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Summary of surveys in Northwest Atlantic Fisheries Organization

Subarea 0, 1999-2019

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Abstract

Research surveys have been conducted in Northwest Atlantic Fisheries Organization (NAFO) Subarea 0 by Canada, using the R/V Paamiut (1999-2017) and a charter vessel C/V Helga Maria (2019). The surveys followed a depth stratified random sampling design and until 2003 sets were selected using a random number draw of grid cells within depth strata. In 2004, the independent and random placement of stations was replaced by a buffered random sampling to automatically avoid selecting stations in adjacent cells. Division 0A has been split in two at approximately 72° N. Surveys covering depths 400-1500m using an Alfredo III bottom trawl were conducted in 0A-South (12 years), 0A-North (3 years), and 0B (7 years). During 2006-2009 a Cosmos trawl was also used to survey shallow strata (100-800 m). There were no surveys in 2002, 2003, 2005, 2018 2020 and 2021. In 2019, surveys were carried out with a chartered vessel, C/V Helga Maria fishing the Alfredo III trawl, but after examining gear performance the indices from the two vessels were not considered comparable to the remainder of the time series, particularly at depths deeper than 700 m. In 2022, surveys will be conducted with a new research vessel (R/V Tarajoq) and new trawl gear (Bacalao 476). These changes in vessel and gear provide an opportunity to expand the area and depths surveyed and improve biological sampling. It is also recommended to establish a protocol for addressing data gaps when strata are missed, and to assess the level of bias in the buffered random stratified set selection compared to other randomization methods.

Background

Research surveys have been conducted in Northwest Atlantic Fisheries Organization (NAFO) Subarea 0 by Fisheries and Oceans Canada, from 1999 to 2017 using the R/V Paamiut and in 2019 using the C/V Helga Maria (Table 1). The surveys followed a depth stratified random sampling design and until 2003 sets were selected using a random number draw of grid cells within depth strata. In 2004, the independent and random placement of stations was replaced by a buffered random sampling to automatically avoid selecting stations in adjacent cells.

Division 0A has been split in two at approximately 72° N. In 0A-South twelve surveys covering depths 400-1500m using an Alfredo III bottom trawl (mesh size of 140 mm and a 30 mm mesh liner in the cod-end), were conducted during 1999-2019, 0A-North was surveyed 3 times, and 0B 7 times. During 2006-2009 a Cosmos trawl was also used to survey shallow strata (100-800 m) and areas outside SA 0 (i.e. Hudson



Strait). There were no surveys in 2002, 2003, 2005, 2018, 2020 and 2021. In 2019, surveys were carried out with a chartered vessel, C/V Helga Maria fishing the Alfredo III trawl, but after examining gear performance the indices from the two vessels were not considered comparable to the remainder of the time series (NAFO 2020). In 2022, surveys will be conducted with a new vessel (R/V Tarajoq) and a new trawl gear (Bacalao 476).

Surveys in Division 0B were conducted in 2000, 2001, 2011 and then annually from 2013 to 2016, with the intention of eventually expanding the index to include both 0A-South and 0B. These surveys all used the Alfredo III trawl.

Because a different vessel was used for the surveys in 2019, several analyses comparing R/V Paamiut and C/V Helga Maria vessels, gear performance, and catch length frequencies were made (Nogueira and Treble, 2020). Both the 1CD and 0A-South surveys were carried out earlier in the year than usual and this effect was also analyzed using Generalized Additive Models (GAMs) to examine the influence of depth and survey timing on the distribution of Greenland halibut (Wheeland 2020). The NAFO Scientific Council determined there was a vessel effect, with the Alfredo gear working differently at depths below 700 m (Nogueira and Treble 2020). In 2019, Greenland halibut were located shallower than typical for the 0A-South survey, with highest abundance and biomass near the shallowest extent of the survey (400-600m) (Wheeland 2020). This distribution was not characteristic of previous 0A-South surveys and it suggested that a portion of the stock may have extended beyond the surveyed area in 2019. Given the results of the gear comparison and the distribution changes observed in 0A-South, the 2019 surveys were considered not comparable to previous years and the 1CD and 0A-South index was not accepted as a basis of advice for the Greenland halibut stock in Subareas 0+1 offshore (NAFO 2020).

