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Analysis of Cod Fillet Production Conversion Factor Data from EEC Vessels Fishing in the Northwest Atlantic, 1982-83

by

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ABSTRACT

Conversion factors are commonly used by factory personnel of the EEC fleets to estimate round weight of catches from fillet and other products in the hold. Factors derived experimentally during previous studies (Kulka 1981 and 1983a), and in the present study were substantially different from those given in the official FAO list of factors (Anon 1980). In most cases the derived factors were also higher than the ones used on individual vessels for product conversion.

Fillet subprocesses, the most complex of production procedures are the focus of this study. Using experimental procedures outlined in Kulka (1983b) data were collected by fisheries observers and technicians during regular production operations of the French and FRG fleets. An analysis of variance of conversion factor data from the winter Labrador Shelf and Gulf of St. Lawrence fisheries revealed no significant differences at the 0.05 level between months fished. Also, the two filleter machines, Badder 190 and Badder 99, used by FRG for northern cod did not produce significantly different yields. Machine classifications were not available for the French fleet in the Gulf of St. Lawrence.

A further analysis revealed significant differences between processes but not between country/area cells. Product to whole weight conversion factors, by species and product type, comprising amalgamated country, area, month, and machine type categories are as follows: Cod, head off straight cut (pre-filleting stage), 1.588±0.097 n=5; cod, gutted head off straight cut (pre-filleting stage) 1.968±0.014 n=74; cod, fillet (untouched by hand, intermediate product form), 2.913±0.035 n=65; cod, fillets skinless (untouched by hand, intermediate product), 3.035±0.033 n=23; cod, fillet skin on (blood spots, fin bits removed), 3.077±0.484 n=3; cod, fillet skinless (blood spots fin bits removed), 3.179±0.065 n=105; cod, fillet skinless trimmed, 3.533±0.136 n=34; cod, fillet skinless boneless, 3.684±0.136 n=34; cod, fillet skinless boneless, 3.684±0.217 n=16; cod, fillet skinless boneless trimmed, 4.208±0.252 n=5; cod, v-fillet skinless, 3.670±0.397 n=5.

Three major products produced during the 1982-83 winter FRG fishery were identified: Skinless fillet (blood spots, fin bits removed), skinless trimmed fillet and skinless boneless fillet, listed in order of importance. The first and third processes dominated on vessels of the French fleet. All other processes constituted less than 5% of the production. Trimmed product, with extensive removal of peripheral flesh, had a mean value significantly different from that of untrimmed product and is thought to be a distinct product form. The ranges of the two product forms however, overlapped almost completely. This range similarity was due to considerable variation in amount of peripheral flesh removed, depending on condition of the fish and size of catch.

Résumé

Le personnel des usines de traitement des flottilles de la CEE utilise communément des facteurs de conversion pour estimer le poids rond des prises à partir du produit transformé, filets ou autres, dans les cales. Les facteurs obtenus expérimentalement dans des études antérieures (Kulka 1981 et 1983a) ainsi que dans la présente étude ont différé substantiellement de ceux mentionnés dans la liste officielle de la FAO (Anon. 1981). Dans la plupart des cas, les facteurs ainsi obtenus étaient également plus élevés que ceux utilisés à bord de bateaux individuels.

La présente étude a été concentrée sur la production de filets, le procédé le plus complexe. Utilisant les méthodes expérimentales décrites dans Kulka 1983b), des observateurs et techniciens ont recueilli des données au cours d'opérations régulières des flottilles de pêche française et allemande (RFA). Une analyse de variance des données sur les facteurs de conversion recueillies dans la pêche d'hiver sur le plateau du Labrador et dans le golfe du Saint-Laurent n'a pas révélé de différences significatives au niveau de 0,05 entre les mois de pêche. De plus, les deux machines à fileter, B190 et B99, utilisées par la RFA dans le traitement de la morue du nord n'a pas donné de rendements significativement différents. Nous n'avons pu obtenir de données sur les machines à fileter de la flottille française dans le golfe du Saint-Laurent.

