

ANNUAL MEETING - JUNE 1954CONVERSION FACTORSCompiled from reports received for the Annual Meeting 1954

France, Norway, Portugal, and Spain have reported on conversion factor experiments carried out on board fishing vessels operating in the Convention Area in 1953 (see Annual Meeting, 1954, docs. no. 17, 11, 3, 6, and 7).

The experiments deal with the cod; for one country, Spain, also with haddock, pollock, and white hake. This survey deals only with the cod. It is not a summary of the reports, but rather a compilation of those parts of the reports which especially call for a comparison, and at the same time give the material necessary for a comparison.

The Portuguese material - by far the largest - is reported on by samples (docs. 3 and 6), it comprises 47 samples or 1299 specimens. The Spanish material (doc. 7), comprising 69 specimens, is reported by individuals. The French (doc. 17) and the Norwegian (doc. 11), respectively 416 and 92 specimens, is reported on as samples. As the varying way in which the experiments were carried out involved differences in the way in which the conditions of the cod (size, maturity, etc.) are described, a compilation and comparison have not always been possible to the extent which would have been desirable.

The following conversion factors for cod from landed to fresh, round weight were found for subareas and by countries. 1) The figures in brackets give the weights in kg. as fresh round used for the experiments:

Subarea	1 (West Greenland)	2 (Labrador)	3 (Newfoundland)
France	2.46 (1000)		2.67 (>100) ¹⁾
Norway	3.12 (369)		
Portugal	2.62 (1700) 2)	3.01 (1434)	2.92 (1900)
Spain			3.53 (309)

The conversion factors found in these samples range from 2.46 to 3.53. The variation is large, so large that we for a landed weight of, say, 1000 tons, by using the lowest factor would get a fresh, round weight of 2,460 tons, by using the highest, 3,530 tons or 43% more. Even within one and the same subarea the range is considerable, for West-Greenland waters from 2.46 to 3.12, for the Newfoundland Banks from 2.67 to 3.53.

The variation of these conversion factors is so wide that it would hardly be advisable to decide on one single conversion factor to be used throughout the whole of the Convention Area and for all fishing fleets concerned.

- 1) The figure by France for Newfoundland is from 1952.
- 2) This figure is very close to the one (2.60) found for Subarea 1 by Denmark in 1952 (Ann. Meet. 1953 doc. 16).

In the statistics for 1952 published by ICNAF (Statistical Bulletin vol. 2) the following conversion factors were used for the countries here concerned. For comparison are given also the conversion factors found by the above mentioned experiments:

	Statistical Bulletin	Experiments
France	2.50	2.46 - 2.67 mean 2.57
Norway	2.41	3.12
Portugal	2.50	2.62 - 2.92, 3.01 mean 2.85
Spain	2.50	3.53

Regarding France there is hardly any difference between the factors now used and those found by the experiments. For Portugal, Norway, and especially for Spain there is, however, a considerable difference. The difference is so large that we f.i. for Spain by using the new conversion factor (3.53) would get a catch of fresh, round cod from the Convention Area for the year of 1952 of 96,000 tons against only 68,000 tons as stated in the Statistical Bulletin based on the old figure (2.50).

The question with which the Commission must be immediately concerned is: Shall we in the next Statistical Bulletin use the conversion factors found by these experiments or shall we continue to use those already adopted under the agreement that further experiments be carried out and considered before more final conversion factors are established.

To answer this question and to plan further experiments it should be worth while to make a comparison of the experiments from last year, especially to try to find out the reasons for the considerable variations of the conversion factors found.

Variations in conversion factors

The variations are due to two series of sources, a) variations in the weight of the discarded parts compared to the weight of what is left, and b) the loss in weight due to the dehydration of the split cod from salting and pressure in the hold. The first series of variations, a, can be caused partly by the conditions of the cod themselves (size, stage of maturity, etc.) and partly by variations in the mode of dressing. The second series, b, can be caused by the different length of the period between salting and landing, by the differing location of the fish in the piles in the hold, and by the quality and quantity of the salt used. This latter series of variations can, however, be affected by the condition of the split cod (varying size and firmness of the flesh).

