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CRUISE REPORT

CLIMATE CHANGE IMPACT ON OCEAN FRONTS ECOSYSTEMS:

The case of the Iberian Upwelling System (SINES)

R/V Sarmiento de Gamboa, Cruise No. SEA02_08,

11-20 September 2022, Lisboa – Lisboa (Portugal)

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Hydrographic dataset already available in SEANOE

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1. Summary

The cruise aboard the R/V Sarmiento de Gamboa, entitled **SINES** and funded by EUROFLEETS+- took place between 11-20th of September 2022. This cruise was planned to be a proof of concept of **multidisciplinary** research: integrating satellite data to past sediment records within classical methods in oceanography research and automated underwater vehicles to tackle the characterization of the **Iberian Margin Upwelling System**. The cooperation and coordination of all the involved partners allowed the measurement and sampling of water, plankton, and sediment samples from discrete levels for more than 40 different tracers/parameters. These new samples can set the baseline to identify, quantify, and validate current ecosystem changes in this upwelling region.

The **cruise started on the 11th of September** leaving the port of Lisbon at 10:30 am in the direction to our first stations, the most coastal ones. However, the expected weather conditions were not appropriate for the continuation of the operations aboard in safety conditions. The **contingency plan** was to transit to the EMSO-PT area after the second station was finished (12th September). The EMSO-PT site is a European Large Scale Research Infrastructure run by CCMAR. There, a CTD and a detailed ADCP track were done to calibrate the sensors and equipment already installed on the current mooring, that were coincidentally serviced a week after. As a follow up, it was decided to run three transects perpendicular to the coast to gain insight of the coastal circulation over the shelf for comparison with an existing dataset (2012). The ADCP tracks were run between the EMSO-PT site (CCMAR mooring station) and the city of Faro. There, in front of Faro, another transect composed of 4 stations (Faro1 to Faro4; Figure 1) was done following the regular sequence of deployments (CTD + Rosette sampler; Multinet; Box-corer).

At the end of Faro 4 (**13th September**) and given the better meteorologic conditions expected for the following days, we sailed to the deepest and furthermost located site of the initial planned SINES transect. To trade off the time spent on the Algarve coast, the three deeper stations initially planned for the SINES transect (St 9, 10 e 11) were replaced by a single station that became Station 3 (~5000 m depth, right in the Tagus Abyssal Plain). The **work followed as expected the following days** with the realization of multiple CTD casts, vertical multinet, microstructure, profiler, plankton net, and box-corer sampling on another 6 stations positioned along the SINES section. On September 17th and 18th, the Autonomous Underwater Vehicle (AUV) team operated out of the port of Arrifana and launched the LAUV-xplore-4 vehicle. The AUV transect, with hydrographic profiles between surface and 100 m, was done following the same heading SINES transect from coast to open ocean.

Given that the weather conditions changed quite a lot and wind blew from north on the 17th and 18th, a small upwelling started to be evident on sea surface temperature and chlorophyll satellite images. For that, we decided to repeat the coastal stations 1 and 2, so that water column conditions, water chemistry and microorganisms' distribution as well communities could be compared to the ones found on the first day 11th under storm conditions. After completion of the repeated stations, the ship left in the direction of Lisbon, **docking at the port of Lisbon on September the 20th at 8:00 am**.

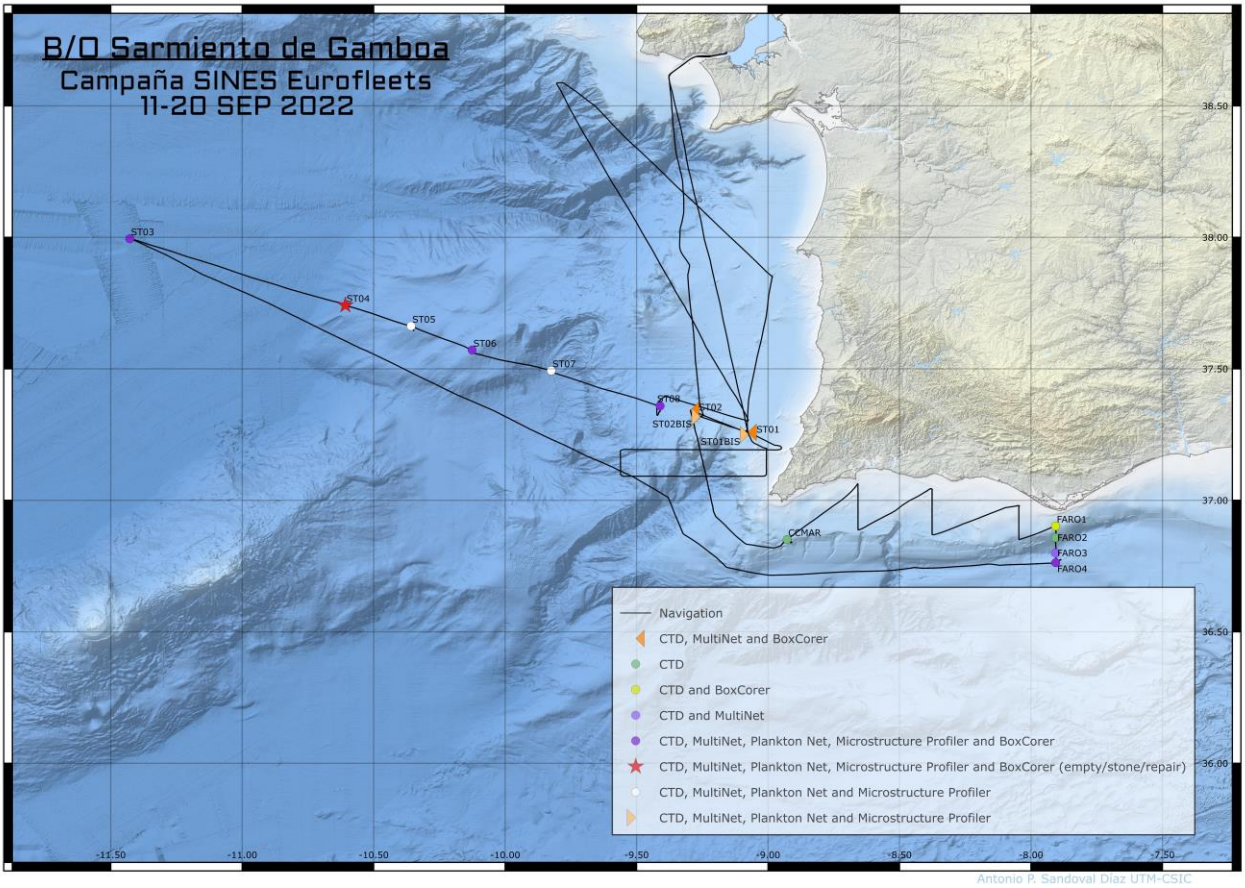

Fig. 1. Working area and track chart of R/V SARMIENTO DE GAMBOA Cruise Eurofleets+ SINES.

2. Research Programme/Objectives

The overall objective of this study is to **identify the changes and risks for marine ecosystem services** deriving from the potential impact of climate change on upwelling fronts, by concentrating on the ecosystem variability of the Iberian Margin upwelling system through a holistic and integrative research approach, joining forefront remote technologies to in situ monitoring and numerical modeling. Our aim is to address ecosystem-societal interactions through the identification of the best quantifiable descriptors that are essential for sustainable management. With this project we hope to addresses societally relevant topics, such as blue carbon economy, coastal-open ocean exchanges, mesoscale subduction processes, and air-sea CO_2 fluxes. The socioeconomic importance of the Iberian Upwelling stimulates the collection of an interdisciplinary database of observations.

The proposed **multidisciplinary expedition** was carried out along a section across the expected upwelling front between 37ºN 9ºW and 38ºN 12ºW. Water column, plankton, and bottom sediments were collected at **15 stations** (Fig. 1). Chemical analyses for dissolved oxygen, pH, and total alkalinity were already performed onboard (**19 CTD casts**); for phytoplankton, micro- and mesozooplankton respectively, **12 vertical multinet hauls** were collected. Bottom sediments were collected by box-core at the stations where known bottom conditions were safe for operation. Sediment cores were split in half so we could use the same core to calibrate proxies used for paleoreconstructions and for studying micro and macrobenthic communities. However, given that

the standard methodology for benthic communities is based on the sample volumes of a complete box, replications were done on two stations. Furthermore, given the large number of analyses planned to be done on the different water samples (see list of parameters in Table 1 and List of Analyses and Proxies at the end of this report), at four of the stations, we repeated the CTD-rosette casts (shallow and full-depth casts) as listed in the Narrative of the Cruise. The complete list of events within the software EARS ("Eurofleets Automatic Reporting System"), the tool for logging events developed by EUROFLEETS, registered **58 operation events** during the cruise.

3. Narrative of the Cruise

Days before: 9 -10 September 2022

Quarentine of all the Lisbon boarding participants who organized a ZOOM to meet each other, learn about everyone's interests on the cruise and revise the cruise plan (Figure 2)

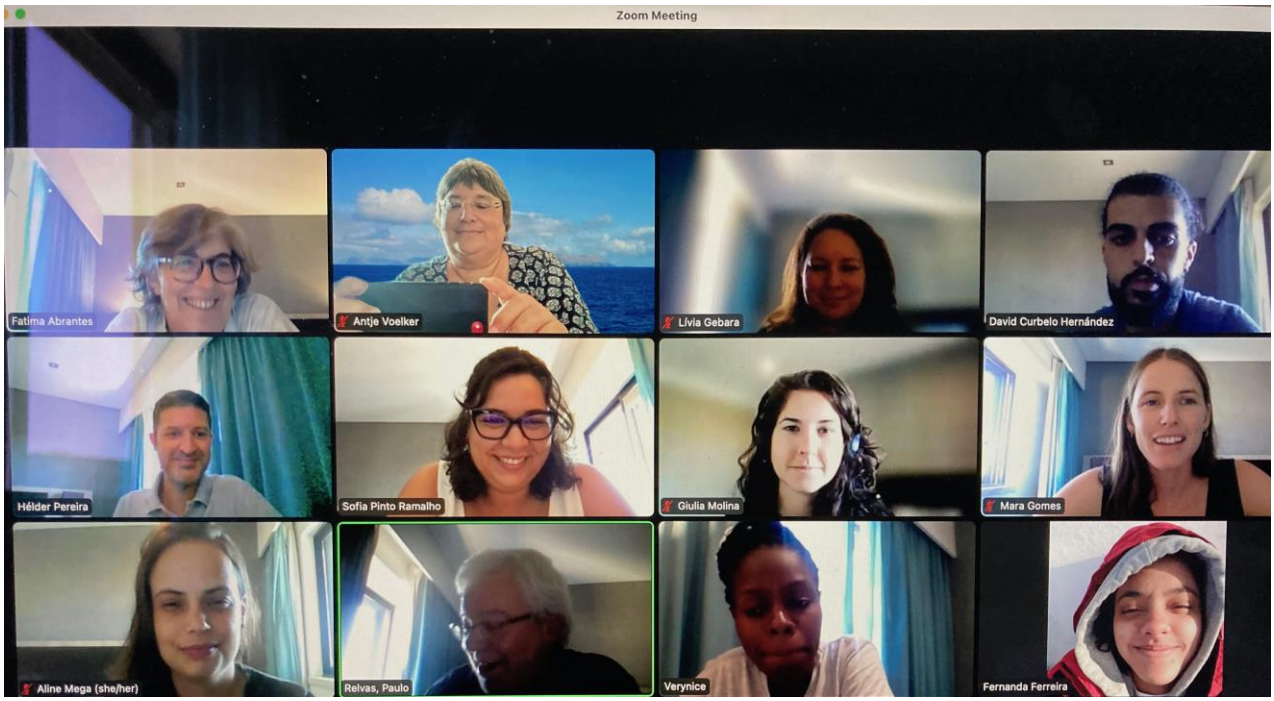

Figure 2 – ZOOM meeting of all the participants that barded Sarmiento de Gamboa in Lisbon.

Day 1: 11 September 2022

First day of sailing. Depart from Lisboa to the working area. Meteorological forecast adverts for adverse weather conditions approaching. Captain, chief technician, and chief scientist agree that working conditions are not going to be the best at the expected location. Therefore, a contingency plan is developed: we will depart from Lisboa as soon as possible this morning to reach the first stations before the storm to maximize the operational working time.

The boarding of the scientific personnel was rescheduled for the early morning after completing customs formalities (and verification of negative PCR-COVID results).

The decision was successful, and we reached the first station before sunset. There, working conditions were still acceptable for the following scientific operations. Most of the operations during the cruise required reaching the bottom (with CTD or with Box-corer), so the realization of these two first stations in relatively shallow depths, ~140 and 800 m respectively, was valuable training and experience.

Hourly schedule (UTC)

6:30 am: Embarkment of personnel in Lisbon (Rocha de Conde de Óbidos).

7:00 am Safety training on board

8:00 am Sailing from Rocha de Conde de Óbidos

10:00 am Preparation of equipment/sampling gear and laboratories before reaching station

11:00 am Sampling training aboard

Station 01 (37.2585302 N; -9.0768038 W; 143.58 mwd)

18:21 CTD 01

19:10 Multinet 01

19:53 Box-corer 01

Station 02 (37.3425105 N; -9.2955375 W; 828.29 mwd)

22:10 CTD 02

23:25 Multinet 02

Day 2: 12 September 2022

The day started while working in the second planned station. Sea conditions started to worse and after the end of BC002 operation (3:00 UTC) the contingency plan was initiated. Impossible working conditions due weather circumstances. It is decided that we would look for shelter East of Cabo Sao Vicente and the Algarve coast. All the docks south of Lisbon were closed to marine traffic.

We sail to the CCMAR mooring site (36º 50'N; 008º 55' W), located in an area SE of Cape St. Vincent, outside and away from the traffic sailing the Traffic Separation Device (TSD), to perform current measurement transects in its vicinity and a CTD cast. The periodic inspection of the mooring will happen soon, so, having high resolution measurements from the shipboard equipment will be of great use to calibrate and adjust tthe sensors installed in the mooring.

Hourly schedule (UTC)

Station 02 (37.3425105 N; -9.2955375 W; 828.29 mwd)

00:41 Box-corer 02

In between we did an ADCP calibration as close to the mooring as possible but within a safety margin

CCMAR station (36.8513008 N; -8.9280555 W. 170.79 mwd)

12:20 CTD 03

The forecast for the region outside the sheltering zone remained unfavourable for at least 24-36 more hours. The strong wind and high wave conditions were approaching our position in 12-18 hours, forcing the ship to remain close to the coastline. An opportunity to realize ADCP transects in the inner shelf of the northern margin of the Gulf of Cadiz, where the coastal counter-current is commonly found. The ADCP transects were done while sailing within a general eastern heading.

Day 3: 13 September 2022

On September 13, our position was close to the Ría Formosa, in front of Faro. There, we performed four oceanographic stations along longitude 007º 54,42' W.

Hourly schedule (UTC)

Faro 1 (36.9021393 N; -7.9066672 W; 103.15 mwd)

06:21 CTD 04

06:40 Box-corer 03

Faro 2 (36.8580265 N; -7.9067107 W; 339.82 mwd)

08:14 CTD 005

Faro 3 (36.799441 N; -7.9067352 W; 763.79 mwd)

09:39 CTD 06

10:33 Multinet 02

Faro 4 (36.762818 N; -7.906234 W; 653.91 mwd)

12:50 CTD 07

13:32 Microstructure Profiler 01

14:49 Vertical phytoplankton net 01

15:25 Multinet 04

16:24 Box-core 04

Once the operations along this fixed longitude ended, the crew members re-evaluated the forecast. Navigation was not a safety problem for the vessel, so the decision was to sail towards the outermost planned station (~20 hours, close to 200 nautic miles).Heading against the current wave and wind direction, we expected to reach the planned station after the expected passing time for the storm.

Day 4: 14 September 2022

Our next station was reached around mid-day and the observed conditions were now proper to work within the safety rules. It was the deepest planned station, more than 5000 m depth right in the Iberian Abyssal plain, so the bottom casts (CTD and BC) operations were quite long.

Hourly schedule (UTC)

ST03 SINES (37.9948028 N; -11.4276952 W; 5092.79 mwd)

15:23 Multinet

17:02 CTD 08 (shallow cast)

18:36 CTD 09 (deep cast)

22:05 Microstructure profiler PF 02

23:30 Vertical phytoplankton net PS 02

23:45 Box-corer 05

Day 5: 15 September 2022

As weather conditions were no longer a main concern and the scientific operations follow as expected. The training and experience gained in the first days allows for keeping a good working rhythm. Communication between crew members: bridge-technicians-scientist was really well stablished and helped to maintain the workflow.

The box-core operation failed. The lack of knowledge of the bottom conditions, and the impossibility to use a sub-bottom profiler, the corer is likely to have hit an outcrop. The equipment reaches the ship deck empty and slightly damaged.

Hourly schedule (UTC)

ST04 SINES (37.7415093 N; -10.6077805 W; 4334.44 mwd)

10:31 CTD 10 (shallow cast)

12:18 CTD 11 (deep cast)

15:20 Microstructure profiler PF03

16:42 Vertical phytoplankton net PS03

17:10 Multinet 06

18:55 Box-core 06 (failed)

Day 6: 16 September 2022

Operations followed as expected. Two complete stations were done in the same day.

The box-corer was repaired by the mechanical technician on board during the day.

Hourly schedule (UTC)

ST05 SINES (37.6626618 n; -10.3578787 W; 3182.88 mwd)

01:57 CTD 12

05:36 CTD 13

06:23 Microstructure profiler PF04

07:48 Vertical phytoplankton net PS04

08:19 Multinet 07

ST06 SINES (37.571529 N; -10.1256968 W; 2606.5 mwd)

12:28 CTD 14

13:43 CTD 15

15:52 Multinet 08

Day 7: 17 September 2022

Operations followed without incidents allowing to complete two stations in the same day.

The box-corer was once again ready to be used i (ST08) and two box-cores were recovered with success. Unfortunately, the winch engine broke down aafter recovering BC010 without possible repairing in situ.

Hourly schedule (UTC)

ST07 SINES (*37.4931948 N; -9.824654 W; 3337 mwd*)

04:02 CTD 16

6:33 Multinet 09

07:50 Vertical phytoplankton net PS06

08:10 Microstructure profiler PF06

ST08 SINES (*37.358897 N: -9.4106298 W; 1081 mwd*)

12:08 CTD 17

13:16 Multinet 010

14:35 BC009

16:12 BC010

18:13 Microstructure profiler PF007

Day 8: 18 September 2022

The main objectives of the cruise in the initially selected area were fulfilled. The project proposal considered the possibility of changing the plan on the basis of satellite information analyzed by the remote participants. With t he information that a thermal front was developing SE of Cape Roca, we decide to sail North to evaluate the promising upwelling front. When reaching the site, y the Portuguese Navy communicated the impossibility to work in the area due to submarine military exercises in the zone. Without authorization to proceed with any scientific research activities or any other type of work in the area comprised between 40ºN and 37.33ºN.we returned to the southern limit to revisited the location of our first two stations (ST01 and 02 "BIS").

Day 9: 19 September 2022

Hourly schedule (UTC)

ST01BIS SINES (*37.2504442 N; -9.073754 W; 140 mwd*)

07:49 CTD 18

08:15 Multinet 011

08:50 Vertical phytoplankton net PS07

09:49 Microstructure profiler PF008

ST02BIS SINES (*37.32 N; -9.25 W; 830 mwd*)

13:22 CTD 19

14:34 Multinet 012

15:42 Vertical phytoplankton net PS08

16:15 Microstructure profiler PF09

Day 10: 20 September 2022

We depart from the last working position towards Lisboa at the end of the last operation to reach the dock the following morning.

Hourly schedule (UTC)

7:00: Lisboa pilot aboard

8:00 am Disembarking from Rocha de Conde de Óbidos

9:00 Samples and equipment material disembarked

End of the cruise.

4. Methodology

This section presents a summary of the main instruments used during the cruise and the sampling procedures.

4.1 Hullmounted Ship Acoustic Doppler Current Profilers (SADCPs)

Two Teledyne RD Instruments Ship Acoustic Doppler Current Profilers (SADCPs) Ocean Surveyor model, are installed on the Sarmiento de Gamboa in a hull (“***quilla***”) that can be lowered at 10m below the surface: one at 75kHz and one at 150kHz (called OS75 and OS150 respectively). Both were launched at the start of the research cruise and kept alive during the entire track (Figure 1). The two SADCPs work simultaneously, sampling the ocean currents till approx. 900 m deep, with increased detail in the upper 300 m (approx.). For sensitive regions, when it was necessary to define the flow field with higher detail, sampling proceeded at lower ship speed, avoiding accelerations, to increase the quality of the ADCPs data. An independent file with the ship attitude and the GPS track was recorded to integrate with the ADCPs file. ADCPs data will be processed on land until the end of the first trimester of 2023, using the Python based software CODAS – Common Oceanographic Data Access System (https://currents.soest.hawaii.edu/uhdas_home/) to clean for high frequency oscillations and obtain the vertical profile of the currents relatively to Earth. Some preliminary plots of the 75 kHz broadband Ocean Surveyor ADCP velocities, regarded as examples of the deeper data processing that will follow, are displayed below.

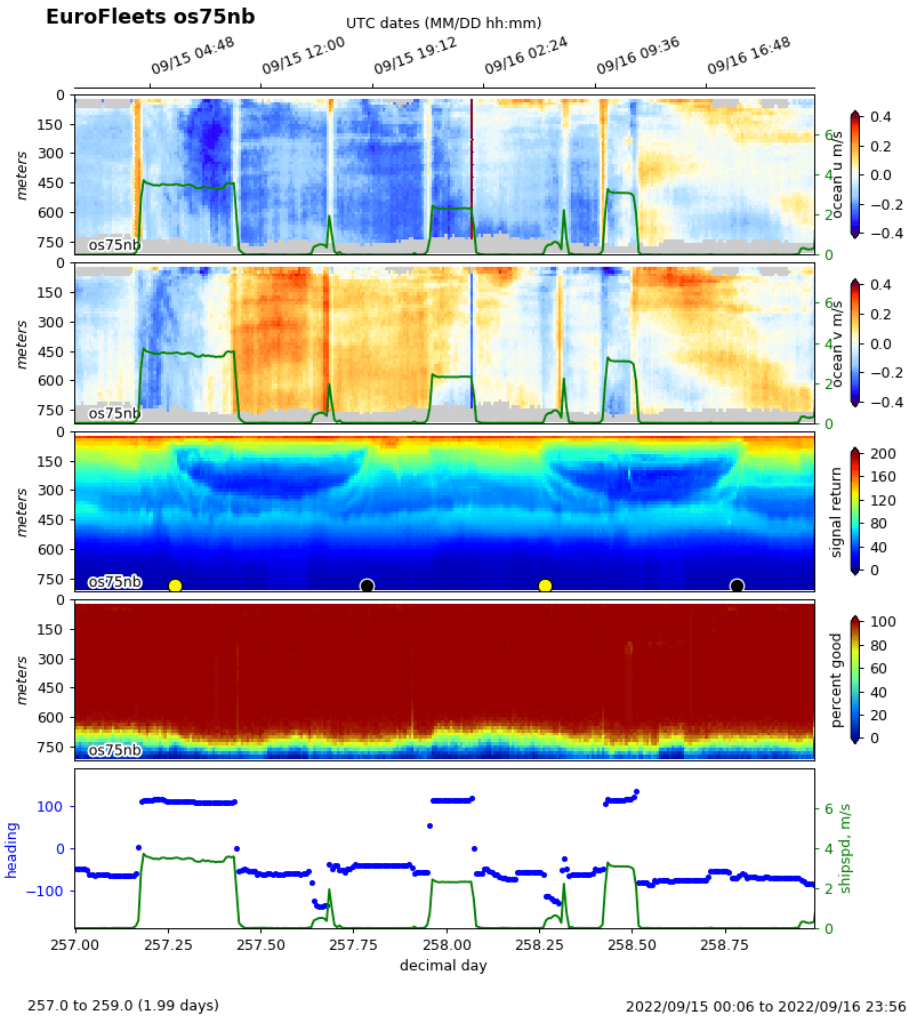

Figure 3 (previous page) – From top to bottom we have: The zonal and meridional velocities of the current along the water column, the intensity of the return acoustic signal, the percentage of good returns, and the heading and the speed of the ship, showing the steaming periods and on station periods. Notice the good return percentage till over 700 m deep. The displayed period is about 2 days.

