



Ecosystem survey 2019 R/V Johan Hjort

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21/09/2020

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## [[1]]
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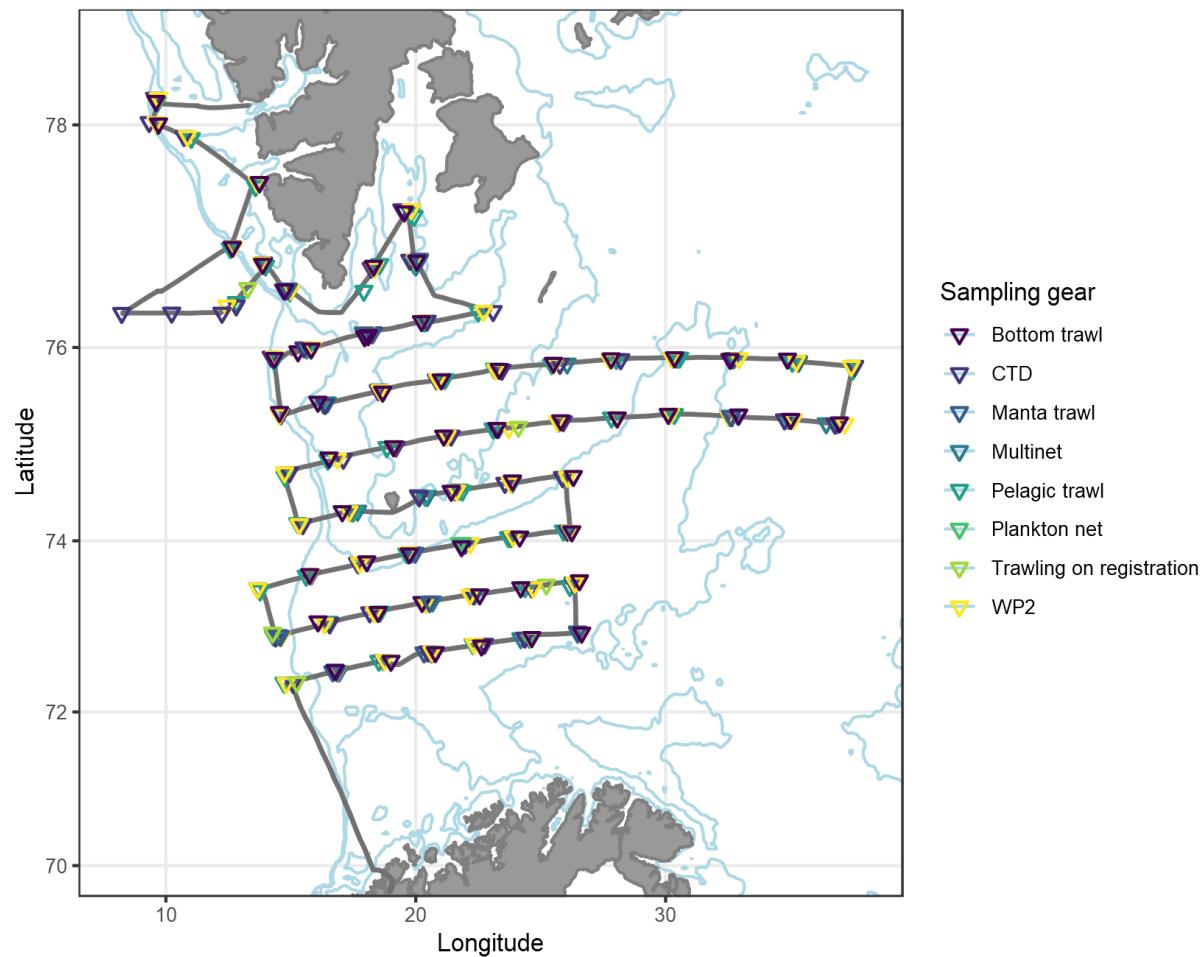
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1 Survey description and data availability

2 Cruise tracks and stations

Cruise tracks from the position log with points indicating start positions for different sampling gear. The points are jittered slightly for better visual representation:

```
## Warning: Ignoring unknown aesthetics: x, y
```



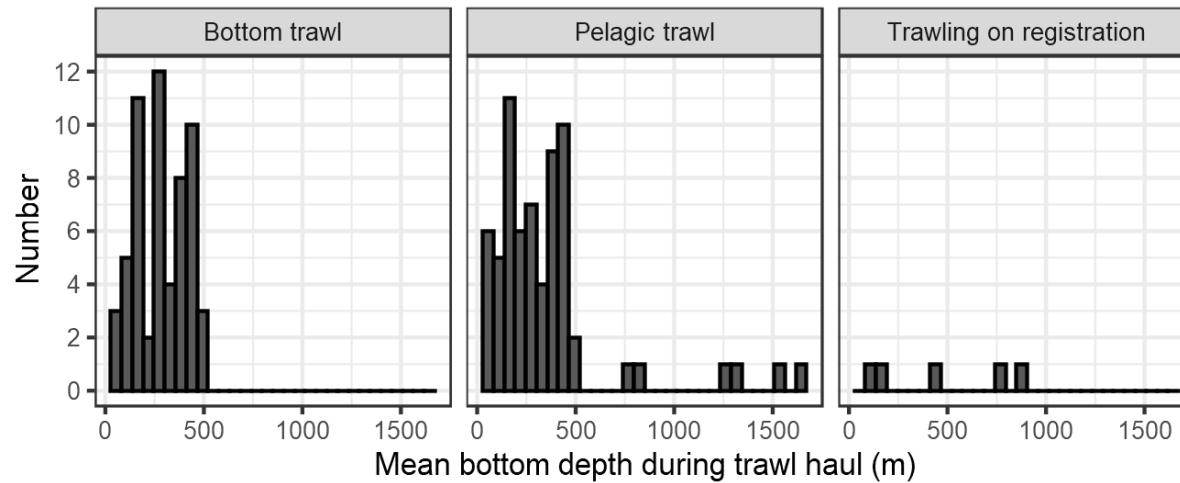
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## Warning in makeTaxaTable(aphias): Some provided Aphia IDs encode non-accepted  
## scientific names.
```

2.1 Trawl sampling effort

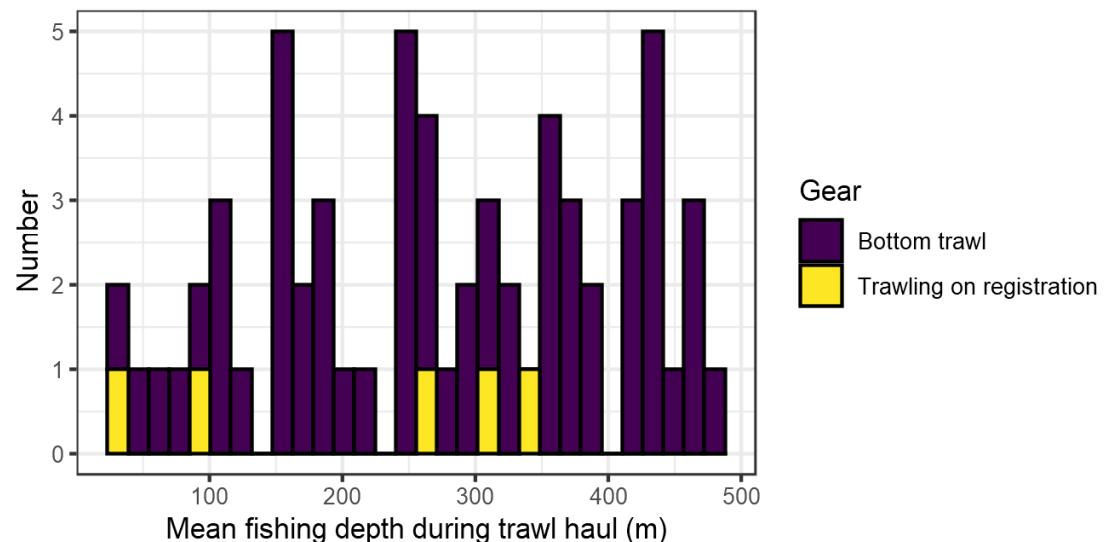
128 trawl hauls were taken during the survey, of which 58 were bottom trawl, 66 pelagic trawl, and 5 were trawling on registration. The trawl hauls covered a total distance of 323.3 km (174.6 nmi).

The sampling stations were located in areas with bottom depths from 43.3 m to 1633.3 m, and the fishing depth varied from 10 m to 473.3 m.

2.1.1 Mean bottom depth during trawl hauls



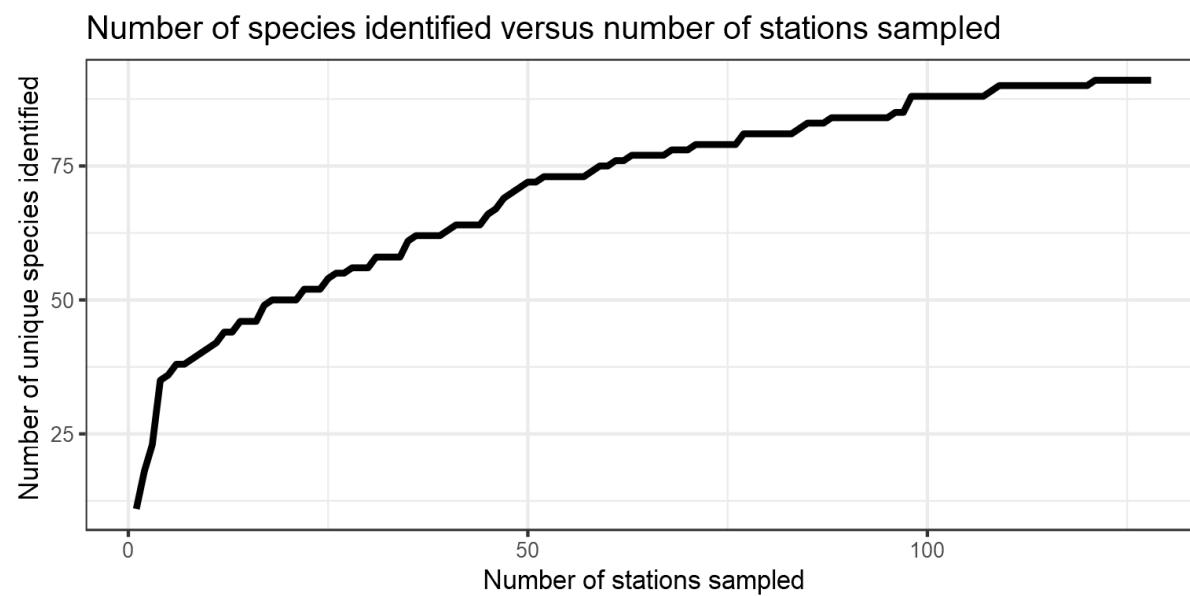
2.1.2 Mean fishing depth during trawl hauls (excluding pelagic hauls)



3 Catch composition

3.1 Species diversity

A total of 91 species were registered in the Sea2Data database during the survey.



3.2 Max catch rate by species for the 20 species with highest catch rates

3.2.1 Bottom trawl

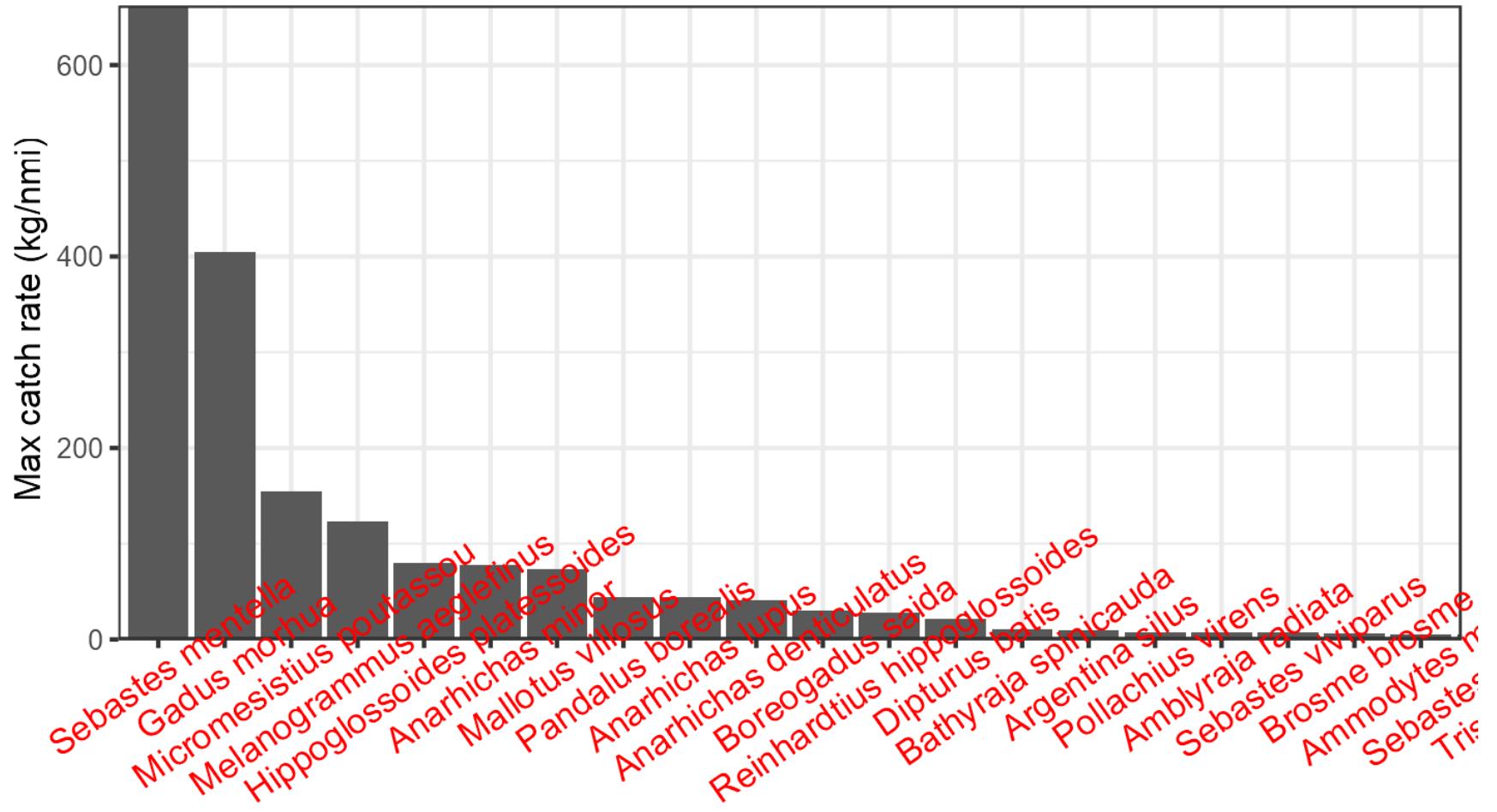
The species with highest catch rates in bottom trawls were Bottom trawl () by biomass, and Bottom trawl () by number.

