

Weekly Report 2

FS Alkor cruise AL534/2: RiverOceanPlastic

Fahrtleitung: Aaron Beck (GEOMAR)

Cruise progress Week 2: European Atlantic shelf seas to the Bay of Biscay

Following the station on Sunday near Sagres, Portugal, we transited northward to Lisbon (Fig. 1). We arrived at the fourth station late Monday afternoon, and woke up on Tuesday to beautiful, glassy weather for sampling. The Tagus River passes through the city of Lisbon and enters the Atlantic Ocean at this site, so we located the station within the lower-salinity river plume.

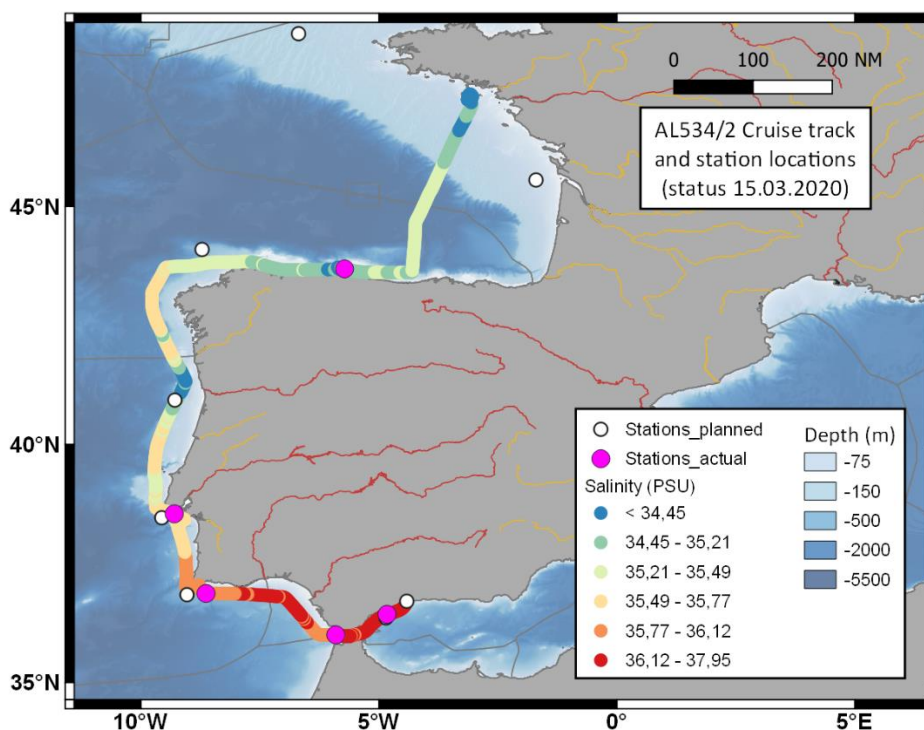


Figure 1. Map of stations completed through week 2. The surface water salinity is shown in colors along the cruise track.

At this station, we conducted our “normal” sampling program (no in situ pumps): CTD water column sampling, followed by sediment sampling with Van Veen grab and multi-corer, and finally our various nets (Fig. 2).

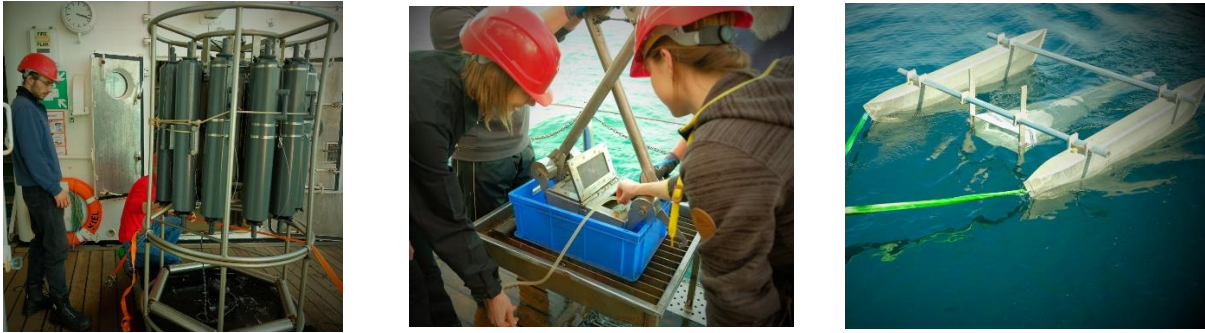


Figure 2. Station 4. (L-R) Water sampling from CTD rosette, draining water from the Van Veen grab before collecting sediment samples, catamaran trawl sampling a glassy sea surface.

