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A description of gutted and head off production for selected species with special reference to conversion factors from product to whole weight

by

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ABSTRACT

The various fleets fishing in the Canadian zone commonly produce gutted and head off fish products, for a variety of species. Application of conversion factors to gutted and head off product records is a convenient and commonly used method to estimate catch weight. However, factors currently used, including those in published lists are often conflicting and ambiguous. In order to improve the accuracy of catch data, this study provides a more accurate description of gutted and head off products produced offshore,and corresponding conversion factors for the twelve national fleets currently fishing in the Canadian zone. Seventeen major processes for 8 species were identified. Twelve showed no significant difference in yield among countries processing machines, months, or areas fished. The exceptions were due to countries using different head or tail cuts independent of machine used or month and area fished. Conversion factors are derived from all of the products with significantly different yields.

RÉSUMÉ

Les diverses flottes pêchant dans la zone canadienne produisent en général une variété d'espèces de poissons étêtés et éviscérés. Il est pratique et répandu d'appliquer des facteurs de conversion aux données sur les produits éviscérés et étêtés pour estimer le poids des prises. Cependant, les facteurs utilisés, y compris ceux paraissant dans les listes publiées, sont souvent contradictoires et ambigus. Pour obtenir des données plus exactes sur les prises, on a inclus dans la présente étude une description précise des produits éviscérés et étêtés au large et des facteurs de conversion correspondants pour les douze flottes nationales qui pêchent actuellement dans la zone canadienne. Dix-sept procédés majeurs ont été identifiés pour 8 espèces. Douze ne présentaient aucune différence de rendement d'un pays, d'une machine de traitement, d'un mois ou d'une zone à l'autre. Les exceptions provenaient de pays utilisant des coupes différentes pour la tête et la queue sans égard à la machine utilisée ou au mois et à la zone de pêche. Des facteurs de conversion sont établis pour tous les produits dont les rendements diffèrent sensiblement.

INTRODUCTION

Foreign factory fleets in the Canadian zone commonly produce gutted and head off fish products, for a variety of species. For the domestic fleet, the dominant product form has been gutted but the proportion of head off fish landed in Canada has increased recently. This change is due primarily to the implementation of the Resource Short Plant Program (RSPP) and special license arrangements. Both involve contracts with foreign vessels to land gutted, head off cod. There has also been a small increase in amount of cod from Div. 2J and 3K processed in this manner by the domestic fleet. With the acquisition of a freezer factory trawler(s) by Canada, landed gutted head off products would increase for other species as well.

The recent growth in gutted head off production has focused attention on the validity of corresponding product to round weight conversion factors. The interest arises because catch statistics are often derived by converting product weight to estimates of round weight. Although application of conversion factors is recognized as the most convenient and accurate method to estimate caught weight, product records and conversion factors must be reliable (Kulka 1983a). However, factors for both gutted and gutted head off products currently being used, including those published in official lists (FAO 1970, NAFO 1980, and STACAC 1984), are often conflicting and ambiguous. These official lists make no reference to background papers or other studies from which factors were derived, hence, it is not possible to assess their validity. Kulka (1983b) did provide some preliminary information on experimentally derived factors for several head off processes. That report is not definitive because in some cases, numbers of observations were limited, processing was sometimes inadequately defined and subprocesses were not always fully delineated. Notably, that paper documented major inconsistencies among the experimentally derived factors and the various lists of currently used factors, including those related to gutted and gutted head off processes.

Considering that the accuracy of catch data is in part dependent on use of appropriate conversion factors, that gutted and gutted head off processing is now widespread and becoming increasingly more common, and currently used or published conversion factors relating to such products are questionable, a large scale examination of this type of production was indicated. Therefore, a long-term study was initiated with the aims of describing gutted and gutted head off production methods for the offshore, delineating the various major product types, and generating a representative set of corresponding conversion factors. This paper sets forth the results of the analysis on major production processes for the twelve national fleets currently fishing in the Canadian zone.

METHODS

Production data relating to observed fisheries, mainly for the Grand Bank and Labrador Shelf were obtained by fishery observers (Fisheries Observer Program, Newfoundland Region) using standard methods (Kulka and Firth 1985). Observer deployments were guided primarily by enforcement requirements rather than for optimizing sampling distribution for research. Hence, data for common production processes were collected opportunistically. In this way over a five year period, 958 samples with accompanying narrative descriptions of production, were taken. Data with each sample consisted of fish weight before and after processing; mean length and number of processed fish; specified fleet; location and time; a detailed description of the product and production machinery used; production quality as it affected processing; production operation strategies such as targeted markets; and values of conversion factors used by the vessel. Such knowledge of production is important to the delineation of product types, hence the need for detailed data as described above.

The object of the study was to observe yield from fish processed in as typical a manner as possible. To satisfy this objective, sampling was carried out in the factories of all observed vessels. Any departures from normal production procedures were noted and atypically processed samples were subsequently removed from the data base. The remaining samples were representative of product output from the various machines and people. The target sample size was the maximum amount of fish that would not lead to undue disruption of ships production. This translated into an average of about 80-100 fish per sample for large species such as cod and Greenland halibut and about 150-200 for smaller species such as redfish and roundnose grenadier. This approach generally resulted in a relatively narrow range of sample weights.

For each species and process separately, raw samples were grouped factorially by country or fleet, by processing implement or machine, by month and by area fished (NAFO Division). Each factor was included because it was easily definable, and might influence conversion rates. In particular, country might delineate head cut differences which in turn would effect yield. Other, finer sources of variation in yield were not included and therefore not separated. For example, quantifying differences among shifts or individual cutting technique would require unrealistic sampling intensity. The aim of the analysis was toward a more practical end: to define a set of gutted and gutted head off conversion factors representative of sea production which could be applied on as broad a basis as possible. To this end an analysis of variance using Proc GLM procedure in Statistical Analysis System (SAS User Guide: Statistics 1985) was set up to detect significant differences among countries, cutting machines, months and NAFO Divisions. Prior to this analysis, compared groups were checked for homogeneity of variance using Bartletts procedure (Ostle and Mensing 1975) and normality was checked using the method of Shapiro and Wilk (1965) in order to verify compliance with the assumptions underlying ANOVA.

A factorial design using all of the categories to be compared (country, machine, month and area) was not possible due to the incomplete and unbalanced sampling of all possible category combinations. This situation resulted in many missing cells or means in the comparison matrix. To circumvent this problem, conversion factor experiments were grouped into concatenated country/machine/month/area combinations and treated in a one way ANOVA as a vector of compared means. In those cases where significant differences were detected at the .01 level among means of the concatenated groups the following procedure was used to determine which of country, machine, month and area were contributing to the observed difference. Systematically omitting each of these four factors and comparing of means for the remaining three, regardless of the fourth, could indicate which of the factors were involved. For example, if after removing country from the concatenated group the subsequent analysis suggested no significant difference (and this was not the case for the subsequent removal of machine, month and area) then country differences were indicated. If more than one of the three-factor concatenated subgroups indicated significant differences among means then further hierarchal investigation was required. This was accomplished by removing two and three factors at once in the various combinations and examining patterns in the probabilities and mean squares. Finally, to investigate possible interactions, the data were sorted by each of country, machine, month and area. The remaining factors were analysed as above but for each sorted set separately. For example, each country separately and subsequently each machine, area and month was analysed by analysis of variance to detect significant differences among the other three factors. In this way each level for all factors was examined independently.

