

Start	2023	03	18	Barcelona, Spain
End	2023	04	04	Marseille, France

SCIENTIFIC INTEREST & CAMPAING OBJECTIVES

The leg from Barcelona (Spain) to Marseille (France) took place between March and April 2024. It was the second leg of the Mediterranean segment of the **Tara EUROPA** expedition. **Tara EUROPA** (<https://fondationtaraoccean.org/en/expedition/tara-europa/>) is the ocean part of the 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* realizes the sampling of coastal waters and aerosols, while in parallel an EMBL team samples shallow waters, sediments, and soils at the corresponding land site. The land-sea synchronization will enable us to characterize environmental gradients from brackish to marine waters. The sampling sites are pre-selected along the coastline or in estuaries and represent either pristine or human-impacted (agriculture, urban areas, industrial areas, harbors) conditions. 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 on weather/navigation conditions.

At each *Tara Europa* station, the team onboard realize a complex suite of 60 protocols, and collect approximately 100 samples that are then stored in appropriate conditions for future analyses in the associated 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.

The leg Barcelona-Marseille was composed of three parts:

- 1) Super site sampling in the Barcelona area (stations 114 to 118, March 19th to 24th)
- 2) Outreach activities in Barcelona (March 25th to 30th)
- 3) Sampling along the route Barcelona to Marseille (stations 119 to 121, April 1st to 3rd)

During the super site, the aerosol team was on *Tara* and synchronized the aerosol sampling on board with the land team. Also, extra water samples were collected and brought to shore (for virus and vesicle analysis) using local boats.

PARTICIPANTS

Table 1: Crew onboard Tara from March 18th to April 4th

	ROLE	Surname, Name
1	CREW – Captain	Samuel Audrain
2	CREW – 1st Officer	Morgann Andrieux
3	CREW – Mechanical engineer	Dave Picaud
4	CREW – Deck	François Aurat
5	CREW – Cook	Sophie Bin
6	CREW – Media	Louise Cognard
7	GUEST – Artist	Ariane Michel (from March 31 st)
8	GUEST – Journalist	Marianne Bliman (from March 31 st)
9	SCIENCE - A – Oceano. Engineer	Thomas Linkowski, then Sergi Salmon (from March 31 st)
10	SCIENCE - B – Bio. Engineer	Morgane Guillam
11	SCIENCE - C – W-Lab genomics	Eric Pelletier
12	SCIENCE - D – Deck Chemical profiling	Jessika Füssel, then Vanessa Pahl (from March 31 st)
13	SCIENCE - E – Chief scientist	Anna Oddone
14	SCIENCE - F – S-Lab sorting/imaging	Emmanuelle Martins
15	SCIENCE – Aerosols and SML	James O’Brien (from March 19 th to 25 th)
16	SCIENCE – Aerosols and SML	Fabienne Wiederkehr (from March 19 th to 25 th)

REALIZED STATIONS

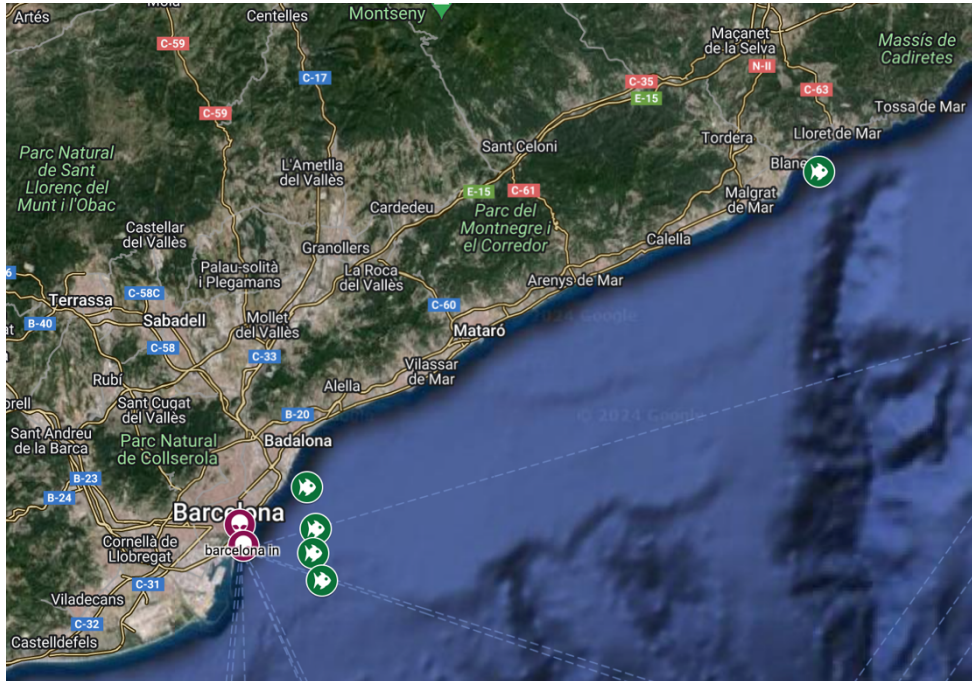


Figure 1a. Locations of sampling stations 114 to 118 – Barcelona super site (March 19th to 24th)

