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Method for Determination of Fish Production Conversion Factors on Commercial Factory Trawlers

by

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ABSTRACT

Product to whole weight conversion factors have long been used to estimate catches at sea where direct weighing is impractical. The official list of factors for North Atlantic species, compiled by FAO is contained in Anon (1980). A subset of this list applicable to the western sector was published by the NAFO Secretariat (1980).

The Coordinating Working Party on Atlantic Fisheries Statistics (CWP) of the Food and Agriculture Organization (FAO) first recognized possible inaccuracies in the current published lists. Except for preliminary data presented by Kulka (1981) none had been derived by experiment at sea under uncontrolled production conditions in the North Atlantic. Many presently used appear to correspond with maximum machine yield capabilities and are not representative of the average situation. Although accuracy and complexity of conversion factors have been topics of discussion at CWP and more recently NAFO and CAFSAC meetings, no written description of collection and analysis procedures have accompanied existing lists of factors. This paper outlines in detail specific methods for technicians collecting data from vessel factories. In order to achieve conformity in deriving conversion factors a standard list of product types, including detailed descriptions, standard sampling methodology with a description of commonly encountered problems and suggestions for data analysis are given. Also, some of the factors which affect magnitude and associated variance of product yield are discussed.

RESUME

On utilise depuis longtemps des facteurs de conversion poids du produit à poids du poisson entier dans l'estimation des prises en mer quand des pesées directes ne sont pas pratiques. Anon (1980) contient la liste officielle des facteurs de conversion d'espèces nord-américaines, compilée par la FAO. Une sous-série de cette liste, applicable au secteur occidental, a été publiée par le secrétariat de l'OPANO (1980).

Le Groupe de travail pour la coordination des statistiques de pêche de l'Atlantique (CWP) de l'Organisation pour l'alimentation et l'agriculture (FAO) a été le premier à reconnaître la possibilité d'erreurs dans les listes existantes. Sauf pour des données préliminaires présentées par Kulka (1981), aucun facteur n'a été établi sur la base d'expériences en mer, dans des conditions de production non contrôlées, en Atlantique nord. Plusieurs facteurs actuellement utilisés semblent correspondre au rendement maximum des machines et ne sont pas représentatifs de la situation moyenne. Bien que la précision et la complexité des facteurs de conversion aient été l'objet de discussions au sein du CWP et, plus récemment, aux réunions de l'OPANO et du CSCPCA, les listes actuelles ne sont pas accompagnées de descriptions des procédés de collection et d'analyse. On trouvera dans le présent article une description des méthodes spécifiques, à l'intention des techniciens chargés de recueillir des données à bord de navires-usines. Afin d'uniformiser la marche à suivre dans la détermination de facteurs de conversion, on inclut une liste standard de types de produits, y compris descriptions détaillées, méthodologie d'échantillonnage standard et problèmes communément recontrés, ainsi que des suggestions pour l'analyse des données. Nous analysons enfin certains facteurs influançant l'ampleur du rendement en produits et la variance qui lui est associée.

INTRODUCTION

Conversion factors have long been used to determine whole weights from fish products both at sea and on shore. Their use serves as a good indirect method to estimate round catch weights. It is not practical to weigh round fish at sea, hence, in situ whole weight estimates using conversion factors applied against product in the hold often yield the most accurate values. Other methods such as "eyeball" estimates of the codend, or holding bin volumetric calculations tend to be less accurate and more time consuming. Precision in determination of stock size and allowable catches for the next fishing year depends to a large extent on the accuracy of fishing mortality estimates and these in turn depend on the reliability of removal data. Accuracy of conversion factors contributes to the quality of the these removals records. For this reason it is useful to examine product to whole weight conversion factors.

In the late 1960's the Food and Agriculture Organization of the United Nations (FAO) recognized the usefulness of conversion factors in deriving removal data and the practical problems involved with their use. They noted the rather large number of processes (and accompanying conversion factors) and the considerable variability of factors used between fleets fishing in the north Atlantic. The Coordinating Working Party on Atlantic Fishery Statistics (CWP) recommended that FAO undertake a compilation and review of all factors used by member countries for fish landed from the north Atlantic. This was the first step in the validation of current factors. In 1971 FAO produced a list of available whole to product weight factors ("Conversion Factors: North Atlantic Species", Anon, 1970). Since publication of this document, the list has been computerized to facilitate ongoing changes and additions. The most recent update of this list was published in 1980 as "Quantity Conversion Factors: Atlantic Fish Species, Landed or Product Weight to Live Weight" (Anon 1980).

The accuracy and complexity of conversion factors used have been topics of discussion at all meetings of the CWP through the 1970's and 80's. At the tenth session (1980), problems were noted in the development and use of representative factors for certain items, particularly complex processes such as those yielding fillets or cured products. At this meeting it was stated that "size and condition of fish have a large influence on recovery rates which may also fluctuate seasonally and by method (subprocess) of production". Also, it was stressed that possible improvement to values of conversion factors could be facilitated by "expanding the classification to include sub-classifications for fish sizes and processing methods". In these statements this group recognized several of the factors that can influence the magnitude and variance of conversion values. In 1980, the Northwest Atlantic Fisheries Organization (NAFO) extracted from the FAO data a list of factors relevant to the fisheries executed on the western side of the Atlantic (NAFO Secretariat 1980). This is the current conversion factor reference list for the countries fishing in the Canadian zone and is the document referred to in the rest of this paper as the "updated FAO list".

Often, countries require fleets of other nations fishing in their economic zone to report their catches either directly or through a fisheries regulating body, as is the case for Canada. Live weight equivalent converted from product weight is the most common type of data making up these catch reports. In 1979 the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) expressed concern over apparent diversity of factors used in the Canadian zone, particularly those used by foreign fleets. Subsequently, data were collected from selected vessels by fishery observers and the problem was confirmed (Kulka 1981). There were many occurrences of conversion factors used other than those contained in the updated FAO list. In certain cases, there existed very considerable discrepancies between vessels or fleets for similar processes. How factors were derived, including those compiled by FAO was unclear but it is thought that some are maximum yield values for equipment determined by the companies manufacturing those processing machines. Comparison of yield specifications in machine manuals with conversion factors used by the vessels indicated this to be the case in certain instances. In addition, other factors with origins unknown were used by certain fleets. It was obvious that most of these had not been derived experimentally under actual working conditions since used factors were often lower than those obtained in preliminary experiments carried out by observers. Maximum machine yield is very unlikely to be achieved in the working environment, particularly at sea. Biased reported round weight estimates due to the use of improper conversion factors were therefore a distinct possibility.