Une autre analyse a révélé des différences significatives entre procédés, mais non entre les cellules pays/région. Les facteurs de conversion de produits à poids rond, comprenant un amalgame de pays, lieux de pêche, mois et types de machines, sont les suivants : morue sans la tête, tranchée droit (stade de préfilettage), 1,588 ± 0,097 n=5; morue éviscérée et étêtée, tranchée droit (stade de préfilettage), 1,968 ± 0,014 n=74; morue, filets (non traités à la main, produit intermédiaire), 2,913 ± 0,035 n=65; morue, filets sans la peau (non traités à la main, produit intermédiaire), 3,035 ± 0,033 n=23; morue, filets avec la peau (taches de sang et petits morceaux de nageoires enlevés), 3,077 ± 0,484 n=3; morue, filets sans la peau (taches de sang et petits morceaux de nageoires enlevés), 3,179 ± 0,065 n=105; morue, filets sans la peau, parés, 3,533 ± 0,136 n=34; morue, filets sans la peau, désossés, 3,684 ± 0,136 n=34; morue, filets sans la peau, désossés, 3,684 ± 0,217 n=16; morue, filets sans la peau, désossés, parés, 4,208 ± 0,252 n=5; morue, filets en v sans la peau, 3,670 ± 0,397 n=5.

On a identifié trois principaux produits préparés par la RFA durant la campagne d'hiver 1982-83 : filets sans la peau (taches de sang et petits morceaux de nageoires enlevés), filets parés sans la peau et filets désossés sans la peau, dans cet ordre d'importance. Le premier et le troisième types de traitements ont prédominé à bord des bateaux de la flottille française. Tous les autres procédés représentaient moins de 5 % de la production. Le produit paré, dont on avait enlevé une quantité de chair périphérique, avait une valeur moyenne nettement différente de celle du produit non paré, ce qui nous porte à croire qu'il s'agit d'une forme de produit distinct. Les gammes des deux formes, cependant, chevauchaient presque totalement. Ceci était dû à une forte variation de la quantité de chair périphérique enlevée, selon la condition du poisson et le volume des prises.

INTRODUCTION

The dominant and most valuable cod product form produced by the fleets of EEC countries is fillets. This product is derived from catches of a 43,085 t quota, (6,500 t in 2GH, 8,200 t in 2J+3KL, 210 t in 3NO, 710 t in 4Vn, 5,170 t in 3Ps and 20,600 t in 4RS 3Pn). Next to Canada, it is the largest national allotment, and is therefore an important component of overall removals. It is fished mainly by FRG vessels on the Northern Labrador shelf and by France in the Gulf of St. Lawrence. Both of these countries produce fillets almost exclusively and use converted product weights as estimates of catch for the fishing log, weekly catch and effort reports submitted to Canada and possibly for catch records reported to NAFO. Therefore, accuracy of conversion factors has a bearing on the accuracy of reported catch data.

Previous limited studies on fillet product forms (Kulka 1981 and 1983a) indicated that the factors used by FRG and France to convert to catch weights, and those listed in the FAO tables (Anon 1980) underestimated catch from products produced by these countries. Origin of the used factors are not substantiated in the literature and often the post-machine subprocess are not differentiated. Given this, a series of experiments was performed for the various fillet subcategories to determine yield under actual working conditions including the effect of post-machine treatments. The majority of detailed data were obtained from the four company fleets of the FRG fishing off Labrador with the rest from six French vessels fishing in the Gulf of St. Lawrence. Effects of subprocess, country, area, machine type and time of year (restricted to the five months of the offshore winter fishery) on yield were examined.