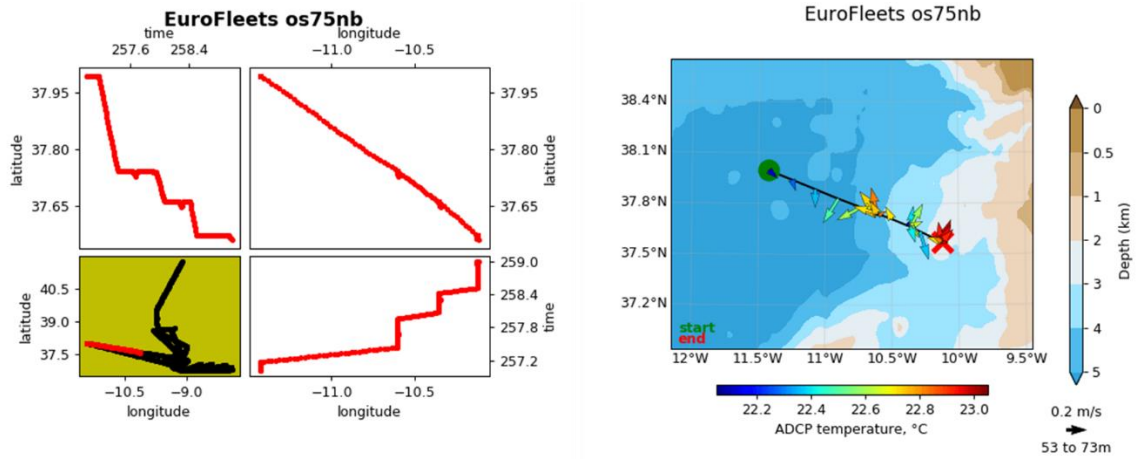

Figure 4 – Left: details of the ship track during the displayed period. The entire ship track is displayed in the bottom left panel, with the displayed track in red. Right: the plan view of the average currents in the 53 – 73 m depth bin, along with the water temperature.

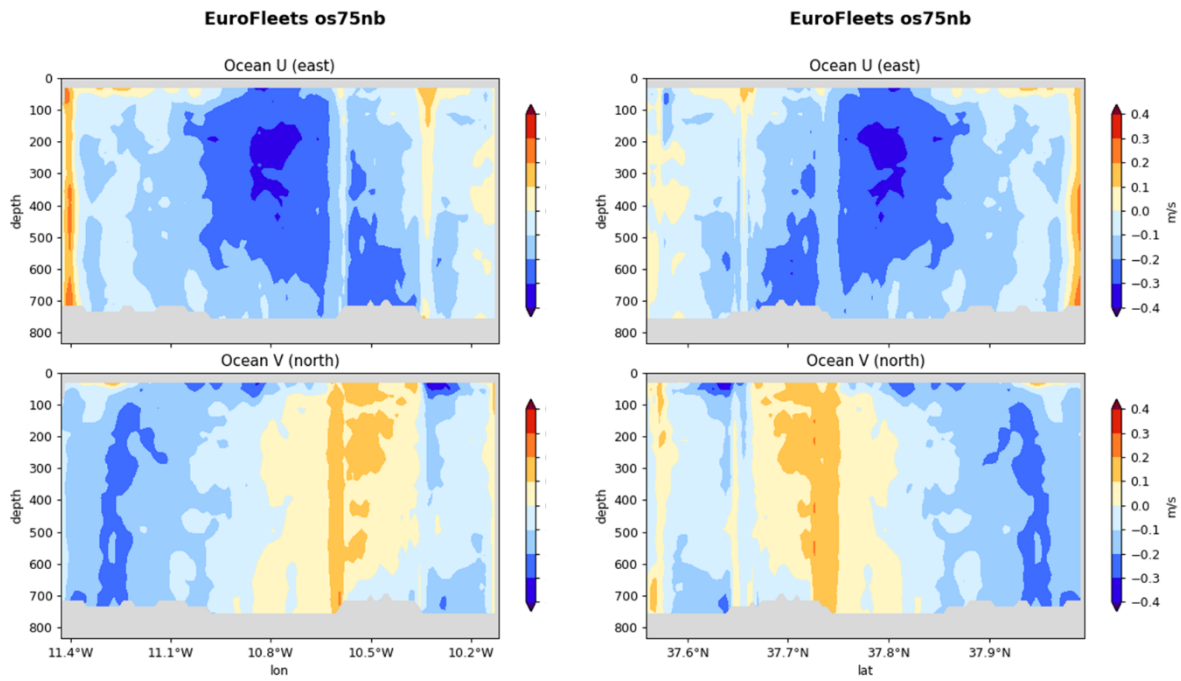

Figure 5 – Top: The zonal component of the current velocity, displayed along the longitude (left) and latitude (right). Positive velocities are towards east. The meridional component of the current velocity, displayed along the longitude (left) and latitude (right). Positive velocities are towards north.

4.2 CTD operations

A CTD model Sea-Bird SBE911 equipped with temperature, conductivity, pressure (digiquartz with TC), fluorescence (WET Labs ECO-AFL/FL), transmittance (Chelsea/Seatech), dissolved oxygen (SBE 43) and PAR (Biospherical/Licor) sensors was used. The CTD operations were controlled by the standard software provided by the instrument manufacturer (Sea-Bird Scientific). Real-time visualization of the data is provided to overview and define the sampling levels to close the Niskin bottles mounted in the rosette sampler, and retrieve the water mass of interest.

The complete list of sensor and the latest calibration date are the following:

- CTD SBE 9 Plus 0851 (13/03/2020)
- Temperature Sensor 1º SBE 3P 4747 (06-Feb-20)
- Conductivity Sensor 1º SBE 4C 3361 (06-Feb-20)
- Temperature Sensor 2º SBE 3P 4746 (06-Feb-20)
- Conductivity Sensor 2º SBE 4C 3357 (06-Feb-20)
- Voltage 0 Sensor Oxigeno SBE43 0707(31-Oct-18) (replaced since cast 004)
- Voltage 0 Sensor Oxigeno SBE43 1072 (31-Oct-18) (replaced since cast 004)
- Voltage 1 (Free)
- Voltage 2 Fluorometer Sensor Wetlabs FLNRTU 3508 (12-Apr-16)
- Voltage 3 Turbidimeter Sensor Wetlabs FLNRTU 3508 (12-Apr-16)
- Voltage 5 Transmissometer Sensor CST-1082DR (15/06/16)
- Voltage 6 Altimeter PSA-916

A first stage data processing was carried out using the SBE Data Processing system and software (Seasave 7.26.7.121, Figure 6). That system includes the conversion of the data into ASCII files, the application of operations to reduce inherent noise, to bin data and compute derived variables and a preliminary display of the vertical profiles and TS diagrams. Detailed processing of the data with specific software allows for further investigation of the water masses (Figure 7) or other specific information according to the objectives, like for example, the depth of the chlorophyll maximum according to the fluorescence sensor. A processed *.cnv file per cast was created with Seasave V7.Metadata and SBE Data Processing routines info included in the header of each cnv file. Variables included: Pressure (Digiquartz, db), two channels for each Temperature (ITS-90, deg C), Conductivity (uS/cm) and Salinity, Practical (PSU); dissolved oxygen raw, SBE 43 (V) and (umol/kg), Fluorescence (mg/m^3), Turbidity (NTU), Beam Transmission (%) and Attenuation (1/m), PAR/Irradiance (umol photons/m^2/sec), Potential Temperature (ITS-90, deg C), Density (density, kg/m^3), Latitude and Longitude (deg), oxygen Saturation, Garcia & Gordon (umol/kg) and Time (seconds).The complete list of CTD profiles is included in the Annex I – CTD profiles.

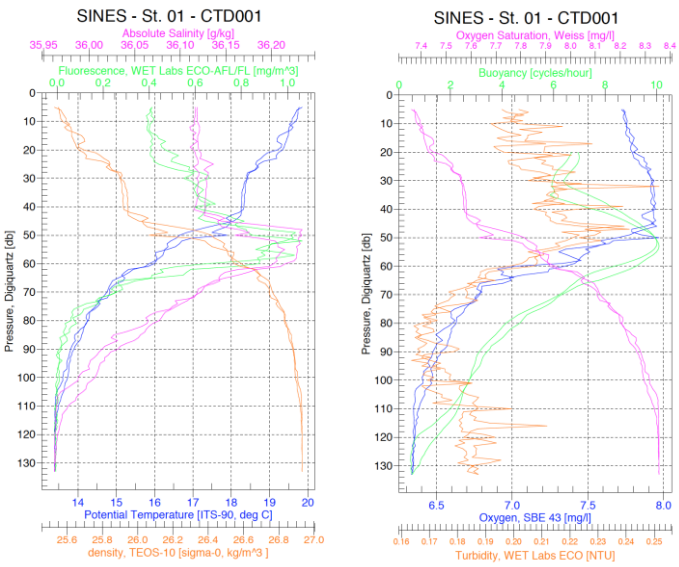

Figure 6 – Example of the CTD sensors data for Temperature, Salinity, Fluorescence, Density, Oxygen saturation, Oxygen SBE, Turbidity and Buoyancy at Station Sines01.

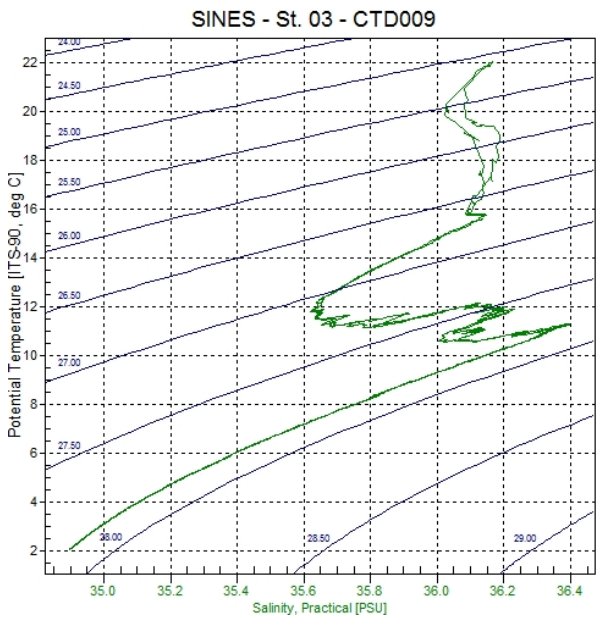

Figure 7 – TS diagram for station SINES03

4.3 Seawater sampling with the Rosette system

A CTD-Rosette equipped with 24 Niskin 12-liter bottles was used to obtain the water samples. The bottles were closed at different depths for sampling of different parameters. To determine the number of bottles needed for each selected depth level at each station (Table 1) a plan considering the number of parameters and number of depth levels to sample for each parameter was prepared

in advance. Depth levels were chosen during the upcast CTD on the basis of the info acquired during the downcast.

Sampling Sheet

Cruise :	**SINES**			*Station :*	*4*		*Date (dd/mm/yy):*	*11/09/22*		*Depth :*	1XX												
Ship :	Sarmiento de Gamboa			*Cast :*	*shallow*		*Start sampling (hh:mm) :*	*00:00:00*	*End sampling (hh:mm):*		1:38:00												
Bt.	CTD Pressure	Oxygen		pH	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Mara	Bt.	Comments
		Flask	Samp T.																				
1	250.0	53	12.9	1.0			64.0				1					.	.					1	
2	250.0									.	2											2	
3	250.0									.	3											3	
4	250.0										4			.								4	
5	250.0										5											5	
6	200.0	54	13.4	6.0		1.0		157.0			6				.	.	.					6	
7	150.0	55	14.1	7.0							7				.	.	.					7	
8	100.0	57	14.8								8				.	.	.					8	
9	DCM-75	58	15.5	9.0	11-2	2.0	65.0				9				.	.					.	9	
10	DCM-75										10			.								10	
11	DCM-75								.	.	11	.	.									11	
12	DCM-75										12							.		.		12	
13	DCM-75										13								.			13	
14	50.0	60	17.0	14.0	13-4	3	66.0	158			14					.	.				.	14	
15	50.0										15			.								15	
16	50.0								.	.	16	.	.									16	
17	25.0	61	21.2	17.0							17											17	
18	25.0										18					.	.				.	18	
19	surface										19											19	
20	surface	62	22.3	20.0	15-6	4.0	67.0				20				.	.	.					20	
21	surface										21			.							.	21	
22	surface								.	.	22	.	.									22	
23	surface										23								.			23	
24	surface										24							.		.		24	
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco	Bt.	Comments

Table 1 – Example of Water Sampling Sheet Plan (Station 04 CTD010)

During the 19 hydrological stations, **456 Niskin bottles were closed.** The sampling of the different variables followed the strict order given in Table 1. When on deck, bottles were carefully sampled by the different participants to collect the amount of water needed for their analysis under the supervision of another participant who confirmed amounts and noted the flask number used for each analysis (Figure 8). The detailed samples collected by variable in each station and depth are listed in the Annex II – List of samples collected with the rosette sampler.

Figure 8 – Seawater sampling from the CTD-Rosette system with 24 Niskin bottles of 12 L each. Sea water collected at different levels is retired from the bottles by the different research groups according to the plan presented in Table 1.

4.3.1 Sampling for Dissolved Oxygen (DO)

Samples of dissolved oxygen were **collected at all stations**. The O_2 samples were always the first to be collected from the Niskin bottle. Samples were collected in calibrated flasks (~120 mL) with a PVC pipe and avoiding bubble formation. Sample fixation (precipitation) was done by adding 0.6 mL of manganous salt ($MnCl_2 \cdot 4H_2O$) and 0.6 mL of alkali-iodide solution (NaOH + NaI). These samples were stored in the dark at least 18 hours before being measured. Then, 1 mL of sulphuric acid is added to dissolve the precipitate and to titrate the O_2 sample with thiosulfate 0.01N using an automatic 5 mL burette "Titrando Metrohm". Taking into account the stoichiometry and the volume of thiosulfate used, O_2 concentration is calculated in µmol kg-1. The O_2 samples were analysed following the widely applied Winkler method (Langdon, 2010). The main purpose is to know oceanic ventilation and infer primary production/remineralization processes in the sunlit layer and additionally for calibrating the O_2 sensor of the CTD. A total number of **199 samples for dissolved oxygen** have been processed aboard. Data processing and quality control of chemical data is expected in early 2023.

4.3.2 Sampling for pH

Seawater pH samples were taken at all depth levels **and at all the stations** inmediatly after the sampling for dissolved oxygen. Best practices for ocean CO_2 measurements were followed (Dickson et al., 2007). pH samples were taken directly from the Niskin bottles into special optical

glass spectrophotometric cells of 28 mL and 100 mm of path length. Bubble generation was avoided at all time during the sample collection process as this can compromise sample integrity. These cells were carefully stored in a thermostatic bath at 25.0ºC approximately one hour before the analysis. pH measurements were performed using the spectrophotometric method (Clayton & Byrne, 1993). This method consists of adding 75 µL of m-cresol purple to the seawater sample and measuring its absorbance at 3 wavelengths, i.e., λHI =434 nm; λI =578 nm and λnon-abs=730 nm. Absorbance measurements were performed with a Perkin Elmer Lambda 859 UV/VIS spectrometer. pH values were calculated including a correction due to the difference between seawater and the indicated acidity. A total number of **196 samples** have been processed aboard **for pH**. Data processing and quality control of chemical data is expected in early 2023.

4.3.3 Sampling for particulate and dissolved organic matter (POM/DOM)

Sampling planning for particulate (POM) and dissolved organic matter (***DOM***) was more intense in the surface levels. The procedure followed best practices for analysis of dissolved organic matter in seawater samples by Halewood et al., (2022). For DOM, previously clean amber vials (20 mL) with polypropylene caps were rinsed and filled with the sample after filtering (volume filtered ~1L). Immediately after, the samples were acid-leached with phosphoric acid (H3PO4) and stored in frozen (-20ºC) conditions. The GFF filter will be analyzed for POM. A total of **76 samples for DOM** are going to be measured on land using high temperature combustion analysis an IRGA Shimadzu TOC5000 analyzer. A total of **42 POM samples** are to be measured on land using a CNH elemental analyzer. Data processing and quality control of POM/DOM data is expected in winter 2023.

4.3.4 Sampling for total alkalinity (TA)

Samples for total alkalinity (TA) were taken at **all the stations** along the cruise section in **a total of 66 samples**. Clean borosilicate glass bottles (600 mL) were rinsed and filled from the bottom using a silicon tube, overflowing half a volume with the help of a silicone tube between the Niskin output and the bottom of the flask. After rinsing the flask thoroughly with the sample, the flask is slowly filled and the bottle overflowed by a considerable volume. Finally, a headspace should be created within the bottle: while this can be neglected for pH samples, for CT and AT a 1% volume headspace is necessary. Samples were stored before the on-board analyses. Measurements of AT were done by an endpoint method using an automatic potentiometric titrator (Dosino 800 Metrohm) with a combined glass electrode (Fontela et al., 2022). There was enough sample at each bottle to perform 2-3 titration replicates. A Knudsen pipette (~186 mL) was used to transfer the samples into an open Erlenmeyer flask in which the potentiometric titration was carried out with HCl (0.1 M). The final volume of titration was determined by means of two pH readings after the endpoint of 4.3 is reached. These AT measurements were done in 3 sessions of analysis. In order to estimate the accuracy of the AT method, we measured the certified reference material (CRM) of CO_2 from CRM Batch number 173 provided by Dr. Andrew Dickson. In addition, an extra calibration (substandard) was made by using a closed container of 75 L filled with open ocean surface water. The repeatability of both CRMs and substandards was on average better than 0.03%. Data processing and quality control of chemical data is expected for early 2023.

4.3.5 Sampling for dissolved inorganic nutrients

Samples for dissolved inorganic nutrients were withdrawn to 30 mL solid-polyetilene containers after rinsing twice with the sample water. Samples were taken in duplicate and preserved frozen at -20ºC until its analysis on land expected in the autumn 2022. A total of **141 samples for inorganic nutrients** have been collected. Data processing and quality control of the data is expected in early 2023.

4.3.6 Sampling for salinity calibrations

The bottles in which the salinity samples are collected and stored are 120 ml Boston Round, int glass bottles with screw caps equipped with Poly-Seal cones to prevent leakage and evaporation. Each bottle is rinsed three times with 30-40 ml of sample water and is then filled only to the shoulder of the bottle. The cap is thoroughly rinsed before being tightly screwed onto the bottle. Samples were measured aboard with a Guildline Autosal Salinometer. A total of **62 salinity samples were processed on board** to calibrate ***in situ*** the CTD sensors (Kawano et al., 2010). Data processing and quality control of chemical data is expected in early 2023.

4.3.7 Sampling for Total and fractional chlorophyll a (***Chla***) concentration

During the oceanographic cruise, samples were collected to determine the amount of Chla in the photic layer of the water column. These Chla levels will also be studied in two size fractions, >2 µm and between 2-0.2 µm. Seawater was collected at three levels at each station: surface, deep chlorophyl maximum (DCM) and a variable depth (within the photic zone). Approximately 500 mL of seawater were collected from each depth. Each sample was pre-filtered through a 200 µm mesh and vacuum pump filtered through 2 µm and 0.22 µm polycarbonate (PC) filters. Then, the filters were stored at -20 ºC until subsequent fluorometric analysis in the onshore laboratories. Its analysis on land is expected for autumn 2022. A total **of 78 samples for Chla** have been collected. Data processing and quality control of this data is expected in early 2023.

4.3.8 Sampling for taxonomy of the phytoplankton community

Taxonomy samples of the phytoplankton community were collected at every station at two depth levels: surface and deep chlorophyl maximum (DCM). Two different fixation methods for sample preservation were used (Lugol 1% and Glutaraldehyde 2%) for each sample. The sample was collected directly from the Niskin bottle, after rinsing the amber glass container (125 mL) with the sample seawater. Then, we add around ~1-1.5 mL of Lugol with a plastic Pasteur pipette, close bottle, shake gently and store in the dark. In the case of 2% Glutaraldehyde we add 9 mL of 25% Glutaraldehyde to a 100 mL sample using disposable plastic pipettes within the fume hood. We close the bottle, shake gently and store the bottles at 4°C until laboratory analysis. Furthermore, one vertical net phytoplankton with 20 µm mesh was done at most stations from DCM to surface. Once on board, the sample was collected into two Falcon 50 mL vials and fixed with 1% Lugol and

2% GLU following the above described protocol. A **total of 56 samples were collected for taxonomy analysis.** The analysis of this biological samples data is expected in early 2023.

4.3.9 Sampling for flow citometry

Seawater samples were also collected for flow cytometry methods to determine abundance and identification of plankton groups. Samples collected with a silicone tube from Niskin bottles from different depths were filtered by 200 µm. For shallow water samples (up to 500 m) a small aliquot of 1.8 mL was collected in duplicate. For deeper water samples (until 5000 m depth) a single 10 mL sample per depth was collected. Samples were fixed with 180 µl of P+G in a 1:10 ratio of final volume. After a short incubation in the dark (10 min) with the fixative agent the samples were cryopreserved in liquid nitrogen for at least another 30 min and subsequently stored at -80°C until further analysison land. The **total number of samples collected for flow cytometry analysis was 82.** The analysis of this biological samples data is expected in early 2023.

4.3.10 Sampling for the extraction of DNA

Large volumes of seawater were collected at different depths in the water column using Niskin bottles attached to the CTD rosette. All seawater samples were initially pre-filtered by 200 µm. For samples shallower than 500 m, between 2-4 L per replicate (4 replicates) were collected and filtered using silicone tubes and peristaltic pumps through 0.22 µm STERIVEX filters/cartridges. For deeper samples (depth range between 1000-5000 m), between 12-36 L per sample (single replicate) were filtered with a peristaltic pump system through a 250 mm diameter 0.22 µm mesh PC filter. Filters were then immersed in liquid Nitrogen and subsequently stored at -80ºC until further analysis on land. **A total of 165 samples were collected for DNA analysis.** The analysis of this biological samples is expected in spring 2023.

4.3.11 Sampling for Biological Nitrogen fixation

Water samples were retrieved from the Niskin bottles in a 12L Nalgene bottle for each depth prefiltered by 200 µm to avoid predation by zooplankton. Biological nitrogen fixation was analysed following the $^{15}N_2$ tracer addition technique (Montoya et al., 1996). A t_0 was filtered to calculate seawater $^{15}N_2$ concentration. Three replicates were stored for incubation in 1L Nalgene bottles carefully closed and guarantying the extraction of all the bubbles. Furthermore, 3mL of $^{15}N_2$ tracer gas was injected in each bottle and settled for incubation at the conditions in which those samples were taken (temperature and light). The incubation system was installed on the deck (Figure 9) with the possibility of achieving three temperature and light conditions. Usually, surface temperature, deep temperature, and a combination of both are used to achieve the deep chlorophyll maximum (DCM) water temperature. After 24 hours of incubation, the samples were filtered through GFF 0.7 µm filters and stored at -20ºC (White et al., 2020).

132 samples for biological nitrogen fixation have been taken. At each station 4 depths were selected; Surface, DCM, 50 metres and an aphotic level that varied between 200 and 700 metres.

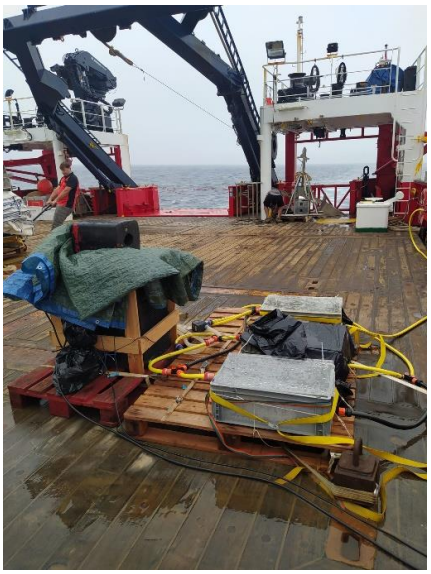

Figure 9. Incubation system for Biological Nitrogen fixation installed on deck aboard the R/V Sarmeinto de Gamboa during the EF+ SINES cruise

4.3.12 Sampling for O and C isotopes

Seawater samples were collected directly into 10 cc crimp top vials from a Niskin bottle, generally from every water level sampled by the Rosette. One series is collected for $\delta^{18}O/^{2}H$ analyses and the other for $\delta^{13}C$-DIC analyses. After collection, the vials are closed with crimped lids and stored in the refrigerator, whereby the $\delta^{13}C$-DIC samples are being poisoned with 20 l of saturated mercury chloride solution before closing. In addition to the regular series, 10 additional $\delta^{18}O/^{2}H$ and $\delta^{13}C$-DIC samples, respectively, were collected at the surface level of Station 26SG-Sines/CCMAR, at the bottom level of station 26SG-Sines/FARO3 (MOW level) and at the bottom level of station 26SG-Sines/003 for an international inter-calibration exercise.