Fish go through differential morphological changes with respect to body growth. If this differential growth were pronounced then product yield could be affected by fish size. To address this problem, average fish length on magnitude of conversion factor was examined using Proc Reg in SAS to determine if slope in a regression of conversion factor on mean length of sampled fish was significantly different from zero.

Sample means were calculated from sample ratios (whole to product weight) using the following formula:

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

where $\bar{x}$ = estimated conversion factor
WWi = whole weight of the ith sample
PWi = product weight of the ith sample
n = number of samples

The associated variance was estimated by

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

Problems can sometimes occur when estimating means from ratios particularly if value of the ratio is not constant over the range of samples weights. In order to verify that this was not occurring, two other estimates were calculated for comparison. For the first, a regression of round weight on product weight was performed using Proc Reg in SAS. With zero intercept, the slope estimates product to round weight conversion factor. However, given the narrow range of sample weights for many of the processes this method was used as a primary means for estimating conversion factors. A third, the ratio estimate (Cochran 1977) was also calculated as follows:

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

The three estimates of product to whole weight conversion factors were compared and aberrant values examined further to determine the reason for the difference. The ratio estimate where appropriate was compared against historical values and differences were noted.

RESULTS

Production data are presented in Table 1. By species and process separately, col. 3 lists the primary estimate of conversion factors (means of ratios) plus associated yield and weight loss. Cols. 4-6 list number of samples on which the estimate was based and 2 measures of variance. Col. 7-8 list the two alternate estimates of conversion factors and Col. 9-10 summarize the final results of the ANOVA procedure. The listed probability refers to the final stage where appropriate separation of data has been done. Col. 10 illustrates compared factors while Col. 11 lists other countries that used the corresponding process but for which no samples were obtained. Diagrams illustrating the head off cuts corresponding to the factors listed in Table 1 can be found in Fig. 1-5.

Regression of round weight on product weight, except for porbeagle, indicated that the intercepts were not significantly different from zero and that variance was relatively constant over the range of samples. In the case of porbeagle, the non-zero intercept may be due to the presence of two different processes as indicated by the data. This could not be verified from narrative descriptions of processing. For all species the 3 estimates, means of ratios, ratio and slope from regression at no time varied by more than 2.2% and the majority were less than 1% different. The variance associated with the means of ratios estimates was low. With one exception coefficients of variations were less than 10%, generally in the 4-6% range. Small sample size (n=5) contributed to a relatively high coefficient of variation of 12.52% for gutted head and tail off Greenland halibut for the German Democratic Republic (GDR).

Of the 17 gutted and head off species/processes examined, 12 showed no significant difference among compared means in the ANOVA (Table 1) and a grand mean was used. With one exception from the remaining 5 cases where significant differences were detected, neither processing machines, NAFO Divisions or months were implicated. Analyses indicated that country was the source of the observed difference. Different cut positions in removal of the head was the underlying cause. The exception, porbeagle indicated significant difference between 4X and 4W. Further investigation revealed that observations of gutted head and tail off production for this species was restricted to two vessels and that actual area fished was very small, restricted along the border of the two divisions. Therefore, the difference in yield was likely not due to area, but to differences in the configuration of head cut between vessels. The exact nature of these differences could not be determined from narratives of production techniques.

The dominant product produced from roundnose grenadier was gutted, head and tail off (Fig. 3). Only hand processing was done, therefore machinery was excluded from the analysis. Comparison of means of the concatenated groups country/month/area, country/month, country/area and month/area resulted in probabilities all less than 0.01. The only significant finding at this level of analysis was an elevated mean square error due to the model for country/area. When countries, months, and areas were compared separately regardless of other factors, only the month comparison indicated a probability level greater than 0.01 (P = 0.1334). However, when for each country separately, months/areas were compared, no significant difference was detected for USSR (P = 0.03) but a difference was detected for GDR (P = 0.003). A more detailed vessel by vessel examination for GDR revealed a significantly lower yield for one of the six vessels observed. When data from this vessel were removed and the analysis rerun, only country was implicated, with month and area having no effect on yield. The difference between USSR and GDR (and the one GDR vessel versus others) as suggested by observer narratives was related to position of the tail cut. Both degree of fin trimming (done only at certain times to satisfy market needs) and head cut variation (single and double cut illustrated in Fig. 3) did not significantly affect yield.

Differences in yield among countries were also noted for the diagonally cut gutted head off redfish product (Fig. 4). A comparison of means grouped by country using Scheffes multiple comparison procedure in SAS indicated a substantially lower value for Japan but no significant difference among the other countries. On average, the yield for Japan was 6.7% lower due to a less steep angled head cut which led to greater retention of flesh posterior to the eyes and on the belly flap.

A comparison of gutted head off products for Greenland halibut indicated a significant difference between GDR and Poland. Accompanying descriptions in narrative reports confirmed that two different head cuts were being used; for GDR a double cut and for Poland a single angled cut (Fig. 5). Both were used in order to remove as much gonad as possible. The double cut, more efficient for gonad removal in fully mature fish, is also more wasteful. A third head off product referred to as steaks or chunks (Fig. 5) is a specialized process for large fish and is produced for a very specific market. Head and tail off Greenland halibut products were also found to be significantly different among countries. Similar to head off procedures GDR utilized a double cut at the head (Fig. 5). Japanese and Faroese processors used a single angled head cut but the former were able to conserve more lateral flesh by using a less radical cut. This resulted in a average 3.2% higher yield than the Faroese method and a 15.5% higher yield than the GDR double cut.

In terms of size, over a wide range, very small fish tended to produce a slightly higher yield than large fish for gutted head off products as reflected by consistently positive but small values of slope from regression of conversion factor on mean length of sampled fish. However, within the normal commercial size range, yield was relatively constant; slopes were found not to be significantly different from zero, with two exceptions. In both cases, the relationship for gutted cod (slope = .0021, r^2 = 0.14) and Japanese processed gutted head and tail off Greenland halibut (slope = 0.0062, r^2 = 0.56) were affected by two outlying points well outside the normal range of commercial processed sizes. Their removal rendered the relationships insignificant indicating as with all other cases that yield was constant for commercial sized fish.

Table 2, a summary of production mix, shows that the above analysis provides estimates of conversion factors for all major observed gutted head off processes for offshore production. With the exception of Canada, gutted head off products comprised a very significant portion of the total in 1984 in the areas examined. Both directed and by-catch species were processed into gutted head off forms in order to meet specific market needs. The most commonly observed processes were gutted diagonal head off redfish, gutted head off witch and a variety of gutted head off or head and tail off Greenland halibut products.