METHODS

Conversion factor data for the 1982-83 EEC fisheries were collected by individually deployed observers for the single stage experiments or observer/technician teams for the more detailed, multistage experiments. As in 1981 (Kulka 1983a), the sampling strategy was to opportunistically collect information for the dominant processes. Observer deployment patterns were guided by critera other than attainment of conversion factor data making a predesigned strategy of sample collection impractical. Information collected for each experiment included process method, whole weight and product weight of sample, number of fish used, mean length of sample, machine type, country, area and other detailed production information as outlined in Kulka (1983b). For serial experiments, intermediate product weights were taken at each stage of processing i.e., after heading, gutting, filleting, trimming, and boning. This enabled examination of subprocessing as it affected yield. Product classification was consistent with the detailed fillet form descriptions given in (Kulka 1983b).

The general techniques of sample selection and recording formats outlined in Kulka (1983b) were used for the present study. Specifically, samples as close to 250 kg as possible were selected from fish culled by the crew to conform to size range of the machinery being used. Samples were weighed using two scales where possible, a 100 kg hanging balance and the ship's scales. The processing room crew were instructed to pass each sample through the heading, skinning and filleting machines and then trim the product in a manner representative of the normal production pattern. Any diversions from this normal pattern were noted.

For practical purposes it is desirable to consolidate categories of factors where possible and a series of experiments were conducted to determine sources of variance. Raw samples were grouped according to process method, stock area, country, machine type, and month. Analysis of variance using the Proc GLM procedure in Statistical Analysis System (SAS users Guide: Statistics 1982) was used to examine differences between classes. Prior to analysis, cells of data were checked for homogeneity using Bartletts procedure (Ostle and Mensing 1975) and frequencies of means were checked for normality using the method of Shapiro and Wilk (Shapiro and Wilk, 1965) in order to verify assumptions underlying analysis of variance. An overall factorial design examining all classes was not possible because of the many missing cells.

To test the effect of time, conversion factor means of skinless and skinless trimmed fillets were compared in a two way analysis of variance for the four months, January-April in which both processes were observed. A factorial design for all processes and months was not possible due to many missing cells. Instead, the amount of overlap of the 95% confidence intervals of the above four months with the remaining two months fished, November and December was examined. Data for this comparison were available only for untrimmed fillets hence November and December were not included in the analysis of variance.

Machine type was not recorded with the 4RS3Pn French data and therefore effect of machine type was examined only for FRG in 2HJ. The machines used for heading were Baader 160 and Baader 423 and for filleting, Baader 190 and Baader 99. Data were sorted by process method and conversion factor estimates for each of the machines used were compared, again using Proc GLM in SAS. As well, effect of average fish length on magnitude of conversion factor was examined using Proc Reg in SAS to determine if slope of conversion factor versus mean length was significantly different from zero. This analysis was done for experiments where fillets were taken directly from the machine, before skinning, trimming or removals of blood spots.

At the next stage, a two-way analysis of variance was performed. The two classes tested were NAFO area/country combinations and fillet subprocess (country/ area comparisons for gutting and heading processes were handled in a separate analysis).

Once the data were consolidated into species/process categories where appropriate, conversion factors for each category were estimated by three methods: mean of sample ratios (whole to product weight), ratio estimate (Cochran 1977), and regression of product on whole weight of samples. For the latter method, the slope for each category yields an estimate of conversion factor if the intercept is zero. This method was not practical for all groups analysed on this study because of very narrow ranges of sample weights. However, in the fillet, untouched product category (before skinning, blood spot removal or trimming) the range was wide enough and a regression was performed. Intercepts were tested and were found not to be significantly different from zero. Given this, the means of ratios and regression estimates of conversion factor means should yield very similar results. The former was chosen for this analysis because sample weight range was narrow in a majority of cases.

Estimates of means of sample ratios were calculated by:

$$\bar{x} = \frac{\sum_{1}^{n} \frac{WW_i}{PW_i}}{n} \quad \text{(mean of sample ratios)}$$

Where $\bar{x}$ = estimated conversion factor for the category

WW_i = whole weight of the ith sample

PW_i = product weight of the ith sample

n = number of samples

The associated variance was estimated by:

$$s^2 = \frac{\sum (x_i - \bar{x})^2}{(n-1)}$$

$$\text{where } x_i = \frac{WW_i}{PW_i}$$

A third method, the ratio estimate (Cochran 1977) was calculated by:

$$\bar{y} = \frac{\sum WW}{\sum PW}$$

Estimates of conversion factors from the latter two methods were compared for all process categories.

