Northwest Atlantic  Fisheries Organization

Serial No. N6415 **NAFO SCS Doc. 14/24**

SCIENTIFIC COUNCIL MEETING – 31 MAY-12 JUNE 2014

Standardized Conversion Factors in the NAFO Regulatory Area: Pilot Project
(originally STACTIC Working Paper 13/26 - Presented by Canada -)

Background

It was agreed at the 2013 STACTIC Intersession that the sampling methodology provided in STACTIC WP 13/3 (NAFO 2013) would be adopted in "concept" and that Canada would develop a modified implementation proposal with the view of reducing the scope and complexity of the methodology. Accordingly, Canada has formulated an abbreviated framework.

Proposal

It is proposed that STACTIC members approve a pilot conversion factor sampling project that:

1) as a first step would examine product conversion factors for Greenland Halibut in the NRA, to will take place over one fishing season, conversion factor experiments to be done by trained technicians during normal production operations

2) as a minimum, 15 samples per product form per country be done, each sample consisting of no less than 40 fish.

3) in the absence of Greenland Halibut fishing while the conversion factor technician is deployed, there is the option to sample other species/products that are being produced to provide preliminary information for later potential work.

Rationale for sample size is elaborated below in the abbreviated framework (Pilot Project - A Sampling Framework for Determining Standard Conversion Factors for Greenland Halibut in the NAFO Regulatory Area).

Deployment Strategy

To accomplish these goals, a level of coverage on the fleets fishing for Greenland Halibut is proposed. The table below shows a count of vessels fishing Greenland Halibut in the NRA (average of the previous 2 fishing seasons). Vessels may fish other species as well in any given month but a vessel is counted if it fishes Greenland Halibut for all or part of the month.

		# Vessels fishing Greenland Halibut											
Avg # Vessels		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
7.1	**ESP**	9	8	8	8	8	8	7	8	8	6	6	1
4.9	**PRT**	1	4	9	8	6	6	3	4	6	5	5	2
2.1	**RUS**	2	2	3	4	2	1	2	2	1	2		2
1.0	**LTU**	1	1	1	1		1	1					
1.0	**EST**									1	1	1	1
1.0	**FRO**	1		1	1	1							

A potential deployment scenario to sample Greenland Halibut conversion factors against this observed fishing pattern of six fishing countries is shown in the table below where Col.2 is number of vessels to be deployed to, Col.3 is days deployed on each vessel, Col. 4 is number of observers deployed at any given time and Col. 5 is associated totals days at sea. For example, for Spain, 3 different vessels fishing Greenland Halibut would be covered for a total of 60 days, one sampling technician rotating among the 3 vessels, 20 days each during the fishing season

			Deployment	
Country	**# Vessels**	**# Days**	**# Conversion Factor Technicians**	**Total Days**
Spain	3	20	1	60
Portugal	2	20	1	40
Russia	2	20	1	40
Lithuania	1	20	1	20
Estonia	1	20	1	20
Faroes	1	20		20
Total			**5**	**200**

Note that 2 technicians would be deployed (rotated among) Lithuania, Estonia and Faroes vessels.

Thus, a total of 5 conversion factor technicians, spending 200 days at sea deployed to 10 vessels would be required to carry out the pilot project. Two hundred days represents about 4% of the fishing activity.

Details of the pilot project, sample, training and equipment requirements and deployment plan are elaborated below.

Pilot Project - A Sampling Framework for Determining Standard Conversion Factors for Greenland Halibut in the NAFO Regulatory Area

Introduction

Sustainable harvest of fishery resources entails a management scheme that incorporates **accurate records of fish catches** from the exploited stocks. A preferred method for estimating round weight catches involves multiplying weight of product in the hold by a product to round weight (whole fish) conversion factor. Due to observed variation in the conversions factors used in the NRA and uncertainty in terms of their accuracy and origin, it was agreed at the 2012 Annual Meeting of NAFO that a scientifically based, independent, and structured analysis is required to determine actual yield pertaining to the products produced from the various species of fish taken in the NRA (NAFO 2013). Following subsequent discussion concerning complexity of undertaking such a broadly based sampling program, it was decided in 2013 to start with a pilot approach, examining the products of a single species, namely Greenland Halibut.

