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**Federal Research Institute**
**Institute for Baltic Sea Fishery**

# Cruise Report

## RV Solea

## Cruise 572

## 21.4.07-02.05.2007

Jan Hesse, Cornelius Hammer

## Introduction and goals of the cruise

Cruise 572 of RV Solea took place between 21.04.07 - 02.05.07. The cruise leaders were the director of the Institute of Baltic Sea Fishery in Rostock (OSF), Cornelius Hammer and dpt. director Christopher Zimmermann. Cruise SO 572 was part of a series of coastal spring surveys conducted in coordination with other research vessels, such a the German research cutter "Clupea" and research cutter "Polarfuchs" from Kiel university with the main objective to investigate the abundance of herring larvae in the Western Baltic Sea (IIIa spring spawning stock) and in addition the occurrence of *Mnemiopsis leidyi.*
A total of 72 stations were taken in coastal and offshore areas to record the geographical distributior larvae abundance of herring, cod, flounder and other fish larvae (Fig. 1). An additional important purpose of the cruise was the instruction of undergraduate students of the University of Rostock in fishery and oceanographic techniques. By means of measurements of salinity and temperature it was attempted clarify whether the Western Baltic Sea provides an ecologically suitable habitat for *Mnemiopsis leidyi* at that given time of mid spring.
The hypothesis of the cruise was that highly saline and warmer regions of the Baltic could provide a basis for survival of *M. leidyi*, a potential predator of herring and cod eggs or larvae. This stood in the light of the question whether or not *M. leidyi* could have a significant or even devastating effect on the population of herring and cod like in the Black Sea.

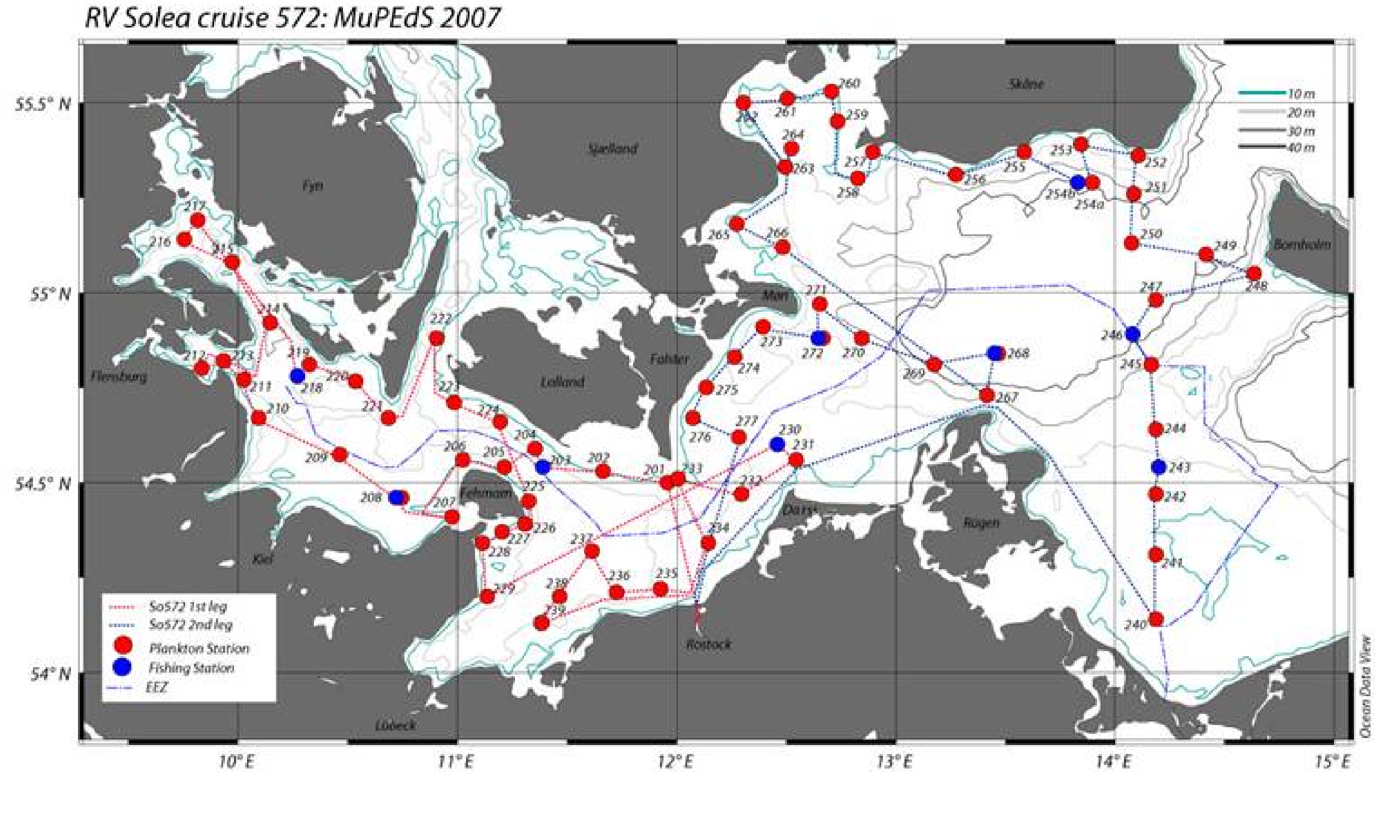


**Figure 1,** Cruise track of SO 572

The cruise started in Rostock Port (Marienehe) 21 April 2007. The cruise was divided into two parts. On the first leg the regions Mecklenburg Bight, Lübeck Bight, Kiel Bight up to the Small Belt were covered. The second part started on the 27 April at Warnemünde, where the crew of students changed. The second leg covered the Arkona Bay, Pomeranians Bight, Arkona Sea and finally the Öresund. The cruise ended 2 May 2007 in Rostock.

## Materials and Methods

For hydrographic measurements, a CTD sensor ("seabird sensor") was used. Salinity and temperatur were measured during the entire period of veering until the bottom was reached. However, no data were received from the oxygen sensor due to malfunction. Water from the bottom was taken with a water sampler and transferred into flasks for salinity calibration in the laboratory.
The program Ocean Data View (ODV) was used to interpolate the data horizontally and vertically a

illustrate the hydrographic situation during the cruise. Water depth, salinity, temperature, potential density and geostrophic velocities are presented, based on the CTD profiles. Transferring the data to ODV w made by means of the software SBE Data Processing to generate a header for each station, which allowed for the use of a spreadsheet that could be imported into ODV. The process required five ste which were taken individually for each station.

Density of water at the sea surface is typically 1027 kg/m$^3$. For simplification, physical oceanographers often quote only the last 2 digits of the density, a quantity they call *density anomaly* or *Sigma* (*s, t, p*):

$$\sigma (s,t,p) = \rho (s,t,p) - 1000 \text{ kg/m}^3$$

σ

(*S, t, p*) is typically 27.00 kg/m$^3$. The Working Group on Symbols in Oceanography recommends th replaced by because was originally defined relative to pure water and it was dimensionless. Here however, we will follow common practice and use σ.

To catch specimens of *Mnemiopsis leidyi*, fish eggs and fish larvae a standard Bongo was used (Fig. 2).

Fig. 2, Prototype Bongo (Picture: http://www.hydrobios.de)

The Bongo consisted of two plankton nets equipped with collecting buckets and a depth sensor. T plankton nets had mesh sizes of 335µm and 780µm respectively. The samples were treated separately, and most fish eggs, larvae and all *M. leidyi* were sorted before preservation. After sifting through the samples, they were fixed with 10% formaldehyde for further and more precise verification in the laboratory.

Two different types of fishing were carried out:

1. Pelagic fishery, performed with a pelagic “Aalhopser” net (see Annex) which was trawled a stations of greater depth.
2. Demersal fishery: A PSN 205 net was used (see Annex), towed at 2-3 knots.

