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Preliminary Cruise Report
Cruise no. 1952

Faroese part of International Ecosystem Summer Survey in the Norwegian Sea 2019

27 June – 13 July 2019

M/T Finnur Friði



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INTRODUCTION

The main aim of this survey was to investigate the distribution and abundance of Northeast Atlantic mackerel (mackerel), Norwegian spring-spawning herring (herring) and blue whiting in the Northeast Atlantic. Zooplankton and hydrographic data were collected along the cruise tracks.

The cruise was part of the joint International Ecosystem Summer Survey in the Nordic Seas (IESSNS). Five parties and six research vessels (see text table below) took part in the survey, coordinated by the “Working Group of International Pelagic Surveys” (WGIPS) in ICES (formerly WGNAPES). The results from all vessels combined were used in the assessment of mackerel, herring and blue whiting by the “Working Group on Widely Distributed Stocks” (WGWIDE) in August-September 2019.

Vessel	Nation
Finnur Friði	Faroes
Vendla	Norway
Kings Bay	Norway
Arni Friðriksson	Iceland
Eros	Greenland
Ceton	Denmark

The present survey report is based on data from M/V *Finnur Friði* only. Therefore no biomass estimate is given due to incomplete coverage of the area. Only the results from the Faroese survey are presented. The combined results with biomass estimates are available in the survey report presented to WGWIDE in September 2019, and which will be part of the WGIPS report from the WGIPS meeting in January 2020.

MATERIAL AND METHODS

Cruise tracks with stations, i.e. predefined pelagic trawl stations and hydrographical stations (CTD and WP2 plankton), are shown in **Figure 1**. Two stations were added to the predetermined stations in western international waters because relatively large abundances of mackerel were observed at the stratum limit. For mackerel, the surface swept-area trawl survey method was used based on 30 min trawling at regularly spaced (approximately 52 nmi apart) trawl stations on equally spaced latitudinal tracks with a randomly selected starting latitude. The specifically designed standard MULTPELT 832 survey trawl (**Table 1**) with standardised rigging was used conforming to standard operational settings (see Nøttestad et al. 2016 for further details). For herring and blue whiting standard acoustic survey methods were used. The acoustic data were recorded with a Simrad EK-60 echo sounder. Data from the hull mounted 38 kHz transducer were logged at sea and used in the fish abundance estimation. The area backscattering recordings (s_A) per nautical mile were averaged by each nautical mile and the recordings were scrutinised on a daily basis with the EchoView 9 software and allocated to herring and blue whiting based on pelagic trawling aimed at the various acoustic recordings. The trawl gear was monitored during trawling with designed trawl sensors measuring depth and spread of the trawl. Light measurements were done during trawling. The 38 kHz Echo sounder was calibrated prior to survey with a standard copper sphere.

RESULTS

The total survey effort (number of trawl stations and biological sampling) is shown in **Table 2 and 3**. The various trawl settings and operation details are given in **Table 4** and the acoustic settings in **Table 5**. The depth of the trawl doors, the door spread and vertical opening of the trawl based on sensor data are given in **Table 6**, and the reported values were all within the standards recommended for the MULTPELT trawl.

Mackerel

Mackerel was caught in all of the 42 predetermined surface trawl stations in the survey area (**Figures 1 and 2**). The average catches of mackerel in the Faroese survey area 2019 was the highest on record and significantly higher than in 2018. It should however be noted that the covered areas have not been identical among years. The catches of mackerel and herring on each surface trawl station are shown as pie charts in **Figure 1**. The highest concentrations of mackerel were generally observed on the Faroe Plateau and on the Faroe - Iceland ridge. The relatively large catches in the southwestern part of the survey area have only been previously observed in 2015.

The mean length of mackerel was 36.4 cm and mean weight 434 g (**Figure 2**). The age distribution (**Figure 2**) shows that the bulk was 5-9 year old fish.

Norwegian spring spawning herring

The average catches of herring indicated similar abundances in 2019 as compared to the recent years. The surveyed area changes somewhat between years and this can affect the observed biomass.

