

Start	2023	10	14	Bilbao, Spain
End	2023	11	14	Cadix, Spain

SCIENTIFIC INTEREST & CAMPAING OBJECTIVES

This Leg left Bilbao (Spain) to Cadix (Spain) through Porto (Portugal) from October 14th till November 14th and was the last leg of year 2023 of the **Tara EUROPA** expedition (April 2023 – July 2024; <https://fondationtaraocan.org/en/expedition/tara-europa/>). This leg is named after **Angeles Alvariño**, a spanish fishery research biologist and oceanographer, on advice of our local collaborator Ibon Cancio. This aims to raise awareness on the significant contribution of this Spanish scientist.

Tara EUROPA is the ocean part of a larger program, **TREC** – Traversing European Coastlines (<https://www.embl.org/about/info/trec/>) –, whose main goals are to: (i) study the invisible biodiversity at the land-sea interface across 19 European countries from Finland to Greece, and understand the effect of environmental changes on the interactions and evolution within and between ecosystems (soil, sediments, air, water); (ii) understand the impact of human activities (pollution and global change) on marine coastal biodiversity and ecosystems; (iii) share systems bio/ecology knowledge and advanced technologies with scientists and the general public from all coastal European countries.

In this framework, a team of 6 international researchers and engineers on board *Tara* realize the sampling of coastal waters and aerosols, at the same time and sites where an EMBL team realizes the sampling of shallow water, sediments, and soils. The sampling sites are pre-selected along the coastline or in estuaries, and represent either pristine or human-impacted (agriculture, cities and ports, pollutions) conditions. There is usually a single *Tara* ocean station at regular coastline sites, and 2 to 4, onshore to offshore stations in estuary or Fjords settings, allowing to characterize environmental gradients from brackish to marine waters, with a putative decreasing impact from land biochemistry. The positions of the coastal stations are pre-adjusted based on historical remote-sensing (ocean color) and oceanographic (bathymetry, currentology) data, and can be slightly modified depending on real-time remote sensing data and weather/navigation conditions. Overall, the *Tara* Europa stations represent a patchworks of coastal water masses with different degrees of impact from the land ecosystems.

At each *Tara* Europa station, the team onboard realize a complex suite of at least 50 protocols, and collect c.a. 100 samples stored in appropriate conditions for future analyses in laboratories. These protocols allow characterization of the biological content and diversity present in the water (from viruses to animals, from genomes, expressed genes, metabolites, proteins, to cellular and organismal features), together with contextual physical, biophysical, chemical and biochemical properties.

PARTICIPANTS – Alvariño Leg

ROLE		NAME, Surname, Affiliation
1	CREW - Captain	Yohan Mucherie
2	CREW - 1st Officer	Mathieu Oriot
3	CREW - Mecano	Dave Picaud
4	CREW - Deck	Francois Aurat
5	CREW - Deck	NA
6	CREW - Cook	From Bilbao to Porto: Sophie Bin From Porto to Cadix: Carole Pire
7	CREW - Media	From Bilbao to Porto: Theo Drieux
8	GUEST - Artist	From Porto to Cadix: Claire Nicolet
9	GUEST - Observer	30/10-01/11 Boris Hallier & Christophe Papon (France Info)
10	SCIENCE - A - Oceano. Engineer	Thomas Linkowski
11	SCIENCE - B – Bio. Engineer	Morgane Guillam
12	SCIENCE - C - W-Lab genomics	Odette Beluche
13	SCIENCE - D – Deck Chemical profiling	Daniel Petras
14	SCIENCE - E –	Flora Vincent (Chief Scientist)
15	SCIENCE - F - S-Lab sorting/imaging	Morgane Ratin

REALIZED STATIONS

For the Alvariño Leg between Bilbao and Cadix, we performed 9 stations along the coast: The locations of the stations are shown in Fig 1, and can be explored interactively in greater details [@here](#), together with a synthetic comment section about each station.