Thus, the objective of this exercise is to design a sampling framework for the derivation of reliable fish product to round weight conversion factors for a single species, namely Greenland Halibut in the NRA based on the broader framework described in NAFO (2013).

Approach

Experiments designed to estimate weight loss from fish processed at sea should:

- represent actual (at sea) production
- be carried out by trained technicians in the factories of ships where the products are made
- target fleets fishing for Greenland Halibut during core fishing season
- ensure representative sampling of production.

Kulka (1981 and NAFO (2013) indicated that variation in processing (i.e. position of head cuts, degree of trimming) is the dominant factor affecting yield. Thus, **this pilot study should focus on method of processing**, detailing subprocessing (trimming level, head cut variants) while making sure that the sampling covers all major fleets and is seasonally and spatially representative of the fisheries for Greenland Halibut in the NRA. To obtain values representative of at sea production, conversion factor experiments must be done at sea by trained technicians in the factories of the vessels during normal production operations. More than one vessel from any fleet should be sampled since different vessels may process the fish differently.

Sample Requirements

The number of samples required to derive a reliable conversion factor for any given product depends on variation in the way that the product is processed, due to variation in cutting and trimming (also related to degree of accuracy of the weighing equipment). Since there is no a priori knowledge of variation in production variation in current fisheries, variance will not be known until after the samples have been collected and analysed. However, an examination of the historic work provides some idea of the sample volume required to derive a reliable factor (Table 1, extracted Kulka 1986). From those historic at sea studies, Kulka (1986) determined that coefficient of variation (a standardized measure of sample

variance) could kept at an acceptable level, less than 10%, if in general, sample size for any particular product exceeded about 15 experiments per specific product type. Thus, minimum number of 15 samples per product should be obtained for each of the various fleets to ensure an acceptable sample size and also to ensure that information on all subprocessing (that might vary among vessels) is captured. If variation in cutting occurs among vessels, it would be prudent to sample more than one vessel per fleet. The more experiments done, the lower the variance and the more reliable the estimate; a target of 15 samples per product per fleet should be considered as a minimum.

Nine known products are as follows: Gutted, Gutted head off, single cut, Gutted head off Japan cut, Gutted head off round cut, Gutted head and tail off, Gutted head and tail off, Japan cut, Fillet with skin & pinbone, Fillet without skin & pinbone, Fillet without skin, with pinbone, based on what was reported by the CPs (see Table 1b).However, it is likely that only 2 or 3 of those product types are being produced in today's fishery although this will not be determined until the project is carried out. The major products should be sampled to the specification stated above but as well, where opportune, minor products should be sampled as well.

Each sample should consist of no less than 40 fish, more if practical. This would allow for differences and head cuts and trimming among the fish in the sample. Average weight of Greenland halibut in commercial catches is about 7 kg (mainly in the 4 to 10 kg range). Thus 40 fish would weigh about 280 kg round. This number should be processed in a relatively short period of time.

Deployment Plan

Conversion factor technicians would be deployed, one per vessel and the duration of the deployment would depend on practical matters, for example, how the deployments are done (boarding in port, transfer at sea etc.). However, 20 day deployments are suggested as a target period. Where a deployment exceeds 20 days because there is no practical way to remove the technician within the 20 day time frame, then the technician can continue to carry out experiments throughout the duration of the trip. Also from a practical standpoint, during any given deployment, the sampling technician should ensure that experiments for each product type produced on that particular ship are done.

The EU has the largest allocation of Greenland Halibut in the NRA, 59% of the quota. Spain takes the largest catches of Greenland Halibut (48% of total in 2013) **fishing steadily from January to September**. Portugal, with the next largest catch (25%) takes most of its allocation during **March to May and in August-September**). Russia, with 18% of the catches fishes mainly during **April to July**. Other countries with small allocations are Estonia (**February-March and December**), Faroes (**January and April**) France, Lithuania, Latvia and Norway.

