	1.400	0.830	33.34	40.72	60.48
57	1.800	1.250	0.700	30.56	44.00	61.12
57	1.850	1.300	0.800	30.00	38.47	56.76
54	1.550	1.100	0.650	29.00	41.00	58.07
54	1.650	1.000	0.700	39.40	30.00	58.79
52	0.900	0.650	0.400	27.78	32.47	55.56
	131.600	90.350	49.910	1,336.86	1,890.31	2,641.51

TABLE 4 - WHITE HAKE

Length cm.	Weight in kgs.			% Losses of weight		
	round, fresh (1)	eviscerated (2)	salted, landed (3)	through heading and eviscerating	through salting	TOTAL
104	11.200	6.300	3.000	43.75	52.38	73.22
97	8.000	4.200	1.900	47.50	54.77	76.25
96	8.300	4.800	2.170	42.17	54.79	73.86
88	6.700	3.300	1.500	50.75	54.55	77.62
83	5.500	2.700	1.250	51.00	53.71	77.28
83	5.500	2.900	1.400	42.28	51.73	74.55
81	4.700	2.400	1.150	49.00	52.09	75.54
79	6.100	2.800	1.300	54.10	53.58	78.69
79	4.500	2.750	1.320	39.00	52.00	70.67
79	4.500	2.500	1.300	44.45	48.00	71.12
79	4.500	2.700	1.350	40.00	50.00	70.00
78	4.500	2.500	1.170	44.45	53.20	74.00
78	5.600	2.400	1.150	57.15	52.09	79.47
77	4.100	2.400	1.150	41.47	52.09	71.96
77	4.200	2.200	1.000	47.62	54.55	76.19
76	4.500	2.100	0.970	53.34	53.81	78.45
76	3.600	2.200	0.970	39.00	55.91	73.06
75	4.000	2.200	1.050	45.00	52.28	73.75
74	3.800	2.000	0.950	47.22	52.50	75.00
72	3.200	1.700	0.820	47.00	51.77	74.38

TABLE 4 (concluded)

Length cm.	Weight in kgs.			% Losses of weight		
	round, fresh (1)	eviscerated (2)	salted, landed (3)	through heading and eviscerating	through salting	TOTAL
72	3.200	2.000	0.950	37.50	52.50	70.32
71	3.100	2.000	0.950	35.49	52.50	70.00
71	3.200	1.950	0.950	40.00	51.29	70.32
70	3.600	1.900	0.950	47.17	50.00	73.62
70	3.000	1.700	0.720	43.34	57.65	76.00
70	3.000	1.800	0.850	40.00	52.78	71.67
69	3.300	1.700	0.850	48.49	50.00	74.25
69	3.100	1.950	0.850	37.10	56.42	72.58
68	3.400	1.600	0.850	53.00	44.88	75.00
66	2.700	1.500	0.800	44.45	46.67	70.38
65	3.000	1.500	0.670	50.00	55.34	77.67
64	3.300	1.400	0.850	57.58	40.00	74.25
64	2.600	1.400	0.700	46.16	50.00	73.08
60	2.300	1.100	0.550	52.31	50.00	71.74
59	2.100	1.100	0.550	47.52	50.00	73.81
53	1.200	0.750	0.370	37.50	50.67	69.17
52	1.500	0.800	0.400	46.67	50.00	73.34
52	1.200	0.750	0.400	37.50	46.67	66.67
	155.800	83.950	40.010	1,728.13	1,963.17	2,798.93

TABLE - 5

Summary Table showing Percentages of Losses and Yields as well as the Conversion Factors I and II for Species and Size groups.

Species	Length	A % loss through heading and eviscerating	B % ready for salting	C Conversion Factor I	D % loss in hold during salting	E % total loss	F % weight of fish landed	G Conversion Factor II	H No. of Specimens weighed
COD	Large 93-130 cm.	48.85	51.15	1.96	49.77	74.31	25.69	3.90	11
	Medium 70-92 cm.	43.36	56.64	1.77	48.80	71.00	29.00	3.48	25
	Small 37-66 cm.	42.00	58.00	1.73	44.30	68.60	31.40	3.20	33
HADDOCK	33-61 cm.	37.00	63.00	1.60	48.42	67.54	32.46	3.10	40
POLLOCK	52-96 cm.	31.35	68.65	1.46	44.76	62.00	38.00	2.64	43
WHITE HAKE	52-104 cm.	46.76	53.24	1.88	52.35	74.33	25.67	3.90	38