Due to very rough weather conditions characterizing the Cap Finistero in October, the first stations of our leg - Ferrol (20/10/23) and Mindelo (22/10/23) - were cancelled, to find shelter in Celeiro. In general, the storm reached 12m swell and 45 knots gusts, making it impossible for us to pass the Cap Finistero.

Further South, Porto was a 'supersite', i.e. extra water samples were taken and brought to shore using local boats. Samples were processed on land in the 'advanced mobile lab' (AML) in the framework of the TREC project (<https://www.embl.org/about/info/trec/mobile-labs/>). Due to challenging weather conditions, water transfer was done on only one station (23/10/23).

To compensate for bad weather at the start of the leg, we took advantage of the excellent conditions after Porto, down in the Gulf of Cadix, to add extra stations specifically on 5-6/11 and 8/11.

Out of 11 members of scientists + crew, 10 had already embarked on Tara. The high level of familiarity that scientists and crew had with life on board likely facilitated our ability as a team to go through the first week where no science could be done.



Figure 1. Locations of the 9 Tara EUROPA sampling stations along Alvarino Leg.

SUMMARY OF ACTIVITIES

(Provide an overview of sampling activities on every day of the Campaign, indicating the number of deployments done for each type of event)

At each *Tara Europa* station, during 4 to 6 hours, we deployed or activated different gears to sample water and aerosols either *in situ* or on *Tara's* deck and mast. The different types of sampling, associated to different sampling gears, are listed in the columns of Table 1, which gives the number of each sampling type (we call 'events') at each station (rows). Details about the timing and basic environmental conditions at each stations are available [@here](#).

Table 1. Types and numbers of sampling gears' deployments and/or sampling activities, for each of the 9 Tara EUROPA stations along the Alvarino Leg. The total number of samples collected at each station is also given in the last column.

Date	Station #	Name	Latitude	Longitude	Cast	Pump A20	Net 5 µm	Net 20 µm	Net 200 µm	Net 680 µm	Bow Pole	ASM	HTSRB	SML	Mercury	eDNA	Aliens in Port	# of samples
23/10/2023	91	Porto shore	41.1378	-8.6775	1	1	1	1	1	2	1	1	1	0	1	0	1	185
25/10/2023	92	Porto offshore	41.1351	-8.7344	1	1	1	1	1	2	1	1	1	0	1	0	0	128
01/11/2023	93	Sagres	37.01895	-8.9086	1	1	1	1	1	2	1	1	1	1	1	0	0	114
03/11/2023	94	Faro	36.9686	-7.8506	1	1	1	1	1	2	1	1	1	1	1	0	0	111
05/11/2023	95	Guadiana shore	37.1359	-7.3991	1	1	1	1	1	2	1	1	1	1	1	0	0	111
06/11/2023	96	Guadiana offshore	37.04637	-7.42610	1	1	1	1	1	2	1	1	1	1	1	0	0	110
07/11/2023	97	Chipiona	36.70700	-6.44400	1	1	1	1	1	2	1	1	1	1	1	0	0	111
08/11/2023	98	Cadix offshore	36.488250	-6.654370	1	1	1	1	1	2	1	1	1	1	1	0	0	110
09/11/2023	99	Cadix shore	36.53720	-6.32030	1	1	1	1	1	2	1	1	1	1	1	0	1	110

Legend:

Pump A20: Deployment of a tubing system in sub-surface waters, connected to a peristaltic pump installed in the wetlab on *Tara's* deck. Water is then filtered through large membranes to concentrate plankton biomass for genetic analyses.

Net: Deployment of various types of plankton nets with specific mesh-sizes (5 µm, 20 µm, 200 µm or 680 µm), either on *Tara's* deck (Decknets, 5 µm, 20 µm) or overboard (200 µm or 680 µm).

Cast: Deployment of the Rosette sampler (holding 5x12L and 8x8L Niskin bottles and sensors) to collect a suite of biophysical data and water samples along the water column.

