



**Cruise Report**  
**FRV „Solea“ Cruise 777**  
**22.05. - 04.06.2020**

**Study on changes in benthic and demersal fish communities**  
**after exclusion of mobile bottom-contacting fishing gear**  
**in marine protected areas of the German Baltic Sea**

**&**

**Long-term survey on demersal fish communities in the German Baltic Sea**

Cruise leader: Dr. Daniel Oesterwind & Michael Kriegl (Thünen-OF)

## 1. Background

a) The pilot mission "Protected Areas Baltic Sea: Effects of the exclusion of mobile bottom contacting fisheries in marine protected areas" funded by the German Marine Research Alliance (DAM) aims to assess changes in the benthic and demersal fish fauna in two contrasting Natura 2000 sites after the exclusion of mobile bottom-contacting fishing gear. This cruise served the purpose of assessing the current status (i.e. before the planned exclusion is implemented) of local fish communities in the marine protected areas Fehmarnbelt and Odra Bank.

Objectives:

- Assessing the fish fauna in the two study sites Fehmarnbelt and Odra Bank using beam trawls
- Collecting specimens for further analysis in the laboratory
- Conducting oceanographic measurements at the study sites (temperature, salinity and oxygen) to interlink fish occurrence with abiotic conditions
- Collecting video material of benthic habitats

b) Since 2003, the Thünen Institute of Baltic Sea Fisheries (OF) has been conducting surveys to assess long-term changes in the distribution and composition of the demersal fish fauna in fixed ecologically characteristic reference areas of the German Baltic Sea EEZ. These surveys are vitally important for e.g. marine spatial planning, the implementation of nature conservation measures and the sustainable management of fish stocks in this area. This cruise aimed at continuing these long-term investigations.

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### Distribution list:

Ship management FFS „SOLEA“  
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-Institute - Institute of Fisheries Ecology  
Thünen-Institute - Institute of Sea Fisheries  
Thünen-Institute - Institute of Baltic Sea Fisheries  
Thünen-Institute - Press office, Dr. Welling  
Thünen-Institute - Presidential office  
Thünen-Institute - Scheduling research vessels, Dr. Rohlf  
Participants

Objectives:

- Assessing the demersal fish fauna in the ecologically distinct regions Kiel Bight, Odra Bank and Arkona Basin using bottom trawls
- Conducting oceanographic measurements (temperature, salinity and oxygen) to interlink fish occurrence with abiotic conditions

## 2. Cruise track

The cruise started on Friday, May 22<sup>nd</sup> 2020 in Rostock Marienehe and was separated into two legs:

During the first leg, fishing was conducted in Kiel Bight: From May 23<sup>rd</sup> until May 27<sup>th</sup>, a total of 10 hauls using the TV3-520 bottom trawl were performed throughout the bight (cf. Fig. 1), with each haul being preceded by a CTD cast. Furthermore, 4 hauls using the 2m beam trawl and 4 hauls using the 3m beam trawl were performed on May 23<sup>rd</sup>, within the marine protected area Fehmarnbelt (Natura 2000 site), in an area that is planned to be closed for mobile bottom-contacting fishing ("exclusion site") in the future. On May 26<sup>th</sup>, 4 hauls using the 3m beam trawl as well as 2 hauls using the 2m beam trawl were performed within a corresponding reference site outside the Natura 2000 site (Fig. 1D). Due to a net rupture, two further hauls using the 2m beam trawl within the reference site could not be realized. Within each site, 4 CTD casts were performed on the day of sampling (cf. Table 1).

While steaming towards Warnemünde on May 27<sup>th</sup>, another haul using the 3m beam trawl, preceded by a CTD cast, was performed on request of researchers from the University of Rostock in order to retrieve live *Arctica islandica* samples. After the successful completion of the first leg, cruise leader Dr. Daniel Oesterwind stepped off in Warnemünde and Michael Kriegl took over as the cruise leader for the second leg.

During the second leg, fishing was conducted in two areas to the east of the island Rügen, namely Arkona Basin as well as Odra Bank: On May 28<sup>th</sup>, 6 hauls using the 3m beam trawl and 7 hauls using the 2m beam trawl were performed within the planned future exclusion site at Odra Bank (cf. Table 1). On May 29<sup>th</sup>, 6 hauls using the 3m beam trawl and 6 hauls using the 2m beam trawl were conducted in the corresponding reference site (Fig. 1E). At each site, 4 CTD casts were performed. Additionally, 10 hauls using the 2m beam trawl and 3 hauls with the 3m beam trawl were performed within the wider area of the Odra Bank.

On May 30<sup>th</sup>, June 2<sup>nd</sup> and June 3<sup>rd</sup>, a total of 9 TV3-520 bottom trawls were conducted within the Odra Bank region, each preceded by a CTD cast. From May 31<sup>st</sup> to June 1<sup>st</sup>, FRV Solea operated within the Arkona Basin, where a total of 8 hauls using the TV3-520 bottom trawls were performed (cf. Fig. 1), each preceded by a CTD cast.

At specific locations within the Fehmarnbelt as well as the Odra Bank region, water samples were collected and prepared for subsequent isotope analysis in the laboratory. In addition, Van Veen grabs were used within the Odra Bank and Fehmarn region in order to retrieve characteristic samples of benthic organisms for isotope analysis. In order to collect visual material of the studied benthic habitats, a camera sledge equipped with a GoPro and lighting system was towed at Fehmarnbelt and Odra Bank, both within the future exclusion sites as well as the adjacent reference sites, for a cumulative duration of at least 30 minutes at each site.

In total, 27 hauls using the TV3-520 bottom trawl, 29 hauls using the 2m-beam trawl and 24 hauls using the 3m-beam trawl were performed as well as 50 CTD profiles recorded (cf. Tab. 4 for exact locations, date and time of gear deployment). Weather conditions were good throughout the whole cruise, which allowed fishing and related activities to be performed as planned.

The fish caught with the TV3-520 bottom trawl were identified to species level, weighed and processed according to BITS standard. The fish caught with the beam trawl were identified to the lowest possible taxonomic level, counted, weighed (in bulk for each species) and frozen for subsequent analysis in the laboratory.

The cruise ended on Thursday, June 4<sup>th</sup> in Rostock Marienehe.

Table 1 Overview of the number of realized beam trawl hauls and CTD casts within the Natura 2000 sites Fehmarnbelt and Odra Bank, separated for management regimes (“Exclusion” = study site planned to be closed for mobile bottom-contacting fishing gear, “Reference” = nearby reference area of the same habitat type).

| Gear          | Fehmarnbelt |           | Odra Bank |           |
|---------------|-------------|-----------|-----------|-----------|
|               | Exclusion   | Reference | Exclusion | Reference |
| 3m beam trawl | 4           | 4         | 6         | 6         |
| 2m beam trawl | 4           | 2         | 7         | 6         |
| CTD casts     | 4           | 4         | 4         | 4         |

