

1 Diets of the Barents Sea cod (*Gadus morhua*) from the 1930s to  
2 2018

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**Abstract**

A new dataset on the diet of Atlantic cod in the Barents Sea from the 1930s to the present day has been compiled, to produce one of the largest fish diet datasets available globally. Atlantic cod is one of the most ecologically and commercially important fish species in the North Atlantic. The stock in the Barents Sea is by far the largest, as a result of both successful management and favourable environmental conditions since the early 2000s. As a top predator, cod plays a key role in the Barents Sea ecosystem. The species has a broad diet consisting mainly of crustaceans and teleost fish, and both the amount and type of prey vary in space and time. The data, from Russia, Norway and the United Kingdom, represents quantitative stomach contents records from more than 400,000 fish, and qualitative data from 2.5 million fish. Much of the data is from joint collaborative surveys between Norway and Russia. The sampling was conducted throughout each year allowing for seasonal, annual and decadal comparisons to be made. Visual analysis shows cod diets have changed considerably from the start of the dataset in the 1930s to the present day. There was a large proportion of herring in the diets in the 1930s, whereas in more recent decades, capelin, invertebrates and other fish dominate. There are also significant interannual asynchronous fluctuations in prey, particularly capelin and euphausiids. Combining these datasets can help us understand how the environment and ecosystems are responding to climatic changes, and what influences the diet and prey switching of cod. Trends in temperature and variability indices can be tested against the occurrence of different prey items, and the effects of fishing pressure on cod and prey stocks on diet composition could be investigated. The dataset will also enable us to improve parametrisation of food web models, and to forecast how Barents Sea fisheries may respond in the future, to management and to climate change. The Russian data is available through joint projects with Polar branch of VNIRO. The UK and Norwegian data (Townhill et al., 2020) is being released with this paper at doi: 10.21335/NMDC-2139169383.

## 64 **1 Introduction**

65 Here we document a new extensive dataset on the stomach content of Atlantic cod (*Gadus morhua*) in the Barents  
66 Sea. We have compiled the dataset by joining historical data from the UK (1930-1964) with historical data from  
67 the Soviet Union/Russia (1947-1983) and more recent (1984-2018) data from a large existing joint Norwegian-  
68 Russian cod stomach-content database. The resulting dataset spans the period from 1930 until present day.

69 Comprehensive information on the predation dynamics of ecologically important species, based upon the analysis  
70 of individual stomach-contents, is vital for an understanding of how the biological components in an ecosystem  
71 are connected (Hyslop, 1980; Holt et al., 2019). Such data can provide detailed knowledge on the diet of a species  
72 in an area at a particular time. When conducted over long temporal scales and across size classes, spatially high-  
73 resolution stomach-content data can provide data that is key to understanding trophic interactions in marine  
74 ecosystems.

75 Unfortunately, long-term high-quality fish population diet data with good spatio-temporal coverage are rare, as  
76 the effort and resources required to collect and analyse stomach-contents at this scale is considerable. However,  
77 due mainly to the stock's commercial importance, both Russia, Norway and the UK have invested considerable  
78 resources in sampling, working up and sustaining stomach-contents data for the Barents Sea (or Northeast Arctic)  
79 cod. Diet data is valuable in understanding trophic interactions; particularly important in areas where multiple  
80 species are caught. For example, diet data allows predation mortality to be included in stock assessments (ICES,  
81 2019), and to understand inter-specific interactions between predators (Durant et al., 2014).

82 To support the cod fishery in the Barents Sea, the UK carried out surveys from the 1930s, mainly collecting catch  
83 and length data, but also recording stomach contents. They collected content data from between a few hundred  
84 to 3,500 stomachs each year, ending in the 1960s. The Norwegian-Russian data originate from a joint research  
85 project on the diet and food consumption of Barents Sea fish, with cod as the main study species, initiated in the  
86 mid-1980s. This was a joint endeavour between IMR (Institute of Marine Research, Norway) and PINRO  
87 (Knipovich Polar Research Institute of Marine Fisheries and Oceanography, since 2019 names the Polar Branch  
88 of the Russian Federal Research Institute of Fisheries and Oceanography (VNIRO); Mehl, 1986; Mehl and  
89 Yaragina, 1992; Dolgov et al., 2007, 2011; Yaragina et al., 2009). An average of 8,153 stomachs were analysed  
90 each year (Holt et al., 2019). In addition, there are also numerous Russian cod diet data that was collected from  
91 the 1930s-80s, (Dolgov et al., 2007; Yaragina and Dolgov, 2011) which are described here and summarized in the  
92 Supplementary Material. These could not be made available in the main dataset published with this manuscript,  
93 but are available under joint research projects.

94 Atlantic cod is one of the most ecologically and commercially important fish species in the North Atlantic and the  
95 Barents Sea stock is by far the largest. As opposed to many other cod stocks and other fish world-wide, the Barents  
96 Sea cod are doing well, a result of both successful management and favourable environmental conditions since  
97 the early 2000s (Kjesbu et al., 2014, Ottersen et al., 2014, Fossheim et al., 2015). Cod plays a key role in the  
98 Barents Sea ecosystem and is the dominating top predator. While cod has a broad diet consisting mainly of  
99 crustaceans and teleost fish, the amount and kind of prey actually available varies in space and time as well as by  
100 cod size (Zatsepin and Petrova, 1939; Yaragina et al., 2009, Johannesen et al., 2012, 2015; Holt et al., 2019).

101 For Atlantic cod, being arguably one of the most important fish on the planet, such diet data exist in several seas:  
102 e.g. the Baltic (Neuenfeldt and Beyer, 2006); on Georges Bank (Tsou and Collie, 2001); the Gulf of Maine, US  
103 (Willis et al., 2013); Icelandic waters (Pálsson and Björnsson, 2011); and the northeast US shelf ecosystem (Link  
104 & Garrison 2002). A comparison of Atlantic cod diet and the role of cod in the various ecosystems was made by  
105 Link et al. (2009). Data on the diet of other northeast Atlantic species have been recently released, allowing  
106 analysis of herring, blue whiting, mackerel, albacore and bluefin tuna diets (Pinnegar et al., 2015). The time series  
107 of these pelagic species begin in the 1860s, and combine data from France, Norway, Iceland, Ireland and the UK.  
108 Here, we compile a similar dataset of Barents Sea cod diet data, from Norway, Russia and the UK.