```
gear <- "Bottom trawl"

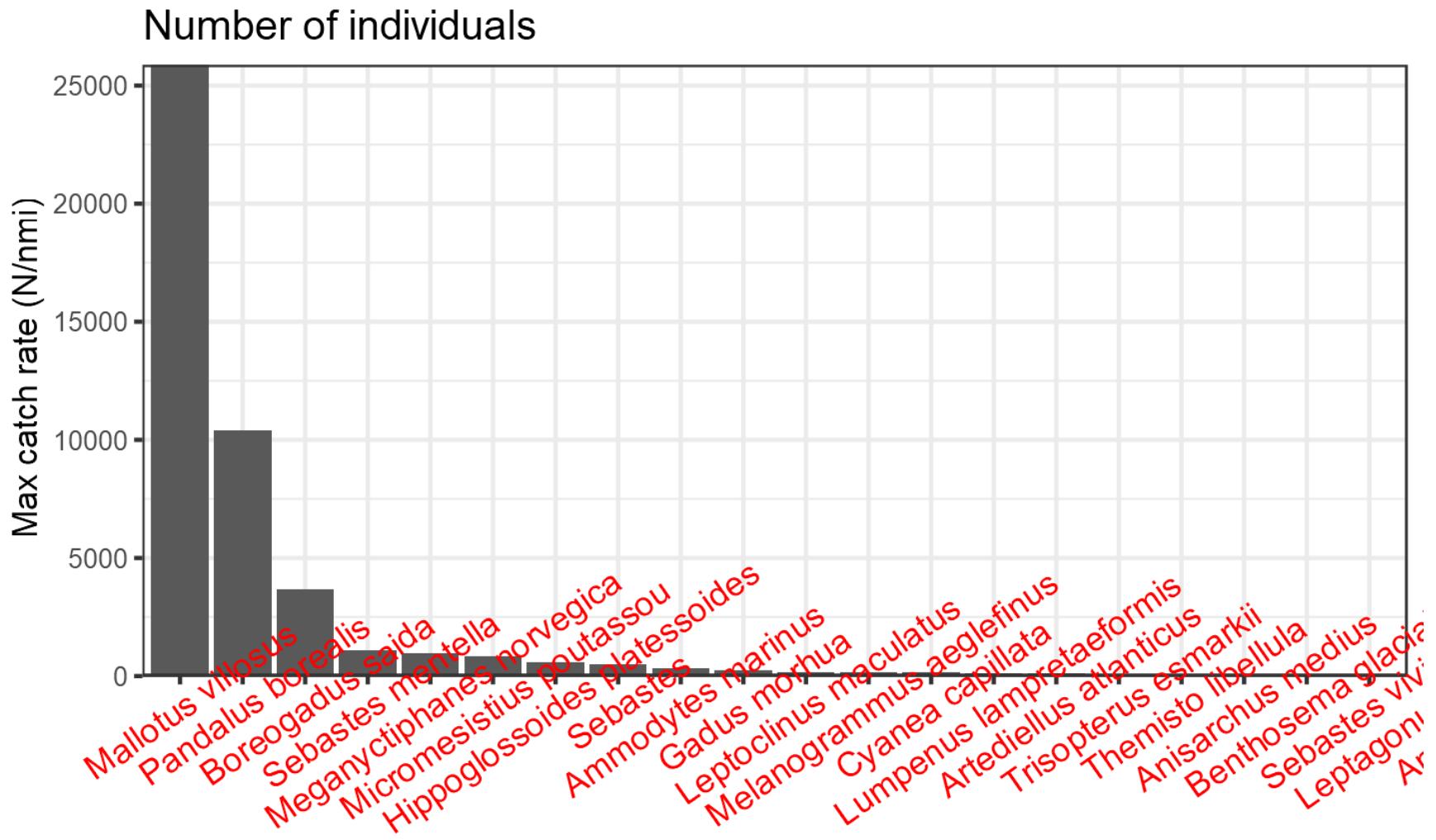
#Weight
ggplot(tst %>% dplyr::filter(gear.text == gear & !is.na(scientificname)),
       aes(reorder(scientificname, -maxW), maxW)) + geom_col() +
  # geom_errorbar(aes(ymin = minW, ymax = maxW)) +
  coord_cartesian(xlim = c(1,20)) + #show the 20 species with highest catches
  scale_y_continuous(expand=c(0,0), limits = c(0,max(tst$maxW[tst$gear.text==gear], na.rm=T)+2)) + theme_bw() +
  theme(axis.text.x = element_text(angle = 35, colour = "red", size = 11),
        axis.title.x = element_blank()) +
  labs(x = "Taxon", y = "Max catch rate (kg/nmi)", title = "Biomass")

## Warning: Removed 2 rows containing missing values (position_stack).
```

Biomass

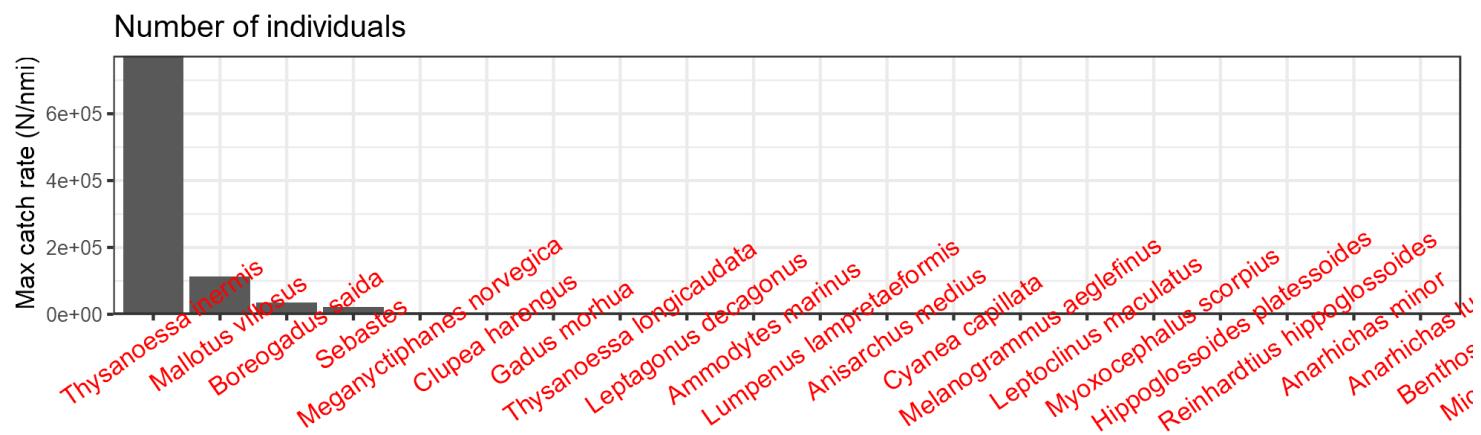
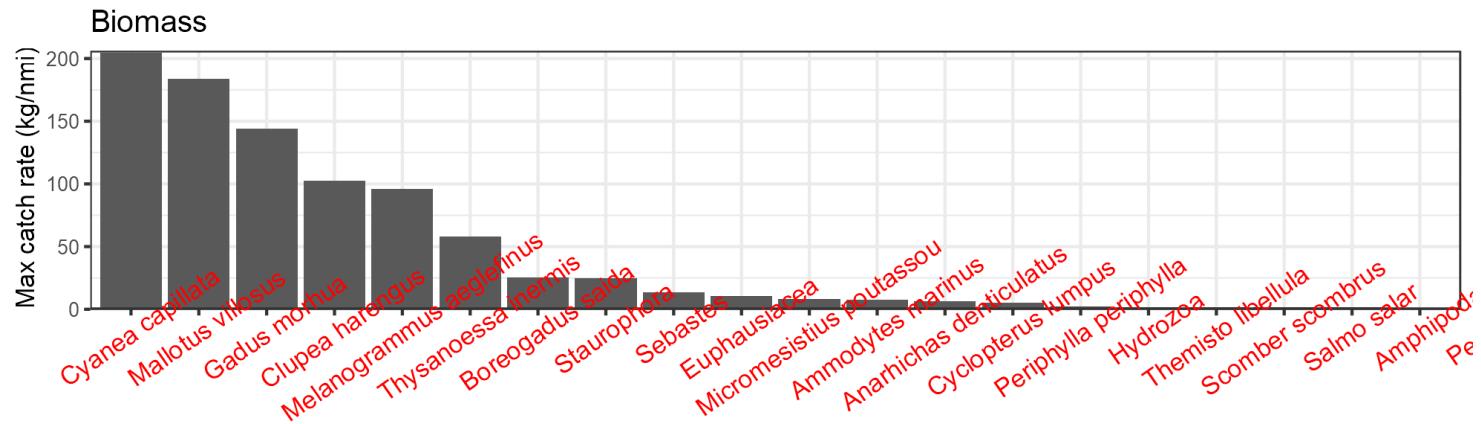


```
#Number  
ggplot(tst %>% dplyr::filter(gear.text == gear & !is.na(scientificname)),  
       aes(reorder(scientificname, -maxN), maxN))+geom_col() +  
# geom_errorbar(aes(ymin = minN, ymax = maxN)) +  
coord_cartesian(xlim =c(1,20)) + #show the 20 species with highest catches  
scale_y_continuous(expand=c(0,0), limits = c(0,max(tst$maxN[tst$gear.text==gear], na.rm=T)+15)) +#, limits = c(0,70)  
theme_bw() + theme(axis.text.x = element_text(angle = 35, colour = "red", size = 11), axis.title.x = element_blank())  
labs(x = "Taxon", y = "Max catch rate (N/nmi)", title = "Number of individuals")
```



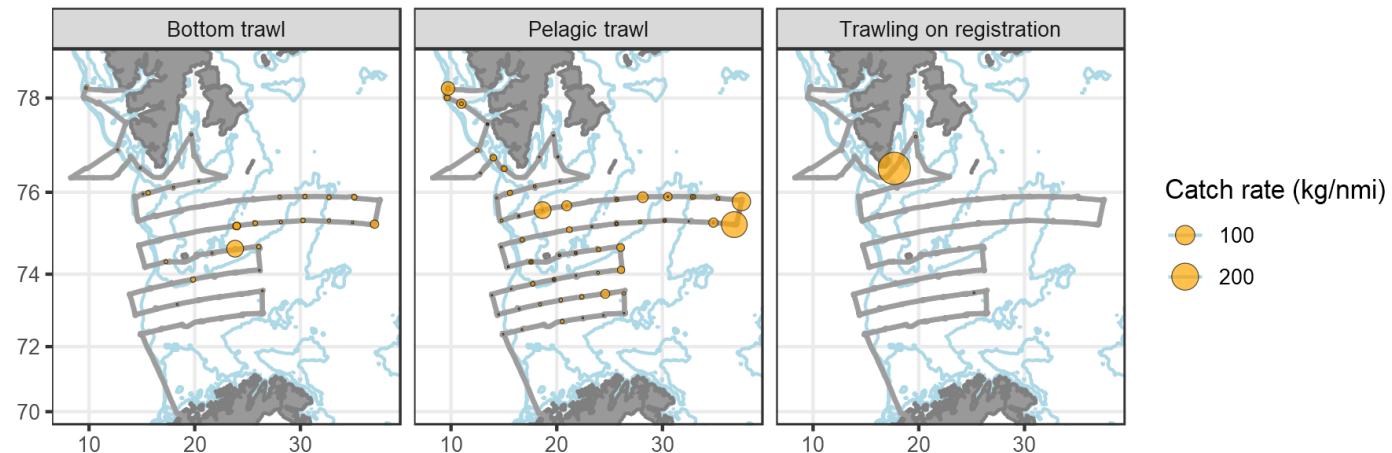
3.2.2 Pelagic trawl

The species with highest catch rates in pelagic trawls were Pelagic trawl () by biomass, and Pelagic trawl () by number.