The fish samples were analyzed on board, and length and weight measurements were taken.
The Stations 204, 235, 236, and 243 are not included in the hydrographic analysis, since on these stations the CTD sensor dropped onto the sea bottom and the data were not analyzed further.

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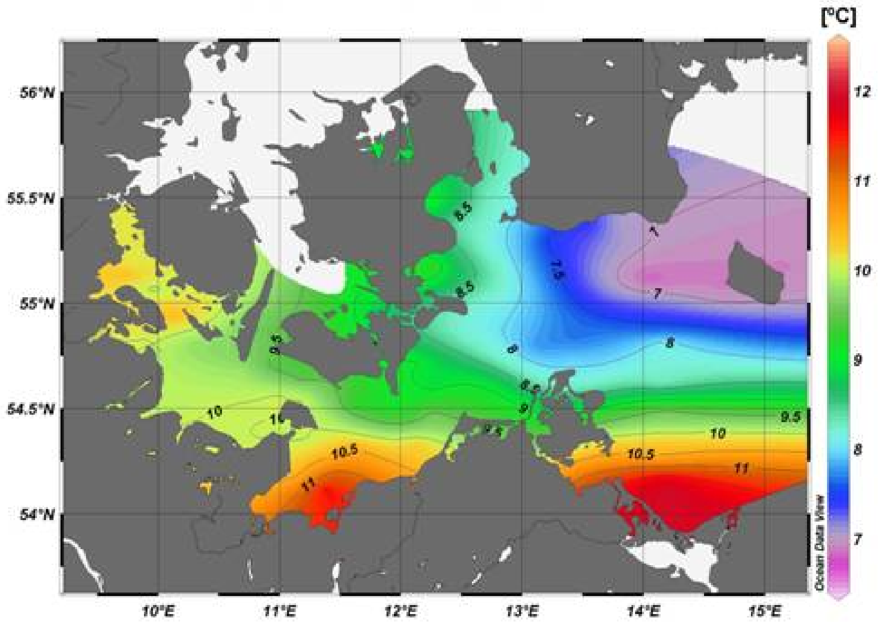
# Results




**Hydrography**

**Figure 3,** Surface Temperature [ºC] of the western Baltic between 21 April and 5 May 2007

On the whole, the surface temperature (Fig. 3) showed a clear stratification from the southwest tc northeast. Warmer, more saline water drained from the Small Belt into the Kiel Bight and in the Lübeck Bight. This trend was strengthened by warmer water flowing out of Mecklenburg Bight. The outer Oder estuary had a similar effect on the surface temperature of the Baltic. The cold water moving out frc eastside of the Baltic induced a stratification of surface water near the coastal line of Svinemünde; the surface temperatures ranged from 11.5 ºC to 7 ºC and even lower. The cold water body moving into Arkona Bay was strong enough to slow down the inflow of warmer and saltier water through the Öresund.

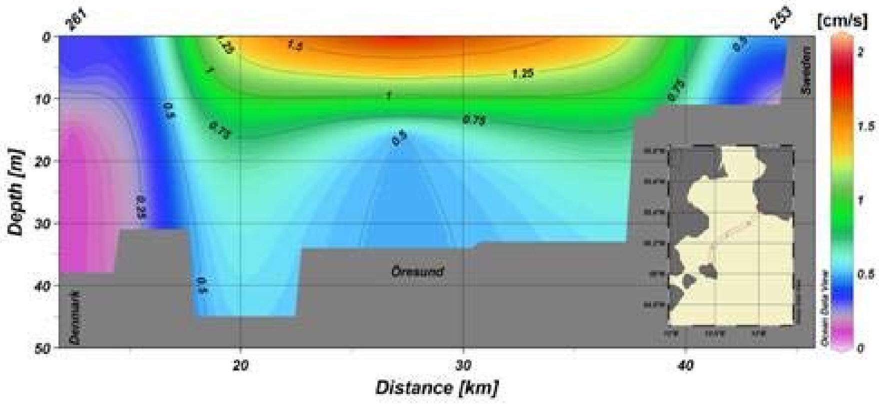



**Figure 4,** Hydrographic section through Öresund with positive geostrophic velocity values [cm/s] flowing eastwards.

At the surface a little inflow of relatively warm and denser water was found flowing eastward througr middle of the Öresund (Fig. 4). It was however very weak and was hardly measurable. At the shores of Denmark and Sweden a marginal outflow of colder and less saline water was measured on the surface.

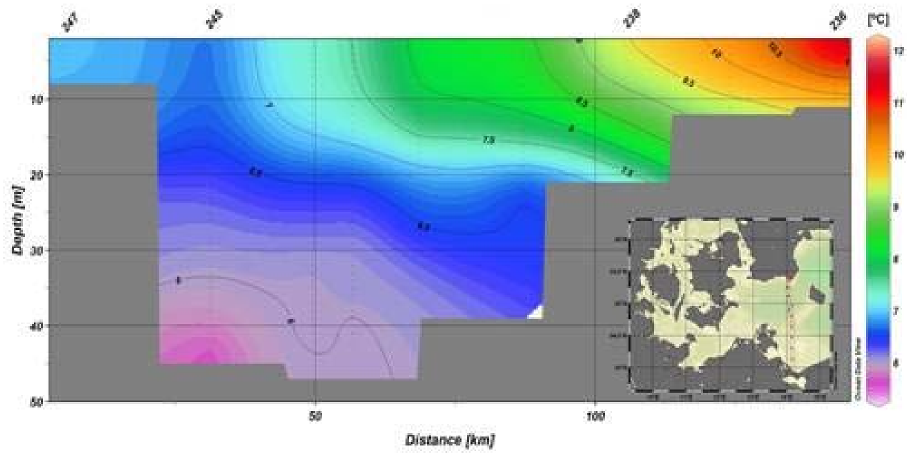



**Figure 5:** Temperature [ºC] stratification in a Section across the Arkona Basin

Fig. 5 gives the temperature section of the Eastern Baltic from the South (left) to the North (right). T surface layer shows a nearly mixed water column. A thermocline at the depth 20-25 m was identified inflow of warmer water from the Oder Estuary caused a more stratified water column in the sou stratification is dissolved by mixing with northern altitude.

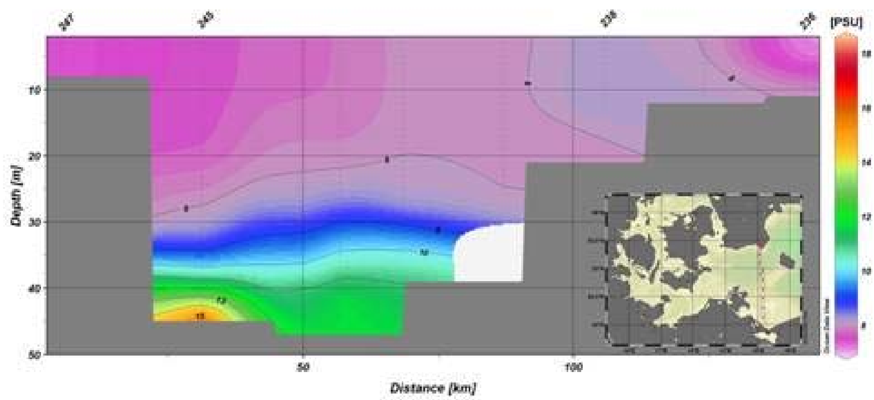



**Figure 6,** Salinity [PSU] stratification in a section across the Arkona Basin

The Salinity distribution of the eastern part of the Western Baltic from the South to the North is given in Fig. 6. Using the same section spine a well mixed water body is found at surface to a water depth 30-35m. At a depth of 35 m a halocline was found. The inflow from the Oder Estuary has only a marginal effect of the stratification on the water column.