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## 110 **2 Data and methodology**

### 111 **2.1 UK Barents Sea surveys**

112 A UK fishery began in the Barents Sea in 1905, with increased exploitation from 1929. Catches of cod and  
113 therefore profits were high, particularly from the 1930s when sea temperatures in the area became warmer  
114 (Cushing, 1966) and cod stock sizes increased to historic high levels in the 1930s-1940s (Hysten, 2002). Aimed at  
115 investigating the cod fishery, and the influence of temperature, which already at the time was known to influence  
116 cod distributions, the UK carried out fisheries surveys in the Barents Sea from the 1930s to the 1960s, with a  
117 break for WWII. The surveys were conducted firstly on-board commercial fishing vessels, and later with a  
118 dedicated Arctic survey vessel, the *RV Ernest Holt* (Graham, 1953). The surveys collected data on cod abundance,  
119 length distributions, temperature, salinity and depth, and samples of cod stomachs were also taken. This was less  
120 systematic than for present-day cruises, and so the data is less statistically robust than for the data for the 1980s  
121 onwards. The frequency of prey items was recorded rather than the mass of each prey item, and no data on stomach  
122 fullness was collected. For the majority of surveys, prey occurrence is recorded for each stomach individually.  
123 For some however, pooled data is provided, for up to 198 stomachs in total. The survey methodology is described  
124 in Graham (1953) and summarised in Townhill et al. (2015). On the *RV Ernest Holt*, a standard otter trawl was  
125 used, with and without Vigneron-Dahl gear. Rather than using a statistically designed survey grid, the scientists  
126 wanted to find large cod groups and so vessels searched for high cod catches, operating more like a commercial  
127 fishing boat.

#### 128 *DAPSTOM database summary*

129 Under the Centre for Environment, Fisheries and Aquaculture Science (Cefas) project Trawling Through Time  
130 (DP332) and the Norwegian-British-Russian research project CoDINA (Cod: Diet and food web dyNAMics),  
131 funded by the Research Council of Norway, the data for these surveys were digitized from paper logbooks held  
132 by Cefas and the stomach data is held in the DAPSTOM database (Cefas, 2014; Pinnegar, 2014). The DAPSTOM  
133 (Database And Portal for Fish STOMach records diet database), described in Pinnegar (2019) contains 256,354  
134 records from 360,561 stomachs, with the first records from the 1830s. These are from 204 species and 9,445  
135 research cruises/sampling campaigns. 28% of the records are for Atlantic cod, mainly for the seas around the UK,  
136 but also including these for the Barents Sea.

137

### 138 **2.2 The joint Norway-Russia research programme on trophic relationships in the Barents Sea**

139 Russian and Norwegian surveys include cod stomach sampling in their regular procedures, as described in Dolgov  
140 et al. (2007 and 2011). The joint research programme began in 1987, initially collecting stomach samples of cod  
141 and haddock with the objectives of quantitative analysis of demersal fish stomachs, calculating consumption by  
142 cod of commercially important prey species, and creating the basis for developing Barents Sea multispecies  
143 models (Dolgov et al., 2007). Since the surveys began, other species have been included to further understand  
144 trophic interactions. The stomach samples are taken on research surveys that use both pelagic and bottom trawls.  
145 Up to ten stomachs are collected for each 10 cm length group at stations which have biological sampling on  
146 Norwegian surveys (Mehl and Yaragina, 1992). On Russian commercial vessels and Russian national surveys,  
147 25 stomachs are sampled per trawl. Unlike the historical UK surveys in the Barents Sea, these stomachs are  
148 weighed and the total weight and degree of digestion for each prey item is recorded. For items that can be  
149 identified and intact, lengths are recorded, as well as the total number of identifiable prey in each stomach.  
150 Maturity and sex are also recorded, and otoliths read to measure age. Only the Norwegian data is included in the  
151 Barents Sea cod dataset, published alongside this paper.

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### 153 **2.3 Barents Sea cod dataset**

154 The UK stomach contents dataset has been merged with the Norway data from 1984 as part of the project  
155 CoDINA, to form the Barents Sea cod dataset. As part of the merging process, data underwent a thorough  
156 quality control, as described in Holt et al., (2018). A description of each prey category is provided in  
157 Supplementary material 1, and the metadata for the dataset is provided in Supplementary material 2. *Data*  
158 *summary*

159 The largest number and geographic spread of samples are from Norwegian surveys, with fewer samples from UK  
160 surveys (Figure 1). The data includes the area to the west and north of Svalbard (Spitsbergen).

161 A total of 400,054 individual stomachs are contained in the Barents Sea cod diet dataset (Table 1). These include  
162 102,197 empty stomachs. The numbers sampled in each year vary according to the number of surveys in each  
163 year, with no stomach data in some years (Figure 2). The number of empty stomachs varies each year (Figure 2).  
164 The UK qualitative data in Figure 2 are the 103 pooled records in the UK dataset, where the contents of more than  
165 one stomach are recorded together. Up to 198 stomachs are combined in each of these records.

166 The Barents Sea cod diet dataset contains data from across the Barents Sea, from the north of Norway, to  
167 Spitsbergen and eastwards to Russia (Figure 1), however the overall coverage and sampling locations varied each  
168 year. The UK surveys in the 1930s and 1940s tended to be in the region south and east of Spitsbergen, and around  
169 Bear Island. From the 1980s onwards, the Norwegian survey area was further to the eastern Barents Sea (Figure  
170 3). There is no data in the dataset for the 1970s, as the UK surveys stopped in the 1960s, and the IMR and PINRO  
171 joint collection of quantitative data did not begin until the 1980s (Dolgov et al., 2007).