In most of the experiments the cod have been weighed when ready for salting as well as when landed. Therefore it is possible to investigate how far the two series of sources influence the conversion factor.

In the following the conversion factor to be used from landed to fresh, round is indicated as "conv. l.", and that from ready for salting to fresh, round as "conv. s.". "Conv. l-s." means the figure by which landed weight shall be multiplied to get weight of cod ready for salting.

The experiments dealt with here yielded the following results:

		conv.s.	conv.l.	conv.l.-s.
France	Subarea 1	1.66	2.46	1.48
"	" 3	1.67	2.67	1.60
Norway	" 1	1.73 ¹⁾	3.12	1.47
Portugal	" 1	1.67	2.62	1.56
"	" 2	1.80	3.01	1.67
"	" 3	1.72	2.92	1.68
Spain	" 3	1.82	3.53	1.85
mean		1.72	2.90	1.61
		Var.1.66-1.82 =0.16 or 9% of mean	Var.2.46-3.53 =1.07 or 37% of mean	Var.1.47-1.85 =0.38 or 24% of mean

The variation in the values of conv.l. is thus four times as big as that found for the values of conv.s., and the variation of conv.l.-s. is nearly three times as large as that of conv.s. Thus the material at hand clearly shows that the variations in the values found are caused mainly during the keeping of the salted cod in the hold of the vessels, and to a far lesser degree by the varying amount of wastage during the dressing after capture. The attached figure 1 shows the range of the variations of the three kinds of conversion factors. In figure 2 are shown in graphic form the figures for conv.l. and conv.s. for the samples from the Portuguese experiments in Subareas 1, 2, and 3. The figure shows clearly the far less range of variation in conv.s. compared to that of conv.l. ²⁾ This difference in variations is also noted in the Portuguese report. The figure further illustrates the very big difference as to the conversion factor that can occur within the same fishing fleet, and the same population of cod, and for the same year and season. This big difference shows the danger involved in trying to determine the conversion factor on a small number of experiments.

Influence of individual size and stage of maturity.

The factors influencing the variations in conversion factor and caused by the conditions of the cod themselves would in the first place be size and stage of maturity.

In the Portuguese report (doc. 3) it is stated that the conversion factor does not vary with individual size of the cod. A plotting of the conversion factors found in the various Portuguese samples (see figure 3) verifies that no pronounced variation occurs.

1) The weight given in the Norwegian experiment is not that as ready for salting but that of "gutted and headless". To get the figure for ready for salting is added 5% of the total weight, i.e. the weight of the first 1/3 of backbone as it is indicated in the Portuguese report (doc. no. 3)

2) The figures for conv.s. found by Canadian experiments correspond closely with the above mentioned found for the European fishing fleets: St. Lawrence Bay (Subarea 4) 1.67 (H. Fougere)
Newfoundland (Subarea 3) 1.63 (MacPherson)

However, the material from Newfoundland shows a somewhat lower factor for samples of cod with a mean size of 3-1/2 - 5 kg./1 ind. than for samples with mean weights below 3-1/2 kg./1 ind., and again a slight increase for the very big fishes, 10-12 kg./1 ind. The experiments from Labrador and West-Greenland do not show any difference. The following table shows the conversion factor found in the Portuguese samples grouped according to individual weight; no. of samples in brackets:

kg./1 ind.	below 3	3-7	above 7
West-Greenland	3.46 (2)	2.63 (12)	2.72 (3)
Labrador	3.06 (5)	2.97 (6)	
Newfoundland	2.98 (3)	2.89 (12)	2.94 (4)

In the Spanish report (doc.7) dealing with cod from Newfoundland the weighings are given individually. The report gives the following conversion factors for the three cullings:

Small -	3.20
Medium -	3.48
Large -	3.90

These figures show, contrary to the Portuguese ones, a clear, gradual increase of the conversion factor with individual size. When the Spanish material is arranged according to length (see fig. 3 d.) two distinct size-groups appear, one with a peak around 45 cm., another with its peak around 80-90 cm., and besides a very few large ones, 120-130 cm. Calculated for these three size-groups the conversion factors are:

ca. 45 cm. -	3.20 (32 ind.)
" 80-90 cm. -	3.62 (34 ind.)
" 120-130 cm. -	3.97 (3 ind.)