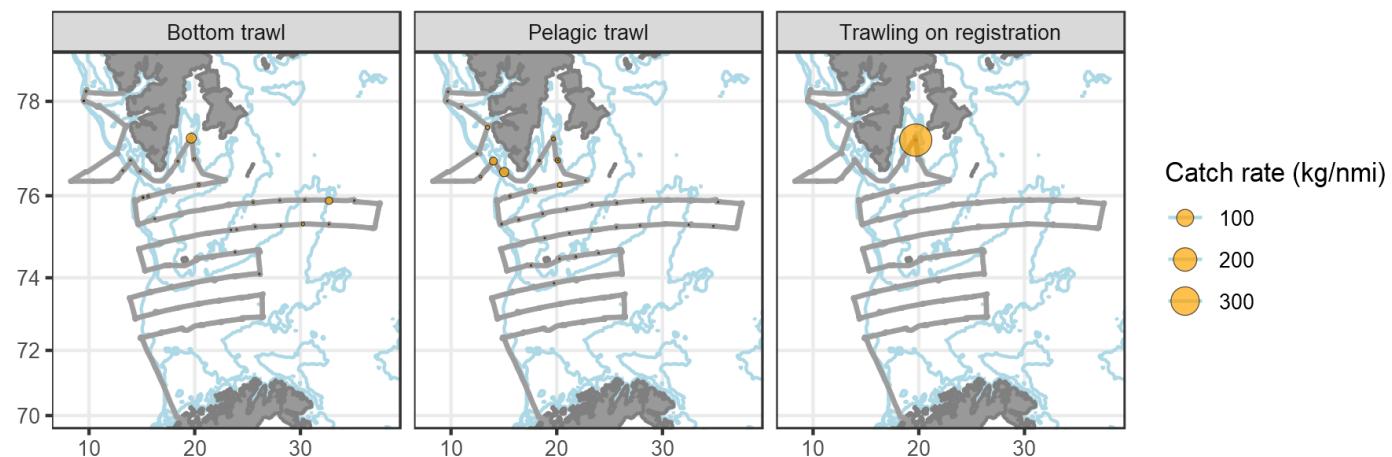


3.3 Spatial variation in catches of common species

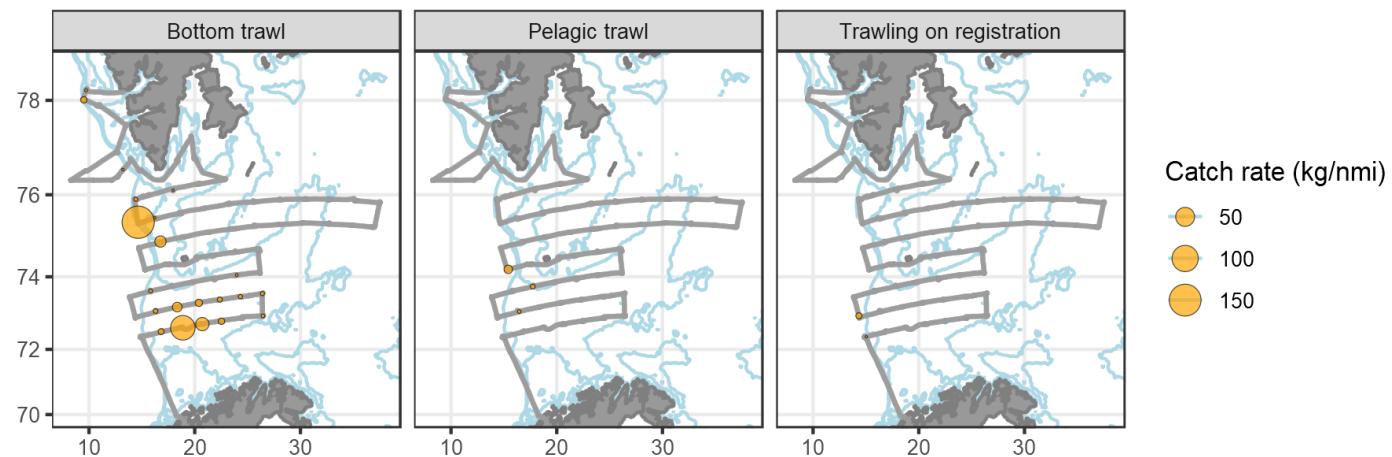
Catch rate (biomass) | 2020 | *Mallotus villosus*



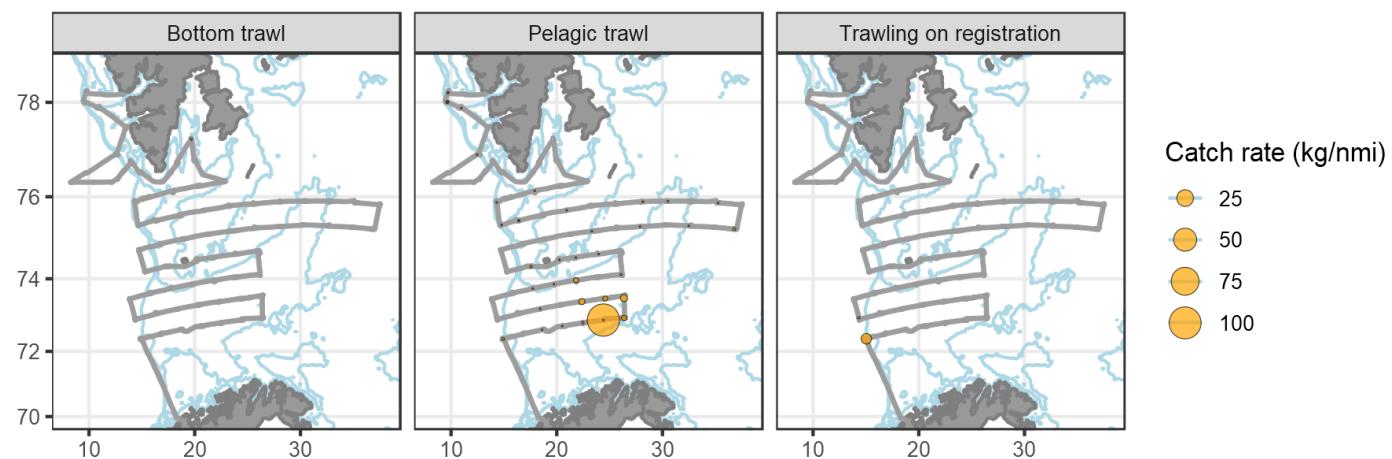
Catch rate (biomass) | 2020 | *Boreogadus saida*



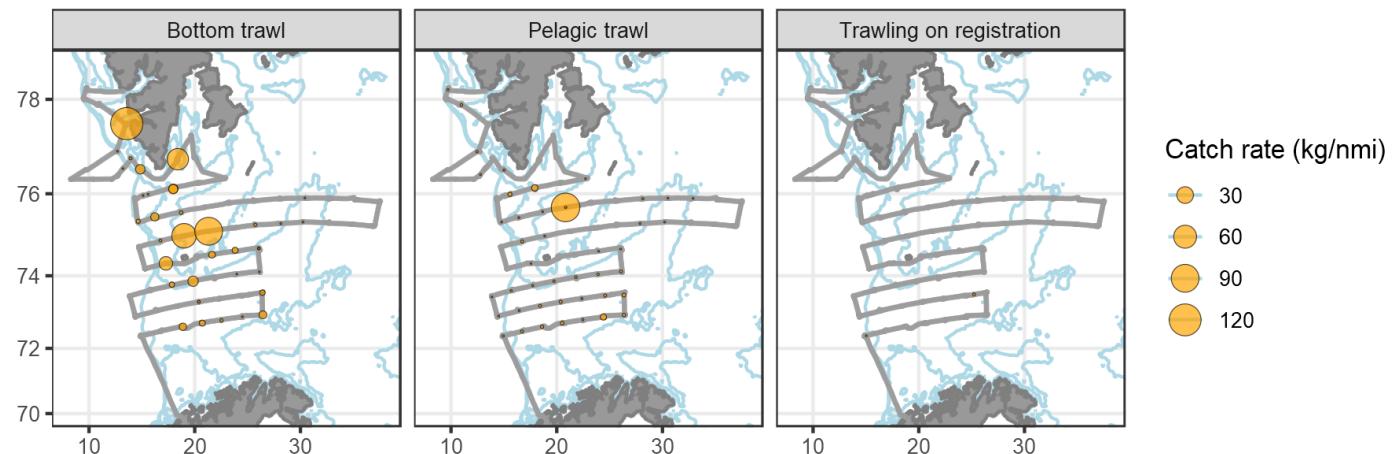
Catch rate (biomass) | 2020 | *Micromesistius poutassou*



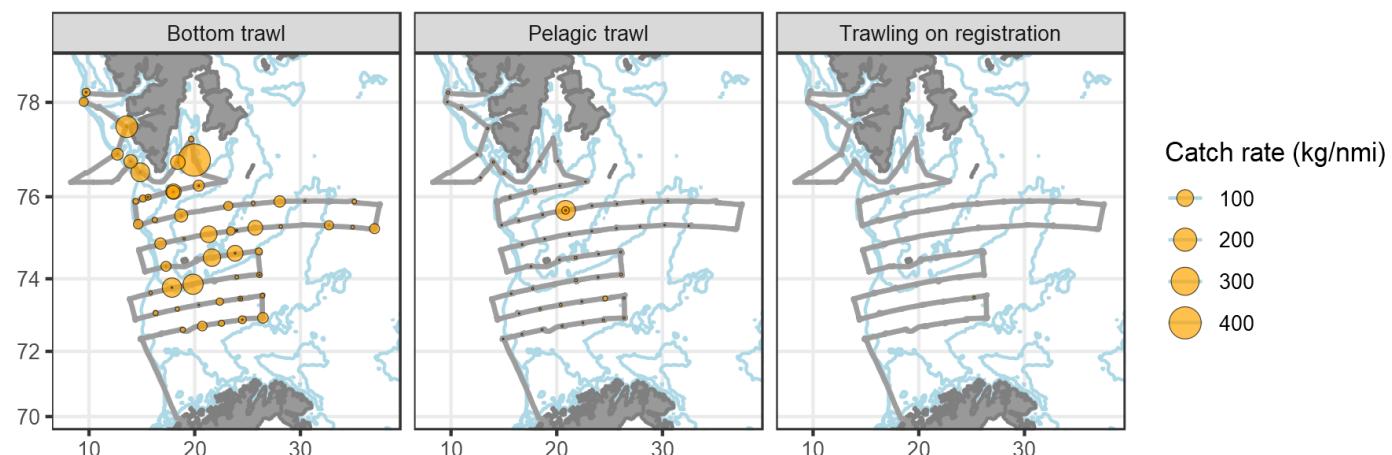
Catch rate (biomass) | 2020 | *Clupea harengus*



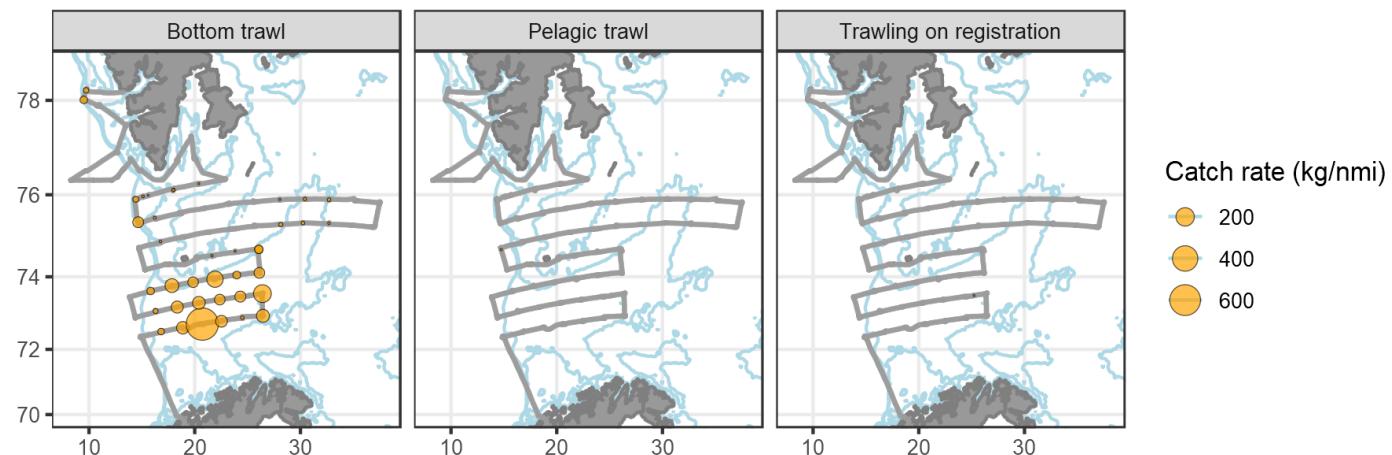
Catch rate (biomass) | 2020 | *Melanogrammus aeglefinus*



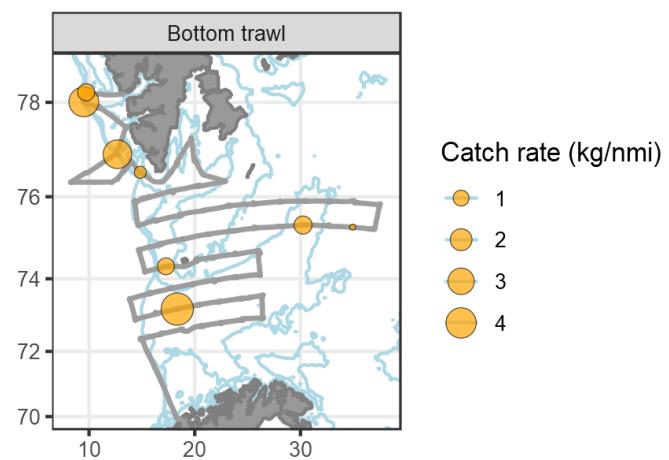
Catch rate (biomass) | 2020 | *Gadus morhua*



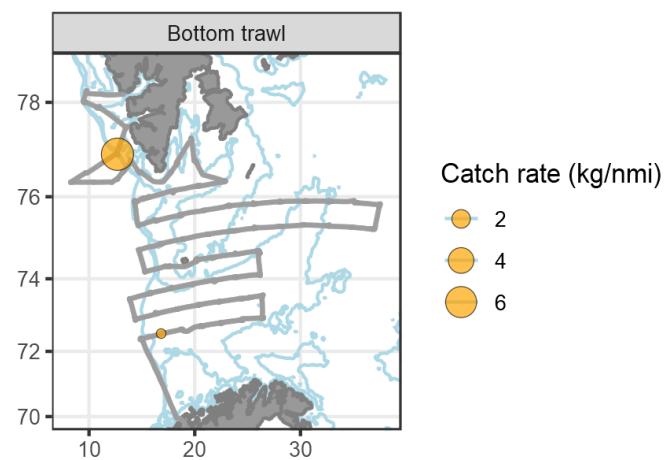