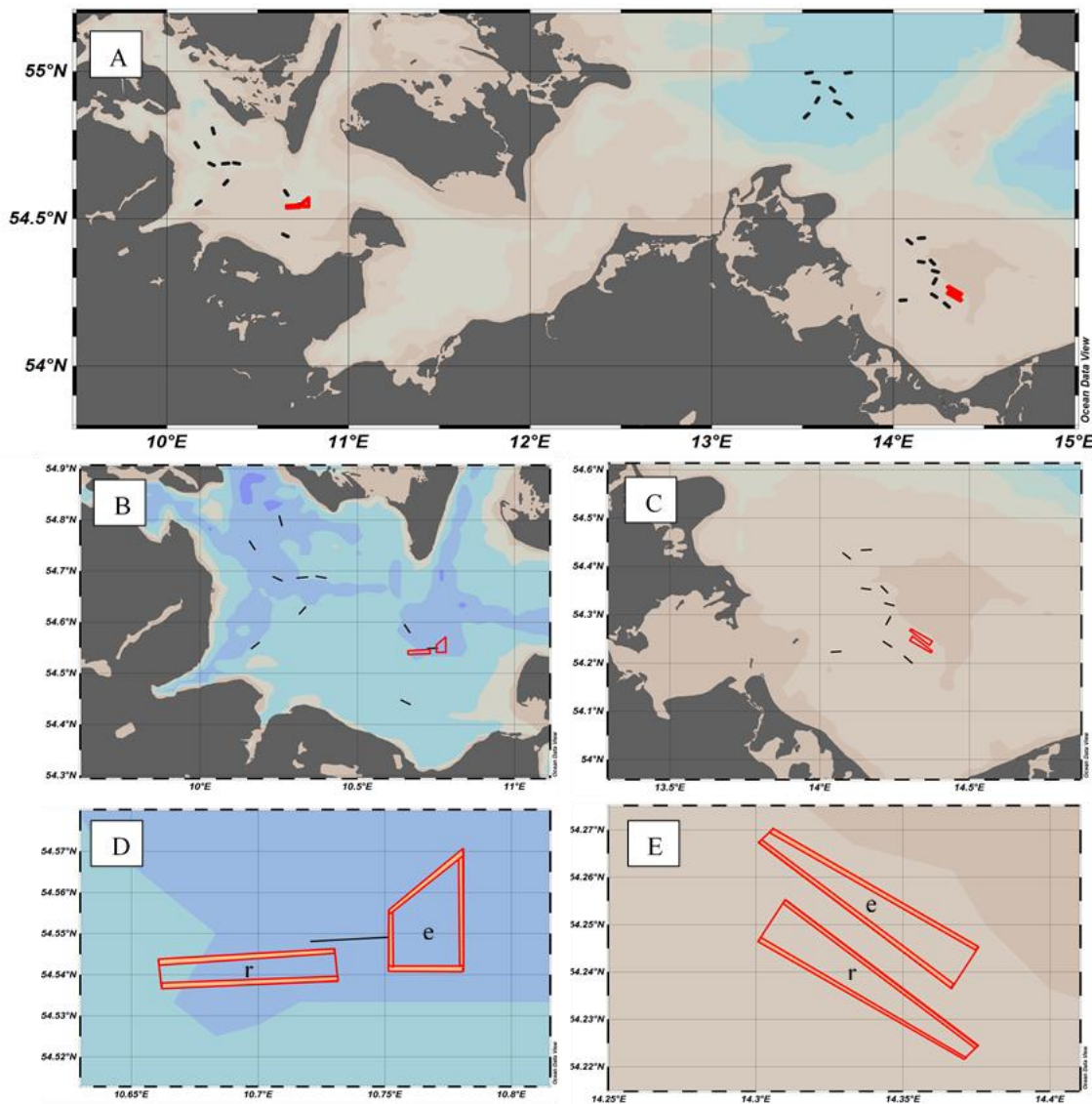


Figure 1 Maps illustrating the fishing stations realized during cruise SB777. An overview map of the German Baltic Sea (A) as well as a close-up of Kiel bight (B) and Odra Bank (C) are shown, with realized TV3-520 bottom trawl hauls indicated by black lines. Studied exclusion sites (“e”) and corresponding reference sites (“r”) are indicated by red polygons. Close-up views on these sites in the areas Fehmarnbelt (D) and Odra Bank (E) show areas sampled with the beam trawls highlighted in orange.

### **3. Preliminary results**

#### **a) Study on changes in benthic and demersal fish communities after exclusion of mobile bottom-contacting fishing gear in marine protected areas of the Baltic Sea**

During the study on benthic and demersal fish communities occurring within the marine protected areas of the German Baltic Sea, a total of 1604 individuals, belonging to 19 species and weighing a total of 42.1 kg were caught with the two different beam trawls.

The fish composition in Fehmarnbelt consisted mainly of dab (*Limanda limanda*), plaice (*Pleuronectes platessa*), and Gobiidae, while the fish composition of Odra Bank was mainly made up of Gobiidae, flounder (*Platichthys flesus*) and plaice (*Pleuronectes platessa*). For the dominant fish species of the two areas, the mean and standard deviation of A) fish abundances per hectare and B) biomass (in kg) per hectare are presented in Figure 2 for Fehmarnbelt and Figure 3 for Odra Bank. For each area, the absolute abundances and biomass per species per management are presented in Table 2.

With a total of 17 species, the Fehmarnbelt region exhibits a higher species richness compared to the Odra Bank region, where only 5 species were found.

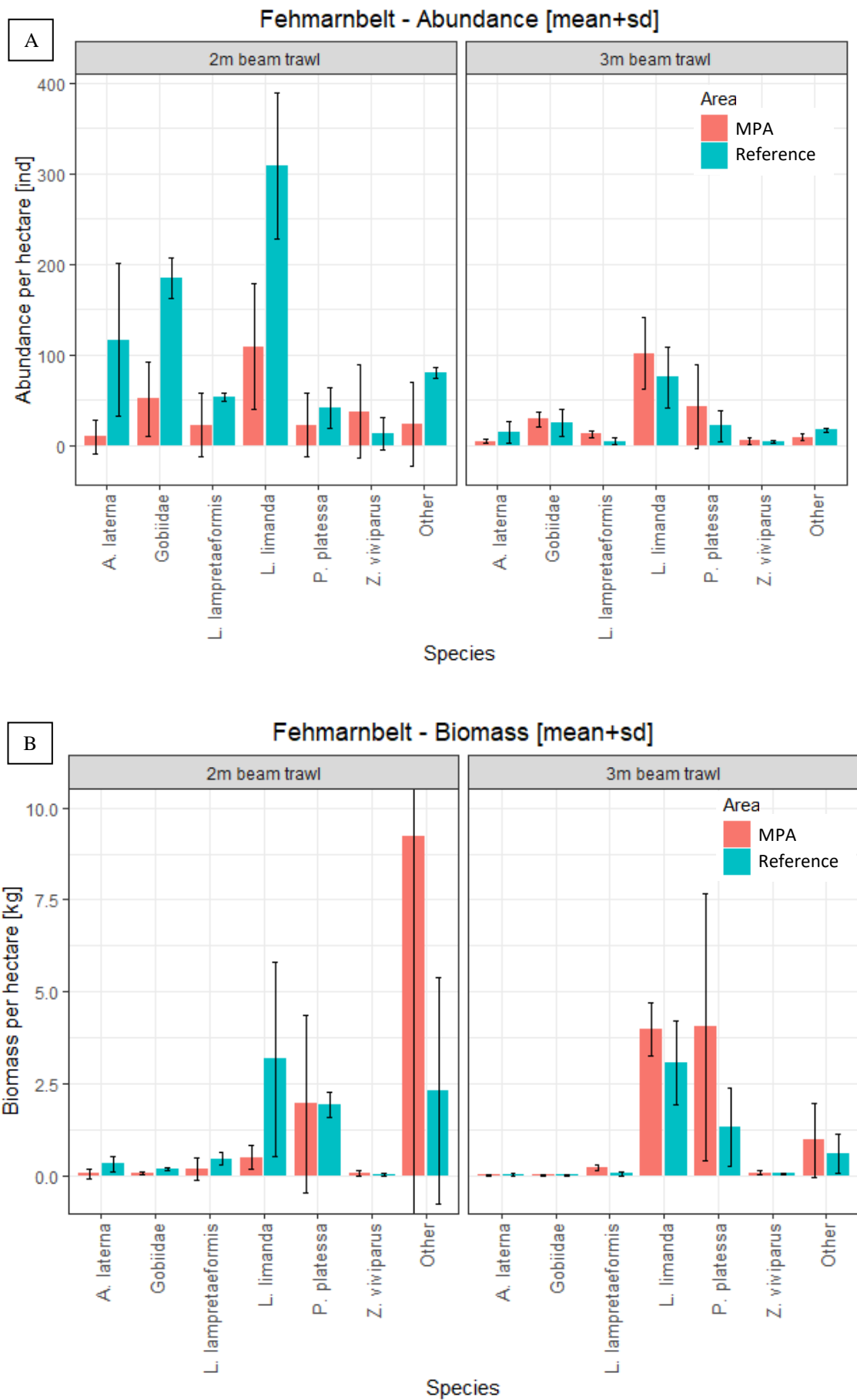


Figure 2 Mean and standard deviation of fish abundances per hectare (A) and biomass per hectare (B) for the dominant fish species of the area Fehmarnbelt, separated for employed fishing gear and management regime (MPA (red) = future exclusion site, Reference (blue) = corresponding reference site)