A total number **of 203 samples were collected for $\delta^{18}O/^{2}H$ and 205 for $\delta^{13}C$-DIC analyses**, respectively. The samples will be analyzed by the DivGM-IPMA/CCMAR team with Antje Voelker as primary leader. Initial $\delta^{13}C$-DIC data should be available by spring 2023, with the $\delta^{18}O/^{2}H$ analyses following in the subsequent months, depending on funding availability. The inter-calibration samples will be distributed to laboratories within Europe, the USA and potentially China and India.

4.3.13 Sampling for Trace Elements

Seawater samples were collected 2 X 40 ml at specific levels for trace element analysis. The water samples were filtered through Millipore Steriflip Sterile filters. All **99 samples** will now go to IPMA to be treated by Emília Salgueiro and Andreia Rebotim.

4.3.14 Sampling for Biomarkers

To explore the value of different types of biomarkers for phytoplankton groups identification, 12 L water samples were filtered through 0.45 µm Glass Filters previously muffled. The selected depths were the surface, Deep Chlorophyll Maximum and the deepest level at each station. Samples are preserved frozen. The **44 samples** taken from all SINES, FARO and CCMAR stations, will now be treated and analyzed at IPMA by Lívia Gebara.

Figure 10 – Filtering water samples for biomarkers and toxins.

4.3.15 Sampling environmental DNA (eDNA)

Three subsamples of 2 L seawater from discrete water depths within the top 200 m and the deepest depth of each profile were filtered for metabarcoding, and metatranscriptomics analysis of environmental DNA. Water was filtered by means of vacuum pump through 0.45 µm nylon member filters immediately after being on board, and filters were kept frozen. These samples will now be taken to CCMAR to be analysed by the group of Ester Serrão.

4.3.16 Sampling for phytoplankton toxines

Water samples were collected from all stations at the surface and the Deep Chlorophyll Maximum depth, for the determination of marine toxins (e.g., domoic acid). **A total of 33 samples** were filtered through ±0.45 µm Wathman®GF/F glass microfibre filter (47 mm diameter). Both the filter and the filtered water were maintained frozen at -20°C and will be treated at IPMA-Algés by Pedro Costa.

4.3.17 DNA Dinoflagellates

With the objective of collecting dinoflagellate cells for DNA analysis of this phytoplankton group, 10 L of seawater were passed through a 20 µm net. However, after the first two stations the amount of material left on the net was practically inexistent. After contacting Sofia Ribeiro and Kenneth Mertens, the responsible for these analyses, we started collecting all the water between the surface and 300m that was left over. Again, after filtering the Faro 1 station, not enough material was retained on the net, and the collection of water for this parameter was aborted.

4.3.18 Sampling for coccolithophores

Seawater samples were collected at discrete water depths along the photic zone on the basis of the CTD profile for each station, on a total of 15 stations. A total amount of 68 coccolithophore samples were taken from the Niskin-bottles at 5 m, 25 m, 50 m, 75/100 m and bottom nepheloid layer (BNL). Furthermore, pigment samples on a total of 30 samples were collected from 5 m and the Deep Chlorophyll Maximum (DCM). Collection time usually took place early in the morning. The filtered material for coccolithophores will be used for studies on communities using a polarizing light microscope (Figure 11). Species composition and abundance will be determined by identification and counting on measured filter transects.

4.3.19 Sampling for high performance liquid chromatography (HPLC)

For pigment analysis, 2L of water were filtered through glass microfiber filters (47 mm diameter, 0.7 mm pore size) using the same filtration system that for coccolithophores. After filtration, filters were immediately stored in -80°C. The filtered material will be used for studies on the distribution and composition of phytoplankton biomass and community composition using High Performance Liquid Chromatography (HPLC).

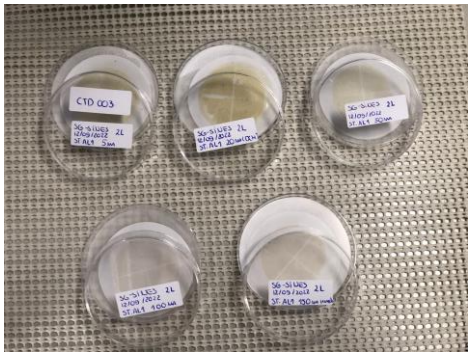

Figure 11 – Filter residues obtained after the filtration of the samples for coccolithophores.

4.4 Vertical Multinet hauls for zooplankton

To characterize different groups of planktonic foraminifera and current living species, these organisms were collected from multiple different depth intervals with a multinet system operating in vertical tows. A multiple opening/closing plankton net sampler (multinet), manufactured by

Hydrobios and using the Maxi version that can operate up to 9 nets per haul, was used to collect planktonic foraminifera and pteropods from the upper water column (Figure 12).

Instrument type and sensors: Multinet "Maxi" HYDRO-BIOS (serial no. 128 08 10). Pressure sensor KELLER/ PA-8/ 8467.8/ SN 180073. Temperature and conductivity sensor SST/1618.

Data processed with OceanLab 3, the data acquisition software for HYDRO-BIOS Instruments. Metadata included in the header of each file. Variables included: Time (hh:mm:ss), Number of net, pressure (dbar), Volume (m^3), Flow in (m/s), Flow out (m/s), flow ratio (%), Temperature (°C), Conductivity (mS/cm), Salinity (PSU), Sound Velocity (m/s), density (kg/m^3), Spec. Cond. (mS/cm), Pitch and roll (°).

Figure 12 – Multinet arriving on deck (left) and sampling operation (right)

The plankton nets have a mesh size of 100 µm. The multinet was hauled vertically opening and closing the plankton nets at pre-defined water depths, i.e., each net sampled/filtered seawater across a specific depth interval. During the campaign 4 to 9 nets (generally 6) were used with the deepest sampling interval starting between 100, 450 and 700m, respectively, depending on the depth of the seafloor and the hydrographic conditions. For each plankton net, the filtered material is collected in a sample cup fixed to the end of the net. After the multinet has been brought back on deck, the material collected in a sample cup is transferred into a 250 ml plastic bottle, respectively, and frozen at -20°C.

A total number of **69 samples were collected during 12 vertical multinet operations**. The frozen samples will be stored at the DivGM of IPMA (Alges, Lisboa, Portugal) and analyzed by members of the DivGM-IPMA/CCMAR team or their students in the upcoming months, depending on funding availability. The complete list of samples by depth is included in Annex III – List of multinet samples.

4.5 Sediment Sampling

Due to technical difficulties, the two box-cores initially planned were only possible in two stations (Stations 6 and 8). As such, the paleogroup and the micro and macro benthic communities' groups have divided most cores (Figure 13).

Figure 13 – (left) Example of a box-core sampling strategy; (right) Washing sediment through a 250 µm mesh for micro and macro benthic communities' separation.

4.5.1 General Sediment Sampling for Proxy Calibration

Sediment samples were obtained with a Giant Box-Corer of 50 * 50 * 50 cm. Box-cores were retrieved at stations listed in the Table 2.

BOX CORE LIST

		Location					Surface Samples										Macrofauna	
Station nº	ID	Latitude (N)	Longitude (W)	Water Depth (m)	Core Height (cm)	Nº Subcores (110 mm diam)	DNA Dinos (spoon)	Revival Dinos (spoon)	DNA microfauna (spoon) UA	Arquivo (100 cc)	Benthic Forams (75 cc)	Planktonic Forams (75 cc)	Texture (25 cc)	Biomarkers (25 cc)	Org + Geochemistry (25 cc)	Diatoms + Coccos + Ostracods (25 cc)	Macrofauna Sampling intervals	Sampled Surface Area
SINES 1	26SG SINES 01 BC01	37.2585357	-9.0767942	142	18	4	X	-	X	X	X	X	X	X	X	X	0-3; 3-5; 5-10; 10-20	1/2
SINES 2	26SGSINES 02 BC02	37.3425052	-9.2955335	830	46	4	X	X	X	X	X	X	X	X	X	X	0-3; 3-5; 5-10; 10-21	1/2
FARO 1	26SG FARO 1 BC03	36.9022888	-7.9068797	102	49	4	X	X	X	X	X	X	X	X	X	X	0-5 Bulk	1/2
FARO 4	26SG FARO 4 BC04	36.7619028	-7.9060038	656	37	4	X	X	X	X	X	X	X	X	X	X	0-5 Bulk	1/2
SINES 3	26SG SINES 03 BC05	37.9949448	-11.4283537	5091	43	4	X	X	X	X	X	X	X	X	X	X	0-3; 3-5; 5-10; 10-20	1/2
SINES 4	26SG SINES 03 BC06	37.7411037	-10.6078577	4335	FALHOU													
SINES 6	26SG SINES 06 BC07	37.5713173	-10.1255752	2068	38	0											0-3; 3-5; 5-10; 10-20	1
SINES 6	26SG SINES 06 BC08	37.5712913	-10.1255702	2608	38	6	X	X	X	X	X	X	X	X	X	X		1/4
SINES 8	26SG SINES 06 BC09	37.3588957	-9.4106272	1081	56	0											0-3; 3-5; 5-10; 10-15	1
SINES 8	26SG SINES 06 BC10	37.3589107	-9.4106272	1081	56	6	X	X	X	X	X	X	X	X	X	X		1/4

Table 2 List of box-cores and sub-samples

As soon as the crew technicians immobilized the heavy box corer, the water over the sediment was siphoned off and passed through a 250 µm mesh to retain any living organisms in suspension.

After the maximum length of the retrieved sediment was measured, the sediment surface was pictured with an ID card , and a quick description of the sediment was noted on the sampling form. The first procedure after description was the sampling with a sterilized spoon of a sample for sedaDNA, microbial DNA and a sample for a dinoflagellates revival experiment. Several frames of known area and 1 cm thick were then placed in the upper part of the sediment to collect the topmost sediment to analyse:

1 Archive sample:	(1x) 10x10 (100 cm^3);
2 Texture:	5x5 (25 cm^3);
3 Planktonic Foraminifera:	5x5 (25 cm^3);
4 Diatoms; Coccolithophores; Ostracods	5x5 (25 cm^3);
5 Benthic Foraminifera:	7x7.15 (50 cm^3);
6 $CaCO_3$+Geochemistry:	7x7.15 (50 cm^3);
7 Biomarkers:	7x7.15 (25 cm^3).

On the rest of the same half of the box, 4 PVC liners of 110 mm diameter (subcores) were introduced into the sediment. These 4 subcorers will be later sliced in 1 cm thick sediment slobs to be analysed for the same parameters for which surface samples were recovered. The material will now be sent to IPMA for further subsampling and distribution by the different groups referred on the initial proposal. Insights gained from this study will ultimately contribute to calibrate the ecological preferences of the target organisms and their potential as environmental proxies for past conditions at the Iberian Continental Margin. The complete sampling form for all the on-board processed cores is available in the Annex IV – Box-corer forms.

4.5.2 Micro and macrofauna Communities

Sediments were sampled for the study of micro- and macrofauna by means of the box-corer. Once the box-corer was on deck, the overlaying water was siphoned through a sieve of 250 μm and the retained fraction was transferred to a labelled vial with 96% Ethanol. After all the water was removed the surface was photographed. A spoon of surfaced sediments was collected into a sterilized plastic bag and eminently frozen at -20°C. Whenever possible dedicated box-core were fully sampled for macrofauna studies, but in the cases where the box-core sediments needed to be shared, approximately half the core was used to study macrofauna. In both situations, any evident large macrofauna individuals were first removed (Figure 14) to avoid further damage and transferred to a vial with 96%ethanol, followed by sediment slicing into four layers: 0-3cm, 3-5cm, 5-10cm and 10-20cm. Each layer was washed on deck through a sieve of 250 μm and the remaining sediment fraction transferred to labelled plastic containers with 96%ethanol. In total 8 box corers were sampled for both micro- and macrofauna communities. The samples will be processed at the University of Aveiro (Portugal) under the responsibility of Clara Rodrigues.

Figure 14 – Examples of echinoid specimens found on Box-core SINES01 (left) and SINES06 (right).

4.6 Vertical plankton net

One vertical plankton net was done at eight stations from deep chlorophyl maximum (DCM) to surface. The full list can be seen in the "Station list" section and in Figure 1. Concentrated phytoplankton samples were obtained by vertical trawling between the surface and DCM m with a 20 µm mesh Apstein type net. Once on board, sample was collected into two Falcon 50 mL vials and fixed with 1% Lugol and 2% GLU in the same way as described above.

4.7 Microstructure vertical profiler MSS-90

The MSS-90 profiler (Figure 15) is equipped with two PNS98 airfoil shear sensors and an FP07 microthermistor, capable of sampling horizontal thermal and velocity gradients with a vertical resolution on the order of 1 cm - 1 mm. With these measurements, thermal variance dissipation rates (x) and turbulent kinetic energy (ε) are obtained, which allow characterizing the turbulence and mixing (through the diapycnal turbulent diffusion rate, kz) of the water column. The MSS09 has additional turbidity and fluorescence sensors, as well as a high-precision CTD, allowing the recording of oceanographic parameters with high resolution. Methodology and preprocessing follow the guidelines described by Chouciño et al., in Moreno-Ostos (2012). The launching operation was performed with the boat's engine stopped, to avoid possible interference with the turbulence generated by the propeller, and downwind, to avoid the cable from rubbing against the boat's hull. Data acquisition and processing was performed with the commercial programs SST-SDA (Standard Data Acquisition) and DATpro from Sea&Sun Technology (www.sea-sun-tech.com). With the MSS90 profiler, direct measurements of turbulent kinetic energy dissipation rates (ε) were performed on a total of nine stations with an average of 4 profiles until 250 m depth by station.

Figure 15 - The microstructure vertical profiler (MSS-90) on deck.

4.8 Autonomous underwater vehicle (AUV) deployment

The deployment of an Autonomous underwater vehicle (AUV) from the port of Arrifana was scheduled for the first days of the cruise. The already mentioned weather conditions delay the deployment, that took finally place between 17-19th of September. The Light Autonomous Underwater Vehicle (LAUV Explore-4) conducted high-resolution surveys measuring temperature and salinity between the surface and 10/50/100 m depth (according to bathymetry) during almost 36 hours of autonomy (Figure 16). The total number of immersion profiles is larger than 100 cycles, with 52 profiles from surface to 100 m depth and back. Special caution and safety guidelines were followed to avoid the collision with other vessels since the zone is a busy route for marine traffic.

A single file (NetCDF format) with the complete deployment (128097 observations) was generated. Metadata included in the file. Variables included: time, position, depth (m), course over ground (º), Vehicle heading, roll and pitch (º), Speed over ground (m/s), Conductivity (S/m), Salinity (PSU), Temperature CTD (ºC), Sound Speed in the seawater (m/s).

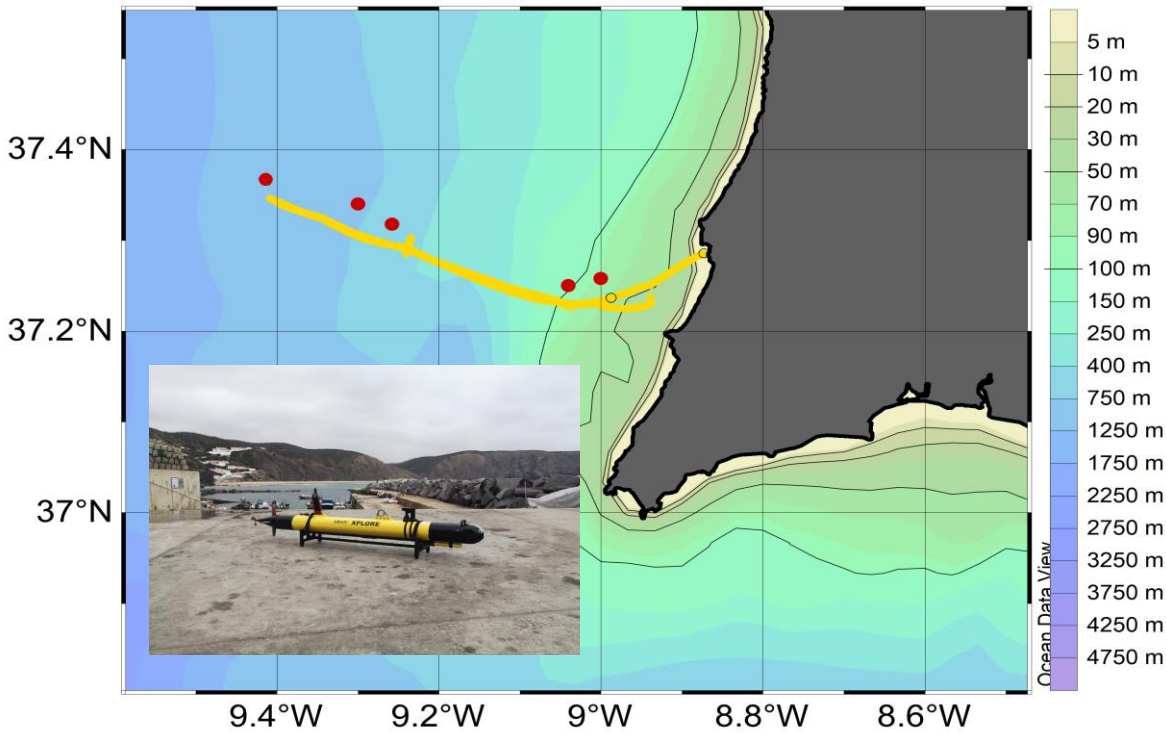

Figure 16 - Study area with the track of the LAUV vehicle (yellow) and the location of the CTD stations done from the vessel (red points)

4.9 Remote sensing data

One of the three main components of the project, along with in situ measurements and preindustrial baseline definition of the sediment samples, it is remote satellite observation. Remote sensing data is important for oceanographic front detection because it provides a synoptic view of the ocean surface, allowing for the identification of ocean fronts. This information is crucial for

understanding ocean circulation patterns and for tracking the movement of pollutants, phytoplankton blooms, and other oceanographic phenomena. This information, developed on land by the remote participants, was followed to define the position of the profile and sampling stations.

Decision making on board was informed by incorporating daily images of Sea Surface Temperature and chlorophyll of the study zone (using mainly the satellite Sentinel-3, European Space Agency -ESA- Earth observation satellites that are part of the Copernicus program), as in the example below.

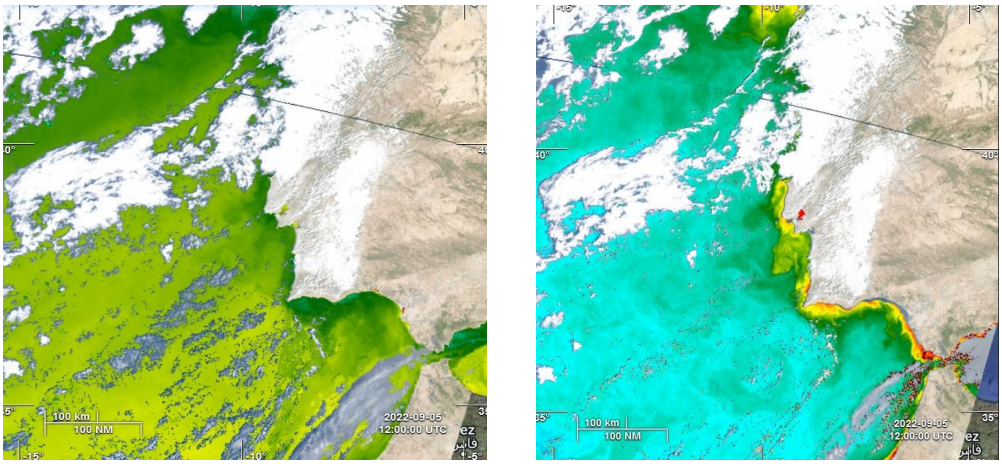

Figure 17 – Two satellite images of the study zone for the same day (5th September 2022, some days before the cruise) showing Sea Surface Temperature (left) and chlorophyll (right).

5. Data and Sample Storage / Availability

A summary of data availability is provided in the table below. All data is currently stored and backed-up across local drives and cloud services of our respective institutions and will be shared in accordance with the terms of the Creative Commons license agreed with EUROFLEETS for the benefit of Open Access/Open Science research. All the new data produced during the cruise will be deposited in the publisher of scientific data in the field of marine sciences: SEANOE. Data published in SEANOE are also automatically duplicated to the EMODnet Data Ingestion portal so that marine data centers of the EMODnet Ingestion network will be informed about the existence and the availability of SINES datasets.

All the Multinet and Box-core samples not immediately used on board will be maintained at 4°C at IPMA for further studies. Macrofauna collected specimens will be deposited in COBI – UA.

Analyses & Proxies	Water column	Sediments
Physical Characterization	Relvas	
ADCP Velocity	Relvas	
AUV	Sousa/Mendes	
Water Chemistry (Sal,O2, Alk, pH)	Fontela	
Inorganic nutrients	Castro	
POC (Particulate Organic Carbon)	Abrantes	
DOC/DON	Fontela	
Air-Ocean exchange CO2	Fontela	
Water isotopes (O, D, C)	Voelker, Shemesh	
Phytoplankton C & N isotopes	Shemesh	
Analysis of Community (DNA)	Fontela	
Microplankton metatranscriptomics	Serrao	
Chl a size-fractionated	Fontela	
Nitrogen Fixation	Fernández-Román	
Microstructure-turbulence profiler	Fernández-Román	
Phytoplankton community composition	Fernández-Román	
Remote sensing satellite: T, S & Altimetry	Muacho, Polito	
Remote sensing satellite: Pigments	Oliveira	
Air-Ocean exchange Heat	Sato	
Phytoplankton Toxins	Costa	Costa
Genetics Other Zooplankton	Serrao	
Microplankton Genomics		Ribeiro
Coccolithophores Assemb	Guerreiro	Guerreiro
Coccolithophores Biomarkers	Rodrigues/Gebara	Rodrigues/Gebara
Isotopes on biomarkers	Rodrigues	Rodrigues
Microplankton Genomics/Dinoflagellates	Ribeiro	Ribeiro
Diatom & Silicofl Assemblages	Fontela/Rigual	Gil
Diatom Biomarkers	Rodrigues	Rodrigues
Plankt. foram. Fauna	Voelker	Voelker
Plankt. foram. Isotopes (O, C)	Voelker	Voelker
Plank. foram. Trace Elements	Salgueiro	Salgueiro
$\delta^{11}B$ isotopes Plank. Forams	Calvo	Calvo
Plank. Foram. Genetics	Kucera	Kucera
Macro Benthics Species/Abund/Genomics		Cunha
Benth. foram. Fauna		Seidenkrantz
Benth. Foram. Isotopes		Seidenkrantz
Benth. Foram. Trace Elements		Alonso-García
$CaCO_3$		Abrantes
Corg; C/ N		Shemesh
$\delta^{13}C$ C_{org}, $\delta^{15}N$ C_{org}		Shemesh
Grain size		Abrantes
XRF		Abrantes
MS		Abrantes
Data Management	Fontela/Abrantes	

Table 3 –Some of the Analyses and Proxies to be measured on the different collected samples and contact responsible.