172 Stomachs have been sampled throughout the year (Figure 4) allowing for seasonal changes in the diet to be  
173 analysed. Sampling is widespread in quarters 1, 3 and 4, but does not go as far north in quarters 1 and 2. This is  
174 because there is ice cover preventing the survey vessels from travelling north and east of Spitsbergen during the  
175 winter. It is generally more limited in geographical area during quarter 2 as few regular surveys have been carried  
176 out in that quarter.

177

178 *Diet composition*

179 The dataset shows that cod diets do not remain constant, and occurrence of different prey items changes each  
180 decade (Figure 5) and year (Figure 6). In the 1930s, when there are fewer records, most of the food items are not  
181 identified to species, and there is a large proportion of other food and other fish in the diets (Figure 5). From the  
182 1940s onwards, most of the fish items found in the stomach are identified to species. The data shows a large  
183 amount of herring in the diet in the 1930s, which is not found again in later decades. In the 1940s and 1950s, there  
184 is a high occurrence of euphausiids in the diet, and this decreases to the 2010s. There is a lower occurrence of  
185 capelin in the earlier decades, particularly in the 1930s and 1960s, and this increases again to a high proportion of  
186 the diet from 1990s onwards. Cod cannibalism is apparent in every decade, with the highest proportion of cod in  
187 the diet at >30% in 1930s, reduced to 20% or less thereafter in later years. These figures show how variable the  
188 diet compositions are between years and decades. There is a large proportion of herring in the diets in the 1930s,  
189 which does not occur again, and in more recent decades, capelin, invertebrates and unidentified fish (other fish)  
190 dominate.

191 Looking at the prey occurrence of the main prey items in each year (Figure 6), there are quite large annual  
192 fluctuations, particularly for capelin, cod, euphausiids and shrimp. Haddock, hyperiids, redfish, polar cod and  
193 herring have fewer annual spikes. Capelin, cod, euphausiids and shrimp have the highest frequency of occurrence  
194 in the earlier part of the time series, to the 1960s. The occurrence is still variable from the 1980s onwards, but to  
195 a lesser degree.

196 The four main prey species of cod (cannibalism), capelin, euphausiids and shrimp were caught across the whole  
197 geographical area of the surveys (Figure 7). All of these species are caught up to the northern limits of the surveys,  
198 around Spitsbergen and across the Barents Sea.

199 **2.4 Russian data on cod diet in the Barents Sea**

200 In addition to the joint Norway-Russia research programme, since 1947, a Russian sampling programme has  
201 collected observations on cod diet in the Barents Sea throughout the year from commercial and research vessels.  
202 During sampling, the degree of stomach fullness was recorded using a five-division scale, ranging from 0: empty  
203 stomach, to 4: stomach expanded and unfolded by food, as well as the presence of different prey items (capelin,  
204 juvenile cod, redfish, herring, shrimp, euphausiids, and other) in the stomach. This qualitative method named  
205 “field feeding analysis” was widely used in Russian investigations of different fish species including cod (see  
206 references in Dolgov et al. 2007 and Yaragina and Dolgov, 2011). From 9 to 45 thousand cod stomachs were  
207 analyzed each year during 1947-1979. As yet, the qualitative Russian stomach samples for years 1947-1983 are  
208 not fully digitized, and so only the digitized data are presented in the supplementary material.

209 There are 24,457 quantitative and 2,599,421 qualitative Russian stomach samples, and the Russian data extends  
210 further east and northeast than the Norwegian or UK data. The Russian data are not available for publication but  
211 are described and presented in a number of papers and reports (e.g. Zatsepin and Petrova, 1939; Mehl and  
212 Yaragina, 1992; Dolgov et al., 2007 and references therein; Yaragina et al., 2009; Yaragina and Dolgov, 2011  
213 and references therein; Holt et al., 2019). They are available under joint research projects. Further information  
214 about the Russian data is provided in Supplementary material 3. The locations of the samples are shown in

215 Figure S3.1, the location in each decade in Figure S3.2, the total number of stomachs in each year, and empty,  
216 are in Figure S3.3, the percentage occurrence of prey in each decade in Figure S3.4, and the time series of  
217 occurrence of the main prey is provided in Figure S3.5.

218 Analysis of the early Russian data also shows that the diets of cod have changed considerably from the 1930s to  
219 the 2000s (Yaragina et al., 2009; Yaragina and Dolgov, 2011), reflecting the trends seen in the Barents Sea diet  
220 database for herring, cod, capelin and polar cod in Figures 5 and 6, although not for haddock. The earliest Russian  
221 investigations into cod diets from the 1930s (Zatsepin and Petrova, 1939) show similar fluctuations in prey, with  
222 interannual asynchronous fluctuations in capelin and euphausiids (Yaragina and Dolgov, 2011), which is also  
223 shown in the data in Figure 6.

224

### 225 **3 Discussion**

226 IMR/PINRO data have been used in numerous publications and assessments, such as Holt et al. (2019) who  
227 investigated how cod diet changes over time, across seasons and with ontogeny. The role of macroplankton in the  
228 diet has been studied by Orlova et al. (2005). The data were used to extrapolate cod cannibalism information back  
229 to the 1940s (Yaragina et al., 2018). Furthermore, these data were used to explore intra-and inter-specific  
230 interactions between top predators in the Barents Sea (Durant et al. 2014). The Arctic Fisheries Working Group  
231 has used the cod diet data to estimate cod predation on North East Arctic cod and haddock and Barents Sea capelin  
232 in their stock assessments (ICES, 2019). Spatial dynamics of cod and their main prey were determined by  
233 Johannesen et al. (2012), and seasonal variations in feeding and growth by Johannesen et al. (2015). The role of  
234 herring and capelin as prey sources have been studied in detail, particularly in relation to size-dependent predation  
235 (Johansen, 2002; 2003; 2004). The stomach data have also been used to assess Ctenophora abundance in the  
236 Barents Sea, by using cod as a Ctenophora sampling tool (Eriksen et al., 2018). They found that Ctenophora are  
237 increasing abundance in cod stomachs in recent years, coinciding with warm seas. The UK dataset covers the  
238 period of the 1940s when temperatures in the Barents Sea were similar to those found today (Boitsov et al., 2012).  
239 Analysis of this earlier dataset has shown how prey choice is influenced by temperature, with implications for the  
240 present day cod population (Townhill et al., 2016). By combining the early and recent years, this new long-term  
241 dataset will allow further comparison of temperature regimes throughout the past century. Also, by using cod as  
242 a sampling tool, the data can be used to investigate occurrence and trends in any of the species on which they  
243 prey. This has been done e.g. by Holt et al. (2021) for cod predation on snow crab (*Chionoecetes opilio*) which is  
244 a newly established species in the Barents Sea. UK data has been used to investigate diets in the last century and  
245 the role of sea temperature (Townhill et al., 2015). This analysis of the UK data alone found that temperature has  
246 a large role to play in explaining the presence of capelin and herring in cod diets. The Russian data were very  
247 useful for the understanding of the fluctuations in the ecosystem (e.g. Yaragina and Dolgov, 2011) and for the  
248 development of multispecies models. By combining these datasets, we can further understand how the  
249 environment and ecosystems are responding to climatic changes, and what influences the diet and prey switching  
250 of cod which is evident in the data. Such a long time series will enable trends in temperature and variability  
251 indices to be tested against the occurrence of different prey items, and investigate whether fishing pressure on cod  
252 and the stocks of their prey affect the diet composition. The dataset will also enable us to improve parametrisation