CONCLUSIONS

Gutted head off products made up a substantial portion of the production on factory trawlers fishing in the study area particularly for redfish, Greenland halibut and witch. For all species, subprocessing was identified as the key factor affecting yield. Observed differences among product forms related to position of the head or tail cut. This variation was independent of machine type or implement used to remove the head. Where yield for a particular process varied among countries, differential positioning or configuration of the head cut was the underlying cause. For example, application by Japanese processors of a steeper diagonal head cut for redfish resulted in a higher yield than for other countries. Similarly for head or tail and head off products of Greenland halibut, variation in yield among countries was attributed to the use of either a single or double cut to remove the head. The latter process, used by GDR for large mature fish only allowed for concomitant removal of the mature gonad. All other countries processed only small or intermediate sized animals and a single cut was adequate to remove most or all of the small immature gonad. Any remaining tissue was extracted by hand without disturbing the periferal flesh and as a result higher yield was attained. On the other hand, removing the head of cod and grenadier with either a single or double diagonal head cut did not affect yield. Rather the observed difference in yield for grenadier between USSR and GDR was due to position of the tail cut.

Catches are commonly estimated by applying conversion factors to the product weight and adjusting for discard. Therefore, accuracy of catch statistics is in part dependent on the use of appropriate factors. The present study indicated that for gutted head off products appropriate factors often were not used. Observed fleets used factors from published list such as NAFO (1980) or from unpublished company lists. By comparing these lists (refer to Table 3) with the values derived in the present study two points became apparent. The factors used by the fleets were generally considerably lower and corresponding product descriptions were ambiguous or incomplete. Their use therefore implies mis-estimated catches across all fleets. Utilizing conversion factors derived in this analysis for general use would not only have the advatange of providing for more accurate estimates of catch but would also considerably reduce the number of factors currently in use. Actual product type could be accurately classified and the appropriate conversion factor applied thereby avoiding existing situations where factors for a particular product are almost as numerous as the numbers of vessels producing the product.

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Table 1. Selected gutted and gutted, head off conversion factors.

Process	Subprocess	Conversion factor[a] yield (loss)	# Samples	Coeff. of variation	99% Conf. interval	Conversion factor[b] Est. 2	Conversion factor[c] Est. 3	ANOVA # Levels compared	ANOVA Probability	Compared categories	Other observed countries[d]
Species = Cod											
Gutted (intermediate and final)[e]	No trimming	1.22 82 (18)	132	4.14	±0.013	1.21	1.21	30	0.04	CAN/POR/FRG/NOR/UK/USR/STP[f] Hand/2H-4W Jan.-Dec.	FAR/DEN
Gutted head off (intermediate and final)	Collar bone in, no trimming	1.55 64.5 (35.5)	58	5.76	±0.032	1.55	1.55	18	0.40	POR/UK/NOR C100/Hand/B415[g] 2H-3N Feb.-Dec.	GDR/JAP POL/USSR
Gutted head off (final)	Collar bone out, straight no trimming	1.69 59.2 (40.8)	29	6.14	±0.053	1.70	1.69	6	0.28	JAP/POR C100/Hand 3KL Apr., Oct.-Dec.	FRG/GDR NOR/POL UK
Gutted head off (final)	Collar out, diagonal no trimming	1.91 52.4 (47.6)	41	6.11	±0.049	1.90	1.90	11	0.07	JAP/POR/USR C100/Hand 2J-3K Dec.-May	
Species = Porbeagle											
Gutted head and tail off (final)	Fins off	1.47 68 (32)	33	3.02	±0.028	1.44	1.45	4	0.003	FAR Hand 4WX	

Table 1. (Cont'd.)

Process	Subprocess	Conversion factor[a] yield (loss)	# Samples	Coeff. of variation	99% Conf. interval	Conversion factor[b] Est. 2	Conversion factor[c] Est. 3	ANOVA # Levels compared	ANOVA Probability	Compared categories	Other observed countries[d]
Species = White Hake											
Gutted head off (intermediate and final)	Collar bone in, no trimming	1.49 67.1 (32.9)	12	3.93	±0.053	1.49	1.48	2	0.72	POR Hand 30 May-June	
Gutted head off (final)	Collar bone out straight, no trimming	1.86 53.8(46.2)	5	3.54	±0.134	1.86	1.86	1	-	POR C100 30 June	JAP
Species = Roundnose Grenadier											
Gutted head and tail off (final)	Diagonal (2 cm tail) USSR	2.41 41.5 (58.5)	87	7.46	±0.060	2.39	2.41	10	0.03	Hand 2H-3K Sept.-Dec.	POL/POR
	GDR	2.52 39.7 (60.3)	91	1.47	+0.052	2.49	2.52	6	0.0003	Hand 2G-3K Aug.-Nov.	
Species = Redfish											
Gutted (intermediate and final)	No trimming	1.16 86.2 (13.8)	15	1.47	±0.018	1.17	1.17	3	0.03	USR Hand 2J3K30 Mar.-Aug.	
Gutted head off (intermediate and final	Collar bone in straight no trimming	1.52 65.8 (34.2)	10	2.32	±0.036	1.49	1.52	2	0.90	USR C100/HND 30 Mar.-Aug.	POR/JAP
Gutted head off (final)	Collar bone out straight no trimming	1.88 53.2 (46.8)	13	7.31	±0.116	1.87	1.88	4	0.15	USR/POL C100/Hand 2J 3K Aug.,Nov., Dec.	FRG/POR

Table 1. (Cont'd.)

Process	Subprocess	Conversion factor[a] yield (loss)	# Samples	Coeff. of variation	99% Conf. interval	Conversion factor[b] Est. 2	Conversion factor[c] Est. 3	ANOVA # Levels compared	ANOVA Probability	Compared categories	Other observed countries[d]
Gutted head off (final)	Diagonal, no trimming JAP	1.84 54.3 (45.7)	28	7.11	±0.069	1.80	1.82	5	0.04	Hand C100 3K 30 Sept.,Oct.	
	Other	2.10 47.6 (52.4)	39	6.69	±0.059	2.0	1.98	11	0.18	GDR/POL/USR Hand 2J-3L Aug., Dec.	CUB/UK POR/FRG NOR
Species = Plaice											
Gutted (final)	No trimming	1.13 88.5 (11.5)	10	2.89	±0.046	1.12	1.12	2	0.02	CAN Hand 3LO Feb., May	POR
Species = Witch											
Gutted head off (final)	Diagonal	1.25 80 (20)	80	5.64	±0.021	1.23	1.24	5	0.13	POL Hand	GDR/JAP POR/UK
Species = Greenland halibut											
Gutted	No trimming	1.09 92.6 (7.4)	83	2.40	±0.001	1.09	1.09	9	0.17	CAN/USR Hand 0,2H,2J Aug.-Nov.	POR
Gutted head off	Double cut (GDR)	1.58 63.3 (36.7)	13	5.40	±0.075	1.55	1.56	4	0.27	GDR Hand 2H, 2J3K Jul.-Aug., Nov.	
	Single cut (POL)	1.46 68.5 (31.5)	109	5.43	±0.021	1.45	1.45	14	0.05	POL Hand 2H,2J3K, June-Feb., May	CAN/FRG GDR/JAP POR/USR FAR/NOR/UK
	Chunked (Steaks) (GDR)	1.62 61.7 (38.3)	8	4.33	±0.087	1.61	1.62	3	0.08	GDR C100 Hand 2J Jul., Aug.	POL

Table 1. (Cont'd.)