6. Participants

No.	Name	Early career (Y/N)	Gender	Affiliation	On-board tasks
1	*Fátima Filomena Guedes Abrantes	N	F	CCMAR/IPMA	Lead box-corer activities
2	*Lívia Gebara Muraro Serrate Cordeiro	N	F	CCMAR/IPMA	Sampling and filtering biomarkers, eDNA, toxines, dinos
3	*Mara Ramos Gomes	Y	M	MARE	Sampling and filtering coccos & HPLC
4	*Aline Martins Mega	Y	M	CCMAR/UAlg/ IPMA	Sampling and filtering isotopes and trace elements
5	*Giulia Silveira Molina	Y	M	CCMAR/UAlg/ IPMA	Multinet sampling
6	*Hélder José Rodrigues Pereira	N	M	Escola Secundária de Loulé	Outreach & Educaton Communication; Box-core team
7	*Sofia Alexandra Pinto Ramalho	Y	F	UAveiro	Box-corer sampling
8	*Paulo José Relvas de Almeida	N	F	CCMAR/Ualg	ADCP & data management
9	*Dunia Rios Yunes	Y	F	NIOZ	Sampling pH, Alk,sal. Analysis DO, pH, Alk.
10	*Antje Helga Luise Voelker	N	F	CCMAR/IPMA	Lead multinet activities
11	*Verynice Herman Temu	Y	M	UDSM	Multinet sampling
12	*David Curbelo Hernández	Y	F	IOCAG-ULPGC	Sampling DO, POM+DOM, nutrients
13	*Sofía Nieto Romero	Y	M	Uvigo	Sampling DO, POM+DOM,nutrients
14	*María Jesús Álvarez Fernández	N	F	IIM-CSIC	Sampling pH, Alk, sal. Analysis DO, pH, Alk.
15	*Daniel Fernández Román	Y	F	UVigo	Sampling and processing Chla, DNA, Cytometry, N2-fixation, Phytoplankton classic. Turbulence profiler management
16	*Marcos Morente Fontela	Y	F	CCMAR	Lead CTD-rosette activities
17	*Antonio Fuentes Lema	N	F	UVigo	Sampling and processing Chla, DNA, Cytometry, N2-fixation, Phytoplankton classic. Turbulence profiler management
18	*Fernanda Ferreira	Y	F	CCMAR/IPMA	Sampling and filtering biomarkers, eDNA, toxines, dinos

*All the on-board cruise participants were funded by EUROFLEETS+. Affiliation list:

CCMAR Centro de Ciências do Mar do Algarve

IPMA Instituto Portugués do Mar e da atmosfera

MARE Marine and environmental Science Centre

UAlg Universidade do Algarve

UAveiro Universidade de Aveiro

NIOZ Royal Netherlands Institute for Sea Research

UDSM University of Dar es Salaam

IOCAG-ULPGC Instituto de Oceanografía y Cambio Global – Universidad de Las Palmas de Gran Canaria

UVigo Universidade de Vigo

IIM-CSIC Instituto de Investigaciones Mariñas – Consejo Superior de Investigaciones Científicas

LSTS-FEUP Laboratório de Sistemas e Tecnologia Subaquática (LSTS), Faculdade de Engenharia da Universidade do Porto

REMOTE PARTICIPANTS‡

N.º	Name	Contribution	Gender	Affiliation
1	Sérgio Muacho	Satellite T Data Analysis	M	IPMA/CCMAR
2	Paulo Oliveira	Satellite Pigments	M	IPMA
3	Renato Mendes	AUV operations	M	LSTS-FEUP
4	João Borges de Sousa	AUV operations	M	LSTS-FEUP
5	João Pereira	AUV operations	M	LSTS-FEUP
6	Wang Dzak Choi	AUV operations	M	LSTS-FEUP

‡The remote participants and their operations have not been funded by EUROFLEETS+

7. Station List

Station number/ID, date and time, position (decimal degrees for expressing latitude and longitude geographic coordinates), bottom depth of the station and operation activity as registered by the EARS application ("Eurofleets Automatic Reporting System") to gather and transfer metadata during cruise and data acquisition events info.

Station	Date	Time	Latitude	Longitude	Depth (m)	Gear/operations
St01	Sept 11	18:21:52Z	37.26	-9.07	143	CTD-rosette; Multinet; Box-corer
ST02	Sept 11	22:10:44Z	37.34	-9.29	828	CTD-rosette; Multinet; Box-corer

CCMAR	Sept 12	12:20:32Z	36.85	-8.92	170	CTD-rosette
FARO 1	Sept 13	06:21:50Z	36.90	-7.90	103	CTD-rosette; Box-corer
FARO 2	Sept 13	08:14:39Z	36.85	-7.90	339	CTD-rosette
FARO 3	Sept 13	09:39:52Z	36.79	-7.90	763	CTD-rosette; Multinet
FARO 4	Sept 13	12:46:27Z	36.76	-7.906	653	CTD-rosette; Multinet; Box-corer; Microstructure Profiler; Vertical phytoplankton net
ST03	Sept 14	15:23:10Z	37.9	-11.43	5092	CTD-rosette (x2); Multinet; Box-corer; Microstructure Profiler
ST04	Sept 15	10:31:49Z	37.74	-10.60	4334	CTD-rosette (x2); Multinet; Box-corer*; Microstructure Profiler Vertical phytoplankton net
ST05	Sept 16	01:57:02Z	37.66	-10.35	3182	CTD-rosette (x2); Multinet, Microstructure Profiler Vertical phytoplankton net
ST06	Sept 16	12:28:36Z	37.57	-10.12	2606	CTD-rosette (x2); Multinet; Box-corer
ST07	Sept 17	04:02:21Z	37.49	-9.82	3335	CTD-rosette; Multinet, Vertical phytoplankton net Microstructure Profiler
ST08	Sept 17	08:02.21Z	37.35	-9.41	1081	CTD-rosette; Multinet; Box-corer, Microstructure Profiler; Vertical phytoplankton net
ST 01BIS	Sept 19	07:49:11Z	37.25	-9.07	140	CTD-rosette; Multinet, Vertical phytoplankton net Microstructure Profiler
ST 02BIS	Sept 19	13:22:13Z	37.32	-9.25	800	CTD-rosette; Multinet, Vertical phytoplankton net Microstructure Profiler

* Notes: Box-core empty with a warped box

8. Outreach

Throughout the expedition, our outreach manager, Helder Pereira, contacted students from several schools, prepared presentations and wrote press notes that were broadly distributed with the communication officers of the involved institutions.

During the SINES cruise the main outreach activities consisted in the writing of a press release and news for the media. We also took advantage of social media and several pictures and videos of the activities done aboard the R/V Sarmiento de Gamboa were sent to the media offices of the different research institutions which participated in the cruise. A presentation about the science beyond the SINES cruise was also prepared and sent to several Portuguese elementary and secondary schools challenging them to send us questions about it. Around 250 students and their teachers replied to the challenge and the answers for their questions were given. On Monday 19th a live video broadcast engaged a class of 11th graders of the Escola Secundária de Loulé. The students who participated in the event asked several questions not only about the science, but also about life aboard. Several scientists contributed to the success of the outreach activities done during the cruise.

Also, spare sediment from the one of box corer taken during the SINES cruise is being actually shared with high school teachers in Portugal to be used as educational resources in the classroom (Escola Professor José Augusto Lucas in Linda-a-Velha and Escola Secundária de Vagos).

You will find the press release and news about the Eurofleets+ SINES cruise in the below URLs:

Comunicado de imprensa | 2022.03.12

Press release | 2022.03.12

Notícia IPMA | 2022.09.28

Notícia CCMAR | 2022.10.01

Besides, during the cruise several participants were tweeting in real time using a specific hashtag **#SINES** (LINK). Some of the pictures and videos posted, like the one below where @eurofleets was tagged, were relatively well received by the oceanographic community of that social media site and the engagement was remarkable and encourageous.

9. References

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10. Acknowledgements

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Eurofleets+

An alliance of European marine research infrastructure to meet the evolving needs of the research and industrial communities

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement Nº. 824077

ANNEX I – CTD PROFILES

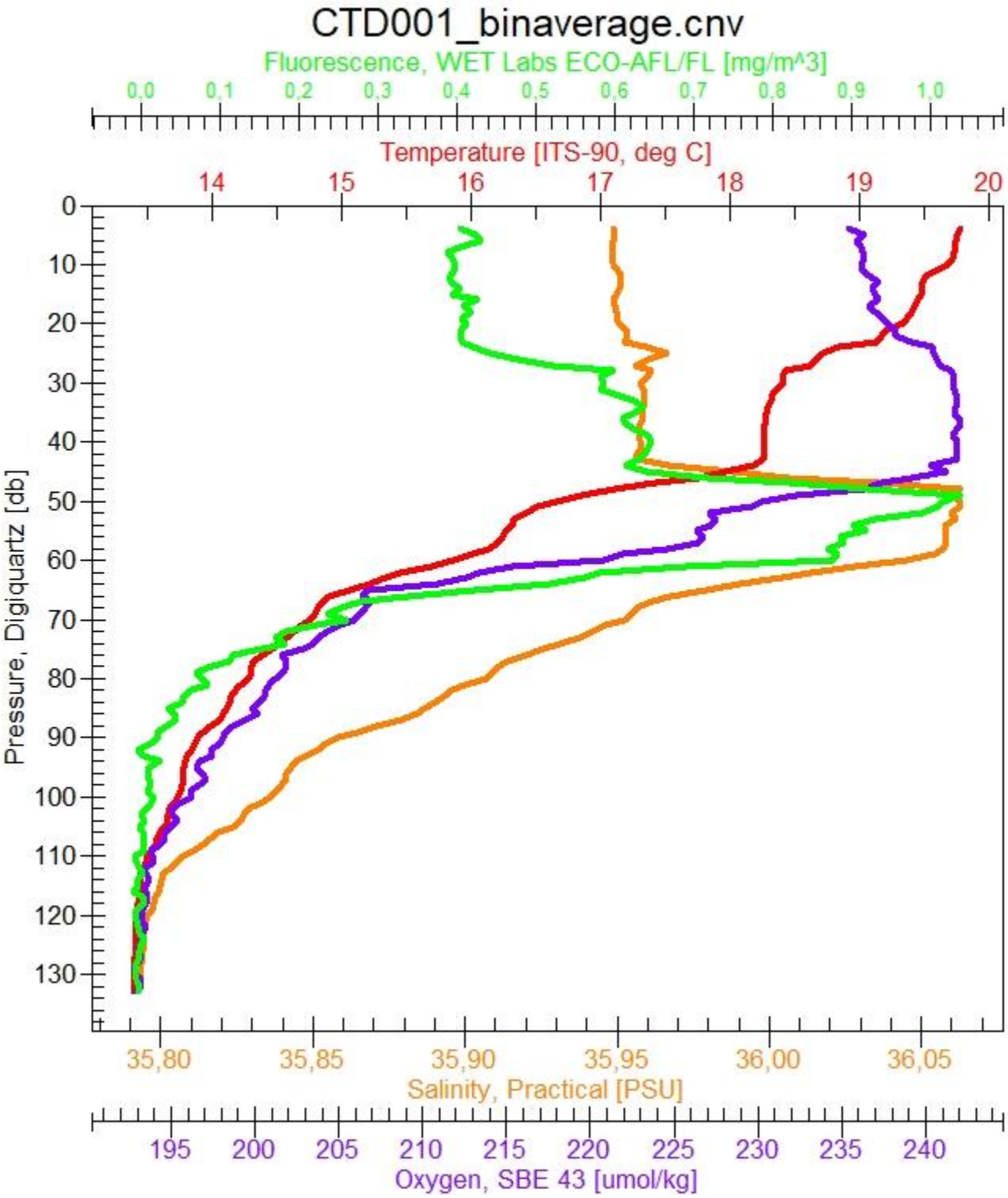
CLIMATE CHANGE IMPACT ON OCEAN FRONTS ECOSYSTEMS:

The case of the Iberian Upwelling System (SINES)

R/V Sarmiento de Gamboa, Cruise No. SEA02_08,

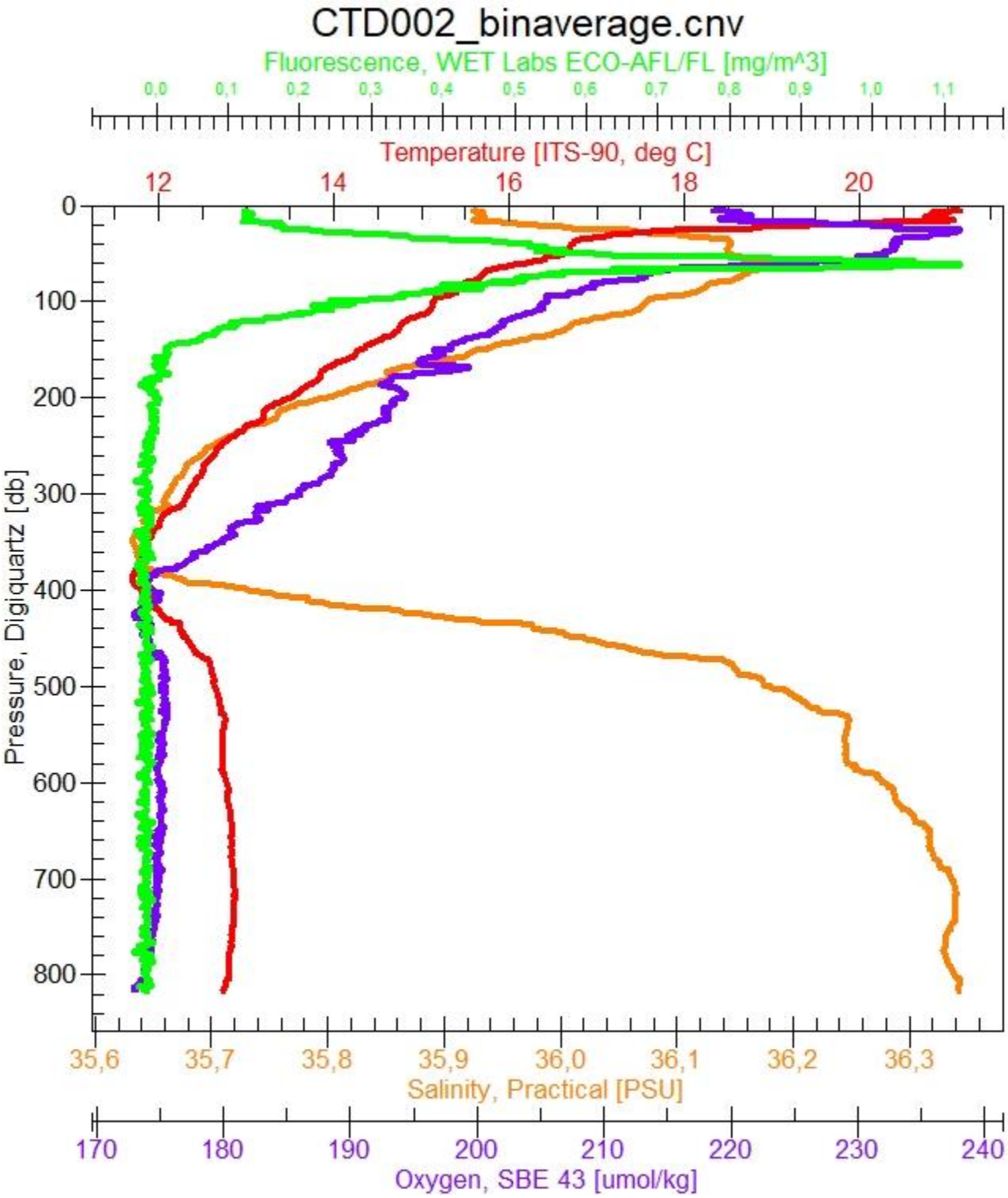
11-20 September 2022, Lisboa – Lisboa (Portugal)

Fontela, Marcos; Abrantes, Fátima; Álvarez-Fernández, María Jesús; Borges de Sousa, João; Curbelo, David; Fernández-Román, Daniel; Ferreira, Fernanda; Fuentes-Lema, Antonio; Gebara, Lívia; Gomes, Mara; Herman, Temu, Verynice; Mega, Aline; Mendes, Renato; Molina, Giulia; Nieto, Sofía; Pereira, Hélder; Ramalho, Sofía; Relvas, Paulo; Ríos, Dunia; Voelker, Antje.



EUROFLEETS+ SINES 2022

R/V Sarmiento de Gamboa, Cruise No. SEA02_08



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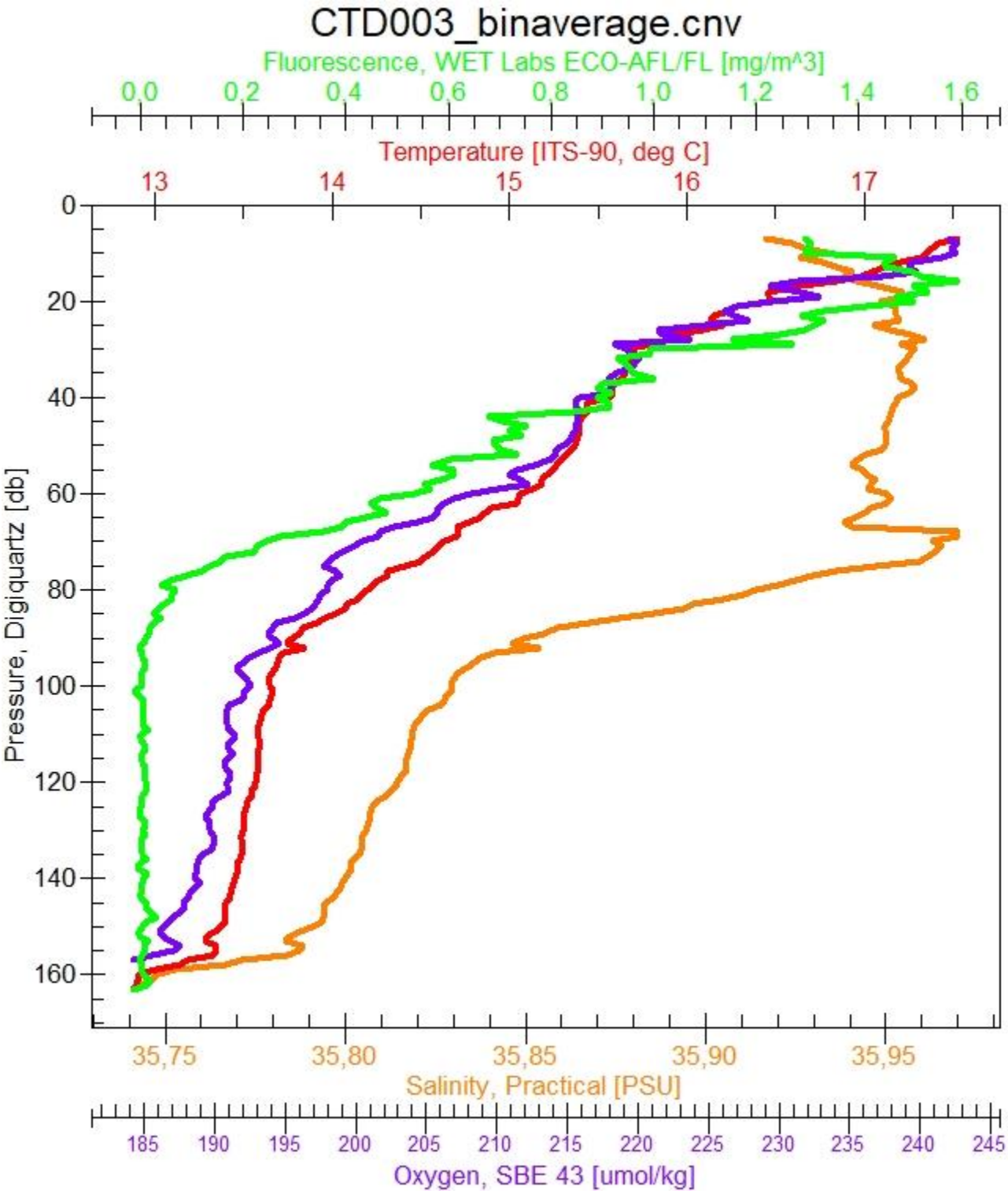

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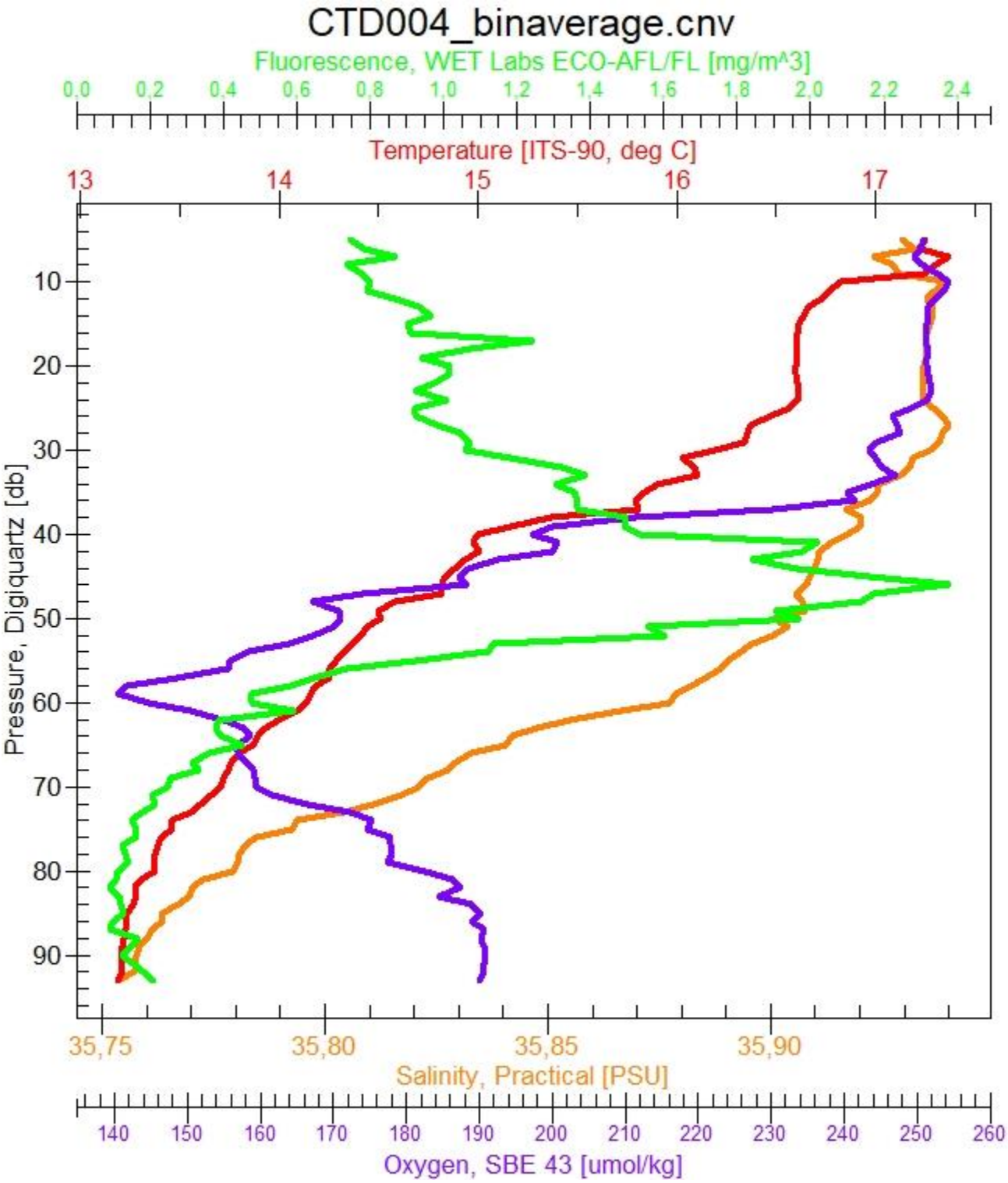