253 of food web models, and to forecast how Barents Sea fisheries may respond in the future, to management and to  
254 climate change.

### 255 **3.1 Limitations**

256 The UK data contains pooled data of up to 198 stomachs in one record, where the stomach data for all of the cod  
257 at one sample station was recorded as one record. This data can be used for qualitative analysis, and exploratory  
258 analysis of the first half of the 20<sup>th</sup> century. The stomach contents from the pooled data have been previously  
259 presented by Brown and Cheng (1946). The UK data are not as robust as more recent data in that a statistically  
260 designed survey was not carried out, and instead the vessels sought the highest catches of cod that they could.  
261 This must be taken into account in any analysis of the dataset, but nonetheless the data is still valuable and is a  
262 record of cod diets in a certain place and time. There is more detail included in the Norwegian-Russian dataset,  
263 such as fullness of stomachs and length and weight of prey. Where such information is required in analysis, the  
264 UK data may be less useful. However, there is a lot of value in the combined dataset, even with fewer parameters  
265 recorded for the earlier years. The UK data shows similar trends in cod diet to quantitative Russian data for the  
266 same time period (Yaragina and Dolgov, 2011), showing that this qualitative data is still useful in investigating  
267 trends in cod diets.

268 The quantitative Norwegian and Russian data is more robust than the UK data, and full details of the sampling  
269 methods are available (Dolgov et al., 2007, 2011). The main limitation is that bottom trawls are generally used  
270 and so the cod are not well sampled if they are high in the water column. However, cod are generally a demersal  
271 species and as such bottom trawling is the most effective sampling method. Also, the sampling is limited in the  
272 Lofoten/Vesterålen area, an important spawning location for Barents Sea cod. Analysis of the stomachs of  
273 spawning cod has only been possible for certain years, owing to the low number of survey stations in the area  
274 (Michalsen et al., 2008). As such, cod stomachs sampled south of 70°N and west of 18°E (Lofoten and nearby  
275 areas), were excluded from the dataset and our analyses, as spawning cod is mainly found in this coastal area  
276 (Michalsen et al., 2008). This analysis showed that herring dominated the diet and stomach fullness was found to  
277 be lower in this area during the spawning period (March and April). As such, the location of the cod should be  
278 considered when using this Barents Sea cod diet dataset.

279

### 280 **4 Summary**

281 The release of the Barents Sea cod diet dataset is a significant contribution to the study of Atlantic cod ecology,  
282 feeding and the Barents Sea ecosystem as a whole. The data have been used in numerous analyses, which has  
283 helped scientists gain a detailed understanding of the stock, mainly analysis of separate datasets. Now, with the  
284 population at a high level, this combined dataset, covering almost 90 years and stretching back to 1930, can be  
285 used to investigate how climate may be affecting the dynamics of the stock, how this may have knock-on effects  
286 within the food web, and what implications this may have for the future of this ecologically and economically  
287 important cod stock.

### 288 **Data Availability**

289 The Barents Sea cod diet database (Townhill et al., 2020) can be accessed and data downloaded from  
290 <https://doi.org/10.21335/NMDC-2139169383>. The prey categories and metadata for the database are found in



291 Supplementary material 1 and 2 respectively. The Russian quantitative data from the joint database (1984-2018)  
292 and the qualitative Russian diet data (1947-1983), which are not yet fully digitized, are not publicly available due  
293 to the Institution policy, but access to these data is granted through contracted collaboration in joint projects with  
294 the Polar branch of VNIRO. Summaries, descriptions and analyses of the Russian data can be found in the  
295 following publications: Zenkevich and Brotskaya, 1931; Zatsepin and Petrova, 1939; Mehl and Yaragina, 1992;  
296 Dolgov et al., 2007; Yaragina and Dolgov, 2011; Holt et al., 2019; Yaragina et al., 2009; and Yaragina and Dolgov,  
297 2011.

## 298 **Author Contribution**

299 BLT conceived the idea for the paper. BB, EJ, NY, AD were all involved in data collection and survey  
300 organisation. REH and BLT formed, cleaned and prepared the new Barents Sea Cod Diet Database. REH and  
301 BLT prepared the figures for the manuscript. BLT wrote the manuscript with contributions from all co-authors.

## 302 **Competing Interests**

303 The authors declare that they have no conflict of interest.

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312 UK stomach content databases, not least the colleagues undertaking the enormous practical task of identifying the  
313 stomach-contents.