Catch rate (biomass) | 2020 | *Sebastes mentella*



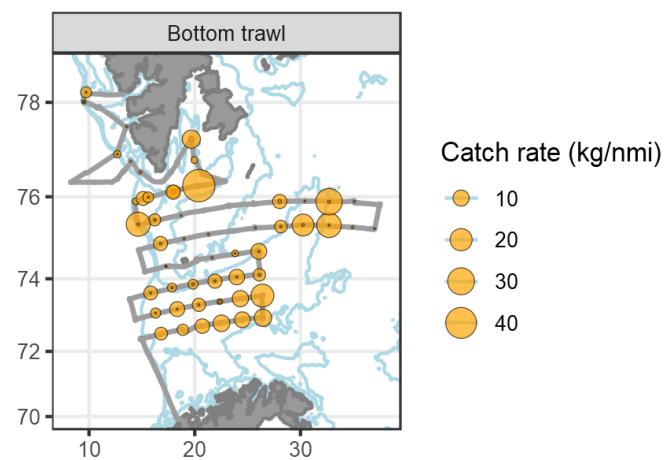
Catch rate (biomass) | 2020 | *Sebastes norvegicus*



Catch rate (biomass) | 2020 | *Sebastes viviparus*

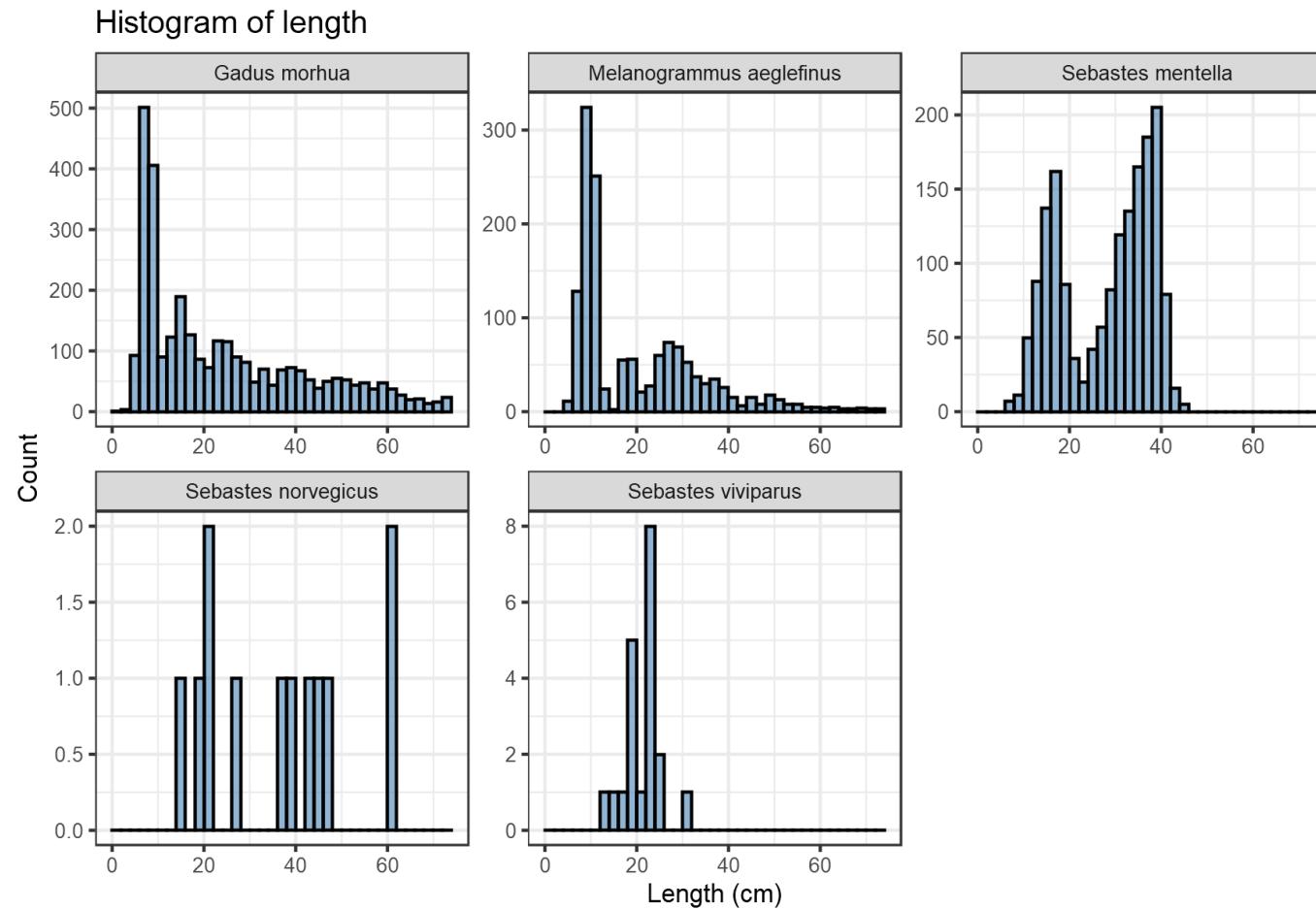


Catch rate (biomass) | 2020 | *Pandalus borealis*

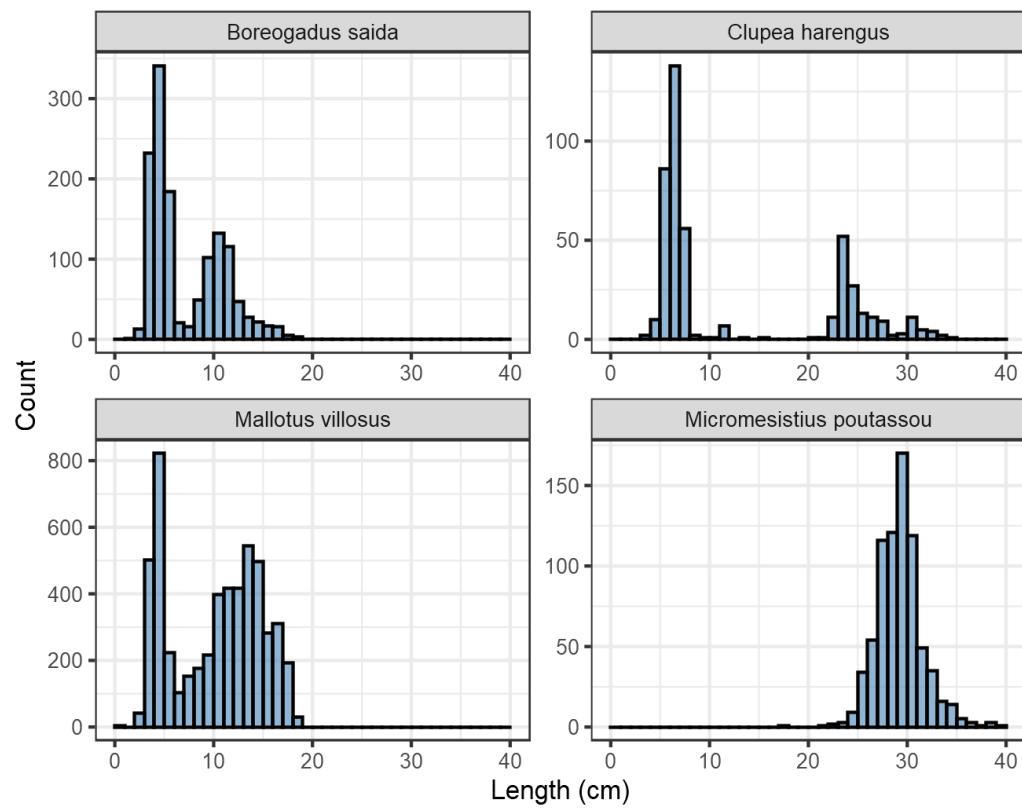


3.4 Length distributions

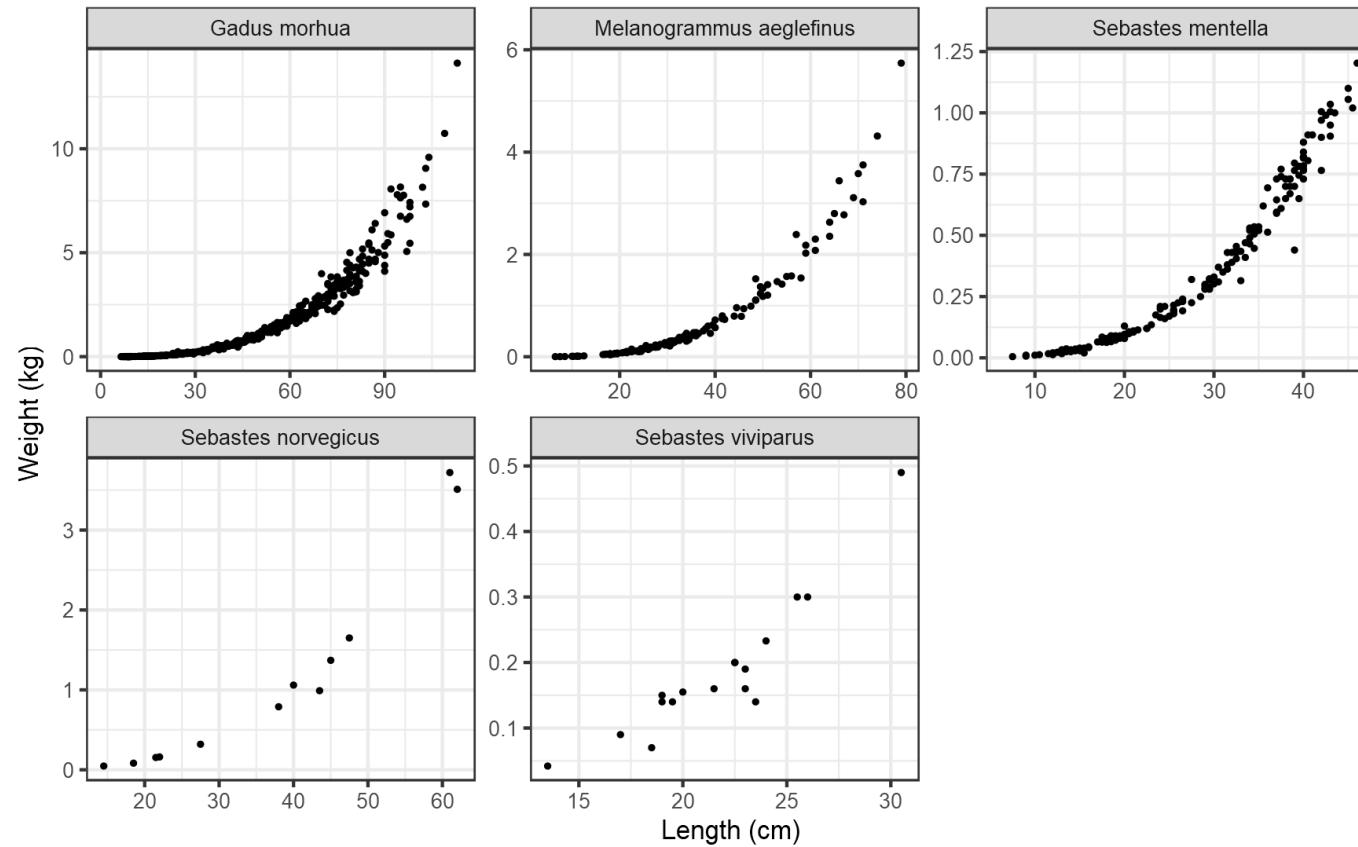
The following figures shows the length distribution of individuals sampled during the survey.

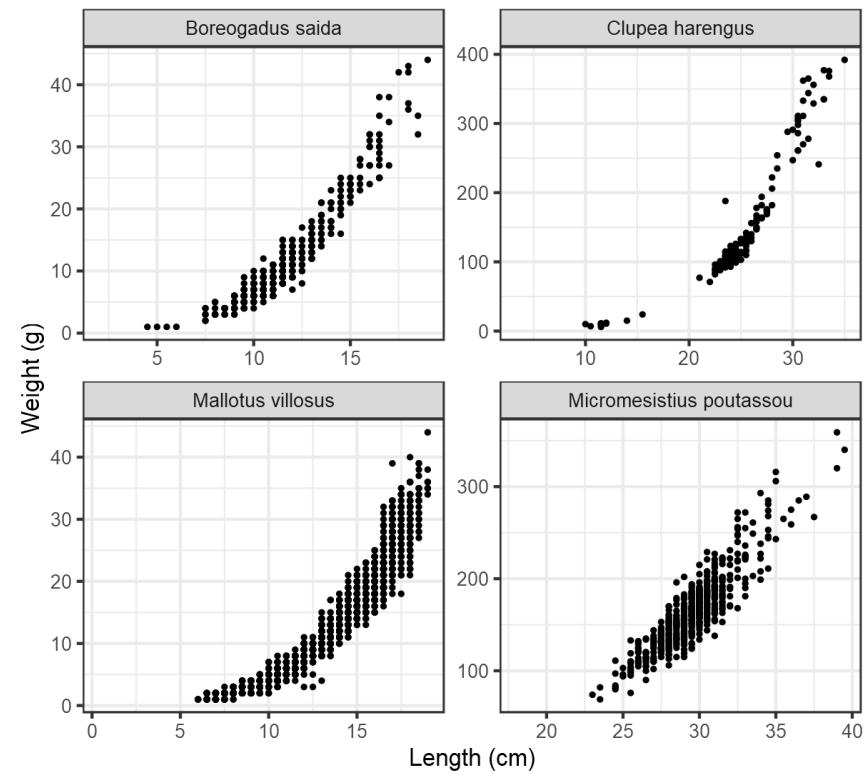


Histogram of length

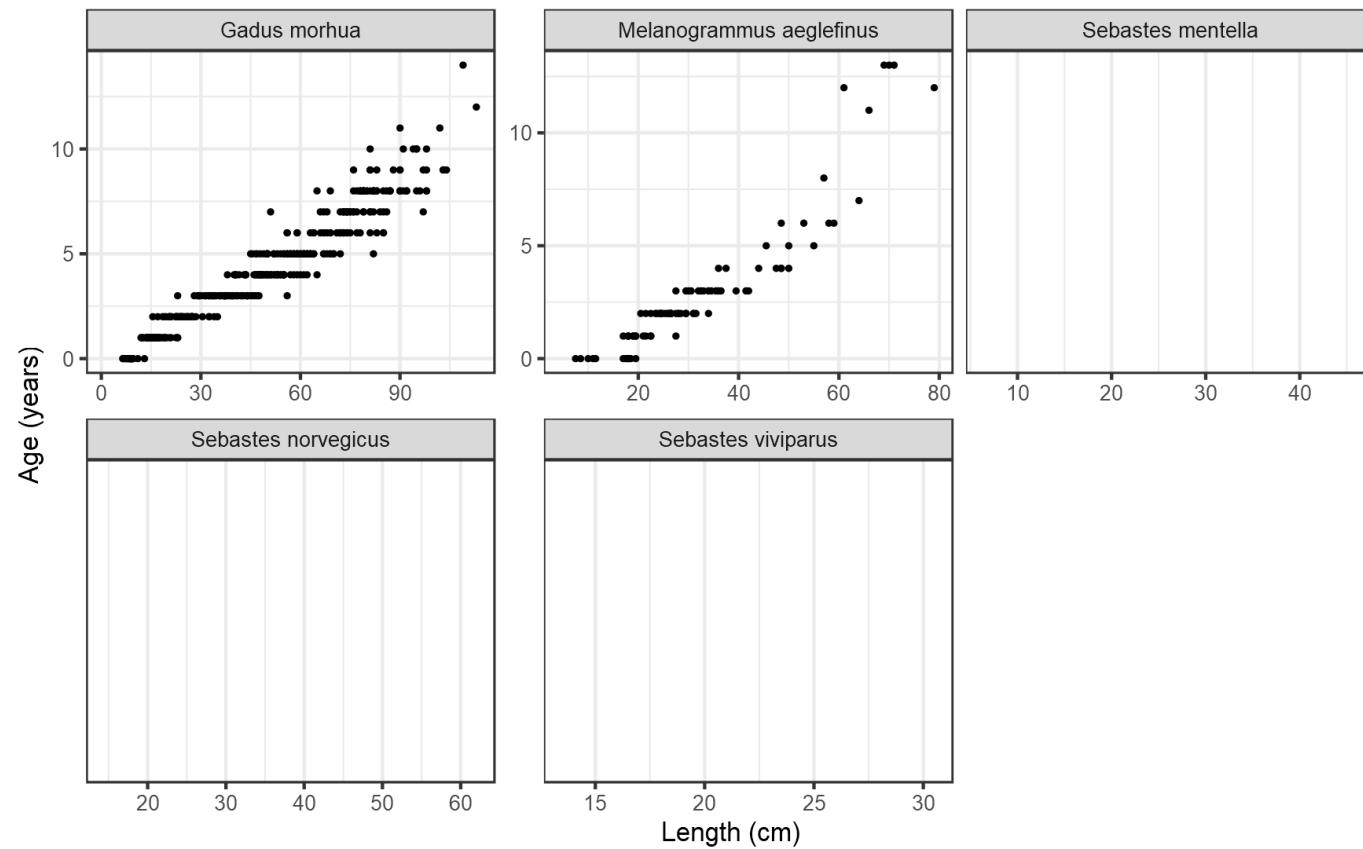


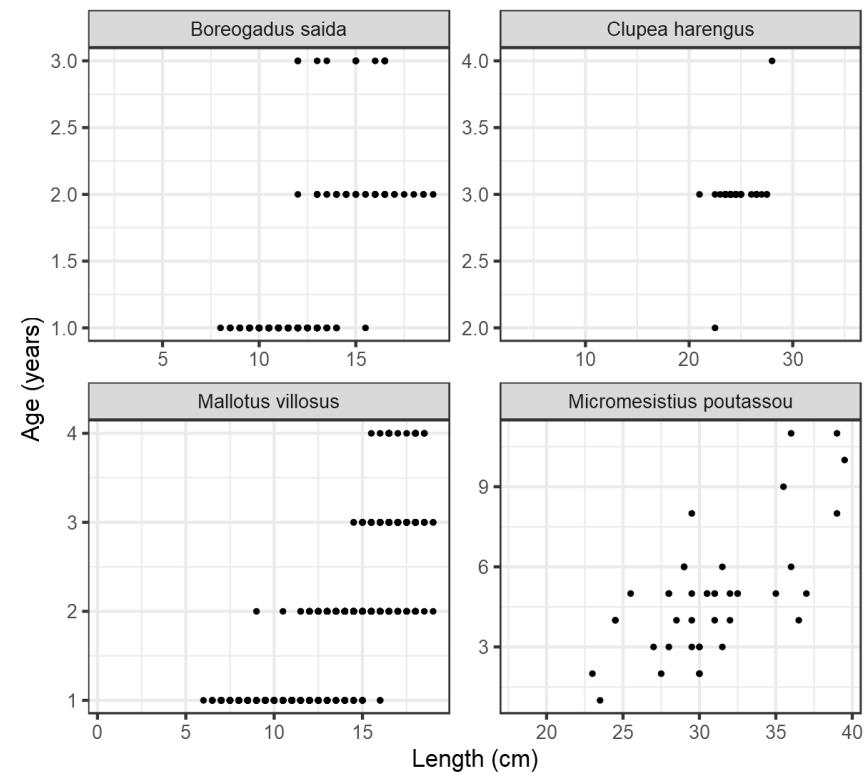
3.5 Length-weight relationships





3.6 Length-age relationships