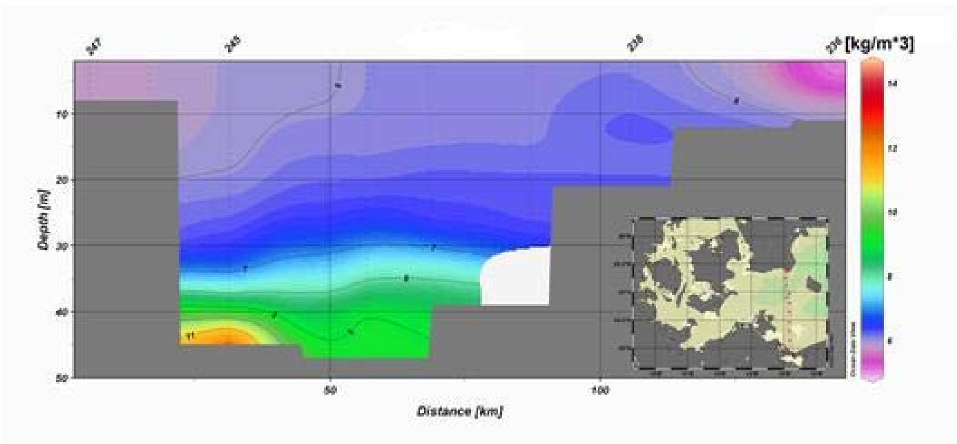



**Figure 7,** Potential density [kg/m$^3$] in a section across the Arkona Basin

Potential Density of the East Baltic from the South to the North is shown in Fig. 7. After calculating potential density the same discontinuity layer was found in temperature as in salinity, at approximatel 35m.

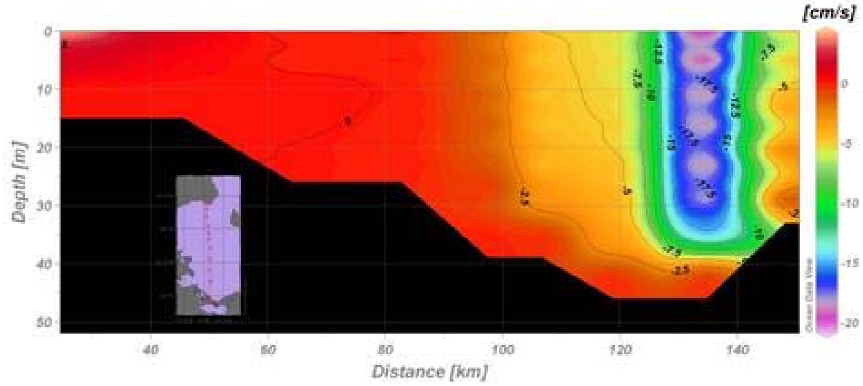



**Figure 8,** Geostrophic velocities [cm/s] in a Section across the Arkona Basin. Positive values show currents to the East and negative values describe velocities to the West.

With the obtained variables in temperature and salinity it was possible to calculate the water de furthermore the geostrophic velocities for the region (Fig.8). In the southern area was a small drift to the East, out from the Oder Estuary. With northern altitude the current changed to the West. The colder fresh water flowed into the Arkona Basin. The water temperature in the area west of the Arkona Sea was relatively homogenous (Fig. 8).

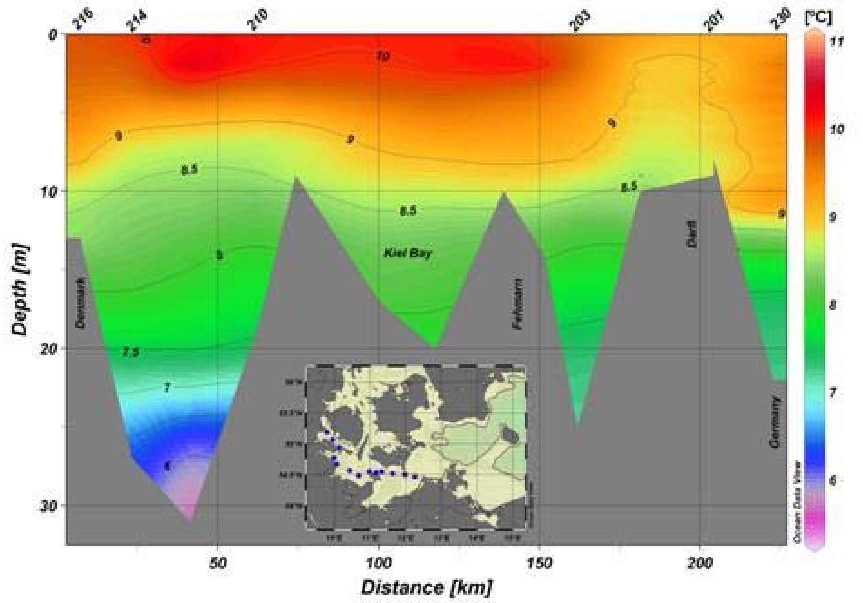



**Figure 8,** Temperature [ºC] distribution in topographic section of the West Baltic

Suitable stations from eastern Denmark to Darßer Ort in Mecklenburg-Vorpommerania were selected for a topographic section of the western Baltic Sea (Fig. 8). An almost stratified water column was prominent in the western part.

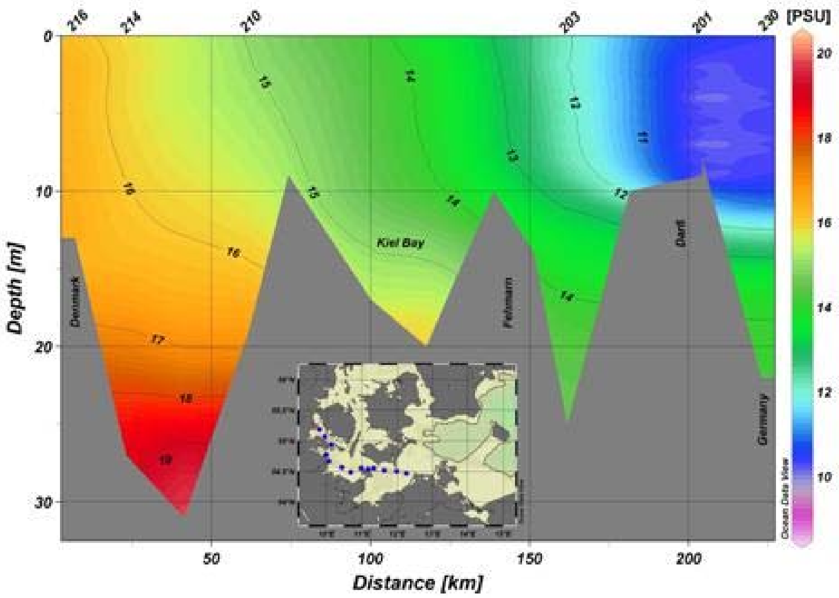



**Figure 9,** Salinity [PSU] distribution in a topographic section

As Fig. 9 illustrates, there is not only a depth stratification of salinity, but also a gradient from east to west. Denser water with higher salinity was found at the bottom whereas water with lower density a salinity was overlaying this. The less saline water was moving in from the east towards the west agains the inflow of the Small and Great Belts. At depths less than 25m a salinity of 19 PSU and more was measured whereas the salinity in the east was much lower at 11 PSU. For this reason there was a strong gradient between east and west.