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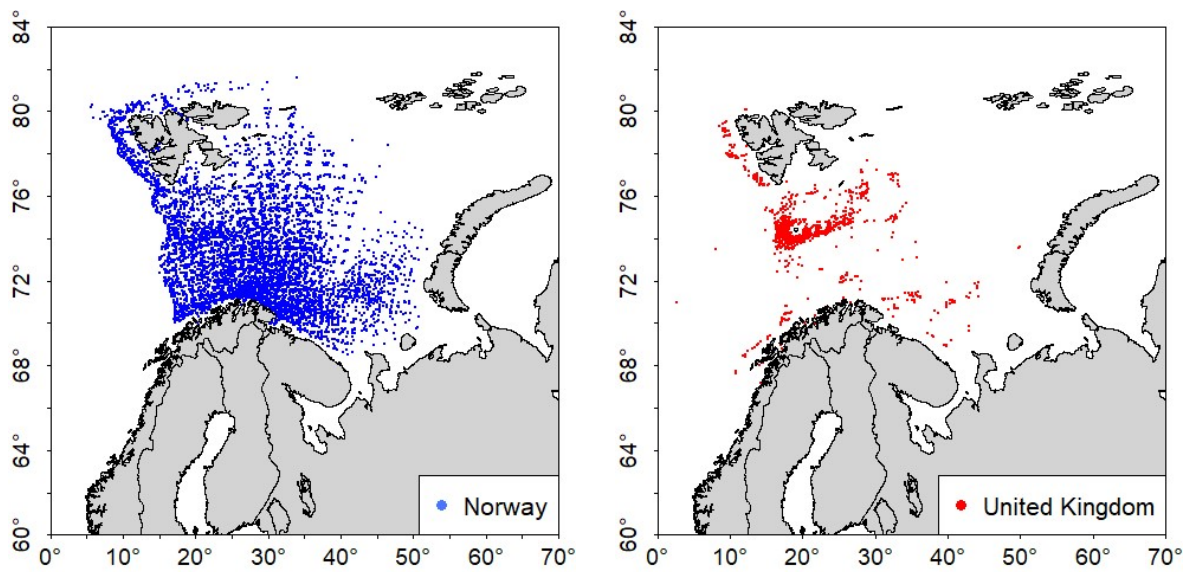
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433 7. Figures



434 **Figure 1. The location of the cod stomach samples taken in the Barents Sea by each institution.**

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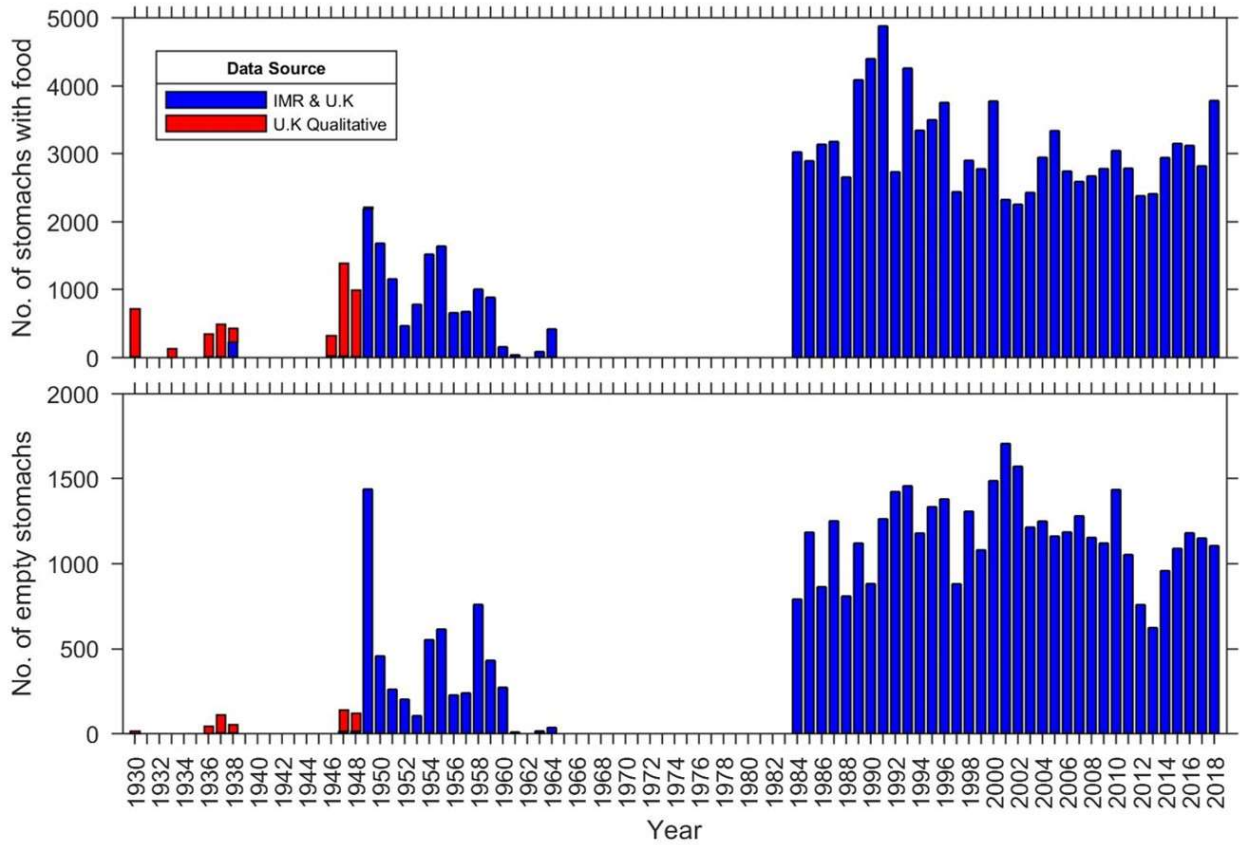
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442 **Figure 2. Number of stomachs sampled in each year, showing those with food contents (upper panel) and those that**  
 443 **were empty (lower panel).**

