Serial No. N7645 NAFO SCR Doc. 25/018

SCIENTIFIC COUNCIL MEETING – JUNE 2025

The Uummannaq Gillnet survey.

by

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NYGAARD, R., CHRISTIANSEN, H., & PETERSEN, I. 2025. The Uummannaq Gillnet survey. *NAFO Scientific Council Research Document*, SCR Doc. 25/018: 1-10.

Abstract

This paper presents the updated indices for the surveys performed by the Greenland Institute of Natural Resources (GINR) in the Uummannaq Fjord located in NAFO division 1A. The stock of Greenland halibut in the Uummannaq fjord was previously surveyed using longlines, but in 2015 the survey was gradually changed to a gillnet survey. The gillnet survey was originally designed for Disko Bay targeting pre-fishery recruits from 30-55 cm. In order to also survey larger commercially sized Greenland halibut a larger meshed section was added in 2016. NPUE and CPUE were particularly high in 2021 but decreasing since.

Introduction

Greenland halibut is of major importance to the people living in Uummannaq and nearby settlements. Atlantic cod and wolffish are landed in the area, but Greenland halibut is by far the most important species locally. Fishery targeting Greenland halibut has taken place in the Uummannaq fjord since the 1960's. Greenland halibut is by far the most important source of income in the area where income is mainly based on traditional fishery and hunting. The fjord is more than 1500 meters deep in the South-Eastern part, with slightly shallower depths the western connection to the Baffin bay (Fig. 1). Several large iceberg producing glaciers are present with the more dominant glaciers located in the South-Eastern part (Qarajaq - store bræ) and North-Eastern parts (Rinks isbræ). The central parts of the Uummannaq fjord are shallower and with smooth bottom contours at depths of 500-700m.

Surveys have been conducted since the 1960's. However, the longline surveys performed poorly, with high year-to-year variability and CPUE's far below commercial CPUEs as calculated from logbooks of the commercial fleet. The low CPUE could have different causes, such as poor bait quality (squid vs. fresh capelin), doll hooks, or heavier auto longlines in the survey, while smaller vessels and dinghies operate light hand-baited longlines. Furthermore, unlike gillnets and trawls, longlines are saturating thereby gradually losing fishing effort as fish compete for the baits. The saturation effect is further affected by abundance of other species. Gillnets and trawls are impacted to a lesser degree by gear saturation. Although appealing, these gears are challenging to use in the Uummannaq Fjord. Trawls are difficult to use in the Uummannaq Fjord due to rocky bottom contours and in some areas very silty and soft bottom. Gillnets are challenging to use because of summer glacier ice, great depths, and Greenland sharks that tend to entangle and destroy gillnets if caught. Nevertheless, gillnets are currently considered the most suitable method. To avoid gillnets being destroyed by Greenland sharks the area west of Uuummannaq is no longer surveyed. Only the south eastern part of the fjord is surveyed. This document presents the main findings of the Gillnet survey in the Uummannaq fjord.

Materials and methods

The gillnet survey is conducted with the GINR research vessel R/V Sanna. Stations are paired two and two, close to each other (0,5-1 NM) to allow for analysis of within-station variability. The gillnets are composed of 60 m long sections with mesh sizes of 46, 55, 60 and 70 mm (knot to knot or half mesh). Since 2016 a 90 mm section (half mesh) has been added to the gillnet survey to increase the number of large Greenland halibut and also survey the commercial part of the stock. Sections are separated with a 2 m open space to prevent catchability interactions. Soak time is approximately 6-18 hours and fishing occurs both day and night.

Length, weight, gutted weight, otoliths, and occasionally DNA samples are regularly collected during the surveys. Otoliths are collected from individual Greenland halibut and frozen in a plastic bag with a printed plastic label with individual information and an automatically created number. At the GINR, otoliths are read after a method originally developed in Norway. In the laboratory otoliths are photographed with translucent light with a Leica S9i stereomicroscope in a 5 MP TIF image. After imaging the otoliths are archived. Digitally archived images are then "read on screen" using ImageJ. In ImageJ both contrast and brightness can easily be adjusted, and a calibration beam allows for digital measurements of otoliths proportions. Images are standardized and attempts for automated digital reading are being tested.
An age length key (ALK) is produced from the aged otoliths for each cm group. If the ALK is incomplete for certain lengths, a backup ALK is used for the missing length combinations. The backup-ALK produced from all inshore areas in a given year, is screened for the missing length-age combinations. To produce a complete backup-ALK, missing ages for certain lengths are estimated from the von Bertalanffy growth equation.
Temperature and depth loggers are attached to most gillnets, measuring the bottom temperature and revealing the sinking rate of the gillnets. The index is currently not corrected for sinking time, which is increases with depth. Sinking time varies from 20 min at shallow depth to almost 60 min in deep stations (900 m). CTD transects have been performed in two recent years. The data is stored by the Greenland Climate Research Centre (GCRC), located in Nuuk.

