TARA_	YYYY	MM	DD	PORT (CITY)
Start	2023	09	16	Galway
End	2023	10	11	Bilbao

SCIENTIFIC INTEREST & CAMPAING OBJECTIVES

This Leg from Galway (Ireland) to Bilbao (Spain) took place from mid-September to mid-October 2023 and was part of the ***Tara*** **EUROPA** expedition (April 2023 – July 2024; https://fondationtaraocean.org/en/expedition/tara-europa/). *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* realized the sampling of coastal waters and aerosols at 14 stations between Galway and Bilbao. Following the Galway super-site samplings, we sailed 3 days back to France and sampled our first station in the Rade de Brest (St. 77), followed by a 2nd station outside the Rade in front of Camaret-sur-mer (St. 78). From there we sailed and passed the Raz de Sein, back to Tara homeport in Lorient, where we sampled within the Rade de Lorient in front of Port-Louis (St. 79). Next, we sampled in front of the Ria d'Étel (St. 80), an important location for Oyster farmers whose work is currently affected (i.e., noroviruses) by limited capacity in wastewater treatment. From there we conducted samplings in the estuaries of two very large rivers, the Loire and Gironde Rivers, which form the most important plumes in the Bay of Biscay, as they provide > 75% of total water runoff. Within the Loire estuary, we first sampled a likely impacted area in front of Donges/Paimboeuf (St. 81), followed by a station likely impacted by the river plume in front of Noirmoutier (St. 82). Next, we sailed south to the Gironde estuary, first sampling within the estuary in front of Mortagne-sur-Gironde (St. 83), followed by two stations likely impacted by the river plume, at the mouth of the estuary near La Tremblade (St. 84), and offshore of the estuary (St. 85). Then, we crossed the Bay of Biscay under very calm conditions towards Bilbao, the next super-site. There, we conducted samplings at five stations within five days. First, we sampled in front of Mundaka (St. 86) and offshore Mundaka (St. 87). We then went on to sample close to shore in front of Plentzia (St. 88), location of the marine station hosting the TREC EMBL mobile labs (AML). Finally, we sampled offshore Bilbao (St. 89) and close to the shore next to the industrial port of Bilbao in La Arena (St. 90). Of note, both offshore stations of the super-site were particularly oligotroph with very low biomass, in contrast with close-to-shore stations with higher Chla concentrations and biomass.

At each *Tara* Europa station, the team onboard realized a complex suite of about 50 protocols, and collected 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 bacteria, unicellular eukaryotes, and small animals, from genomes, expressed genes, metabolites, proteins, to cellular and organismal features), together with contextual physical, biophysical, chemical and biochemical properties. At stations and in between stations we continuously sampled with a flowthrough system pumping from 1.5m below surface and containing a thermosalinograph (SBE45, Seabird Sci.), a spectrophotometer (AC-s, Seabird Sci.) and backscattering sensor (Hyper-BB, Sequoia Sci.), a CDOM fluorometer (Seapoint), an imaging flow cytobot (McLane) and a flow-cytometer Cytosense (Cytobuoy) and multi excitation and emission fluorometer for pigment concentration (Fluoroprobe, bbe). Additionally, we measured during day time from sensors on the deck spectral radiance as well as band-integrated photosynthetically available radiation.

PARTICIPANTS

ROLE		NAME, Surname, Affiliation
1	CREW - Captain	Martin Hertau and Yohann Mucherie (Tara)
2	CREW - 1st Officer	Pierre Landoeuer (Tara)
3	CREW - Mecano	Laurent Rogniaux (Tara)
4	CREW - Deck	Elise Lebaron (Tara)
5	CREW - Deck	David Monmarche and Mathieu Oriot (Tara)
6	CREW - Cook	Sophie Bin (Tara)
7	CREW - Media	Leslie Moquin (Tara)
8	GUEST - Artist	Renata Padovan (Brazil)
9	GUEST - Observer	
10	SCIENCE - A - Oceano. Engineer	Solenne Caous (Tara) and Josep + Arnau (EMS)
11	SCIENCE - B – Bio. Engineer	Morgane Guillam and Douglas Couet (CNRS)
12	SCIENCE - C - W-Lab genomics	Julie Poulain (Genoscope)
13	SCIENCE - D – Deck Chemical profiling	Maïa Henry (Jena University)
14	SCIENCE - E – Deck/Chief Scientist	Samuel Chaffron (CNRS / Nantes University)
15	SCIENCE - F - S-Lab sorting/imaging	Zoé Meriguet (Sorbonne University) and Soraya Zwahlen (EMBL)