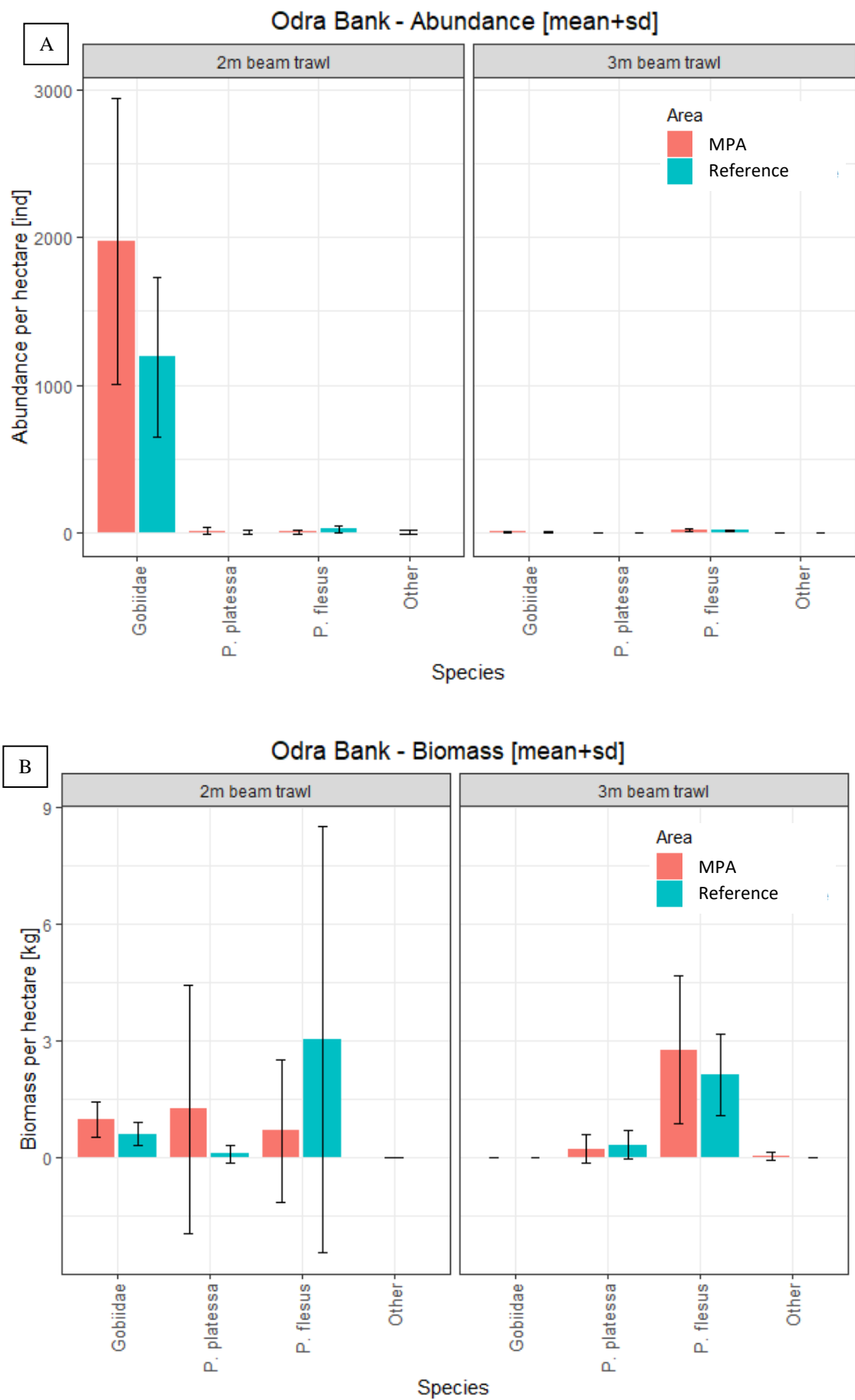


Figure 3 Mean and standard deviation of fish abundances per hectare (A) and biomass per hectare (B) for the dominant fish species of the area Odra Bank, separated for employed fishing gear and management regime (MPA (red) = future exclusion site, Reference (blue) = corresponding reference site)

Table 2 Fish species caught during the cruise SB777 in the areas Fehmarnbelt and Odra Bank using 2m and 3m beam trawls. Absolute abundances (total number of individuals caught) and absolute biomass (total weight of individuals caught) are indicated per fish species, separated for management regime (Exclusion = study site planned to be closed for mobile bottom-contacting fishing gear, Reference = nearby reference area of the same habitat type).

| Species                         | Fehmarnbelt     |              |  |                 |             |  | Odra Bank       |             |  |                 |             |  | Sum             |              |
|---------------------------------|-----------------|--------------|--|-----------------|-------------|--|-----------------|-------------|--|-----------------|-------------|--|-----------------|--------------|
|                                 | Exclusion       |              |  | Reference       |             |  | Exclusion       |             |  | Reference       |             |  | Abundance [ind] | Biomass [g]  |
|                                 | Abundance [ind] | Biomass [g]  |  | Abundance [ind] | Biomass [g] |  | Abundance [ind] | Biomass [g] |  | Abundance [ind] | Biomass [g] |  |                 |              |
| <i>Zoarces viviparus</i>        | 12              | 155          |  | 7               | 98          |  | 0               | 0           |  | 0               | 0           |  | 19              | 253          |
| <i>Pholis gunnellus</i>         | 0               | 0            |  | 2               | 9           |  | 0               | 0           |  | 0               | 0           |  | 2               | 9            |
| <i>Gadus morhua</i>             | 0               | 0            |  | 13              | 17          |  | 0               | 0           |  | 0               | 0           |  | 13              | 17           |
| <i>Platichthys flesus</i>       | 2               | 822          |  | 0               | 0           |  | 45              | 7423        |  | 50              | 6065        |  | 97              | 14310        |
| Gobiidae undet.                 | 53              | 61           |  | 55              | 58          |  | 547             | 272         |  | 251             | 129         |  | 906             | 520          |
| <i>Limanda limanda</i>          | 182             | 6753         |  | 149             | 5406        |  | 0               | 0           |  | 0               | 0           |  | 331             | 12159        |
| <i>Ctenolabrus rupestris</i>    | 2               | 8            |  | 4               | 25          |  | 0               | 0           |  | 0               | 0           |  | 6               | 33           |
| <i>Arnoglossus laterna</i>      | 8               | 51           |  | 33              | 91          |  | 0               | 0           |  | 0               | 0           |  | 41              | 142          |
| <i>Pleuronectes platessa</i>    | 74              | 7093         |  | 39              | 2398        |  | 6               | 872         |  | 6               | 879         |  | 125             | 11242        |
| <i>Taurulus bubalis</i>         | 1               | 96           |  | 0               | 0           |  | 0               | 0           |  | 0               | 0           |  | 1               | 96           |
| Syngnathidae undet.             | 0               | 0            |  | 0               | 0           |  | 0               | 0           |  | 1               | 1           |  | 1               | 1            |
| <i>Myoxocephalus scorpius</i>   | 0               | 0            |  | 0               | 0           |  | 1               | 109         |  | 0               | 0           |  | 1               | 109          |
| <i>Solea solea</i>              | 2               | 1204         |  | 6               | 772         |  | 0               | 0           |  | 0               | 0           |  | 8               | 1976         |
| <i>Lumpenus lampretaeformis</i> | 23              | 401          |  | 11              | 130         |  | 0               | 0           |  | 0               | 0           |  | 34              | 531          |
| <i>Sprattus sprattus</i>        | 0               | 0            |  | 1               | 13          |  | 0               | 0           |  | 0               | 0           |  | 1               | 13           |
| <i>Agonus cataphractus</i>      | 1               | 18           |  | 3               | 27          |  | 0               | 0           |  | 0               | 0           |  | 4               | 45           |
| <i>Enchelyopus cimbrius</i>     | 1               | 8            |  | 1               | 2           |  | 0               | 0           |  | 0               | 0           |  | 2               | 10           |
| <i>Merlangius merlangus</i>     | 7               | 300          |  | 4               | 349         |  | 0               | 0           |  | 0               | 0           |  | 11              | 649          |
| <i>Trisopterus minutus</i>      | 1               | 10           |  | 0               | 0           |  | 0               | 0           |  | 0               | 0           |  | 1               | 10           |
| <b>Sum</b>                      | <b>369</b>      | <b>16980</b> |  | <b>328</b>      | <b>9393</b> |  | <b>599</b>      | <b>8676</b> |  | <b>308</b>      | <b>7074</b> |  | <b>1604</b>     | <b>42123</b> |