Because of the uncertain origin and considerable variation in conversion factors, the concept of collecting experimental data utilizing fishery observers at sea was developed. The method of determining values using simulated laboratory experiments was rejected because of possible error if exact simulation of factory conditions was not achieved.

In preliminary work on conversion factors at sea (Kulka 1981) significant discrepancies between experimental and used factors were noted. These findings warranted a full study in order to derive more realistic factors. This paper cited differences in size of factors between area, season, and processing method, differences due to size of catch (more loss of flesh when fish are placed through a machine or trimming procedure at a faster rate) and size of fish. Obviously, there exists influencing factors which significantly reduce the relative amount of product less than the maximum yield that a particular machine can produce. Also, several practical problems or barriers which could lead to biased results became apparent during the execution of preliminary experiments. Data collected in those early experiments must be considered as minimum estimates only since machines were often reset and hand trimming was either done much more carefully than usual or not at all. With this in mind a standard methodology is presented here along with a discussion of the problems encountered in performing experiments. The methods outlined pay attention to practical detail. This approach is the key to gathering realistic data from a rather uncontrolled environment.

METHODS

Scientific personnel must be placed on board vessels during periods spanning much of the regular fishing activity to facilitate the acquisition of representative production data. Simulated lab experiments for most machine and hand processes would be inadequate. Information derived from such lab work could be biased because it would not be affected by factors encountered only in the actual working environment. Effects of different machinery or even age of the machinery, differences in cutting or trimming techniques between individuals or crews and biological differences in the processed species are examples of such factors. The procedures for collecting such data can be handled adequately by two trained people in detailed, large-scale experiments or by one person on a limited basis in a monitoring mode. Utilization of fisheries observers to perform conversion factor experiments in conjunction with their regular duties has been tested and proven to be feasible. The nature of an experiment allows for one person to monitor all stages adequately in order to make sure that the procedures are not adversely affected in any way. Since experiments can be extensive and time consuming, the observer would be restricted to simple, single process tests. Given the wide coverage by observers this approach would allow for an overview of production factor levels for many fleets and processes.

While performing more detailed experiments, ie. quantitatively defining the components contributing to the variance, it is better to use a team of two to collect the amount and the type of experimental data required. In order to carry out intervessel, interfleet, intermachine comparisons, or determine the relationship between size of fish and conversion factor or do time series experiments, large numbers of more complex experiments are necessary.

Prior to performing any experiments it is important to gather relevant data pertaining to the factory operation. This can be written into a structured trip report. Specifications for machines used and products produced should be noted and recorded. It is particularly important to observe and define the subprocesses and the extent to which each is used. By a series of observations throughout the trip, actual machine and factory capacities can be estimated and compared to theoretical capacities recorded in the manufacturers handbook. Factors that limit maximum turnout should be noted. Included should be a narrative specifying how production figures, fishing log figures, and reported catches were derived. An accompanying diagram of the factory showing layout of the various processing machines and a flowchart of processing routes will also aid in the definition of factors that limit turnout, processing efficiency and product yield.

The handling of various species can differ quite significantly between countries, fleets, or even individual vessels. Confusion may arise as to which process or subprocess was used and what it should be called. To avoid confusion, each process encountered should be documented in the report and accompanied by diagrams of fish showing such details as cut angles and extent of trimming. Factors that might adversely affect product yield should also be recorded. These may range from quality of fish, biological influences such as gonad size or fish size, to quality and maintenance of equipment (poor quality leading to excessive waste of muscle) and the extent of hand trimming performed. Finally, a record must be kept of the conversion factors in current use by the vessel and their origin, where possible. To insure proper experimental procedures and sample selection, much of this data should be compiled during the first few days of the trip. Particular attention should be paid to such practical details as convenient sampling position as well as observation points along the route of production.

Once practical aspects are worked out, consideration can be given to the type of sample to be selected. In order to simulate actual factory conditions the samples can be selected by factory personnel. If the aim is to determine an average factor for a vessel, random size samples of a single species should be collected. A processing machine, however, is restricted in the size of fish that it can process. Within a randomly selected sample taken from a catch it is possible that size of some fish may fall outside the limits of the processing machine. When this occurs the under or oversized fish will have to be removed leaving a preselected size range conforming to the machinery. Forcing improperly sized fish through a processor would produce erroneous results. Complete randomness is not preserved by this method for testing of a particular machine but it does simulate actual conditions. The machinery can often accommodate a wide size range and this tends to be a minor problem or vessels will carry several types of machines for a single process that together can handle the full size range of fish being caught. In order to determine an average conversion factor regardless of machine or combination of machines used for processing, the randomly selected sample must be partitioned into size strata conforming to the size range capabilities of each of the machines being used. Each component of the original sample can then be put through the appropriate processing machine. For this approach the experimenter would have to select a sufficiently large sample such that there are enough fish in the smallest component. Sending an insufficient number of fish through a machine could produce unreliable results given the considerable variability from fish to fish in the position of flesh cuts and proportion of parts removed. The sample components once processed, can be recombined and weighed. This approach has two drawbacks. The first is that it does not illustrate differences between machines. The second is that two or possibly three machines would have to be monitored simultaneously. Considerable preparation, attention to detail and a team of two would be necessary to perform this type of operation. Alternatively a series of independent size selected samples conforming to each of the various machine types can be processed and then post-weighted according to the actual size distribution in the catch. Both of the above methods will result in an average conversion factor for the size of fish taken and will also yield data differences between machines.