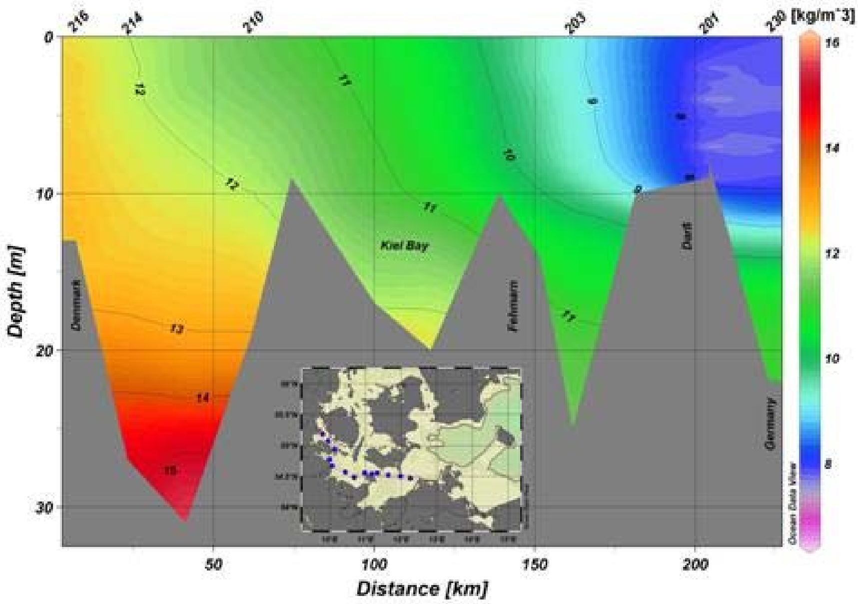



**Figure 10,** Potential density [kg/m$^3$] in a topographic section

As described in Fig. 9 fresh water moved from the east towards the west. At the same time there was inflow of saltier water from the Small and Big Belts which resulted in a stratified water column. T calculated potential density (Fig.10) confirmed the expectation. The calculated potential density underlined the stratification of the water column shown in Figure 8, 9. The more dense water was located in the depth, as in the deep basins near the shore of north Germany and east Denmark.

## Fish egg and larvae distribution

The distribution of counted eggs and larvae are presented below.

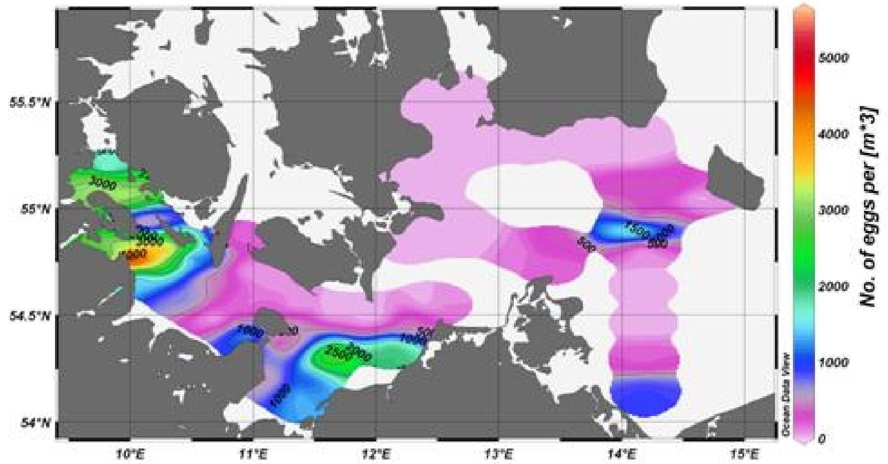



**Figure 11,** total amount of eggs per $m^3$ in the western Baltic

As Figure 11 illustrates a major appearance of fish eggs was found in the region of Kiel and the Small Belt. Similarly dense occurrences were found near the coast of Rostock and near Bornholm.

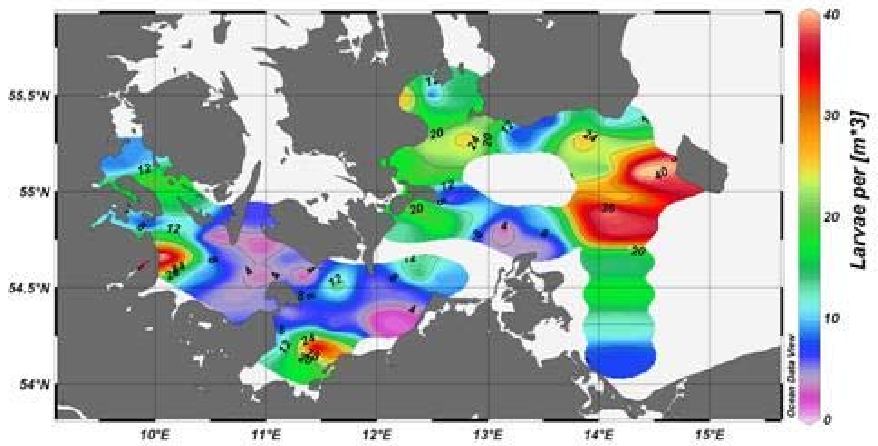



**Figure 12,** aggregated larvae [$m^3$] in the western Baltic

Figure 12 exemplifies an essential distribution of larvae in pelagic zones near Bornholm and Oresund. As compared to Figure 11 relatively many larvae were found in the coastal region of Kiel and north of Wismar. It must be noted that results from RV "Clupea" which sampled the near shore areas for her larvae are not included here.

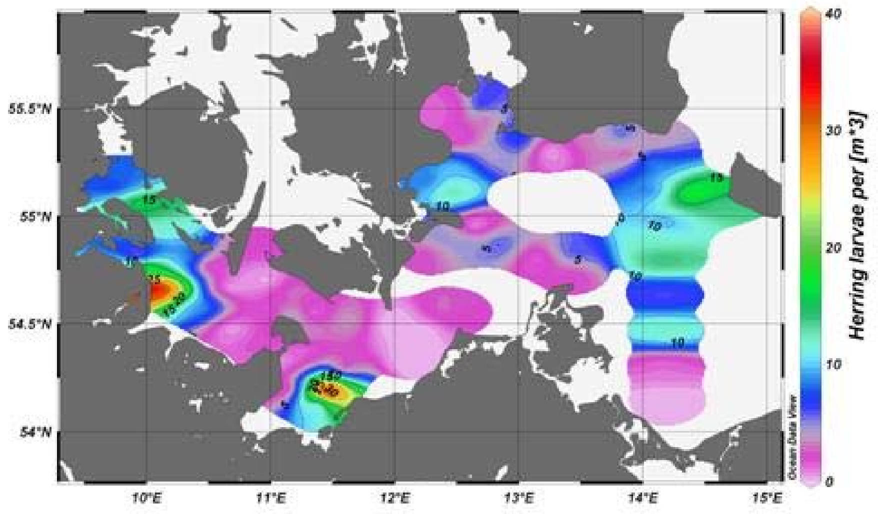


**Figure 13,** *Clupea harengus* larvae per [$m^3$] distribution in the western Baltic

Figure 13 shows a similar distribution of herring larvae near the coast of Kiel (outflow of Schley) and northern of Wismar as Figure 11.
Highest concentrations of non-herring larvae were found near Bornholm.