A new research vessel, R/V Tarajoq, will be ready to carry out all three surveys in 2022. This change in survey vessel provided an opportunity to improve the gear and a decision was made by the Greenland Institute of Natural Resources (GINR) and Fisheries and Oceans Canada (DFO) to replace the Alfredo III with a Bacalao 476 bottom trawl. These changes in vessel and gear also provide an opportunity to improve the surveys by reviewing past design and sampling practices, for example by expanding area and depths surveyed.

Survey Objectives

The main objective is to conduct a multispecies trawl survey that can provide information to support the SA0+1 Offshore Greenland halibut stock assessment. Biological sampling includes:

- (1) To collect data to estimate biomass and abundance indices for all commercial and non-commercial fish species.
- (2) To collect biological samples to assess length frequency, sex, maturity, age determination and growth (otoliths), and feeding ecology of Greenland halibut (stomachs), and other species as required (e.g. shrimp in the 0A-South survey).
- (3) To enumerate and collect biological samples from invertebrate species in order to determine their distribution and assess biodiversity.
- (4) To obtain temperature data from each station.

Vessel and Gear

Characteristics of the R/V Paamiut, the C/V Helga Maria and the R/V Tarajoq are provided in Table 2 and description of the gear in Table 3. The Alfredo III trawl (Figure 2) was an old design with differences in external dimensions between double and single meshes, and with mesh measured on the inside. This made repairs to the trawl difficult because the outer meshes are of different sizes and require a special sewing ratio. It takes people with special skills to maintain a trawl like the Alfredo, and many of these gear technicians are retired. The Bacalao 476 has the same mesh size on the outside for both single and double meshes, with mesh size varying on the inside (depending on the thickness of the net, single or double net). It is easier to maintain, which minimizes the risk of errors in repair and maintenance of the trawl and it will also be easier to order a new net, without risking changes in mesh sizes.



The Alfredo III had 60 cm chain rigging between the trawl and the 21" rock hopper gear which caused an unknown number of fish and invertebrates to escape. The Bacalao trawl will have the trawl shackled directly onto a steering chain attached to 24" rock hopper gear, reducing the chance of escapement compared to the old Alfredo rigging. With the larger rock hopper gear there will also be less damage to the trawl, and the possibility of more successful sets when fishing on rough bottom.

The difference between both trawls in terms of volume/circumference is not large, and both have a 30 mm cod-end liner. However, the inner mesh size is around 136 mm for the Bacalao 476 compared to 140 mm for the Alfredo III. This slightly smaller mesh size and reduced escapement between the rock hopper bottom gear and the net is expected to increase the catch of juvenile fish and smaller fish species.

Survey Design

From 1999 to 2006 the depth stratification scheme for Subarea 0 was based on depths 401-500, 501-750, 751-1000, 1001-1250, and 1251-1500 m (Treble 2002) (Figures 4 and 5). In 2008, the depth stratification was updated to facilitate comparison with the 1CD survey and strata covering 401-600, 601-800, 801-1000, 1001-1200, 1201-1400, and 1401-1500 m were established (Treble 2009) (Figure 6 and 7). Sets from surveys conducted from 1999-2006 were allocated to the new strata and the indices re-calculated. In 2014, to protect sensitive benthic habitat, a decision was made not to conduct bottom trawl surveys in Subarea 0 in areas that had been closed to fishing, therefore, strata in 0A with designation B1 were removed and the index re-calculated for previous years to standardize the time series (Treble 2016).

The Subarea 0 survey strata are divided into 6 nm² grid cells with the station located at the center of the cell. From 1999 to 2001 sets were selected based on a typical randomization strategy, if two stations were selected very near each other an alternate station was selected. Since 2004 the grid cells/stations have been selected using a buffered random method developed by Kingsley *et al.*, (2004, 2008), see a description below. The number of stations in each stratum is allocated proportional to the total stratum area (1 station per 750 km²) with a minimum of two randomly placed trawls conducted per stratum (Bishop, 1994). Since 2014 the 0A-South survey design has had 77 sets and the 0B survey 92 sets (Tables 6 and 7).

Future Surveys in Subarea 0

An expansion of the Canadian survey, to include 0B and area within 200-400m in both 0A-South and 0B, is planned for 2022 (Figure 7). The stratification will use new updated bathymetry (GEBCO 2020). Areas that are proposed to be excluded from the new design are:

1) Portions of strata B2 and A1 (Figure 4 and 11) that fall within the south-west corner of the Disko Fan Conservation Area and were not previously removed;

2) Portions of strata A4 and A5 (Figure 4 and 11) that fall within the Tallurutiup Imanga (Lancaster Sound) National Marine Conservation Area;

3) Portions of most depth strata in 0B that fall within the Davis Strait and Hatton Basin Conservation Areas (Figure 11);

4) Area within 12 nm of the Baffin Island coast that fall within the Nunavut Settlement Area.