REALIZED STATIONS

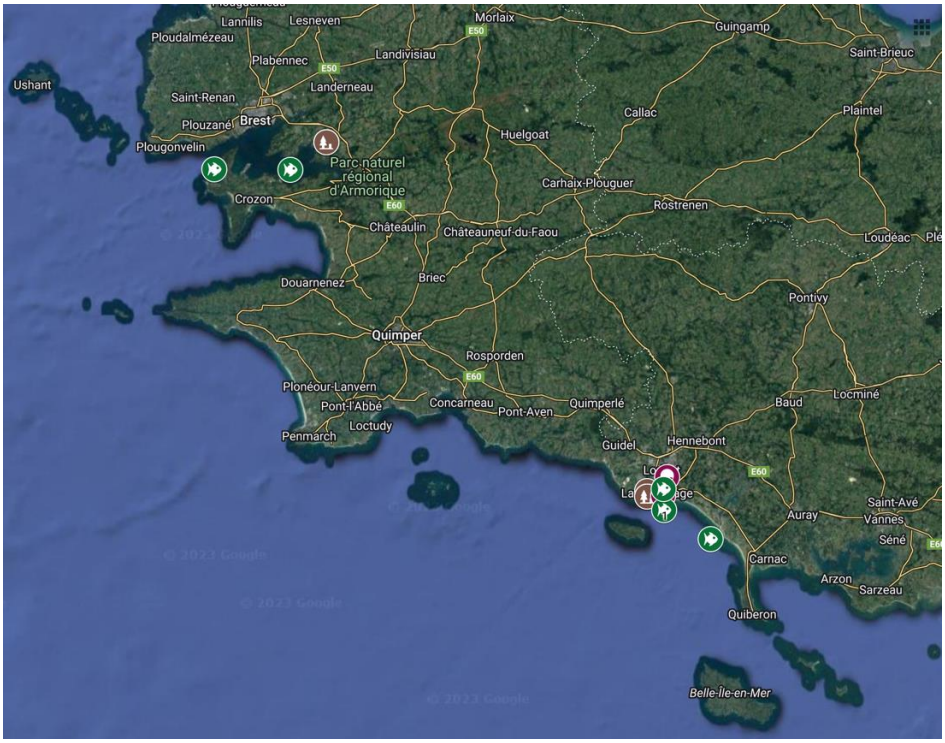

***Figure 1**. Locations of sampling stations in Brittany (France). Alien station was sampled in and out of the Lorient port.*