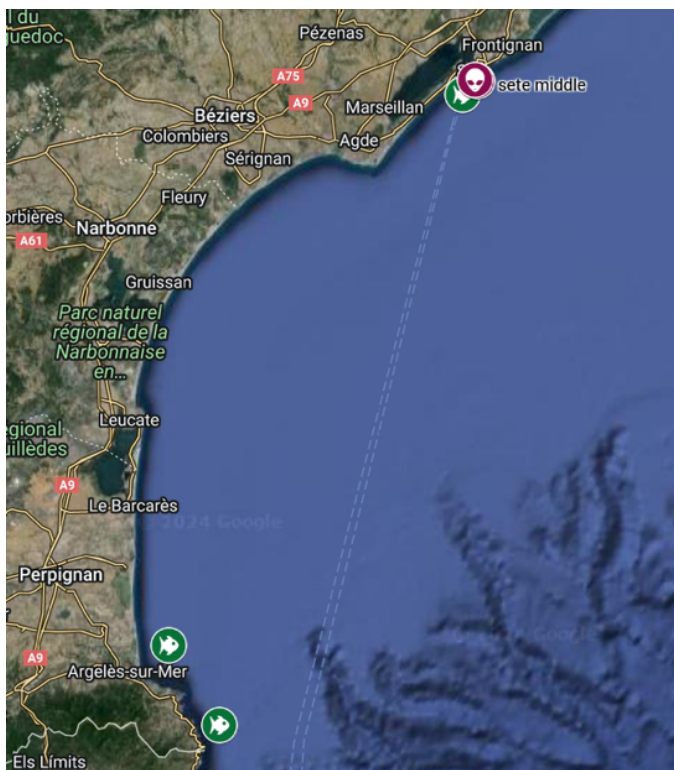


Figure 1b. Locations of sampling stations 119 to 121 – Barcelona to Marseille (March 31st to April 4th)

SUMMARY OF ACTIVITIES

Table 2. Types and numbers of sampling gears' deployments and/or sampling activities, for each of the XX Tara EUROPA stations along the XXXX – XXXX 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	eDNA	HTSRB	SML	Mercury	Aliens in Port	# of samples
20/03/2024	114	Barcelona super site 1	41.4082	2.2548	1	1	1	1	1	2	1	1	1	0	1	1	0	194
21/03/2024	115	Barcelona super site 2	41.3738	2.2648	1	1	1	1	1	2	1	1	1	0	1	1	0	196
22/03/2024	116	Barcelona super site 3	41.3537	2.2616	1	1	1	1	1	2	1	1	1	1	1	1	1	195
23/03/2024	117	Barcelona super site 4	41.3310	2.2711	1	1	1	1	1	2	1	1	1	0	1	1	0	177
24/03/2024	118	Blanes super site 5	41.6687	2.8194	1	1	1	1	1	2	1	1	1	0	1	1	0	180
01/04/2024	119	Banyuls	42.4719	3.1988	1	1	1	1	1	2	1	1	1	0	1	1	0	125
02/04/2024	120	Argelès sur Mer	42,587	3,1018	1	1	1	1	1	2	1	1	1	0	1	1	0	125
03/04/2024	121	Sète	43.3748	3.6740	1	1	1	1	1	2	1	1	1	0	1	1	1	126

Legend table 2:

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 or 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.

eDNA: Deployment of a pumping system (Watera capsule) for environmental DNA analysis.

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 0.5L 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 CAMPAING

Table 3. Total number of samples along the leg. The details of the number of samples per protocol per station can be found [@here](#).