Vessels direct for Greenland halibut year round in the NRA. A sampling **Deployment Plan** would be based on recent fleet activity when directing for Greenland Halibut in the NRA (Table 1, Fig. 1). Number of vessels observed to be fishing for Greenland Halibut in any month was as follows: Spain – 6-9 except December (1); Portugal – 3-9 except January, Russia – 1-4. Other countries, Lithuania, Estonia and Faroes constituted 1 vessel per month during 4 months.

Thus, a deployment plan should allow for at least three vessels to be covered for Spain, 2 vessels for Portugal and Russia and one vessel for each of Lithuania, Estonia and the Faroes. The deployments for

Spain can occur in any month except December since there are between 6 and 9 vessels fishing for Greenland Halibut at any given time. For Portugal, the deployments are best set between February and November, for Lithuania, January to July, for Estonia, September to December and Faroes, January to May (Table 2, Fig. 1).

Each deployment for each vessel should be 20 days to ensure ample time to collect sufficient samples. Prior to deployment, it should be confirmed that the vessels will definitely be directing for Greenland Halibut during that period.

Qualifications and Training of Conversion Factor Technicians

Conduct of experiments designed to estimate weight loss from fish when processed at sea (conversion factor experiments) is best conducted by individuals with previous experience at sea working in the factories of ships fishing in the NRA collecting scientific data.

In order to carry out the work in an effective manner, the technicians will require training specifically on how to conduct conversion factor experiments. Training could be done over a period of 3 to 5 days, 3 day if individuals selected to do the work are experienced at going to sea on commercial fishing vessels in the northwest Atlantic and collecting scientific information while on board (trained technicians). The extra days would be required for safety training and familiarity of on board vessel processes for less experience individuals. The most effective training may be done by personnel who are familiar with sampling techniques and conditions at sea and have previously undertaken training in the collection of data at sea.

Training should include but not restricted to the following topics:

- **On Board Operations –** The technician will need to become familiar with the operations of processing factories on board offshore fishing vessels.
- **Safety –** Standard at sea safety training will be required. The focus should be on collection and processing of samples of fish in the ships factory.
- **Production Methods and Products** – The **conversion factor technician** will need to become very familiar with the different types of products that are produced on board the vessel. This would include understanding variations in how a particular product is cut, trimmed or otherwise altered. For example, shape of the head cut (angle of the cut, single cut vs. double cut) and location of the head cut (how far back) in head off product clearly influences yield, leaving more or less flesh on the body.
- **Sampling Methodology** – The **conversion factor technician** will have to learn how to select samples of fish for production, how measure and weigh those fish and how to track the sample through the various production stages.
- **Data Records and Coding** – The technician will need to become familiar with any forms designed to capture information on production and fish yield, including codes.

- **Interactions with Ships Crew** – The technician should be instructed on how best to interact with the ship's crew in order to gain cooperation in the conduct of conversion factor experiments.

- **Skill Testing –** Once trained, the technician will need to be tested to determine if the proper skill level has been achieved.

Equipment Requirements

Weigh Scales - The most important piece of equipment to be used to conduct conversion factor experiments would be a scale to weigh the samples, before and after processing. Such a scale must be of sufficient precision and have the capacity to weigh baskets of fish totalling about 25 to 75 kg. One product commonly used by the Canadian Atlantic fishing industry is Marel marine weigh scales (http://www.marel.com/systems-and-equipment/fish/Weighing/Marine-Scales/303/default.aspx?prdct=1).

Baskets – Several baskets are required to hold the fish and the fish products while they are being weighed. Specifications for such baskets are available from observer program companies and DFO.

Rope – If using hanging scales, some rope to hang up the baskets will be required.

Measuring board – A standard measuring board will be required to measure the fish. Boards can be obtained from DFO or the observer program companies.

Safety Equipment – Required safety equipment will be specified by the proper authorities i.e. what is required to be carried by anyone deployed to the vessel. Normally included would be an immersion suit, rubber safety boots, gloves and helmet, as required for work in the factory of the vessel. **Conversion factor technicians** would be outfitted in a manner similar to fisheries observers.