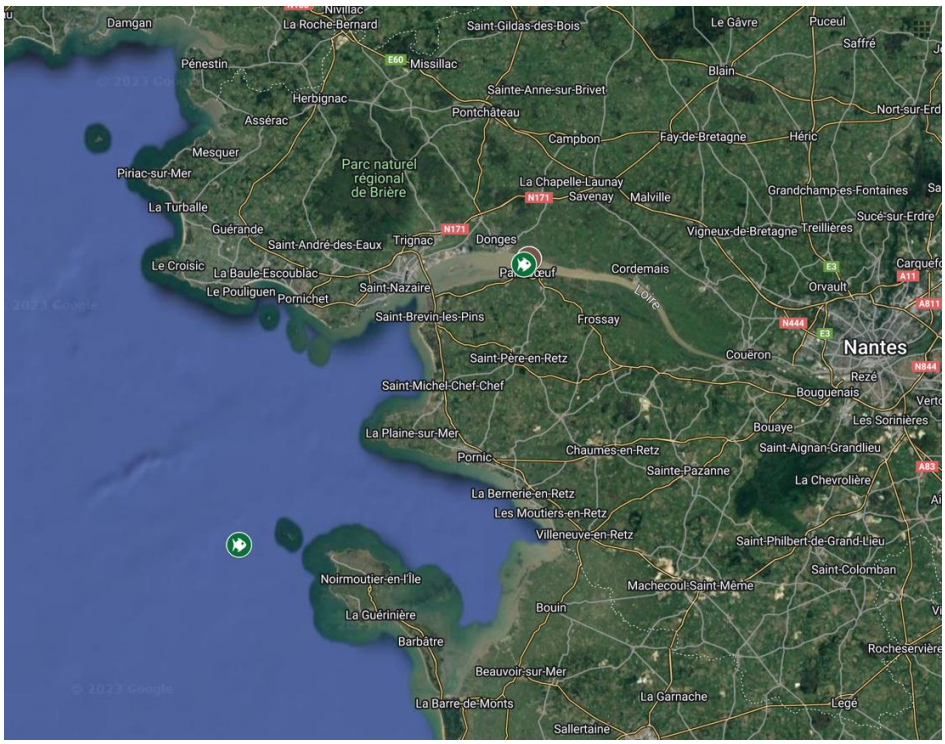

***Figure 2.** Locations of sampling stations in the Loire estuary (France).*

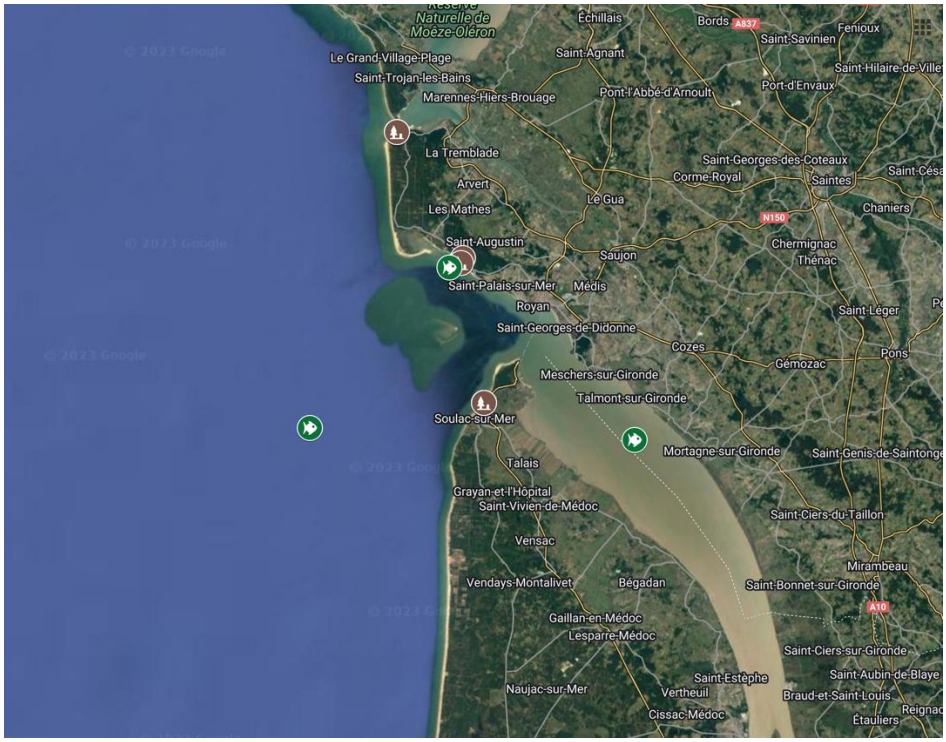

Figure 3. *Locations of sampling stations in the Gironde estuary (France).*

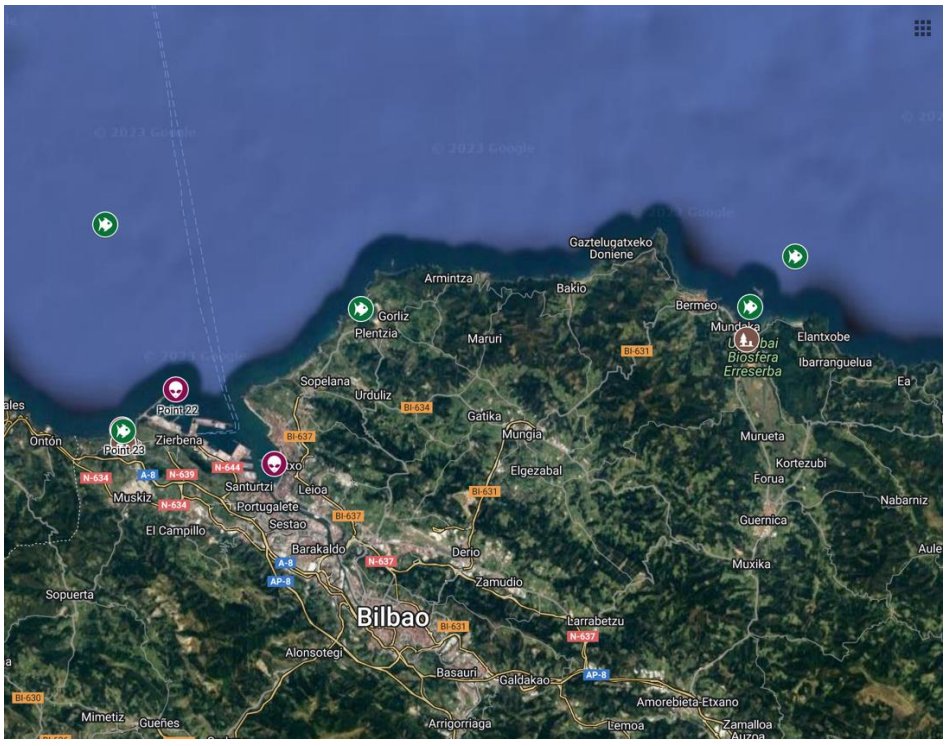

Figure 4. *Locations of service-site sampling stations in the Bilbao region (Euskadi, Spain).*