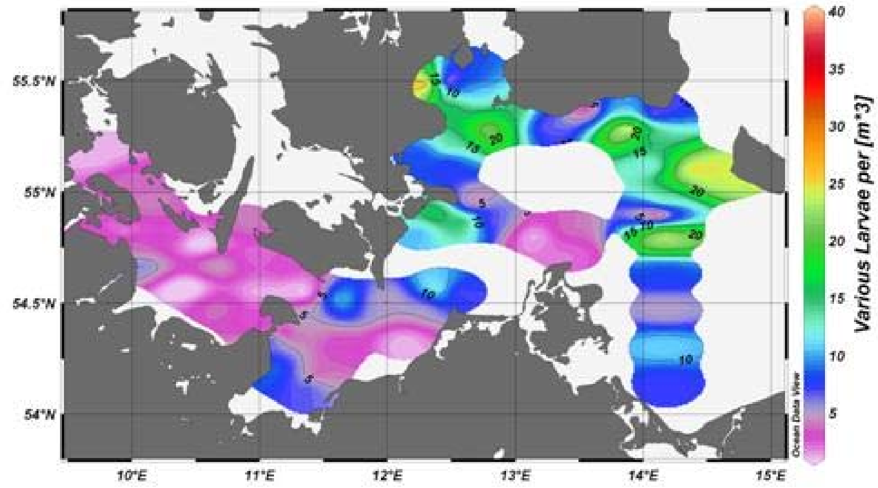



**Figure 14,** distribution of various non-herring fish larvae

Figure 14 illustrates the distribution of various non-herring fish larvae. In comparison to Figure 12 in region around Bornholm highest concentrations are found and the appearance in the Small Belt is nearly zero.

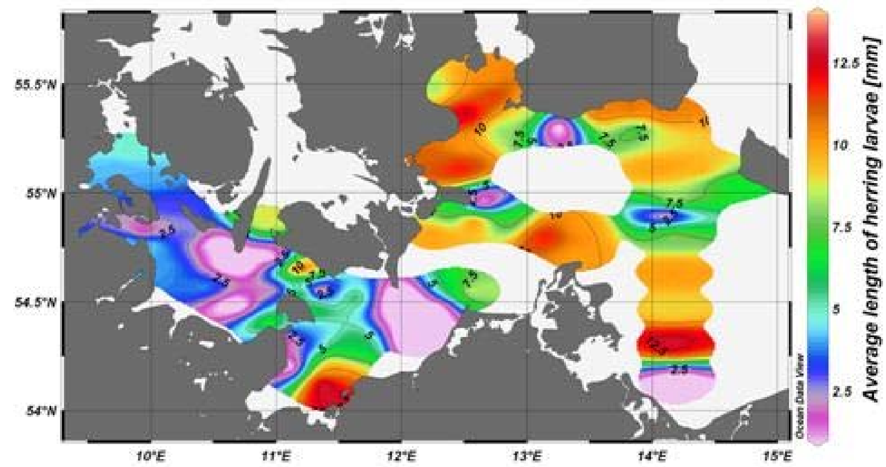



**Figure 15,** average length of herring larvae in the western Baltic

Figure 15 shows that the largest larvae were found in Oresund, at the Island of Rügen, southern Sweden and Wismar. The smallest larvae were found in Kiel Bight and the Small Belt.

### ***Mnemiopsis leidyi*** **abundance and characterization of the habitat**

Counted individuals and the distribution of *Mnemiopsis leidyi* were plotted in the figures below.

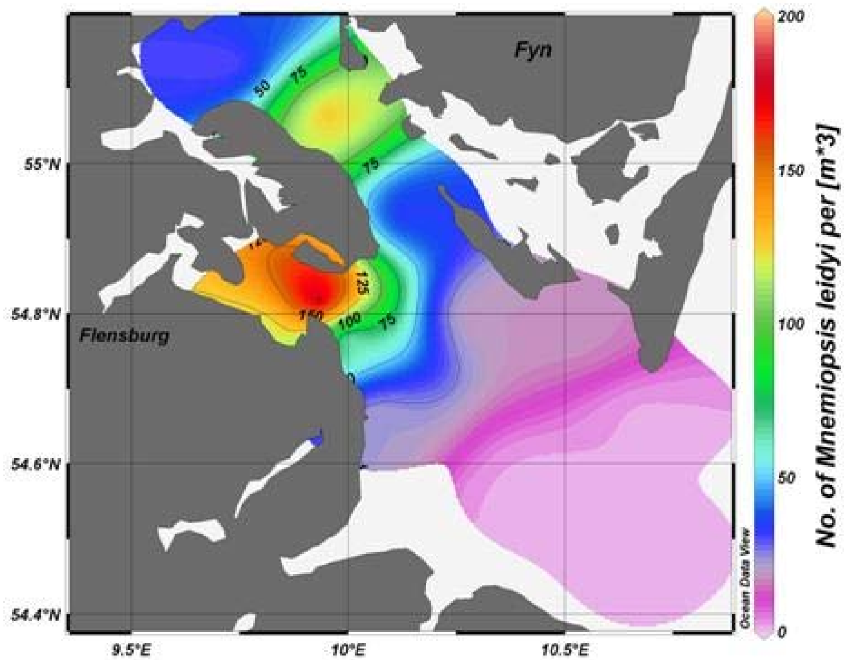



**Figure 16,** *Mnemiopsis leidyi* abundance in Small Belt

Figure 16 illustrates the abundance of *M.leidyi* in the Small Belt. There is a congruent distribution of fish eggs/larvae (Fig. 11, 12) and number ctenophores in this region.

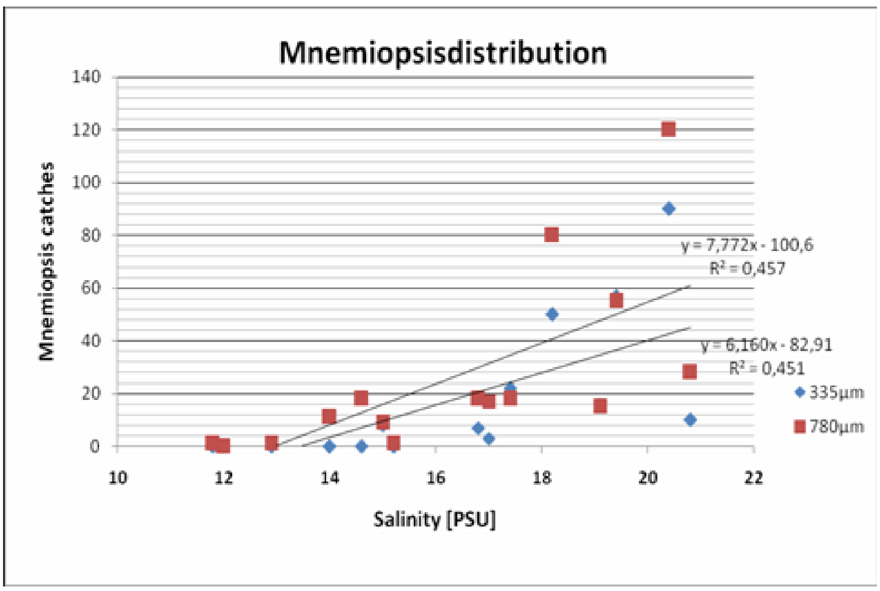



**Figure 17,** Distribution of *Mnemiopsis leidyi* with salinity

*Mnemiopsis leidyi* were predominantly caught in water columns with a practical salinity unit above 10. Most specimens were found at a range of approximately 15 to 22 PSU, with a maximum of 120 individuals at a PSU above 22. As it is known fron the Black Sea, *M. leidyi* appears generally in warmer and saltier areas. It might therefore be possible that for the immigration in the Baltic, salinity may become a limiting factor.