A second more specialized type of experiment would involve choosing a range of size selected samples in order to test the effect of fish size on magnitude of conversion factor. Since overall variance is quite high, relatively large numbers of samples are necessary in order to obtain a clear answer whether correlation between size of fish and size of conversion factor exists over the range of a particular machine or over the range of all sizes caught. An experimenter should be able in most cases to obtain about 35 samples during 3 weeks of fishing, a sufficiently large number of samples for the above design. Of course the proportion of each of the design types used depends on the type of answers desired.

Samples thus obtained (random or size selected) must be carefully weighed, measured, and counted. Since loss of some product units (ie. fillets) during normal processing operations is not unusual it is important to count not only whole fish in the sample prior to processing but also the product units as they emerge from each stage. This ensures that error will not be introduced into the results due to abnormal product loss or gain. Often, practical problems related to processing by the crew arise and can affect the outcome of the experiments. Any abnormalities in processing procedures should be noted on the data sheet as per Table I. For weighing samples it is necessary for the sake of portability to use light, compact scales. Chatillon spring dial models of 100 kg capacity, similar to those used on research vessels are adequate. Heavier but still portable triple beam balances (ie. Chatillon model PBB52) may provide superior measures as they are affected less by vertical movement due to sea swell. Some accuracy in sample weights is sacrificed using portable models but practical matters such as sea transfer dictate that they be used. To overcome part of the problem a second scale might be used to verify the first reading. Ships scales can often be used for this purpose since they are usually quite accurate.

From preliminary work it has been determined that 250 kg is a practical upper limit for sample size. On some vessels the limit may be lower and sample size will have to be reduced. Samples larger than 250 kg can cause excessive disruption to the factory operation as well as creating too large a workload for the experimenter, thereby reducing monitoring effort. A sample of about 200-250 kg will delay regular production for only about 20 minutes to ½ hour if properly planned.

Records of weights, measurements, and counts for each experiment can be recorded on any standard frequency recording sheet. The raw data, sample weight, counts, and mean size of fish (unsexed) can then be summarized onto a form that includes the following information: vessel identifier, species processed, flag of vessel, sample number, set number, date, process method (see Table III for a coded list and description of processes), whole weight of fish, product weight, number of fish in the sample, type of processing machinery, the area fished, and type of sample ie. random, size selected, etc. An additional category called "problem type" may be added in order to code, on an experiment by experiment basis, information which might detrimentally affect the outcome. A general form containing all of the above categories is presented as Fig. 1 and is recommended as the standard format.

Prior to performing experiments, communication with the captain or fishing captain is essential. The timing of runs and selection of machines must be prearranged. Attention to such practical details can ensure the success of the operation. It is also important to inform factory personnel operating the equipment to be tested that no special measures should be taken during the experiment such as tuning of machinery or more careful trimming procedures. The aim is to obtain an average value reflecting typical product yield rather than a machine optimum factor.

Once the appropriate morphometric data have been recorded, the production equipment to be used should be cleared and the sample can then be passed through the machinery. It is important to monitor each stage carefully making sure no fish are added or lost. Any occurences leading to altered yield should be recorded. Because the experiment is performed in a rather uncontrolled environment careful monitoring procedures and attention to detail are essential. Once the fish have passed through, the product must be counted to confirm that number of fish in equals number out aside from normal product loss. The sample can then be reweighed. If there are intermediate processes such as heading and gutting before filleting, the intermediate product weights should be recorded. In this way experimental efficiency can be maximized. The final step is to divide whole weight by product weight to yield the conversion factor estimate for a particular experiment. Conversion factor estimates are determined by using whole weight to product weight ratios rather than using the inverse of the slope from a regression of whole weight on product weight. This is done because sample weights (whole) are restricted to a narrow range averaging about 250 kg (or some other practical upper limit). As previously mentioned, larger sample size would cause excessive disruption in the factory and smaller size may result in weight estimate problems due to relative magnitude of hanging balance error.

The experimental design will as always depend on the type of answer required. In the simplest case the experimenter may wish to determine a mean conversion factor value for each process category with appropriately small variance. Raw samples may be grouped according to process method, machine type, stock area, vessel (particularly where hand processing predominates), and condition of fish (size, gonad stage, etc.). An analysis of variance would determine which cells were not significantly different and these could be consolidated, thereby reducing the number of categories. In preliminary experiments the standard deviation of the mean for certain of the fillet processes with widely varying degree of hand trimming, ranged as high as 0.25 (all other processes had lower variances). In these categories where very high variances were observed, to estimate population mean by $\bar{x}$ with an error of no more than 3% at the 95% confidence level, about 30 samples would be needed. Most experimental groups, however would require less intensive sampling per category due to lower expected variance. A minimum of 10 samples per cell is recommended for most process categories in order to ensure an adequate level of precision. This level of sampling intensity can easily be achieved if vessels are grouped into a single category (ie assume no significant differences between vessels). Otherwise experiments designed to test inter-vessel difference would require large numbers of samples depending on fleet size.

In the context of commercial operations it is practical to reduce the number of production categories and corresponding conversion factors. It is very impractical for estimating catch weights to have different factors for each area, season, or subprocess, hence consolidation of categories should be done where possible. Amalgamating the groups also has the obvious advantage of increasing sample size in the pooled cells. Before cells comparisons are carried out variance of classes to be grouped should be checked for homogeneity using a procedure such as Bartetts test (Ostle and Mensing 1975) and frequencies of means should be checked for normality. An effetive method is that of Shapiro and Wilk (Shapiro and Wilk 1965).

RESULTS

Many of the large trawlers of the foreign fleets have elaborate factories containing many types of fish processing machinery capable of producing a variety of market products from all commercial species. From preliminary observations a list of the most common machine types was compiled. A description of each type including maximum output, production range, theoretical yield and fish size capacity is presented in Table II. It can serve as a quick reference for anyone collecting or analysing conversion factor and auxillary technical data on processing. It is particularly useful to compare theoretical and actual machine efficiency as it has a direct bearing on product yield. These differences in efficiency can often provide an explanation for differences between vessels carrying similar equipment.