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)

Table 1.

date	Station number	Station Name	Latitude	Longitude	Number of samples	Cast Z0	Pump A20 Omics	Net 5 um	Net 20 um	Net 200 um	Net 680 um	Bow Pole	ASM	eDNA	HTSRB	SML	Mercury	Aliens in Port
20/09/2023	77	Brest Bay	48.3000	-4.389	100	1	1	1	1	1	2	1	1	1	0	1	0	0
21/09/2023	78	Camaret bay	48.3007	-4.5980	100	1	1	1	1	1	2	1	1	1	0	1	0	0
22/09/2023	79	Lorient	47.7132	-3.3649	109	1	1	1	1	1	2	1	1	1	0	1	0	1
25/09/2023	80	Ria Etel	47.6209	-3.2354	109	1	1	1	1	1	2	1	1	1	1	1	0	0
26/09/2023	81	Loire Donges	47.2951	-2.0368	111	1	1	1	1	1	2	1	1	1	0	1	0	0
27/09/2023	82	Loire offshore	47.033	-2.428	109	1	1	1	1	1	2	1	1	1	0	1	0	0
01/10/2023	83	Gironde inside	45.4943	-0.9033	111	1	1	1	1	1	2	1	1	1	0	1	0	0
02/10/2023	84	Gironde middle	45.6603	-1.1578	110	1	1	1	1	1	2	1	1	1	0	1	0	0
03/10/2023	85	Gironde offshore	45.5059	-1.3490	112	1	1	1	1	1	2	1	1	1	0	1	0	0
06/10/2023	86	Bérmeo shore	43.4177	-2.6899	189	1	1	1	1	1	2	1	1	1	1	1	0	0
07/10/2023	87	Bermeo offshore	43.443	-2.659	191	1	1	1	1	1	2	1	1	1	0	1	0	0
08/10/2023	88	La plentzia	43.4167	-2.9569	189	1	1	1	1	1	2	1	1	1	0	1	0	0
09/10/2023	89	Bilbao offshore	43.4589	-3.1324	190	1	1	1	1	1	2	1	1	1	0	1	0	0
10/10/2023	90	Bilbao shore	43.356	-3.120	190	1	1	1	1	1	2	1	1	1	1	1	0	1

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 XL 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 eastuary 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 all protocols performed at each station.

protocol name	Protocol category	Storage T°	TOTAL of samples
PM	Oceanography/Biogeochemistry	- 20°C	49
FOI	Oceanography/Biogeochemistry	- 20°C	42
PA	Oceanography/Biogeochemistry	- 20°C	14
S023-L (long read)	Nucleic Acids/Sequencing	- 20°C	14
S320-L (long read)	Nucleic Acids/Sequencing	- 20°C	14
E20	Nucleic Acids/Sequencing and imaging	- 20°C	14
MB320	Chemical profiling	- 20°C	27
MB033	Chemical profiling	- 20°C	27
PPL	Chemical profiling	- 20°C	66
HLB	Chemical profiling	- 20°C	56
S20-L	Nucleic Acids/Sequencing	- 20°C	14
S200-L	Nucleic Acids/Sequencing	- 20°C	14
S680-L	Nucleic Acids/Sequencing	- 20°C	14
MB20	Chemical profiling	- 20°C	14
NUT	Oceanography/Biogeochemistry	- 20°C	42
ASM	Aerosol	- 20°C	48
pMeHg	Chemical profiling	- 20°C	0
pTHg	Chemical profiling	- 20°C	0
fMeHg	Chemical profiling	4°C	0
fTHg	Chemical profiling	4°C	0
ufTHg	Chemical profiling	4°C	0
THg (from bow pole)	Chemical profiling	4°C	14
CDOM	Oceanography/Biogeochemistry	4°C	42
DOC	Oceanography/Biogeochemistry	4°C	42
TOC	Oceanography/Biogeochemistry	4°C	42
S<0.2 (Virus)	Nucleic Acids/Sequencing	4°C	28
FM5	imaging	4°C	28
DGAS	Oceanography/Biogeochemistry	4°C	99

