**Preliminary Cruise Report**
Cruise no. 2130

# Faroese part of International Ecosystem Summer Survey in the Norwegian Sea 2021

1 – 21 July 2021

Jákup Sverri


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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 five research vessels (see text table below) took part in the survey, coordinated by the "Working Group of International Pelagic Surveys" (WGIPS) in ICES. 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 2021.

| **Vessel** | **Nation** |
|---|---|
| Jákup Sverri | Faroes |
| Vendla | Norway |
| Eros | Norway |
| Árni Fríðriksson | Iceland |
| Ceton | Denmark |

The present survey report is based on data from *Jákup Sverri* 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 late August 2021, and which will be part of the WGIPS report from the WGIPS meeting in January 2022.

## 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**. For mackerel, the surface swept-area trawl survey method was used based on 30 min trawling at regularly spaced (approximately 60 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. For herring and blue whiting standard acoustic survey methods were used. The acoustic data were recorded with a Simrad EK-80 echosounder. Data from the 38 kHz transducer mounted on a drop keel 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 LSSS 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 of the trawl and spread of the trawl doors. 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** the reported values were all within the standards recommended for the MULTPELT trawl. The acoustic settings are shown in **Table 5**.

### Mackerel

Mackerel was caught in 33 of the 34 predetermined surface trawl stations in the survey area. The catches of mackerel and herring on each surface trawl station are shown as pie charts in **Figure 1**. The average catches of mackerel in the Faroese survey area 2021 were somewhat lower than in

2020. It should however be noted that the covered areas have not been identical among years. The largest catch (per ½ hour trawl haul) was observed in international waters (**Figure 1**). The catch rates in the southern area were low in 2021. The distribution of catches by 1/5 hour trawling was uneven in 2021 as opposed to recent years with more even catch rates from one station to the next.

The mean length of mackerel was 37.6 cm and mean weight 488 g (**Figure 2**). The age distribution shows that the bulk was 5, and 7-11 year old fish.

**Norwegian spring spawning herring**
The average abundance of herring indicated lower abundances in 2021 than in recent years. Herring was observed in north of the Faroes and northeast of the Faroes on the Iceland-Faroe Ridge (**Figure 1** and **3**). On the on the eastern Icelandic plateau some mixing of Icelandic summer spawning herring was observed. The vertical distribution of herring was very shallow in 2021, and was seen as small schools in the upper 40 m throughout the survey area. This may lead to an underestimation of the herring since an unknown part may be distributed shallower than 9 meters, which is the depth of the transducer under the drop keel.

The length distribution of herring was mainly 30-37 cm herring (**Figure 4**). The age distribution shows that the 2016 year class was well represented in the western area in 2021, with more than 30% of the aged fish (**Figure 4**). The 2013 year class was, however, also well represented in the catches in the Faroese survey area. Relatively few specimens were older than 8 years.

**Blue whiting**
Blue whiting was distributed in the whole area as rather loose scattering layers from 100 m down to about 350-400 m (**Figure 5**). The concentrations were somewhat higher on the Iceland-Faroe Ridge and in the southern part of the surveyed area (**Figure 5**). In the south schools of 0-group blue whiting were observed.

The length and age distribution of blue whiting is shown in **Figure 6**. The mean length was 25.6 cm and the mean weight was 114 g, but these numbers do not tell the true story, as the length distribution consisted of two groups. A lower group of 0-group blue whiting with a mean length of 15 cm and a group of larger fish (> 21 cm) consisting of 1 to 7 year old fish. The 0-group blue whiting observed in several stations on the southernmost transects.

**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. No salmon was caught this year.

**Zooplankton**
Zooplankton was sampled on all trawl stations with WP2 200 µm zooplankton net. In total 34 stations. The main zooplankton throughout the survey area was *Calanus finmarchicus*, which is the main food source for mackerel and herring during summer, mixed with krill and amphipods. The abundance was generally highest on the Faroe Plateau and in the northern areas (**Figure 7**).