RESULTS

For fillet samples taken directly off the machine, a regression of mean length on conversion factor was performed. The slope was found not to be significantly different from zero. Also, no systematic patterns in the residuals were noted. Therefore, fish length over the commerical size range of 44-78 cm does not have a significant effect on size of the conversion factor.

Table 1 presents the ANOVA results for FRG and French cod fillet or pre-fillet stage conversion factors. Comparisons of conversion factor monthly means for Janaury to April in a two way analysis of variance with trimmed and untrimmed process method indicated a significant difference between the two process methods but not between months at the 0.05 level. For the other two months of fishing, November and December where only trimmed product was observed, overlap of 95% confidence intervals for each of November and December was nearly complete with the January to April confidence interval. This suggested that for practical purposes there was no difference in magnitude of conversion factors between months over the whole fishing period, November to April. Data for FRG in 2H was excluded from the analysis of variance because of abnormally low trimmed process values obtained for this area. Trimming by the crew during 80% of experiments performed in 2H was much lighter than was done for experiments in other areas and during normal production.

An analysis of variance to examine machine type differences for FRG was done for the heading process (pre-filleting stage) and the filleting process before and after skinning (Table 1). In order to eliminate the confounding effects of post machine treatments such as trimming and boning, experiments used for machine-type comparisons involved weighing of products directly off the filleting machine, or right after skinning, before any form of hand processing was done. No significant differences were detected at the 0.05 level between the Baader 160 and 423, the two machines used by FRG vessels to head the fish. Also, no significant difference was detected between the Baader 190 and 99 filleting machines, before or after skinning on a Baader 51. These were the only machines normally used by the FRG fleet for heading, filleting and skinning cod. Given the results of the above analyses, machine type and months were not differentiated in presentation of conversion factors.

From a two way analysis of variance (one class a concatenated country/area category and the other, fillet subprocess), a highly significant difference was detected between fillet subprocesses at the 0.05 level but not between country/area cells (FRG/2H, FRG/2J, FRA/3L, FRA/4R, FRA/4Vn, FRA/3Pn). Using the results of the above analyses, samples from the various countries and areas were consolidated. A list of conversion factors by process method is given in Table 2. The reduction produced twelve fillet and pre-fillet categories. The first five listed are not final products and the following three are common fillet product forms identified for each of the countries; skinless, skinless trimmed and skinless boneless. These and other fillet forms are illustrated in Figure 1 (this data summary is a modified version of the quality control sheet used by Nordsee, one of the FRG companies participating in the Labrador cod fisheries).

Two different estimates of conversion factors, mean of sample ratios and the ratio estimate (Cochran 1977) were compared for the twelve categories listed in Table 2. One method did not tend to produce estimates higher than the other. Also, in all but two cases the estimates were no more than 1.5% apart, 7 being less than 1% different. The two estimates were therefore considered equivalent and only one, the mean of sample ratios is presented in Table 2. Conversion factors derived in the study are applicable to all EEC cod fisheries because countries, areas, months, and machinery observed corresponded with the actual fishing activity.

Two indicators of variance of the categorized sample means, the coefficient of variation ($s/\sqrt{\bar{x}}$) and the 95% confidence interval ($\pm s/\sqrt{n} \times t$), accompany the estimates. Relative size of variance is also indicated in the last column of Table 2 by the distance of the 95% confidence limit away from the mean.

Separate and combined estimates of trimmed and untrimmed products are presented in Table 2, as it is unclear whether peripheral trimming is a distinct subprocess. Figure 2 illustrates the considerable overlap in range of the 2 products except for the tail skewed to the right for trimmed fillets.