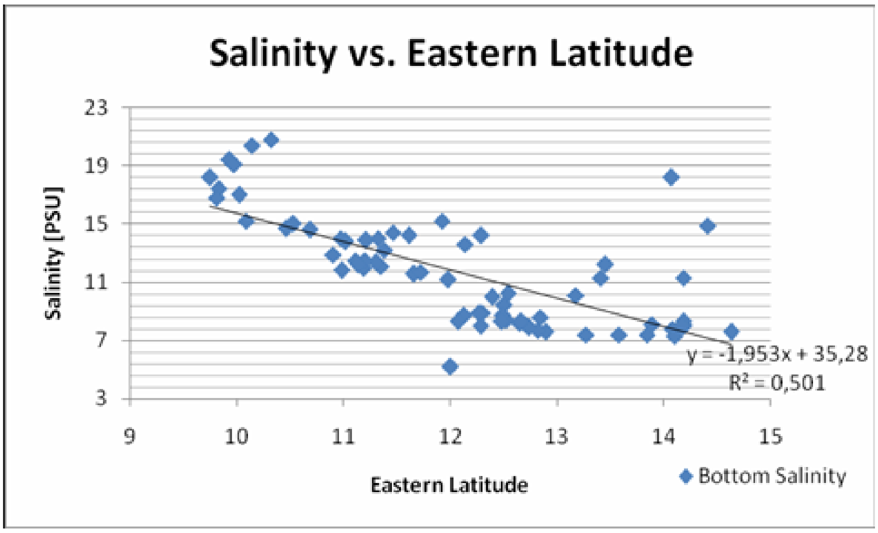



**Figure 18,** Salinity distribution in dependence with Eastern Latitude

As described in Fig. 17 most *Mnemiopsis* catches occurred at higher salinities. The figure shows that the salt concentration decreased wit increasing eastern latitude, from 20 PSU at Kiel Bight to approximately 9 PSU near Bornholm.

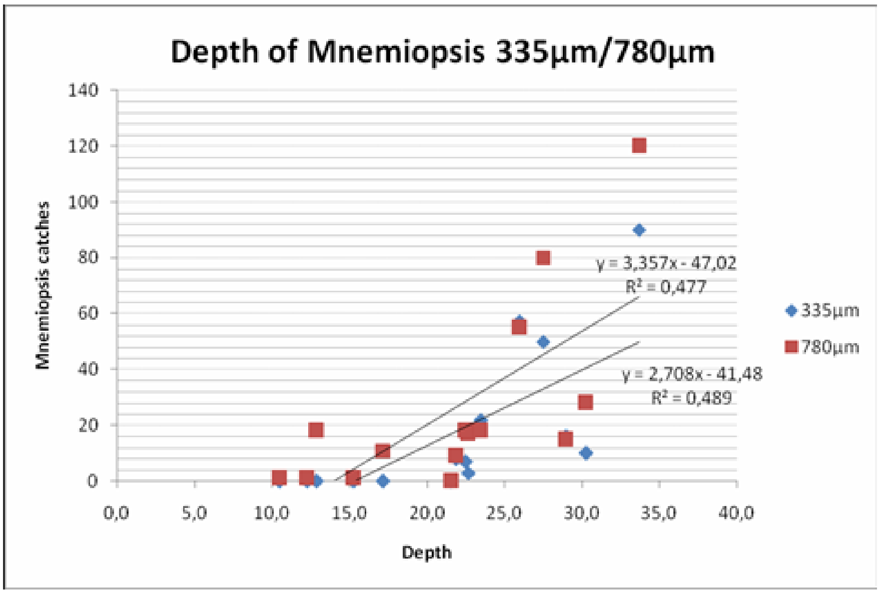



**Figure 19,** Distribution of *Mnemiopsis leidyi* in dependence with depth

Highest concentrations were found at depths of less than 30m. This may coincide with higher concentration in deeper areas, where however the temperature was lower.

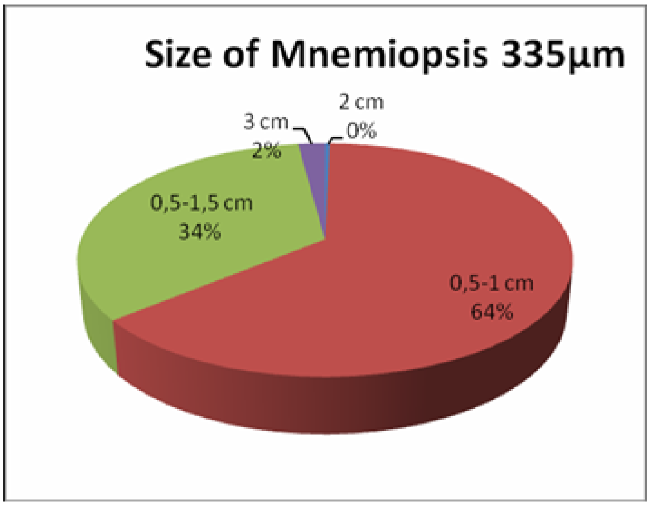



**Figure 20a,** Diameter of *Mnemiopsis leidyi* in Bongo catches with 335 µm mesh size

The average size of *M. leidyi* in the catch was 0.5 - 1cm, with the exception of some individuals bigger than 1 cm. The estimate of th size depended however on the individual measuring technique of the investigators; the technique remained to some degree subjective. For this reason there are the classes of 0.5 - 1.5cm and 0.5 – 1.0cm. The same problem occurs in figure 20b.

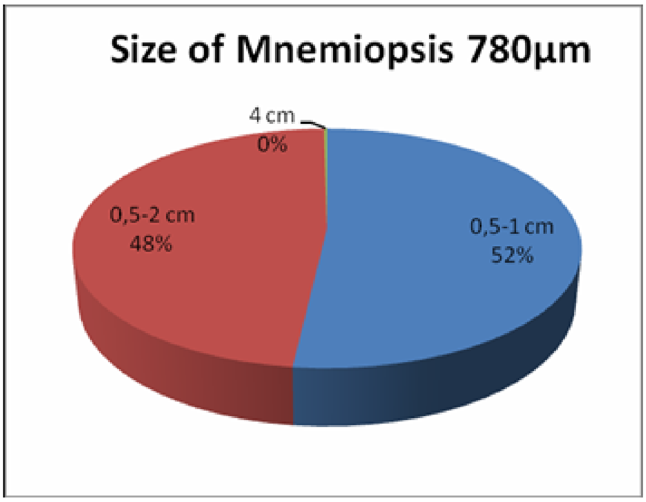



**Figure 20b:** Diameter of Mnemiopsis in Bongo catches with 335 µm mesh size.

In comparison with the 335µm Bongo the individuals seem to be bigger in the 780µm Bongo (Fig. 20b).

## Conclusions

### Hydrography and *Mnemiopsis leidyi* appearance

The description of a patricular biological situation like the immigration of *Mnemiopsis leiydi* in the western Baltic requires the analysis of the abiotic factors of the habitat. The first step is to characterizing temperature, salinity, density and oxy concentration, whereas special events like inflows or outflows to the Baltic (Small and Big Belt and Øresund) have major effects on these factors.

Our investigations indicate that during the cruise nearly no inflow occurred (Fig. 4). Figure 8 exemplify only very small outflow velocities caused fresh water inflow. As a result of heavy winter and spring storms between January and March the surface was more mixed near Bornholm than at the more sheltere coastal regions of Kiel and Rostock.  However, we found a thermocline at 30-35m depth (Fig. 7) in Arkona Basin and a stratified water column in the Small Belt. Due to the pushing of fresh water from the east stratification not only in the deep but rather at east to west latitude. This stratification could have had an effect on the distrib ution of *Mnemiopsis leidyi* in this area. After some time of adaption to lower salinity and temperature some individuals may have migrated vertically due to better food quality (fish egg/larvae) as there is no thermocline forming a barrier impeding their migration.

Unlike to the situation in the Small Belt the thermocline in Arkona Basin generates a barrier for further spreading (Fig. 17-19) and it is most likely that *M.leidyi* is trapped in these deeper basins due to lower salinity near the surface. In the Figures 17 -19 our accuracy is limited to the $R^2$. We only reach an explanation of the variance of nearly 50%.
This may be a problem of limited samples to be obtained in the limited time.

Our investigation covered only 10 days; therefore it is a very short time period with few observations p area. For a more detailed classification of the western Baltic a longer time period and/or more rese vessels should be conducted.