Herring was observed in a broad band from east of the Faroes in a northwestern direction towards Iceland (**Figure 1 and 3**). The herring in the Faroese survey area may originate from several herring stocks, and the herring has not been split into stocks in this report. The herring east of the Faroes is thought to be mainly local Faroese autumn-spawning herring (**Figure 1**). The herring north of the Faroes and towards Iceland is Norwegian spring-spawning herring, while the herring close to eastern Iceland can be of the Icelandic summer-spawning origin (**Figure 1 and 3**).

The herring was mainly observed in the upper 10-50 m throughout the survey area. The highest abundancies were observed from the eastern part of the surveyed area and on the Faroe-Iceland ridge (**Figure 3**).

The length distribution of herring showed two tops, one at 32 cm and one at 35 cm (**Figure 4**). The age distribution shows several year-classes of similar magnitude, whereas the 2013 year class is now the most abundant year class (30% of the aged fish) in the Faroese survey area.

Blue whiting

Blue whiting was found in a rather loose scattering layer from 50-100 m down to about 350-400 m north of the Faroe Plateau and along the Faroe – Iceland ridge (**Figure 5**). The density of the blue whiting layer was higher in the continental slope areas and on the Iceland-Faroe Ridge as seen from the s_A values per each nautical mile. In the southernmost part of the survey area dense aggregations of 0-group blue whiting were observed.

The length distribution of blue whiting is shown in **Figure 6**. The mean length was 25.6 cm and the mean weight 116 g, thus rather small fish. On the two southernmost stations 0-group blue whiting were caught. The bulk of the blue whiting was 4 and 5 year old.

Other species

Lumpfish of all sizes were caught in small numbers in the upper 30 m of the water column in several stations throughout the surveyed area. One Atlantic salmon was also caught south of the Faroes.

Zooplankton

Zooplankton was sampled on all trawl stations with WP2 200 µm zooplankton net. In total 41 stations. The main zooplankton throughout the survey area was probably *Calanus finmarchicus*, which is the main food source for mackerel and herring during summer. The abundance was generally quite uniform except from lower abundances in the southwestern part of the survey area (**Figure 7**).

Hydrography

The sea-surface temperature (SST) in the surveyed area was between 7 and 13°C (**Figure 8**). Temperature and salinity casts down to 500 m if possible were taken along the track (42 stations).

References

Nøttestad, L., Utne, K. R., Oskarsson, G. J., Jónsson, S., Jacobsen, J. A., Tangen, Ø., Anthonypillai, V., Aanes, S., Vølstad, J. H., Bernasconi, M., Debes, H. H., Smith, L., Sveinbjørnsson, S., Holst, J. C., Jansen, T., and Slotte, A. 2016. Quantifying changes in abundance, biomass, and spatial distribution of Northeast Atlantic mackerel (*Scomber scombrus*) in the Nordic seas from 2007 to 2014. *ICES Journal of Marine Science* 73, 359-373.

Table 1. Trawl specifications for the Faroese MULTPELT 832 in July 2019.

Circumference (m)	832
Vertical opening (m)	36.5
Mesh size in codend (mm)	40
Typical towing speed (kn)	4.7 (4.5–4.9)

Table 2. Survey effort for Finnur Friði 27 June - 13 July 2019.

Effective survey period	Length of cruise track (nmi)	Trawl stations	CTD stations	Plankton sampling	Aged fish mackerel/herring/blue whiting	Length-measured fish
28/6-12/7	~2800	49	42	41	668/334/196	4748/1129/712

Table 3. Summary of biological sampling in the Faroese IESSNS survey from 27 June - 13 July 2019. Numbers denote the maximum number of individuals sampled for each species for the different determinations.

