Northwest Atlantic Fisheries Organization

Serial No. N6947 **NAFO SCS Doc. 19/12**

SCIENTIFIC COUNCIL MEETING - JUNE 2019

Denmark/Greenland Research Report for 2018

Compiled by

Greenland Institute of Natural Resources
P.P. Box 570, DK-3900 Nuuk, Greenland

This report presents information on catch statistics from the commercial Greenland fishery in 2018 at West Greenland. Furthermore, the report gives a brief overview over the research carried out in by the Greenland Institute of Natural Resources. For further information on GINR survey activities planned 2019 and 2020 visit www.natur.gl . For future research activities, education, collaboration opportunities, infrastructure, logistics and much more, visit Isaaffik – the arctic gateway www.isaaffik.org.

WEST GREENLAND (NAFO SUBAREA 1)

A. Status of the fisheries

In 2018, Greenland vessels were not involved in fishery in other NAFO subareas than subarea 1.

Provisional statistics for the fisheries from 2015 to 2018 are presented in Table 1.

Additional information

1. Shrimp

The shrimp stock off West Greenland is distributed in NAFO SA 1 (Div. 1A-1F), but a small part of the habitat, and of the stock, intrudes into the eastern edge of Div. 0A (east of 60°30' W). Northern shrimp is found mainly in depths between 150 and 600 m. The stock is assessed as a single population. The Greenland fishery exploits the stock in SA 1, Canada in Div. 0A.

Three fleets, one from Canada and two from Greenland (vessels above and below 75 GRT) have participated in the fishery since the late1970s. The Canadian fleet and the Greenland offshore fleet (> 75 GRT) have been restricted by areas and quotas since 1977. The fishery by the Greenland coastal fleet (< 75 GRT) was unrestricted until 1997, when quota regulation was imposed. Mesh size is at least 44 mm in Greenland, 40 mm in Canada. To reduce the bycatch, sorting grids have been mandatory for Greenlandic vessels since 2002, but exemption was given for all vessels under 75 GRT until 2011. Discarding of shrimps is prohibited.

Greenland requires that logbooks should record catch live weight, but for shrimps sold to on-shore processing plants an allowance was made for crushed and broken shrimps in reckoning quota draw-downs, which were based on weight sold, not on weight caught. From 1st of January 2011 the quotas is required to be drawn down by the amount caught without allowances for shrimps landed in poor condition.

Catches of shrimp gradually increased throughout the 1980's and 1990's and reached a level around 157000 t by 2005-2006. In 2018, the total catches in Subarea 1 were 94078 t of shrimp (*P. borealis*), of which 90443 t were taken by Greenlandic trawlers.

The early fishery was concentrated in NAFO Division 1B, but from the late 1980s the fishery spread southwards, - and by 1996–98 Divisions 1C–1F were producing nearly 70% of the catches. Since then the range of the fishery has contracted northwards and since 2007 Divisions 1C-1F have yielded only about 10-20% of the catch. In recent years up to 40% of the catch has been taken in Division 1A alone. This is especially due to increased fishing in the Disko Bay. This is consistent with results from the survey, in which the proportion of survey biomass in Disko Bay has been high since 2005 and the proportion of survey biomass in the northern Areas has been high since 2003.

2. Greenland halibut

The stocks of Greenland halibut in the North West Atlantic are assessed in several management units. Greenland halibut in East Greenland (ICES XIV) is considered to be a part of a stock also distributed in Icelandic and Faroese waters. Greenland halibut in Baffin Bay and Davis Strait, (NAFO SA 0 and 1 including inshore Div. 1B-1F) is assessed as one stock while the inshore stock in NAFO Div. 1A is considered isolated from the offshore stock and assessed by fjord area (Disko bay, Uummannaq and Upernavik districts).