Results

A few experimental gillnet stations were set in Uummannaq from 2011 to 2014, but these are hardly representative of changes in the stock (Table 1). Since 2015, only gillnet stations were set, and the survey was completed in all years. From 2015 to 2017 both the NPUE and CPUE gradually decreased (Table 2 and Fig. 2). From 2018 to 2021 the NPUE increased to the highest observed in the time series. However, in 2022 the indices decreased substantially compared to 2021 and the decrease continued in 2023 and 2024. Greenland halibut is observed in all stations (Fig. 3).
The gradual decrease in CPUE from 2015 can also be seen as a as a gradual decrease in the larger Greenland halibut after 2016 (Fig. 4). This is also seen as lower numbers of Greenland halibut caught in the 90 mm mesh (Fig. 5).
The high NPUE observed in 2020 was mainly caused by unusually high numbers of small Greenland halibut around 40 cm in the survey (Fig. 4 and 5). Higher numbers of smaller Greenland halibut in the size range from 30 to 40 are observed in recent years except in 2023 indicating good recruitment (Fig 4).
The survey Catch-At-Age (CAA) also indicates a shift towards younger fish (Table 4 and Fig. 6). Cod, redfish, roughhead grenadier, Arctic skate, thorny skate, and spotted wolffish are also caught in the survey. CPUEs are currently not presented for these species.

Discussion

As in Disko Bay, both the length distribution and the CAA implies good recruitment in recent years. In the Uummannaq fjord gillnet survey smaller Greenland halibut around 30-40 cm are seen to a smaller degree. This may be related to the deeper location of the gillnet stations. It is possible that smaller Greenland halibut are present in shallower water than most gillnet stations and that larger Greenland halibut seek greater depths in some years. The initial decrease in the CPUE was caused by the gradual disappearance of the largest individuals. This is recognizable in both the more gradual decrease in the CPUE compared to the NPUE, and in the length distribution.

References

Boje, J. and Lyberth, B. (2005) Survey Calibration for Greenland Halibut in Division 1A Inshore. NAFO Scr. Doc.05/57 (N5143)

Simonsen, C.S., Boje, J. and Kingsley, M.C.S., 2000. A Review Using Longlining to Survey Fish Populations with Special Emphasis on an Inshore Longline Survey for Greenland Halibut (*Reinhardtius hippoglossoides*) in West Greenland, NAFO Division 1A. NAFO Scr.Doc., 00/29

Table 1. Number of stations by gear.

Year	Longline	Gillnet	Vessel	Notes (mesh size)
1993	21	-	AJ	
1994	-	-	AJ	
1995	19	-	AJ	
1996	24	-	AJ	
1997	-	-	-	No survey
1998	23	-	AJ	
1999	10	-	AJ	
2000	-	-	-	No survey
2001	4	0	AJ	
2002	-	-	-	No survey
2003	-	-	-	No survey
2004	-	-	-	No survey
2005	21	0	AJ	
2006	16	0	AJ	
2007	21	0	AJ	
2008	-	-	-	No survey
2009	-	-	-	No survey
2010	-	-	-	No survey
2011	16	4	AJ	
2012	28	3	Sa	
2013	28	7	Sa	
2014	23	4	Sa	
2015	18	28	Sa	46,55,60,70 + 90 mm section added at some stations
2016	0	49	Sa	46,55,60,70,90
2017	0	48	Sa	46,55,60,70,90
2018	0	54	Sa	46,55,60,70,90
2019	0	44	Sa	46,55,60,70,90
2020	0	46	Sa	46,55,60,70,90
2021	0	52	Sa	46,55,60,70,90
2022	0	43	Sa	46,55,60,70,90
2023	0	38	Sa	46,55,60,70,90
2024	0	44	Sa	46,55,60,70,90

Research vessels: RV Adolf Jensen (AJ), RV Sanna (Sa).