The Norwegian experiment comprises six samples with only a smaller variation in mean weight:

no. of cod	kg./ind. (fresh, round)	Conversion factor.
15	3.470	3.10
16	3.490	3.09
13	3.520	3.11
14	3.780	3.08
17	4.590	3.16
17	4.650	3.12

There is here only a very small rise of the conversion factor from the smaller to the larger cod.

The way in which the French experiments are reported do not make a comparison by size possible.

What explanation can be found for the differing results of the Spanish and Portuguese experiments? The nature of the material of cod used in the two sets of experiments differs considerably. The Portuguese material was fished in summer and autumn, when the cod were recovering or had recovered from spawning; the Spanish, however, in March, just before or during the spawning season. As the Spanish report says "in the specimens of the larger size the sexual glands were in a state far advanced near to the spawning. On the contrary the younger individuals of the smaller sizes had sexual glands that were not yet fully developed". Thus, contrary to the Portuguese material,

the cod used in the Spanish experiments, and especially the larger ones, had fully ripe sexual glands.

The following survey gives the conversion factors for these two experiments calculated for the same area and size groups:

	Grand Bank	Portugal, summer	Spain, spring
kg./ind. (below 3		2.98	3.05
3-7		2.89	3.36
(above 7		2.95	3.76

For the smallest size group there is hardly any difference, only 0.07, in conversion factor, whereas for the two larger groups, 3-7 and over 7 kg., the difference is considerable, 0.47 and 0.81.

Thus the disagreement of the two sets of experiments vanishes with a closer study. The high conversion factor in the Spanish experiment is due to the fact that the cod were about to spawn, the low one in the Portuguese being due to the recovering or recovered stage of the cod.

A confirmation of the influence of season (stage of maturity) on conversion factor is found by a comparison of two Spanish experiments from Subarea 3 in 1952. An experiment from 10 May (spawning season) with big cod (9 kg./ind.) gave a conversion factor of 3.17, whereas an experiment from 14 August (recovered cod, 5 kg./ind.) gave a figure of only 2.50. The period in the hold was the same, 3 months, in both cases.

Possible influence of length of time in the hold.

Another considerable disagreement in results is found in Subarea 1 (West-Greenland). Here there is a fairly good agreement between the French and the Portuguese experiments, 2.46 and 2.62 respectively. However, the Norwegian experiment, also from 1953, gives a much higher conversion factor, viz. 3.12.

The details of these three sets of experiments are as follows:

France, Fylla Bank		
29 July, fresh round	1,000 kg. - 416 spec.,	2,400 kg./ind.
" " , ready for salting	603 kg. - conv.s.	1.66
2 Oct., landed	407 kg. - conv.l.	2.46
Norway, Holsteinsborg Deep		
30 July, fresh round	369 kg. - 92 spec.,	4,010 kg./ind.
" " , gutted headless	238 kg. 1) conv.	1.59
" " , ready for salting	213 kg. 1) conv.s.	1.73
14 Aug., 15 days salting	128 kg. - conv.	2.89
14 Sept. landed	118 kg. 2) conv.l.	3.12
Portugal, West-Greenland, summer		
a) 200 kg. fresh round	- 87 spec., 2,300 kg./ind.	conv.s. 1.55
		conv.l. 2.46
b) 1,200 kg. fresh round	- 305 spec., 3,900 kg./ind.	conv.s. 1.69
		conv.l. 2.63
c) 300 kg. fresh round	- 38 spec., 7,900 kg./ind.	conv.s. 1.65
		conv.l. 2.72

- 1) The correction for backbone removed, 5% of fresh round weight is taken from the Portuguese report.
 2) Stipulated (from experience) cf. Norwegian report (doc. no. 11).