Process	Subprocess	Conversion factor yield (loss)[a]	# Samples	Coeff. of variation	99% Conf. interval	Conversion factor Est. 2[b]	Conversion factor Est. 3[c]	ANOVA # Levels compared	Probability	Compared categories	Other observed countries[d]
Gutted head and tail off	Double cut (GDR)	51.6 (48.4)	5	12.52	±0.502	1.92	1.93	1	-	2H Nov.	
	Single Cut (JAP)	1.49 67.1 (32.9)	19	6.25	±0.060	1.48	1.49	4	0.17	Hand/C100 2J, Sept.,Nov.,Dec.	NOR/POR
	Single cut (FAR)	1.58 63.9 (36.1)	40	4.76	±0.032	1.58	1.58	4	0.04	Hand 0 June, Sept.	

[a] Based on means of ratios.

[b] Value of slope in regression of product on whole weight (intercepts were found not be significantly different from zero except for porbeagle).

[c] Ratio estimate (Cochran, 1977).

[d] Process observed but no conversion factors performed.

[e] Intermediate = Intermediate Process, Final = Final process put down or landed.

[f] CAN=Canada, CUB=Cuba, DEN=Denmark, FAR=Faroes, FRG=Federal Republic of Germany, GDR=German Democratic Republic, JAP =Japan, POL=Poland, POR=Portugal, STP=St. Pierre, NOR=Norway, UK=United Kingdom; USR=USSR

[g] Processing machinery for deheading fish include hand processing, C100 (circular saw) and various Baader machines denoted by B plus three numeric digits.

Table 2. Summary of observed gutted and head off production, 1984.

Process	Country	Percent[a] of total production	Directed or by-catch
Species = <u>Cod</u>			
Gutted	STP[b]	100	DIR
	CAN	98	DIR
	POR	2	DIR
GHO (Gutted head off) collar in	UK	98	DIR
	RSPP[c]	13	DIR
	JAP	10	BY
	NOR	7	BY
	POR	2	BY
GHO Collar out straight	JAP	12	DIR
	POR	8	DIR
	POL	3	BY
	RSPP	2	BY
	FRG	<1	BY
	GDR	<1	BY
GHO Collar out diagonal	RSPP	76	DIR
	POR	2	BY
GHO and tail off	JAP	74	BY
Species = <u>White Hake</u>			
GHO Collar in	POR	1	BY
GHO Collar out	JAP	12	BY
Species = <u>Roundnose Grenadier</u>			
GHO and tail off	GDR	65	DIR
	USR	~75 (other years)	DIR
Species = <u>Redfish</u>			
Gutted	RSPP	64	BY
GHO Collar in	JAP	<1	BY
GHO Collar out straight	POR	27	DIR
GHO Collar out diagonal	UK	100	BY
	CUB	98	DIR
	JAP	97	DIR
	GDR	94	DIR

Table 2. (Cont'd.)

Process	Country	Percent[a] of total production	Directed or by-catch
	POR	73	DIR
	POL	65	DIR
	RSPP	27	BY
	FRG	17	BY
Species = Plaice			
Gutted	CAN	51	DIR
	POR	5	BY
Species = Witch			
GHO	POL	100	DIR
	POR	100	BY
	UK	100	BY
	GDR	98	DIR
	JAP	14	BY
Species = Greenland halibut			
Gutted	CAN	79	DIR
GHO			
single or double cut	FAR	100	DIR
	UK	100	BY
	GDR	95	DIR
	NOR	88	BY
	POR	79	BY
	POL	68	DIR
	FRG	60	BY
	JAP	5	DIR
	CAN	<1	DIR
GHO + tail off	JAP	99	DIR
single or double cut	POR	21	BY
	NOR	12	BY

[a]Based on round weight estimates of observed vessels.

[b]Refer to Footnote f of Table 1 for an elaboration of country abbreviations.

[c]RSPP - Resource Short Plant Program - foreign vessels contracted to catch, process and land Canadian quota.

Table 3. Historical factors, gutted and gutted head off.

Species	Process[a]	Subprocess	New factor	Country	ICNAF[b] PRE-70	FAO 1970	NAFO 1980	Kulka 1983	Kulka Firth 1985	STACAC 1984	STACAC (1985)[c]
Cod	Gutted	-	1.22	All	1.2			1.22	1.22	1.2	
				IRE[d]							
				BEL DEN		1.18	1.18				
				CAN UK		1.20	1.20				
				FAR		1.11	1.11				
				NET							
				FRA FRG		1.24	1.24				
				GRE		1.22	1.22				
				ICE		1.25	1.25				
				POL		1.19	1.19				
				SPA		1.33	1.33				
				SWE		1.15	1.15				
				USA		1.17	1.17				
				NOR			1.20				
Cod	A) Gutted, head off	Collar in	1.56	All	1.6					1.6	A) Collar in-1.6
				CAN		1.38	1.38				
				DEN		1.60	1.60				
	B) Gutted, head off	Collar out, straight	1.69	ALL							
				GRE		1.52	1.52				B) Collar out-2.0
				NOR YOUNG		1.40	1.40				
				NOR SPAWN		1.60	1.60				C) Collar out-1.8 (JAP)

Table 3. (Cont'd.)

Species	Process[a]	Subprocess	New factor	Country	ICNAF[b] PRE-70	FAO 1970	NAFO 1980	Kulka 1983	Kulka Firth 1985	STACAC 1984	STACAC (1985)[c]
Cod	C) Gutted, head off	Collar out, diagonal	1.91	All							
				NOR OTHER			1.42	1.42			
				POL			1.78	1.78			
				SWE			1.40	1.40			
				BEL				1.64			
				UK				1.50			
				FRG				1.71			
				USR				1.56			
				JAP						1.71	
Porbeagle	Gutted Head & tail off	Fins trimmed	1.47	FAR					1.47	1.47	
White hake	Gutted Head off	A) Collar in	1.49	All							1.6
				USA		1.35	1.34	1.34			
				POL			1.72				
		B) Collar out straight		CAN			1.38	1.38			
			1.86	POR							
RN Grenadier	Gutted Head & tail off	Diagonal	2.41	USR			2.11	2.11	2.33	2.33	
			2.52	GDR							

Table 3. (Cont'd.)

Species	Process[a]	Subprocess	New factor	Country	ICNAF[b] PRE-70	FAO 1970	NAFO 1980	Kulka 1983	Kulka Firth 1985	STACAC 1984	STACAC (1985)[c]
Redfish	Gutted	-	1.16	All	1.2						
				CAN		1.20	1.20	1.17	1.17	1.12	
				FRA FRG NET		1.07	1.07				
				ICE		1.06	1.06				
				POL		1.11	1.11				
				UK		1.12	1.125				
				FRA			1.10				
				NOR			1.20				
	Gutted head off	A) Collar out straight	1.88	ALL						1.6	A) 1.8 (collar out straight)
				NOR	1.6		1.65	1.53	1.53		
				FRG		2.02	2.02				
				POL		1.82		1.98	1.98		
		B) Diagonal	JAP-1.84 Other-2.10	BEL			1.44				B) 2.0 (collar out diagonal)
											C) 1.5 (collar in)
Plaice	Gutted	-	1.13	ALL							
				CAN	1.1	1.1	1.1	1.15	1	.1	
				FRG		1.11					
				GRE		1.05					
				POL		1.18					
Witch	Gutted head off	Diagonal	1.25	ALL							
				FRG		1.39	1.39	1.28	1.28		
				POL		1.31		1.28	1.28	1.35	
				CAN						1.35	

Table 3. (Cont'd.)

