

Survey report
FRV Walther Herwig III, WH 479
06 June – 04 July 2024

Chief scientist: Dr. Matthias Bernreuther

Summary

This survey is part of a coordinated effort of ICES (International Council for the Exploration of the Sea) to conduct an International Deep Pelagic Ecosystem Survey in the Irminger Sea and adjacent waters in June/July 2024, estimating the abundance and biomass of the two pelagic beaked redfish (*Sebastes mentella*) stocks and conducting additional observations relevant to integrated ecosystem assessment in the area.

The main objectives and the coordination of this international survey were discussed and planned by the "ICES Working Group on International Deep Pelagic Ecosystem Surveys (WGIDEEPS), which met at ICES headquarters in Copenhagen, Denmark, 13-15 February 2024 (ICES. 2024. ICES Scientific Reports. 6:29. 14 pp. <https://doi.org/10.17895/ices.pub.25471120>).

The survey takes place every third year and was scheduled to be a joint survey by Germany with FRV "Walther Herwig III" and by Iceland with RV "Árni Friðriksson". The survey of "Walther Herwig III" started on 6 June and ended on 4 July 2024. Within this period, the distribution and density of redfish was recorded, and the length composition, individual weights, sex and maturity, stomach contents and the infestation with parasites were analyzed. In addition, the hydrographic conditions of the environment were recorded.

Verteiler:

Schiffsführung FFS „Solea“ „Walther Herwig III“
BA für Landwirtschaft und Ernährung (BLE) Fischereiforschung
BM für Ernährung und Landwirtschaft (BMEL), Ref. 614
BA für Seeschifffahrt und Hydrographie (BSH), Hamburg
Deutscher Angelfischerverband e.V.
Deutsche Fischfang-Union, Cuxhaven
Deutscher Fischereiverband Hamburg
Doggerbank Seefischerei GmbH, Bremerhaven
Erzeugergemeinschaft der Deutschen Krabbenfischer GmbH
Euro-Baltic Mukran
GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel
Kutter- und Küstenfisch Sassnitz

LA für Landwirtschaft, Lebensmittels. und Fischerei (LALLF)
LFA für Landwirtschaft und Fischerei MV (LFA)
Landesverband der Kutter- u. Küstenfischer MV e.V.
Leibniz-Institut für Ostseeforschung Warnemünde
Thünen-Institut - Institut für Fischereiökologie
Thünen-Institut - Institut für Seefischerei
Thünen-Institut - Institut für Ostseefischerei
Thünen-Institut - Pressestelle
Thünen-Institut - Präsidialbüro
Thünen-Institut - Reiseplanung Forschungsschiffe, Dr. Rohlf
Fahrteilnehmer*innen

1. Research program

1.1. Survey design

The objective of the survey was to record a hydroacoustic profile of the area where it was possible to measure beaked redfish (*Sebastes mentella*), undisturbed by echoes from other smaller fishes and plankton (acoustic layer). This is generally possible above the deep scattering layer (DSL). Within and deeper than the DSL (around 350-1000 m), redfish abundance was investigated by standardized trawl hauls (Gloria type 1024 pelagic trawl). The Trawl hauls were carried out also within the acoustic layer to get information about the length structure of the stock and to compare the catch rates with the acoustic values. Therefore, it was possible to obtain absolute fish density values from the trawl results. Three types of trawl hauls were conducted:

- Depth shallower than the DSL, trawl duration 65 min (T1; approx. 4 nautical miles)
- Depth within the DSL, but shallower than 500 m, trawl duration 65 min (T2; approx. 4 nautical miles (two horizons))
- and below 500 m, trawl duration 115 min (T3; approx. 7 nautical miles (three horizons))

The Gloria type 1024 pelagic net was fitted with a multiple codend sampling device: the 'multisampler', allowing successive sampling at three distinct depth zones within one trawl haul and without 'contamination' from one depth to the next and no sampling during shooting or hauling of the trawl. The hauls were evenly distributed along the transects (hydroacoustic measurements) across the area in a compromise between available working time and distances to sail. Individual fish data, such as fish length, weight, sex, maturity, stomach fullness, parasitic infestation and pigments on the skin and in the muscle tissue, were recorded. For the determination of age structure, fish otoliths (ear stones) were collected. For subsequent genetic analyses of the stock structure, tissue samples of the gill filaments were taken.