Acoustic registrations

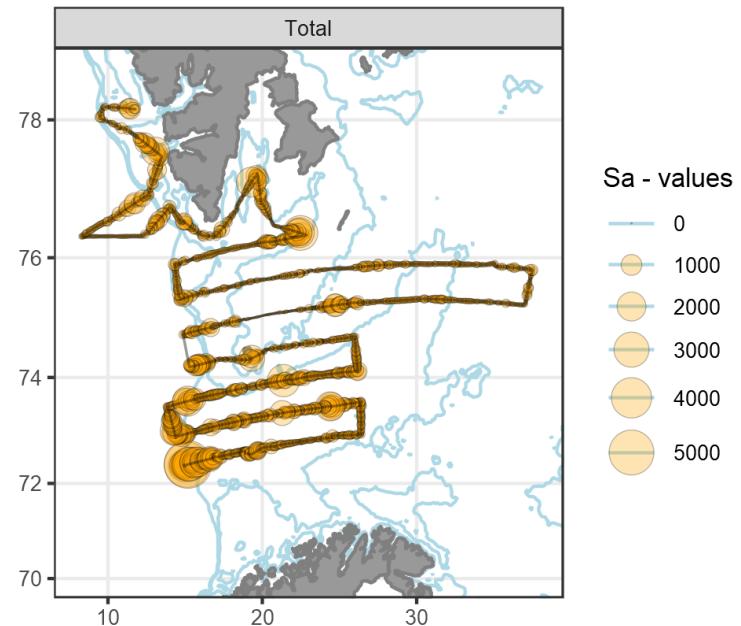
A total of 4365.164 km (2357 nmi) of acoustic transects were scrutinized.

3.7 Example echograms

3.8 Depth-integrated acoustic backscatter

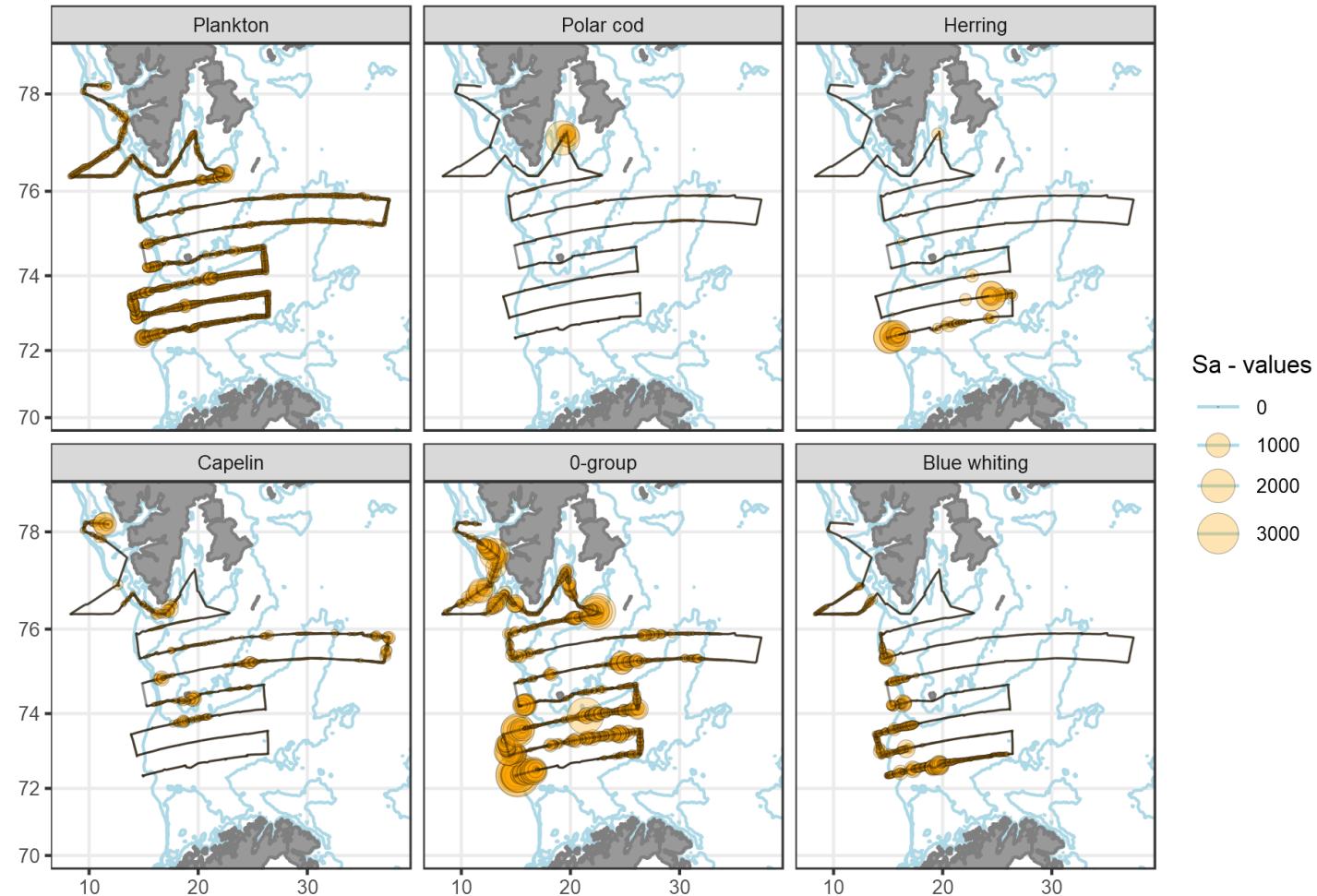
3.8.1 Total backscatter

Ecosystem survey Johan Hjort | 2019 | 38 kHz



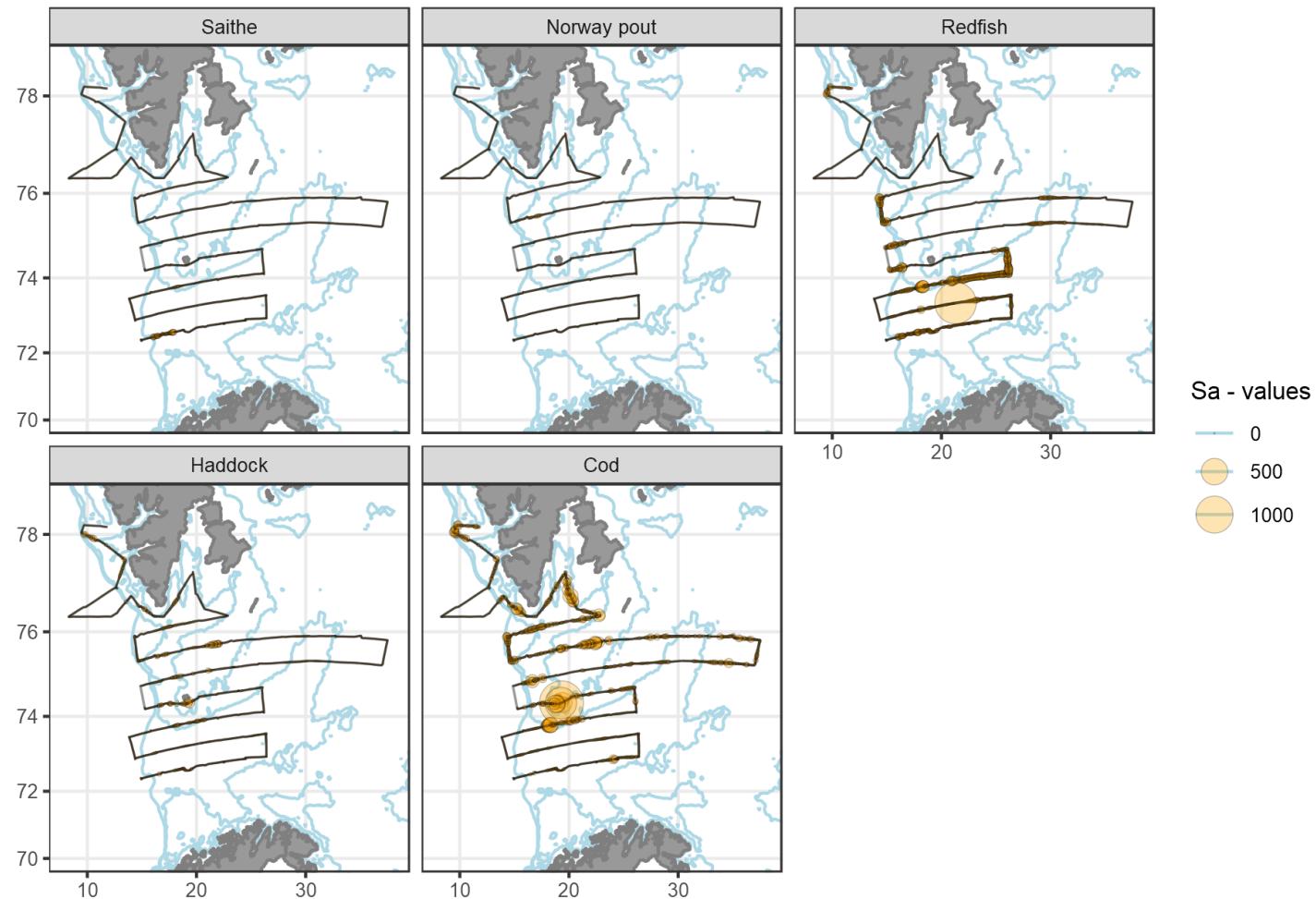
3.8.2 Pelagic species

Ecosystem survey Johan Hjort | 2019 | 38 kHz



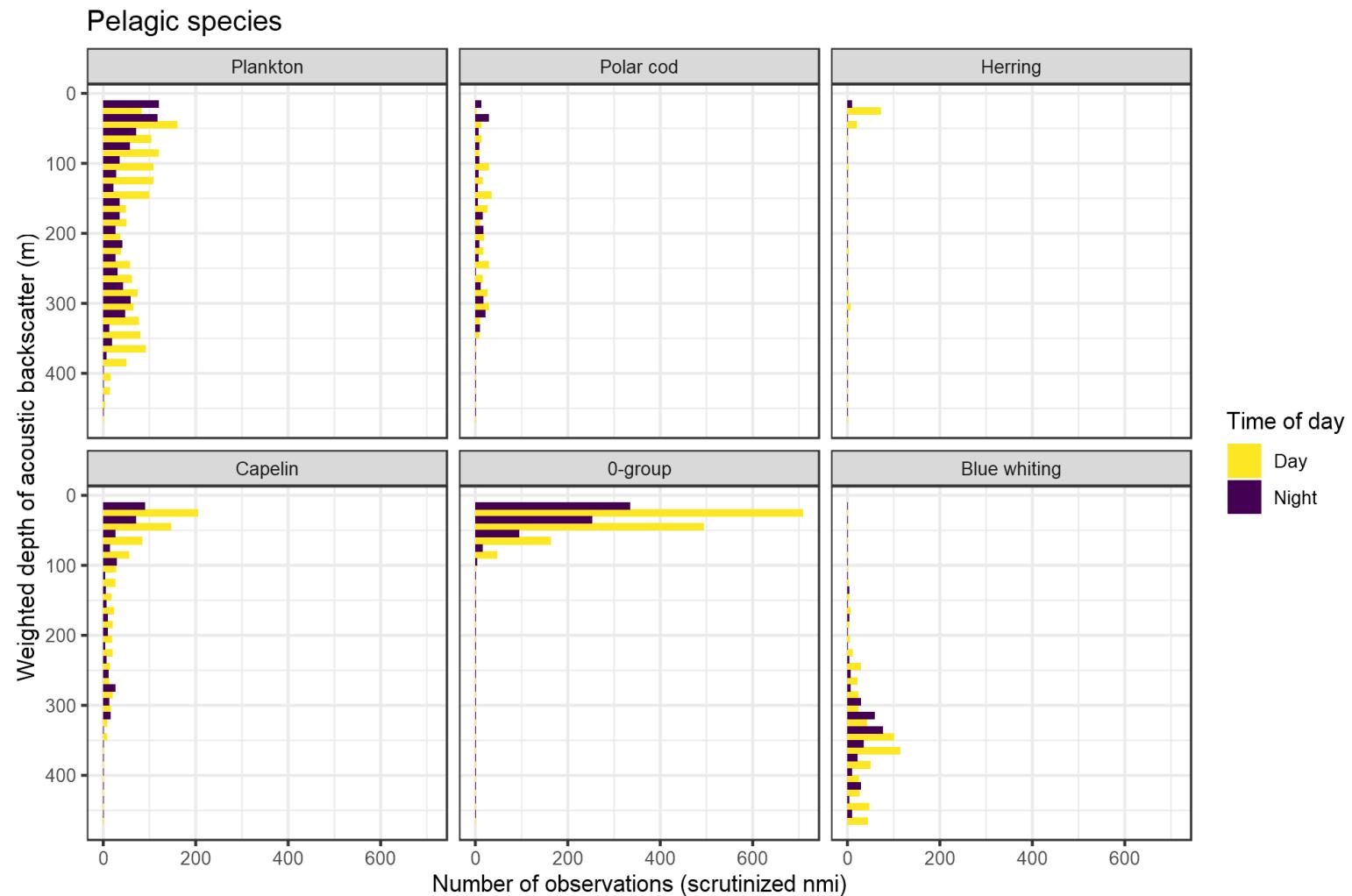
3.8.3 Demersal species

Ecosystem survey Johan Hjort | 2019 | 38 kHz

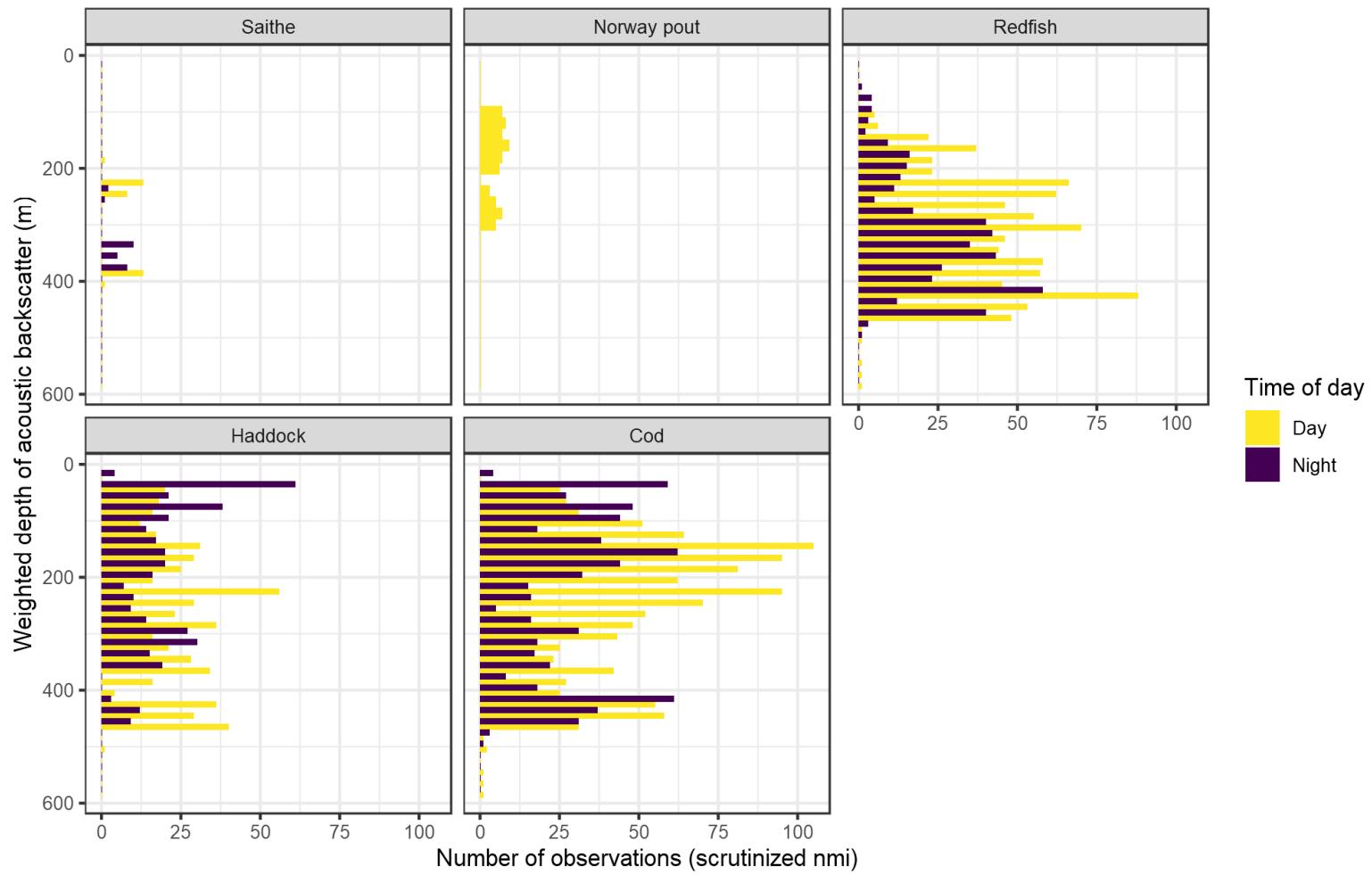


3.9 Acoustic backscatter in depth channels

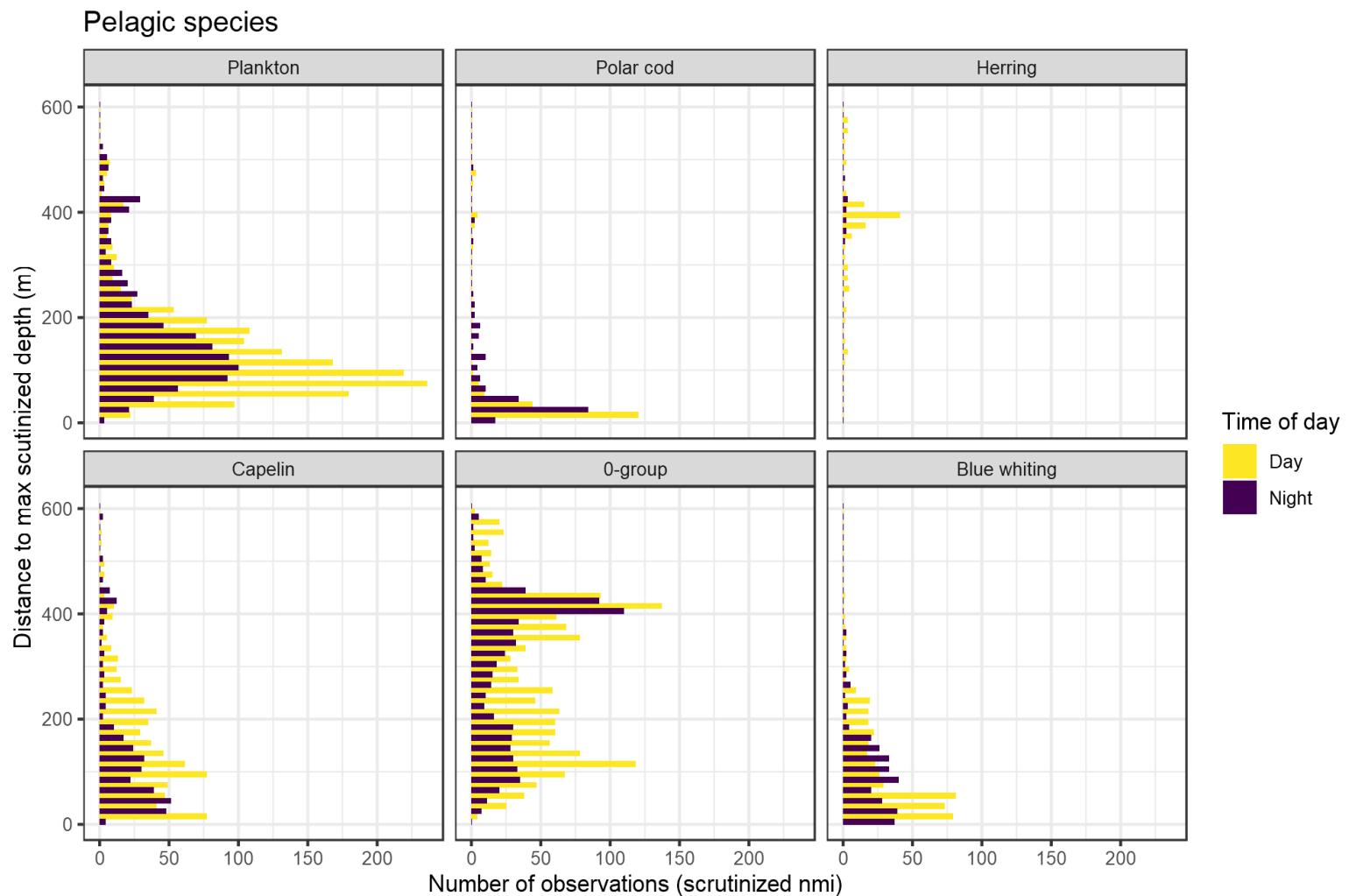