**Stomach analysis**
As part of the biological sampling this year, a veterinary student from the Univ. in Toulouse (France) participated on board. She sampled three stomachs from each species (mackerel, herring and blue whiting) from each haul, in total around 170 stomachs. Immediately after each haul, the stomach content was identified to species level if possible or to family level, where after the whole content was frozen for weighing ashore. A visual grading of the stomach fullness was made, as well

as the weight of the full and emptied stomach to give a "wet weight" measure of the content. At the lab the content from each fish was dried in an oven at around 60 degrees for five days, to produce a "dry weight" measure of the content. This method worked well on board, and this was the first time such analyses were made on board during the survey. Traditionally all stomachs were frozen for later work-up at the lab after the survey, so this method worked very well. An interesting result from the preliminary stomach analysis was that the mackerel feeding in the northern part of the surveyed area had higher stomach content than the fish in the south. This also corroborates well with the results from the zooplankton samples which show higher biomass in the samples from the northern areas (**Figure 7**).

**Hydrography**

Temperature and salinity casts down to 500 m were taken along the track (34 stations), not shown in the report.

**Table 1**. Trawl specifications for the Faroese MULTPELT 832 in July 2021.

| | |
|---|---|
| Circumference (m) | 832 |
| Vertical opening (m) | 44.5 |
| Mesh size in codend (mm) | 45 |
| Typical towing speed (kn) | 4.6 |

**Table 2**. Survey effort for Jákup Sverri 1-21 July 2021.

| Effective survey period | Length of cruise track (nmi) | Trawl stations | CTD stations | Plankton sampling | Aged fish mackerel/herring/ blue whiting | Length-measured fish |
|---|---|---|---|---|---|---|
| 2-19/7 | ~3050 | 34 | 34 | 34 | 625/421/233 | 3057/1400/969 |

**Table 3.** Summary of biological sampling in the Faroese IESSNS survey from 1-21 July 2021. Numbers denote the maximum number of individuals sampled for each species for the different determinations.

| | Species | No |
|---|---|---|
| Length measurements | Mackerel | 100 |
| | Herring | 100 |
| | Blue whiting | 100 |
| | Other fish sp. | 20-50 |
| Weighed, sexed and maturity determination | Mackerel | 15-25 |
| | Herring | 15-25 |
| | Blue whiting | 5-50 |
| | Other fish sp. | 20-50 (weighed) |
| Otoliths/scales collected | Mackerel | 15-25 |
| | Herring | 15-25 |
| | Blue whiting | 5-50 |
| | Other fish sp. | 0 |
| Stomach sampling | Mackerel | 6 |
| | Herring | 6 |
| | Blue whiting | 6 |
| | Other fish sp. | 0 |
| Tissue for genotyping | Genetic samples (lumpfish) | 20 |

**Table 4**. Trawl settings and operation details during the IESSNS survey in 2021.

| **Properties** | **Jákup Sverri** |
|---|---|
| Trawl producer | Vónin |
| Warp in front of doors | Dynex – 38 mm |
| Warp length during towing | 350(350-360) m |
| Difference in warp length port/starboard | 7 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) | 4.6 (3.7-5.4) |
| Trawl height (m) | 44.5 (40-55) |
| Door distance (m) | 98.5 (87-106) |
| Turn radius | 5 degrees BB turn |
| A fish lock in front end of cod-end | Yes |
| Headline depth | 0 m |
| Float arrangements on the headline | Kite with + 2 buoys (fender) on each wingtip |
| Weighing of catch | All weighed |

**Table 5.** Acoustic instruments and settings for the primary frequency in the IESSNS survey in 2021.

| **Parameter** | **Jákup Sverri** |
|---|---|
| Echo sounder | Simrad EK80 |
| Frequency (kHz) | 18,70,**38**,120,200,333 |
| Primary transducer | ES38-7 |
| Transducer installation | Drop keel |
| Transducer depth (m) | 6-9 |
| Upper integration limit (m) | 15 m |
| Absorption coeff. (dB/km) | 10.7 |
| Pulse length (ms) | 1.024 |
| Band width (kHz) | 3.064 |
| Transmitter power (W) | 2000 |
| Angle sensitivity (dB) | 21.9 |
| 2-way beam angle (dB) | -20.4 |
| TS Transducer gain (dB) | 26.96 |
| $s_A$ correction (dB) | -0.16 |
| alongship: | 6.55 |
| athw. ship: | 5.45 |
| Maximum range (m) | 500 |
| Post processing software | LSSS 2.10.1 |