Table 2. CPUE and NPUE from the gillnet survey in Uummannaq.

Year	Number of stations	CPUE	SE	NPUE	SE	Number of stations
2011	4	11.17	2.41	10.14	2.07	Few
2012	3					Few
2013	7	27.60	10.59	19.46	8.59	Few
2014	4	4.74	2.65	7.48	3.55	Few
2015	28	31.58	6.77	18.28	4.66	Intermediate
2016	50	21.06	2.95	14.33	2.029	Full program
2017	48	23.45	2.38	14.16	1.51	Full program
2018	54	10.91	1.32	8.27	0.90	Full program
2019	44	11.73	1.35	10.96	1.10	Full program
2020	46	22.88	2.54	20.39	2.82	Full program
2021	52	30.39	3.26	26.49	3.42	Full program
2022	43	16.76	1.86	15.73	1.60	Full program
2023	38	11.51	1.11	11.17	1.22	Full program
2024	44	8.50	0.70	9.68	0.79	Full program

Table 3. Number of Greenland halibut otoliths collected in the Uummannaq survey.

Year	Area	Gillnet	Aged	Method
2004	Uummannaq	?	?	Not in Database
2005	Uummannaq	218	0	Dried
2006	Uummannaq	142	0	Dried
2007	Uummannaq	333	0	Dried
2008	Uummannaq	-	0	Frozen
2009	Uummannaq	-	0	Frozen
2010	Uummannaq	-	0	Frozen image
2011	Uummannaq	240	0	Frozen image
2012	Uummannaq	359	0	Frozen image
2013	Uummannaq	327	0	Frozen image
2014	Uummannaq	209	13	Frozen image
2015	Uummannaq	197	0	Frozen image
2016	Uummannaq	421	0	Frozen image
2017	Uummannaq	585	160	Frozen image
2018	Uummannaq	395	0	Frozen image
2019	Uummannaq	399	0	Frozen image
2020	Uummannaq	436	0	Frozen image
2021	Uummannaq	592	580	Frozen image
2022	Uummannaq	483	34	Frozen image
2023	Uummannaq	358	346	Frozen image
2024	Uummannaq	336	193	Frozen image

Table 4. Catch-At-Age table for the Uummannaq gillnet survey.

Year	Index val	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15	Age16
2012	82.3	0	0	3	12	8	21	12	9	9	6	2	0	0	0	2
2013	324.4	0	0	10	71	71	74	51	23	10	8	4	0	0	0	2
2014	124.7	0	0	5	32	56	18	10	0	4	0	0	0	0	0	0
2015	304.7	0	0	4	31	34	83	71	41	23	10	2	2	1	1	2
2016	243.5	0	1	9	26	50	52	50	29	16	6	1	1	0	0	1
2017	236.0	1	0	0	9	17	18	28	34	34	18	20	28	10	5	12
2018	137.9	0	2	8	14	26	24	20	10	9	10	4	2	6	1	2
2019	182.7	0	0	14	41	42	35	25	13	5	4	2	1	0	0	0
2020	339.8	0	6	63	114	73	51	21	8	3	2	0	0	0	0	0
2021	441.6	0	1	34	78	124	103	53	27	14	3	3	0	1	0	1
2022	262.1	0	3	24	140	62	15	11	5	1	0	0	0	0	0	0
2023	186.2	0	1	7	77	51	23	19	6	2	1	0	0	0	0	0
2024	161.4	0	1	22	65	45	20	7	1	0	0	0	0	0	0	0

Table 5. Length-weight relationship for Greenland halibut in the Uummannaq region.

Year	Area	Number of fish	Log a	b	R^2
2012	Uummannaq	357	-12.708	3.259	0.984
2013	Uummannaq	313	-12.666	3.252	0.983
2014	Uummannaq	209	-12.692	3.251	0.992
2015	Uummannaq	197	-13.093	3.370	0.982
2016	Uummannaq	421	-12.730	3.262	0.991
2017	Uummannaq	581	-12.916	3.326	0.975
2018	Uummannaq	393	-12.540	3.224	0.988
2019	Uummannaq	397	-12.170	3.137	0.986
2020	Uummannaq	432	-12.534	3.235	0.991
2021	Uummannaq	591	-12.825	3.311	0.988
2022	Uummannaq	482	-12.760	3.283	0.988
2023	Uummannaq	358	-12.674	3.254	0.984
2024	Uummannaq	336	-12.514	3.202	0.989

Figure 1. Map of the Uummannaq fjord.