1.2. Acoustic registration

The recordings were made with a 38 kHz Simrad EK60 echosounder with Simrad EK80 software. A hull-mounted transducer was used, the vessel speed was 10 knots, and a depth range from 0-350 m was covered. The echo integration, the allocation of the area backscattering strength (sA) to redfish was carried out with the EchoView software.

1.3. Oceanography

CTD (Conductivity, Temperature, Depth) stations were conducted before or after each trawl station with a Seabird 911 CTD-probe. Additionally, CTD stations were carried out at the corners of the transects. The mean distance between the stations was about 60 nmi. All CTD stations reached a depth of 1000 m.

1.4. Environmental DNA (eDNA)

On selected stations, water samples were obtained at various depths from which the environmental DNA (eDNA) was extracted. A comparison with the fishing hauls carried out in parallel will be used to determine whether a correlation can be established between the abundance of redfish and the measured eDNA.

2. Narrative

FRV "Walther Herwig III" left Bremerhaven at 2:00 p.m. on Thursday, 06 June 2024, heading towards the calibration position in Scotland (Loch Eriboll). Loch Eriboll was reached in the

evening of 08 June and the calibration of the hydroacoustic system was conducted in the morning of 09 June. The vessel left the area and sailed westwards to the survey area, reaching the start position of the first transect in the evening of 13 June. The measurements started with a CTD station in the night of 14 June. Due to winch problems, Trawl fishing was not possible, so on the first transect only CTDs were carried out in addition to the hydroacoustic measurements (Figure 1). After the first transect, the remaining survey tracks were sampled as planned. However, due to heavy weather, the vessel had to leave the area on the second last survey track on 27 June, heading towards Bremerhaven. FRV "Walther Herwig III" was back in the port of Bremerhaven on Thursday 04 July 2024 at noon.

3. Preliminary results

3.1. Calibration

The hull-mounted Simrad EK60 split-beam echosounder (with EK80 software and frequencies 18, 38, 70, 200 kHz) was calibrated in Loch Eriboll, Scotland, on 09 June 2024.

3.2. Acoustic measurements

The hydroacoustic data was recorded through the entire time in the survey area. Earlier investigations have shown that the acoustic values obtained from oceanic redfish exhibit a clear diurnal variation, due to a different degree of mixing with smaller scatter. In order to compensate for these effects to some degree, the acoustic data obtained during periods of the most pronounced mixing, i.e., during the darkest hours of the night, were discarded and to estimate the values within the missing sections by interpolation.

In further data processing, the number of fish was calculated for statistical rectangles, the size of which was 2 degrees in latitude and 4 degrees in longitude. A length-based target strength (TS) model was used for all length groups for the estimation of the number of pelagic redfish in the survey area: $TS = 20 \times \lg(L) - 71.3$ dB.

The total number of fish within e.g., a subarea (Figure 1) was then obtained by summation of the individual rectangles. The acoustic results were further divided into the number of individuals and biomass based on the biological samples representative for that subarea.

For the entire survey area, single-fish echoes from redfish were expected to be detectable down to 350 m. In order to include all echoes of interest, a low integration threshold was chosen. The integration threshold was set at -80 dB/m³ for echo integration.

3.3. Fish sampling

During the survey, 27 trawl hauls were carried out with the Gloria type 1024 pelagic net (the geographical distribution of the hauls is shown in Fig. 1). The maximum amount of beaked redfish caught by FRV "Walther Herwig III" in the survey area was 14.2 kg/nmi (mean: 1.6 kg/nmi). The total catch of the survey consisted of 305 individual redfish with a total weight of 184 kg. The largest concentrations were found between a longitude of 38° and 44°W and latitude of 56° and 58°N (Figure 2). The mean total length of redfish caught below 500 m (deep pelagic stock; "> 500 m" in Figure 3), was 37.0 ± 2.4 cm with a mean weight of 633 ± 135 g, whereas the mean total length of redfish caught above 500 m (shallow pelagic stock; "< 500 m" in Figure 3) was 36.1 ± 2.0 cm and a mean weight of 601 ± 90 g.