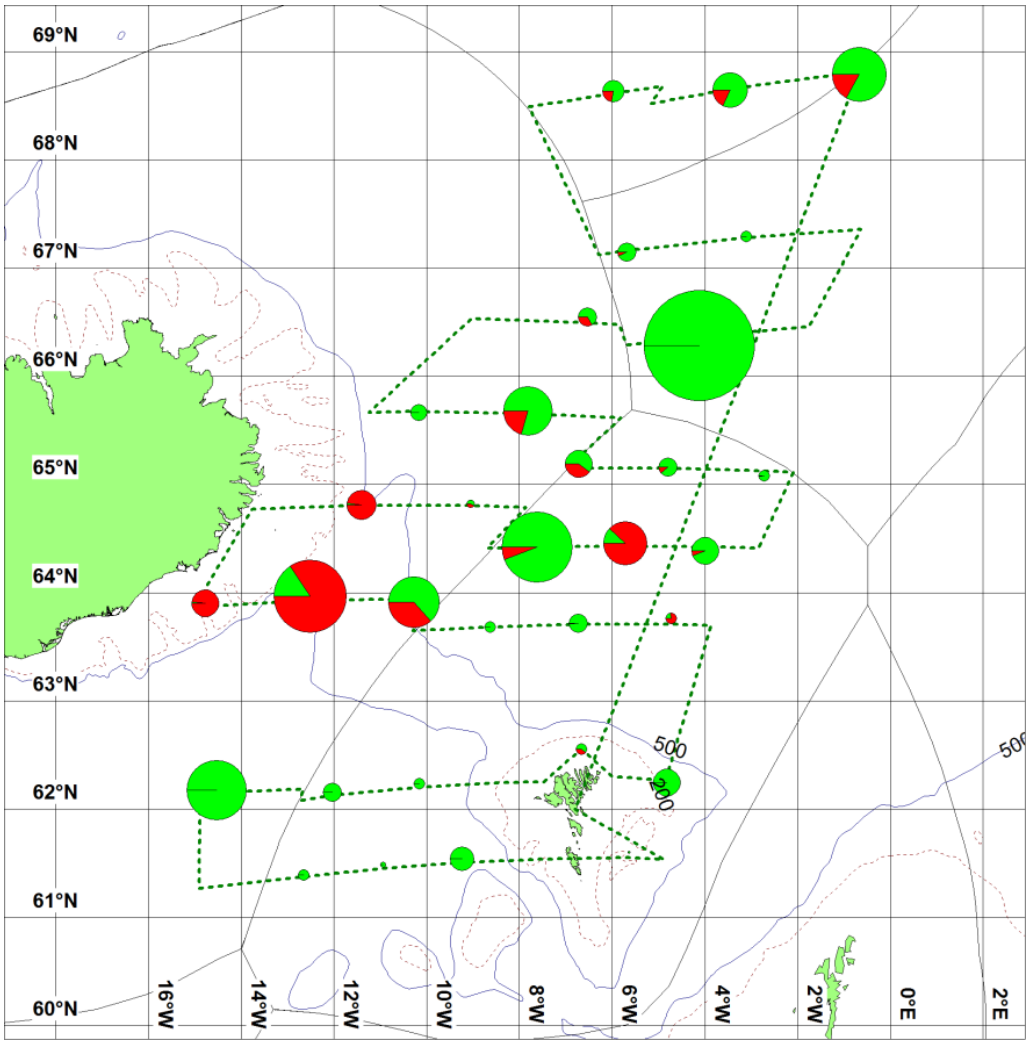


**Figure 1.** Cruise tracks with predetermined trawl/CTD/WP2 stations (circles) approximately 52 nmi apart during the IESSNS 2021 cruise with *Jákup Sverri* cruise 2130, 1-21 July 2021. The total covered distance was 2600 nautical miles. Catch of mackerel (green) and herring (red) by ½ hour trawl haul is shown on the pie charts. The size of the circles corresponds to total amount of fish caught (in tonnes).