CONCLUSIONS

Three major products forms, skinless fillets, skinless boneless fillets and skinless trimmed fillets were produced for market by the FRG and French vessels examined in this study. The predominant product produced during the observed period was skinless fillets although conditions such as market requirements, size of fish, and quality of fillets during processing appeared to affect product mix. For example, Nordsee a major FRG company, employed numerical product codes stamped on the packing boxes to differentiate product. The company can direct production of the entire fleet so as to maintain an overall marketing strategy which can be changed even while the fleet is at sea.

Also, product mix varies with the size of fish in the catch. For cod up to 75 cm with no major imperfections on the fillets, skinless product is produced. Skin on fillets were produced from large fish, over 70 cm with few imperfections. Boning was done for small fish only and these were also trimmed if ragged edges and bruising were extensive. Because bruising of the flesh is more extensive for fish held for longer periods and when storage areas are fuller, the necessity for more extensive blood spot removal was greater for large catches and this led to reduced yield. Amount of peripheral trimming done was highly variable depending partly on the effect of machinery on the fillet and it varied from set to set. Soft fish generally resulted in ragged edged fillets requiring greater trimming. The trimmed product also appeared to be produced specificially as a special low yield, high value product, in response to market requirements. Overall, product mix for a given period is unpredictable because it is dependent on the prevailing, volatile conditions.

Regardless of product mix, a single conversion factor of 2.95 was used by ten of the thirteen FRG vessels observed and 2.81 was used by the six French vessels. These factors would result in underestimates of round weight respectively for France and FRG as follows: skinless fillet 12% and 7%, skinless trimmed fillet 21% and 17% and skinless boneless fillet 24% and 20%. In an extreme case, one FRG vessel using 2.6 as an all purpose factor would have underestimated round weight from skinless boneless product by 30%.

Similar discrepancies were noted for values given in the FAO list (Anon 1980) for several countries. Also, classification of subprocesses on the list were unclear. The product forms listed, fillets and blocks frozen, fillets skin on frozen and fillets skinless frozen are ambiguous and each category contains a wide range of overlapping values for the countries listed. The French factor, 2.81 listed under the frozen fillet category, matched the one used by that country while the listed and used FRG value, 2.95 was found under a different category, frozen skinless fillets, in the FAO list. A second FRG factor of 2.64 could be found under the skin on product category where the French factor, 2.81 was listed. Cod fillet factors derived from experiments as listed in Kulka (1983a) were matched more closely to those derived in the present study than those in previously published lists.

Each stage in the subprocessing of fillets on EEC vessels contributed significantly to reduction in yield, whereas flag of the vessel, the area, the machine types that were examined and time of year had no significant effect. Conceivably, if cod were caught and processed in the spring when the gonads are greatly enlarged, yield could be less compared to the winter fishery. However, EEC fisheries in recent years have been confined to the winter period. With respect to machinery, the Badder 190 filleter, a modern (about 6 years old) self adjusting unit, capable of handling 30 to 75 cm fish did not produce a significantly better yield than the older Baader 99 units capable of processing larger fish in the 65-100 cm range. Similarly, the two heading machines Baader 423 and 160 used on FRG vessels produced similar yields for different size ranges of fish.

Weight reduction at each subprocess stage was substantial. Removal of the head as a prefilleting operation resulted in a 37% loss. Removal of the viscera contributed a further weight loss of 13%, bringing the total for gutted and headed fish to 50% of original weight. The heading cut as a prefilleting stage resulted in more extensive removal of thoracic flesh than the heading cut as a final stage for market, gutted, head off product. Weight loss was 9% greater at this intermediate stage when compared to the final gutted head off form produced by Japan (Kulka 1983a). Conversion of gutted, head off fish to fillets resulted in a further 16% weight loss (some of this due to actual loss of fillets in the machine), 1.5% was due to removal of blood spots and fin bits, 3.5% for peripheral trimming and 4.5% for the boning procedure. All together 11% of the original round weight of the fish (32% of the original fillet weight) could be removed in post machine treatments, including skinning. This points up the importance of differentiating subprocesses and acounting for associated reduction in yield when dealing with conversion factors. The factors used by French and FRG vessels appear to disregard fillet post machine treatment weight loss since used factors were very similar to the 2.913 fillet (untouched by hand) factor derived in this study.