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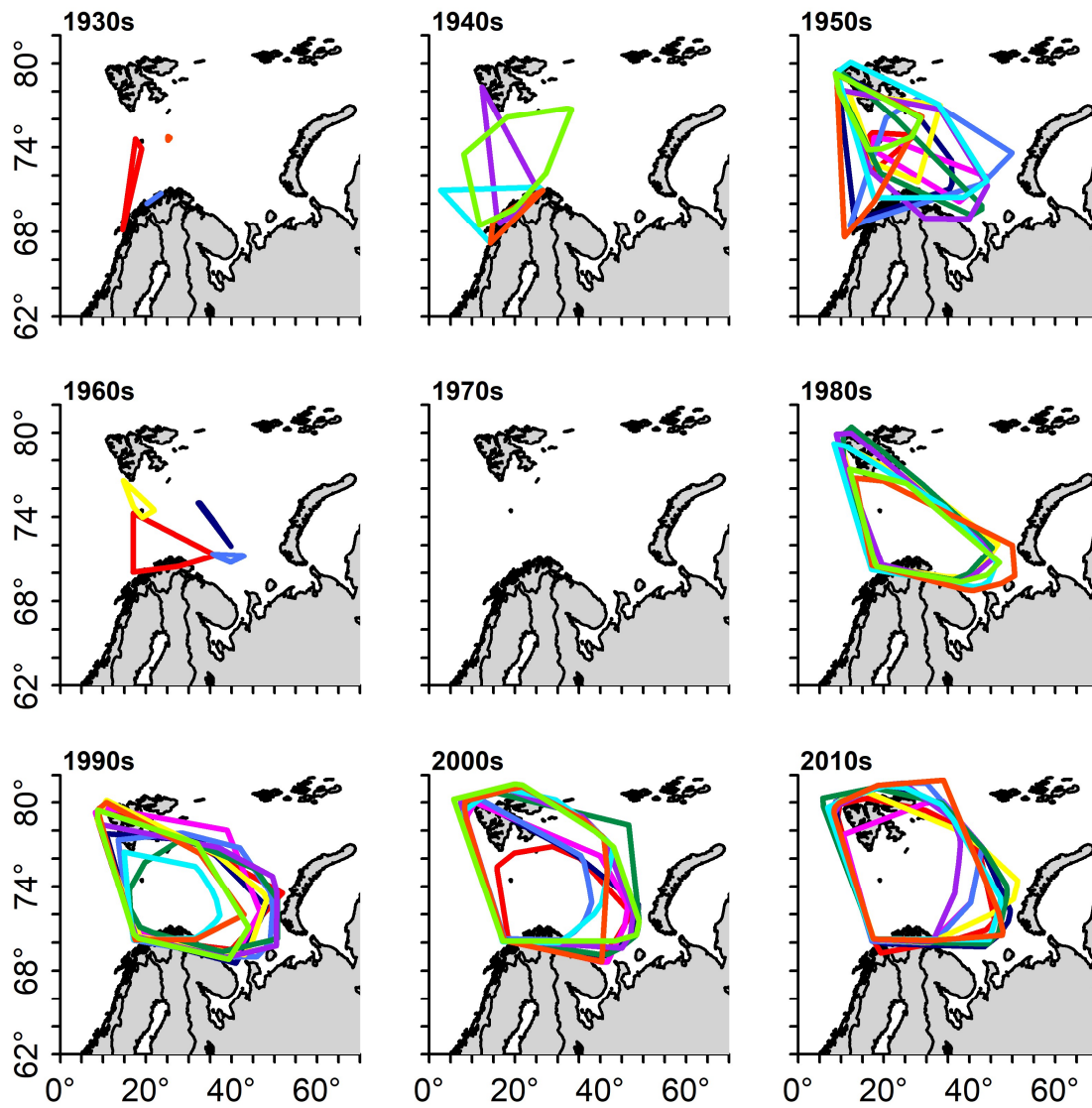
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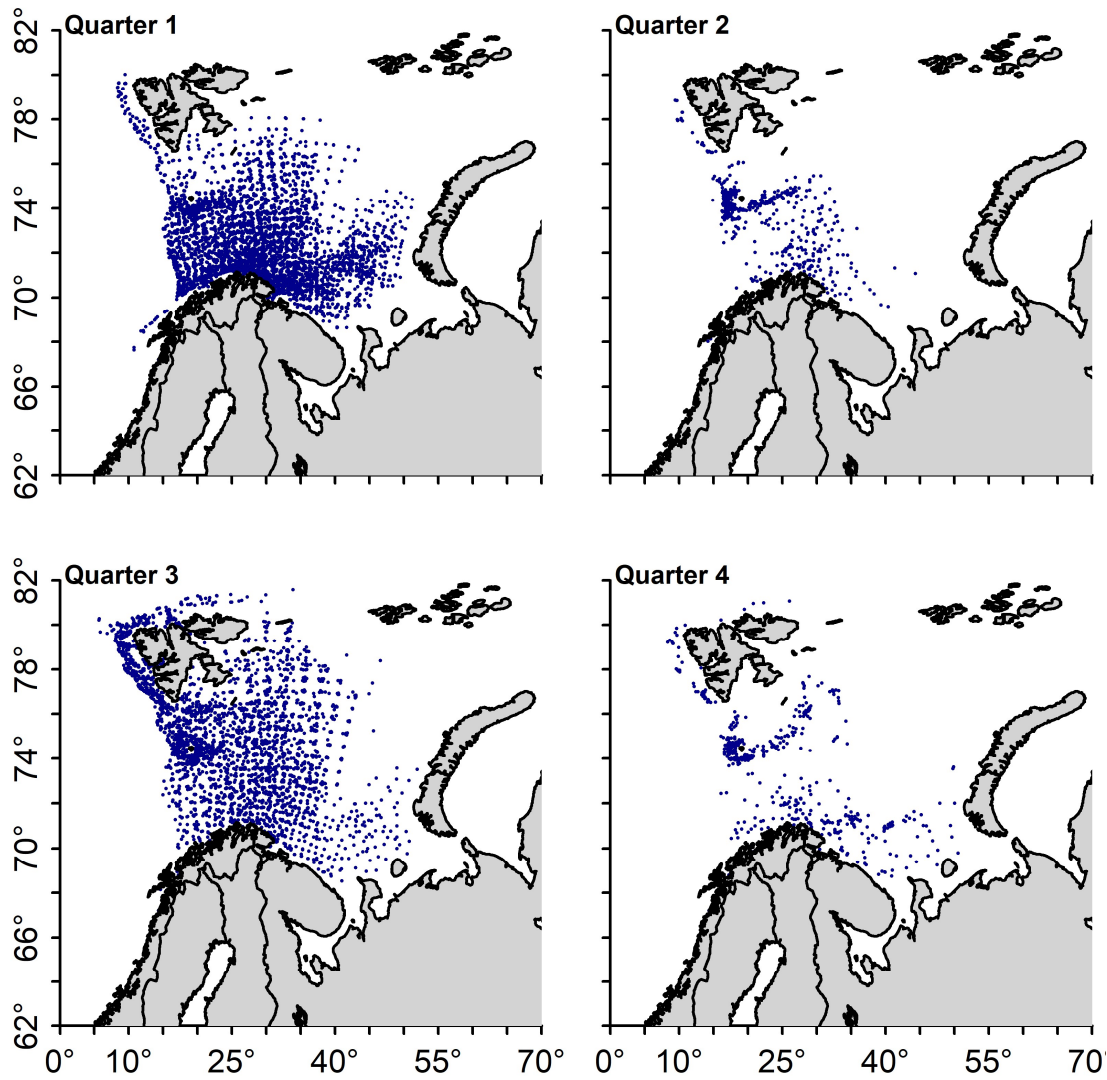
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Figure 3. Extent of the sampling coverage in each decade. Red = year 0 e.g. 1940, dark blue = year 1 e.g. 1941, pink = year 2 e.g. 1942, navy blue = year 3 e.g. 1943, yellow = year 4 = 1944, dark green = year 5 e.g. 1945, purple = year 6 e.g. 1946, pale blue = year 7 = 1947, orange = year 8 e.g. 1948, pale green = year 9 e.g. 1949.