Individual fish data of 305 redfish, such as fish total length, weight, sex, maturity, stomach fullness, parasitic infestation and pigments on the skin and in the muscle tissue, were recorded. For the determination of age structure, otoliths (ear stones) of 275 fishes were collected. For genetic analyses tissue samples from gill filaments of 141 (46% of all redfish caught) redfish were taken and stored in Ethanol.

3.4. Oceanography

36 CTD (Conductivity, Temperature, Depth) stations were performed with the Seabird 911 CTD-probe. The stations were evenly distributed and the mean distance between the stations

was about 60 nmi. Additionally, CTD stations were carried out at the corners of the transects. All CTD stations reached a depth of 1000 m. Water temperatures in 200-1000 m depth varied between 3.3 and 7.9 °C (Figure 4).

3.5. eDNA sampling

Water samples were taken at different depths (200 – 700 m) on 9 stations. The water was filtered through special filters (45 µm pore size) and frozen at 80°C for later analyses in the laboratory.

4. Participants

Name	Function	Institution
1. Matthias Bernreuther	Scientist in charge	TI-SF
2. Lea Hartkens	Hydroacoustics (Hy)	TI-SF
3. Felix Bügler	Fisheries biology (Fi)	TI-SF
4. Julia Feldhinkel	Hy	TI-SF
5. Anton Höper	Fi/Hy	TI-SF
6. Nina Müller	Fi/Hy	TI-SF
7. Tim Taege	Fi/Hy	TI-SF
8. Michael Welling	Hy	TI-SF
9. Jan Zimmermann	Fi/Hy	TI-SF
10. Abigail Deac	Hy	TI-SF

5. Acknowledgement

Many thanks to Captain Werner Stumpp and FRV "Walther Herwig III" crew members for their excellent support and hospitality and to all participants for their reliable and responsible teamwork.



Dr. Matthias Bernreuther, Chief scientist

6. Figures

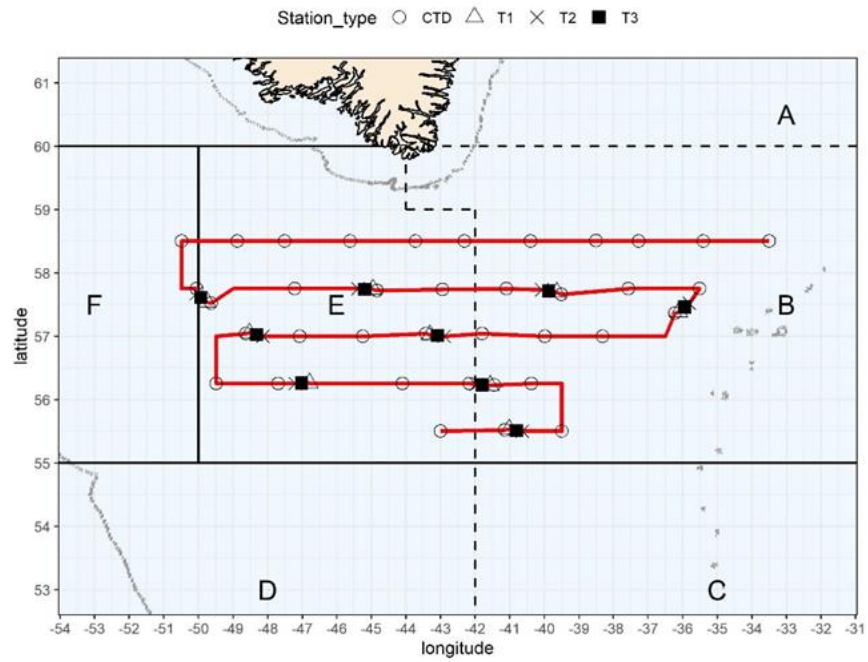


Figure 1. Cruise tracks and stations conducted by FRV Walther Herwig III during the International Deep Pelagic Ecosystem Survey (IDEEPS) on redfish in June/July 2024.