We continued our northward transit Tuesday afternoon, and arrived at our next planned station at the Douro River outflow on Wednesday morning. Unfortunately, the weather forecast predicted rapidly worsening conditions, so we cancelled the station and took advantage of the good weather to transit an additional 24 h around the Costa da Morte (Death Coast) to a sheltered headland at Gijón. Although there are no major rivers at this location, we did observe a slight freshening in surface waters (Fig. 1), perhaps from outflow from small rivers such as the Nalón.

We completed a full program of sampling at Gijón on Thursday (12 March), including in situ pumps. We also did several shallower WP3 vertical net tows to evaluate if gelatinous zooplankton are more abundant in deep or shallow waters. The catamaran trawl at this station again returned one tow with abundant mesoplastic objects (Fig. 3).



Figure 3. (L) The net tows overwhelmingly collect diverse assemblages of copepods, small fish, and gelatinous zooplankton. (Photo: A. Peterson) (R) Occasional tows contain visible plastic objects, such as these collected by the catamaran trawl at our fifth station. Coarse fibers and irregular plastic sheet fragments are the most common objects encountered.

Underway seawater system for dissolved and particulate water samples

In addition to collecting water samples from the CTD rosette, we also obtain water samples from the ship's uncontaminated seawater supply. These samples will be used for measurement of plastic leachates (e.g., phthalates) and other anthropogenic organic compounds (performed by GEOMAR), as well as per- and polyfluoroalkyl substances (PFAS) and UV-absorbers (performed by HZG). These compounds are plastic-derived or persistent anthropogenic pollutants, and little is known about their distribution in European shelf seas.

Suspended particulates for microplastic determination are also collected from the underway seawater using a stainless steel filter similar to those deployed on the in situ pumps. This filter collects microplastic particles $>10\ \mu\text{m}$. Microplastics will be analyzed in shore-based laboratories after the cruise, and these data will help illustrate the lateral and vertical distribution of microplastics along the European margin.

We crossed the Bay of Biscay on Friday, 13.03, through 4-5 m seas. We waited out the poor weather conditions near the island of Bangor, France, on Saturday and Sunday, and look forward to continuing the cruise track further this week.

Initial results

Salinity

Variations in salinity along the cruise track (Fig. 1) show the clear freshening of surface waters near river mouths. The purpose of this cruise is to determine the role of rivers in delivering microplastics and associated contaminants to European shelf seas (hence the name "RiverOceanPlastic"), so we're monitoring changes in salinity to ensure that we target continental freshwater outflows. In general, the CTD profiles show a well-mixed water column (Fig. 4), as would be expected during this time of year. At our stations near river inputs, decreased salinities are clearly visible in surface waters.