Fillet production involves a rather complex set of steps and associated with each is a considerable amount of variability. Differences observed between used factors including those in the official FAO list and values derived in this study suggest that catch weights for cod (and other species, Kulka 1983a) have been considerably underestimated in the past. Adoption of these experimentally derived conversion factors would be an important step in improving the quality of reported removal statistics for Labrador and Gulf of St. Lawrence cod stocks. Additional work is required to examine other processes and species.

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Table 1. Analyses of variance of cod fillet conversion factors, EEC 1982-83

Category	[a]Compared classes	F-Value	PR≥F	S	Sample Size
Cod (factorial analysis)	NAFO/country Fillet process	3.10 20.89	0.19 0.01	No Sig	155
	MACHINE (FRG)				
Cod Gut head off str	B160, B423	0.21	0.65	No	74
Cod Fillet-before hand processing or skinning	B190, B99	3.01	0.09	No	65
Cod Fillet-before hand processing skinless	B190, B99 (filleters) B51 (Skinner)	0.83	0.37	No	26
	MONTH (FRG and FRANCE)				
Cod (factorial analysis)	Fillet process 1, 2, 3, 4	16.92 2.51	0.01 0.07	Sig No	76

[a]Refers to month or machine or other category compared

Table 2. Estimated conversion factors for 1982-83 EEC analysis.

Country Countries	Area/s	Month/s	Process	Conversion Factors	[c]Type	FAO Conv. Factor	# Samples	Coeff. Variation	95% CI	[a]95% CI as a % of $\bar{x}$
COD, HEAD OFF, STRAIGHT CUT (PRE-FILLET STAGE)										
FRG	2J	2	circular saw	1.588	I	-	5	0.050	0.097	6.1
COD, GUTTED										
FRG, UK	2H,3K	5,11	hand	1.160	I	1.11-1.33	5	0.069	0.099	6.2
COD, GUTTED, HEAD OFF STRAIGHT CUT (PREFILLET STAGE)										
FRG	2H,2J	2,11,12	B423, B160	1.968	I	-	74	0.031	0.014	0.7
COD, FILLET (UNTOUCHED BY HAND)										
FRG	2H,2J	11,12	B99, B190	2.913	I	2.11-3.70	65	0.083	0.035	1.2
COD, FILLET, SKINLESS (UNTOUCHED BY HAND)										
FRG	2H	1,12	B99, B190	3.035	I	2.23-3.50	23	0.044	0.033	1.1
COD, FILLET, SKIN ON (BLOOD SPOTS, FIN BITS REMOVED)										
[b]FRA, FRG	4R,2H	3,12	B99	3.077	F	2.11-3.70	3	0.063	0.484	15.7
COD, FILLET, SKINLESS (BLOOD SPOTS, FIN BITS REMOVED)										
FRA, FRG	2H,2J, 3L,3Pn 4R,4Vn	1,2,3 4,11,12	B99, B190	3.179	F	2.23-3.50	105	0.106	0.065	2.0
COD, FILLET SKINLESS, TRIMMED										
FRA, FRG	2J,3Pn 4R,4Vn	11,12 1,2	B99 B190	3.533	F	2.23-3.50	34	0.207	0.136	1.9

. . . Cont'd.

Table 2. (Cont'd.)