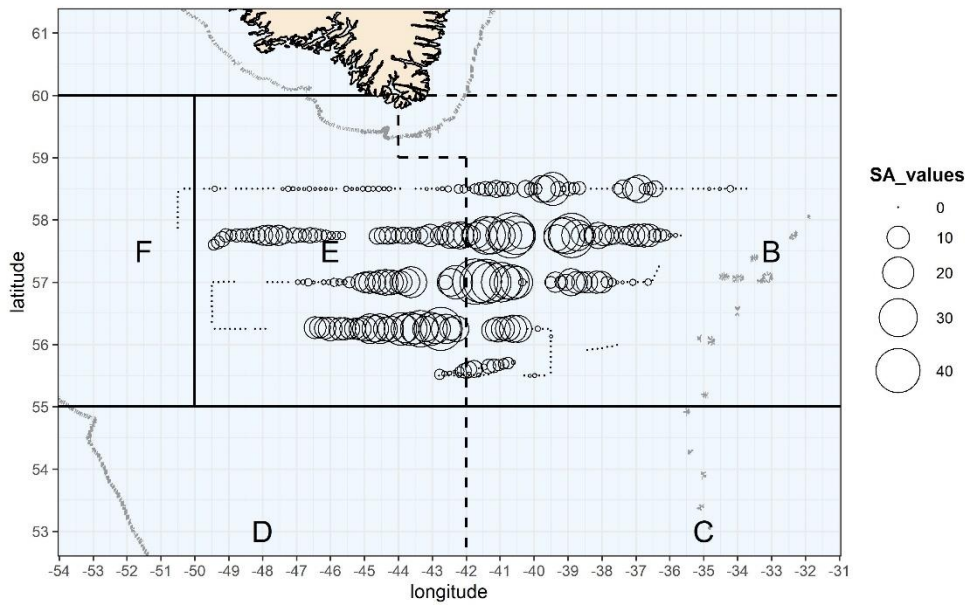


Figure 2. Redfish acoustic estimates shallower than the deep scattering layer (DSL). Average SA values by 5 NM of sailed distance by FRV Walther Herwig III during IDEEPS in June/July 2024.

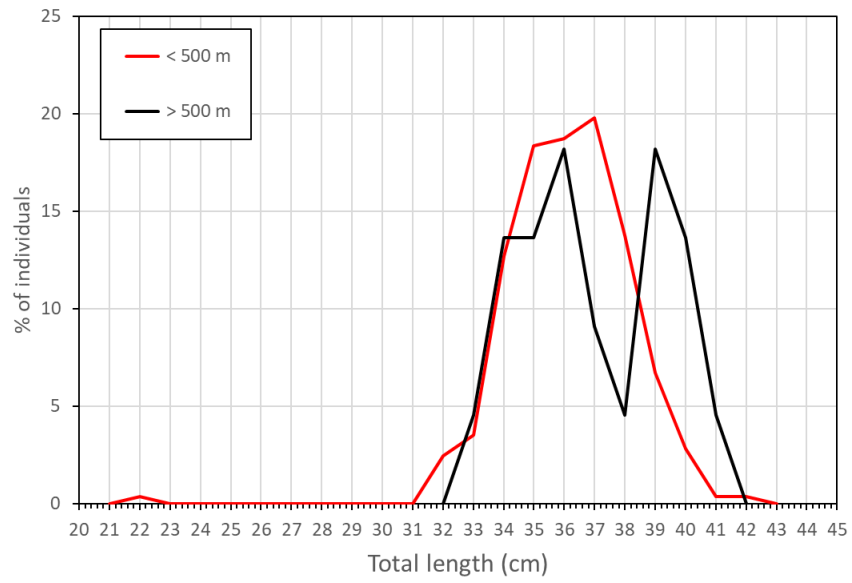


Figure 3. Length distribution of beaked redfish *Sebastes mentella* in the trawls of FRV Walther Herwig III (in % of individuals) shallower than 500 m (< 500 m) and deeper than 500 m (> 500 m) during IDEEPS in June/July 2024.