3.9.1 Distance from the surface to weighted depth of acoustic registrations



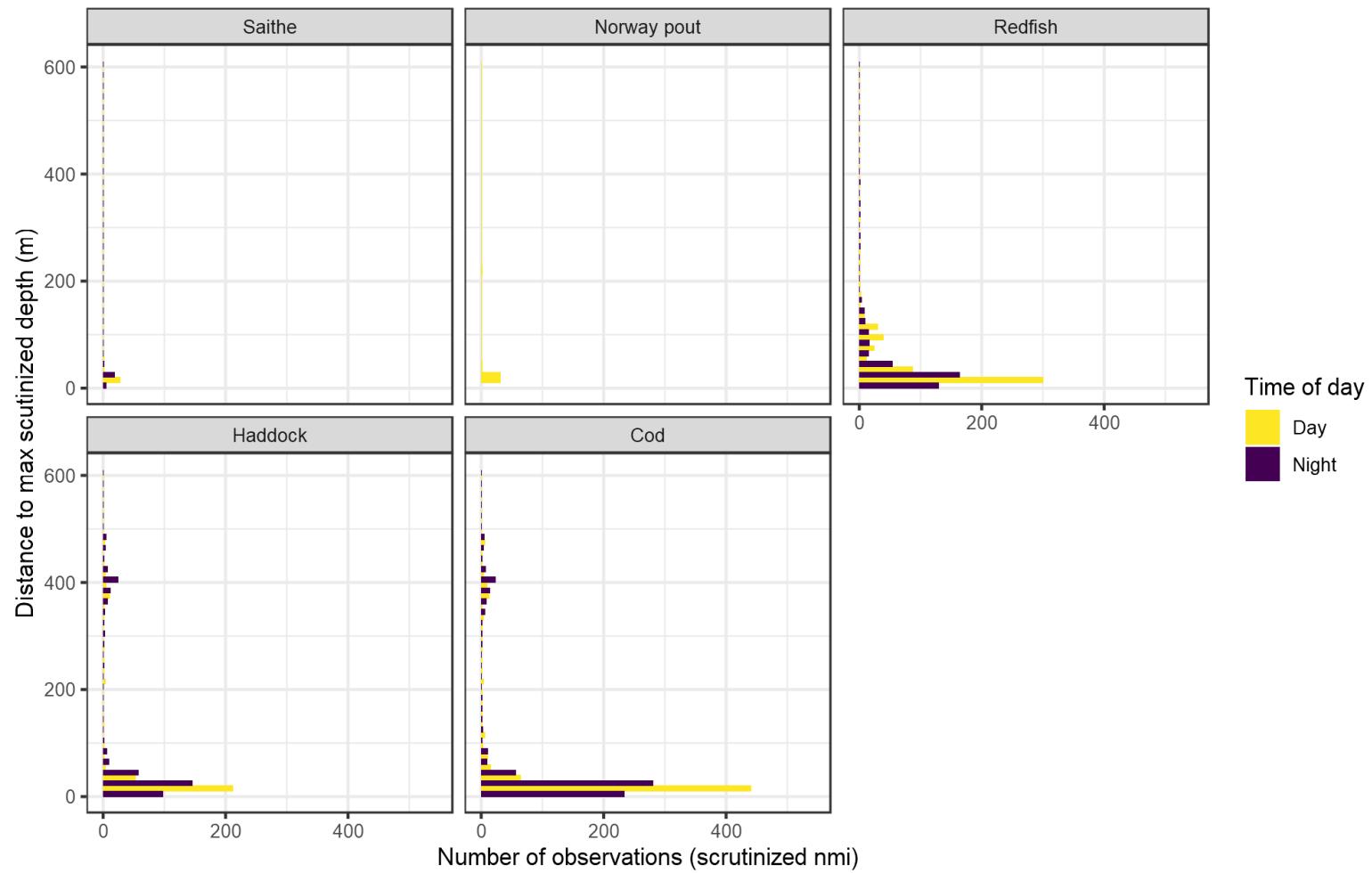
Demersal species



3.9.2 Distance from the seafloor (or max scrutinized depth) to weighted depth of acoustic registrations



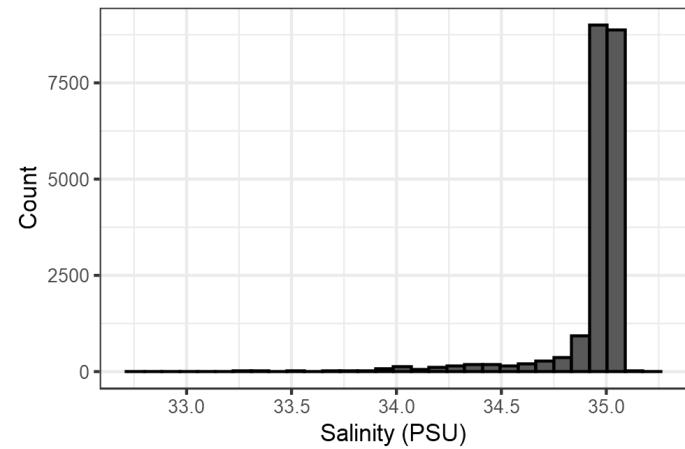
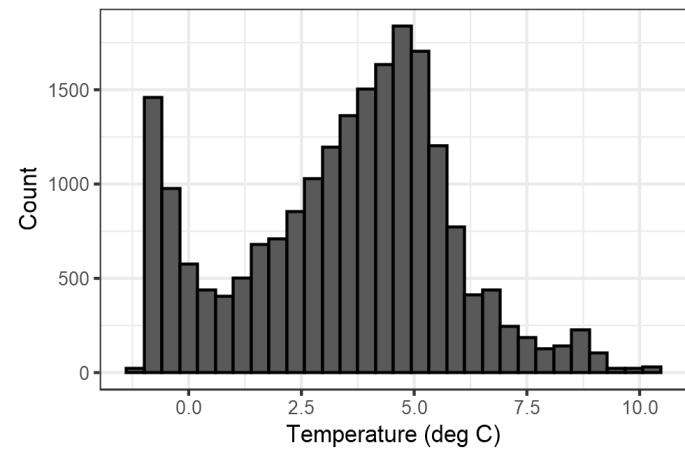
Demersal species



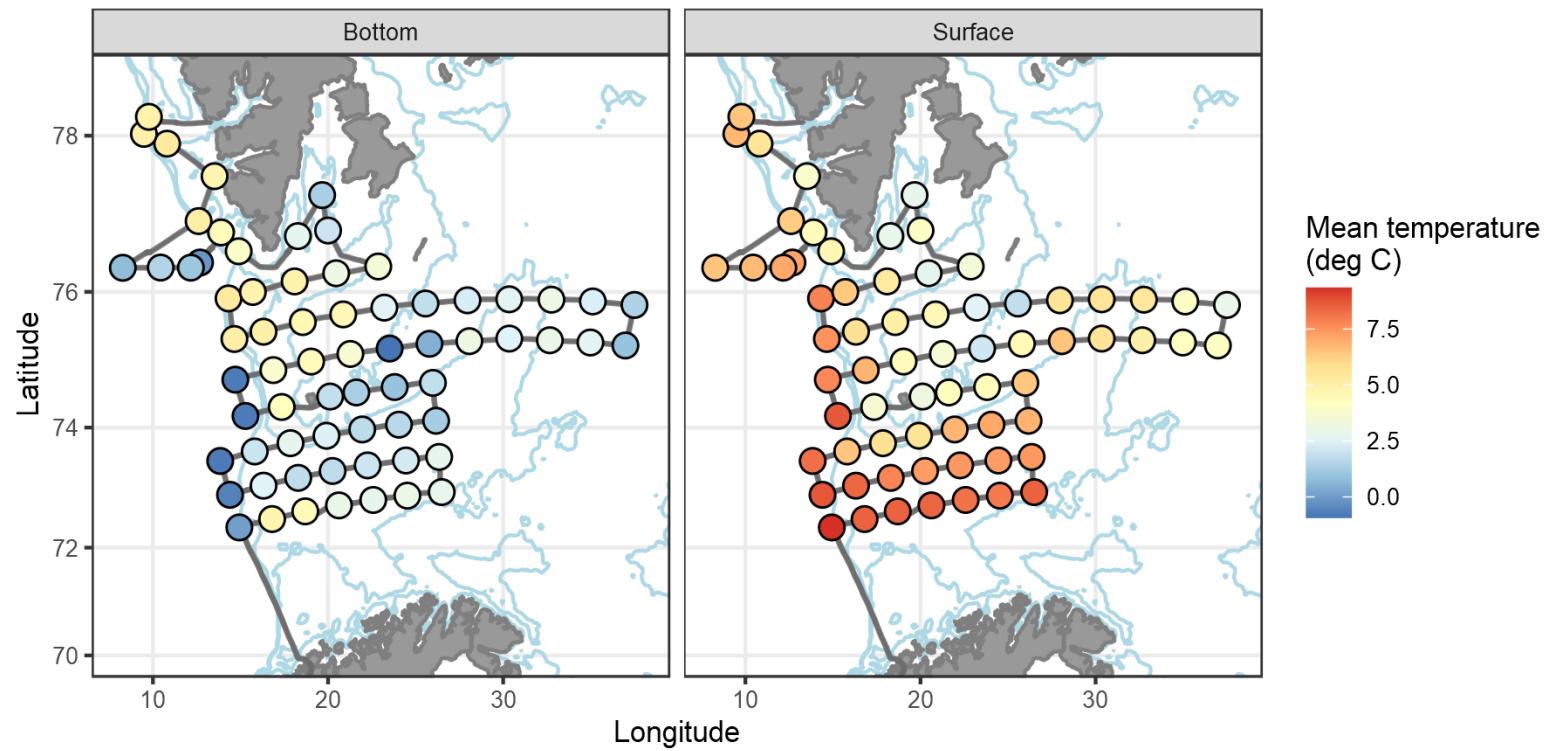
4 CTD

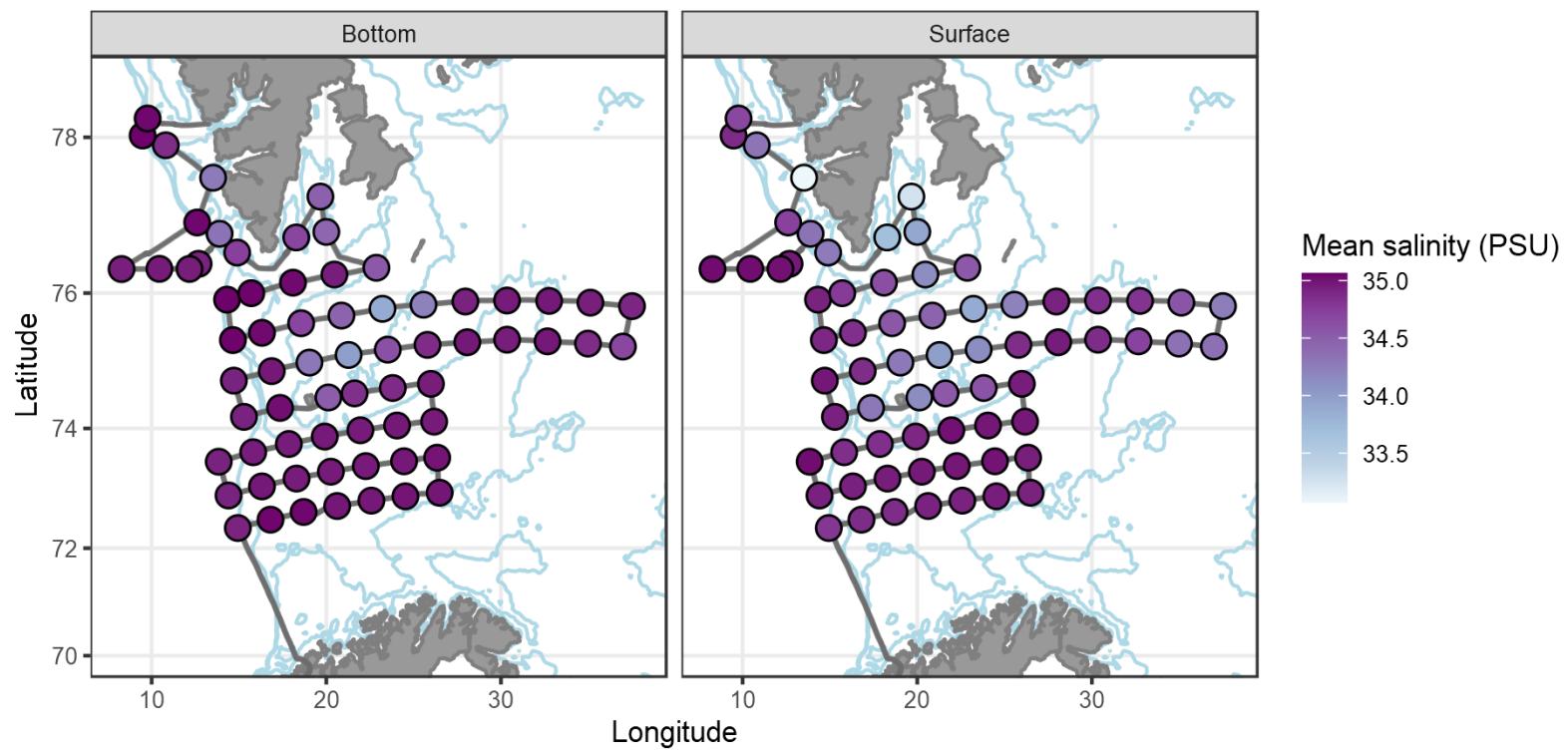
4.1 Summary of measurements

68 CTD casts were done during the survey, covering a total depth of 20.6 km.

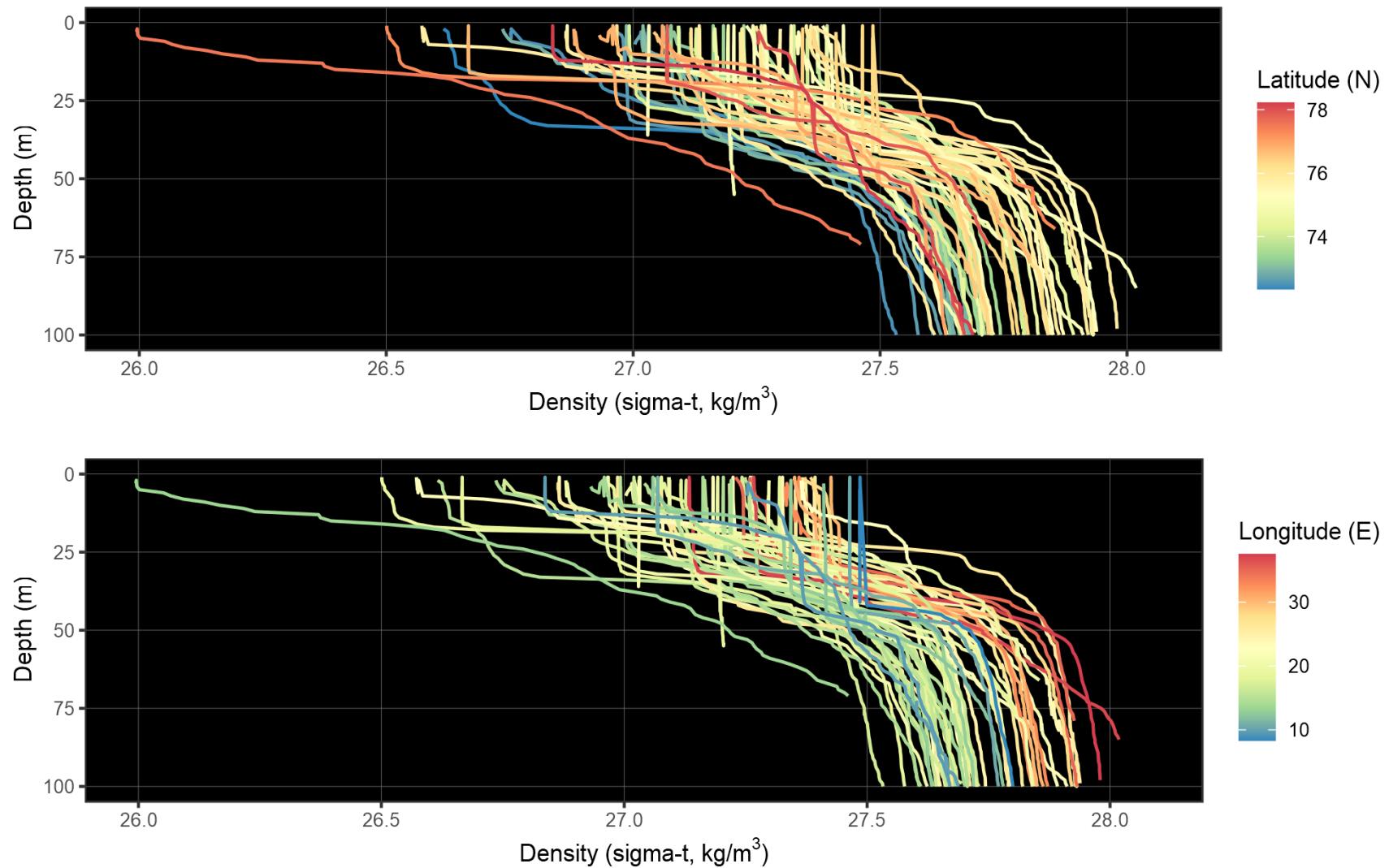


4.2 Variation in temperature and salinity with bathymetry and geographical location

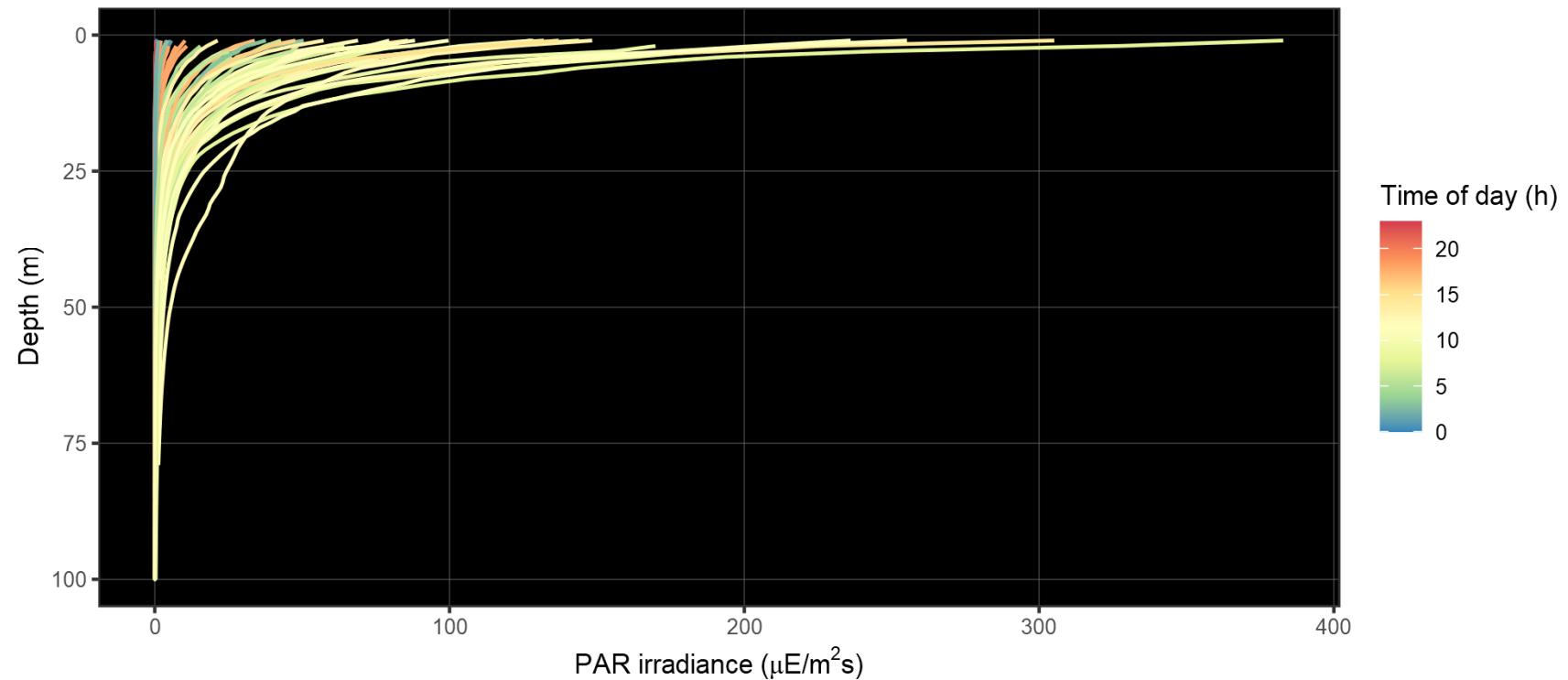




4.3 Density in the water column