The total number of sets planned for 0A-South and 0B would be 79 and 118, respectively (Tables 8 and 9).

There is also a small area at 601-800 m in 0B, near the boundary with 0A, that is currently combined into a single stratum (B1-600) (Table 9). Catches tended to be more similar to adjacent areas in 0A, in the range of 0.5 to 1.5 t/km2 (Treble 2016). Areas at similar depths in southern portions of 0B tended to be larger suggesting these two areas within 0B are not homogenous and should not be merged into a single stratum. Rather than creating a very small stratum within 0B we might consider merging this area with the associated depth strata in 0A (strata A1). It is not unusual for survey strata to cross management boundaries. This is being proposed for some strata in Divs. 1CD and it also occurs in other Canadian surveys (Rideout et al., 2021).



Buffered random sample selection

In 2004, the spatial placement of stations was changed in all DFO and Greenland Institute of Natural Resources (GINR) surveys, from independent and random, to a buffered random placement that aims to avoid spatial clustering of stations (Kingsley et al., 2004, 2008).

The buffered random sampling method was developed by the GINR in order to avoid having to repeat the random selection (re-draw) if two stations were selected too close to one another, or there were clusters of stations that resulted in large spaces without stations. Stations are placed randomly within a stratum, but not closer to one another than a fixed limiting distance or buffered distance that (Kingsley et al. 2004, 2008). For the 0A-South survey the radius of the buffer around the selected grid cells is 17 km, or approximately one 6 nm² grid cell. The buffered set selection method is well described in Kingsley et al. (2004, 2008) but it has not been validated for bias (e.g., by simulation). There is no statistical proof that the method remains unbiased, or is less biased than random selection or re-sampling (to address a situation where stations are initially selected close together), although in principle a large bias is unlikely. Validation of the method and demonstration of its utility is needed.

Missing Strata

Missing strata has been a problem for the 0A-South survey in several of the early years, in particular 2006 was considered incomplete and is not used in the assessment. No attempt has been made to correct the total index or estimate biomass/abundance in these missed strata, and it has been assumed that the missed strata biomass was zero.

In the 1A to 1F Fish and Shrimp Survey, when a stratum has been missed, an "area correction" is included. The area of the missing stratum is added to the next stratum of similar depth, and that "corrected area" is the one used for the biomass and abundance indices estimation.

The NAFO Scientific Council has also observed problems with survey coverage over the years and in 2019 STACREC **recommended** the *following actions for future years whenever survey coverage issues arise*:

• The STACREC report should contain, after the general survey presentation, a summary of the decisions and conclusions stock by stock regarding whether the survey can be used as a stock index for that year.

• The mean proportion (over time) of total survey biomass in the survey strata missed that year should be calculated.

• At this time, the following may be used as initial ("preliminary") guidelines based on the value of the mean proportion of total survey biomass in the survey strata missed in that year:

o If it is <10% : the survey index of that year is most likely acceptable.

o If it is between 10% and 20% : the survey index of that year is questionable and needs to be examined carefully before deciding whether it is acceptable.

o If it is >20% : the survey index of that year is most likely not acceptable. Any decision to accept it would require a clear and well justified rationale.

These are preliminary guidelines and sampling biases may also be relevant in the considerations for each specific stock and survey. In particular, the finer structure of the indices needs to be considered if they are used disaggregated by age or length in stock assessments.

It has been suggested that an added guideline might be: For age groups where there is a greater than 10% difference between total survey biomass in the survey strata missed that year in the index used (total or mean numbers), then it should be excluded from the model, if the model can handle missing values. However, there was no time to discuss this at the June 2020 meeting and therefore this discussion will be deferred to June 2021.



An approach to dealing with missing strata should be determined and defined for both the SA 0 and 1 deepwater surveys. It is suggested that the same method used in the 1A to 1F Fish and Shrimp Survey could be considered. However, some guidance around this approach may be needed. For example it might be acceptable in cases where <10% of the survey strata are missed but becomes less so as the proportion of missed strata increases.

Sampling Protocols

The sampling protocol separates length, sex and maturity measurements from age (otoliths) and other biological parameters:

•Length, sex and maturity are recorded for all individuals caught in a typical set. If the catch is too large (this is not defined currently), a sub-sample is taken and these are sampled for length, sex and maturity.