## Long-term survey on demersal fish communities in the German Baltic Sea

During this year's survey on demersal fish communities in the German Baltic Sea, 53 586 individuals belonging to 27 species and weighing a total of 4 140.5 kg (~4.1 tons) were caught with the TV3-520 bottom trawl. The fish composition consisted mainly of the flatfishes: *L. limanda*, *P. flesus* and *P. platessa*, the Gadoids: *G. morhua* and *M. merlangus*, and the clupeids: *S. sprattus* and *C. harengus*. Overall, dab (*L. limanda*) was the most abundant demersal species in the catch (Tab. 3). For the following assessment of the demersal fish fauna, the pelagic species herring and sprat were not considered.

Largest biomasses in the catch, relative to towed distance, occurred in the Arkona Basin (114.1 kg/nm), followed by the Kiel bight (109.8 kg/nm) and Odra Bank (41.6 kg/nm). The weight and number per towed distance of the main fish species caught are presented in table 3.

In 2020, cod biomass in the Arkona Basin amounted to 72.75 kg/nm. Compared to previous years, this value falls within the lower range of assessed cod biomass in this area (2018: 64.36 kg/nm; 2016: 225.9 kg/nm; 2015: 154.6 kg/nm; 2014: 127.9 kg/nm; 2013: 101.5 kg/nm; 2012: 76 kg/nm). Cod constituted 63.7% of catches in the Arkona Basin.

During this year's survey, 97.8% of the cod catches (according to biomass) occurred in SD24 (Arkona Basin and Odra Bank).

Preliminary results show highest fish abundances in the Kiel Bight (1137 individuals/nm), followed by Arkona Basin (503 individuals/nm) and Odra Bank (235 individuals/nm). The high fish abundances in Kiel bight are mainly driven by large quantities of dab (897 individuals/nm) and - to a lesser extent - plaice (130 ind/nm) in the catch. The catch in Arkona bay is dominated by cod (240 ind/nm), followed by whiting (90 ind/nm) and flounder (86 ind/nm), while flounder (176 ind/nm) is dominating the catch in Odra bank.

Overall, dab constituted the largest biomass of demersal fish species (35.1%), followed by cod (26.9%), flounder (19.1%) and plaice (13.1%), while whiting contributed 4.8% of the total biomass. The residual 20 species accounted for the remaining 1% of the total biomass. The highest number of species was found at Kiel Bight (22 fish species), followed by Odra Bank (11 fish species) and Arkona Basin (8 species).

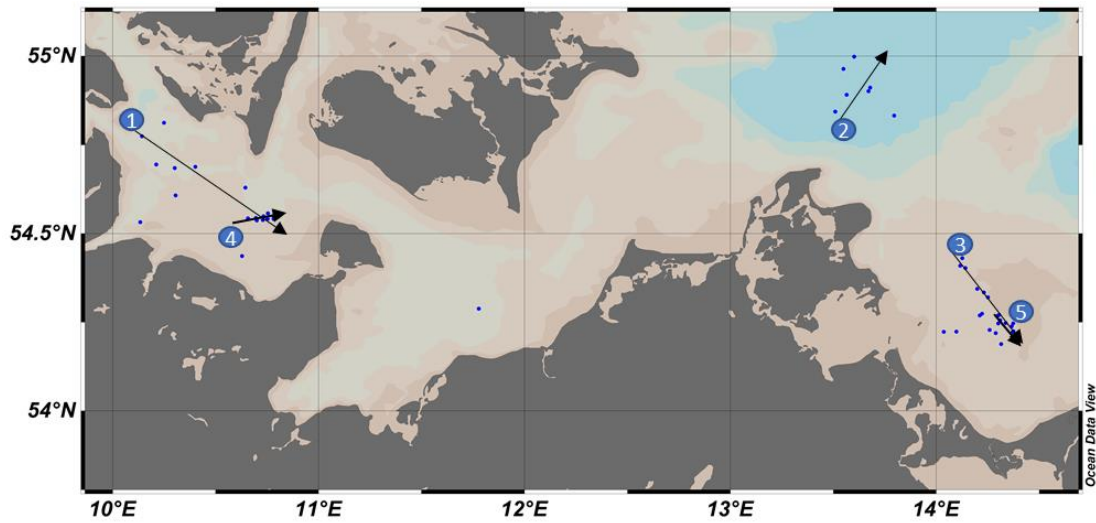
For the purpose of age determination, a total of 300 otoliths in SD 22 and 570 otoliths in SD 24 were sampled from cod (*Gadus morhua*), dab (*Limanda limanda*), flounder (*Platichthys flesus*), plaice (*Pleuronectes platessa*), turbot (*Scophthalmus maximus*) and brill (*Scophthalmus rhombus*).



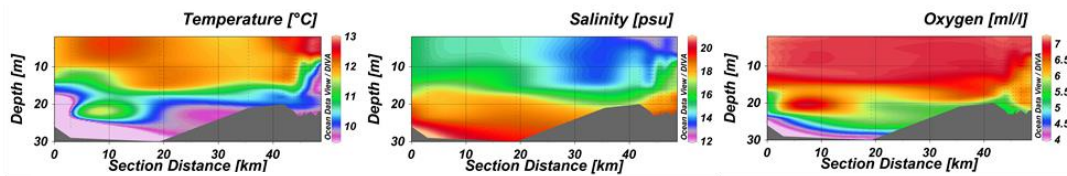
Table 3 Main fish species caught during the long-term survey on demersal fish communities in the German Baltic Sea during this year's cruise SB777 in the areas Kiel Bight, Arkona Basin and Odra Bank using a TV3-520 bottom trawl.