	Species	Faroes
Length measurements	Mackerel	100
	Herring	100
	Blue whiting	100
	Other fish sp.	20-50
Weighed, sexed and maturity determination	Mackerel	25
	Herring	25
	Blue whiting	25
	Other fish sp.	20-50 (weighed)
Otoliths/scales collected	Mackerel	25
	Herring	25-50
	Blue whiting	25-100
	Other fish sp.	0
Stomach sampling	Mackerel	5
	Herring	5
	Blue whiting	5
	Other fish sp.	0
Tissue for genotyping	No genetic samples	0

Table 4. Trawl settings and operation details during the IESSNS survey in 2019.

Properties	Finnur Friði
Trawl producer	Vónin
Warp in front of doors	Dynema – 30mm
Warp length during towing	350-360 m
Difference in warp length port/starboard	0-10 m
Weight at the lower wing ends	2*400 kg
Setback in metres	6 m
Type of trawl door	Injector F-15
Weight of trawl door (kg)	2000
Area trawl door (m ²)	6
Towing speed (knots)	4.5 (3.8-5.3)
Trawl height (m)	42.7
Door distance (m)	102.8
Trawl width (m)	58.5
Turn radius	5-10 degrees BB turn
A fish lock in front end of cod-end	Yes
Trawl door depth (port, starboard, m)	3-12,4-19
Headline depth	0 m
Float arrangements on the headline	Kite + 1 buoys on each wingtips +1 buoy on Kite
Weighing of catch	All weighed

Table 5. Acoustic instruments and settings for the primary frequency in the IESSNS survey in 2019.

Parameter	M/V Finnur Fríði
Echo sounder	Simrad EK 60
Frequency (kHz)	38,120, 200
Primary transducer	ES38B
Transducer installation	Hull
Transducer depth (m)	8
Upper integration limit (m)	Not used
Absorption coeff. (dB/km)	9.8
Pulse length (ms)	1.024
Band width (kHz)	2.43
Transmitter power (W)	2000
Angle sensitivity (dB)	21.9
2-way beam angle (dB)	-20.3
TS Transducer gain (dB)	26.67
s _A correction (dB)	-0.58
alongship:	7.16
athw. ship:	7.22
Maximum range (m)	500
Post processing software	Sonardata Echoview 10.x

Table 6. Descriptive statistics for trawl door spread, vertical trawl opening and tow speed for the Faroese IESSNS survey in July 2019. Two different kinds of data were analyzed, manually reported towing speed values from (one value per station from the GPS) and digitally recorded data from trawl sensors. Digitally recorded data were filtered prior to calculations; for trawl door spread all values < 70 m and > 150 m were deleted and for vertical opening all values < 25 m and > 60 were deleted. The average values per station were used to calculate overall mean, maximum (max), minimum (min) and standard deviation (st.dev.). Number of trawl stations used in calculations is also reported – stations with fewer than 10 registrations were excluded.

Finnur Fríði	
Trawl doors horizontal	
Number of stations	39
mean	102.2
max	108.9
min	95.9
st. dev.	2.7
Vertical trawl opening (m)	
Number of stations	40
mean	43.8
max	58.5
min	33.3
st. dev.	4.0
Speed (over ground, nmi)	
Number of stations	41
mean	4.5
max	5.7
min	3.6
st. dev.	0.41