•The target sample for otoliths has been 10 fish per cm per sex for the entire survey (e.g. 0A-South or 0B). Technicians are asked to spread the sampling out across sets using their judgement as to how many samples to take from each set . The computer keeps track of the running total. Once the sample is full for a particular sex/size class then sampling stops, whether the survey is complete or not.

This sampling scheme is assumed to be representative of the whole survey area. However, there is likely bias in the otolith sampling protocol because the last sets may not be sampled to the same degree as earlier sets, even if the technicians do their best to spread out the sampling. Some sizes will be preferentially sampled at some sites compared to others. Sampling is not representative and it is very likely that the estimated age compositions are biased and this could compromise assessment and spatial models. Simulation studies of Canadian surveys (Regular et al., 2020), Norwegian surveys with North Sea cod (Jourdain et al., 2020), and Northeast Arctic cod (Aanes and Volstad, 2015) determined that the strategy of taking small age samples from as many sets as possible is better than taking more age samples from fewer sets. When otoliths are sampled from every set the bias disappears.

For the new survey time series it is proposed that otolith samples be collected from each set. We are considering 1 fish/cm/sex/set. This will likely result in larger samples of the most abundant sizes but a structured sub-sampling of this otolith collection could be made later, during the actual age reading.

Conclusions and Recommendations

It is hoped that this review of surveys and their design will be a useful reference. There have been two recommendations that have been identified:

- An approach to dealing with missing strata should be determined and defined for both the SA 0 and 1 deep-water surveys.
- Validation of the buffered random stratified set selection method and an assessment of its' utility is needed.

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		0A-South	0B			
Year	Vessel	(valid	(valid	Dates	Gear	Comments
		sets)	sets)			
1999	R/V Paamiut	54		Oct. 7-19	Alfredo III	
2000	R/V Paamiut		64	Oct. 9-19	Alfredo III	
2001	R/V Paamiut	39	36	Sept. 16-23/Oct. 19-26	Alfredo III	
2002	ns			ns	Alfredo III	
2003	ns			ns	Alfredo III	
2004	R/V Paamiut	55		Oct. 14-24	Alfredo III	0A-North also surveyed during Sept. 4-12
2005	ns			ns	Alfredo III	
						Shallow strata also surveyed with Cosmos
2006	R/V Paamiut	46		Oct. 27-Nov. 7	Alfredo III	trawl during Aug. 26-Sept. 5
2007	R/V Paamiut			Oct. 14-30	Cosmos	Cosmos gear used to survey Eastern
						Hudson Strait (SFA3 and Resolution Island)
2008	R/V Paamiut	74		Oct. 8-Nov. 4	Alfredo III / Cosmos	Cosmos gear used to sample additional sets
						in shallow strata during this trip
						Cosmos gear used to survey Western and
2009	R/V Paamiut			Oct. 9-25	Cosmos	Eastern Hudson Strait (SFA3)
2010	R/V Paamiut	77		Oct. 17-Nov. 6	Alfredo III	0A-North also surveyed during this trip
2011	R/V Paamiut		84	Sept. 23-Oct. 15	Alfredo III	
2012	R/V Paamiut	75		Sept. 29-Oct. 27	Alfredo III	0A-North also surveyed during this trip
2013	R/V Paamiut		84	Sept. 22-Oct. 14	Alfredo III	
2014	R/V Paamiut	83	58	Sept. 22-Oct. 18	Alfredo III	
2015	R/V Paamiut	76	70	Sept. 26-Oct. 9	Alfredo III	
2016	R/V Paamiut	76	81	Oct. 7-20	Alfredo III	
2017	R/V Paamiut	74		Oct. 27-Nov. 8	Alfredo III	
2018	ns			ns	Alfredo III	
2019	C/V Helga Maria	72		Aug. 15-25	Alfredo III	
2020	ns			ns	Alfredo III	
2021	ns			ns	Alfredo III	
2022	R/V Tarajog	tbd	tbd	Oct. 29-Nov. 28	Bacalao 476	

Table 1.	Surveys carried out in Divisions 0A and 0B with R/V Paamiut and C/V Helga Maria.