| Species                      | Kiel Bight                          |       |              |        | Arkona Basin                       |       |             |       | Odra Bank                          |       |             |       | Sum           |              |
|------------------------------|-------------------------------------|-------|--------------|--------|------------------------------------|-------|-------------|-------|------------------------------------|-------|-------------|-------|---------------|--------------|
|                              | 10 hauls   towed distance: 15.45 nm |       | Abundance    |        | 8 hauls   towed distance: 12.75 nm |       | Abundance   |       | 8 hauls   towed distance: 12.70 nm |       | Abundance   |       | Biomass       | Abundance    |
|                              | kg                                  | kg/nm | n            | n/nm   | kg                                 | kg/nm | n           | n/nm  | kg                                 | kg/nm | n           | n/nm  | kg            | n            |
| <i>Gadus morhua</i>          | 20,8                                | 1,3   | 165          | 10,7   | 927,5                              | 72,7  | 3056        | 239,7 | 39,4                               | 3,1   | 64          | 5,0   | 987,8         | 3285         |
| <i>Merlangius merlangus</i>  | 28,9                                | 1,9   | 706          | 45,7   | 148,5                              | 11,6  | 1153        | 90,4  | 0,1                                | 0,0   | 1           | 0,1   | 177,5         | 1860         |
| <i>Limanda limanda</i>       | 1265,4                              | 81,9  | 13864        | 897,3  | 26,1                               | 2,1   | 211         | 16,5  | 0,3                                | 0,0   | 15          | 1,2   | 1291,8        | 14090        |
| <i>Platichthys flesus</i>    | 114,4                               | 7,4   | 342          | 22,1   | 204,4                              | 16,0  | 1100        | 86,3  | 384,6                              | 30,3  | 2230        | 175,6 | 703,4         | 3672         |
| <i>Pleuronectes platessa</i> | 239,9                               | 15,5  | 2012         | 130,2  | 148,4                              | 11,6  | 885         | 69,4  | 92,2                               | 7,3   | 540         | 42,5  | 480,5         | 3437         |
| <i>Sprattus sprattus</i>     | 368,7                               | 23,9  | 22471        | 1454,4 | 2,5                                | 0,2   | 200         | 15,7  | 40,5                               | 3,2   | 2605        | 205,1 | 411,8         | 25276        |
| <i>Clupea harengus</i>       | 44,0                                | 2,9   | 1219         | 78,9   | 2,5                                | 0,2   | 64          | 5,0   | 3,3                                | 0,3   | 68          | 5,4   | 49,9          | 1351         |
| Others                       | 26,3                                | 1,7   | 477          | 30,9   | 0,2                                | <0,1  | 3           | 0,2   | 11,2                               | 0,9   | 135         | 10,6  | 37,8          | 615          |
| <b>Sum</b>                   | <b>2108,6</b>                       |       | <b>41256</b> |        | <b>1460,2</b>                      |       | <b>6672</b> |       | <b>571,7</b>                       |       | <b>5658</b> |       | <b>4140,5</b> | <b>53586</b> |
| <b>Sum (excl. clupeids)</b>  | <b>1695,8</b>                       |       | <b>17566</b> |        | <b>1455,2</b>                      |       | <b>6408</b> |       | <b>527,8</b>                       |       | <b>2985</b> |       | <b>3678,8</b> | <b>26959</b> |

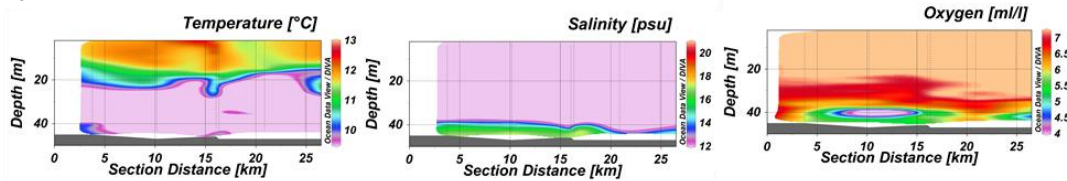
## Oceanographic Data



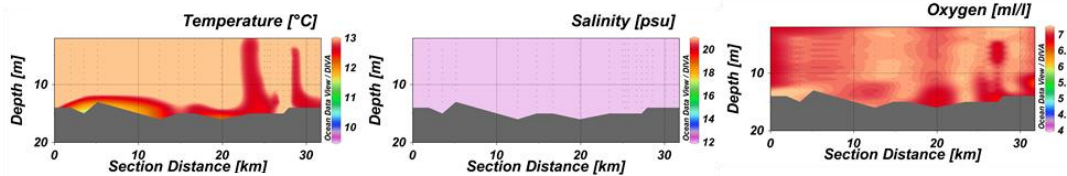
### 1) Transect - Kiel Bight



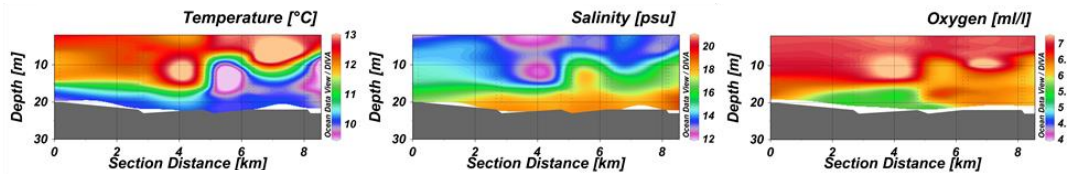
### 2) Transect - Arkona Basin



### 3) Transect - Pomeranian Bay



### 4) DAM - Fehmarnbelt



### 5) DAM - Odra Bank

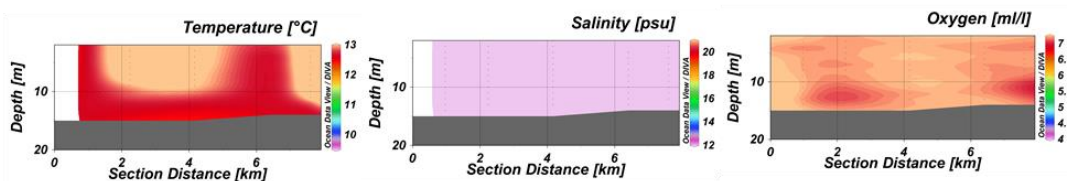


Figure 4 Overview of performed CTD casts during SB777 with gridded temperature, salinity and oxygen profiles for the different study areas.

**Kiel Bight:** CTD data illustrates an expected oceanographic situation, with salinity (13 -20 psu) increasing with depth, and temperature (10 – 13°C) as well as oxygen content decreasing with depth.

**Arkona Basin:** A well-mixed water layer with temperatures around 12°C [ $\pm 1^\circ$ ] was found in surface waters reaching up to the thermocline in 20m water depth. Water temperatures below the thermocline ranged between 9-10°C. The halocline was found to be in a depth of 40m.

**Pomeranian Bay:** The water column at Odra Bank was, in general, well-mixed with temperatures ranging around 12°C and salinity values of  $\sim 13$  psu. However, comparatively higher temperatures observed along the Odra Bank indicated a warm water current flowing along this morphological structure.