References

Kulka, D.W. 1981. An examination of the product form to whole weight conversion used by the foreign fleets in 1980 (Nfld. Observer Program). CAFSAC Res. Doc. 81/60. 38 p.

Kulka, D.W. 1983a. Method for determination of fish production conversion factors on commercial factory trawlers. CAFSAC Res. Doc. 83/25. 32 p.

Kulka, D.W. 1983b. Analysis of fish production conversion data collected in 1981 from the Northwest Atlantic. CAFSAC Res. Doc. 83/38. 14 p.

Kulka, D. W. 1983c. Analysis of cod fillet production conversion factor data from EEC vessels fishing in the Northwest Atlantic, 1982-1983. CAFSAC Res. Doc. 83/40. 15 p.

Kulka, D. W. 1985. A description of gutted and head off production for selected species with special reference to conversion factors from product to whole weight. CAFSAC Res. Doc . 85/105, 27 p.

Kulka, D. W. 1986. Aspects of offshore production of fish products for stocks of the Grand Banks and Labrador Shelf. Can. Tech. Rep. Fish. Aquat. Sci. No 1481. 46 p.

NAFO 2012a. Standardization of Conversion Factors in the NAFO Regulatory Area Serial No. N 6095 NAFO /FC Doc. 12/21 (Adopted) 2 p.

NAFO 2012b. Standardization of Observer program data and Reporting requirements in the NAFO Regulatory Area Serial No. N6096 NAFO/FC Doc. 12/22 (Adopted) 1 p.

NAFO 2013. Northwest Atlantic Fisheries Organization **Conservation and Enforcement Measures**. Serial No. N6131 NAFO/FC Doc. 13/1.

NAFO 2013. A sampling framework and methodology to determine standard conversion factors for selected fish species in the NAFO Regulatory Area. STACTIC WP 13/3.

Figures and Tables

Table 1a. Experimentally derived conversion factors in the NRA and surrounding waters (from Kulka 1986).

Product	Country	Sample size	Conversion Factor	Yield (%)	Coefficient of Variation
Species =Greenland halibut				0	
Gutted	All	83	1.09	92	2.4
Gutted, head off, single cut	Poland	109	1.46	69	5.43
Gutted, head off, double cut	GDR	13	1.58	63	5.4
Chunked (steaks)	GDR	8	1.62	62	4.33
Gutted, head and tai 1 off, single cut	Japan	19	1.49	67	6.25
	Faroes	40	1.58	63	4.76
Gutted, head and tai 1 off, double cut	GDR	5	1.94	52	12.52
Fi 11 et	Poland	35	2.42	41	5.04
Fillet, skinless, trimmed	All	74	2.96	34	6.41
Topside fillet, skin on	USSR	51	5.5	18	7.45
Heads	USSR	44	3.22	31	7.12
Bodies	USSR	59	2.44	41	10.75

Table 1b. Compilation of conversion factors used in the NRA, extracted from STACTIC WP 12/25 rev.1. Values are provided by each Contracting Party and are compared to the experimentally derived values from Kulka (1981, 1983 a, b, c, 1985) where applicable.

Country	Species	Product Form	Conv. Factor	Kulka Factor	% Diff.
EU	Greenland halibut	Gutted	1.08	1.09	0.92
EU	Greenland halibut	Gutted head off	1.39	?	
Faroes	Greenland halibut	Fillet with skin & pinbone	1,97		
Faroes	Greenland halibut	Fillet without skin & pinbone	1,97		
Faroes	Greenland halibut	Fillet without skin, with pinbone	1,97		
Faroes	Greenland halibut	Gutted head on	1,10		
Faroes	Greenland halibut	Gutted without head	1,20		
Faroes	Greenland halibut	Japan Cut, with tail	1,43		
Faroes	Greenland halibut	Japan Cut, without tail	1,50		
Japan	Greenland halibut	Gutted head off	1.449	?	
Norway	Greenland halibut	Gutted	1.1	1.09	0.92
Norway	Greenland halibut	Gutted head off Japan cut	1.5		
Norway	Greenland halibut	Gutted head off round cut	1.2		
Russia	Greenland halibut	Gutted head and tail off	1.4	1.49	6.04
St Pierre	Greenland halibut	Gutted	1.1	1.09	0.92
St Pierre	Greenland halibut	Gutted head off	1.15	?	