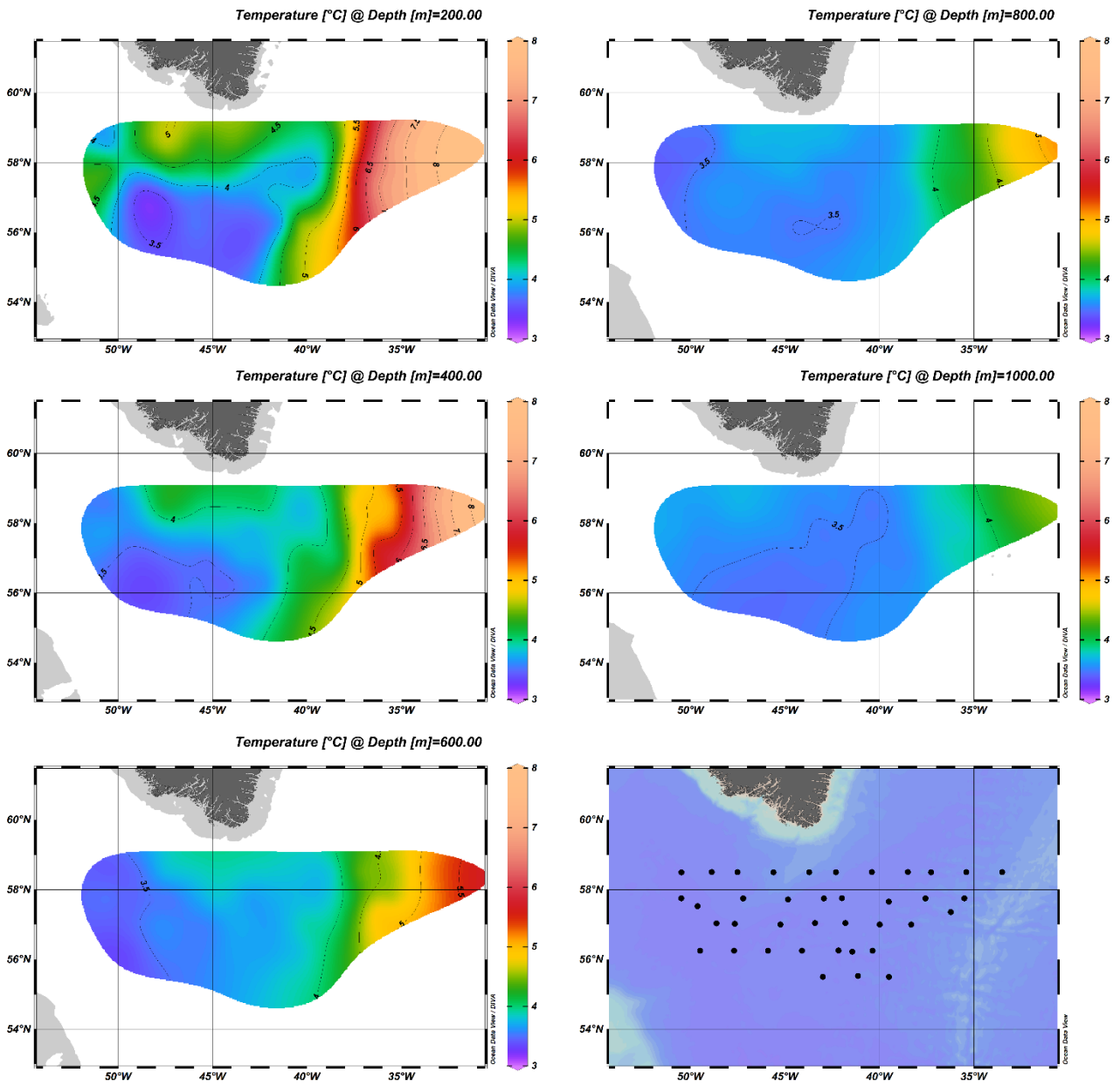


Figure 4. Temperature distribution (°C) at different depths in the German part of the survey area covered by FRV Walther Herwig III during IDEEPS in June/July 2024 (plotted with ODV, Schlitzer, Reiner, Ocean Data View, <https://odv.awi.de>, 2023).