#### 4. Cruise participants

|                       |            |                       |
|-----------------------|------------|-----------------------|
| Dr. Daniel Oesterwind | scientist  | Thünen-OF             |
| Michael Kriegl        | scientist  | Thünen-OF             |
| Thomas Hogh           | technician | Thünen-OF             |
| Tom Jankiewicz        | technician | Thünen-OF             |
| Dr. Martin Paar       | scientist  | University of Rostock |

Dr. Daniel Oesterwind (TI-OF)  
(Scientist in charge, 1<sup>st</sup> leg)

Michael Kriegl, M.Sc. (TI-OF)  
(Scientist in charge, 2<sup>nd</sup> leg)

## Station list

Table 4 Overview of the performed activities during FRV Solea cruise 777, including station number, date and time (UTC) of deployment, area of deployment, device identifier (OTB = otter bottom trawl, TBB = beam trawl, CTD = oceanographic probe) as well as latitude and longitude at the time of first bottom contact for beam trawls, otter bottom trawls, video sledge and Van Veen grabs as well as at the start of gear deployment for CTD casts.

| Station     | Date & Time (UTC) | Area        | Device Code  | Latitude      | Longitude      |
|-------------|-------------------|-------------|--------------|---------------|----------------|
| SOL777_1-1  | 23.05.2020 05:40  | Kiel Bight  | CTD SBE19+   | 54° 32.914' N | 010° 43.940' E |
| SOL777_1-2  | 23.05.2020 05:56  | Kiel Bight  | OTB TV3-520  | 54° 32.848' N | 010° 44.112' E |
| SOL777_2-1  | 23.05.2020 07:30  | Fehmarnbelt | CTD SBE19+   | 54° 33.398' N | 010° 45.210' E |
| SOL777_2-2  | 23.05.2020 07:50  | Fehmarnbelt | TBB 3m       | 54° 33.531' N | 010° 45.476' E |
| SOL777_3-1  | 23.05.2020 09:00  | Fehmarnbelt | CTD SBE19+   | 54° 32.849' N | 010° 46.852' E |
| SOL777_3-2  | 23.05.2020 09:12  | Fehmarnbelt | TBB 3m       | 54° 33.062' N | 010° 46.809' E |
| SOL777_4-1  | 23.05.2020 10:14  | Fehmarnbelt | CTD SBE19+   | 54° 32.446' N | 010° 46.866' E |
| SOL777_4-2  | 23.05.2020 10:28  | Fehmarnbelt | TBB 3m       | 54° 32.458' N | 010° 46.719' E |
| SOL777_5-1  | 23.05.2020 11:27  | Fehmarnbelt | CTD SBE19+   | 54° 32.446' N | 010° 45.043' E |
| SOL777_5-2  | 23.05.2020 11:36  | Fehmarnbelt | TBB 3m       | 54° 32.579' N | 010° 45.074' E |
| SOL777_6-1  | 23.05.2020 12:50  | Fehmarnbelt | TBB 2m       | 54° 33.464' N | 010° 45.384' E |
| SOL777_7-1  | 23.05.2020 14:02  | Fehmarnbelt | TBB 2m       | 54° 33.484' N | 010° 46.815' E |
| SOL777_8-1  | 23.05.2020 14:33  | Fehmarnbelt | TBB 2m       | 54° 32.478' N | 010° 46.536' E |
| SOL777_9-1  | 23.05.2020 15:00  | Fehmarnbelt | CTD SBE19+   | 54° 32.435' N | 010° 45.159' E |
| SOL777_9-2  | 23.05.2020 15:13  | Fehmarnbelt | TBB 2m       | 54° 32.648' N | 010° 45.115' E |
| SOL777_10-1 | 24.05.2020 05:29  | Kiel Bight  | CTD SBE19+   | 54° 48.724' N | 010° 14.975' E |
| SOL777_10-2 | 24.05.2020 05:44  | Kiel Bight  | OTB TV3-520  | 54° 48.334' N | 010° 15.185' E |
| SOL777_11-1 | 24.05.2020 07:42  | Kiel Bight  | CTD SBE19+   | 54° 46.424' N | 010° 08.563' E |
| SOL777_11-2 | 24.05.2020 07:55  | Kiel Bight  | OTB TV3-520  | 54° 45.979' N | 010° 08.972' E |
| SOL777_12-1 | 24.05.2020 09:56  | Kiel Bight  | CTD SBE19+   | 54° 41.671' N | 010° 12.709' E |
| SOL777_12-2 | 24.05.2020 10:12  | Kiel Bight  | OTB TV3-520  | 54° 41.479' N | 010° 13.207' E |
| SOL777_13-1 | 24.05.2020 12:25  | Kiel Bight  | CTD SBE19+   | 54° 41.086' N | 010° 18.065' E |
| SOL777_13-2 | 24.05.2020 12:40  | Kiel Bight  | OTB TV3-520  | 54° 41.183' N | 010° 18.827' E |
| SOL777_14-1 | 25.05.2020 05:27  | Kiel Bight  | CTD SBE19+   | 54° 31.923' N | 010° 08.025' E |
| SOL777_14-2 | 25.05.2020 05:42  | Kiel Bight  | OTB TV3-520  | 54° 32.120' N | 010° 08.461' E |
| SOL777_15-1 | 25.05.2020 07:24  | Kiel Bight  | CTD SBE19+   | 54° 36.416' N | 010° 18.356' E |
| SOL777_15-2 | 25.05.2020 07:37  | Kiel Bight  | OTB TV3-520  | 54° 36.708' N | 010° 18.579' E |
| SOL777_16-1 | 25.05.2020 09:58  | Kiel Bight  | CTD SBE19+   | 54° 41.267' N | 010° 24.134' E |
| SOL777_16-2 | 25.05.2020 10:11  | Kiel Bight  | OTB TV3-520  | 54° 41.262' N | 010° 23.244' E |
| SOL777_17-1 | 25.05.2020 12:45  | Kiel Bight  | CTD SBE19+   | 54° 37.759' N | 010° 38.691' E |
| SOL777_17-2 | 25.05.2020 13:02  | Kiel Bight  | OTB TV3-520  | 54° 37.327' N | 010° 38.943' E |
| SOL777_18-1 | 25.05.2020 14:13  | Fehmarnbelt | Video sledge | 54° 32.834' N | 010° 42.951' E |
| SOL777_18-2 | 25.05.2020 14:36  | Fehmarnbelt | Video sledge | 54° 32.858' N | 010° 42.742' E |
| SOL777_18-3 | 25.05.2020 15:09  | Fehmarnbelt | Video sledge | 54° 32.485' N | 010° 45.618' E |
| SOL777_19-1 | 26.05.2020 05:28  | Fehmarnbelt | CTD SBE19+   | 54° 32.274' N | 010° 43.746' E |
| SOL777_19-2 | 26.05.2020 05:41  | Fehmarnbelt | TBB 3m       | 54° 32.320' N | 010° 43.783' E |
| SOL777_20-1 | 26.05.2020 06:22  | Fehmarnbelt | CTD SBE19+   | 54° 32.203' N | 010° 41.988' E |
| SOL777_20-2 | 26.05.2020 06:37  | Fehmarnbelt | TBB 3m       | 54° 32.260' N | 010° 41.769' E |
| SOL777_21-1 | 26.05.2020 07:15  | Fehmarnbelt | CTD SBE19+   | 54° 32.558' N | 010° 39.453' E |
| SOL777_21-2 | 26.05.2020 07:28  | Fehmarnbelt | TBB 3m       | 54° 32.623' N | 010° 39.899' E |
| SOL777_22-1 | 26.05.2020 08:27  | Fehmarnbelt | CTD SBE19+   | 54° 32.606' N | 010° 41.737' E |
| SOL777_22-2 | 26.05.2020 08:38  | Fehmarnbelt | TBB 3m       | 54° 32.704' N | 010° 41.847' E |
| SOL777_23-1 | 26.05.2020 09:12  | Fehmarnbelt | TBB 2m       | 54° 32.762' N | 010° 43.510' E |
| SOL777_24-1 | 26.05.2020 10:11  | Fehmarnbelt | TBB 2m       | 54° 32.756' N | 010° 43.438' E |
| SOL777_26-1 | 26.05.2020 10:52  | Fehmarnbelt | Video sledge | 54° 32.771' N | 010° 43.627' E |
| SOL777_27-1 | 26.05.2020 11:37  | Fehmarnbelt | Video sledge | 54° 33.061' N | 010° 45.031' E |
| SOL777_28-1 | 26.05.2020 11:54  | Fehmarnbelt | Video sledge | 54° 33.002' N | 010° 45.244' E |
| SOL777_29-1 | 26.05.2020 13:06  | Fehmarnbelt | Video sledge | 54° 33.932' N | 010° 46.240' E |