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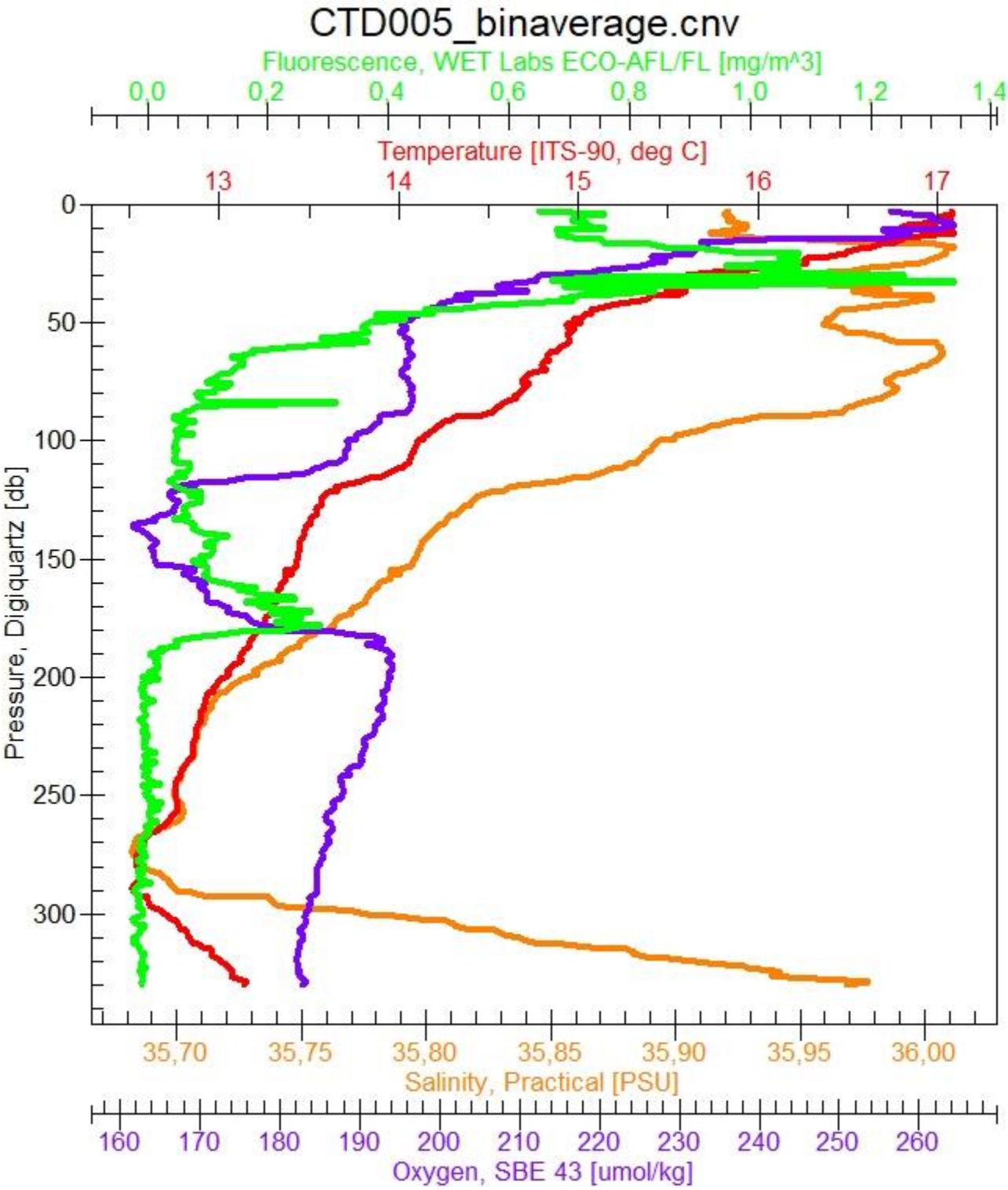
R/V Sarmiento de Gamboa, Cruise No. SEA02_08



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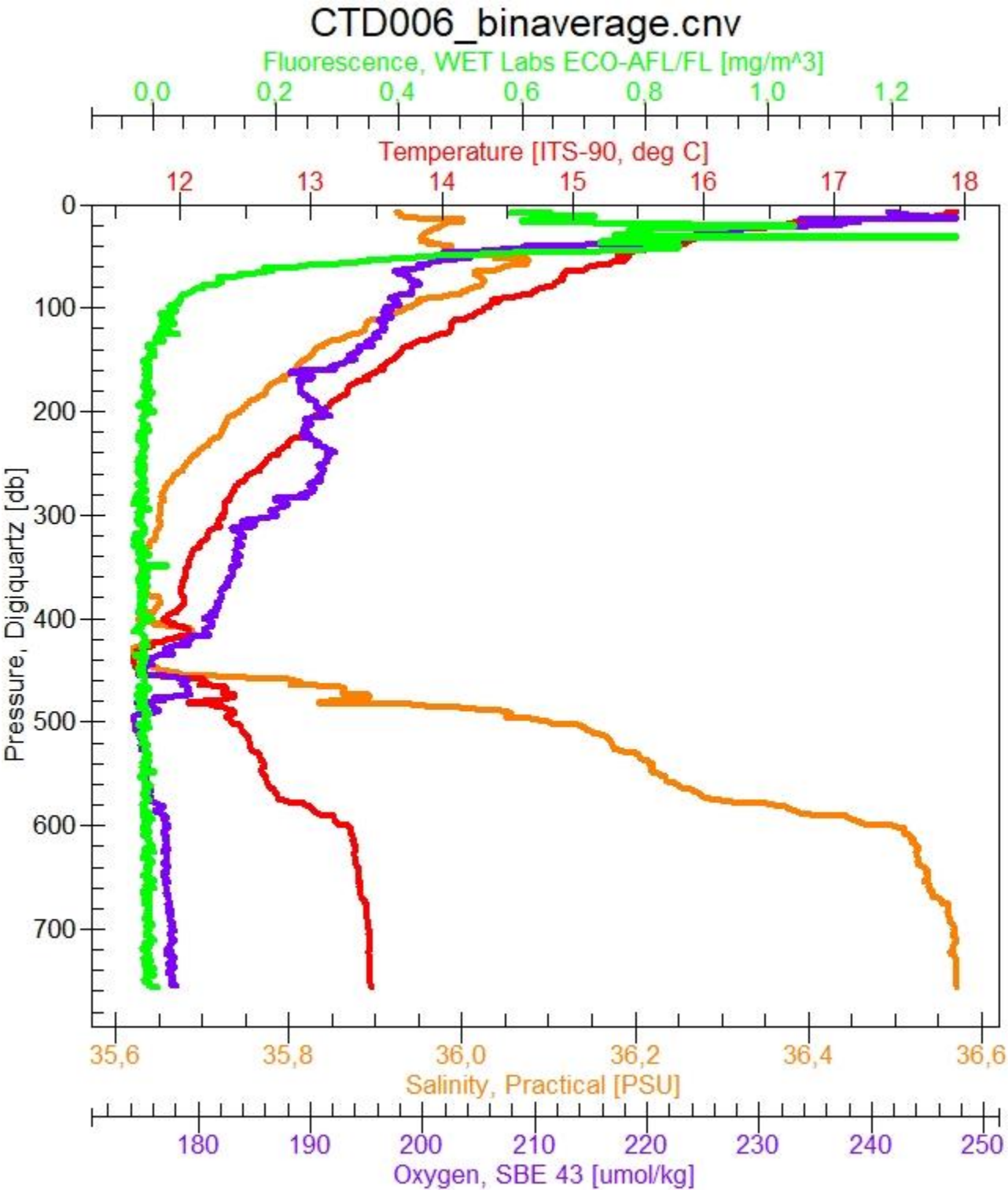
R/V Sarmiento de Gamboa, Cruise No. SEA02_08



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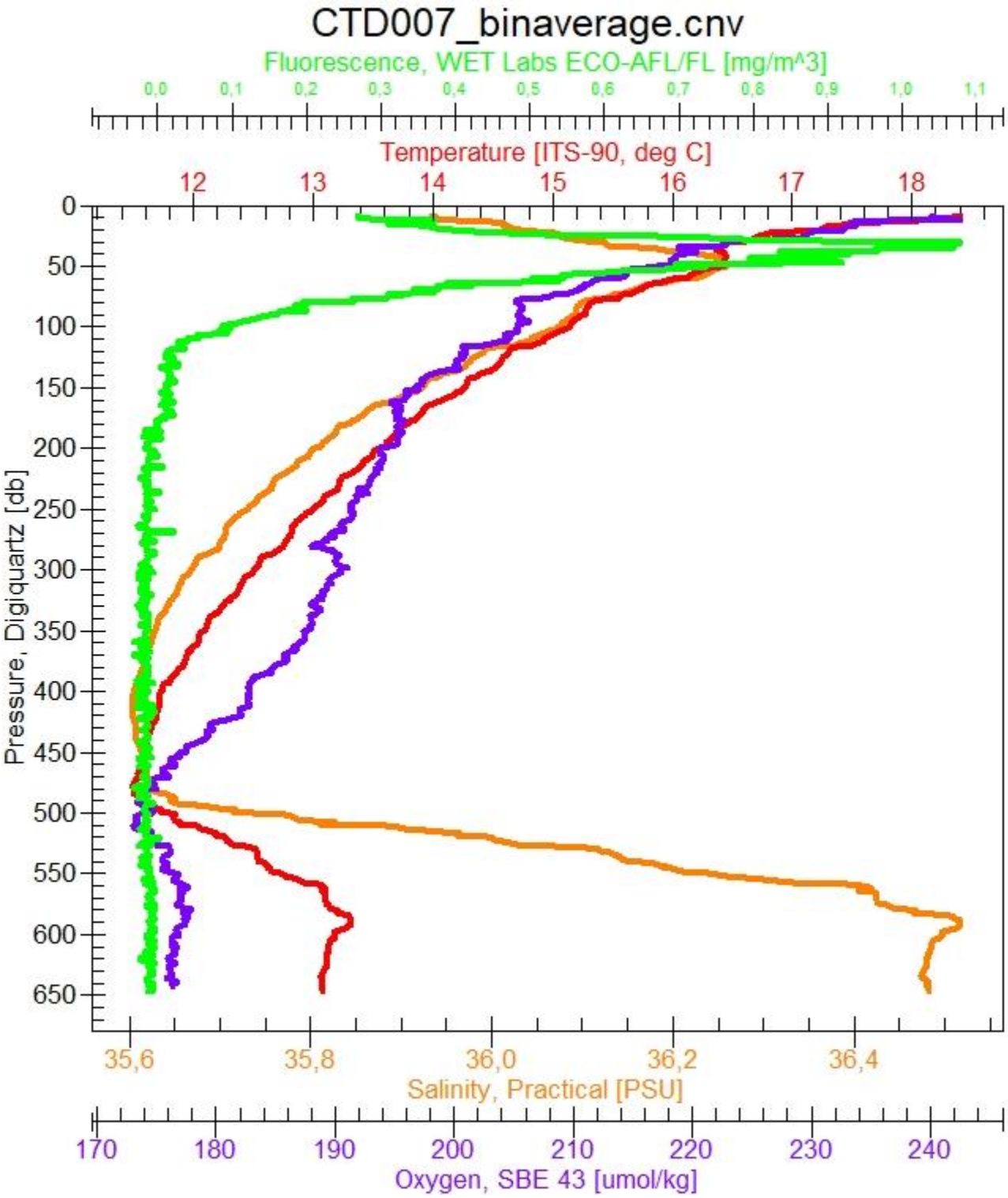
R/V Sarmiento de Gamboa, Cruise No. SEA02_08



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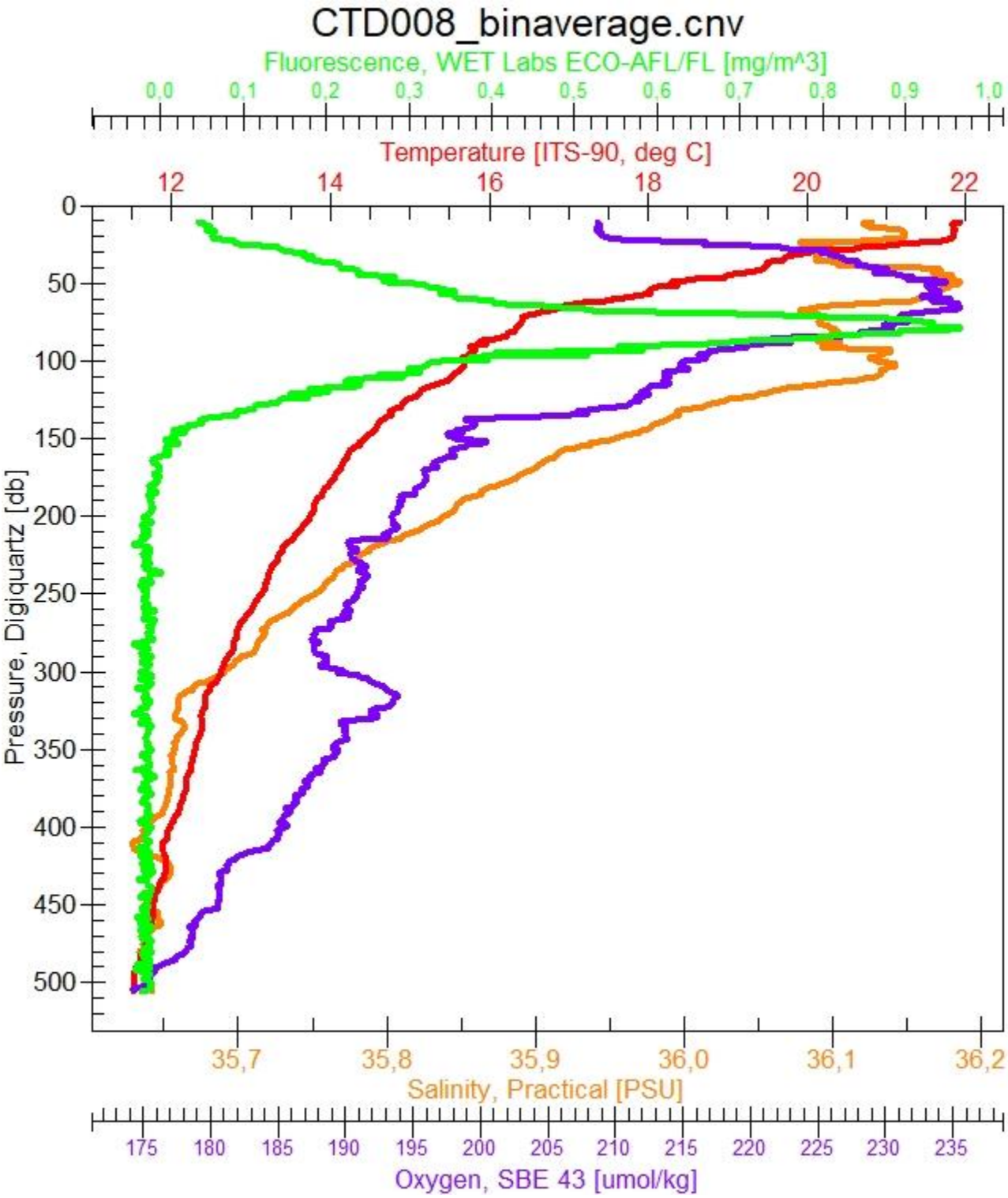

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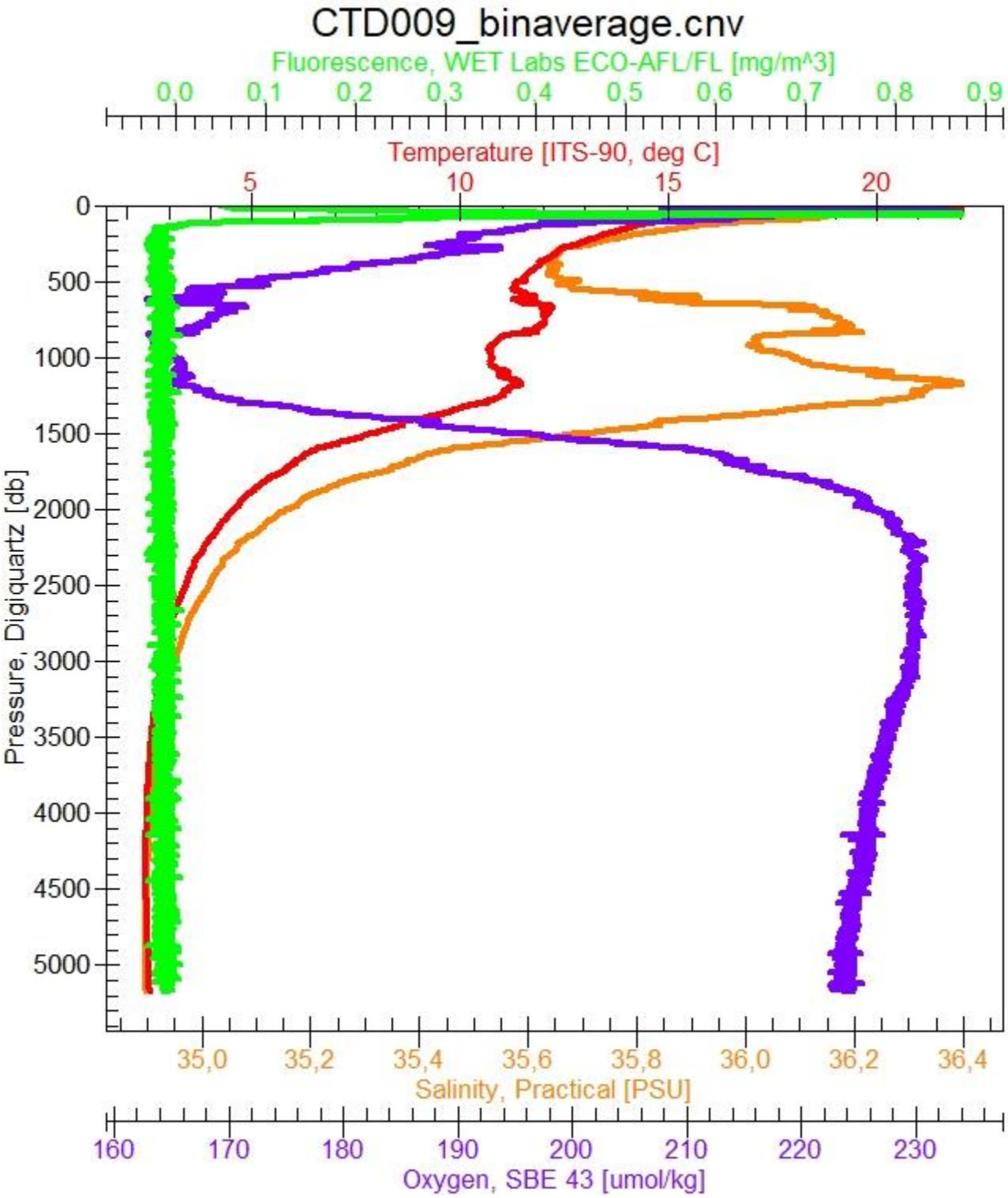

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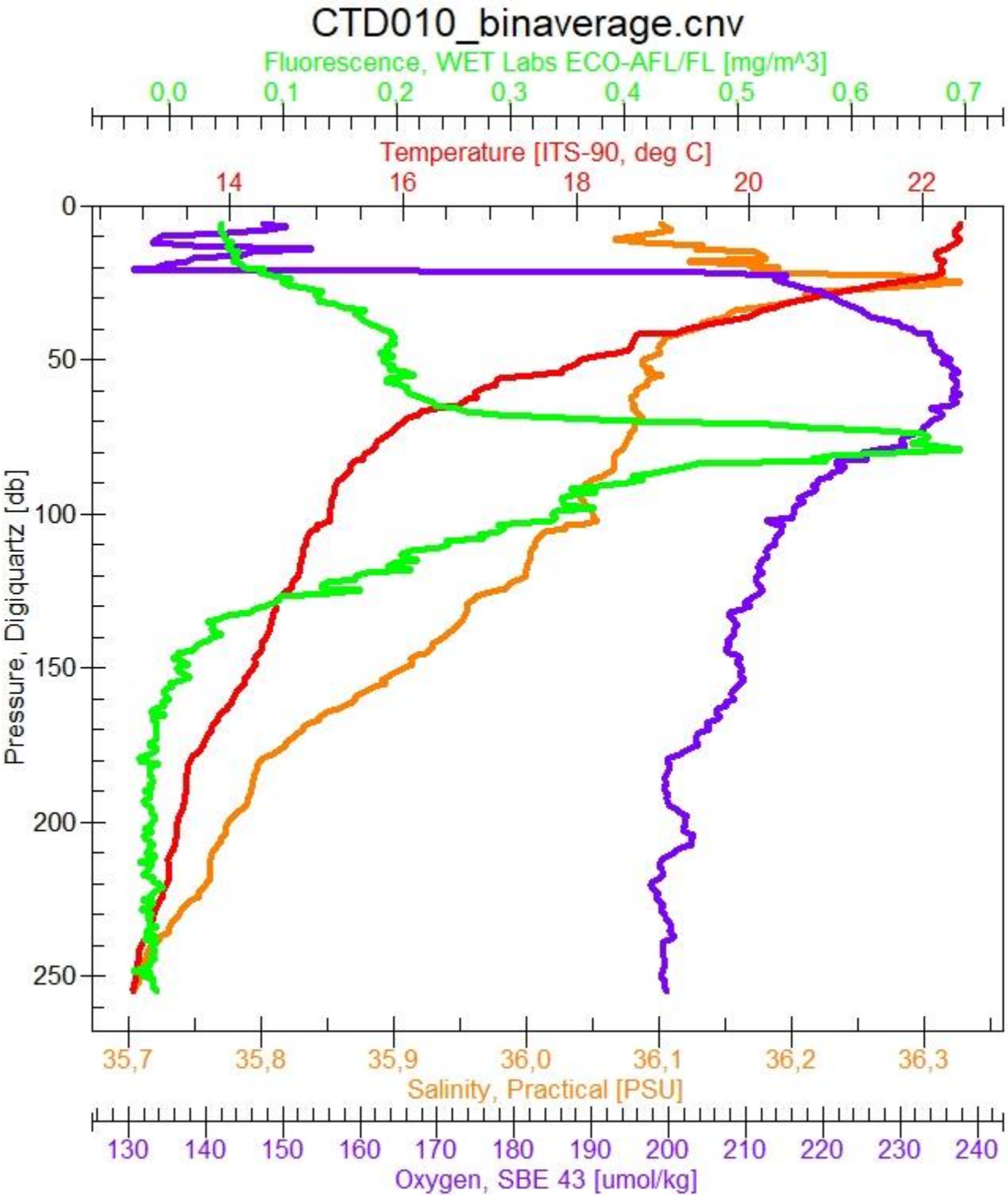

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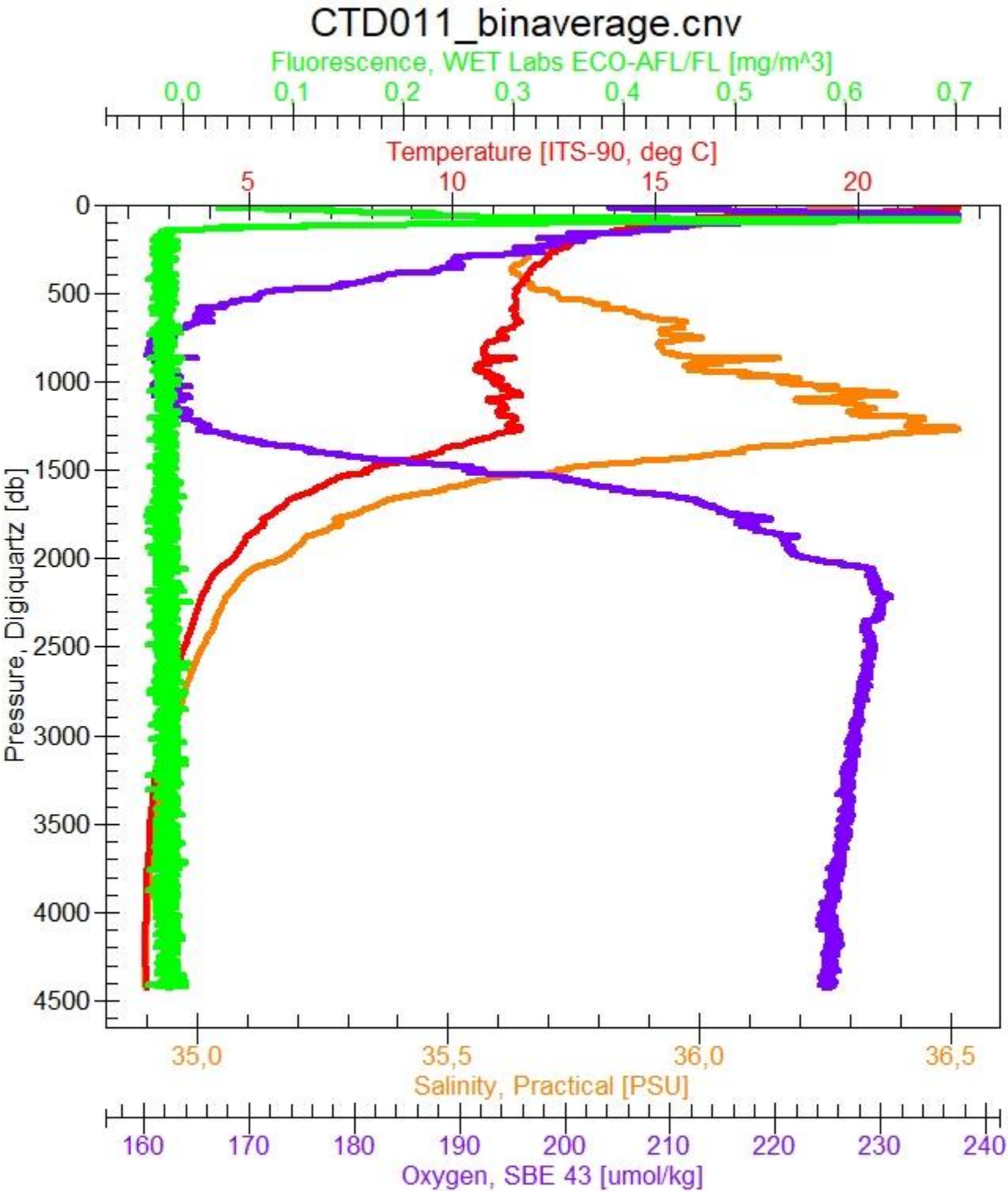