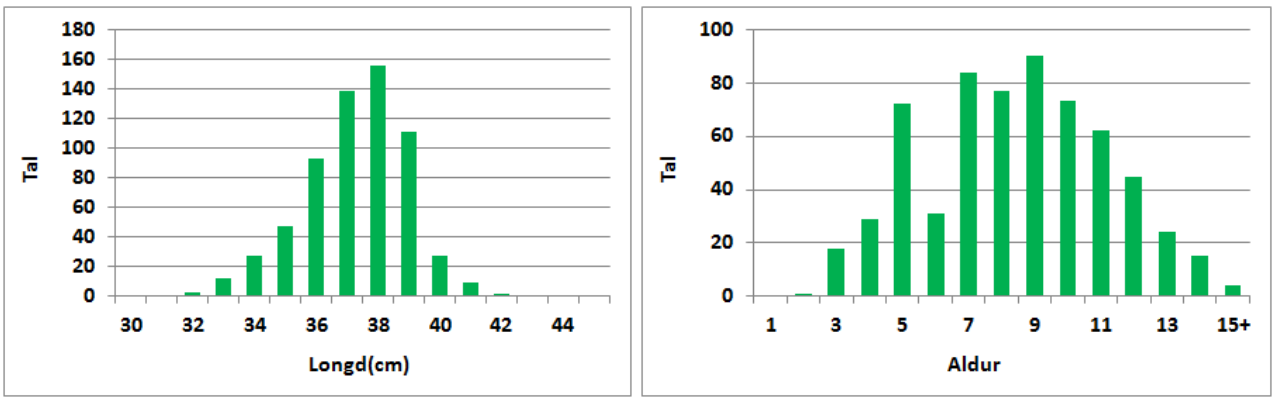


**Figure 2.** Length (left) and age (right) distribution of mackerel during the IESSNS 2021 cruise, *Jákup Sverri* cruise 2130, 1-21 July 2021.