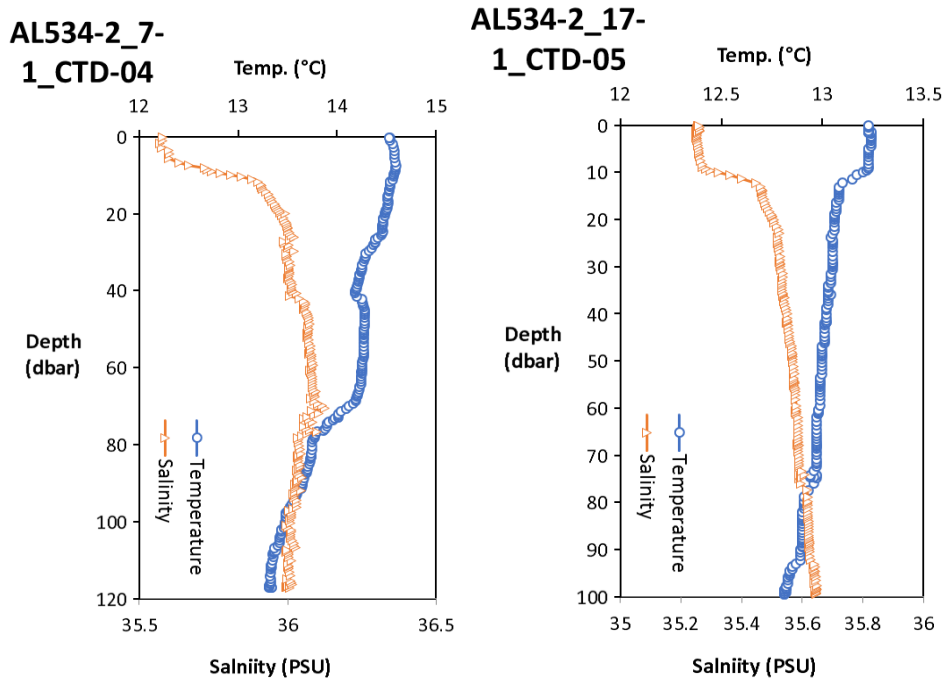


Figure 4. Water column profiles of salinity and temperature at stations near Lisbon (CTD-04) and Gijón (CTD-05).

Gelatinous zooplankton

Net hauls have so far provided valuable insights into the gelatinous zooplankton communities along our transect from the Mediterranean Sea into the North Atlantic Ocean. While our sampling sites in the Strait of Gibraltar were mostly populated by pelagic tunicates (salps), several hydromedusae (e.g. *Liriope* sp. with abundances of up to 1 ind. m⁻³; Fig. 5a), the siphonophore *Verella vellella* (Fig. 5b) and the ctenophore *Pleurobrachia pileus* (Fig. 5c) were dominant along the Portuguese shoreline.

In some cases, we observed artificial fibers attached to various morphological structures of the jellies. We have so far prepared ca. 250 jellyfish samples for subsequent in-depth analysis of associated microplastic particles.

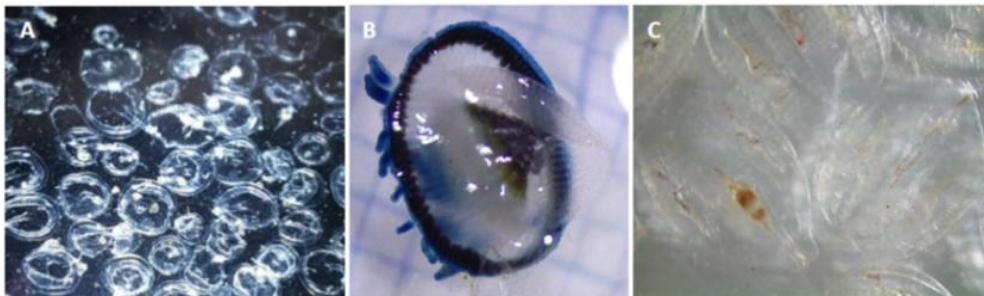


Figure 5. Dominant gelatinous zooplankton along the Portuguese shoreline. (a) *Liriope* sp., (b) *Vellella vellella*, and (c) *Pleurobrachia pileus*. (Images: J. Goldstein)

Litter spotting

We have so far completed about 80 nmi of litter spotting, and typically see about 0.1 – 1 object per nautical mile. Two examples of floating plastic debris are shown in Fig. 6. Often, as in these images, the microplastic objects are clearly weathered and deteriorating.



Figure 6. Floating plastic debris observed along the northwest Iberian coastline. (Images: S. Hamisch)

Table 1. Overview of device deployments and samples collected during Week 2

Device name	Number
CTD/Niskin rosette	2
Van Veen Grab	7
Mini-MUC sediment cores	13
WP3 Net tows (500 µm)	9
Bongo Net tows (300 µm*)	6
Catamaran Trawls (300 µm)	6
In situ pumps	2
Underway samples	26
Litter spotting	8
<i>Total</i>	<i>79</i>

* Note error in Week 1 report. Both Bongo nets have a mesh size of 300 µm.

With greetings from the Bay of Biscay on behalf of the cruise participants,

Aaron Beck, GEOMAR Helmholtz Centre for Ocean Research Kiel

(47° 21' N, 3° 07' W) Monday, 16 March 2020