Country Countries	Area/s	Month/s	Process	Conversion Factors	[c]Type	FAO Conv. Factor	# Samples	Coeff. Variation	95% CI	[a]95% CI as a % of $\bar{x}$
				COD, FILLET, SKINLESS (TRIMMED OR UNTRIMMED)						
FRA, FRG	2H,2J, 3L,3Pn 4R,4Vn	11,12 1,2,3, 4	B99 B190	3.286	F	2.23-3.50	228	0.107	0.045	1.4
				COD, FILLET, SKINLESS, BONELESS						
FRA, FRG	2J,4R 4Vn	2,4	B99 B190	3.684	F	2.81-3.48	16	0.110	0.217	5.5
				COD, FILLET, SKINLESS, BONELESS, TRIMMED						
FRA, FRG	2J,4R 4Vn	2,3	B99 B190	4.208	F	-	5	0.048	0.252	4.2
				COD, V FILLET, SKINLESS						
FRG	2J	2	B190	3.670	F	-	5	0.087	0.397	7.6

[a]$(t \times S.E. \div \bar{x})x100$

[b]some experiments on French vessels may have been performed on B38 and B338 filleters

[c]I - intermediate product, not yet processed to its final form
F - final product, ready for storage and marketing

Figure I. FILLET PRODUCTION DATA SUMMARY

TRIP NO. ________ SET NO. ________ DATE (DMY) ________

VESSEL ________	SPECIES ________	FISH LENGTH (cm) ________	GUTTING MACHINE ________
LOCATION ________	FISH QUALITY: FRESH / MEDIUM / SOFT	SAMPLE WEIGHT (kg) ________ IN OUT	HEADING MACHINE ________
DEPTH ________	FISH CONDITION: LEAN / NORMAL / FAT	NO. FISH ________	FILLETING MACHINE ________
			OTHER ________
			TRIMMING ________

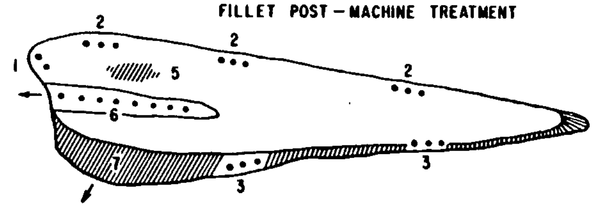
PRODUCTION

	PRODUCTION STAGE	PROCESS CODE	MACHINE	Kg.	% OF SET
1	GUTTED	100			
2	GUTTED HEAD OFF	112			
3	SKIN ON, BLOOD SPOTS, FIN BITS NOT REMOVED (DIRECTLY OFF THE FILLETING MACHINE)	207			
4	SKINLESS, BLOOD SPOTS, FIN BITS NOT REMOVED	206			
5	*SKIN ON, BLOOD SPOTS, FIN BITS REMOVED, NOT TRIMMED	215			
6	*SKINLESS, BLOOD SPOTS, FIN BITS REMOVED, NOT TRIMMED	213			
7	*SKIN ON, TRIMMED (PERIFERAL FLESH REMOVED)	205			
8	*SKINLESS, TRIMMED (PERIFERAL FLESH REMOVED)	203			
9	*SKIN ON, BONELESS	212			
10	*SKINLESS, BONELESS	210			
11	*SKIN ON, BONELESS, TRIMMED (PERIFERAL FLESH REMOVED)	202			
12	*SKINLESS, BONELESS, TRIMMED (PERIFERAL FLESH REMOVED)	200			

*PROCESSES 5—15 ALL HAVE BLOOD SPOTS AND FIN BITS REMOVED / SKIN IS SHADED AREA

	PRODUCTION STAGE	PROCESS CODE	MACHINE	Kg.	% OF SET
13	*V. FILLET, SKINLESS	310			
14	*V. FILLET, SKINLESS, TRIMMED (PERIFERAL FLESH REMOVED)	300			
15	*OTHER (DRAW DIAGRAM AND DESCRIBE)				

FILLET POST — MACHINE TREATMENT



*REMOVAL OF BLOOD SPOTS AND FIN BITS IS NOT DEFINED AS TRIMMING. TRIMMING IS REMOVAL OF PERIFERAL FLESH AS SHOWN IN SHADED AREA (7).