Bow pole: Manual handling of a long stick for clean, contamination-free collection of small volumes of surface water stored for laboratory analyses of trace elements.

ASM (Aerosol Sampling Mast): Pumping system installed on *Tara's* mast to collect and concentrate aerosols.

HTSRB (Hyperspectral Tethered Spectral Radiometer Buoy): Deployment of a floating gear with sensors to measure optical properties (hyper-spectral radiometry) of surface seawater.

SML (Surface Micro-Layer sampler): Deployment of a screen sampler on the ocean surface to collect 1L of surface microlayer water.

Mercury: Specific filtration protocol to measure mercury from a Niskin bottle, performed at estuary sites.

Aliens in port: Deployment of an *in-situ* pumping system (*Watera* capsules) to concentrate biomass from 30L of subsurface water for eDNA analyses

INVENTORY OF SAMPLES COLLECTED DURING THE CAMPAIGN

Table 2. Total number of samples preserved for each of the 50 protocols performed at each *Tara Europa* station along the Alvarino Leg. The details of the number of samples per protocol per stations can be found [@here](#).

protocol name	Protocol category	Storage T°	TOTAL of samples
PM	Oceanography/Biogeochemistry	- 20°C	<u>32</u>
FOI	Oceanography/Biogeochemistry	- 20°C	<u>27</u>
PA	Oceanography/Biogeochemistry	- 20°C	<u>9</u>
S023-L (long read)	Nucleic Acids/Sequencing	- 20°C	<u>9</u>
S320-L (long read)	Nucleic Acids/Sequencing	- 20°C	<u>9</u>
E20	Nucleic Acids/Sequencing and imaging	- 20°C	<u>9</u>
MB320	Chemical profiling	- 20°C	<u>18</u>
MB033	Chemical profiling	- 20°C	<u>18</u>
PPL	Chemical profiling	- 20°C	<u>41</u>
HLB	Chemical profiling	- 20°C	<u>39</u>
S20-L	Nucleic Acids/Sequencing	- 20°C	<u>9</u>
S200-L	Nucleic Acids/Sequencing	- 20°C	<u>9</u>
S680-L	Nucleic Acids/Sequencing	- 20°C	<u>9</u>
MB20	Chemical profiling	- 20°C	<u>9</u>
NUT	Oceanography/Biogeochemistry	- 20°C	<u>27</u>
ASM	Aerosol	- 20°C	<u>23</u>
pMeHg	Chemical profiling	- 20°C	<u>0</u>
pTHg	Chemical profiling	- 20°C	<u>0</u>
fMeHg	Chemical profiling	4°C	<u>0</u>
fTHg	Chemical profiling	4°C	<u>0</u>
ufTHg	Chemical profiling	4°C	<u>0</u>
THg (from bow pole)	Chemical profiling	4°C	<u>9</u>
CDOM	Oceanography/Biogeochemistry	4°C	<u>27</u>
DOC	Oceanography/Biogeochemistry	4°C	<u>27</u>
TOC	Oceanography/Biogeochemistry	4°C	<u>27</u>
S<0.2 (Virus)	Nucleic Acids/Sequencing	4°C	<u>18</u>
FM5	imaging	4°C	<u>18</u>