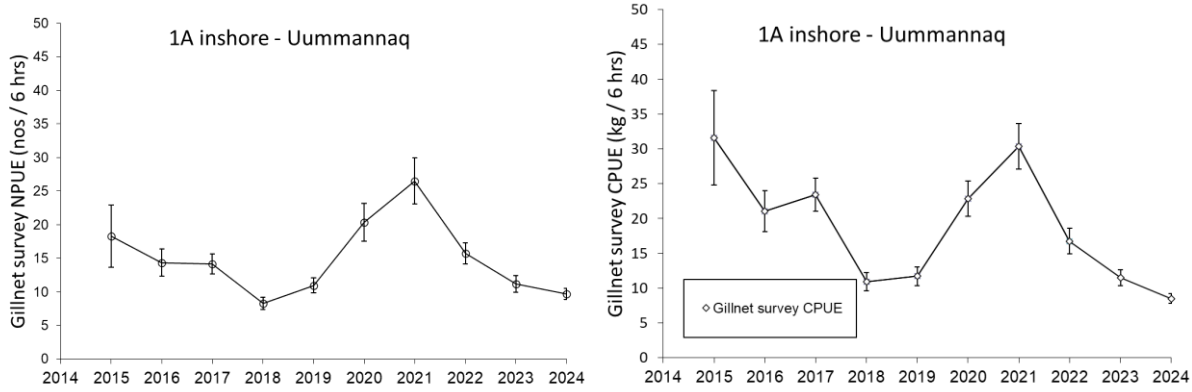

Figure 2. Greenland halibut NPUE (left) and CPUE (right) from the GINR gillnet survey in the Uummannaq fjord. Low number of stations before 2015.

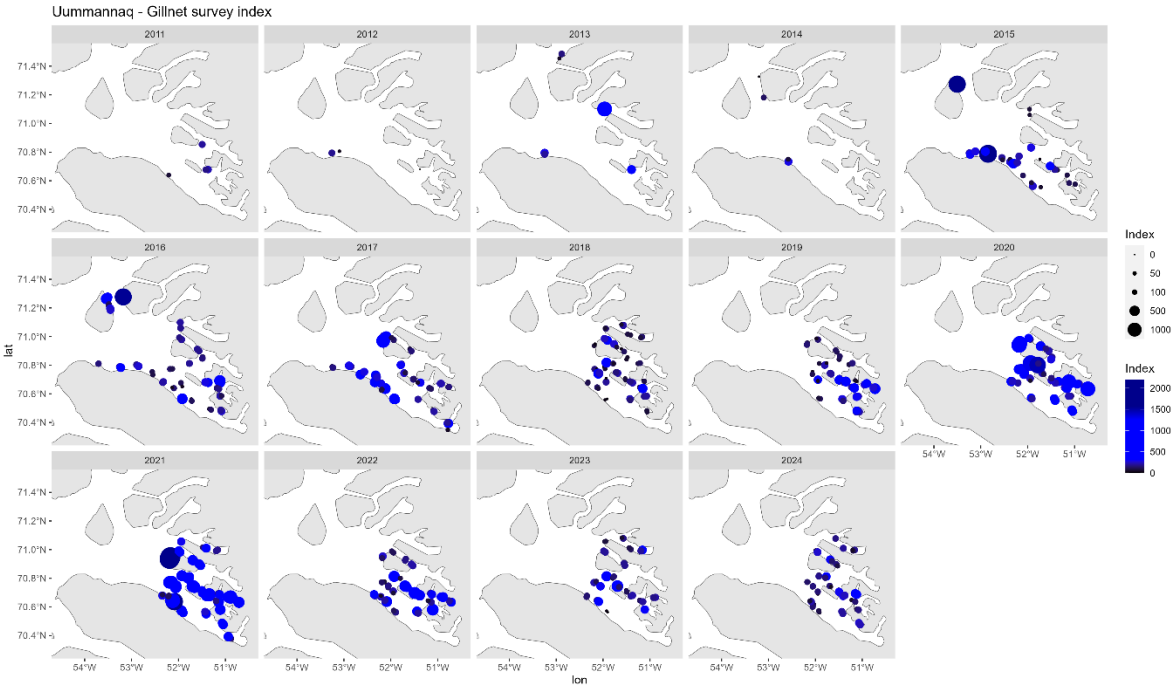

Figure 3. NPUE index of Greenland halibut per station in the Uummannaq gillnet survey.