The total catches of Greenland halibut (*Reinhardtius hippoglossoides*) in NAFO Subarea 1 amounted to 43311 t in 2018, of which 16220 t were taken offshore by large vessels and 27091 t were landed from small boats operating inshore in the fjords. The offshore catches were mainly taken by trawlers at the traditional fishing grounds in division 1CD and west of the Disko Island in division 1A, while the inshore catches are from small vessels and open boats using gillnets and longlines. Greenland vessels operating offshore caught 11032 t (7953 t in division 1AB + 3079 t in division 1CD) and other nations caught 5188 t (655 t in division 1AB + 4533 t in division 1CD). Inshore landings decreased to 27091 t (24787 t in division 1A inshore, 2052 in division 1BCDEF and 252 t in the Qaanaaq fjord).
Trawl fishery is banned inshore, with the exception of shrimp trawl fishery in the Disko bay and a small area inshore in division 1B. Sorting grids in the shrimp fishery have been mandatory offshore since 2002 with a sorting grid dispensation given to the smaller shrimp vessels operating inshore until 2011. In 2018, 3 t of Greenland halibut was reported as bycatch in the shrimp fishery. Length frequency samples are available from trawlers fishing in Div. 1AB and Div. 1CD and land based factories.

3. Cod

Cod (*Gadus morhua*) found in Greenland is a mixture of four separate "stocks" that are defined by their spawning areas: I) offshore West Greenland waters; II) West Greenland fjords cod III) offshore East Greenland and offshore Icelandic waters and IV) inshore Icelandic waters (Therkildsen et al. 2013). Therkildsen et al. (2013) showed a relatively stable spatial and temporal distribution of these spawning stocks during actual spawning events, but the proportional contribution of the different components to commercial and survey catches in different areas, seasons and years and the associated variation is unclear. However, Icelandic inputs are believed to have been responsible for the previous large year classes in Greenland (i.e. 1984 and 2003). A proportion of these cod return to Iceland when reaching maturity. Previously the stocks have been assessed together. From 2012 the inshore component (West Greenland, NAFO Subarea 1) was assessed separately from all offshore components. From 2016 the offshore components have been assessed separately with the West Greenland offshore component being comprised in the offshore area corresponding to NAFO subdivisions 1A, 1B, 1C, 1D and 1E. The East Greenland offshore component is

comprised in the offshore area corresponding to NAFO subdivision 1F in SouthWest Greenland and East Greenland (ICES subarea XIV). The stocks are assessed by the ICES North-Western Working Group (NWWG), see ICES (2017) and ACFM (2017) report.

West Greenland offshore div 1A-1E
Offshore catches in the fishery in 2018 amounted to a total of 4 187 tons, of these 628 t where fished on the inshore quota. Main fishing grounds were Tovqussaq Bank (NAFO div 1C, between 66o15-66o30N) where half of the total catch (2 000 t) was caught and on Dana Bank (NAFO div 1D and 1E, between 62o00-63o00N) where the other half (2 000 t) of the total catch was caught. Other areas of minor catched was Fyllas and Fiskenæs Bank (NAFO 1D) between Tovqussaq Bank and Dana Bank and Narssalik Bank south of Dana Bank (NAFO 1E).

Inshore cod fishery
The TAC for the coastal fishery was set at 36,500 t in 2018 and it was allowed to fish offshore in West Greenland on the inshore quota. The coastal fishery took 22.290 t in 2018. The most important fishery is the pound net fishery that takes place during summer and autumn. Gillnets, jigs and longlines constitutes the rest of the total catch.

East Greenland ICES XIV and NAFO 1F
In 2018 all countries fished their quota resulting in a total of 15.068 t with 1.819 t caught in SouthWest Greenland (NAFO 1F) and 13.249 t caught in East Greenland.

4. Salmon

The fishery for Atlantic salmon in Greenland waters started around 1960 and peaked in the early seventies at a catch of more than 2,000t a year. The fishery was quota regulated from 1972, but due to declining stocks, in June 1998 NASCO agreed that no commercial fishery for salmon should be allowed, but that the catch at West Greenland should be restricted to internal consumption. Since then export of salmon from Greenland has been banned by law, and the fishery has been reduced to an internal subsistence fishery within Greenland. After 1997, it has been mandatory to report private catches of salmon. From 2002 licensed fishermen were allowed to sell salmon to institutions, local markets and restaurants only, but in 2012 pressure by fishermen, led to the opening of factory landings for the Greenlandic home market, at a selected few factories. However, factory landings were not allowed after 2015. In 2018, total reported catches of 40.4 t were reported (39.6 in West Greenland).