During a preliminary data collection program it was noted that product was often significantly higher during experiments than during actual production operations. This was due to more efficient setting of machinery and greater care taken by the crew while trimming of the product. Although this problem can often be avoided by properly instructing the factory crew prior to a run, when it cannot the problems should be noted on the data sheet. Table I provides a list of coded problem types.

None of the previously published data on conversion factors was accompanied by descriptions of product types that were included in the lists. In order to standardize the product descriptions and eliminate semantic ambiguities, a list of processes and accompanying detailed descriptions was developed. They are presented in Table III. Much of the data included in this table were derived from processing machine hand books and in situ observations and were made to conform as much as possible to definitions used by industry. Where discrepancies were noted between countries or vessels, the dominant description was used.

CONCLUSIONS

Conversion factors of uncertain origin have been in use for many years to derive catch weights of round fish from product in the hold. These factors have seldom if ever been scientifically derived from production line experiments in the factories of commercial vessels such that they reflect actual yield. Many of the existing values represent maximum machine yields listed by manufacturers of the processing machinery or modified versions of such. Preliminary experiments illustrate that those maximum levels are seldom achieved. Also, single factors often apply to a wide range of species even though the official FAO list is given on a species by species basis. It is very likely that different species have significantly different yields for a given product.

In order to derive accurate estimates of removals, conversion factors must be species specific and as precise as possible. The methodolies outlined in this paper are designed to capture the appropriate data. Standardization, particularly of processing method definitions is the primary step to producing a reliable series of product to whole weight conversion factors. In situ experiments following standard procedures are necessary to improve this particular aspect of commercial fishery data acquisition.

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Table I. CONVERSION FACTOR PROJECT

PROBLEM TYPES

CODE	DESCRIPTION
2	Minor adjustments to processing equipment by the crew in order to enhance product yield (machines more finely tuned than normal).
3	Major adjustments to processing equipment by the crew in order to enhance product yield.
4	Hand trimming procedures more carefully done than is typical (removal of blood spots and fins) leading to greater yield.
5	Reduced edge trimming on the top quality products leading to abnormally high yield (refers to trimmed products only).
6	Minor adjustments to equipment and more careful hand trimming procedures conjunctly leading to abnormally higher yield ("untrimmed product")
7	Major adjustments to equipment and more careful hand trimming procedures leading to high yield ("untrimmed product").
8	Minor adjustments to equipment and reduced edge trimming (trimmed product only).
9	Major adjustments to equipment and reduced edge trimming (trimmed product only).
10	Lost product (less than 1% yield), atypical of this equipment.
11	Lost product (1-3% of yield), atypical of this equipment.
12	Lost product (greater than 3% of yield), atypical of this equipment.
13	Lost product (less than 1% of yield) due to improperly set equipment or crew interference. This was the typical situation throughout the trip.
14	Lost product (equaling 1-3% of the yield) due to improperly set equipment or crew interference. This was the typical situation throughout the trip.

Table I. (Cont'd.) CONVERSION FACTOR PROJECT

PROBLEM TYPES

CODE	DESCRIPTION
15	Lost product (greater than 3% of the yield) due to improperly set equipment or crew interference. This was the typical situation throughout the trip.
16	Poor quality fish (ie-fish gone soft from extended deck storage) leading to jamming of equipment resulting in reduced yield.
17	Addition of product during an experiment by the crew leading to artifically increased yield.
18	Enlarged gonads in the fish being processed possibly contributing to a reduced yield.
19	Full stomachs in the fish being processed possibly contributing to a reduced yield.
20	Oversized or undersized fish being forced through the equipment leading to reduced yield.
21	Headed fish (ungutted) with partial removal of viscera with the head.
22	Excessive removal of meat during processing due to improperly tuned or ageing equipment (typical of the operation.
23	Not the dominant process used during this trip.

Table II. Selected modern fish production machinery

Name of Machine	Product	Species	Max. Output (prod. Unit/ min)	Production Range (kg/hr)	Theoretical Yield (%)	Fish Size Range (cm)	Comments
Baader 38	filleting	gadoids	40 (fish)			40-55	
Baader 47	skinning	whitefish redfish flatfish	60 (fillets)				high quality small fish (max 220mm fillets).
Baader 50 (Baader 51 similar)	skinning	whitefish flatfish	150 (fillets)				high yield large fish adjustable
Baader 57	skinning	whitefish	50 (fillets)				
Baader 150	filleting	redfish	40 (fish)	409-1544 (at 34%)	32-37 (ungutted)	30-55	can handle ungutted fish unskinned
Baader 157	filleting	redfish	80 (fish)	150-850 (at 33%)	33 (ungutted)	17-35	ungutted fed unskinned
Baader 158	gutting	whitefish	55 (fish)	500-2000 at 85%	85	25-45	head on collar bone attached
Baader 159A	gutting	gadoids	40 (fish)			35-77	" "

Table II. (cont'd.) Selected modern fish production machinery.

Name of Machine	Product	Species	Max. Output (prod. Unit/ min)	Production Range (kg/hr)	Theoretical Yield (%)	Fish Size Range (cm)	Comments
Baader 160	heading gutting	gadoids	40 (fish) (25-40)			35-70	
Baader 161	heading gutting	gadoids	28 (fish)			50-90	Head cut optional (V-shaped cut)
Baader 162	gutting	gadoids	28 (fish)			50-90	Head cut optional V-shaped cut
Baader 166	gutting	gadoids	40(fish) (28-40)			35-70	head cut optional v-shaped cut
Baader 170	filleting	flatfish	40 (fish)	150-400 (at 47%)	47 (from gutted)	25-35	
Baader 175	heading	flatfish	40 (fish) (30-40)	400-2500 (at 45%)	45 (skin on)	31-52	gutted or ungutted or bobtailed
Baader 184	filleting (skinning)	whitefish (incl.gadoids)	24-40(fish)	250-2500 (at 48%)	48 (after gutted)	30-70 (27-55 modified)	collar bone cutter avail. pregutted & headed

Table II. (cont'd.) Selected modern fish production machinery.