Mean a, b, and c.	conv.s.	1.66	1)
" " " " "	conv.l.	2.62	1)

It is seen that the conv.s. varies only little from country to country. France - 1.66, Norway, 1.73, and Portugal, 1.66. Here it should be noted that an experiment on cod wastage carried out by Dr. Figueiredo in West-Greenland (doc. 4) gave a conv.s. of 1.73, i.e. the same as that found in the Norwegian experiment, and further that Danish experiments with Greenland cod (Ann. Meet. 1953 doc. 16) yielded a conv.s. of 1.62, very close to the figures found in the 1953 experiments.

Thus the conversion factor for "ready for salting" is very much the same for all experiments in Greenland waters, the Norwegian included. The high Norwegian conversion factor for landed cod therefore cannot be caused by a greater wastage, either caused by the conditions of the cod themselves or by different dressing; it must be due to a greater loss during salting and keeping in the hold, meaning probably to one or more of the following factors: a) length of period in the hold, b) pressure in the pile, and c) condition and quantity of the salt.

The reports offer no possibility of testing b and c. The length of the period in the hold (a) was as follows:

Norway,	30/7 - 14/9,	46 days (1 sample) - Conv.F.	3.12
Portugal,	58 days (var. 13-94 days, 17 samples) - Conv.F.	2.62	
France,	29/7 - 2/10,	65 days (1 sample) - Conv.F.	2.46

The cod kept the shortest time in the hold thus has the highest conversion factor. One should have expected the opposite to be the case.

Neither does a comparison of the separate samples of the Portuguese experiments give a definite answer to the question of a possible influence from the length of time in the hold:

	Days kept in hold,	No. of samples in (),	- Conv.F.
Greenland	23-43 (8) - 2.56,	59-72 (15) - 2.62,	88-96(4) 2.75
Labrador	19-35 (4) - 3.13,	54-86 (7) - 3.08	
Newfoundland	12-30 (12) - 2.99,	36-53 (7) - 2.78	

For W.-Greenland there is a slight increase of conversion factor with number of days in hold, for the two other areas on the contrary a small decrease. But, as it is also stated in the Portuguese report, definite conclusions cannot be drawn as the position of the samples in the pile (the pressure) was not considered.

A comparison of the following Spanish experiments from Subarea 3, 1952 (Ann. Meet. 1953, doc. 16) may throw some light on the question of influence of the length of time in the hold.

- a. 20 cod, 5 kg. per ind.
caught 14 Aug., landed 11 Nov. - 89 days - conv.l. 2.50
- b. 15 cod, 9 kg. per ind.
caught 10 May, landed 14 Aug., - 96 days - conv.l. 3.17

1) Calculated from the basic material.

- c. 44 cod, 2.270 kg. per ind.
caught 30 May, landed 8 Nov. - 162 days - conv. 1. 3.08
- d. 46 cod, 2.170 kg. per ind.
caught 7 April, landed 6 Nov. - 213 days - conv. 1. 3.12

The low conversion factor of 50 for the sample from 14 August may well be due to the fact that these cod were in the recovered stage. The other three samples from spring (spawning season) show hardly any difference in the size of their conversion factors. Thus a prolongation of the period in the hold from about 90 to about 160-210 days should not cause any changes in conversion factors. In this connection it could be noted that the Spanish Research Report for 1953 (doc. 8) states: "The curing of the fish during salting in the hold was controlled, and it was observed that in 10 days the salted cod specimens under control had dehydrated to the constant weight." This indicates that a prolonged stay in the hold should affect only little the size of the final conversion factor.

Thus far the experiments at hand do not offer any decisive evidence as to the influence of the length of the period in the hold on the conversion factor.

Further it has not been possible to find any explanation why, i.e. the Norwegian salted cod in only 46 days suffer a far bigger loss than, i.e. the French cod from the same area and the same season in no less than 65 days.

This difference in loss is considerable and of importance also from a purely economic point of view. It indicates that the Norwegian vessels from an original catch of, say, 1,000 tons fresh, round, land only 320 tons, the French vessels, however, no less than 407 tons, i.e. 27% more, which may easily come to the difference between a paying and a non-paying trip.

Considering this it should be of interest, if not for the Commission's statistical needs, then for the fishing industries, to have the conversion factor experiments continued beyond the landing and right until the time when the dried cod are stored for sale. This would tell us if a greater loss during the salting and keeping in the hold would be remedied through a smaller loss during drying.

quantity of salt used.