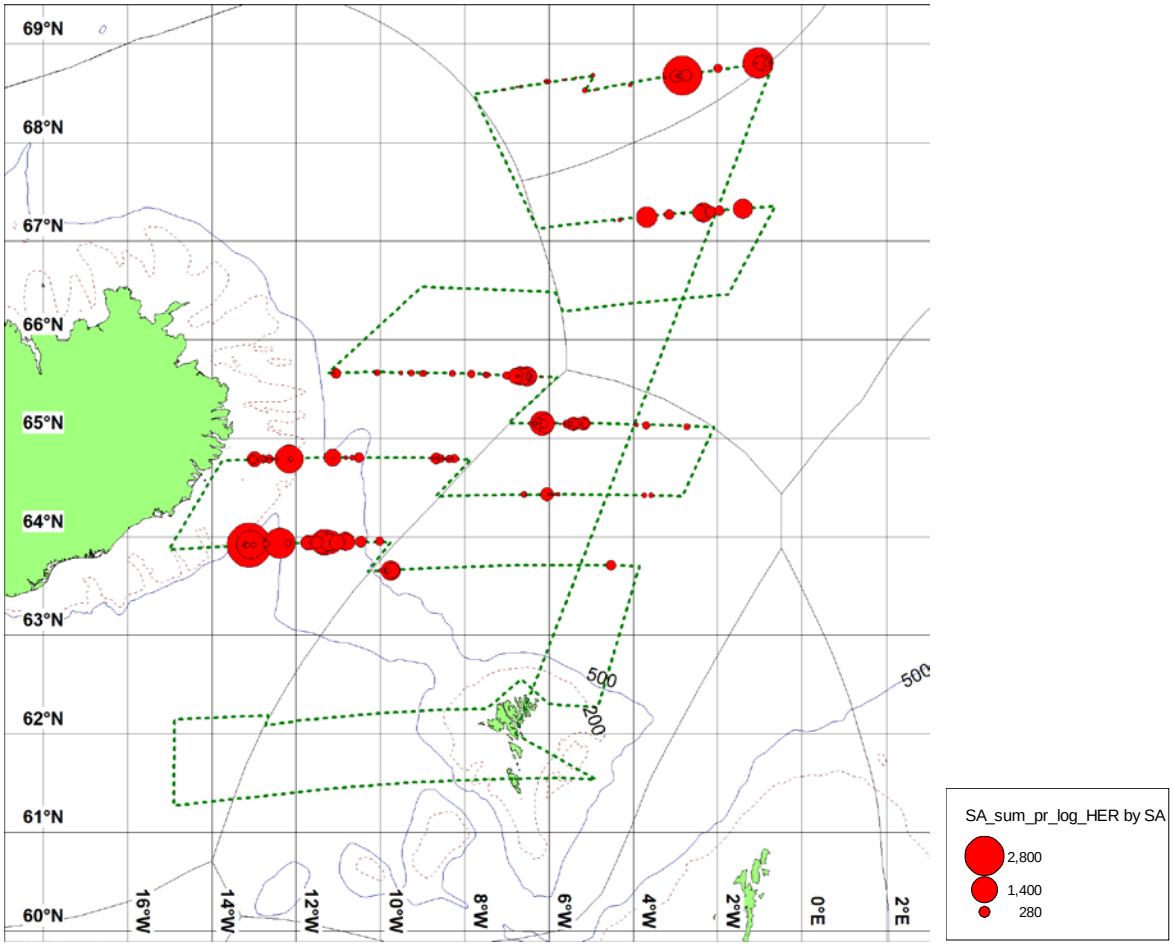


**Figure 3.** Mean integration values ($s_A$ $m^2/nm^2$) per nautical miles of herring along the cruise track. The size of the circles corresponds to amount of fish detected. IESSNS 2021 cruise, *Jákup Sverri* cruise 2130, 1-21 July 2021.

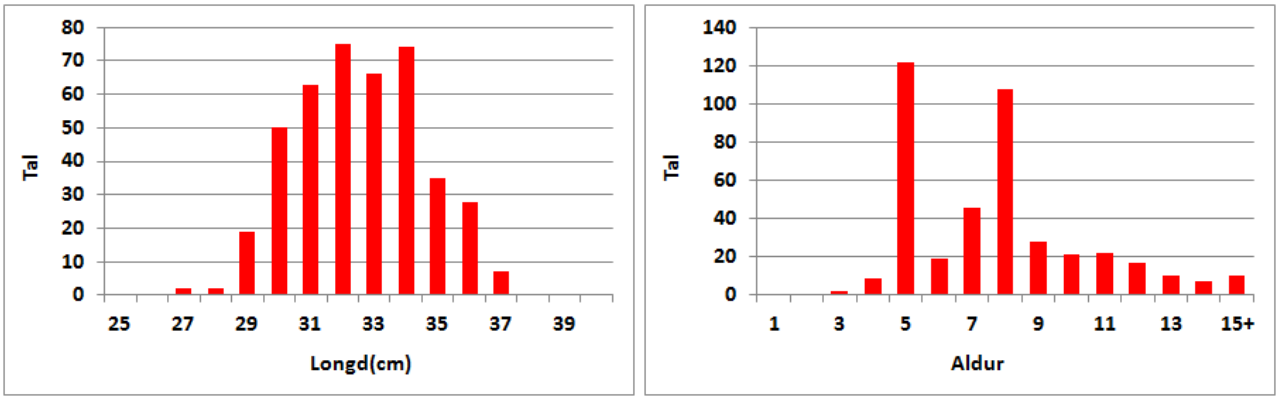


**Figure 4.** Length (left) and age (right) distribution of herring during the IESSNS 2021 cruise, *Jákup Sverri* cruise 2130, 1-21 July 2021.