5. Capelin

The capelin (*Mallotus villosus*) fishery in West Greenland is carried out inshore and in the spawning season only (May-July). Only part of the catches are reported, as capelin are used directly by fishermen for bait and dog food during the capelin season. Reported catches of capelin amounted to 265 t in 2018 and comprise a mixture of factory landed capelin for bait, human and animal consumption landed from small open boats mostly and logbook reported bycatch in shrimp fisheries. The majority of the catches are taken in the northern part of West Greenland (NAFO 1A and 1B).

6. Redfish

Two species of redfish of commercial interest occur off West Greenland inshore and offshore, golden redfish (*Sebastes norvegicus*) and deep-sea redfish (*Sebastes mentella* Travin). Relationships to other North Atlantic

redfish stocks are unclear, but the nearest stocks are the demersal and pelagic stocks in East Greenland and the Irminger Sea. Redfish catches in West Greenland are reported as redfish (unspecified, mainly by-catch), golden redfish and beaked redfish (deep-sea redfish).

Demersal redfish
In 2018, logbook reported catch and bycatch of redfish in the offshore fleet amounted to 43 t. of these 7 t (deep-sea) were reported by other nations and 35 t from Greenland (8 t unspecified redfish, 7 t deep-sea redfish and 28 of golden redfish) were reported by Greenlandic vessels.
Inshore reported factory landings of commercially sized redfish amounted to 150 t.

Pelagic redfish
The aggregations of pelagic redfish *S. mentella* found in the NAFO Convention Area likely belong to the same stock of pelagic redfish from the Irminger Sea. The stock is assessed by ICES (NWWG report 2017) and the assessment covers the pelagic redfish in ICES Divisions Va, Vb, and XIV and in the NAFO Div. 1F, 2H and 2J. The pelagic fishery on *S. mentella* in NAFO Div. 1F started in 1999 and from 2000 - 2009, significant catches with up to 20% of total catches as in 2003 were taken in NAFO Divisions 1F outside Greenlands EEZ and 2J. In 2013, 3113 t were taken in the NAFO 1F, but since then no catches have been reported by the Greenlandic fleet in 1F.

7. Grenadiers

There are two species of grenadiers of commercial interest in Greenland, roundnose grenadier (*Coryphaenoides rupestris*) and roughead grenadier (*Macrourus berglax)*. Grenadiers are mainly taken as a bycatch in the Greenland halibut fishery. In 2018, 3 t of roughhead grenadier were landed to factories in Uummannaq 3 t were reported by forging vessels. Roundnose grenadier were exclusively reported by offshore vessels, 11 t from Greenland and 13 t from other nations.

8. Snow Crab

Snow crab (*Chionoecetes opilio*) is distributed along the west coast of Greenland from division 1A to 1F. The fishery is conducted mainly by Greenland vessels. Since 2004, the crab resource has been managed in 6 areas (from North to South: Upernavik, Uummannaq-Disko Bay, Sisimiut, Maniitsoq-Kangaamiut, Nuuk-Paamiut and Narsaq-Qaqortoq). The fishing fleet is dominated by small vessels (less than 75 GRT), which have exclusive rights for fishing inshore within the basis-line as well as offshore. Large vessels (greater than 75 GRT) may only fish in all offshore areas (outside the basis-line). Total allowable catch (TAC) restrictions have been imposed since 1995, but have only limited the catch in some years and management areas since 2004.

The number of vessels with licenses to participate in the snow crab fishery increased from 1999 to 2002 from approximately 120 vessels to 392 vessels. Since then the number of both large and small vessels have decreased substantially as the abundance of the resource has also declined.
The total catch in NAFO Subarea 1 peaked in 2001 with approximately 15.100 t. From 2001 to 2006 total landings decreased markedly to 2,200 t, and since annual landings have remained stable at approx 2.100 t. (table 1). Most of the landings are based on fishery in the management areas Nuuk-Paamiut, Disko Bay-Uummannaq and Sisimiut and total fishing effort (trap hauls) has declined by more than 90% since 2001 (from 3,416 to about 319 thousand trap hauls during 2001-2014).