**Fish egg/larvae vs. *Mnemiopsis leidyi* appearance**:
We found higher off-shore abundances of larvae of *Clupea harengus* near Kiel Bight, the Small Belt and in the coastal region of Wismar (Figure 11). The occurrence of eggs near Bornholm leads to the conclusion mostly to be cod eggs due to their spawning areas in pelagic zones of the West Baltic.
The hydrography indicates that temperature, and in basins deeper than 20m salinity (Fig. 8, 9), pr sufficient survival conditions for *M. leidyi.* Therefore a predatory effect on herring eggs by *M.leidyi* in phytal regions is unlikely. By contrast, it is more likely for cod eggs and larvae in the pelagic regions. As seen in Figure 16 there is an overlapping of abundance of fish eggs and *M.leidyi*. However, the major appearance of *M.leidyi* deeper than 25m (Fig. 19), due to less salinity on the surface, may create a barrier and therefore predation on cod eggs.

**Acknowledgements:**

We thank the crew of RV SOLEA for support and good will. Special thanks go to Manfred Stein and Annika Elsheimer, from the vTI-Institute for Sea Fisheries in Hamburg. Their knowledge of ODV and prep-work on the analyzed data was vital for this cruise report.

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**Attachments**

Table1: Location of investigated stations

| Station | Plankton Hol Nr | Datum | Zeit | Pos. Breite N | Pos. Länge E | |
|---|---|---|---|---|---|---|
| 201 | 1 | 23.04.2007 | 13:21 | 54°30.2493 | 11°59.2 | Plankton |
| 202 | 2 | 23.04.2007 | 15:01 | 54°31.50 | 11°39.3 | Plankton |
| 204 | 3 | 23.04.2007 | 17:18 | 54°35.47 | 11°21.0 | Fischerei |
| 205 | 4 | 23.04.2007 | 18:48 | 54°32.32 | 11°12.3 | Plankton |
| 206 | 5 | 24.04.2007 | 19:53 | 54°33.47 | 11°00.9 | Plankton |
| 207 | 6 | 24.04.2007 | 08:00 | 54°24.46 | 10°58.4 | Plankton |
| 209 | 7 | 24.04.2007 | 11:06 | 54°34.4 | 10°27.4 | Plankton |
| 210 | 8 | 24.04.2007 | 12:40 | 54°40.19 | 10°05.1 | Fischerei |
| 211 | 9 | 24.04.2007 | 13:33 | 54°45.9821 | 10°01.4 | Plankton |
| 212 | 10 | 24.04.2007 | 14:38 | 54°47.9583 | 09°49.9 | Plankton |
| 213 | 11 | 24.04.2007 | 15:33 | 54°49.3678 | 09°55.8 | Plankton |
| 214 | 12 | 24.04.2007 | 17:15 | 54°55.9978 | 10°08.4 | Plankton |
| 215 | 13 | 24.04.2007 | 18:34 | 55°04.6157 | 09°58.1 | Plankton |
| 216 | 14 | 24.04.2007 | 19:40 | 55°08.0945 | 09°44.8 | Plankton |
| 217 | 15 | 24.04.2007 | 20:26 | 55°11.5955 | 09° 48.3 | Plankton |
| 219 | 16 | 25.04.2007 | 06:40 | 54°48.3 | 10°19.0 | Plankton |
| 220 | 17 | 25.04.2007 | 07:40 | 54°46 | 10°32.9 | Plankton |
| 221 | 18 | 25.04.2007 | 09:00 | 54°40.0 | 10°41.0 | Fischerei |
| 222 | 19 | 25.04.2007 | 10:35 | 54°52.9 | 10°54.2 | Plankton |
| 223 | 20 | 25.04.2007 | 12:05 | 54°42.6 | 10°58.6 | Plankton |
| 224 | 21 | 25.04.2007 | 13:28 | 54°39.4 | 11°11.2 | Plankton |
| 225 | 22 | 25.04.2007 | 16:06 | 54°27.1 | 11°18.9 | Plankton |
| 226 | 23 | 25.04.2007 | 16:35 | 54°23.4 | 11°18.1 | Plankton |
| 227 | 24 | 25.04.2007 | 17:05 | 54°22.0 | 11°12.0 | Plankton |
| 228 | 25 | 25.04.2007 | 17:45 | 54°20.3 | 11°06.6 | Plankton |
| 229 | 26 | 25.04.2007 | 18:45 | 54°12.2 | 11°07.6 | Plankton |
| 231 | 27 | 26.04.2007 | 06:58 | 54°33.46 | 12°32.5 | Plankton |
| 232 | 28 | 26.04.2007 | 08:15 | 54°28.2 | 12°17.1 | Plankton |
| 233 | 29 | 26.04.2007 | 09:20 | 54°30.3 | 11°59.8 | Plankton |
| 234 | 30 | 26.04.2007 | 10:39 | 54°20.2 | 12°08.2 | Fischerei |
| 235 | 31 | 27.04.2007 | 07:50 | 54°12.9 | 11°55.4 | Plankton |
| 236 | 32 | 27.04.2007 | 09:21 | 54°13.4 | 11°43.1 | Plankton |
| 237 | 33 | 27.04.2007 | 11:31 | 54°18.9 | 11°36.7 | Plankton |
| 238 | 34 | 27.04.2007 | 12:47 | 54°12.1 | 11°27.6 | Plankton |

| | | | | | | |
|---|---|---|---|---|---|---|
| 239 | 35 | 27.04.2007 | 13:53 | 54°07.5 | 11°23.0 | Plankton |
| 240 | 36 | 28.04.2007 | 06:22 | 54°08.1 | 14°11.0 | Plankton |
| 241 | 37 | 28.04.2007 | 07:39 | 54°18.3 | 14°11.0 | Plankton |
| 242 | 38 | 28.04.2007 | 08:54 | 54°28.2 | 14°10.9 | Plankton |
| 244 | 39 | 28.04.2007 | 10:39 | 54°38.2 | 14°10.9 | Plankton |
| 245 | 40 | 28.04.2007 | 12:56 | 54°48.5 | 14°10.5 | Plankton |
| 247 | 41 | 28.04.2007 | 16:35 | 54°58.5 | 14°11.0 | Plankton |
| 248 | 42 | 29.04.2007 | 06:03 | 55°03.2 | 14°37.8 | Plankton |
| 249 | 43 | 29.04.2007 | 07:07 | 55°06.2 | 14°24.7 | Fischerei |
| 250 | 44 | 29.04.2007 | 08:34 | 55°07.8 | 14°04.4 | Plankton |
| 251 | 45 | 29.04.2007 | 10:35 | 55°15.8 | 14°05.0 | Plankton |
| 252 | 46 | 29.04.2007 | 11:29 | 55°21.4 | 14°05.8 | Fischerei |
| 253 | 47 | 29.04.2007 | 12:41 | 55°23.2 | 13°50.5 | Plankton |
| 254 | 48 | 29.04.2007 | 14:55 | 55°17.1 | 13°53.6 | Plankton |
| 255 | 49 | 29.04.2007 | 16:34 | 55°22.1 | 13°34.9 | Plankton |
| 256 | 50 | 29.04.2007 | 17:55 | 55°18.3 | 13°15.9 | Plankton |
| 257 | 51 | 30.04.2007 | 06:00 | 55°22.1 | 12°53.5 | Plankton |
| 258 | 52 | 30.04.2007 | 07:17 | 55°18.0 | 12°49.3 | Plankton |
| 259 | 53 | 30.04.2007 | 08:45 | 55°27.2 | 12°43.9 | Plankton |
| 260 | 54 | 30.04.2007 | 10:23 | 55°31.8 | 12°41.7 | Plankton |
| 261 | 55 | 30.04.2007 | 11:30 | 55°30.6 | 12°29.9 | Fischerei |
| 262 | 56 | 30.04.2007 | 12:41 | 55°29.9 | 12°18.1 | Plankton |
| 263 | 57 | 30.04.2007 | 13:58 | 55°22.5 | 12°31.4 | Plankton |
| 264 | 58 | 30.04.2007 | 15:09 | 55°13.8 | 12°29.4 | Plankton |
| 265 | 59 | 30.04.2007 | 16:30 | 55°10.9 | 12°16.2 | Plankton |
| 266 | 60 | 30.04.2007 | 17:34 | 55°07.1 | 12°28.8 | Plankton |
| 267 | 61 | 01.05.2007 | 06:01 | 54°43.5 | 13°25.1 | Plankton |
| 268 | 62 | 01.05.2007 | 08:10 | 54°50.5 | 13°27.0 | Plankton |
| 269 | 63 | 01.05.2007 | 09:22 | 54°48.7 | 13°10.3 | Plankton |
| 270 | 64 | 01.05.2007 | 10:50 | 54°52.6 | 12°50.5 | Plankton |
| 271 | 65 | 01.05.2007 | 12:45 | 54°58.2 | 12°38.7 | Plankton |
| 272 | 67 | 01.05.2007 | 14:13 | 54°52.9 | 12°38.8 | Plankton |
| 273 | 68 | 01.05.2007 | 15:10 | 54°54.7 | 12°23.2 | Plankton |
| 274 | 69 | 01.05.2007 | 16:30 | 54°49.8 | 12°15.5 | Plankton |
| 275 | 70 | 01.05.2007 | 17:27 | 54°44.0 | 12°07.7 | Plankton |
| 276 | 71 | 02.05.2007 | 06:01 | 54°36.7 | 12°04.4 | Plankton |
| 277 | 72 | 02.05.2007 | 07:17 | 54°37.2 | 12°16.6 | Fischerei |