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457 **Figure 4. Sampling coverage in each quarter over all years combined. Each dot denotes a stomach sample.**

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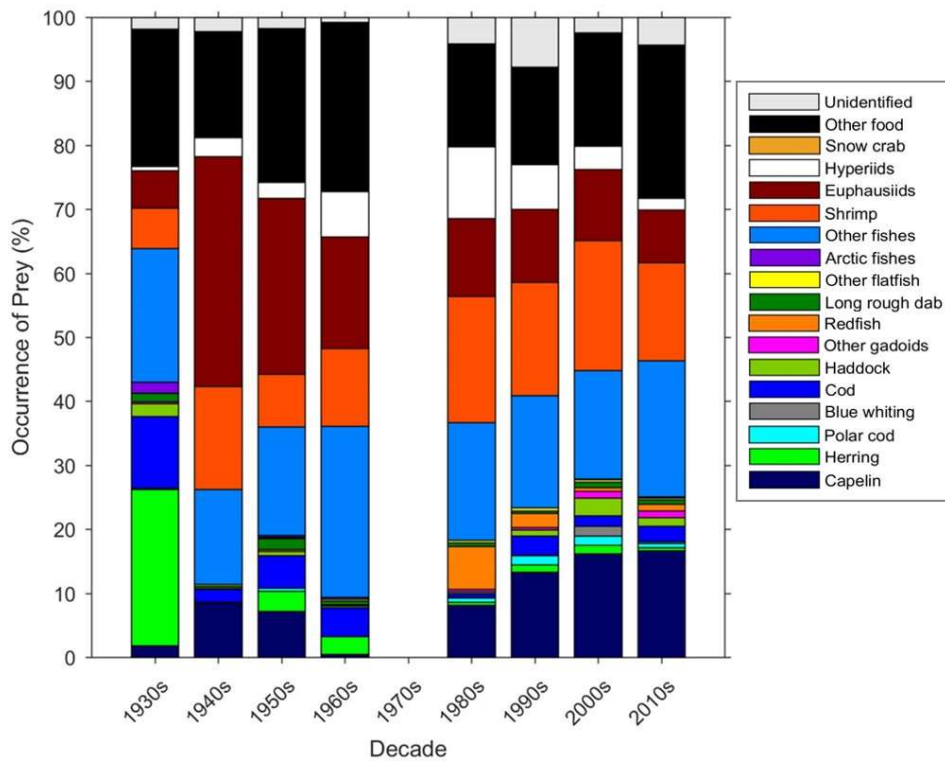
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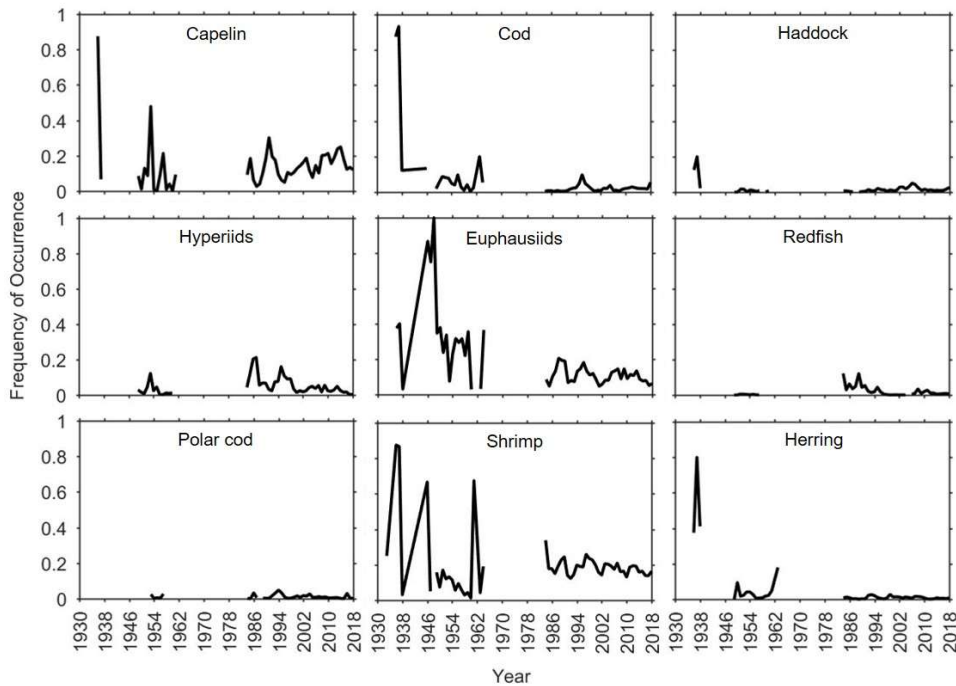