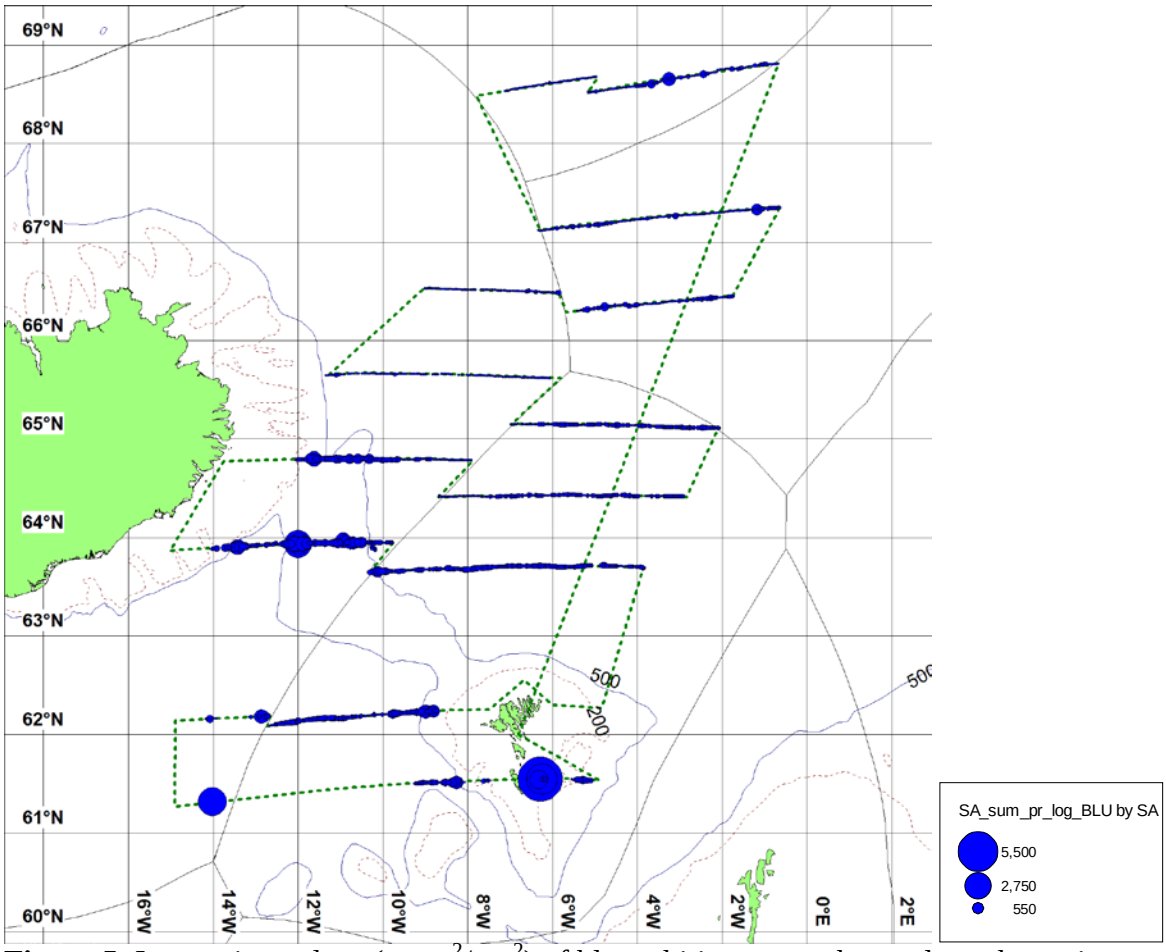


**Figure 5.** Integration values ($s_A$, $m^2/nm^2$) of blue whiting per each nm along the cruise tracks. The size of the circles corresponds to amount of fish. IESSNS 2021 cruise, *Jákup Sverri* cruise 2130, 1-21 July 2021.