Table 2. Count of vessels fishing for Greenland Halibut in the NRA by month. Individual vessels may fish more than one species in a particular month.

		Greenland Halibut											
Avg # Vess		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
7.1	**ESP**	9	8	8	8	8	8	7	8	8	6	6	1
4.9	**PRT**	1	4	9	8	6	6	3	4	6	5	5	2
2.1	**RUS**	2	2	3	4	2	1	2	2	1	2		2
1.0	**LTU**	1	1	1	1		1	1					
1.0	**EST**									1	1	1	1
1.0	**FRO**	1		1	1	1							

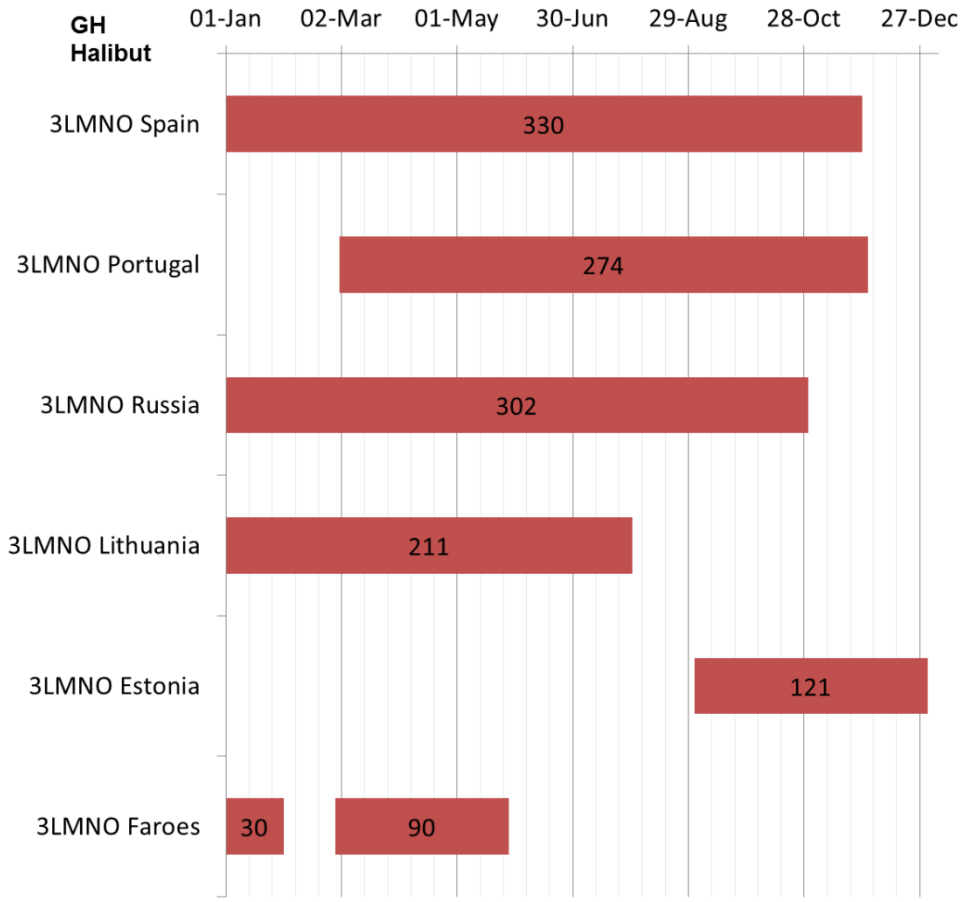

Figure 1. Sampling Timeline. Gantt Chart illustrating Greenland Halibut fishing season by country in the NRA. Number in box is number of days.