protocol name	Protocol category	Storage T°	TOTAL of samples	protocol name	Protocol category	Storage T°	TOTAL of samples
PM	Oceanography/Biogeochemistry	- 20°C	28	DGAS	Oceanography/Biogeochemistry	4°C	72
FOI	Oceanography/Biogeochemistry	- 20°C	24	DGAS-EXE	Oceanography/Biogeochemistry	4°C	39
PA	Oceanography/Biogeochemistry	- 20°C	8	FC-P	imaging	LN2	16
S023-L (long read)	Nucleic Acids/Sequencing	- 20°C	8	SML-FC	imaging	LN2	58
S320-L (long read)	Nucleic Acids/Sequencing	- 20°C	8	FC-G	imaging	LN2	16
E20	Nucleic Acids/Sequencing and imaging	- 20°C	8	HPLC	Oceanography/Biogeochemistry	LN2	10
MB320	Chemical profiling	- 20°C	18	SML-320	Nucleic Acids/Sequencing	LN2	87
MB033	Chemical profiling	- 20°C	18	SML-023	Nucleic Acids/Sequencing	LN2	87
PPL	Chemical profiling	- 20°C	42	HC	Nucleic Acids/Sequencing	LN2	64
HLB	Chemical profiling	- 20°C	32	HC-G	Nucleic Acids/Sequencing	LN2	64
S20-L	Nucleic Acids/Sequencing	- 20°C	8	CP-G	Nucleic Acids/Sequencing	LN2	24
S200-L	Nucleic Acids/Sequencing	- 20°C	8	SG	Nucleic Acids/Sequencing	LN2	16
S680-L	Nucleic Acids/Sequencing	- 20°C	8	S023-S	Nucleic Acids/Sequencing	LN2	16
MB20	Chemical profiling	- 20°C	8	S320-S	Nucleic Acids/Sequencing	LN2	16
NUT	Oceanography/Biogeochemistry	- 20°C	24	S20-S	Nucleic Acids/Sequencing	LN2	16
ASM	Aerosol	- 20°C	41	S200-S	Nucleic Acids/Sequencing	LN2	16
pMeHg	Oceanography/Biogeochemistry	- 20°C	0	P023	Nucleic Acids/Sequencing	LN2	8
pTHg	Oceanography/Biogeochemistry	- 20°C	8	P320	Nucleic Acids/Sequencing	LN2	8
Hg-20	Oceanography/Biogeochemistry	- 20°C	8	SG5	Nucleic Acids/Sequencing	LN2	16
Hg-200	Oceanography/Biogeochemistry	- 20°C	8	S02-2000 QN	Nucleic Acids/Sequencing	LN2	10
Hg-680	Oceanography/Biogeochemistry	- 20°C	8	SML-CP	Nucleic Acids/Sequencing	LN2	87
NAT	Oceanography/Biogeochemistry	- 20°C	32	DICTA	Oceanography/Biogeochemistry	RT	8
PPN2	Oceanography/Biogeochemistry	- 20°C	24	SAL	Oceanography/Biogeochemistry	RT	4
fMeHg	Chemical profiling	4°C	8	MTE	Chemical profiling	RT	8
fTHg	Chemical profiling	4°C	0	F200	imaging	RT	8
ufTHg	Chemical profiling	4°C	0	F680	imaging	RT	8
THg (from bow pole)	Chemical profiling	4°C	8	F2000	imaging	RT	0

CDOM	Oceanography/Biogeochemistry	4°C	24	Flowcam	imaging	Data	8
DOC	Oceanography/Biogeochemistry	4°C	24				
TOC	Oceanography/Biogeochemistry	4°C	24				
S<0.2 (Virus)	Nucleic Acids/Sequencing	4°C	16				
FM5	imaging	4°C	16				
FM20	imaging	4°C	16				
eDNA	Nucleic Acids/Sequencing	4°C	8				

TOTAL SAMPLES Tara Europa Barcelona-Marseille 1313

Table 4. 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	18
AS	Aerosols	LN2	18
HPLC underway	Oceanography/Biogeochemistry	LN2	0
FC-P underway	Imaging	LN2	0
FC-G underway	Imaging	LN2	0
SAL-underway	Oceanography/Biogeochemistry	RT	0
AI	Aerosols	RT	18

TOTAL SAMPLES UNDERWAY Tara Europa Barcelona-Marseille 54

COMMENTS

Tara Europa Station #	Comments
1	Water transfer OK, good synchronisation for the nets 5 and 20µm. Good weather, sunny and no wave. The station took longer (approx. 7h) because of new scientists onboard. Aerosols team on-board during all the supersite.
2	Good synchronisation with the local boat for the nets and the transfer of water. Good weather.
3	Good synchronisation with local boat. DCM started to appear. Alien + HTSRB was done.
4	Station started at sunrise. Last station in Barcelona for the supersite. Sampling very close to anchored, large cargos ship at the entrance of Barcelona harbour.
5	Last station of the supersite (Blanes, location of a long-term time series). Station started at sunrise. Good weather, transfer of water with Tara's dinghy. No synchronisation with the local boat.
6	Well-mixed water column, no DCM. First station for the operator D. Good weather. RAS.
7	Station in front of the Canigou mountain (Pyrenées). Very good weather, no waves. Water column well mixed with low concentration of chl-a and no DCM
8	Station at anchor, except for the nets. Calm sea but with long waves. Sunny day. Aliens done.