Name	R/V Paamiut	C/V Helga Maria	R/V Tarajoq
Vessel type- generic	Research (former Fishing)	Fishing	Reaserch
Vessel type -detailed	Trawler	Trawler	Trawler
Status	Stopped	Active	In construction
Call sign	OYZC	TFDJ	OYLD
Flag	Greenland	Iceland	Greenland
Gross tonnage (t)	1084	1470	2860*
Net tonnage (t)	325	441	**
Machinery power (Kw)	1471	2200	2900/3600
Length overall (m)	58.61	56.88	61.4
Maximum breadth (m)	11.21	12.62	16
Maximum draught (m)	4.2	6	6.4
Propulsion (BHP)	2000	2992	3943/4896
Fuel type and capacity (m3	Diesel 257	Diesel 238.4	Diesel 475
Year built	1971	1988	2021

Table 2.Vessel characteristics for R/V Paamiut , C/V Helga Maria and R/V Tarajoq.

*to be confirmed **not determined yet

Table 3.Gear and door specifications for the Alfredo III and Bacalao 476 trawl gear (note the door
change in 2004). In the formula used to calculate wing spread, t is the length of the trawl (m),
L is the distance between doors (m), and s is the length of the bridles (m).

Gear	Alfredo III	Bacalao 476
Vertical trawl opening (m)	5.6	4.5*
Distance between doors (m)	120 -145	151.8*
Wing spread (m)	V = 10.122 + L * 0.142.	$V = (t_{l} \cdot L) / (t_{l} + s_{t})$
Inside mesh size (mm)	140	136
Door (cm)	Pre-2004: Greenland Perfect (370*250)	Shark injector (353*273)
	Post- 2004: Shark injector (353*273)	
Door type (kg)	Pre- 2004: 2400 with extra 20 kg	2850
	Post- 2004: 2850	
Cod-end mesh size (mm)	44	44
Mesh-liner in the cod-end (mm)	30	30
Rock hopper (inches)	21	24

*gear simulations at 360 m depth.

Table 4.Stratification of Division 0A used in 1999-2006. Strata 24, 25, and 30-34 are from a previous
stratification scheme (Bowering, 1987). Strata 40-61 are from a stratification scheme
developed in 1999. The area listed for the older strata corresponds to that area which lies
within Division 0A only.

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Stratum	Sq. N Miles	Units	Depth Range (m)
024	457	130	401-500
025	1780	510	501-750
030	1099	310	751-1000
031	496	140	1001-1250
032	301	90	1251-1500
033	184	50	501-750
<u>034</u>	75	20	401-500
040	1671	480	1251-1500
041	698	200	1001-1250
042	577	160	751-1000
043	609	170	501-750
044	375	110	401-500
045	348	100	501-750
046	370	110	751-1000
047	883	250	1001-1250
048	843	240	1251-1500
049	712	200	1251-1500
050	650	190	1001-1250
051	574	160	751-1000
052	635	180	501-750
053	276	80	401-500
054	852	240	501-750
055	334	100	401-500
056	200	60	401-500
057	652	190	501-750
058	350	100	501-750
059	600	170	751-1000
060	671	190	1001-1250
061	730	210	1251-1500

Table 5.Stratification used in Division 0B survey, 2000-2006 (Bowering, 1987).

Stratum	Sq. N Miles	Approx .	Depth	SETS per	# sets
		# units	(m)	300 sq mi.	planned
3	2616	748	401-500	8.72	9
4	4671	1335	501-750	15.57	16
5	2070	592	751-1000	6.90	7
6	1975	564	1001-1250	6.58	7
7	1641	469	1251-1500	5.47	6
10	1566	448	401-500	5.22	5
11	2311	661	501-750	7.70	8
12	943	270	751-1000	3.14	3
13	343	98	1001-1250	1.14	2
24	1449	414	401-500	4.83	5
25	2130	609	501-750	7.10	7
Total	21715			72.38	75

Stratum	Depth (m)	Area (km²)	Set Allocation
A1-4	400-600	2152	3
A2-4	400-600	4649	6
A3-4	400-600	785	2
A4-4	400-600	1922	3
B2-4	400-600	2519	3
-	Sub-total	12027	17
A1-5	600-800	795	2
A2-5	600-800	2250	3
A3-5	600-800	760	2
A4-5	600-800	2483	3
B2-5	600-800	5108	7
-		11396	17
A1-6	800-1000	604	2
A2-6	800-1000	1145	2
A3-6	800-1000	1020	2
A4-6	800-1000	1376	2
B2-6	800-1000	2656	4
-		6801	12
A1-7	1000-1200	745	2
A2-7	1000-1200	1873	2
A3-7	1000-1200	1307	2
A4-7	1000-1200	1636	2
B2-7	1000-1200	1789	2
-		7349	10
A1-8	1200-1400	813	2
A2-8	1200-1400	2151	3
A3-8	1200-1400	1146	2
A4-8	1200-1400	1072	2
B2-8	1200-1400	1779	2
-		6961	11
A1-9	1400-1500	498	2
A2-9	1400-1500	1153	2
A3-9	1400-1500	684	2
A4-9	1400-1500	710	2
B2-9	1400-1500	346	2
		3390	10
Total		47924	77