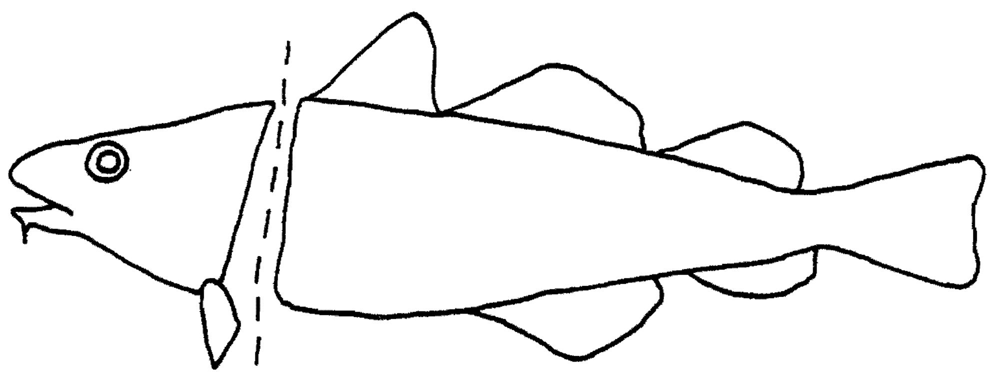
Name of Machine	Product	Species	Max. Output (prod. Unit/ min)	Production Range (kg/hr)	Theoretical Yield (%)	Fish Size Range (cm)	Comments
Baader 185	filleting (skinning)	whitefish (incl.gadoids)	24-34(fish)		~48	50-100	must be pregutted & headed
Baader 188	filleting	whitefish (incl.gadoids)	27(fish)	200-1700 (at 42%)	42 after gutting	35-70	must be pre-gutted & pre-headed
Baader 189	filleting	gadoids	24-34(fish)	400-3200 (at 45%)	45 (after gutting)	40-85	must be pre-gutted & headed with collar bone cutter
Baader 190	filleting	gadoids					similar to 189
Baader 338	filleting	gadoids	40 (fish)			50-70	
Baader 410	V-cut heading	whitefish	24-34(fish)	400-3200		40-85	matched to a B189 (fillet)
Baader 412	V-cut heading	whitefish				50-120	
Baader 415	round cut heading	whitefish	26-39(fish)			50-110	"klipfish production" for dryed fish products.

Table II. (cont'd.) Selected modern fish production machinery.

Name of Machine	Product	Species	Max. Output (prod. Unit/ min)	Production Range (kg/hr)	Theoretical Yield (%)	Fish Size Range (cm)	Comments
Baader 417	wedge-cut heading	whitefish	40(fish)			30-70	goes to fillet production (B187)
Baader 419	wedge cut heading	whitefish	25(fish)				
Baader 424	straight cut heading suction gutter	whitefish	60(fish)			30-110	cuts at any angle. ie, redfish angle cut.
Baader 440	Split (saltfish)	gadoids	25(fish)	2000-18000		50-120 (40-100)	headed and gutted first

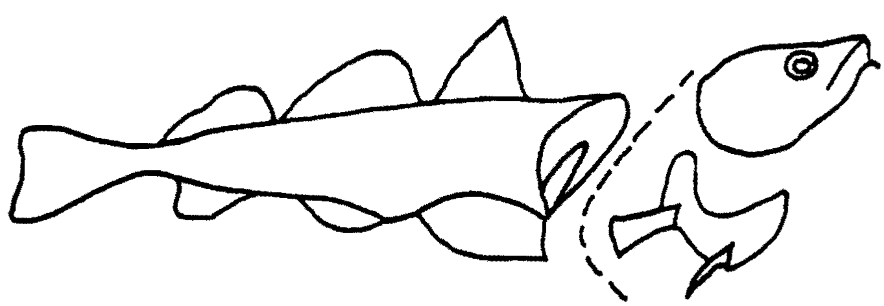
Table III. A Description of Product Types (Northwest Atlantic).

Code	Product Description
010	Head off, by machine unspecified (not gutted) - Several types of of cuts can be made, often specific to further processing, (ie. filleting, splitting, etc). Four major types have been identified as described in 012 to 015.
011	Head off, by hand (not gutted) - Head removed by hand with viscera intact.
012	a) Straight cut - single simple cut just posterior to the gill flaps, often done on simple machines such as a band saw as follows:



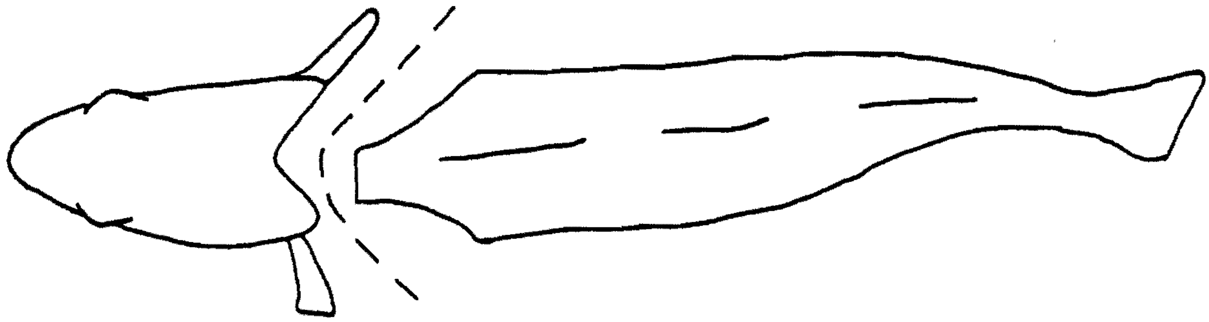
The final product from this operation is often gutted.