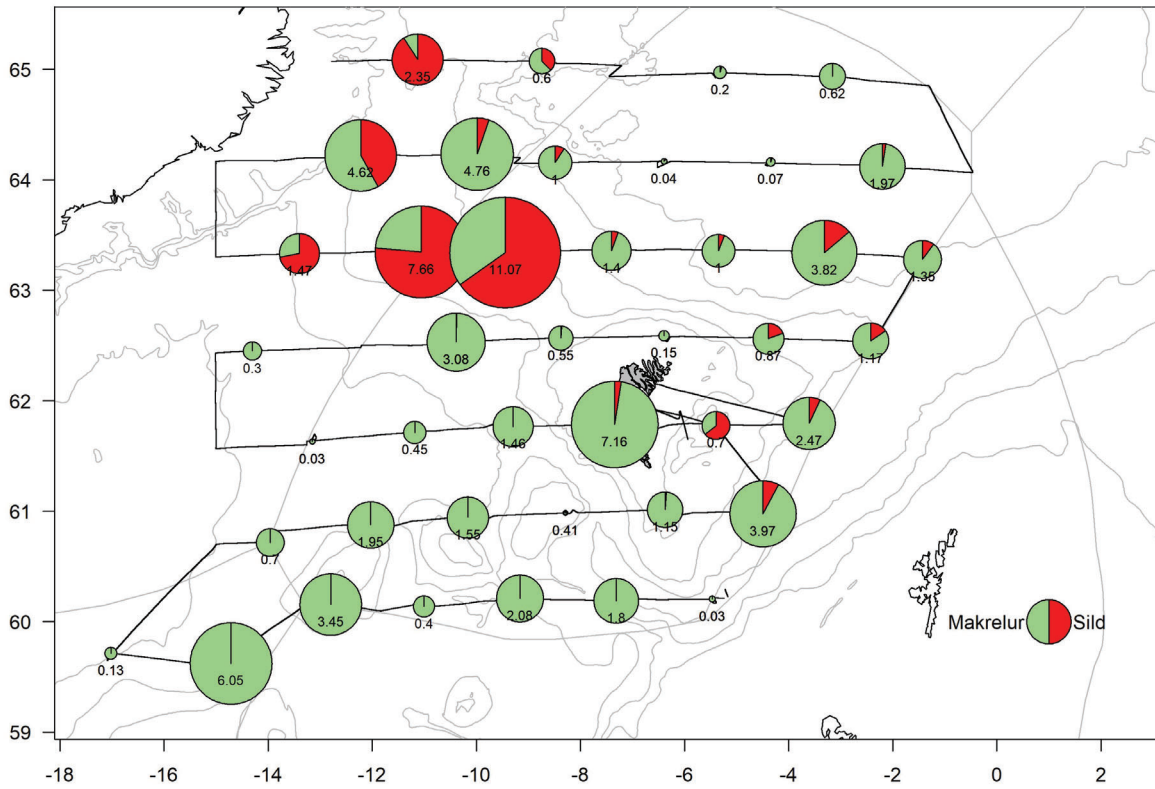


Figure 1. Cruise tracks with predetermined trawl/CTD/WP2 stations (circles) approximately 52 nmi apart during the IESSNS 2019 cruise with *Finnur Fríði* cruise 1952, 27 June - 13 July 2019. The total covered distance was 3000 nautical miles. Catch of mackerel (green) and herring (red) by ½ hour trawl haul is shown on the pie charts. The size of the circles corresponds to total amount of fish caught (in tonnes).

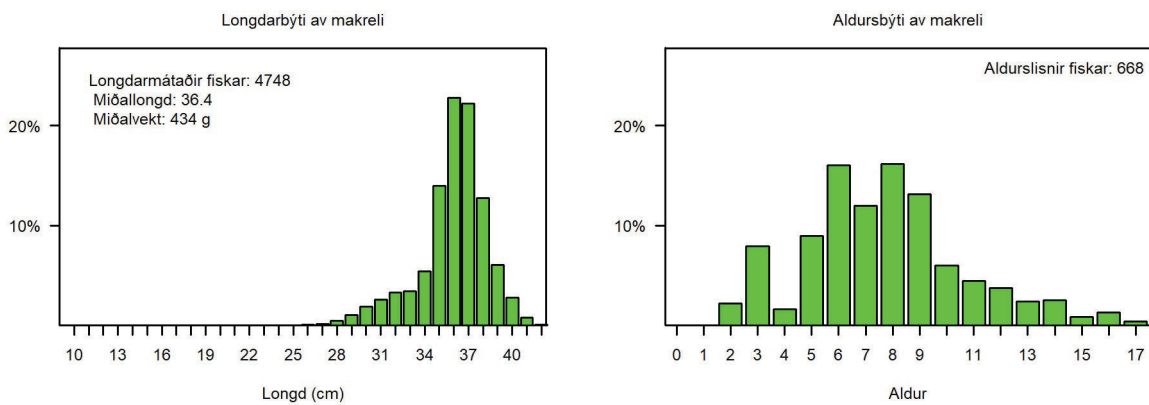


Figure 2. Length (left) and age (right) distribution of mackerel during the IESSNS 2019 cruise, *Finnur Fríði* cruise 1952, 27 June - 13 July 2019.