The quantity of salt used was considered in the Portuguese Report (docs. 3 and 6). The following is a comparison of amounts of salt used in the various samples (no. of samples in brackets) and the resulting conversion factors:

	W. Greenland			Labrador		Newfoundland	
kg. salt	18-20(9)	21-29(6)	30-40(2)	8-12(6)	13-20(5)	11,5-18(9)	19-26(10)
Conv.F.	2.75	2.49	2.44	2.89	2.94	3.03	3.00

For W.-Greenland the lowest factor is found for those samples where most salt was used. This is contrary to what should be expected. The result is not confirmed by those from the two other areas, where hardly any variation is found between heavily and lightly salted samples. Therefore not much attention can be paid to the results. At most they show either that salt is

always used in excess, which from an economic point of view may be worth mentioning, or that salt from the other parts of the pile counteract a lack of salt in the sample in question.

The amount of salt used was not considered in any of the other reports.

The main results of the comparison of the reports on conversion factors for cod landed by European vessels fishing in the Convention Area are:

1. The conversion factors found vary considerably, from 2.46 to 3.53. The following scheme gives the conversion factors found in the experiments from 1952 and 1953, added are a few, partly older, observations from Canada. The underlined figures give the conversion factor from landed to fresh, round, the not underlined gives the corresponding ones from "ready for salting" (split cod) to fresh, round.

	Subarea				Mean	Used in 1952 Stat.
	1	2	3	4		
France rec. ¹	<u>2.46</u> -1.66		<u>2.67</u> -1.67		<u>2.57</u> -1.67	<u>2.50</u>
Norway rec.	<u>3.12</u> -1.73				<u>3.12</u> -1.73	<u>2.41</u>
Portugal						
Spain rec.	<u>2.62</u> -1.67	<u>3.01</u> -1.80	<u>2.92</u> -1.72		<u>2.85</u> -1.73	<u>2.50</u>
Spain sp.			<u>3.08</u> <u>3.12</u> <u>3.17</u> 1.61 <u>3.53</u> -1.82 <u>2.50</u>		<u>3.08</u> -1.71	<u>2.50</u>
Denmark rec.						
Denmark rec.	<u>2.60</u> -1.62				<u>2.60</u> -1.62	<u>2.50</u> ²⁾
Canada (?)			<u>2.43</u> -1.63 <u>2.68</u>	<u>2.38</u> -1.67	<u>2.50</u> -1.65	<u>2.68</u>
Mean	<u>2.70</u> -1.67	<u>3.01</u> -1.80	<u>2.80</u> -1.69	<u>2.38</u> -1.67	<u>2.82</u> -1.69	<u>2.52</u>

The variations are considerable even within one and the same country and one and the same subarea.

2. The conversion factor found from "ready for salting" (split cod) to fresh, round varies by far less than that from the landed stage:

ready for salting, 1.61-1.82, mean 1.69, var. 0.21 or 12% of m.
landed 2.38-3.53, mean 2.82, var. 1.15 or 41% of m.

This indicates that it will be much easier to arrive to a reliable factor for "ready for salting" than for landed, and that such a factor when used will give more accurate catch statistics. It is therefore worth to consider to use records on weights of "ready for salting" wherever they should be available and to aim at procuring such records, when possible.

- 1) As far as possible the conversion factors are given separately for cod caught during or near to the spawning season -sp.- and for cod caught later in the year -rec.-, as recovering or recovered.
- 2) Faroese landings.

3. Size (individual length or weight) does not seem to influence the conversion factor in any appreciable degree.
4. The stage of maturity (spawning or recovered cod) influences the factor considerably.
5. The French and Portuguese experiments show a somewhat higher conversion factor for Subarea 3 than for Subarea 1.
6. The small variation of the conversion factor "ready for salting" shows, a) that the way of dressing of the cod is about the same in the various fishing fleets, and b) that the percentage of wasted parts is nearly the same for the various cod populations.

For some countries we still lack experiments on conversion factors for the Convention Area. For others there are only a single or very few experiments at hand. For the two countries (Portugal and Spain) who have reported the most extensive researches the separate figures vary very much, and the reasons for these variations can as yet only be partly explained.