013	b) V-cut heading - Laterally flat cut, V-shaped on the side view, designed to remove collar bone but retain maximum neck meat as follows:



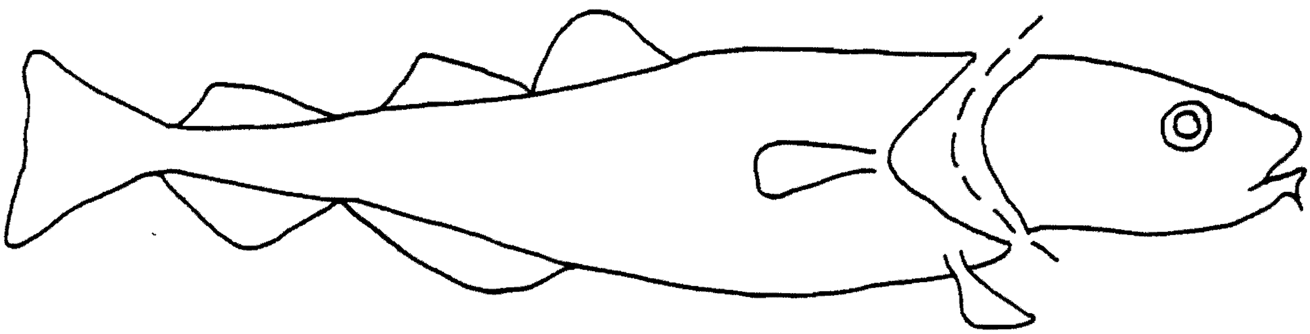
This process often precedes filleting

014 c) Wedge cut heading - Wedge shaped cut in the lateral plane, collar bone, removed, maximizes neck flesh and prepares fish for filleting as follows:



usually precedes filleting.

015 d) Round cut heading - Very similar to the v-cut but with the collar bone intact as follows:



- always precedes splitting.

100 Gutted - Total removal of viscera by machine or hand, head intact.

106 Gutted, head off (straight cut) - head removed as described above, total removal of viscera.

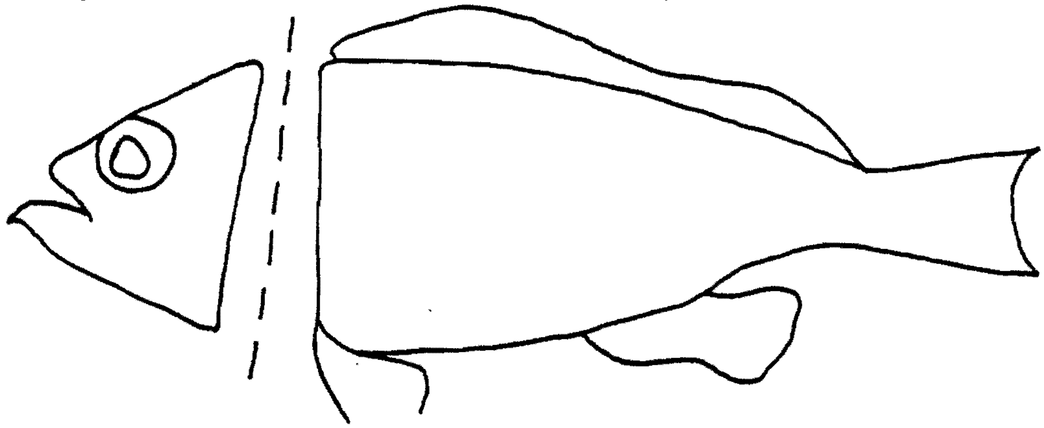
107 Gutted, head off (V-cut)- head removed as described above, total removal of viscera.

108 Gutted, head off (Wedge-cut) - head removed as described above, total removal of viscera.

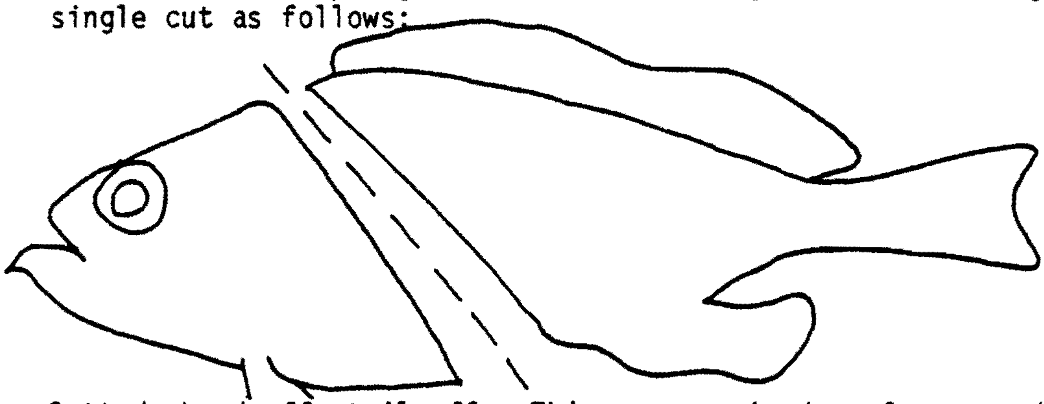
109 Gutted, head off (Round-cut) - head removed as described above, total removal of viscera.

110 <u>Gutted, head off (unspecified)</u> - head off by hand or machine, total removal of viscera.

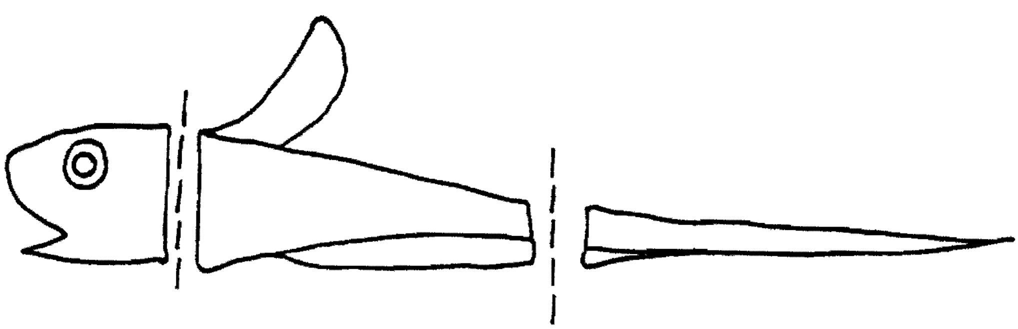
111 <u>Head off, straight cut, (redfish)</u> - Special case for redfish using a very similar cut to that described in process 012 as follows:



112 <u>Head off, diagonal cut, (redfish)</u> - Special case where head is removed at a sharp angle with much of the gut removed during the single cut as follows:



120 <u>Gutted, head off, tail off</u> - This process is done for grenadiers only as shown;



121 <u>Gutted, head off, tail off trimmed</u> - This process is done for grenadiers only as shown above but with all fins removed.