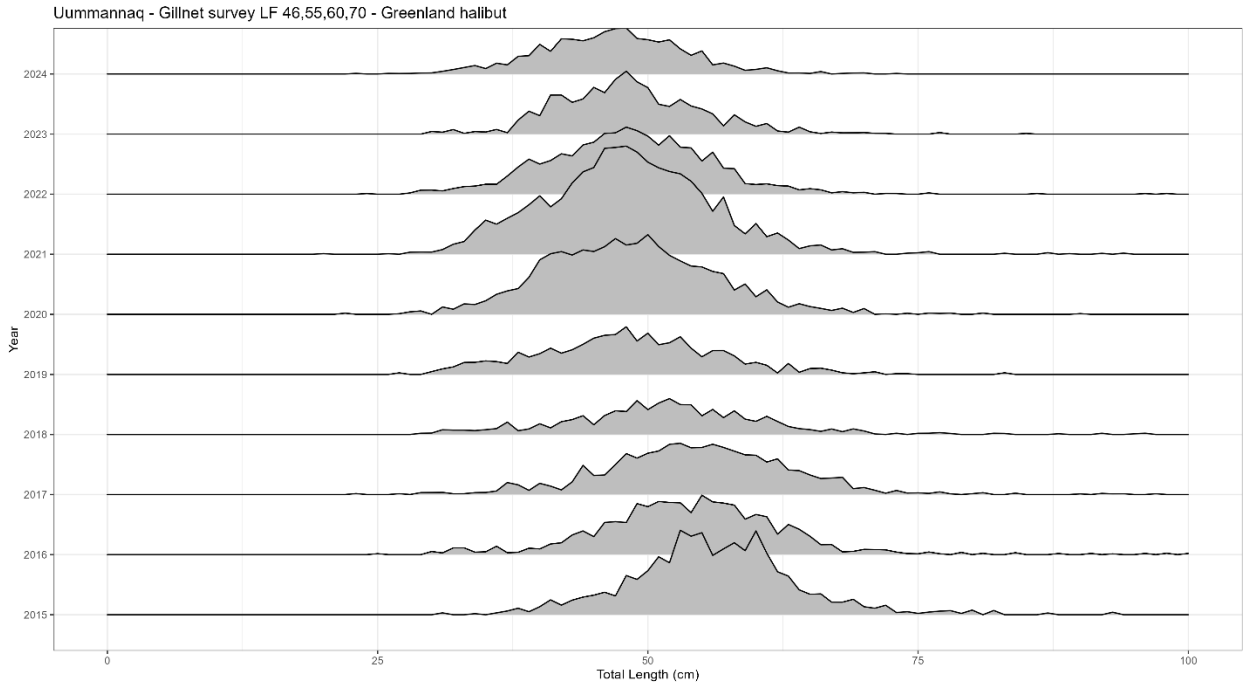

Figure 4. Observed length frequency distribution (N/100hr) for Greenland halibut from the gillnet survey in Uummannaq meshsizes 46,55,60,70.