For these reasons it is evident that the experiments should be continued.

With the great variations found even in experiments within the same fishing fleet and the same subarea and year (cfr. the Portuguese reports, docs. 3 and 6) it is obviously a lengthy procedure to arrive at a reliable average.

Therefore it would be advisable to investigate more closely why the conversion factors found vary. This means that the conditions (size, maturity) of the cod used should be examined and stated, as well as the conditions working on the cod during curing (length of period in hold, pressure, position in pile, salt). Experiments should be carried out not in bulk only, but also individually.

In reporting on experiments the details should be recorded in order that the results can be compiled and duly compared for mutual control.

The question that arises in this connection is, what conversion factors to use in the meantime. From the table above it is seen that the figures now in use fall somewhat below those found by the new experiments. Obviously an adjustment, at any rate for the European fishing fleet, of the figure from the ca. 2.50 now used to around 2.80 would give a more true picture of the catches in our area. However, changes of conversion factors render the comparison of statistics from one year to another difficult, therefore it could be considered to keep the factors now in use, pending more final adjustments through further experiments.

Erik M. Poulsen,
Executive Secretary.

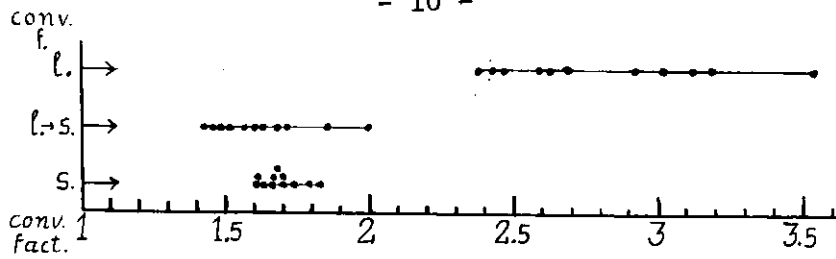


Fig. 1. Range of variations of conversion factors in experiments by Canada, Denmark, France, Portugal, and Spain.
s. Conv.f. ready for salting to fresh, round
l.-s. Conv.f. landed to ready for salting
l. Conv.f. landed to fresh, round.

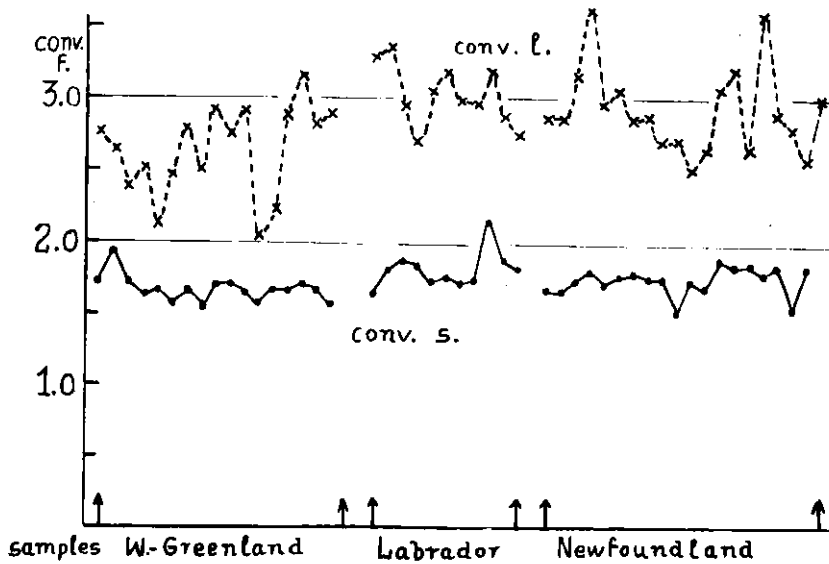


Fig. 2. Variation of conversion factors for cod from "ready for salting to fresh, round (conv.s.), and from landed to fresh, round (conv.l.). For conv.s. each . indicates a sample, for conv.l. each x indicates a sample. Portuguese experiments 1953 in Subarea 1 (W. Greenland), Subarea 2 (Labrador) and Subarea 3 (Newfoundland).