9. Wolffish

There are three species of wolffish in subarea 1, Atlantic wolffish (*Anarhichas lupus*), spotted wolffish (*Anarhichas minor*) and Northern wolffish (*Anarhichas denticulatus*). Only the two first are of commercial interest. In the past, these stocks have mainly been taken as a by-catch in the offshore fisheries targeting Cod, Greenland halibut and shrimp, but occasionally are directly targeted. A directed small-boat fishery still exists in the West Greenlandic fjords mostly targeting spotted wolffish and when quotas for other more valuable species have been fished. In 2018, 240 t of wolffish were caught in NAFO subarea 1. 157 t (mainly spotted wolffish), were landed to factories by open boats and smaller vessels from the fjords and 104 t were taken as bycatch offshore and partly landed to factories.

10. Scallops

Total catches of Icelandic scallops (*Chlamys islandica*) in NAFO Subarea 1 increased to 707 t in 2018. All catches are taken in inshore areas in Div. 1A, 1B, 1C and 1D. New fishing grounds near Sisimiut (1B) was found in 2003 and quotas for two new areas was introduced in 2004.

11. Lumpfish

Total landings of lumpfish (*Cycloperus lumpus*) in NAFO Subarea 1 increased from 1.200 t in 2000 to almost 9.000 t in 2003 and remained at a high level until 2011 where catches reached 11.443 t. Catches are taken in inshore areas in Div. 1A, 1B, 1C, 1D, 1E and 1F with the majority being caught in 1D. The fishery is conducted over a short time period of one to two months and over a vast coastline from 59° N to 72° N. Total landings of lumpfish roe in 2018 amounted to 1004 t, which was converted to 6765 t whole weight. The historically used conversion factor is however under evaluation. Carcasses and males are increasingly being used instead of being discarded an in 2018, 33t were landed as instead of being discarded. Carcasses are however included in the estimate of total landings via the roe to whole weight conversion factor.

12. Greenland cod

Greenland cod (*Gadus ogac*) is mostly by-catch in other fisheries. Greenland cod is mostly used for human consumption as dried or frozen fish for the local Greenlandic market. Total reported landings in 2018 amounted to 19 t.

13. Arctic char

Arctic char (*Salvinus alpinus*) is taken in gillnets when returning to natal rivers during their annual feeding migrations in coastal areas. Factory landings were 12 t in 2018 and the production is mainly for the Greenlandic market. There is no reporting required for private fisheries, which presumably is considerably larger.

14. Atlantic halibut

Catches of Atlantic halibut (*Hippoglossus hippoglossus*) peaked in the beginning of the 1960's and the mid 1980's at a level of 600 to 1000 t per year. In 2018, 11 t were landed to factories and 4 t were reported in logbooks from vessels operating offshore.

15. Polar cod / Arctic cod

Reported catches of polar cod (*Boreagadus saida*) is mainly taken as bycatch in the shrimp fishery. In recent years part of the bycatch has been landed and used internally in Greenland, for bait in other fisheries. In 2018, 27 t were reported as by-catch in the shrimp fishery.

16. Fish not specified

Fish not specified (FAO: MZZ) are logbook reported by-catch of mixed fish. The by-catch was mainly reported from shrimp trawlers indicating that is mainly small fish of noncommercial interest that are not sorted by the shrimp trawl sorting grids. In total 608 t of non-specified fish were reported in 2018 and of these 593 t were reported by Greenland vessels.

17. Large sharks

Large sharks (FAO: SHX/GSK) are without doubt exclusively Greenland sharks *somniosus microcephalus*. In 2018, 100 t of large sharks were reported. 98 t from offshore trawlers and 2 t taken as bycatch in the Uummannaq fjord, indicating that they were taken in fisheries targeting Greenland halibut and cod. Shrimp-trawls are equipped with sorting grids and no sharks were reported via shrimp logbooks. From the East Greenland area 44 t were reported by Greenland vessels and 3 t from forging vessels.