protocol name	Protocol category	Storage T°	TOTAL of samples
FM20	imaging	4°C	<u>18</u>
eDNA	Nucleic Acids/Sequencing	4°C	<u>9</u>
DGAS	Oceanography/Biogeochemistry	4°C	<u>81</u>
FC-P	imaging	LN2	<u>18</u>
SML-FC	imaging	LN2	<u>30</u>
FC-G	imaging	LN2	<u>18</u>
HPLC	Oceanography/Biogeochemistry	LN2	<u>11</u>
SML-320	Nucleic Acids/Sequencing	LN2	<u>45</u>
SML-023	Nucleic Acids/Sequencing	LN2	<u>45</u>
HC	Nucleic Acids/Sequencing	LN2	<u>72</u>
HC-G	Nucleic Acids/Sequencing	LN2	<u>72</u>
CP-G	Nucleic Acids/Sequencing	LN2	<u>27</u>
SG	Nucleic Acids/Sequencing	LN2	<u>16</u>
S023-S	Nucleic Acids/Sequencing	LN2	<u>18</u>
S320-S	Nucleic Acids/Sequencing	LN2	<u>18</u>
S20-S	Nucleic Acids/Sequencing	LN2	<u>18</u>
S200-S	Nucleic Acids/Sequencing	LN2	<u>18</u>
P023	Nucleic Acids/Sequencing	LN2	<u>9</u>
P320	Nucleic Acids/Sequencing	LN2	<u>9</u>
SG5	Nucleic Acids/Sequencing	LN2	<u>18</u>
S02-2000 QN	Nucleic Acids/Sequencing	LN2	<u>4</u>
SML-CP	Nucleic Acids/Sequencing	LN2	<u>45</u>
DICTA	Oceanography/Biogeochemistry	RT	<u>9</u>
SAL	Oceanography/Biogeochemistry	RT	<u>3</u>
MTE	Chemical profiling	RT	<u>9</u>
F200	imaging	RT	<u>9</u>
F680	imaging	RT	<u>9</u>

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TOTAL SAMPLES Tara Europa	1081
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Table 3. Total number of samples preserved for each of the 4 protocols performed underway during the *Tara Europa* navigation. The details of the number of samples per protocol per stations can be found [@here](#).

protocol name	Protocol category	Storage T°	TOTAL of samples
AF	Aerosols	- 20°C	37
AS	Aerosols	LN2	37
HPLC underway	Oceanography/Biogeochemistry	LN2	4
FC-P underway	Imaging	LN2	4
FC-G underway	Imaging	LN2	4
AI	Aerosols	RT	37

TOTAL SAMPLES UNDERWAY Tara Europa	123
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COMMENTS

Tara Europa Station #	Comments
91	First station for op. D, E and F. For this station, because of the late sun rise, we didn't sample at the slack time of low tide. Because of the very bad weather we decided for this supersite to only collect 25L of seawater < 3µm and 2L of water from the Niskin for the transfer of water. Aliens protocol was done during this station. The aerosol team came onboard this morning. Station at anchor for pumping and Rosette and adrift for the nets.
92	Very bad conditions (wind + waves). Tara was rolling a lot. No transfer of water because impossible for the small boat to go outside with this weather. All the operators were more or less sick but all the protocols were done. Aerosol team still in the boat. Adrift station.
93	Beautiful weather with a beautiful view (cliffs). Mussel's farms and fishing harbour close to the station. HTSRB was done.
94	Very good sunny weather. Everything runs great. HTSRB and Salinity were done. Station at anchor during the rosette and all the pumping but adrift for the nets and bow pole.
95	Good weather, no waves. Station at anchor for rosette and pumping. Adrift for the nets. Dish washing was done just before the station!! A flowmeter broke during the 680-µm trawl: a new trawl was done with a new flowmeter. A HTSRB was done. Station just in front of the Guadiana River (river at the border between the Portugal and Spain). We stay in the Portugal area.
96	Offshore station of the Guadiana River transect. Good weather too. No problem. The station ends just before the sun set.
97	Warm weather, no cloud, no wave. Very turbid area, lot of sandy patches. The dish washing was done 1h before the sampling. HTSRB was done. A cod-end of 200-µm net was lost during a trawl.
98	Good weather no wind, no waves. Very clear water, no turbid. SAL and HTSRB were done. All the station was adrift. Mat took video in the water of the rosette when it was closed. We sampled during the ebb tide but no during slack tide because too late (night).
99	Last station of 2023! Everything was ok. We sampled during the ebb tides but not during slack tide because too late (night). Aliens was done.