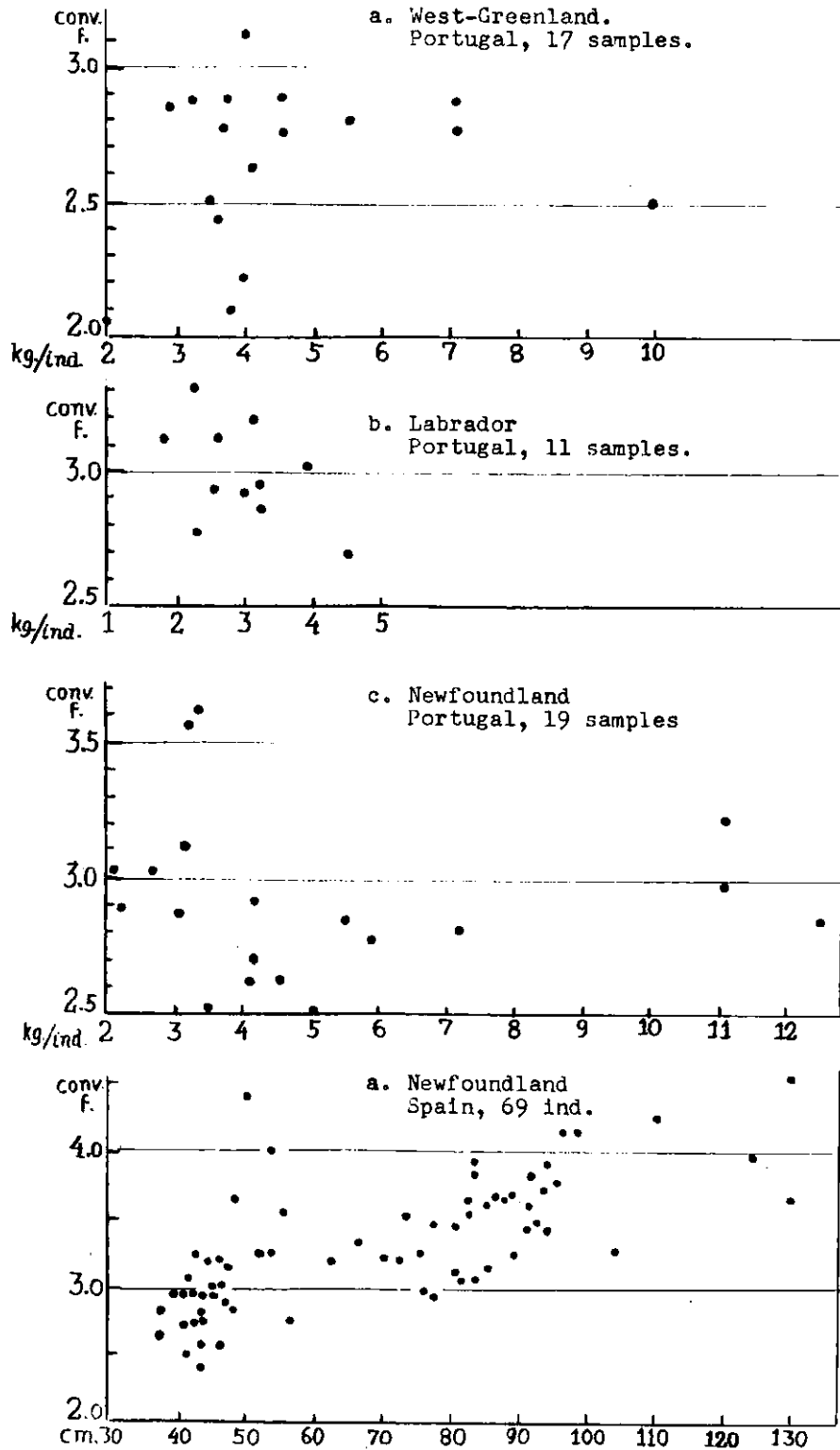


Fig.3. Conversion factors. Portuguese experiments - each dot a sample, Spanish experiments - each dot an individual.