B. Special Research Studies

a. Hydrography Studies

Hydrographic conditions are yearly monitored at 10 hydrographic standard sections and stations in June/July across the continental shelf off West Greenland. Data are uploaded to the ICES database.

b. Trawl Surveys in Greenland

The Greenland shrimp and fish survey in NAFO 1 and ICES XIV
Since 1988, an annual stratified random trawl survey SFW (Shrimp Fish West) has been conducted by the Greenland institute of natural resources on the West Greenlandic shelf between 59º15'N and 72º30'N from the 3 mile limit down to the 600 m and the Disko Bay. The main purpose of the survey is to evaluate the biomass and abundance of the Northern shrimp (*Pandalus borealis*), but since 1992 data on fish species have been included. In 2007 this survey was expanded to include the East Greenland shelf to Dohrn Bank at 67ºN. The survey was done with a chartered vessel in 2018 and only the West Greenland shelf was covered.

Greenland halibut trawl survey in 1CD
A Greenland offshore trawl survey for Greenland halibut was initiated in 1997. The survey is a continuing of the joint Japanese/Greenland survey carried out in the period 1987-95. From 1997 the survey has covered NAFO Div. 1C and 1D between the 3 nm line and the midline against Canada at depths between 400 and 1500 m. Due to vessel decommission, the survey was not updated in 2018.

Greenland halibut trawl survey in 1AB offshore
In 2001 the survey area was expanded to include NAFO Div. 1B-1A (to 74°N) and in 2004 a survey was

conducted in the northern part of the Baffin Bay (73°N-77°N) (Div. 1A) at depths down to 1500 m. In 2010 was conducted a survey in Div. 1A to 75°30' where 93 successful hauls were made. There has been no deep-sea survey in the area since then.

Greenland halibut trawl survey in ices XIV offshore
In 1998, Greenland Institute of Natural Resources initiated a bottom trawl surveys in ices XIVb with R/V PAAMIUT, which has been rigged for deep sea trawling. The survey is primarily aimed at Greenland halibut (Reinhardtius hippoglossoides) and redfish (Sebastes spp.) and covered various areas between Cape Farewell and 72N at depths down to 1500 m. No survey since 2017.

EU-Germany survey in ICES XIV and NAFO 1
An annual stratified random trawl survey has been conducted by Germany since 1982 in West and East Greenland from 67°N in West Greenland to 67°N in East Greenland covering the depthzone between 0-400 m. The main purpose of the survey is to evaluate the biomass and abundance of the Atlantic cod. The survey time series shows two abundance peaks in 1987-1989 caused by the 1984 and 1985 YC and from 2005 and onwards caused by the 2003 and younger Year classes. No survey in 2018.

Nuuk Fjord trawlsurvey in division 1D inshore
In 2015, a trawlsurvey was initiated in the Nuuk fjord with the GINR research vessel RV Sanna. The purpose is to evaluate the local stock of Greenland halibut, shrimp and cod. The survey was also conducted in 2017, 2018, 2019 and is expected to continue in the future.

c) Gillnet surveys

Cod recruitment gillnet survey
A survey using gangs of gill nets with different mesh-sizes has been developed and used since 1985 with the objective of assessing the abundance of age 2 and age 3 cod in the inshore areas of NAFO subdivisions 1B and 1D (historically NAFO subdivision 1F has also been surveyed).

Greenland halibut gillnet surveys in 1A inshore
In 2001 longline survey in the the Disko Bay was changed to a gillnet survey. The survey normally covers 4 transects and each gillnet setting is compiled of 4 different nets with differing mesh size (46, 55, 60, 70 and 90 mm halfmesh). from 2013 to 2016 the surveys in Uummannaq and Upernavik gradually changed from longline surveys to gillnet surveys.

d) Snow crab surveys

Annual monitoring program (trap survey) was initiated in 1997 in Disko Bay (Div. 1A) and Sisimiut (Div. 1B). Since 2001 annual offshore trap survey has been conducted in more southern areas in West Greenland (Div. 1C and 1D) but has been canceled since 2010. Large and small meshed conical traps are used. Snow crab are enumerated by sex, carapace width and carapace condition. The chelae height is measured in males and the abdomen width in females, respectively for maturity determination. Ovary contents, clutch weight, sperm load and egg development stage in females is determined and females were sampled in relation fecundity studies. The objective of both monitoring programs is to assess the abundance of snow crab in inshore and offshore waters of Greenland. Results from this survey are presented in the Technical Report Series of the Greenland Institute of Natural Research.