Species	Process[a]	Subprocess	New factor	Country	ICNAF[b] PRE-70	FAO 1970	NAFO 1980	Kulka 1983	Kulka Firth 1985	STACAC 1984	STACAC (1985)[c]
Greenland halibut	Gutted	-	1.09	ALL							
				CAN		1.10	1.10	1.10			1.1
				FRG		1.10	1.11	1.11			
				GRE			1.05	1.05			
				UK				1.125			
				NOR				1.10			
Greenland halibut	Gutted head off	Diagonal		ALL							
			GDR-1.58	GDR							
			POL-1.46	POL			1.43	1.43	1.45	1.45	
				CAN			1.15	1.15			1.35
				GRE			1.35	1.35			
				NOR			1.20	1.20			
Greenland halibut	Gutted head off	Chunked belly flap removed	1.62	GDR POL							
Greenland halibut	Gutted head off	Tail off									
			GDR-1.94	GDR							
			JAP-1.49	JAP							
			FAR-1.58	FAR							
				FRG			1.44	1.44			

[a]Refer to Fig. 2-5 for a diagramatic description of head and tail cuts.
[b]Refer to list of references for full citation.
[c]Interim conversion factors as specified by STACAC, derived from preliminary data submitted to CAFSAC.
[d]Refer to Foonote f of Table 1 for a elaboration of country abbreviations. Other not listed in Table 1 are: BEL=Belgium, GRE=Greece, ICE=Iceland, IRE=Ireland, NET=Netherlands, SPA=Spain, SWE=Sweden, USA=United States.

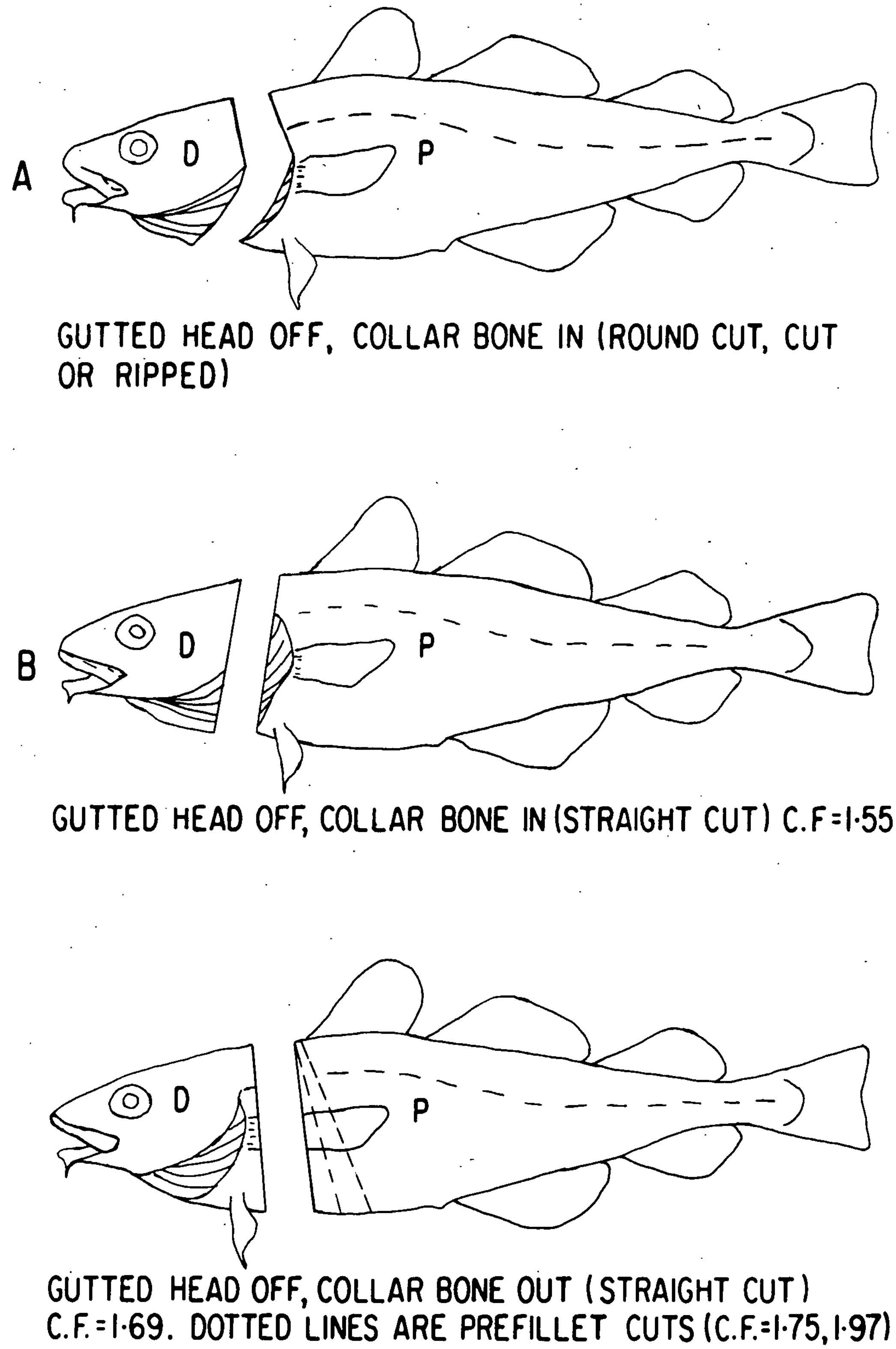
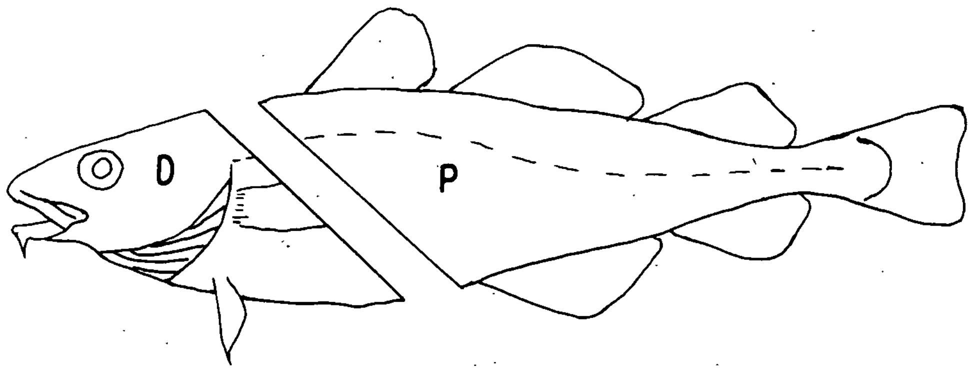