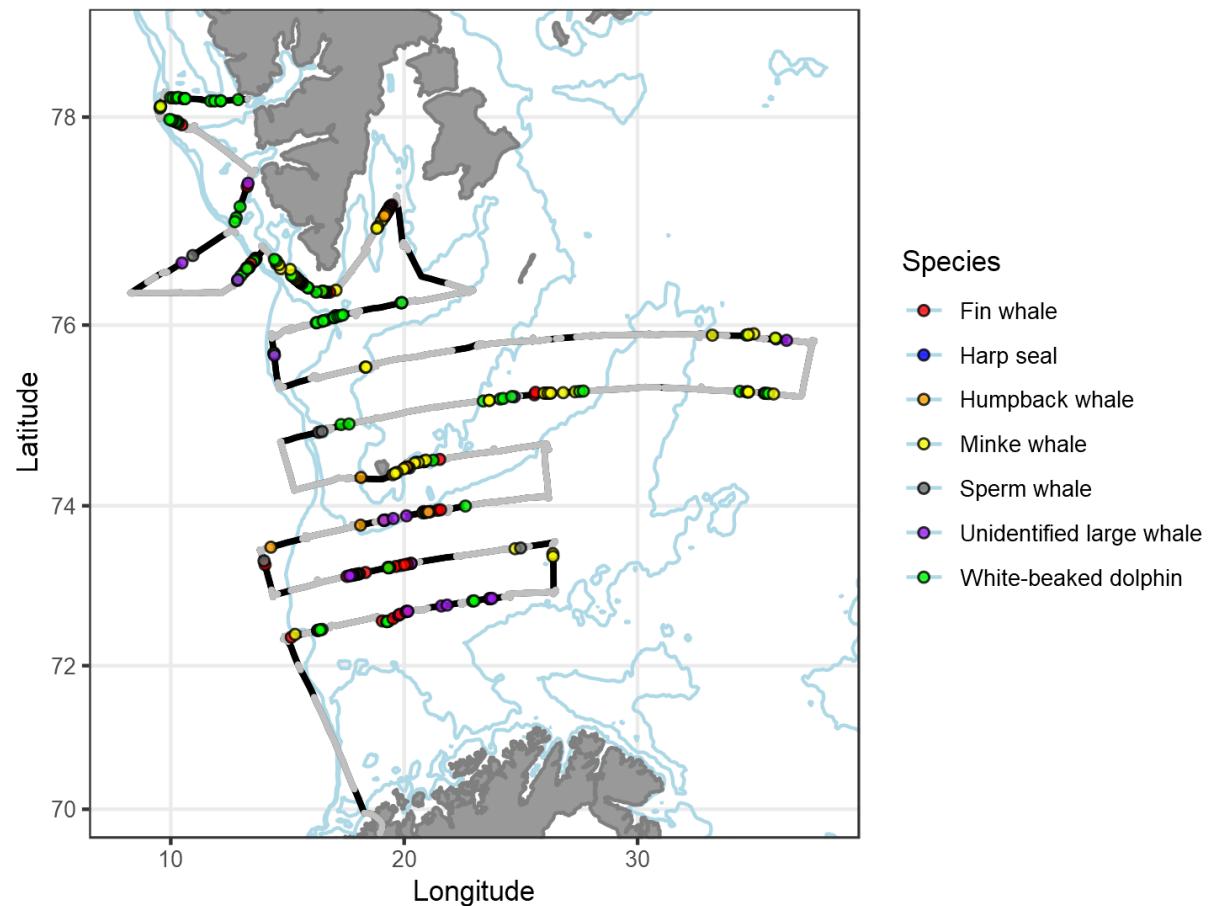
4.4 Light in the water column



5 Whales

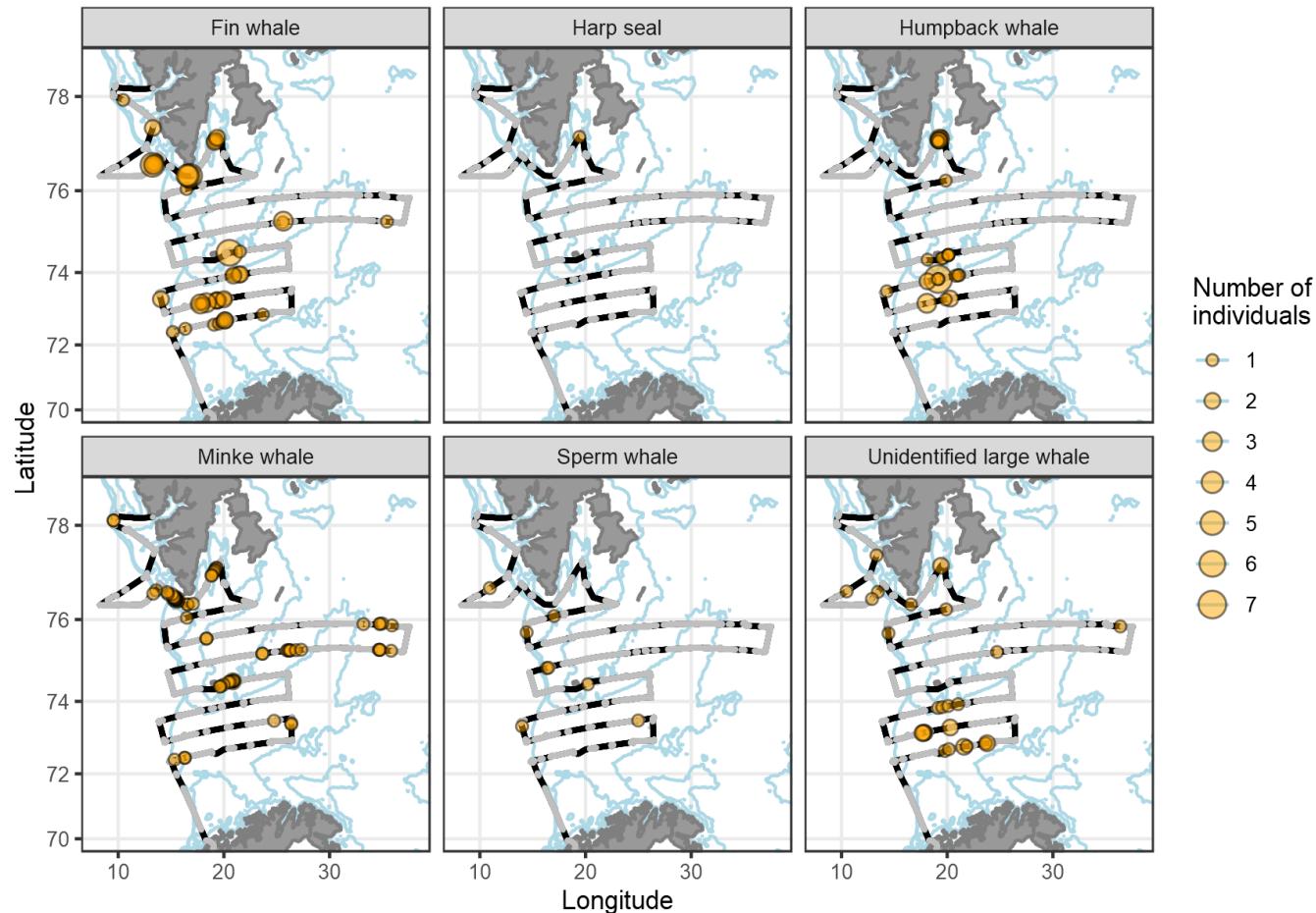
5.1 Positions of sightings by species

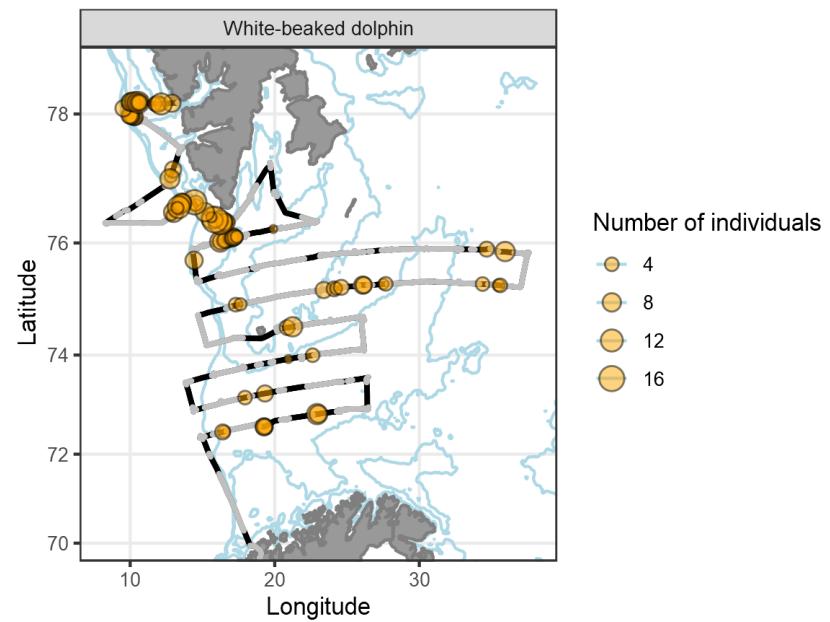
This figure shows presence/absence sightings of whales and seals along the cruise track. The cruise track colour indicates whether the observers have been on watch (black) or off watch (grey).



5.2 Number of individuals

Here the circles are proportional to the number of individuals observed at the location. The cruise track colour indicates whether the observers have been on watch (black) or off watch (grey).





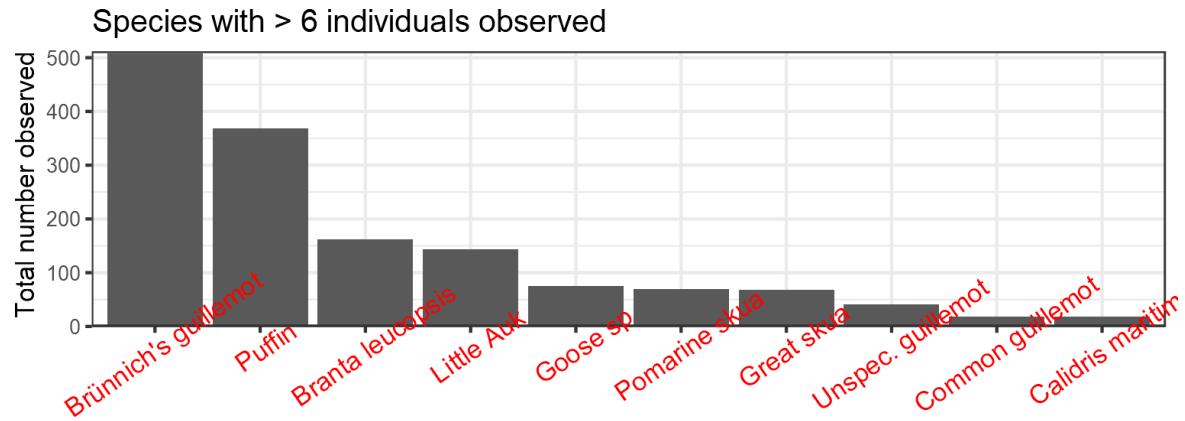
Seabirds (non ship followers)