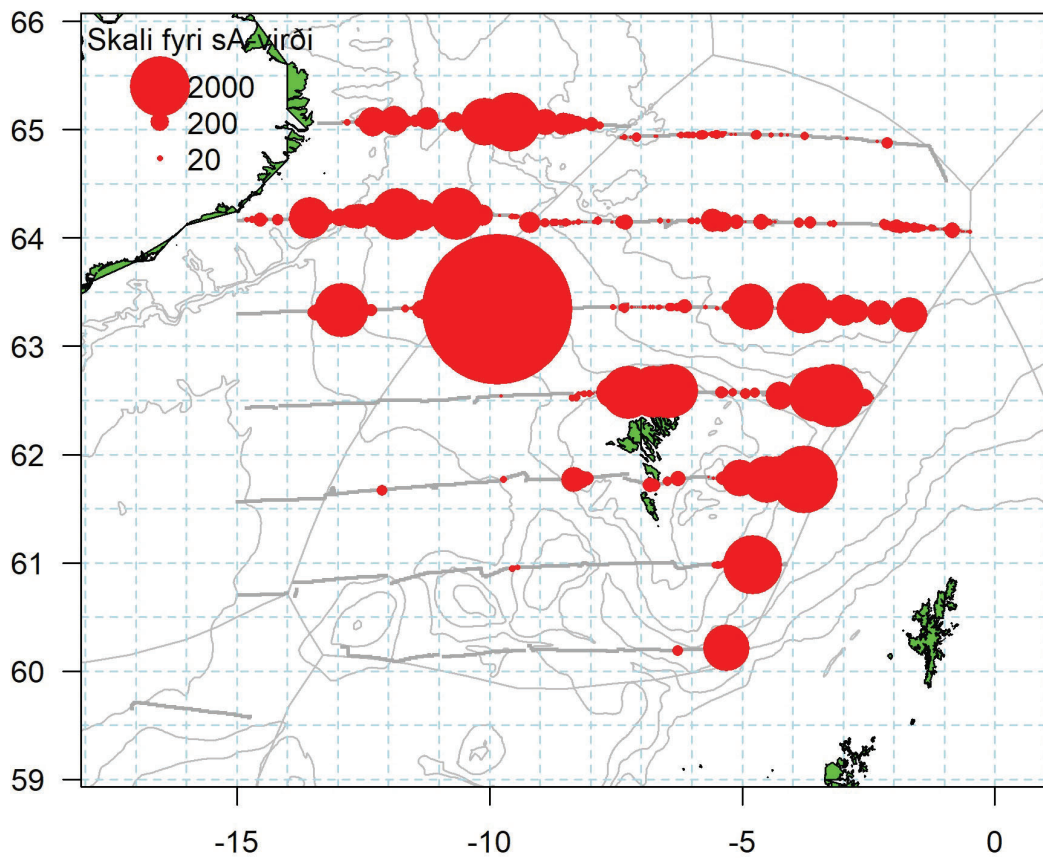


Figure 3. Mean integration values ($s_A \text{ m}^2/\text{nm}^2$) per nautical miles of herring along the cruise track. The size of the circles corresponds to amount of fish detected. IESSNS 2019 cruise, *Finnur Fríði* cruise 1952, 27 June - 13 July 2019.