Table 6.0A-South survey stratification (2008-2019) with area and set allocation based on a coverage
of 1 set per 750 km².

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Strata	Depth (m)	Area (km²)	Set Design (1/750km²)
Dida	()	1.00000	(1//001111)
D4-1	400-600	17396.93	23
D4-2	400-600	19276.73	26
D5-1	600-800	2282.96	3
D5-2	600-800	8052.15	11
	800-		
D6-1	1000	8053	11
	1000-		
D7-1	1200	6586	9
	1200-		
D8-1	1400	4754	6
	1400-		
D9-1	1500	1965	3
Totals		68367	92

Table 7.Survey stratification for 0B (2008-2016) with area and set allocation based on a coverage of 1
set per 750 km².

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Table 8.Division 0A-South stratification scheme revised for 2022 and future surveys, based on updated
bathymetry, removal of area falling within fishery closures (Strata A1 and B2) and marine
conservation areas (Strata A4 and A5), merging of the remainder of strata B2 into A1, and
addition of depths 200 m to 400m up to 12 nm from the Baffin Island coast. Set allocation is
based on 1 set per 750 km².

Stratum	Depth (m)	Area (km²)	Set Allocation
A1-200	200-400	939	2
A2-200	200-400	3060	4
A3-200	200-400	1826	2
A4-200	200-400	2156	3
	Sub-total	7981	11
A1-400	400-600	3458	5
A2-400	400-600	2703	4
A3-400	400-600	834	2
A4-400	400-600	954	2
		7949	13
A1-600	600-800	4105	5
A2-600	600-800	1821	3
A3-600	600-800	705	2
A4-600	600-800	1972	3
		8604	13
A1-800	800-1000	4051	6
A2-800	800-1000	1234	2
A3-800	800-1000	1009	2
A4-800	800-1000	1463	2

		7758	12
A1-1000	1000-1200	3475	5
A2-1000	1000-1200	2109	3
A3-1000	1000-1200	1209	2
A4-1000	1000-1200	1415	2
		8208	12
A1-1200	1200-1400	1984	3
A2-1200	1200-1400	2344	3
A3-1200	1200-1400	1197	2
A4-1200	1200-1400	1242	2
		6767	10
A1-1400	1400-1500	558	2
A2-1400	1400-1500	1327	2
A3-1400	1400-1500	695	2
A4-1400	1400-1500	814	2
		3394	8
Total		50660	79

Table 9.The 2022 Division 0B stratification scheme revised based on updated bathymetry, removal of
area falling within fishery closures and addition of depths 200-400m up to 12 nm from the
Baffin Island coast. Set allocation is based on 1 set per 750 km².

			Assigned
		Area	Sets
Stratum	Depth (m)	(km2)	(1/750km2)
B1-200	200-400	18016	24
B2-200	200-400	29003	39
	Sub-total	47019	63
B1-400	400-600	12604	17
B1-600	600-800	7467	10
B1-800	800-1000	8212	11
B1-1000	1000-1200	6672	9
B1-1200	1200-1400	4446	6
B1-1400	1400-1500	711	2
		87131	118

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Figure 1. Northwest Atlantic Fisheries Organization Subarea 0+1.

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Figure 2. Wing spread is estimated as $V = (t_1 * L) / (t_1 + S_t)$, where t_1 is the length of the trawl, S_t is the length of the bridles and L is the distance between the doors.



Figure 3. Stratification scheme for North Atlantic Fisheries Organization Division 0A, 1999-2006.



Figure 4. Stratification scheme for North Atlantic Fisheries Organization Division 0B, 1999-2006.



Figure 5. Stratification scheme for 0A-South surveys, 2008 to 2019, 66° N to 72° N.



Figure 6. Stratification scheme for Division 0B surveys, 2008-2016.



Figure 7. Stratification scheme for Division 0A-South and 0B proposed for use in the new time series, beginning in 2022.