A map of GINR research vessel stations for 2018 is given in fig 2.

e) Marine mammals

For yearly summaries of studies of marine mammals in Greenland, see the annual reports of the North Atlantic Marine Mammal Commission (NAMMCO).

GREENLAND FISHERY IN OTHER NAFO SUBAREAS

References

Anon. 2017. Scientific Council Reports. Northwest Atlantic Fisheries organization. Halifax NS, Canada 2017.

Jørgensen, O.A., 2017. Survey for Greenland Halibut in NAFO Divisions 1C-1D, 2016**.** *NAFO SCR Doc.*, No. 17/0XX3, Serial No. N. xxxx

Mortensen J., 2017 Report on hydrographic conditions off Southwest Greenland June/July 2016. *NAFO SCR Doc.*, No. 16/001, Serial No. N xxxx.

Therkildsen, N.O.,Hemmer-Hansen, J.,Hedeholm, R.B., Wisz, M.S., Pampoulie, C., Meldrup, D., Bonanomi, S., Retzel, A., Olsen, S.M. & E. E., Nielsen. 2013. Spatiotemporal SNP analysis reveal pronounced biocomplexity at the northern range margin of Atlantic cod Gadus morhua. Evoltutionary Applications. DOI 10.1111/eva. 12055

Table 1. Estimated catches (t) at West Greenland (NAFO Subarea 1).

NAFO SUBAREA		**Div. 1ABCDEF**					**Other nations**	**Greenland**
Species	FAO	2014	2015	2016	2017	2018	2018	2018
American Plaice	PLA	nd	1	<1	<1	0	0	0
Arctic char	ACH	21	17	11	18	12	0	12
Atlantic halibut	HAL	14	13	9	18	15	0	15
Atlantic salmon	SAL	58	61	25	28	40	0	40
Atlantic cod	COD	20280	33981	40279	36805	28296	-	28296
Capelin	CAP	346	338	377	389	265	0	265
Snow crab	CRQ	2.157	2088	2.126	2.501	2.862	0	2.862
Greenland cod	GRC	35	22	19	7	19	0	19
Greenland halibut	GHL	31.513	39.709	46.276	40.738	43.311	5.188	38.123
Roughhead Grenadier	RHG	9	7	0	0	6	3	3
Roundnose Grenadier	RNG	6	29	78	29	24	13	11
Haddoc	HAD	1	11	0	1	0	0	0
Herring	HER				1	0	0	0
Lumpfish	LUM	8.127	7.089	5.030	7.483	6.765	0	6.765
Polar cod	POC	158	114	37	22	27	0	27
Arctic cod	ATG	146	3	2	0	0	0	0
Redfish (unspecified - bycatch mainly)	RED	16	26	18	22	1	0	1
deep-sea redfish	REB	0	2	15	30	15	8	7
Redfish golden	REG	156	244	132	189	178	0	178
Saithe	POK	0	0	0	0	0	0	0
Scallops	ISC	633	799	735	526	707	0	707
Greenland Shark	GSK	nd	63	16	65	100	0	100
Dogfish sharks	DGX				1	2	0	2
Shrimp (P.boreallis)	PRA	83224	68875	80127	85829	93078	2635	90.443
Shrimp (P.montagui)	AES	1380	2024	3180	672	133	0	133
Skate	SKA	1	6	22	15	22	1	21
Wolffishes	CAT	897	400	188	240	261	104	157
Tusk	USK	-	6	17	32	56	0	56
Fish not specified	MZZ	758	610	555	839	608	15	593
Sum total		149.936	156.538	179.274	176.500	176.803	7.967	168.836

NOTE: Catch figures are provisional.