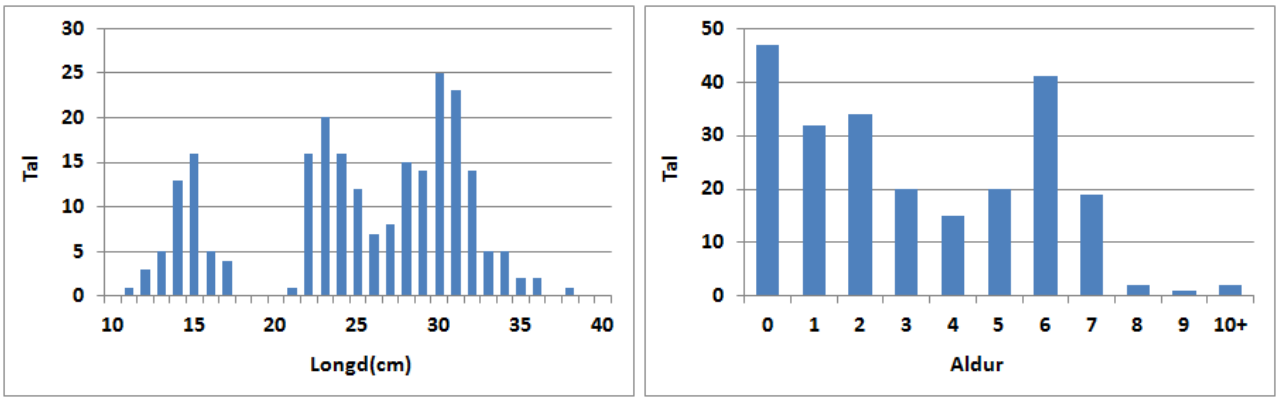


**Figure 6.** Length (left) and age (right) distribution of blue whiting during the IESSNS 2021 cruise, *Jákup Sverri* cruise 2130, 1-21 July 2021.

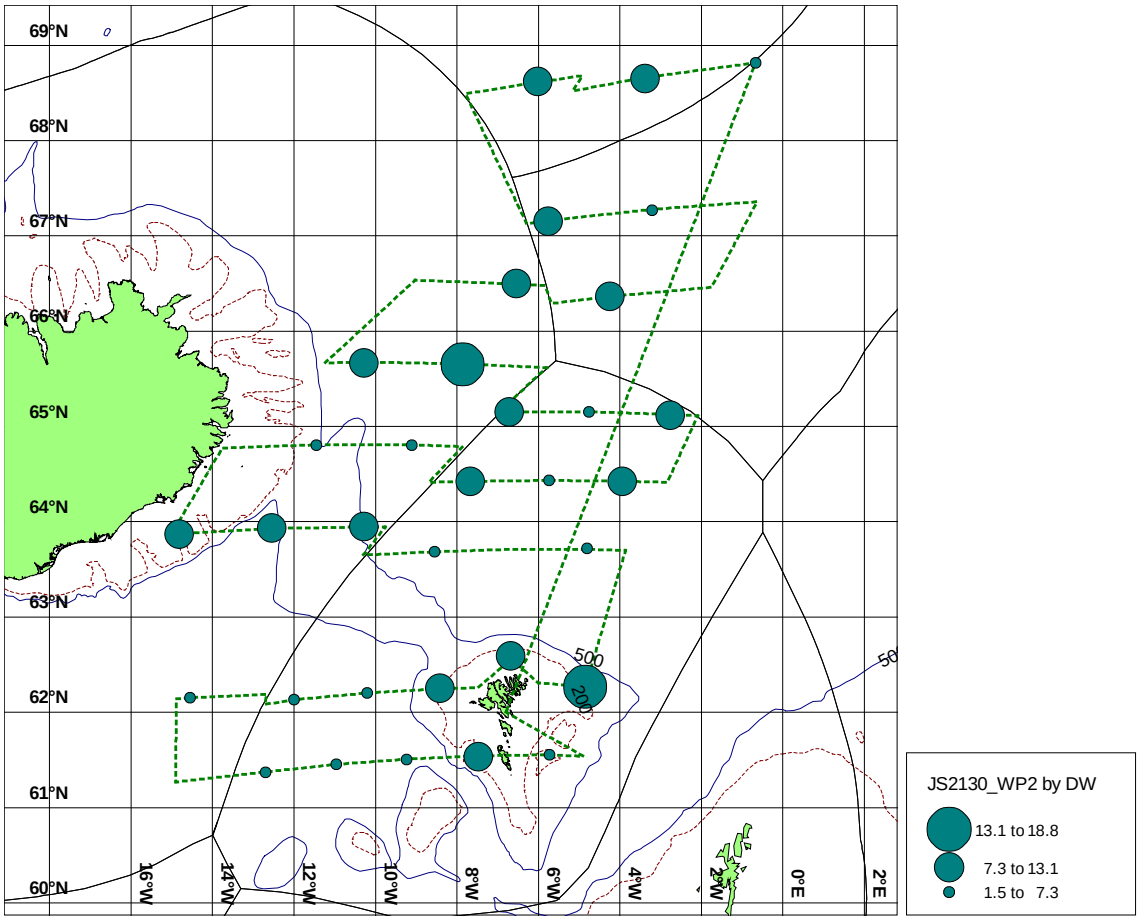


**Figure 7.** Zooplankton biomass (g/m$^2$) during the IESSNS 2021 cruise, *Jákup Sverri* cruise 2130, 1-21 July 2021.