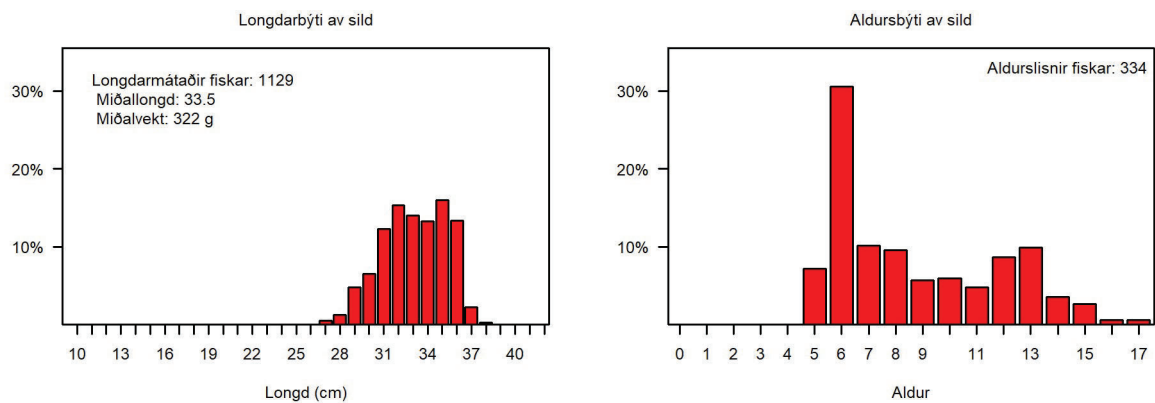


Figure 4. Length (left) and age (right) distribution of herring during the IESSNS 2019 cruise, *Finnur Fríði* cruise 1952, 27 June - 13 July 2019.

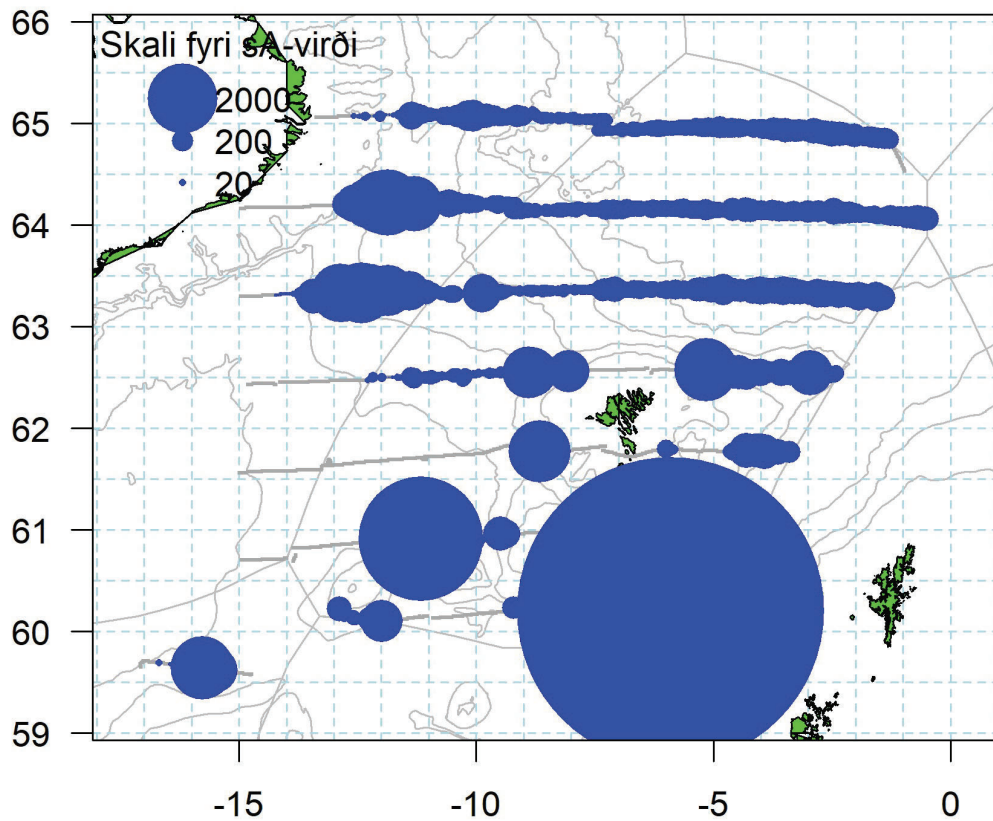


Figure 5. Integration values ($s_A, m^2/nm^2$) of blue whiting per each nm along the cruise tracks. The size of the circles corresponds to amount of fish. IESSNS 2019 cruise, *Finnur Fríði* cruise 1952, 27 June - 13 July 2019.