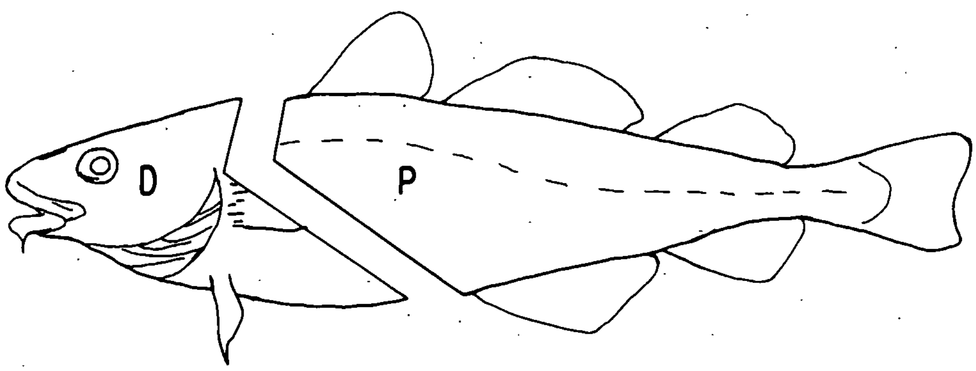
Fig. 1. Gutted head off cod products illustrating configuration of observed head cuts. Product A and B result in the same yield. D signifies discarded portion of the fish which may go to meal and P signifies the product frozen or iced (Fig.1-5).

A



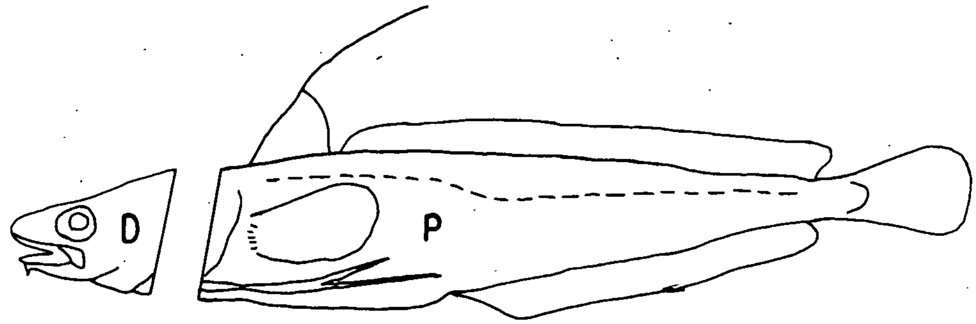
GUTTED HEAD OFF, COLLAR BONE OUT DIAGONAL (SINGLE)

B

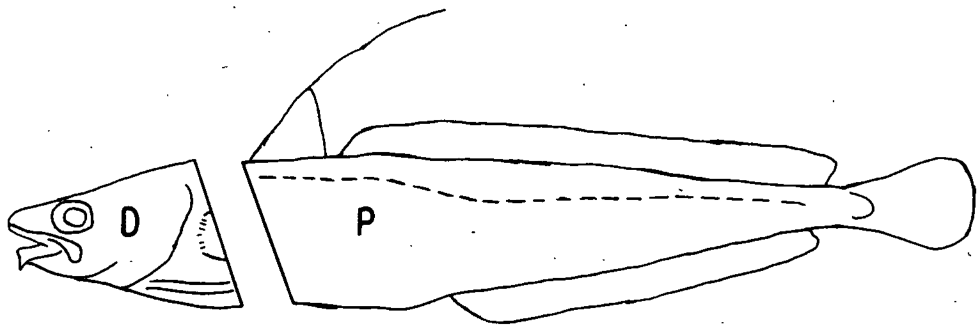


GUTTED HEAD OFF, COLLAR BONE OUT, DIAGONAL (DOUBLE)
C. F. = 1·91

Fig. 1. (cont.) Gutted head off cod products illustrating configuration of observed head cuts.



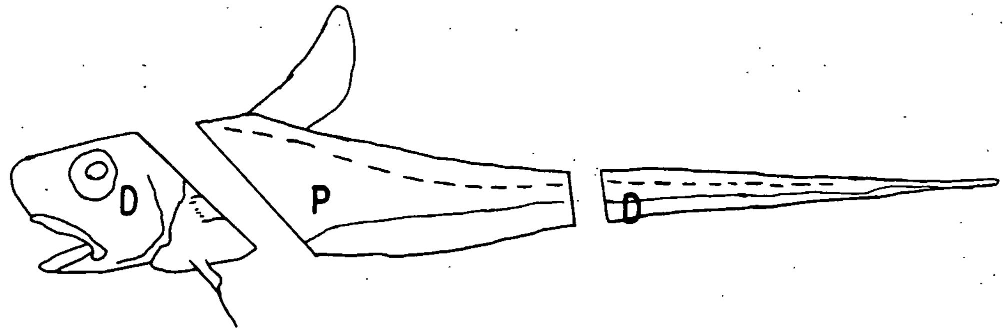
GUTTED HEAD OFF, COLLAR BONE IN C.F. = 1·49



GUTTED HEAD OFF, COLLAR BONE OUT C.F. = 1·86

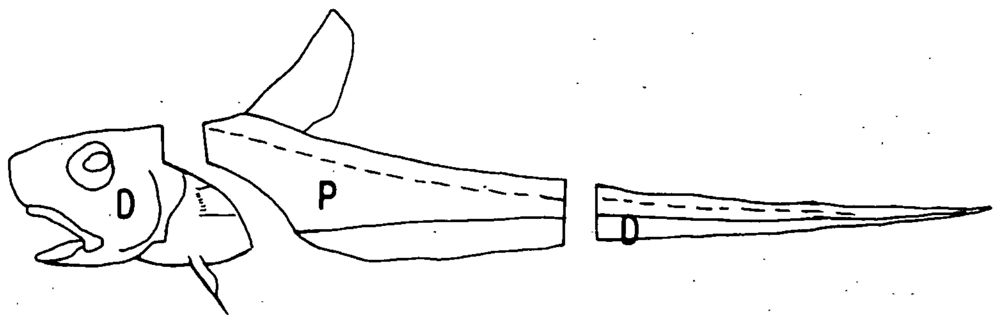
Fig. 2. Gutted head off white hake products illustrating configuration of observed head cuts.

A



GUTTED HEAD AND TAIL OFF, COLLAR BONE OUT (SINGLE CUT)

B



GUTTED HEAD AND TAIL OFF, COLLAR BONE OUT (DOUBLE CUT) C. F. = 2·41 (USSR), 2·52 (GDR)

Fig. 3. Gutted head and tail off roundnose grenadier products illustrating observed head and tail cuts.