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| SOL777_31-1 | 26.05.2020 15:24 | Fehmarnbelt | Video sledge  | 54° 32.516' N | 010° 42.177' E |
| SOL777_32-1 | 27.05.2020 04:54 | Kiel Bight  | OTB TV3-520   | 54° 26.392' N | 010° 40.584' E |
| SOL777_32-2 | 27.05.2020 05:35 | Kiel Bight  | CTD SBE19+    | 54° 26.984' N | 010° 37.723' E |
| SOL777_33-1 | 27.05.2020 10:24 | Nienhagen   | CTD SBE19+    | 54° 17.276' N | 011° 46.700' E |
| SOL777_33-2 | 27.05.2020 10:39 | Nienhagen   | TBB 3m        | 54° 17.145' N | 011° 47.142' E |
| SOL777_34-1 | 28.05.2020 05:35 | Odra Bank   | CTD SBE19+    | 54° 16.066' N | 014° 18.006' E |
| SOL777_34-2 | 28.05.2020 05:47 | Odra Bank   | TBB 3m        | 54° 15.944' N | 014° 18.330' E |
| SOL777_35-1 | 28.05.2020 06:21 | Odra Bank   | CTD SBE19+    | 54° 14.254' N | 014° 21.956' E |
| SOL777_35-2 | 28.05.2020 06:31 | Odra Bank   | TBB 3m        | 54° 14.328' N | 014° 21.740' E |
| SOL777_36-1 | 28.05.2020 06:57 | Odra Bank   | TBB 3m        | 54° 14.947' N | 014° 20.474' E |
| SOL777_37-1 | 28.05.2020 07:33 | Odra Bank   | CTD SBE19+    | 54° 14.749' N | 014° 22.427' E |
| SOL777_37-2 | 28.05.2020 07:44 | Odra Bank   | TBB 3m        | 54° 14.738' N | 014° 22.394' E |
| SOL777_38-1 | 28.05.2020 08:08 | Odra Bank   | TBB 3m        | 54° 15.206' N | 014° 21.098' E |
| SOL777_39-1 | 28.05.2020 08:38 | Odra Bank   | CTD SBE19+    | 54° 16.201' N | 014° 18.271' E |
| SOL777_39-2 | 28.05.2020 08:50 | Odra Bank   | TBB 3m        | 54° 16.162' N | 014° 18.463' E |
| SOL777_40-1 | 28.05.2020 10:03 | Odra Bank   | TBB 2m        | 54° 15.995' N | 014° 18.192' E |
| SOL777_41-1 | 28.05.2020 10:14 | Odra Bank   | TBB 2m        | 54° 15.771' N | 014° 18.667' E |
| SOL777_42-1 | 28.05.2020 11:24 | Odra Bank   | TBB 2m        | 54° 15.296' N | 014° 19.853' E |
| SOL777_43-1 | 28.05.2020 11:40 | Odra Bank   | TBB 2m        | 54° 14.450' N | 014° 21.476' E |
| SOL777_44-1 | 28.05.2020 12:20 | Odra Bank   | TBB 2m        | 54° 14.766' N | 014° 22.291' E |
| SOL777_45-1 | 28.05.2020 12:36 | Odra Bank   | TBB 2m        | 54° 15.541' N | 014° 20.214' E |
| SOL777_46-1 | 28.05.2020 12:53 | Odra Bank   | TBB 2m        | 54° 16.073' N | 014° 18.681' E |
| SOL777_47-1 | 28.05.2020 13:23 | Odra Bank   | CTD SBE19+    | 54° 14.838' N | 014° 20.199' E |
| SOL777_48-1 | 28.05.2020 13:45 | Odra Bank   | Video sledge  | 54° 15.835' N | 014° 19.796' E |
| SOL777_48-2 | 28.05.2020 14:40 | Odra Bank   | Video sledge  | 54° 15.155' N | 014° 18.932' E |
| SOL777_49-1 | 29.05.2020 05:28 | Odra Bank   | CTD SBE19+    | 54° 13.322' N | 014° 22.197' E |
| SOL777_49-2 | 29.05.2020 05:42 | Odra Bank   | TBB 3m        | 54° 13.410' N | 014° 22.025' E |
| SOL777_50-1 | 29.05.2020 06:10 | Odra Bank   | TBB 3m        | 54° 13.988' N | 014° 20.364' E |
| SOL777_51-1 | 29.05.2020 06:39 | Odra Bank   | CTD SBE19+    | 54° 14.767' N | 014° 18.055' E |
| SOL777_51-2 | 29.05.2020 06:49 | Odra Bank   | TBB 3m        | 54° 14.718' N | 014° 18.344' E |
| SOL777_52-1 | 29.05.2020 07:21 | Odra Bank   | CTD SBE19+    | 54° 15.300' N | 014° 18.581' E |
| SOL777_52-2 | 29.05.2020 07:32 | Odra Bank   | TBB 3m        | 54° 15.223' N | 014° 18.780' E |
| SOL777_53-1 | 29.05.2020 07:56 | Odra Bank   | TBB 3m        | 54° 14.552' N | 014° 20.133' E |
| SOL777_54-1 | 29.05.2020 08:25 | Odra Bank   | CTD SBE19+    | 54° 13.453' N | 014° 22.491' E |
| SOL777_54-2 | 29.05.2020 08:35 | Odra Bank   | TBB 3m        | 54° 13.515' N | 014° 22.404' E |
| SOL777_55-1 | 29.05.2020 09:10 | Odra Bank   | TBB 2m        | 54° 13.330' N | 014° 22.188' E |
| SOL777_56-1 | 29.05.2020 10:04 | Odra Bank   | TBB 2m        | 54° 14.096' N | 014° 20.043' E |
| SOL777_57-1 | 29.05.2020 10:24 | Odra Bank   | TBB 2m        | 54° 14.771' N | 014° 18.162' E |
| SOL777_58-1 | 29.05.2020 10:43 | Odra Bank   | TBB 2m        | 54° 15.278' N | 014° 18.680' E |
| SOL777_59-1 | 29.05.2020 11:22 | Odra Bank   | TBB 2m        | 54° 14.390' N | 014° 20.542' E |
| SOL777_60-1 | 29.05.2020 11:42 | Odra Bank   | TBB 2m        | 54° 13.533' N | 014° 22.360' E |
| SOL777_61-1 | 29.05.2020 12:10 | Odra Bank   | Van Veen Grab | 54° 15.370' N | 014° 19.959' E |
| SOL777_65-1 | 29.05.2020 13:44 | Odra Bank   | TBB 2m        | 54° 17.841' N | 014° 21.244' E |
| SOL777_66-1 | 29.05.2020 14:17 | Odra Bank   | Video sledge  | 54° 17.903' N | 014° 21.654' E |
| SOL777_67-1 | 30.05.2020 05:27 | Odra Bank   | CTD SBE19+    | 54° 11.315' N | 014° 18.954' E |
| SOL777_67-2 | 30.05.2020 05:41 | Odra Bank   | OTB TV3-520   | 54° 11.546' N | 014° 18.544' E |
| SOL777_68-1 | 30.05.2020 06:41 | Odra Bank   | CTD SBE19+    | 54° 13.669' N | 014° 15.551' E |
| SOL777_68-2 | 30.05.2020 06:56 | Odra Bank   | OTB TV3-520   | 54° 13.940' N | 014° 14.753' E |
| SOL777_69-1 | 30.05.2020 07:59 | Odra Bank   | CTD SBE19+    | 54° 16.147' N | 014° 12.661' E |
| SOL777_69-2 | 30.05.2020 08:12 | Odra Bank   | OTB TV3-520   | 54° 16.442' N | 014° 12.876' E |
| SOL777_70-1 | 30.05.2020 09:59 | Odra Bank   | CTD SBE19+    | 54° 19.172' N | 014° 15.044' E |
| SOL777_70-2 | 30.05.2020 10:12 | Odra Bank   | OTB TV3-520   | 54° 19.222' N | 014° 14.201' E |
| SOL777_71-1 | 30.05.2020 11:30 | Odra Bank   | CTD SBE19+    | 54° 20.012' N | 014° 13.876' E |
| SOL777_71-2 | 30.05.2020 11:45 | Odra Bank   | OTB TV3-520   | 54° 20.300' N | 014° 13.781' E |