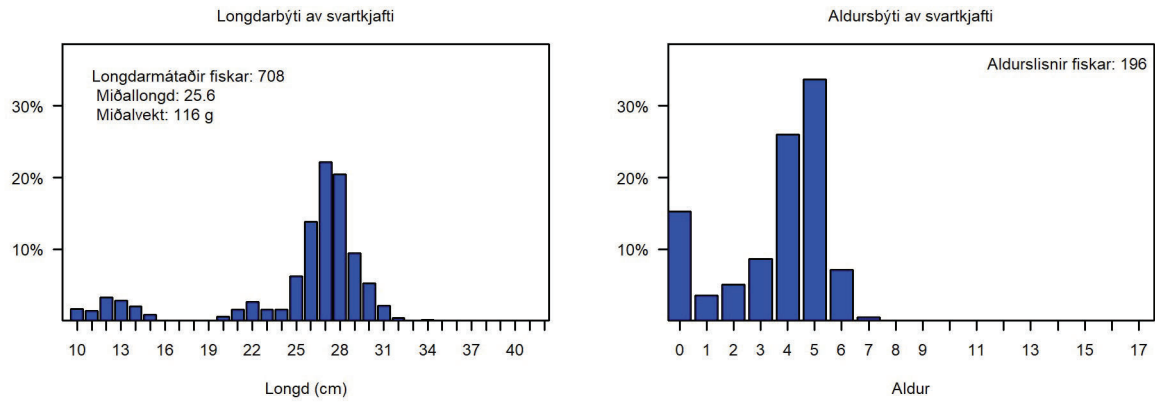


Figure 6. Length (left) and age (right) distribution of blue whiting during the IESSNS 2019 cruise, *Finnur Fríði* cruise 1952, 27 June - 13 July 2019.

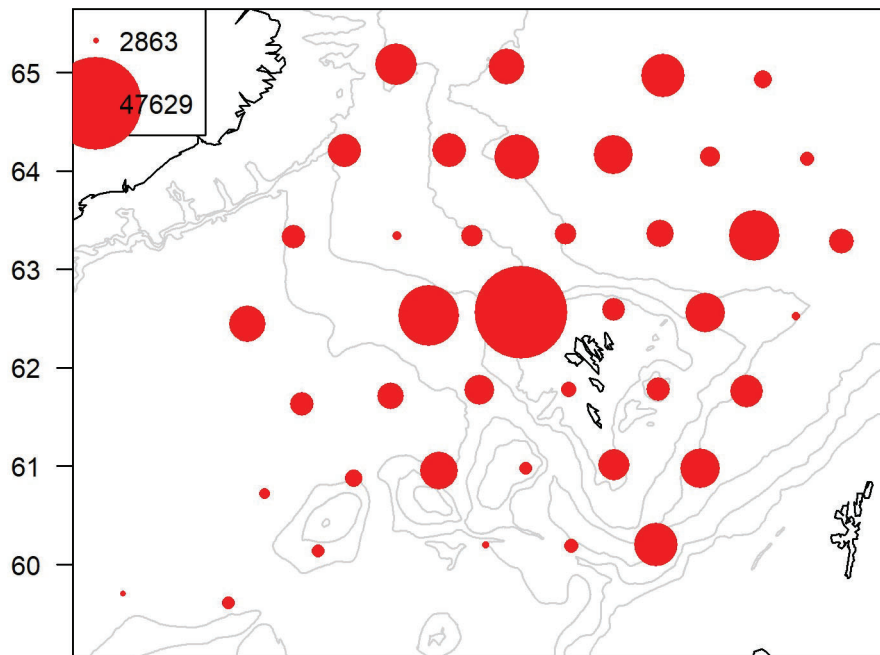


Figure 7. Zooplankton abundance (mg/m²) during the IESSNS 2019 cruise, *Finnur Fríði* cruise 1952, 27 June - 13 July 2019.