Table 2: Salinity and Station depths + *Mnemiopsis leidyi* catches

| Plankton Probe No | Depth [m] | Salinity [PSU] | MN 335 | MN 780 | MN total |
|---|---|---|---|---|---|
| 1 | 12 | 11,2 | 1 | 0 | **1** |
| 2 | 10,30 | 11,6 | 1 | 0 | **1** |
| | | | | | Fischerei |
| 3 | 15,90 | 12,1 | 1 | 0 | **1** |
| 4 | 18,10 | 13,9 | 2 | 3 | **5** |
| 5 | 12,10 | 13,8 | 0 | 2 | **2** |
| 6 | 13,80 | 14 | 0 | 1 | **1** |
| | | | | | Fischerei |
| 7 | 19,5 | 14,7 | 1 | 0 | **1** |
| 8 | 10,5 | 15,2 | 0 | 1 | **1** |
| 9 | 22,7 | 17 | 3 | 17 | **20** |
| 10 | 23,5 | 17,4 | 22 | 18 | **40** |
| 11 | 26,0 | 19,4 | 57 | 55 | **112** |

| | | | | | |
|---|---|---|---|---|---|
| 12 | 33,7 | 20,4 | 90 | 120 | **210** |
| 13 | 29,0 | 19,1 | 16 | 15 | **31** |
| 14 | 27,5 | 18,2 | 50 | 80 | **130** |
| 15 | 22,5 | 16,8 | 7 | 18 | **25** |
| | | | | | Fischerei |
| 16 | 30,3 | 20,8 | 10 | 28 | **38** |
| 17 | 21,9 | 15 | 8 | 9 | **17** |
| 18 | 12,9 | 14,6 | 0 | 18 | **18** |
| 19 | 15,3 | 12,9 | 0 | 1 | **1** |
| 20 | 12,3 | 11,8 | 0 | 1 | **1** |
| 21 | 21,60 | 12 | 0 | 0 | **0** |
| 22 | 17,20 | 14 | 0 | 11 | **11** |
| 23 | 14,60 | 12,4 | 0 | 0 | **0** |
| 24 | 12,70 | 12,5 | 0 | 0 | **0** |
| 25 | 11,00 | 12,5 | 0 | 1 | **1** |
| 26 | 11,40 | 12,2 | 0 | 0 | **0** |
| | | | | | Fischerei |
| 27 | 12,10 | 10,2 | 0 | 2 | **2** |
| 28 | 24,00 | 14,2 | 2 | 7 | **9** |
| 29 | 11,90 | 5,2 | 0 | 0 | **0** |
| 30 | 19,10 | 13,6 | 0 | 3 | **3** |
| 31 | 19,00 | 15,2 | 4 | 3 | **7** |
| 32 | 25,00 | 11,7 | 1 | 3 | **4** |
| 33 | 25,40 | 14,2 | 3 | 3 | **6** |
| 34 | 21,60 | 14,4 | 6 | 7 | **13** |
| 35 | 20,00 | 13,2 | 2 | 6 | **8** |
| 36 | 14,90 | 8 | 0 | 0 | **0** |
| 37 | 16,30 | 8,1 | 0 | 0 | **0** |
| 38 | 14,30 | 8,3 | 0 | 0 | **0** |
| | | | | | Fischerei |
| 39 | 28,70 | 8 | 0 | 0 | **0** |
| 40 | 28,50 | 8 | 0 | 0 | **0** |
| | | | | | Fischerei |
| 41 | 44,60 | 11,3 | 0 | 0 | **0** |
| 42 | 19,50 | 7,6 | 0 | 0 | **0** |
| 43 | 45,5 | 14,9 | 0 | 0 | **0** |
| 44 | 46,5 | 18,2 | 1 | 0 | **1** |
| 45 | 34 | 7,8 | 0 | 0 | **0** |
| 46 | 14,5 | 7,3 | 0 | 0 | **0** |
| 47 | 17,2 | 7,4 | 0 | 0 | **0** |
| 48 | 38,5 | 8,1 | 0 | 0 | **0** |
| | | | | | Fischerei |
| 49 | 15,5 | 7,4 | 0 | 0 | **0** |
| 50 | 15,5 | 7,4 | 0 | 0 | **0** |
| 51 | 12,5 | 7,6 | 0 | 0 | **0** |
| 52 | 12,8 | 7,7 | 0 | 0 | **0** |
| 53 | 11,5 | 7,9 | 0 | 0 | **0** |
| 54 | 12,5 | 8,1 | 0 | 0 | **0** |
| 55 | 12,5 | 9,4 | 0 | 0 | **0** |
| 56 | 11,7 | 8,9 | 0 | 0 | **0** |
| 57 | 21,5 | 8,4 | 0 | 0 | **0** |
| 58 | 21,7 | 8,7 | 0 | 0 | **0** |
| 59 | 14 | 8,9 | 0 | 0 | **0** |
| 60 | 14,5 | 8,3 | 0 | 0 | **0** |
| 61 | 31 | 11,3 | 5 | 0 | **5** |
| 62 | 45,5 | 12,2 | 1 | 1 | **2** |
| 63 | 42,6 | 10,1 | 0 | 0 | **0** |

| | | | | | |
|---|---|---|---|---|---|
| 64 | 23,7 | 8,6 | 0 | 0 | **0** |
| 65 | 21,4 | 8,2 | 0 | 1 | **1** |
| | | | | | Fischerei |
| 67 | 18,5 | 8,3 | 0 | 1 | **1** |
| 68 | 21,8 | 10 | 0 | 0 | **0** |
| 69 | 19,5 | 8,9 | 0 | 0 | **0** |
| 70 | 13,2 | 8,7 | 0 | 0 | **0** |
| 71 | 11,8 | 8,3 | 0 | 0 | **0** |
| 72 | 19 | 8 | 1 | 3 | **4** |
| | | | | | **734** |

| | | |
|---|---|---|
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