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| SOL777_72-1  | 30.05.2020 12:34 | Odra Bank    | CTD SBE19+    | 54° 20.636' N | 014° 11.925' E |
| SOL777_72-2  | 30.05.2020 12:51 | Odra Bank    | OTB TV3-520   | 54° 20.690' N | 014° 11.110' E |
| SOL777_73-1  | 30.05.2020 14:00 | Odra Bank    | CTD SBE19+    | 54° 24.527' N | 014° 06.945' E |
| SOL777_73-2  | 30.05.2020 14:13 | Odra Bank    | OTB TV3-520   | 54° 24.783' N | 014° 06.301' E |
| SOL777_74-1  | 31.05.2020 05:30 | Arkona Basin | CTD SBE19+    | 54° 50.591' N | 013° 30.563' E |
| SOL777_74-2  | 31.05.2020 05:51 | Arkona Basin | OTB TV3-520   | 54° 50.458' N | 013° 30.311' E |
| SOL777_75-1  | 31.05.2020 07:19 | Arkona Basin | CTD SBE19+    | 54° 53.436' N | 013° 33.827' E |
| SOL777_75-2  | 31.05.2020 07:38 | Arkona Basin | OTB TV3-520   | 54° 53.884' N | 013° 34.313' E |
| SOL777_76-1  | 31.05.2020 09:56 | Arkona Basin | CTD SBE19+    | 54° 54.661' N | 013° 40.738' E |
| SOL777_76-2  | 31.05.2020 10:22 | Arkona Basin | OTB TV3-520   | 54° 55.125' N | 013° 40.775' E |
| SOL777_77-1  | 31.05.2020 11:59 | Arkona Basin | CTD SBE19+    | 54° 59.512' N | 013° 43.070' E |
| SOL777_77-2  | 31.05.2020 12:19 | Arkona Basin | OTB TV3-520   | 54° 59.639' N | 013° 43.767' E |
| SOL777_78-1  | 01.06.2020 05:29 | Arkona Basin | CTD SBE19+    | 54° 49.930' N | 013° 47.748' E |
| SOL777_78-2  | 01.06.2020 05:53 | Arkona Basin | OTB TV3-520   | 54° 49.998' N | 013° 47.393' E |
| SOL777_79-1  | 01.06.2020 07:37 | Arkona Basin | CTD SBE19+    | 54° 59.908' N | 013° 36.086' E |
| SOL777_79-2  | 01.06.2020 07:56 | Arkona Basin | OTB TV3-520   | 54° 59.852' N | 013° 34.772' E |
| SOL777_80-1  | 01.06.2020 09:55 | Arkona Basin | CTD SBE19+    | 54° 57.849' N | 013° 32.938' E |
| SOL777_80-2  | 01.06.2020 10:15 | Arkona Basin | OTB TV3-520   | 54° 57.835' N | 013° 33.597' E |
| SOL777_81-1  | 01.06.2020 11:59 | Arkona Basin | CTD SBE19+    | 54° 54.077' N | 013° 40.266' E |
| SOL777_81-2  | 01.06.2020 12:18 | Arkona Basin | OTB TV3-520   | 54° 53.933' N | 013° 41.040' E |
| SOL777_83-1  | 02.06.2020 05:24 | Odra Bank    | CTD SBE19+    | 54° 24.138' N | 014° 08.501' E |
| SOL777_84-1  | 02.06.2020 06:23 | Odra Bank    | CTD SBE19+    | 54° 25.820' N | 014° 07.558' E |
| SOL777_84-2  | 02.06.2020 06:35 | Odra Bank    | OTB TV3-520   | 54° 25.994' N | 014° 08.172' E |
| SOL777_86-1  | 02.06.2020 10:04 | Odra Bank    | CTD SBE19+    | 54° 13.172' N | 014° 17.288' E |
| SOL777_86-2  | 02.06.2020 10:18 | Odra Bank    | TBB 2m        | 54° 13.136' N | 014° 17.381' E |
| SOL777_87-1  | 02.06.2020 10:33 | Odra Bank    | TBB 2m        | 54° 13.077' N | 014° 17.534' E |
| SOL777_88-1  | 02.06.2020 11:32 | Odra Bank    | TBB 2m        | 54° 13.044' N | 014° 17.369' E |
| SOL777_92-1  | 02.06.2020 13:01 | Odra Bank    | CTD SBE19+    | 54° 13.392' N | 014° 05.842' E |
| SOL777_93-1  | 02.06.2020 13:10 | Odra Bank    | Van Veen Grab | 54° 13.301' N | 014° 05.768' E |
| SOL777_94-1  | 02.06.2020 13:21 | Odra Bank    | Van Veen Grab | 54° 13.321' N | 014° 06.175' E |
| SOL777_95-1  | 02.06.2020 13:31 | Odra Bank    | Van Veen Grab | 54° 13.522' N | 014° 06.012' E |
| SOL777_96-1  | 02.06.2020 13:43 | Odra Bank    | TBB 2m        | 54° 13.417' N | 014° 05.829' E |
| SOL777_97-1  | 02.06.2020 13:55 | Odra Bank    | TBB 2m        | 54° 13.314' N | 014° 05.811' E |
| SOL777_98-1  | 02.06.2020 14:08 | Odra Bank    | TBB 2m        | 54° 13.289' N | 014° 06.227' E |
| SOL777_99-1  | 02.06.2020 14:23 | Odra Bank    | TBB 3m        | 54° 13.343' N | 014° 05.648' E |
| SOL777_100-1 | 02.06.2020 14:43 | Odra Bank    | TBB 3m        | 54° 14.136' N | 014° 06.068' E |
| SOL777_101-1 | 03.06.2020 05:31 | Odra Bank    | TBB 3m        | 54° 13.317' N | 014° 07.008' E |
| SOL777_102-1 | 03.06.2020 06:04 | Odra Bank    | CTD SBE19+    | 54° 13.374' N | 014° 02.161' E |
| SOL777_102-2 | 03.06.2020 06:17 | Odra Bank    | OTB TV3-520   | 54° 13.581' N | 014° 02.643' E |
| SOL777_103-1 | 03.06.2020 07:36 | Odra Bank    | CTD SBE19+    | 54° 16.409' N | 014° 13.336' E |
| SOL777_103-2 | 03.06.2020 07:54 | Odra Bank    | TBB 2m        | 54° 16.351' N | 014° 13.219' E |
| SOL777_104-1 | 03.06.2020 08:27 | Odra Bank    | TBB 2m        | 54° 16.233' N | 014° 13.253' E |
| SOL777_105-1 | 03.06.2020 08:39 | Odra Bank    | TBB 2m        | 54° 16.259' N | 014° 13.403' E |
| SOL777_106-1 | 03.06.2020 08:52 | Odra Bank    | Van Veen Grab | 54° 16.196' N | 014° 13.130' E |
| SOL777_107-1 | 03.06.2020 09:02 | Odra Bank    | Van Veen Grab | 54° 16.224' N | 014° 13.508' E |
| SOL777_108-1 | 03.06.2020 09:13 | Odra Bank    | Van Veen Grab | 54° 16.365' N | 014° 13.169' E |