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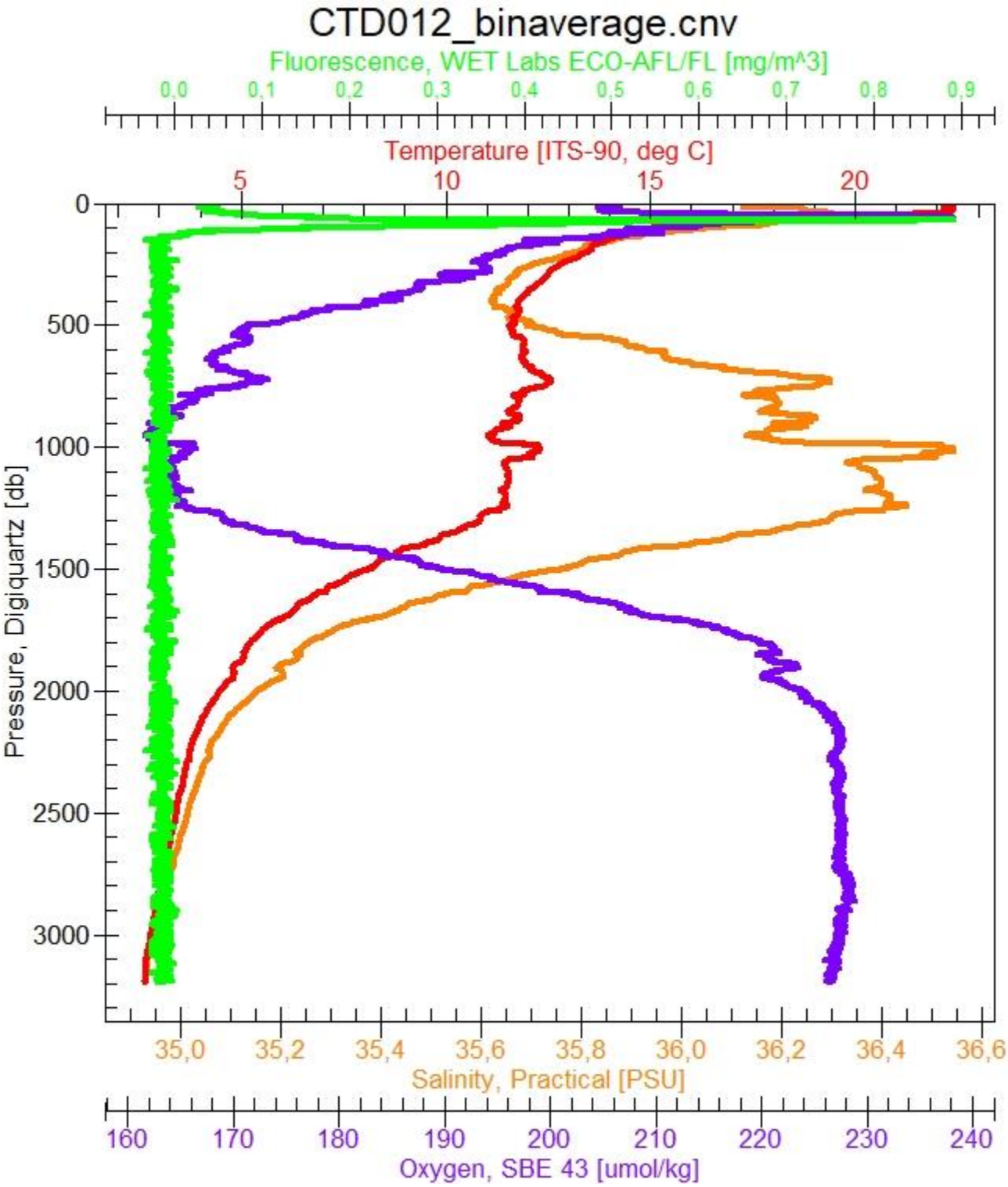

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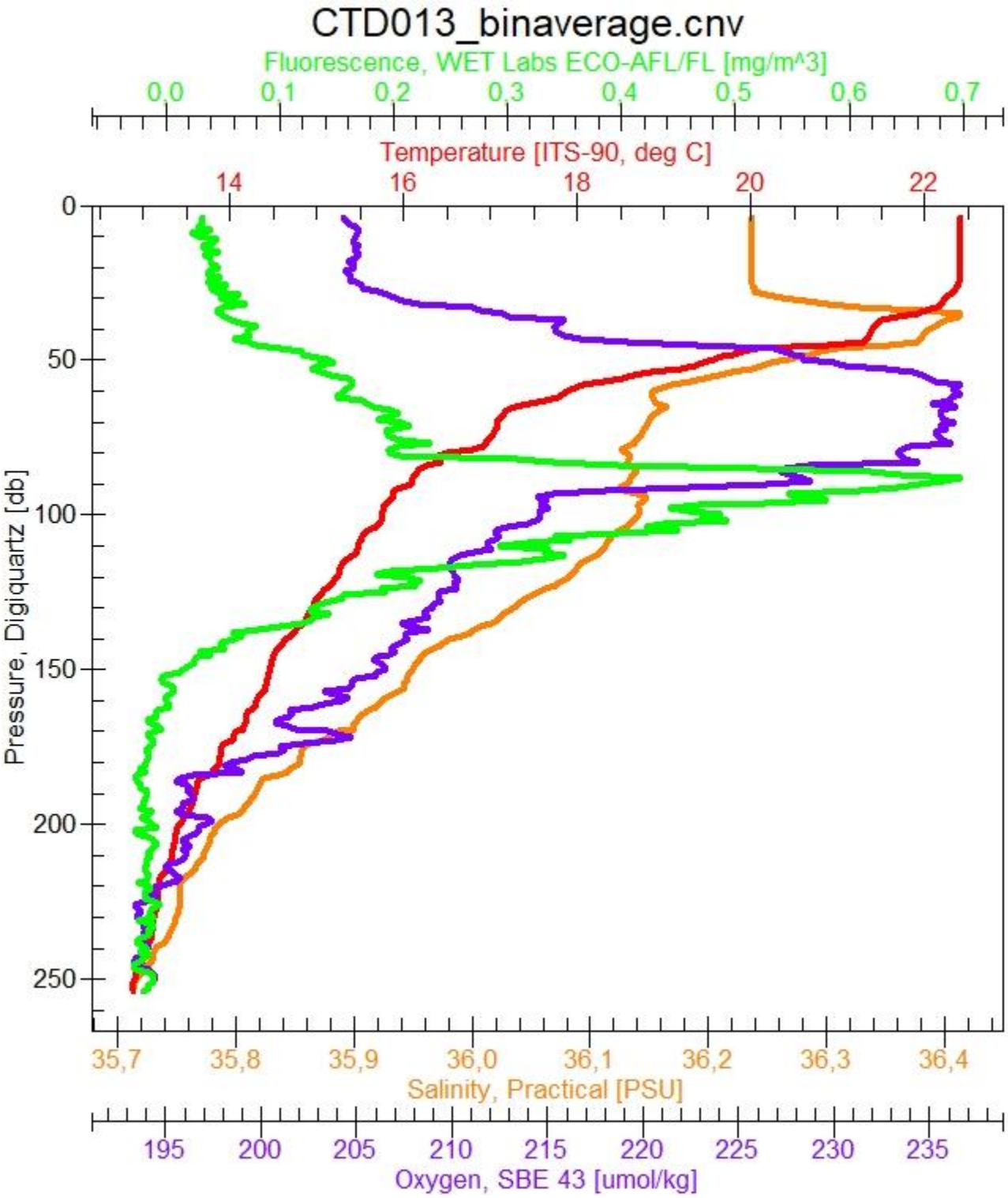

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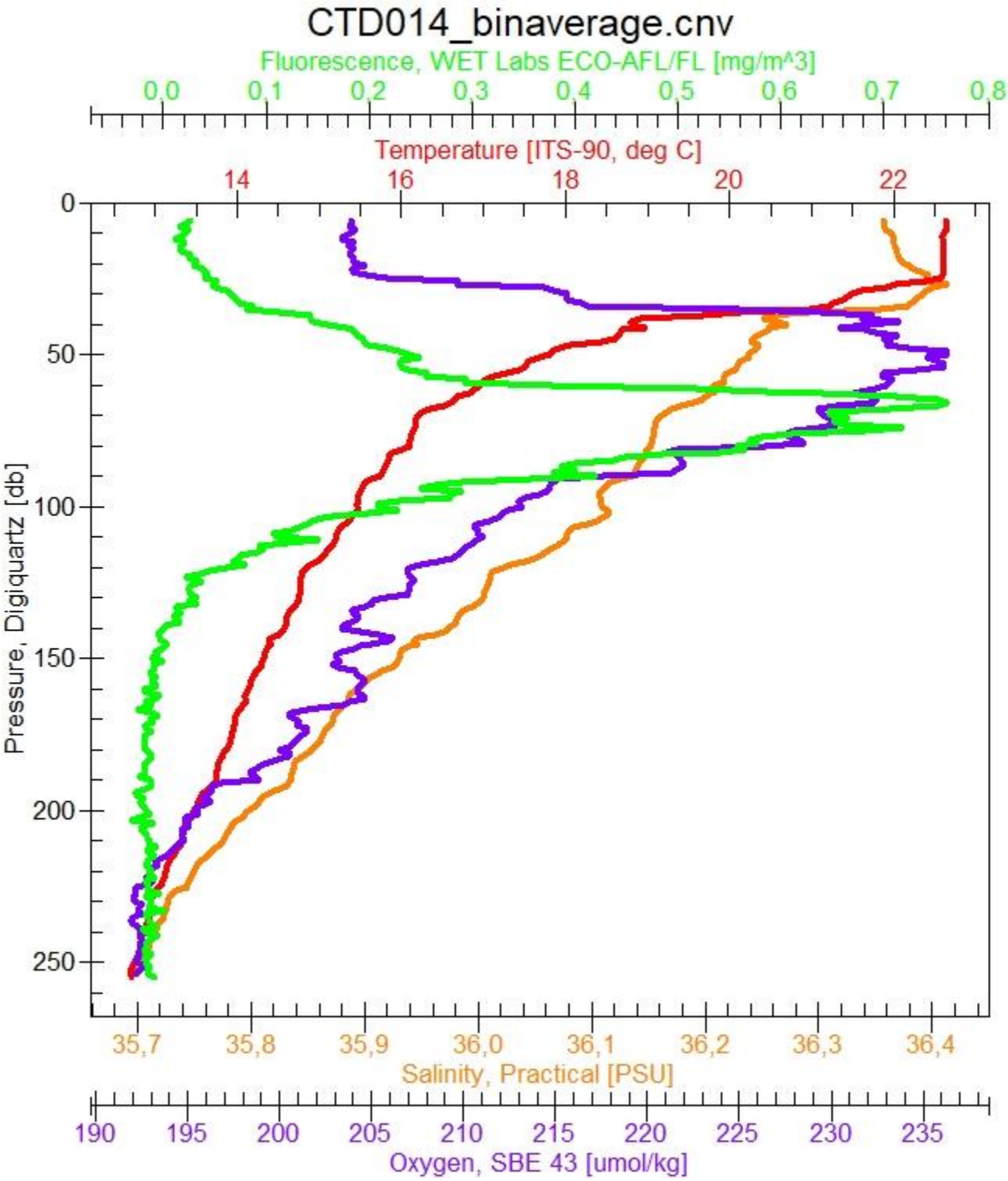

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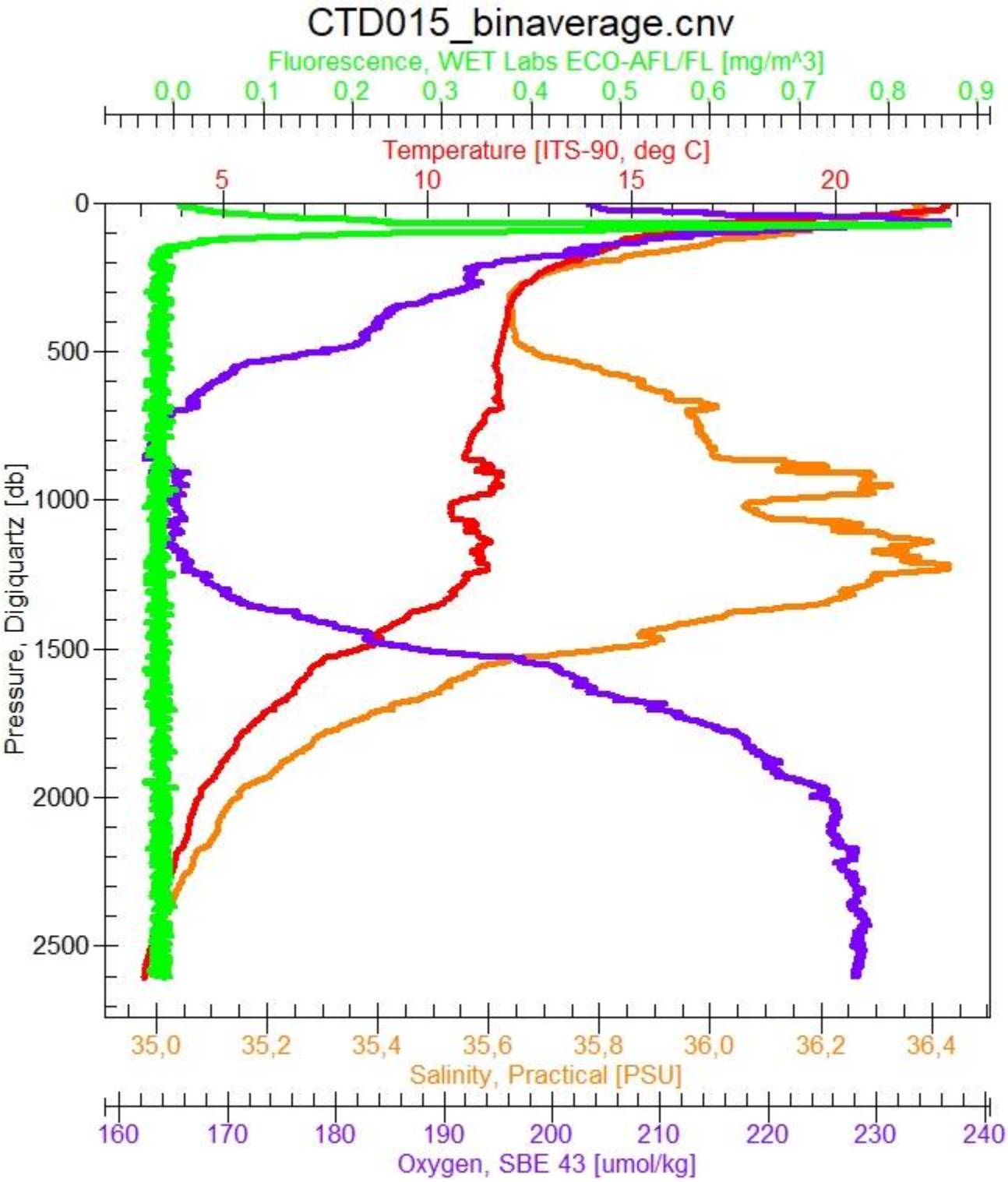

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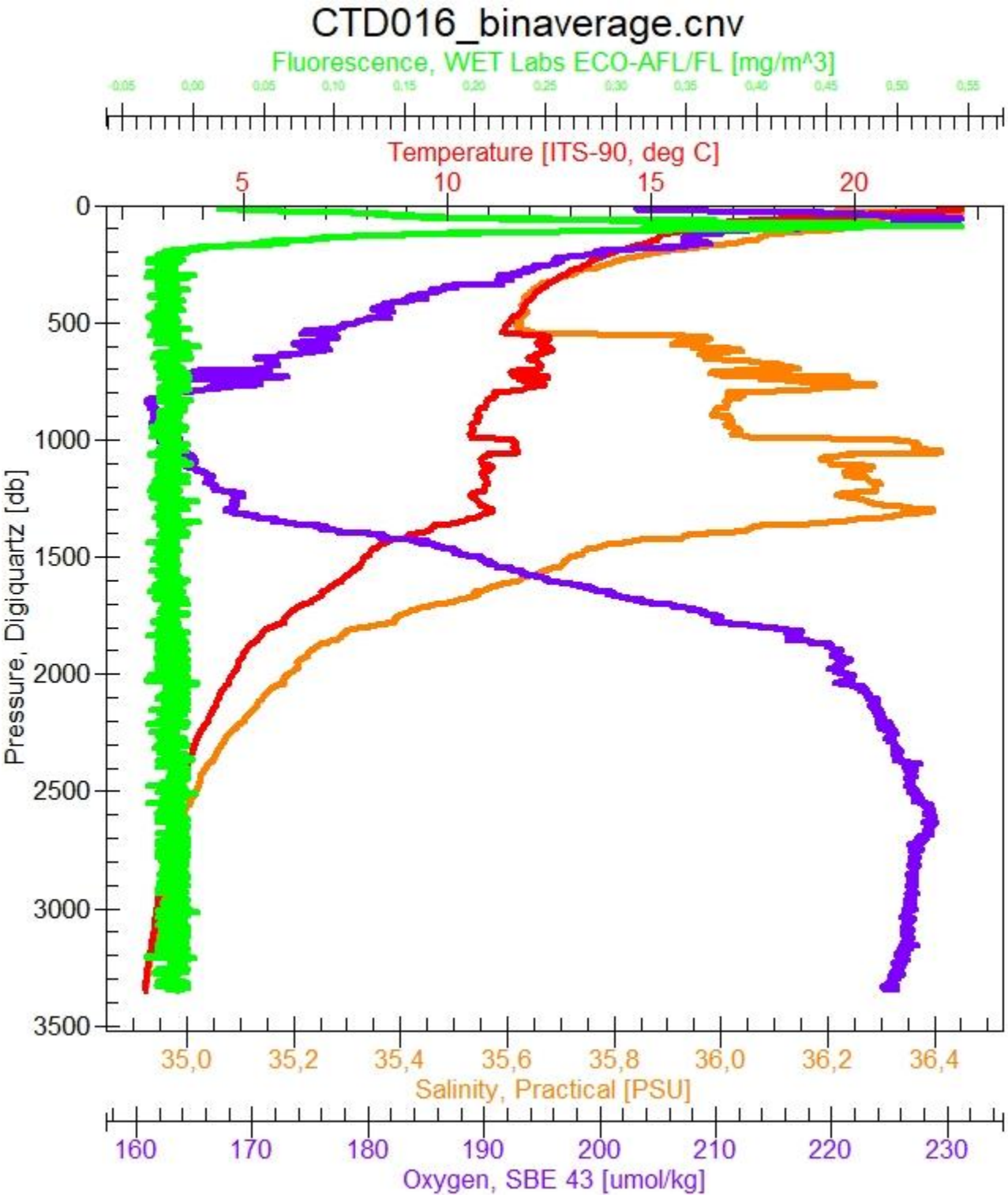

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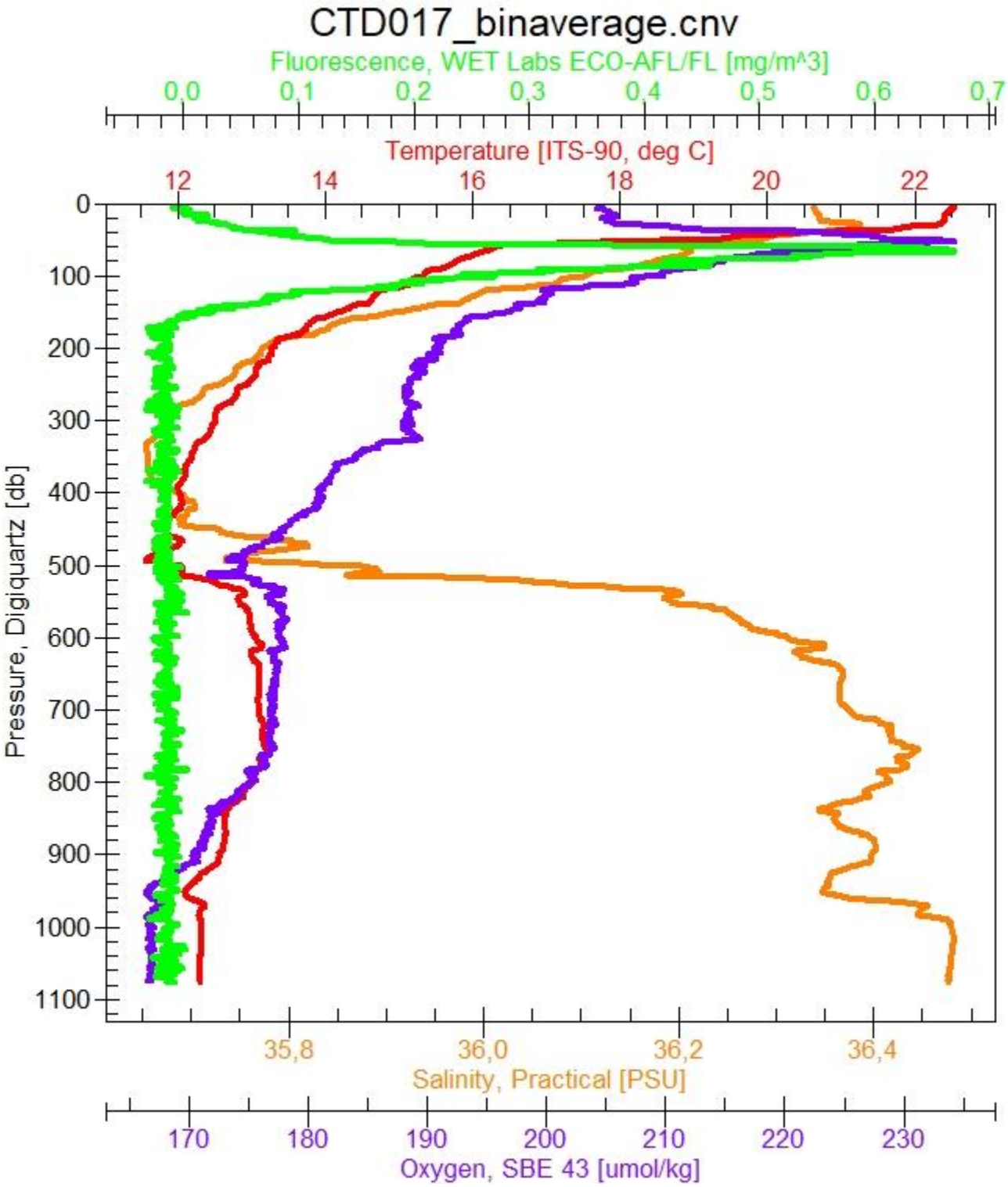