	POST — MACHINE PROCESSING	PARTS REMOVED (YES/NO)	% OF SAMPLE	COMMENTS
1	HEAD BONES			
2	DORSAL SPINES			
3	CAUDAL SPINES			
4	SKINNING DEFECTS			
5	BLOOD SPOTS			
6	* VERTEBRAL REMNANTS (BONELESS PRODUCT)			
7	# PERIFERAL TRIMMING # (TRIMMED PRODUCT)			
8	OTHER			

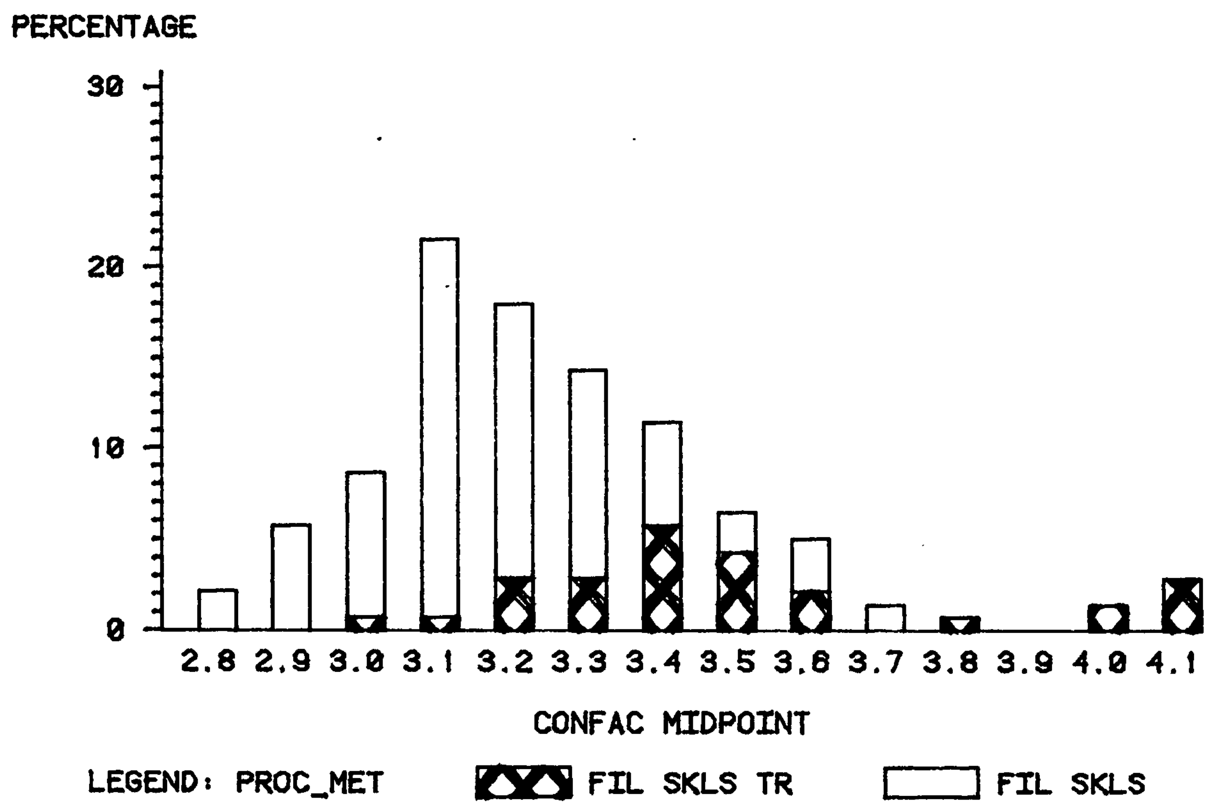
#SPECIFY LIGHT OR HEAVY TRIMMING

*BONELESS PRODUCT IS REMOVAL OF WEDGE (6)

FIG 2– DISTRIBUTION OF CONVERSION FACTORS

SKINLESS AND SKINLESS TRIMMED FILLETS 1982-3,EEC

SPECIES=COD



SKINLESS FILLETS:TRIMMED $\bar{x}$=3.53,UNTRIMMED $\bar{x}$=3.18