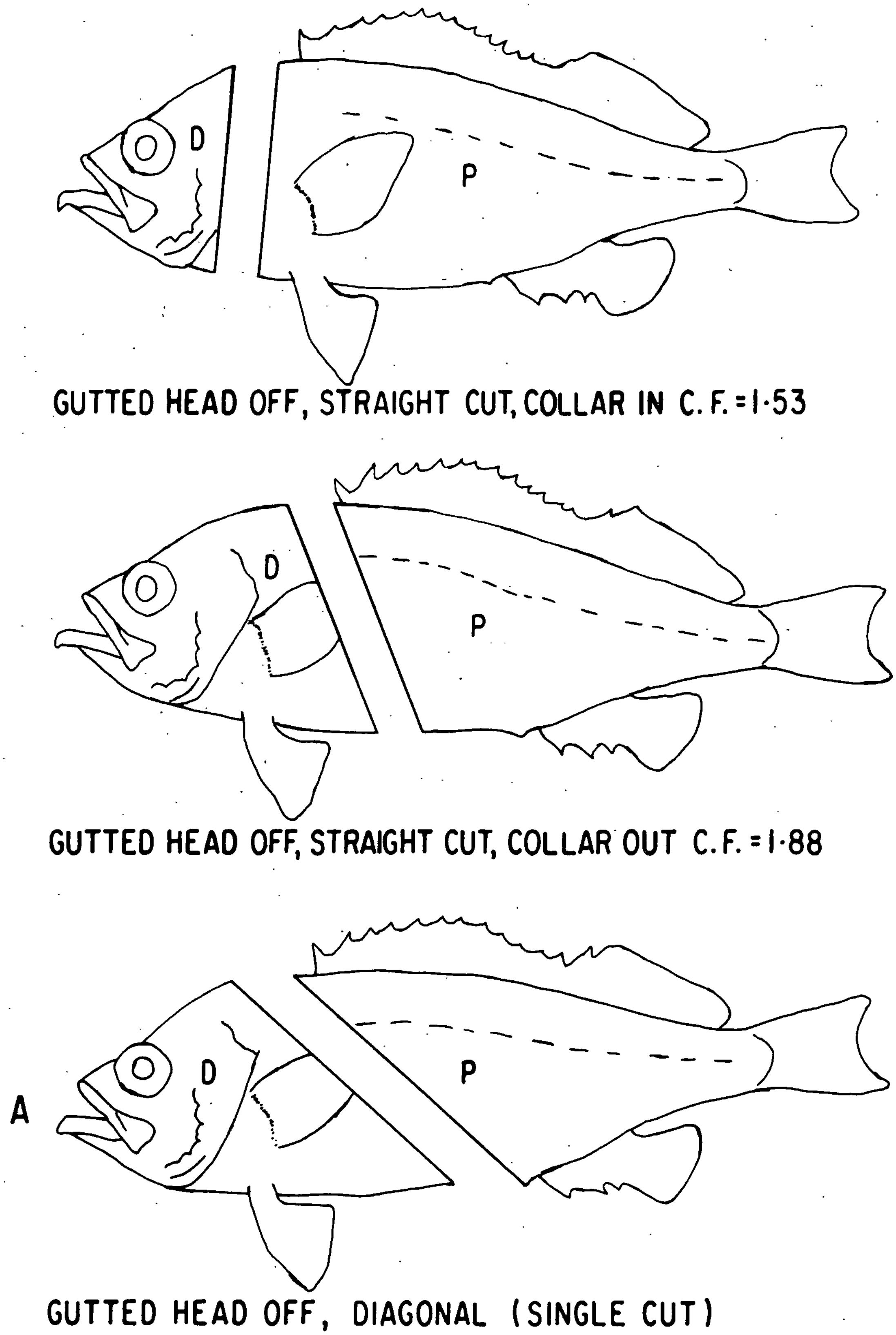
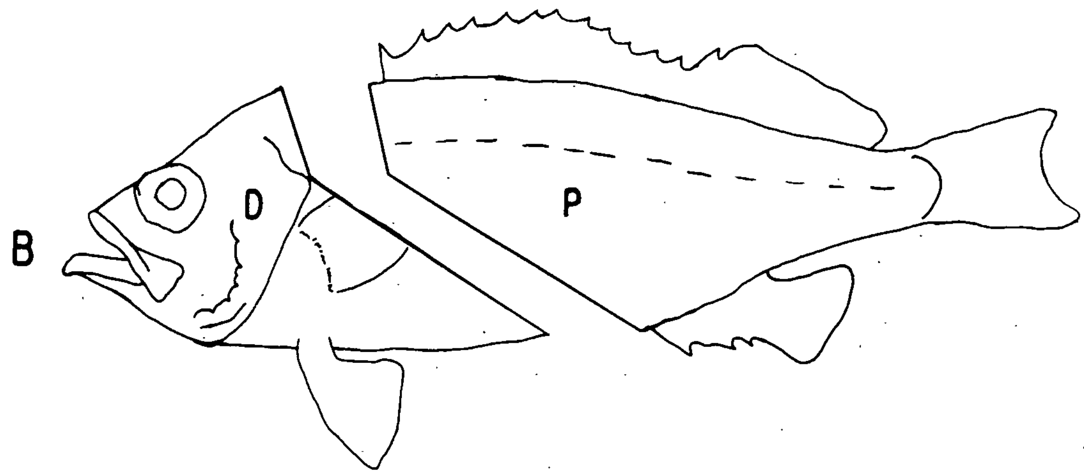
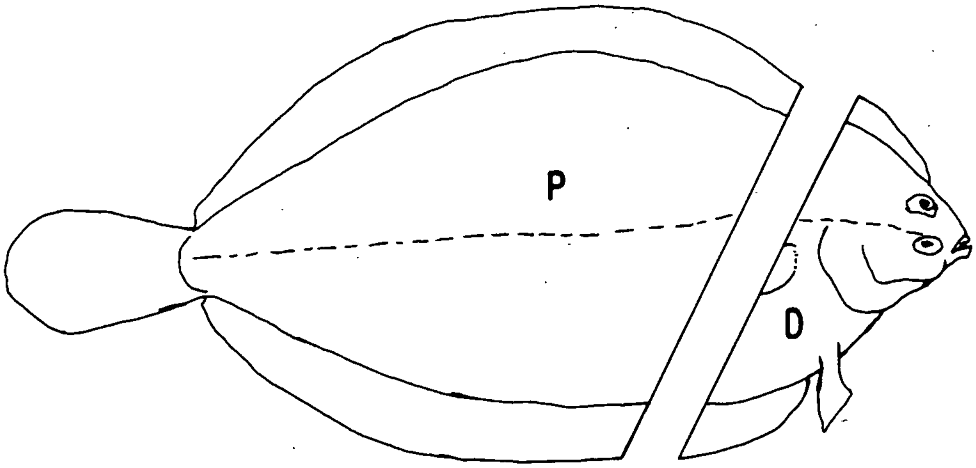


Fig. 4. Gutted head off redfish products illustrating configuration of observed head cuts.