122 <u>Gutted, head and tail off, fins trimmed, scaled</u> - same as process 121, with scales scraped.

123 <u>Gutted, head and tail off, scaled</u> - same as 120 but with scales scraped.

124 <u>Gutted, head and tail off, boneless, trimmed</u> - same as process 121, bones removed.

125 <u>Gutted, head and tail off, boneless</u> - same as process 120, bones removed.

126 <u>Gutted, head off, fins trimmed</u> - same as process 110 but with fins removed.

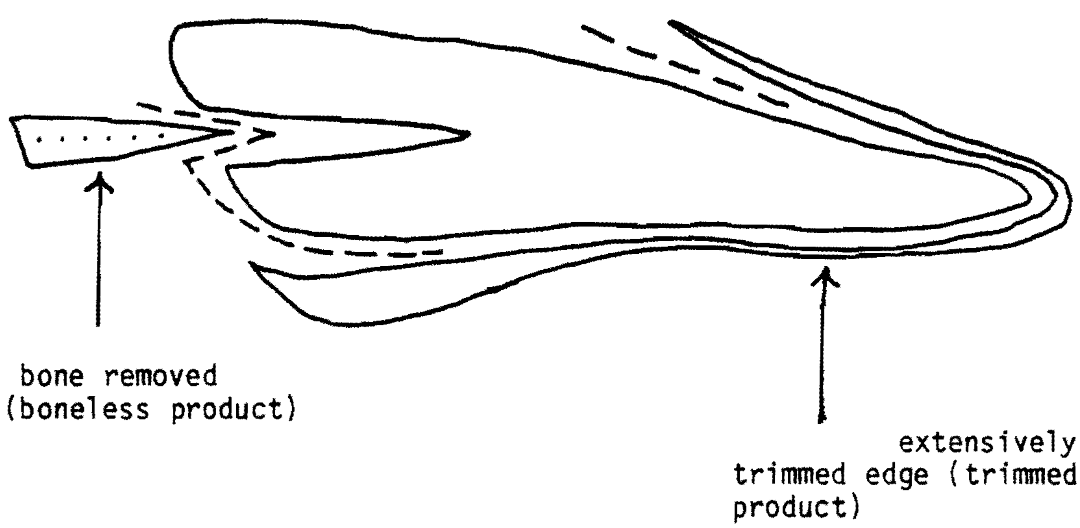
128 <u>Gutted, head and tail off, fins trimmed</u> - for porbeagle only, same as process 126, but tail removed.

129 <u>Gutted and gilled</u> - Viscera and gills removed.

130 <u>Split fish green (gutted, head off, soundbone removed)</u> - fish are headed and gutted by machine or hand using the round cut (process 015). The backbone is then removed and the fish are split open ready for salt.

135 <u>Split fish, salted (gutted, head off, sound bone removed and in salt)</u> - as in process 130 but after fish have been cured in salt.

200 <u>Fillets, skinless, boneless, trimmed</u> - skin removed by hand or machine, blood spots and fin parts removed, bones (lateral spines) removed and extensive edge trimming particularly at the belly flap. This is the highest quality product possible and one with the lowest yield as follows:



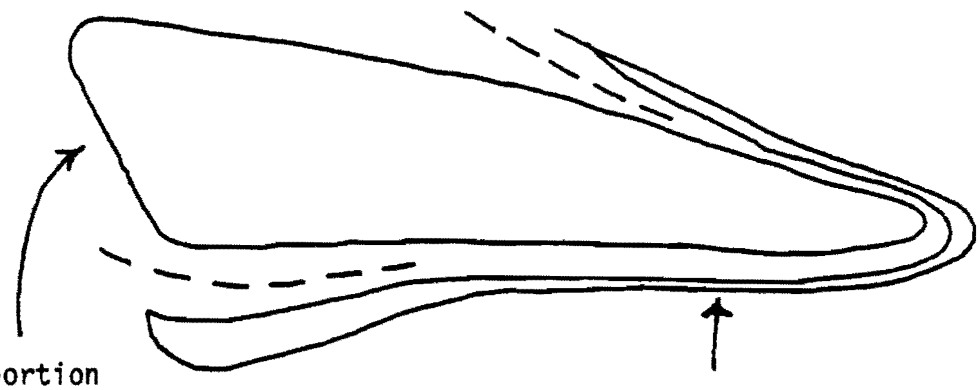
* - removal of blood spots and fins parts does <u>not</u> constitute "trimming"

**- "<u>boneless</u>" refers to the removal of the lateral spines at the midlateral, anterior position of the fillet by a V-shaped cut.

201 Fillets, scaled, boneless, trimmed - same as process 200, with scales scraped but skin left on.

202 Fillets, skin on, boneless, trimmed - same as process 200 with skin and scales intact.

203 Fillets, skinless, bone in, trimmed - same as process 200 but with bone (lateral spines) intact as follows:

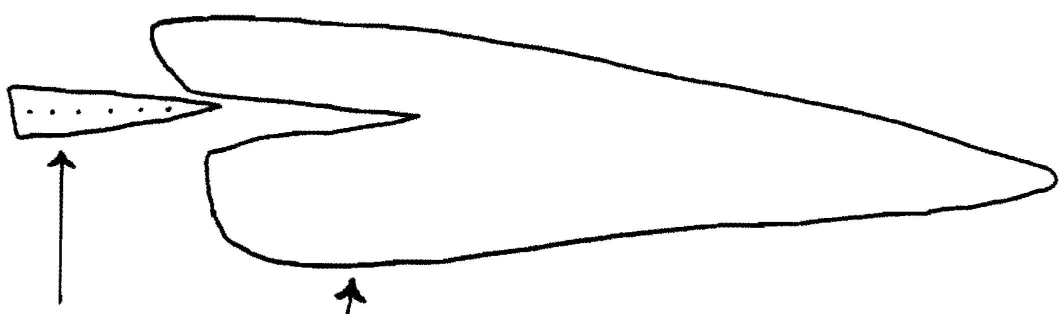


* removal of blood spots and fin parts does not constitute "trimming".

