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### Cruise report

### FRV „Clupea“

### Cruise 364,

27.06.-08.07.2022

Cruise leader: Dr. Jörn Peter Scharsack

## CONMAR-Fish Effects of marine dumped munition on fish in the Baltic Sea

### Summary

This cruise was performed to investigate if fish are affected by munition compounds (MC) leaking from marine dumped munitions. Bottom dwelling flat fish (dab, *Limanda limanda*, and flounder *Platichthys flesus*) were taken in focus, since they live in close proximity to marine dumped munition. Flatfish were collected with bottom gill nets in Lübeck Bay and Kiel Bay near munition dumps and in 2-4 miles distance from the munition (controls). Additionally, sediment samples were collected with a van Veen gripper. On ship, fish were inspected for diseases and sampled for tissue and body fluids for later laboratory investigations. Sediment samples were sieved and preserved for later analysis. In Lübeck Bay, sampling was not performed at all planned locations, due to the lack of oxygen above seafloor at depth >10m. As a compromise, we moved to more shallow regions in close proximity to the dumped munition. In Kiel Bay, sampling focussed on the munition dumpsite 'Kolberger Heide'. Sediment samples were successfully collected in a transect east and another west of Kolberger Heide. Sampling with bottom gill nets was hindered by heavy wind and waves, causing high amounts of floating algae, which got entrapped in the overnight placed nets. Netting was repeated for 4h over day, which was more successful.

## Background

During and after WW I and II huge amounts of munition were dumped in the Baltic Sea (approx. 300kt). Due to corrosion munition compounds (MC) such as explosives are leaking into the marine environment, and concerns about environmental effects of MC are rising. The present cruise was performed in frame of the project CONMAR in the BMBF DAM mission SustainMare, which aims to compile information on marine dumped munitions in German coastal waters, with the aim to develop strategies for clearance measures. Furthermore, collected information will be used for a screening of the marine munition problem requested by the German Conference of Environment Ministers. The present cruise aimed to sample in two areas with marine dumped munition in the German Baltic Sea, namely the Kolberger Heide in Kiel Bay and Hafkrug and Pelzer Haken in Lübeck Bay.

## Research Programme

The present cruise aimed to address two main hypotheses, (i) flatfish living in proximity to marine dumped munition take up leaking MC and might be altered in their health and (ii) composition of benthic (seafloor) organisms changes with distance to dumped munition due to potential toxic effects of MC. Accordingly, two series of samplings were performed at each dumping area.

### Selection sampling sites

A prerequisite for the sampling of fish and benthic biota is the availability of oxygen above seafloor. Therefore, a CTD down to 1m above seafloor was performed at each potential sampling site. If oxygen content was <4ml/L or <50% saturation, sampling was not performed since fish avoid areas with oxygen deficiency and van Veen sampling aimed at aerobic benthic organisms.

### Sampling of flat fish

Bottom dwelling flat fish (dab, *Limanda limanda*, and flounder *Platichthys flesus*) were taken in focus, since they live on the seafloor and in close proximity to marine dumped munition. Previous studies found traces of munition compounds in bile of dab collected near the munition dump site Kolberger Heide. Furthermore, elevated frequency of liver nodules (tumours) were observed in dab collected from Kolberger Heide. The present cruise aimed to substantiate previous findings in fish collected from Kolberger Heide and to expand the sampling to munition dump sites in Lübeck Bay which was not sampled for fish previously.

Flatfish were collected with bottom gill nets in Lübeck Bay and Kiel Bay in close proximity to munition dumps and in 4 miles distance from the munition (controls). On ship, fish were reared in tanks with sea water supply until sampling. Fish were killed with an overdose of clove oil inspected for externally visible diseases, and

measured for weight and length. Body fluids (blood, bile, urine) and tissue samples (liver, spleen, muscle) were collected for later laboratory analysis.

## **Sediment sampling**

Sediment samples were collected along transects with a van Veen gripper. The transect started as close as possible to the dumped munition, at the same position, where the gill nets for the flat fish were placed. From there replicate sediment samples were taken starting at 100m distance from the first sampling and then continued with 100-500m distance until the position for the second gill net was reached. Sediment samples were sieved, washed and preserved with formalin for later laboratory analysis.

## **Narrative**

### **Sampling in Lübeck Bay**

The cruise started on June 26 from Rostock to Lübeck bay, which was reached in the afternoon. Since in the area Pälzer Haken Süd >10m water depth, oxygen was not detectable above seafloor, bottom gill nets (2x4 50m nets) were placed closer to the shoreline at about 10 m depth with a distance of 2 miles. This was not optimal, since the distance to the dumped munitions was <2 miles, but it was still possible to collect fish from the area. Overnight the ship went to Neustadt Harbour. On the next day, the nets were taken up and 16 dab were sampled.

We moved West to Hafkrug Mitte where no oxygen was measured above seafloor at 15m. Moving south, further two CTDs did not reveal oxygen above seafloor. Only when we reached more shallow waters <12m depth, oxygen was detected and we started a transect direction south for sediment sampling. Gill nets, 2x4 50m nets) were placed alongside the transect. On the next day (29.6.2022) gill nets had collected 19 flounders which were sampled.

Next spot was Hafkrug Nord, where we measured oxygen above seafloor at 12m and started a transect sediment sampling Northwards. Again, gill nets were placed along the transect overnight. On the next day 10 flounders and 3 dab were sampled from the nets. A third sediment sampling transect was placed North west of Pelzer Haken at 12m depth with oxygen. From the placed nets, 10 flounders and 6 dab were collected the next day and sampled.

After the sampling, the cruise progressed towards Kiel harbour, where the ship stayed over the weekend.

### **Sampling in Kiel Bay**

Starting July 4th, bottom gill nets were placed west of the Kolberger Heide munition dump site with 2 miles transect for sediment sampling in between. Due to heavy winds, the more western placed net was covered

with algae and the few fish that were trapped were attacked by shore crabs. None of the fish was sampled. The net placed next to Kolberger Heide was less afflicted by algae and shore crabs and 3 flounders 3 plaice and 12 dab were sampled.

Due to the wind, no nets were placed over night. On the next day, nets were placed east from Kolberger Heide with a 2 mile transect for sediment sampling in between the nets. The net further away from Kolberger Heide (control) yielded 9 dab and 1 flounder while the net next to Kolberger Heide had only one dab and one flounder.

## Preliminary results

In Lübeck Bay, sampling in close proximity to dumped munition was hindered by the lack of oxygen at depth >10m. As a compromise, we went closer to the shore and sampled at depth <12m which yielded sufficient numbers of flounder and dab. However, a clear differentiation between nets placed next to munition and those placed in a distance that may serve as unpolluted control was not achieved. Nevertheless, fish were collected in an area with high abundance of dumped munition. In Kolberger Heide, sampling was affected by heavy wind and only one net was successfully sampled next Kolberger Heide and one as control nets in 2 miles distance from Kolberger Heide. Sediment sampling in two transects, one east and the other west from Kolberger Heide was not affected by the heavy wind. Due to further increase of wind, the cruise was ended one day earlier as originally planned.

## Participants

<b>Name</b>	<b>Institution</b>	<b>Function</b>
Jörn Peter Scharsack	TI-FI	Cruise leader
Tammo Cremer	TI-FI	Engineer
Oguz Senmeyvaci	TI-FI	Technician
Andrey Vedenin	Senckenberg	Scientist

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