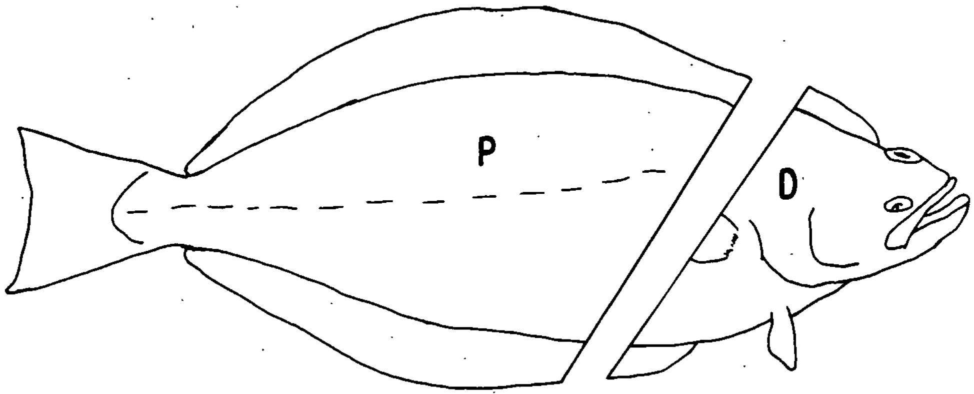


GUTTED HEAD OFF, DIAGONAL (DOUBLE CUT)
C. F. = 1·84 (JAP), 2·10 (OTHER)

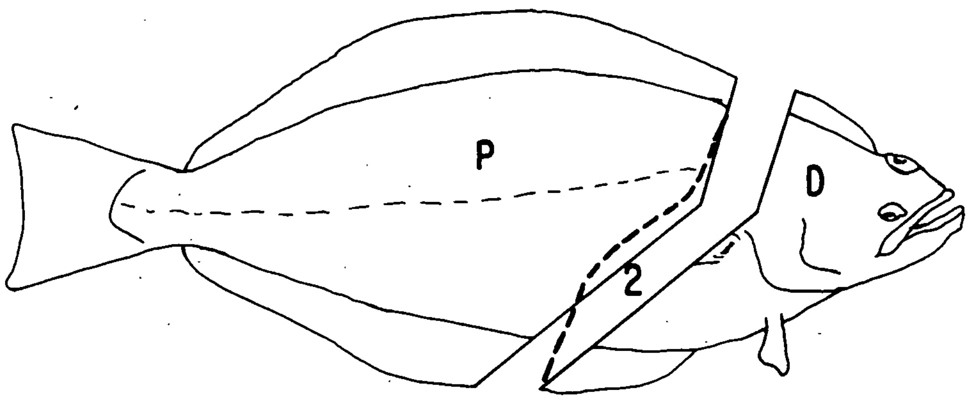
Fig. 4. (cont) Gutted head off redfish products illustrating configuration of observed head cuts.



WITCH, GUTTED HEAD OFF, COLLAR BONE OUT (SINGLE CUT) C.F. = 1·25

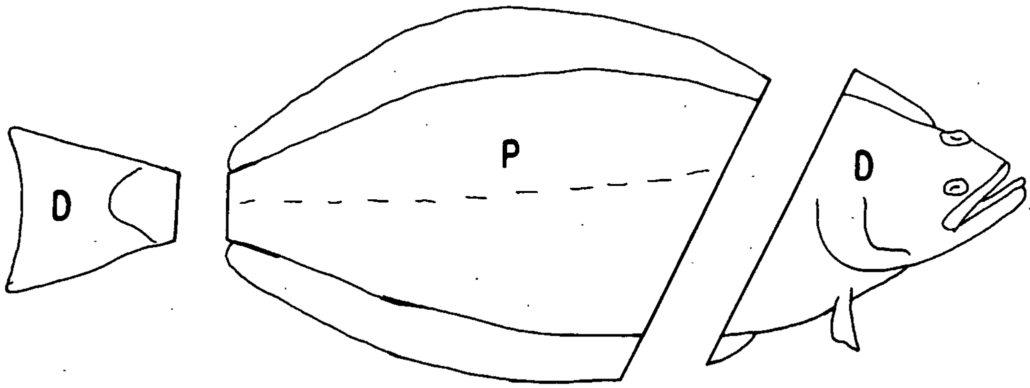


GREENLAND HALIBUT, GUTTED HEAD OFF, COLLAR BONE OUT (SINGLE CUT) C. F. = 1·46 (POL)

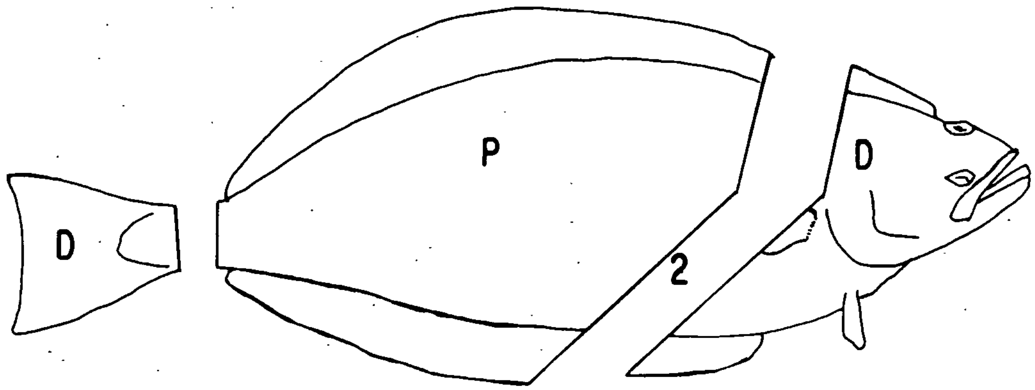


GREENLAND HALIBUT, GUTTED HEAD OFF, COLLAR BONE OUT (DOUBLE CUT) C.F. = 1·58, CUT No. 2 IS VARIABLE DEPENDING ON SEX AND MATURITY, CURVED CUT (DOTTED LINE) USED OCCASIONALLY

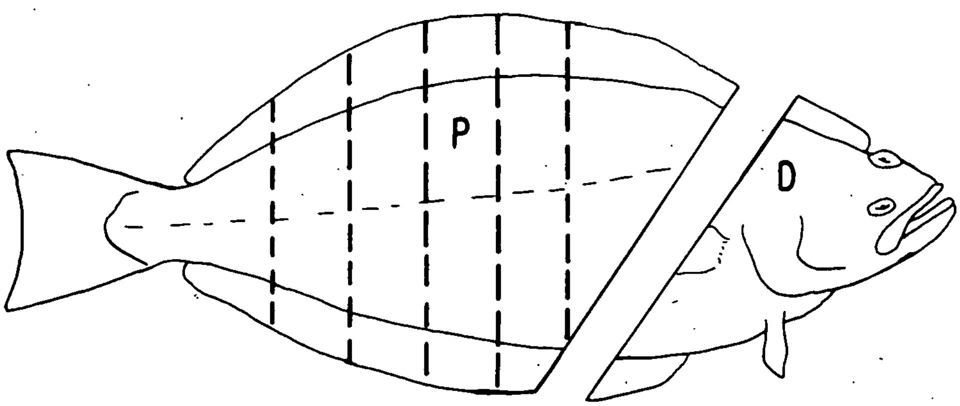
Fig. 5. Gutted head and tail off flatfish products illustrating configuration of head and tail cuts.



GREENLAND HALIBUT, GUTTED HEAD AND TAIL OFF, COLLAR BONE OUT (SINGLE CUT) C. F. = 1·49 (JAP), 1·58 (FAR, SOME FIN TRIMMING)



GREENLAND HALIBUT, GUTTED HEAD AND TAIL OFF, COLLAR BONE OUT (DOUBLE CUT) C. F. = 1·94, CUT No. 2 IS HIGHLY VARIABLE DEPENDING ON SEX AND MATURITY



GREENLAND HALIBUT, CHUNKED (STEAKED), BELLY FLAP OUT, TAIL INCLUDED, C. F. = 1·62

Fig. 5. (cont) Gutted head and tail off products illustrating configuration of observed head and tail cuts.