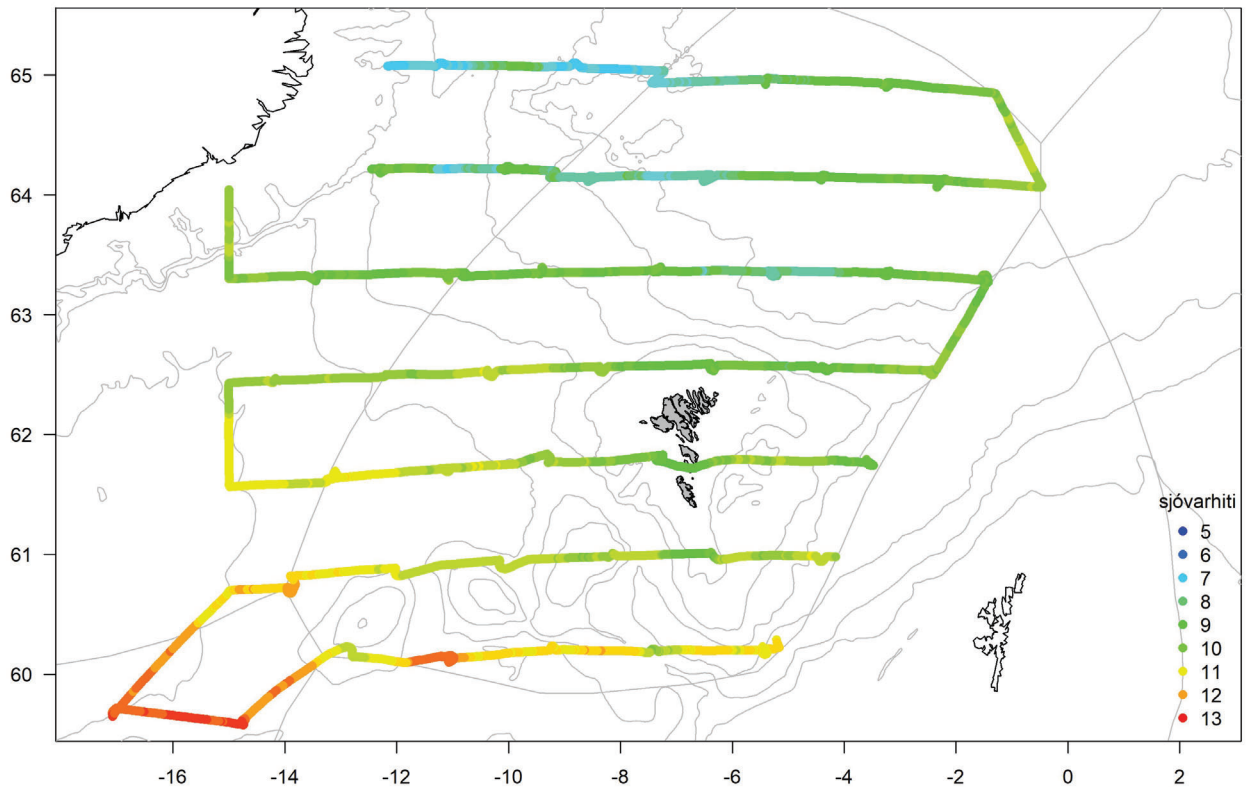


Figure 8. The sea-surface temperature (°C) along the cruise track during the IESSNS 2019 cruise, *Finnur Friði* cruise 1952, 27 June - 13 July 2019.