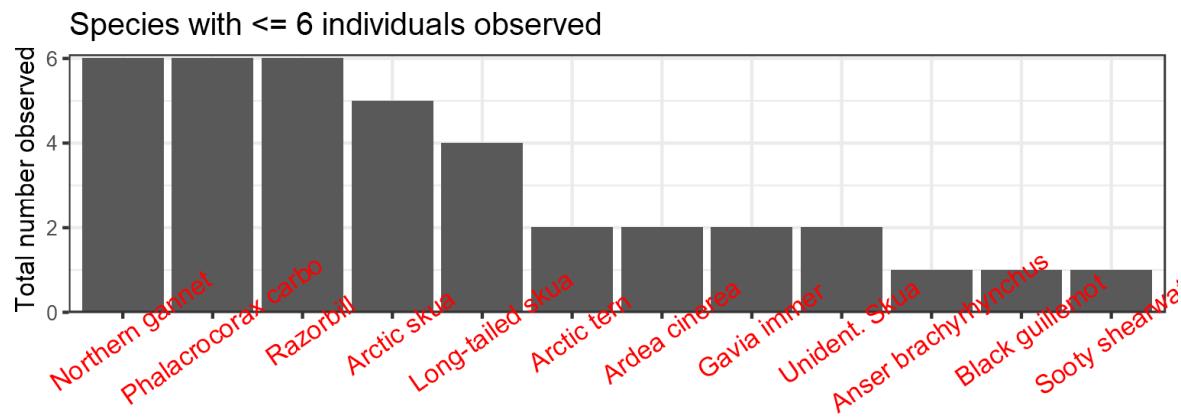
- NB work to generalise this code -

5.3 Summary of observations

The most frequently observed seabird species was Puffin, while the species with highest group numbers (number of individuals in a single sighting) was *Branta leucopsis*. Brünnich's guillemot, Puffin, and *Branta leucopsis* were the species with the three highest total number of observations.

6 species were observed only once: *Anser brachyrhynchus*, Arctic tern, *Ardea cinerea*, Black guillemot, Goose sp, Sooty shearwater.





5.4 Spatial distribution of observations

The cruise track colour indicates whether the whale observers have been on watch (black) or off watch (grey). -NB update with bird effort-