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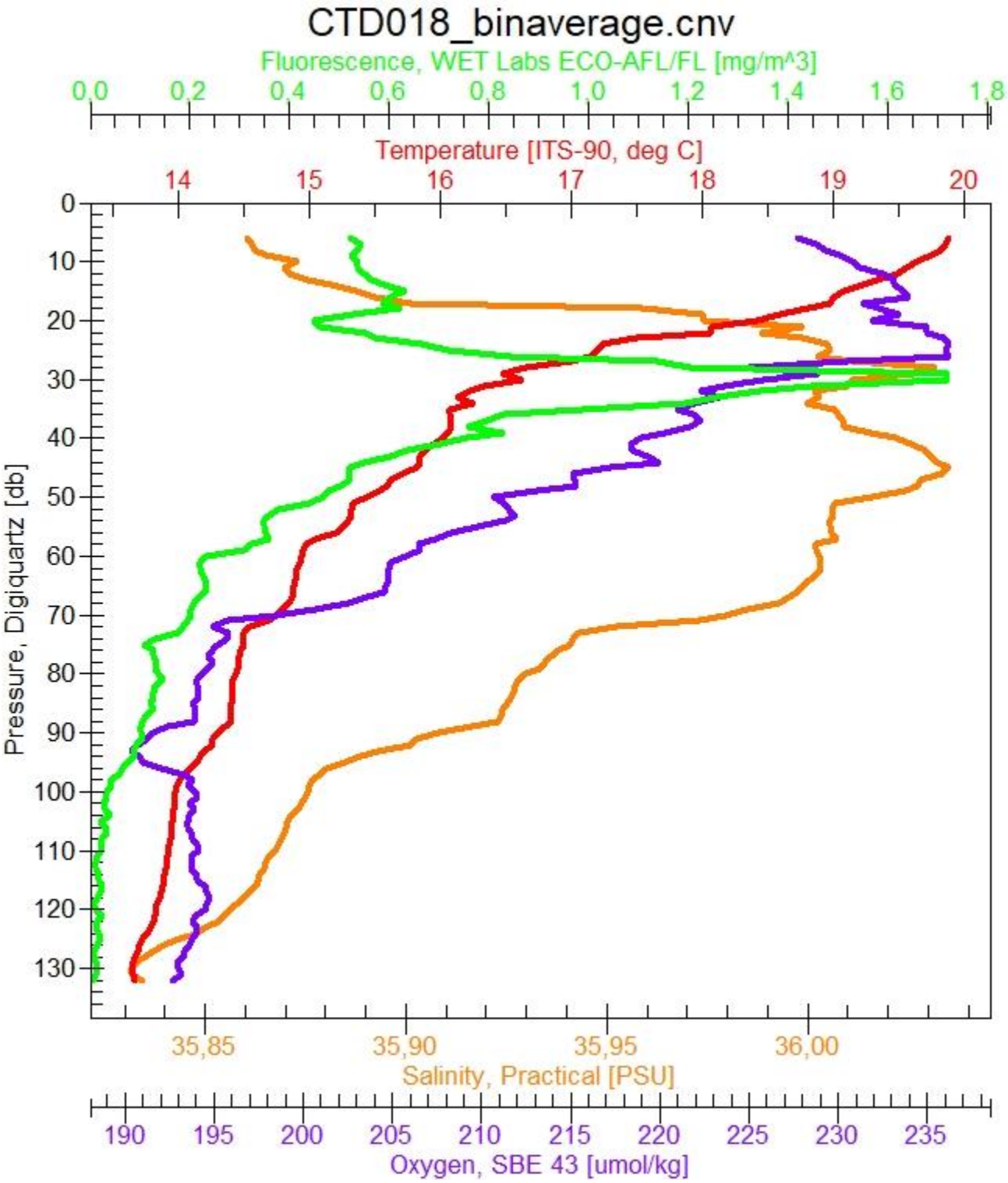

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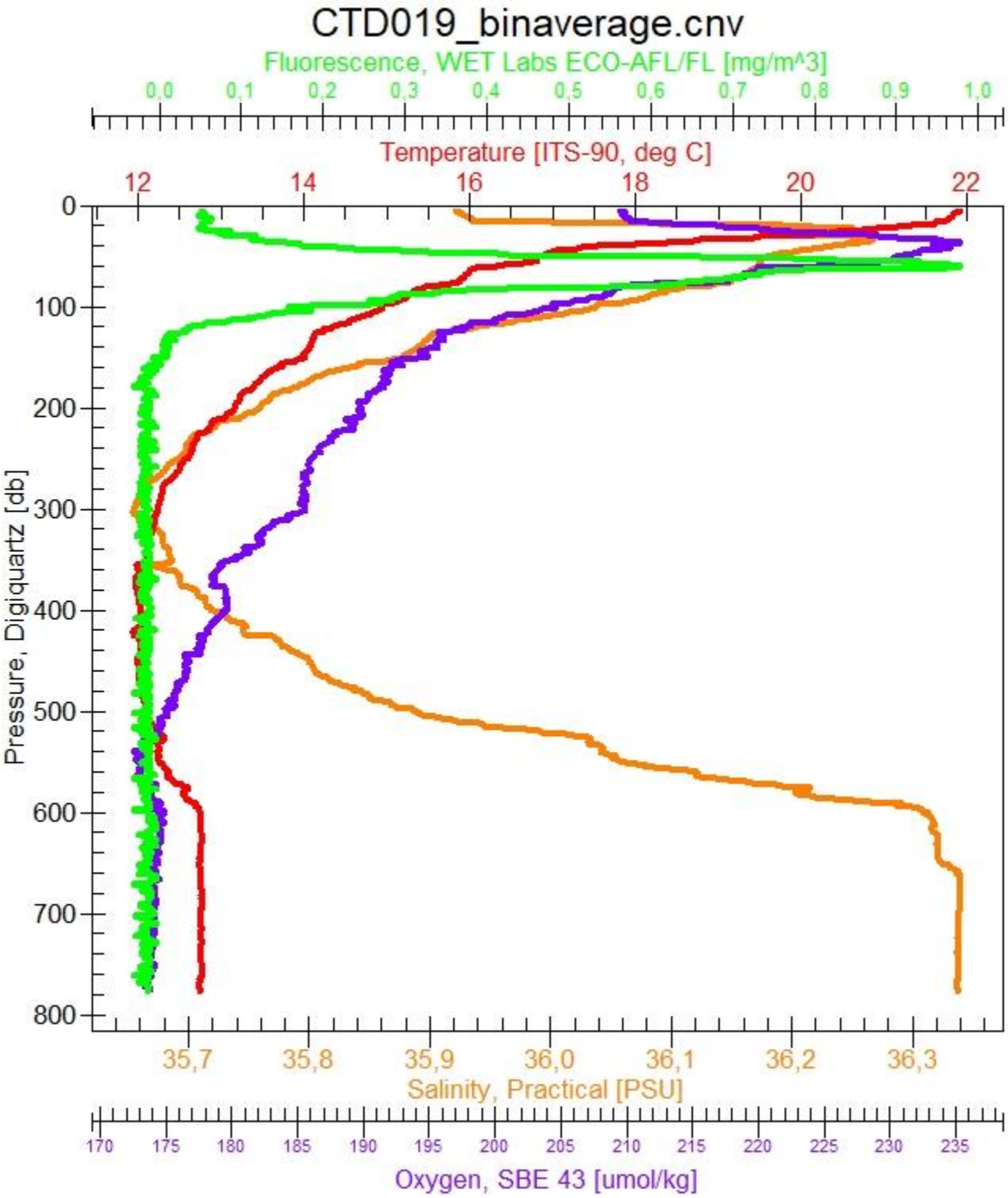

EUROFLEETS+ SINES 2022

R/V Sarmiento de Gamboa, Cruise No. SEA02_08

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An alliance of European marine research infrastructure to meet the evolving needs of the research and industrial communities

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ANNEX II – SAMPLING SHEETS

CLIMATE CHANGE IMPACT ON OCEAN FRONTS ECOSYSTEMS:

The case of the Iberian Upwelling System (SINES)

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Sampling Sheet

Cruise : **SINES** *Station :* *1* *Date (dd/mm/yy):* *11/09/22*

Ship : Sarmiento de Gamboa *Cast :* *1*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	DINO	Cocco	HPLC	Bt.	Comments
		Flask	Samp T.																						
1	132.3	1	13.5	1			verde1	1	151						0.3	0.4	0.4	6.0						1	
2	132.5																		12.0					2	
3	131.4																				10.0			3	
4	101.5	3	13.7	4	1.0	2.0	v2	2	152					6.0	0.3	0.4	0.4							4	
5	101.1										8.0	0.5	0.2											5	
6	100.8																							6	open
7	100.8																							7	open
8	73.4	5	14.7	8				3							0.3	0.4	0.4	6.0				2.0		8	
9	73.3																				10.0			9	
10	50.7	6	16.9	10	2.0	3.0	v3	4	153									6.0						10	
11	50.8									0.5	8.0	0.5	0.2											11	
12	50.5													6.0	0.3	0.4	0.4			1.5		2.0		12	
13	50.3																		12.0					13	
14	50.9																				10.0		2.0	14	
15	24.7	13	18.6	15	3.0	4.0		5							0.3	0.4	0.4	6.0						15	
16	24.7										8.0	0.5	0.2									2.0		16	
17	25.1																							17	open
18	10.01244	14	19.15	18																				18	
19	10.34438																							19	
20	5.7	18	20.0	20	4.0	5.0	v4	6	154									6.0						20	
21	5.3									0.5	8.0	0.5	0.2											21	
22	4.9													6.0	0.3	0.4	0.4			1.5		2.0		22	
23	5.2																		12.0					23	
24	5.9																				10.0		2.0	24	
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	DINO	Cocco	HPLC	Bt.	Comments

Sampling Sheet

Cruise : **SINES** *Station :* *2* *Date (dd/mm/yy):* *11/09/22*

Ship : Sarmiento de Gamboa *Cast :* *1*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Cocco/HPLC
		Flask	Samp T.																		
1	814.6	22	12.8	1.0			verde5	7.0	155.0							0.4	0.4				
2	704.5	25	13.0	2.0				8.0										6.0			
3	704.4																		12.0		
4	605	27	13.1	4		1	v6	9	156						0.3	0.4	0.4				
5	604																				
6	605																				
7	504	28	13.2	7.0	5.0	6.0		10.0								0.4	0.4				
8	402	30	12.6	8.0	6.0	7.0		11.0								0.4	0.4				
9	303	31	13.1	9.0			v7	12.0	157.0							0.4	0.4				
10	203	32	14.0	10.0				13.0								0.4	0.4				
11	151	33	15.0	11.0				14.0							0.3	0.4	0.4	6.0			
12	101	34	15.7	12.0			v8	15.0						6.0							
13	100																				
14	100										8.0	0.5	0.2								
15	75	35	16.1	15.0														6.0			2.0
16	60	36	16.3	16.0			v9	16.0	158.0					6.0							
17	60															0.4	0.4		12.0		
18	60									0.5	8	0.5	0.2								
19	61																	6.0		1.5	
20	25	37	17.4	20.0			v10	17.0										6.0			2.0
21	5													6.0							
22	4									0.5	8.0	0.5	0.2		0.3	0.4	0.4				
23	4																		12.0		
24	4																	6.0		1.5	
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *CCMAR* *Date (dd/mm/yy):* *12/09/22*

Ship : Sarmiento de Gamboa *Cast :* *1*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Cocco	HPLC
		Flask	Samp T.																				
1	149.9	39	13.5	1.0								1				.	.	.					
2	149.0											2								.			
3	148.2											3										2.0	
4	100.8	46	13.8	4.0			v11		159.0			4				.	.	.					
5	100.7											5											
6	101.9											6										2.0	
7	75.5	47	14.3	7.0								7				.	.	.					
8	52.2	48	14.9	8.0			v12					8	.			.	.	.					
9	51.8											9								.			
10	51.8											10							.				
11	52.6											11									.		
12	51.7											12										2.0	
13	19.4	49	15.8	13.0					160.0			13				.	.	.					
14	19.4											14											
15	19.6											15											
16	20.3											16	.										
17	19.8											17										4	
18	5.1											18											
19	5.1	51	17.7	19.0			v13		161.0			19	.			.	. +10	.+10					
20	5.1											20										4.0	
21	5.1											21									.	4.0	
22	5.1											22								.			
23	5.1											23							.				
24	5.1											24											
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco	HPLC

Sampling Sheet

Cruise : **SINES** *Station :* *FARO1* *Date (dd/mm/yy):* *13/09/22*

Ship : Sarmiento de Gamboa *Cast :* *1*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Cocco/HPLC
		Flask	Samp T.																			
1	91.5	53	13.2	1.0	7.0	8.0	14.0	18.0	162.0			1										
2	92.4											2								.		
3	92.7											3							.		.	
4	92.7															.		.				
5	92.0																					.
6	76.1	54	13.4	6.0																		
7	75.5											7										
8	75.8											8										
9	52.0	55	14.3	9.0	8.0	9.0	15.0	19.0	163.0			9										
10	51.6											10				.		.				
11	51.1											11										
12	50.6											12										
13	51.0	OPEN										13	.									
14	51.6											14										.
15	40.8	57	14.7	15.0								15										.
16	41.2											16							.		.	
17	41.5											17								.		
18	24.5	58	16.1	18.0				20.0				18										
19	25.3											19	.									
20	25.8											20										
21	5.1	60	17.0	21.0	9.0	10.0	16.0	21.0	164.0			21	.									
22	5.4											22				.		.				.
23	5.2											23								.		
24	5.5											24							.		.	
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *FARO2* *Date (dd/mm/yy):* *13/09/22*

Ship : Sarmiento de Gamboa *Cast :* *1*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Cocco/HP
		Flask	Samp T.																			
1	327.8	61	13.0	2.0	10.0	11.0	verde17	22.0	165.0			1				.		.				
2	327.6											2								.		
3	327.8											3							.		.	
4	328.3											4										
5	303.3	62	13.3	5.0								5				.		.				
6	303.5											6										
7	252.7	63	12.8	7.0								7				.		.				
8	201.5	64	13.0	8.0			verde18	23.0	166.0			8				.		.				
9	150.6	67	13.5	10.0	11.0	12.0		24.0				9				.		.				
10	149.5											10										
11	150.3											11										
12	151.5											12										
13	102.0	69	14.2	.								13				.		.				
14	101.8											14										
15	50.7	70	15.0	14.0			verde19	25.0	167.0			15						.				
16	51.0											16										
17	35.8	77	15.3	17.0	12.0	13.0						17				.		.				
18	34.7											18										
19	34.2											19								.		
20	34.4											20							.		.	
21	5.4	79	16.9	22.0			verde20	26.0	168.0			21				.		.				
22	5.9											22										
23	6.4											23								.		
24	5.6											24							.		.	
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *FARO3* *Date (dd/mm/yy):* *13/09/22*

Ship : Sarmiento de Gamboa *Cast :* *1*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	cco/HP
		Flask	Samp T.																			
1	751.7	80	13.3	1.0			verde21	28.0				1										
2	752.1											2								.		
3	752.5											3							.		.	.
4	753.2											4					. +10	. +10				
5	704.1	81	13.3	20.0			verde22	29.0	169.0			5				.	.	.				
6	600.9	83	13.2	6.0								6					.	.				
7	600.5											7										
8	501.2	85	12.5	24.0			verde23	30.0				8				.	.	.				
9	402.3	87	12.2	9.0								9					.	.				
10	301.8	88	12.5	23.0								10				.	.	.				
11	199.7	89	13.2	11.0			verde24	31.0	170.0			11					.	.				
12	151.3	91	13.7	12.0								12				.	.	.				
13	102.2	93	14.4	13.0								13										
14	101.2											14										
15	50.0	95	15.5	15.0			rojo1	32.0				15										
16	49.4											16				.	.	.				
17	24.5	96	14.2	16.0								17										
18	24.9											18				.	.	.				.
19	25.0											19								.		
20	24.8											20							.		.	
21	3.6	100	17.8	21.0			rojo2	33.0	171.0			21				.	.	.				
22	4.5											22										
23	4.5											23								.		
24	4.4											24							.		.	.
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *FARO4* *Date (dd/mm/yy):* *13/09/22*

Ship : Sarmiento de Gamboa *Cast :* *1*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal
		Flask	Samp T.						
1	643.6	102	13.0	1.0			rojo3	34.0	172.0
2	644.5								
3	644.1								
4	603.8	103	13.1	4.0					
5	503.9	104	12.2	5.0	13.0	14.0	rojo4	35.0	173.0
6	504.3								
7	502.3								
8	398.3	106	12.0	8.0			rojo5	36.0	174.0
9	301.0	107	12.6	9.0					
10	201.5	108	13.6	10.0	14.0	15.0	rojo6		175.0
11	100.6	111	15.1	11.0					
12	49.5	114	16.3	12.0	15.0	16.0	rojo7	37.0	176.0
13	48.8								
14	49.8								
15	31.0								
16	30.0	115	16.5	16.0	16.0	17.0		38.0	
17	29.6								
18	29.9								
19	30.6								
20	4.2	116	18.6	20.0			rojo8	39.0	177.0
21	4.7								
22	5.0								
23	4.0								
24	3.4								
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal

Bt.	fito	DNA	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Cocco/HP
1						.	.	.				
2										.		
3									.		.	.
4							.	.				
5							.	.				
6	.	.	.	.	.							
7	.	.	.	.	.							
8							.	.				
9						.	.	.				
10							.	.				
11						.	.	.				
12						.	.	.				
13	.	.	.	.								
14					.							
15					.							
16						.	.	.				
17	.	.	.	.								
18										.		.
19									.		.	
20						.	.	.				
21					.							.
22	.	.	.	.								
23										.		
24									.		.	
Bt.	fito	DNA	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *3* *Date (dd/mm/yy):* *14/09/22*

Ship : Sarmiento de Gamboa *Cast :* *shallow*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Cocco/HP
		Flask	Samp T.																			
1	502.1	1	11.8	1.0		18.0	9.0	40.0	178.0			1				.	.	.				
2	503.7										.	2										
3	504.3										.	3										
4	502.7											4			.							
5	404.0	3	12.1	5.0			10.0	41.0				5					.	.				
6	302.3	5	12.7	6.0			11.0	42.0	179.0			6				.	.	.				
7	202.8	6	13.8	7.0			12.0	43.0				7										
8	201.6											8				.	.	.				.
9	100.6	13	15.7	9.0			13.0	44.0				9				.	.	.				
10	76.0	14	16.1	10.0	19.0	21.0		45.0				10				.	.	.				
11	76.7									.	.	11	.	.								
12	76.5											12							.		.	
13	76.6											13								.		
14	76.7											14			.							.
15	51.1	18	17.8	15.0	18.0	20.0	14.0	46.0	180.0			15					.	.				.
16	51.0											16			.							
17	51.4									.	.	17	.	.								
18	25.9	22	19.8	18.0				47.0				18					.	.				
19	25.7											19			.							
20	3.8	25	21.9	20.0	17.0	19.0	15.0	48.0				20										
21	3.6											21			.	.	.	.				.
22	2.9									.	.	22	.	.								
23	3.0											23								.		
24		OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	24	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *3* *Date (dd/mm/yy):* *14/09/22*

Ship : Sarmiento de Gamboa *Cast :* *bottom*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	cco/HP
		Flask	Samp T.																			
1	5104.5	27	4.5	1.0			16.0					1				.	.+10	10.0				
2	5105											2								.		
3	5037	28	4.4	3.0		22.0	17.0	49.0	151.0			3					.	.				
4	5036										.	4										
5	5037										.	5										
6	4534	30	4.2	6.0			18.0	50.0				6					.	.				
7	4030	31	4.3	7.0		23.0	19.0	51.0	152.0			7				.	.	.				
8	3525	32	4.5	8.0			20.0	52.0				8					.	.				
9	3023	33	4.7	9.0		24.0	21.0	53.0	153.0			9				.	.	.				
10	2517	34	5.2	10.0			22.0	54.0				10					.	.				
11	2014	35	6.2	11.0		25.0	23.0	55.0	154.0			11				.	.	.				
12	2015										.	12										
13	2014										.	13										
14	1764	36	7.0	14.0			24.0	56.0				14				.	.	.				
15	1512	37	8.6	15.0		26.0	M1	57.0				15					.	.				
16	1258	39	11.2	16.0			M2	58.0				16					.	.				
17	1258										.	17										
18	1260										.	18										
19	1008	46	11.5	19.0		27.0	M3	59.0	155.0			19				.	.	.				
20	906	47	11.7	20.0			M4	60.0				20					..	..				
21	806	48	12.2	21.0		28.0	M5	61.0	156.0			21					..	..				
22	704	49	12.7	22.0			M6	62.0				22					..	..				
23	605	51	12.4	23.0		29.0	M7	63.0				23					..	..				
24		OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	24	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *4* *Date (dd/mm/yy):* *15/09/22*

Ship : Sarmiento de Gamboa *Cast :* *shallow*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	cco/HP
		Flask	Samp T.																			
1	253.6	53	12.9	1.0	20.0	30.0		64.0				1					.	.				
2	253.6										.	2										
3	253.4										.	3										
4	253.7											4			.							
5	253.6											5										
6	202.0	54	13.4	6.0			1.0	68.0	157.0			6				.	.	.				
7	151.4	55	14.1	7.0								7				.	.	.				
8	101.4	57	14.8									8				.	.	.				
9	75.7	58	15.5	9.0	21.0	31.0	2.0	65.0				9				.	.	.				.
10	75.3											10			.							
11	75.5									.	.	11	.	.								
12	75.1											12							.		.	
13	74.9											13								.		
14	51.6	60	17.0	14.0	22.0	32.0	3	66.0	158			14					.	.				.
15	51.7											15			.							
16	51.7									.	.	16	.	.								
17	25.4	61	21.2	17.0								17										
18	25.7											18					.	.				.
19	6.0											19										
20	5.5	62	22.3	20.0	23.0	33.0	4.0	67.0				20				.	.	.				
21	4.6											21			.							.
22	4.8									.	.	22	.	.								
23	5.0											23								.		
24	5.2											24							.		.	
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *4* *Date (dd/mm/yy):* *15/09/22*

Ship : Sarmiento de Gamboa *Cast :* *bottom*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	cco/HP
		Flask	Samp T.																			
1	4377	63	4.1	1.0			v5	69.0				1				.	.+10	10.0				
2	4377											2								.		
3	4376											3								.		.
4	4029	64	4.3	4.0		34.0	v6	70.0	159.0			4				.	.	.				
5	4029										.	5										
6	4030										.	6										
7	3525	67	4.4	7.0		35.0	v7	71.0				7					.	.				
8	3020	69	4.7	8.0		36.0	v8	72.0	160.0			8				.	.	.				
9	2518	70	5.2	9.0		37.0	v9	73.0				9					.	.				
10	2014	77	6.1	10.0		38.0	v10	74.0	161.0			10				.	.	.				
11	2016										.	11										
12	2015										.	12										
13	1763	79	6.9	13.0			v111	75.0				13				.	.	.				
14	1510	OPEN	OPEN	OPEN		OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	14	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	
15	1259	80	11.5	15.0		39.0	R1	76.0				15					.	.				
16	1260										.	16										
17	1259										.	17										
18	1009	81	11.6	18.0		40.0	r2	77.0	162.0			18				.	.	.				
19	806	83	11.2	19.0			r3	78.0				19					.	.				
20	707	85	11.6	20.0		41.0	r4	79.0	163.0			20					.	.				
21	605	87	12.1	21.0			r5	80.0				21					.	.				
22	504	88	12.1	22.0		42.0	r6	81.0				22				.	.	.				
23	404	89	12.4	23.0			r7	82.0				23					.	.				
24	302	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	24	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POm	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *5* *Date (dd/mm/yy):* *16/09/22*

Ship : Sarmiento de Gamboa *Cast :* *bottom*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Cocco/HP
		Flask	Samp T.																			
1	3021	91	5.0	1.0		43.0	verde14	83	164.0			1				.	.	.				.
2	3021											2							.		.	
3	3020											3								.		
4	3021											4										
5	2512	93	5.6	5.0			15.0	84				5				.	.	.				
6	2015	95	6.4	6.0		44.0	16.0	85	165.0			6					.	.				
7	1763	96	7.2	7.0			17.0	87				7					.	.				
8	1764										.	8										
9	1764										.	9										
10	1510	100	9.5	10.0		45.0	18.0	86				10					.	.				
11	1512											11										
12	1259	102	11.6	12.0			19.0	88				12					.	.				
13	1259											13										
14	1259											14										
15	1003	103	12.6	15.0		46.0	20.0	89	166.0			15				.	.	.				
16	806	104	12.6	16.0								16					.	.				
17	706	106	12.8	17.0			21.0	90				17					.	.				
18	606	107	12.4	18.0								18					.	.				
19	504	108	12.4	19.0		47.0	22.0	91	167.0			19				.	.	.				
20	403	114	12.5	20.0			23.0					20					.	.				
21	302	111	13.0	21.0				92				21					.	.				
22	202	115	13.9	22.0			verde24	93				22				.	.	.				
23	101	116	15.9	23.0								23				.	.	.				.
24	102											24										
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *5* *Date (dd/mm/yy):* *16/09/22*