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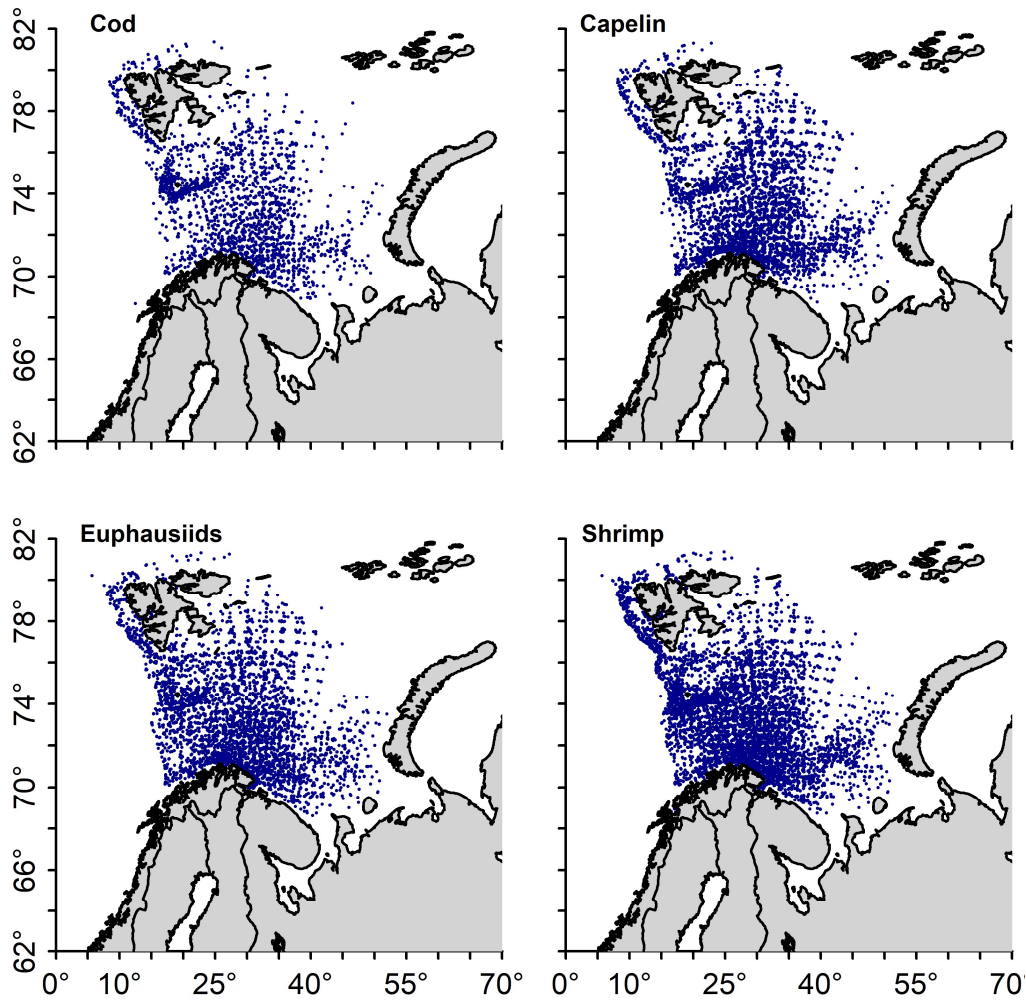
470 **Figure 5. The percentage occurrence of prey in each decade. The percentage occurrence of each prey item is calculated**  
 471 **based on the total prey items in each decade and excludes empty stomachs.**

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474 **Figure 6. Time series of occurrence of the main prey items in the dataset, excluding empty stomachs. The frequency of**  
 475 **occurrence of each prey item is calculated based on the total number of stomachs in each year.**



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477 Figure 7. The presence of the main prey species in stomachs over all years combined. Each dot denotes a stomach  
 478 sample.

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481 8 Table

482 **Table 1. The data available on Barents Sea cod stomachs**

Source	Years	Total number of stomachs (Incl. Empty)	No. by quarter	Empty stomachs (number, n)	Area	Pooled or single stomachs	Fishing gear	Main prey species	Published in Barents Sea cod diet dataset
UK	1930-1949	103 records totalling 4532 stomachs	Q1: 263 Q2: 685 Q3: 2235 Q4: 1349	Unknown	Western Barents Sea, focused on Bear Island and Spitsbergen	Pooled	Commercial trawls	Euphausiids, shrimp, fish	Y
UK	1930-1964	19003	Q1: 2935 Q2: 6314 Q3: 4159 Q4: 5595	Q1: 850 Q2: 2498 Q3: 656 Q4: 1586	Bear Island, Spitsbergen	Single	Otter trawl	Euphausiids, shrimp, cod, capelin, herring	Y
Norway	1984-2018	146 360	Q1: 85 644 Q2: 6343 Q3: 49 032	Q1 26 723 Q2: 2079 Q3: 10 599	Western and central Barents Sea	Single	Pelagic, bottom and commercial trawl	Cod, capelin, shrimp, euphausiids	Y

			Q4: 5341	Q4: 1238					
Russia	1986-2018	234 587	Q1: 26 274 Q2: 42 933 Q3: 60 638 Q4 104 742	Q1: 5970 Q2: 14 162 Q3: 8339 Q4: 27 453	Western, eastern and central Barents Sea	Quantitative	Pelagic, bottom and commercial trawl	Shrimp, euphausiids, capelin, other fish, hyperiids	N
Russia	1934 - 2018	3 304 134	Not available	n= 709 112	Western, eastern and central Barents Sea	Qualitative	Pelagic and bottom trawl	Capelin, euphausiids, shrimp, cod	N

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