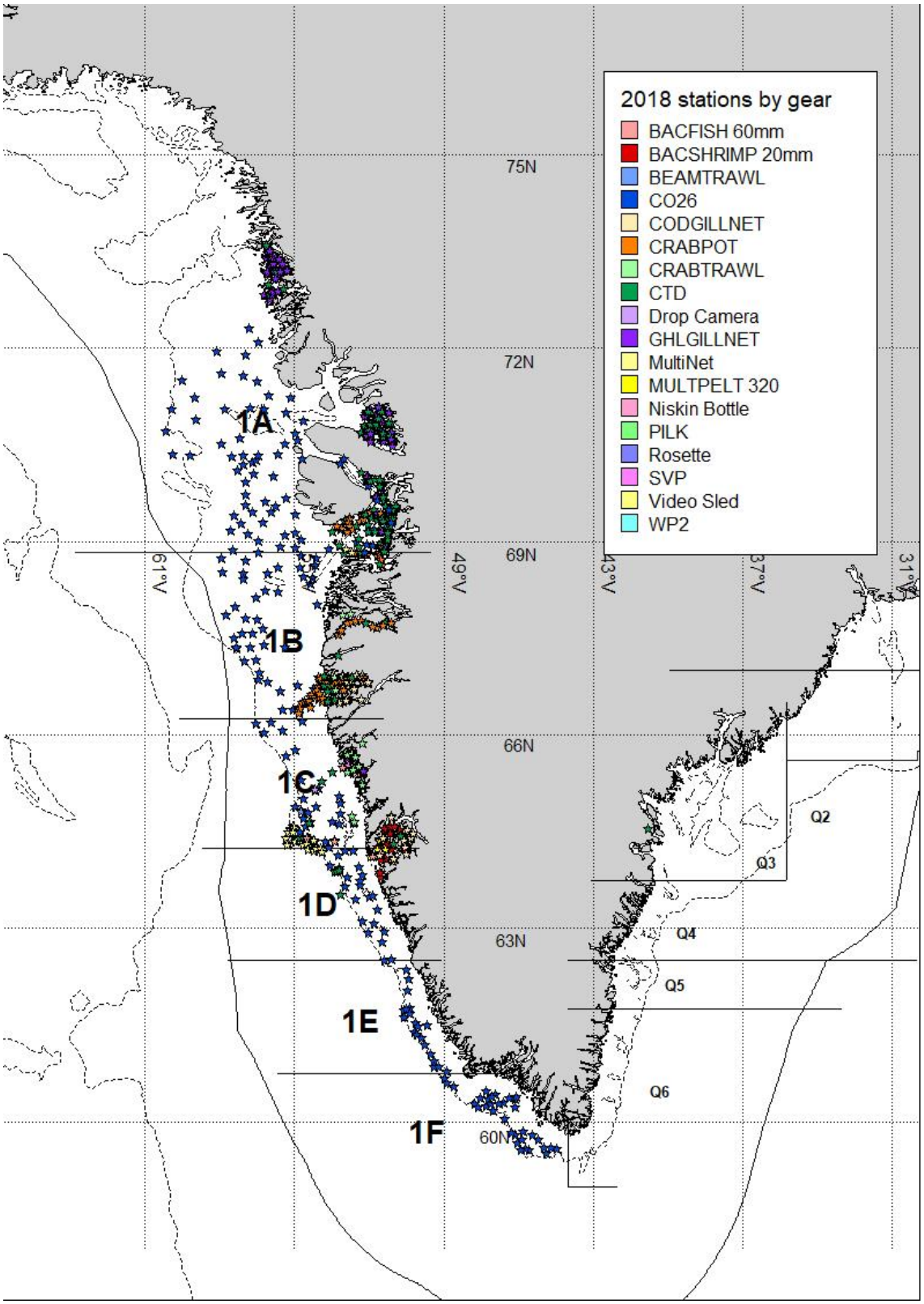

Figure 1. Distribution of GINR stations from RV Pâmiut and RV Sanna and small boats operating out of Nuuk. Stations from chartered vessels related to pelagic activities and hydrography are not included.