Ship : Sarmiento de Gamboa *Cast :* *shallow*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Cocco/HP
		Flask	Samp T.																			
1	252.5	120	13.0	2.0	24.0	48.0		94				1					.	.				
2	252.6										.	2										
3	253.1										.	3										
4	202.3	218	13.5	3.0								4			.							
5	151.1	220	14.4	4.0								5										
6	152.4											6				.	.	.				
7	101.5	222	15.7	8.0			rojo8		168.0			7										
8	101.2											8				.	.	.				
9	91.4	232	15.9	9.0	25.0	49.0		95				9				.	.	.				
10	91.3											10			.							.
11	90.8									.	.	11	.	.								
12	91.2											12							.		.	
13	90.9											13								.		
14	50.6	233	18.2	11.0	26.0	50.0	rojo9	96				14					.	.				
15	51.1											15			.							.
16	50.9									.	.	16	.	.								
17	51.4											17										
18	25.8	234	21.8	13.0								18					.	.				.
19	4.8											19							.		.	
20	4.7	236	22.1	14.0	27.0	51.0	rojo10	97				20				.	.	.				
21	4.8											21			.							.
22	4.7									.	.	22	.	.								
23	4.2											23								.		
24	4.6	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	24	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *6* *Date (dd/mm/yy):* *16/09/22*

Ship : Sarmiento de Gamboa *Cast :* *shallow*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	cco/HP
		Flask	Samp T.																			
1	252.9	239	12.8	1.0								1										
2	254.1											2				.	.	.				
3	201.8											3					.	.				
4	201.3	244	13.5	4.0			rojo11	98				4										
5	151.6	1	14.3	5.0								5										
6	151.6											6				.	.	.				
7	100.2	3	15.5	7.0			12.0		169.0			7										
8	101.1											8				.	.	.				.
9	60.1	5	17.2	9.0	28.0	52.0		99				9										
10	60.1											10				.	.	.				.
11	60.0									.	.	11	.	.								
12	60.0	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
13	59.9											13							.		.	
14	60.6											14								.		
15	49.6	6	18.1	15.0	29.0	53.0	13		170.0			15										
16	49.3											16				.	.	.				.
17	25.0	13	22.0	17.0				100				17				.	.	.				.
18	25.7									.	.	18										
19	25.8									.	.	19										
20	3.6	14	22.4	20.0	30.0	54.0	rojo14	101.0				20	.	.		.	.	.				
21	4.5									.	.	21										
22	5.0									.	.	22										
23	3.8											23								.		
24	3.4											24							.		.	.
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *6* *Date (dd/mm/yy):* *16/09/22*

Ship : Sarmiento de Gamboa *Cast :* *bottom*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	cco/HP
		Flask	Samp T.																			
1	2586	18	4.6	.		55.0	15roja	102				1				.	.	.				.
2	2586											2							.		.	
3	2587											3								.		
4	2516	OPEN	OPEN	OPEN		OPEN	OPEN	OPEN	OPEN	OPEN		4		OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	
5	2518										.	5										
6	2517										.	6										
7	2266	22	5.4	7.0								7					.	.				
8	2013	25	5.8	8.0		56.0	**18**	103				8				.	.	.				
9	1762	27	7.4	9.0								9					.	.				
10	1510	28	7.6	10.0			16.0	104				10				.	.	.				
11	1258	30	9.3	11.0		57.0	17.0	105	171.0			11				.	.	.				
12	1258										.	12										
13	1258										.	13										
14	1004	31	11.0	14.0		58.0	19.0	106				14					.	.				
15	907	32	12	15.0								15					.	.				
16	806	33	11.0	16.0			20.0	107	172.0			16				.	.	.				
17	705	34	11.8	17.0								17					.	.				
18	604	35	12.1	18.0			21.0	108				18					.	.				
19	503	36	12.2	19.0		59.0	22.0					19					.	.				
20	503										.	20										
21	503										.	21										
22	404	37	12.4	22.0			23	109				22					.	.				
23	302	39	12.8	23.0			24.0	110				23				.	.	.				
24	202	46	14.1	24.0								24					.	.				
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *7* *Date (dd/mm/yy):* *17/09/22*

Ship : Sarmiento de Gamboa *Cast :* *bottom*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Cocco/HP
		Flask	Samp T.																			
1	3325	47	4.4	1.0			M1	111				1					.	.				.
2	3324											2							.		.	
3	3325											3								.		
4	3023	49	4.7	4.0		60.0	2.0	112				4					.	.				
5	2518	48	5.2	5.0			3.0	113				5				.	.	.				
6	2014	276	6.3	6.0		61.0	4.0	114	173.0			6					.	.				
7	1763	280	7.2	7.0								7					.	.				
8	1512	282	8.8	8.0			5.0	115				8					.	.				
9	1260	284	11.2	9.0								9				.	.	.				
10	1008	285	11.9	10.0		62.0	6.0	116	174.0			10					.	.				
11	806	286	11.6	11.0								11					.	.				
12	605	288	12.6	12.0								12					.	.				
13	503	289	11.9	13.0		63.0	7.0	117				13					.	.				
14	402	291	12.4	14.0								14					.	.				
15	254	293	13.5	15.0								15				.	.	.				
16	201	295	14.2	16.0			8.0	118	175			16					.	.				
17	152	296	15.0	17.0								17				.	.	.				.
18	92	315	16.3	18.0	31.0	64.0	9.0	119				18	.	.		.	.	.				
19	92											19								.		
20	92											20							.		.	.
21	51	316	18.9	21.0	32.0	65.0		120		.		21	.	.			.	.				.
22	4	317	22.1	22.0	33.0	66.0	10.0	121		.		22	.	.		.	.	.				
23	4.3											23								.		
24	4.2											24							.		.	.
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *8* *Date (dd/mm/yy):* *17/09/22*

Ship : Sarmiento de Gamboa *Cast :* *1*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	Cocco/HP
		Flask	Samp T.																			
1	1005	318	12.2	1.0		67.0	verde15	122				1				.	.	.				.
2	1005											2							.		.	
3	1006											3								.		
4	1006										.	4										
5	805	319	12.8	5.0				123				5					.	.				
6	705	320	13.0	6.0		68.0	16.0	124				6					.	.				
7	603	321	13.0	7.0				125				7					.	.				
8	504	322	12.2	8.0	34.0	69.0	17.0	126	176.0			7				.	.	.				
9	252	323	13.3	9.0			18.0	127				8			.	.	.	.				
10	252									.	.	9	.	.								
11	101	325	15.4	11.0	35.0	70.0	19.0	128	177.0			11				.	.	.				
12	101											12			.							.
13	100									.	.	13	.	.								
14	64	326	16.1	14.0	36.0	71.0	20.0	129				14					.	.				
15	65											15			.							.
16	64									.	.	16	.	.								
17	65											17								.		
18	66											18							.		.	
19	50	327	17.4	19.0				130				19				.	.	.				.
20	5	51	22.2	20.0	PERDIDAS	PERDIDAS	21.0	131				20				.	.	.				
21	3											21			.							.
22	3.3									.	.	22	.	.								
23	4.3											23								.		
24	5.0											24							.		.	
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *1BIS* *Date (dd/mm/yy):* *19/09/22*

Ship : Sarmiento de Gamboa *Cast :* *1*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	cco/HP
		Flask	Samp T.																			
1	132	93	13.7	1.0								1					.	.				.
2	132											2							.		.	
3	132											3								.		
4	101	95	13.9	4.0			1.0	132	178.0			4					.	.				
5	101											5										
6	100											6										
7	75	96	14.4	7.0								7					.	.				
8	75											8										
9	50	100	15.2	9.0	37.0	72.0	2.0	133				9					.	.				
10	50									0.5	8.0	10										
11	50											11			.							.
12	50											12										
13	30	102	16.3	13.0	38.0	73.0	3.0	134	179.0			13					.	.				
14	30											14										
15	29											15										.
16	29									.	8.0	16	.	.								
17	29											17			.					.		
18	29											18							.		.	
19	5	103	19.6	19.0	39.0	74.0	4.0	135	180.0			19					.	.				
20	5											20			.							.
21	5									0.5	8.0	21	.	.								
22	5											22								.		
23	6											23							.		.	
24	5											24										
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

Sampling Sheet

Cruise : **SINES** *Station :* *2BIS* *Date (dd/mm/yy):* *19/09/22*

Ship : Sarmiento de Gamboa *Cast :* *1*

Bt.	CTD Pressure	Oxygen		pH	POM	DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	$\delta^{13}C$	$\delta^{18}O$	eDNA	Biomk	Toxi	cco/HP
		Flask	Samp T.																			
1	774	104	12.7	1.0			roja5	136				1					.	.				.
2	774											2							.		.	
3	774											3								.		
4	705	106	12.7	4.0								4					.	.				
5	602	107	12.8	5.0			6.0	137	151.0			5					.	.				
6	503	108	12.4	6.0			7.0	138				6					.	.				
7	402	111	12.3	7.0								7					.	.				
8	301	114	12.6	8.0			8.0	139				8					.	.				
9	202											9										
10	101	115	15.0	10.0	40.0	75.0	9.0	140	152.0			10					.	.				
11	101									0.5	8.0	11	.	.								
12	101											12			.							
13	60	116	16.2	13.0	41.0	76.0	10.0	141				13					.	.				
14	59											14			.							.
15	60									.	8.0	15	.	.								.
16	60											16								.		
17	59											17							.		.	
18	24											18										
19	25	218	20.0	19.0								19					.	.				
20	5	220	21.2	20.0	42.0	77.0	verde1	142				20					.	.				.
21	5									0.5	8.0	21	.	.								.
22	4											22			.							
23	5											23			.					.		
24	5											24							.		.	
Bt.	CTD pres.	O_2 flask	O_2 temp.	pH	POM/DOM	POM/DOM	Alk.	Nutri	Sal	fito	DNA	Bt.	Chla	cyto	Nfix	TE	δ13C	δ18O	eDNA	Biomk	Toxi	Cocco

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°. 824077

ANNEX III – MULTINET SAMPLES

CLIMATE CHANGE IMPACT ON OCEAN FRONTS ECOSYSTEMS:

The case of the Iberian Upwelling System (SINES)

R/V Sarmiento de Gamboa, Cruise No. SEA02_08,

11-20 September 2022, Lisboa – Lisboa (Portugal)

Fontela, Marcos; Abrantes, Fátima; Álvarez-Fernández, María Jesús; Borges de Sousa, João; Curbelo, David; Fernández-Román, Daniel; Ferreira, Fernanda; Fuentes-Lema, Antonio; Gebara, Lívia; Gomes, Mara; Herman, Temu, Verynice; Mega, Aline; Mendes, Renato; Molina, Giulia; Nieto, Sofía; Pereira, Hélder; Ramalho, Sofía; Relvas, Paulo; Ríos, Dunia; Voelker, Antje

EUROFLEETS+ SINES - LIST OF MULTINET SAMPLES					
Station	MN nº	Depth range (m)	Volume filtered (m^3)	Remarks	contact: Antje Voelker, IPMA
SINES 01	MN 001	80-60		Heave in 1-1,5 m range	
		60-40			
		40-20		net haul stalled at 30 m for 1-2 minutes	
		20-0			
SINES 02	MN 002	450-350	64	Heave in 1-1,5 m range	
		350-200	99		
		200-100	70		
		100-80	11		
		80-60	15		
		60-40	11		
		40-20	20		
		20-0	20		
FARO 03	MN 003	550-450	no flowmeter/volume	4 nets torn/destroyed; basket with cups fell over on deck	
		450-300	readings		
		300-200			
		200-100			
		100-80			
		80-60			
		60-40			
		40-20			
		20-0		Heave +/-0,5-1 m	
FARO 04	MN 004	450-300	49	net torn	
		300-200	97		
		200-100	86	net torn	
		100-80	20		
		80-60	21		
		60-40	20		
		40-20	13		
		20-may	23		
SINES 03	MN 005	700-450	259	Heave generally within +/-1 m	
		450-300	147	cup net torn at bottom; no sample	
		300-200	86		
		200-100	99		
		100-60	39	cup net has tear	
		60-5	(not written down)	net torn; quality of sample questionable	
SINES 04	MN 006	700-300	no correct flowmeter/	net torn, no sample	
		300-200	no volume readings		
		200-100			
		100-60		no sample, discarded by mistake	
		60-40			
		40-5		Heave +/-0,5-1 m	
SINES 05	MN 007	450-300	126	Heave generally +/-0,5 m	
		300-200	90		
		200-100	73		
		100-80	14	DCM	
		80-40	34	subsurface O_2 maximum	
		40-5	41		
SINES 06	MN 008	450-300	124	Heave generally +/-0,5 m	
		300-200	80	sample partially lost/cup fell on floor	
		200-100	93	net has big tear; quality questionable	
		100-80	17		
		80-40	34		
		40-5	27		
SINES 07	MN 009	450-300	108	Heave generally +/-0,5 m with peaks of +/- 1m	
		300-200	62		
		200-100	68		
		100-60	29		
		60-5	40		
SINES 08	MN 010	445-300	98	Heave generally +/-0,5 m with peaks of +/- 1m	
		300-200	55		
		200-100	52		
		100-60	23		
		60-5	34		
SINES 01B	MN 11	100-80	13	Heave +/- 0,4 m	
		80-60	8		
		60-40	9		
		40-20	9		
		20-0	13		
SINES 02B	MN 12	450-300	75	Heave +/- 0,4 m with some peaks of 0,6 m	
		300-200	46		
		200-100	45		
		100-40	31		
		40-5	18		

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An alliance of European marine research infrastructure to meet the evolving needs of the research and industrial communities

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ANNEX IV – BOX-CORER FORMS

CLIMATE CHANGE IMPACT ON OCEAN FRONTS ECOSYSTEMS:

The case of the Iberian Upwelling System (SINES)

R/V Sarmiento de Gamboa, Cruise No. SEA02_08,

11-20 September 2022, Lisboa – Lisboa (Portugal)

Fontela, Marcos; Abrantes, Fátima; Álvarez-Fernández, María Jesús; Borges de Sousa, João; Curbelo, David; Fernández-Román, Daniel; Ferreira, Fernanda; Fuentes-Lema, Antonio; Gebara, Lívia; Gomes, Mara; Herman, Temu, Verynice; Mega, Aline; Mendes, Renato; Molina, Giulia; Nieto, Sofía; Pereira, Hélder; Ramalho, Sofía; Relvas, Paulo; Ríos, Dunia; Voelker, Antje

BOXCORER FORM

Cruise : SINES EUROFLEETS+	Vessel : SARMIENTO DE GAMBOA
Date : 11 / 09 / 2022	Time (GMT) on deck: 22 H 29 M
Station nº : SG 26 SG 01 — BC 01	Water depth (m): 143
Latitude: 37.2585 (N)	Longitude: -9.0768 (W)

Remarks

Responsible:

Liner	Objective	Core length (cm)	Liner type	Remarks
1				
2				
3				
4				
5				
6				
7				
8				

Surface sampling (volume): cc

Benthic forams 75
Planktonic forams 25
Organic + Geoch 25
Diatoms + Coccos+ Ostrac 25

Other sampling:

Texture 75
Archive 100
DNA- Dinos (1 spoon)
DNA micro (1 spoon UA)

Surface Description:

(Color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

Box with a max height of 18 cm
Sandy mud rich in biogenics; presence of shell fragments

Lateral Description:

(Depth, color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

BOXCORER FORM

Cruise : SINES EUROFLEETS+	Vessel : SARMIENTO DE GAMBOA
Date : 12 / 09 / 2022	Time (GMT) on deck: 01 H 34 M
Station nº : SG 26 SG SINES 02 — BC02	Water depth (m): 830
Latitude: 37.3425 (N)	Longitude: -9.2955 (W)

Remarks

Responsible: FA

Liner	Objective	Core length (cm)	Liner type	Remarks
1	TBD	46	110 PVC	
2	TBD	46	110 PVC	
3	TBD	46	110 PVC	
4	TBD	46	110 PVC	
5				
6				
7				
8				

Surface sampling (volume):

Benthic forams
Planktonic forams
Organic + Geoch
Diatoms + Coccos + Ostrac

Other sampling: Archive
Texture
DNA Dinos Micros UA
DNA revival

Surface Description:

(Color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

Greenish Mud

Important compaction downcore

Lateral Description:

(Depth, color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

BOXCORER FORM

Cruise : SINES EUROFLEETS+	Vessel : SARMIENTO DE GAMBOA
Date : 13 / 09 / 2022	Time (GMT) on deck: 07 H 10 M
Station n° : SG26 SG FARO01 — BC03	Water depth (m): 130
Latitude: 36, 9022 (N)	Longitude: -7.9068 (W)

Remarks

Sampled for Paleo and micro and macro benthic communities

Responsible: FA

Liner	Objective	Core length (cm)	Liner type	Remarks
1	TBD	49	110 PVC	
2	TBD	49	110 PVC	
3	TBD	49	110 PVC	
4	TBD	49	110 PVC	
5				
6				
7				
8				

Surface sampling (volume):

Benthic forams
Planktonic forams
Organic + Geoch
Diatoms + Coccos + Ostrac

Other sampling: Archive
Texture
DNA Dinos Micros UA
DNA revival

Surface Description:

(Color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

Brown greenish mud sediment highly bioturbated and irregular

Lateral Description:

(Depth, color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

BOXCORER FORM

Cruise : SINES EUROFLEETS+	Vessel : SARMIENTO DE GAMBOA
Date : 14 / 09 / 2022	Time (GMT) on deck: ____ H ____ M
Station n° : SG 26 SG FARO04 — BC04	Water depth (m): 656
Latitude: 36.9021 (N)	Longitude: -7.9066 (W)

Remarks

Sampled for Paleo and micro and macro benthic communities

Responsible: FA

Liner	Objective	Core length (cm)	Liner type	Remarks
1	TBD	37	110 PVC	
2	TBD	37	110 PVC	
3	TBD	37	110 PVC	
4	TBD	37	110 PVC	
5				
6				
7				
8				

Surface sampling (volume):

Benthic forams
Planktonic forams
Organic + Geoch
Diatoms + Coccos + Ostrac

Other sampling: Archive
Texture
DNA Dinos Micros UA
DNA revival

Surface Description:

(Color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

Brown greenish mud sediment rich in foraminifera
Roundish pieces of darker sediment at the top and also downcore.
Contamination of sediment from the previous site?

Lateral Description:

(Depth, color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

BOXCORER FORM

Cruise : SINES EUROFLEETS+	Vessel : SARMIENTO DE GAMBOA
Date : 15 / 09 / 2022	Time (GMT) on deck: 03 H 51 M
Station n° : SG 26 SG SINES 03 — BC05	Water depth (m): 5091
Latitude: 37.9949448 (N)	Longitude: -11.4283537 (W)

Remarks

43 cm

Responsible: FA

Liner	Objective	Core length (cm)	Liner type	Remarks
1	TBD	43	110 PVC	
2	TBD	43	110 PVC	
3	TBD	43	110 PVC	
4	TBD	43	110 PVC	
5				
6				
7				
8				

Surface sampling (volume):

Benthic forams 75
Planktonic forams 75
Organic + Geoch 25
Diatoms + Coccos + Ostrac 25

Other sampling: Archive 100
Texture 75
DNA Dinos Micros UA
DNA revival

Surface Description:

(Color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

Homogeneous surface of creme color mud

Lateral Description:

(Depth, color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

BOXCORER FORM

Cruise : SINES EUROFLEETS+	Vessel : SARMIENTO DE GAMBOA
Date : 16 / 09 / 2022	Time (GMT) on deck: 00 H 10 M
Station n° : SG26 SG SINES 04 — BC06	Water depth (m): 4337
Latitude: 37.7411 (N)	Longitude: -10.6078 (W)

Remarks

FAILED!

Responsible: FA

Liner	Objective	Core length (cm)	Liner type	Remarks
1				
2				
3				
4				
5				
6				
7				
8				

Surface sampling (volume):

Benthic forams
Planktonic forams
Organic
Diatoms

Other sampling: Archive
Texture
DNA Dinos Micros UA
DNA revival

Surface Description:
(Color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

Lateral Description:
(Depth, color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

BOXCORER FORM

Cruise : SINES EUROFLEETS+	Vessel : SARMIENTO DE GAMBOA
Date : 16 / 09 / 2022	Time (GMT) on deck: 20 H 45 M
Station nº : SG 26 SG SINES 06 — BC07	Water depth (m): 2607
Latitude: (N)	Longitude: (W)

Remarks

Complete core for micro and macro benthic communities
Sampled in Slabs 0-3; 3-5; 5-10; 10-15 cm

Responsible:
FA / SR

Liner	Objective	Core length (cm)	Liner type	Remarks
1				
2				
3				
4				
5				
6				
7				
8				

Surface sampling (volume):

Benthic forams
Planktonic forams
Organic
Diatoms

Other sampling:

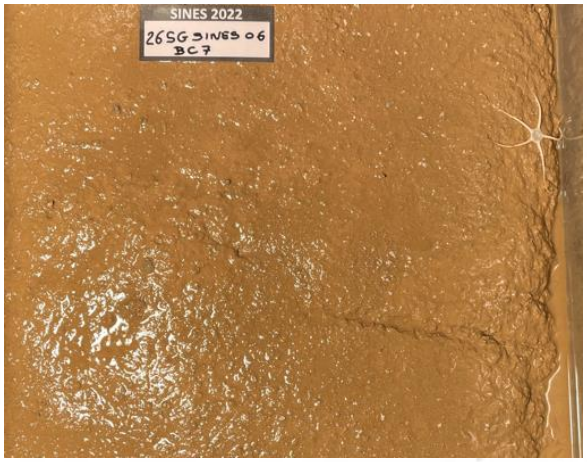
Surface Description:

(Color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

Light brown mud very plastic and rich in pteropods.
Complete ofiuro (starfish)

Lateral Description:

(Depth, color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)



BOXCORER FORM

Cruise : SINES EUROFLEETS+	Vessel : SARMIENTO DE GAMBOA
Date : 16 / 09 / 2022	Time (GMT) on deck: 23 H 52 M
Station n° : SG 26 SG SINES 06 — BC08	Water depth (m): 2607
Latitude: (N)	Longitude: (W)

Remarks
Most of the core was sampled for Paleo (Surfaces), 3 transp liners & 3 110 mm liners
rest of the material for micro and macro benthic communities

Responsible:
FA

Liner	Objective	Core length (cm)	Liner type	Remarks
1	TBD	38	Transp	
2	TBD	38	Transp	
3	TBD	38	Transp	
4	TBD	38	110 PVC	
5	TBD	38	110 PVC	
6	TBD	38		
7				
8				

Surface sampling (volume):
Benthic forams
Planktonic forams
Organic / geoch
Diatoms / coccos/ ostracods

Other sampling: Archive; Texture
DNA dinos
DNA micros
Revival dinos

Surface Description:
(Color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

Light brown mud very plastic and rich in pteropods and foraminifera.

Lateral Description:
(Depth, color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

BOXCORER FORM

Cruise : SINES EUROFLEETS+	Vessel : SARMIENTO DE GAMBOA
Date : 17 / 09 / 2022	Time (GMT) on deck: 15 H 27 M
Station n° : SG 26 SG SINES — BC09	Water depth (m): 1081
Latitude: 37.5712913 (N)	Longitude: -10.1255702 (W)

Remarks Soft sediment filling the entire box-core without any water over sediment

Possibility of disturbed top

Used only for micro and macro benthic communities

Responsible: FA/ SR

Liner	Objective	Core length (cm)	Liner type	Remarks
1				
2				
3				
4				
5				
6				
7				
8				

Surface sampling (volume):

Benthic forams

Planktonic forams

Organic + Geoch

Diatoms + Coccos + Ostrac

Other sampling: Archive

Texture

DNA Dinos Micros UA

DNA revival

Surface Description:

(Color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

Light brown very soft and water rich mud

Lateral Description:

(Depth, color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

BOXCORER FORM

Cruise : SINES EUROFLEETS+	Vessel : SARMIENTO DE GAMBOA
Date : 17 / 09 / 2022	Time (GMT) on deck: 17 H 19 M
Station n° : SG 26 SG SINES — BC10	Water depth (m): 1081
Latitude: 37.3589107 (N)	Longitude: -9.4106272 (W)

Remarks Soft sediment filling the entire box-core without any water over sediment

Possibility of disturbed top

Responsible:

Liner	Objective	Core length (cm)	Liner type	Remarks
1	TBD	56	110 PVC	
2	TBD	56	110 PVC	
3	TBD	56	110 PVC	
4	TBD	56	110 PVC	
5	TBD	56	110 PVC	
6	TBD	56	110 PVC	
7				
8				

Surface sampling (volume):

Benthic forams
Planktonic forams
Organic + Geoch
Diatoms + Coccos + Ostrac

Other sampling: Archive
Texture
DNA Dinos Micros UA
DNA revival

Surface Description:

(Color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)

Light brown very soft and water rich mud

Lateral Description:

(Depth, color, sediment type, structures, bioturbation, presence of biogenics or minerals, etc)