204 Fillets, scaled, bone in, trimmed - same as process 203 but scales and skin intact.

205 Fillets, skin on, scales on, bone in, trimmed - same as process 203 but with skin and scales intact.

210 Fillets, skinless, boneless - skin and V-portion with spines removed (as in process 203) but no trimming. Blood spots and fin portions removed as follows:



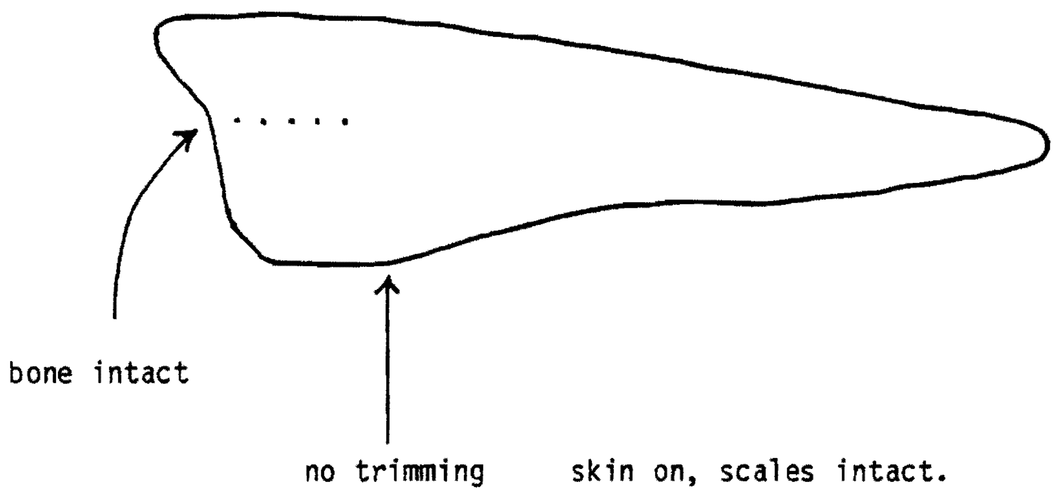
211 Fillets, scaled, boneless - same as process 210 but skin intact and scales scraped.

212 Fillets, skin on, scales on, boneless - same as process 210 but with skin and scales intact.

213 Fillets, skinless, bone in - same as process 203 with skin removed but no trimming, ie blood spots and fin bits removed but no trimming of the fillet perimeter. Lateral spines are intact.

214 Fillets, scaled, bone in - same process as 213 with skin intact but scales scraped.

215 Fillets, skin on, scales on, bone in - Fillets as they emerge from the machine after removal of blood spots and skin bits. No special removal of bone or perimeter flesh as follows:



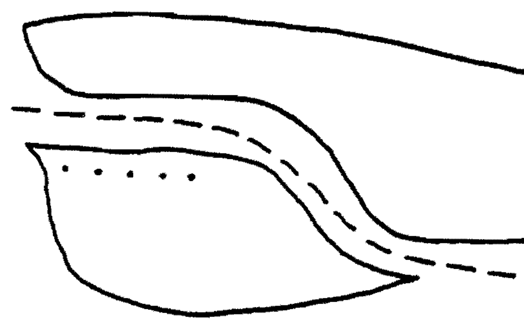
300 V-cut fillets, skinless, trimmed - special cut fillet that has the bone and belly flap removed. In addition, the perimeter is trimmed and the skin removed as follows:

301 V-cut fillets, scaled, trimmed - the same as process 300 but with skin intact and scales scraped.

302 V-cut fillets, skin on, scales on, trimmed - the same as process 300 but with skin and scales in tact.

304 V-cut fillets (unspecified) - V-cut portion removed but further processing is unknown.

310 V-cut fillets, skinless - same as process 300 but no trimming of the perimeter (blood spots and fin bits removed) as follows:



311 V-cut fillets, scaled - same as process 310 but skin intact and scales scraped.

312 V-cut fillets, skin on, scales on - same as 310 but with skin and scales intact.

400-416 Topside fillet only - This series of 16 subprocesses apply only to turbot and the secondary subprocessing (ie. trimming) is identical to the 300 series descriptions but with only the top fillets removed (see 300-312).

503 Livers - whole livers removed.

504 Bodies (head off, gutted, topside fillet removed) - This product refers only to turbot. It is the remainder after removal of the topside fillets, the head and the viscera.

505 Head only - usually refers to turbot.

510 Tail off (bobtailed) - refers to flatfish only. The tail at the caudle peduncle is removed.

600 Cooked peeled frozen (shrimp) - head, legs, and exoskeleton (shell) are removed and the remaining muscle cooked.

610 Cooked frozen (shrimp)- whole shrimp cooked.

700 Tubed (squid) - head, viscera and tail removed.

CONVERSION FACTOR DATA SUMMARY

Page ___ of ___

VESSEL NAME ______________________ SPECIES NAME ______________ TRIP NO. (1-3)

CFV (4-13) SPECIES CODE (14-17) COUNTRY (18-19)

3	3		6		3	4	4	5	3	3	4	2	3	1	
SAMPLE NUMBER	SET NUMBER	YY	DATE MM	DD	PROCESS METHOD	WHOLE WEIGHT	PRODUCT WEIGHT	CONVERSION FACTOR	NO. OF FISH	MEAN LENGTH	MACHINE TYPE	PROBLEM TYPE	NAFO DIV.	SAMPLE TYPE	COMMENTS

Fig. 1. Format for the Conversion Factor Data Summary Sheet.