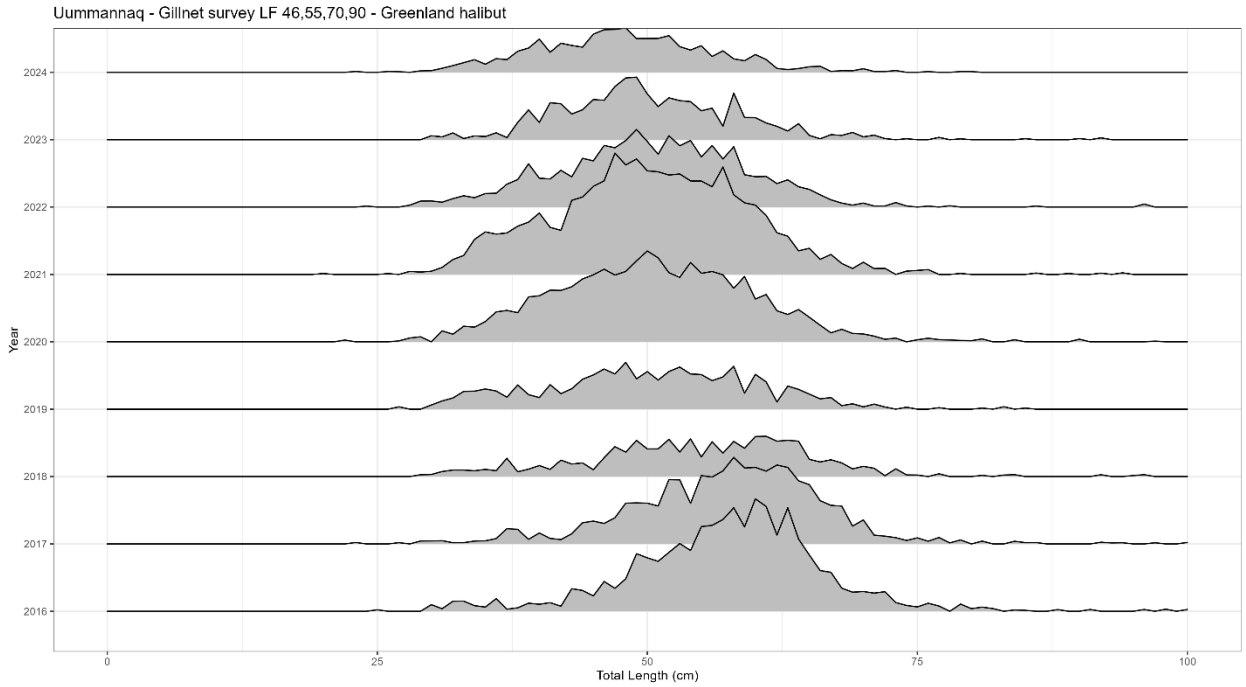

Figure 5. Observed length frequency distribution (N/100hr) for Greenland halibut from the gillnet survey in Uummannaq meshsizes 46,55,70,90.

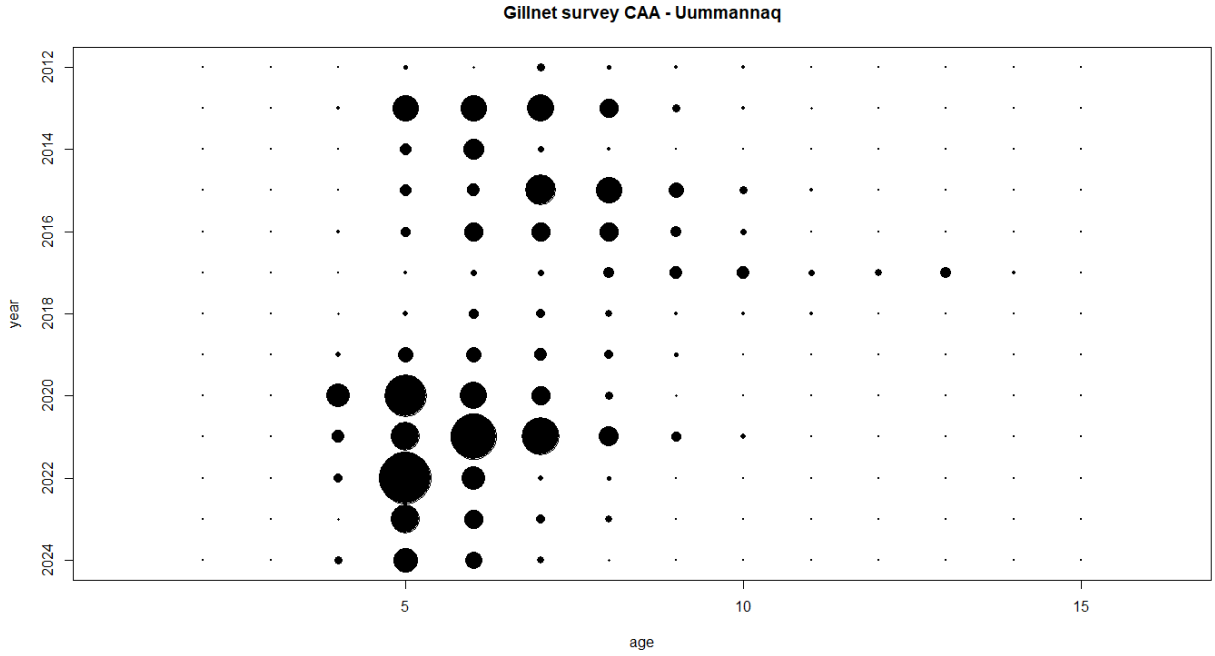

Figure 6. Catch-At-Age bubble plot from the gillnet survey in Uummannaq.