protocol name	Protocol category	Storage T°	TOTAL of samples
FM20	imaging	4°C	28
eDNA	Nucleic Acids/Sequencing	4°C	14
FC-P	imaging	LN2	28
SML-FC	imaging	LN2	88
FC-G	imaging	LN2	28
HPLC	Oceanography/Biogeochemistry	LN2	16
SML-320	Nucleic Acids/Sequencing	LN2	132
SML-023	Nucleic Acids/Sequencing	LN2	132
HC	Nucleic Acids/Sequencing	LN2	112
HC-G	Nucleic Acids/Sequencing	LN2	112
CP-G	Nucleic Acids/Sequencing	LN2	42
SG	Nucleic Acids/Sequencing	LN2	28
S023-S	Nucleic Acids/Sequencing	LN2	28
S320-S	Nucleic Acids/Sequencing	LN2	28
S20-S	Nucleic Acids/Sequencing	LN2	28
S200-S	Nucleic Acids/Sequencing	LN2	28
P023	Nucleic Acids/Sequencing	LN2	14
P320	Nucleic Acids/Sequencing	LN2	14
SG5	Nucleic Acids/Sequencing	LN2	28
S02-2000 QN	Nucleic Acids/Sequencing	LN2	10
SML-CP	Nucleic Acids/Sequencing	LN2	132
DICTA	Oceanography/Biogeochemistry	RT	14
SAL	Oceanography/Biogeochemistry	RT	7
MTE	Chemical profiling	RT	14
F200	imaging	RT	14
F680	imaging	RT	14
F2000	imaging	RT	0

TOTAL SAMPLES Tara Europa Galway (Ireland) – Bilbao (Spain)	1897

Table 3. Total number of samples preserved for each of the 4 protocols performed underway during the Tara Europa navigation from Galway to Bilbao. 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	39
AS	Aerosols	LN2	39
HPLC underway	Oceanography/Biogeochemistry	LN2	0
FC-P underway	Imaging	LN2	0
FC-G underway	Imaging	LN2	0
AI	Aerosols	RT	39
TOTAL SAMPLES UNDERWAY Tara Europa Galway (Ireland) – Bilbao (Spain)			

COMMENTS

Tara Europa Station #	Comments
77	SC: This first station of the leg took place in front of Île Longue in the Bay of Brest, in good company with the Marine Nationale, under heavy rain and heavy winds. Due to weather conditions, the joint sampling with land team could not happen and sampling on land was performed the day before. Due to time constraint we had to sample starting at the end of ebb tide (instead of beginning of ebb tide). Some scientists were sea sick before the station but we nevertheless managed to complete it in about 3h30! MG: Very bad weather for this station: a lot of wind (>30 knots) + rain. No waves. All station was at anchor even for the nets because there were a lot of currents. First station for the Op. E. Rosette has a problem the first time we tried, but worked the 2nd time.
78	SC: This station took place in front of Camaret-sur-Mer, adrift for sampling the water mass coming out the Bay of Brest. Due to time constraint we had to sample starting at the end of ebb tide (instead of beginning of ebb tide). Great weather for this one with low winds and sun! MG: Changing weather, just little waves. At the beginning of the station the flow entered in the bay of Brest. All the station was adrift. Beautiful cliff of Crozon just in front of us.
79	SC: This station took place in Tara homeport, Lorient! We did joint sampling with the land team starting at 7am in front of Port Louis before a very nice stopover (eating oysters). Again, great weather with no rain and no sun for that one. MG: Station started at night (early morning). Good weather. At anchor for the rosette and pumping of water and adrift for the nets.
80	SC: This station was an extra station in front of the Étel ria in partnership with the Bretagne region and the syndicat ostréicole de la Ria d'Étel (Morbihan) and the Syndicat

	mixte de la Ria d'Étel (SMRE). HTSRB was done for this station. And again, beautiful weather for this station, which we ended up with a swim in front of Étel 😊. DC: Nice conditions in front of ria etel. Htsbr at the end of the station. At anchor.
81	SC: Station within the Loire River in front of Donges / Paimbœuf, likely impacted by nearby industry (e.g., oil refinery). Water with low salinity down to 19mg/L and heavily charged with sediments. Lower volumes of water had to be filtered. Joint sampling with land team did not occur as they sampled the previous day (coordination problem?). DC: Inside the estuary, very blackish turbid water, with current. Inversion of current during the station, we rising current for the nets. Sunny day.
82	SC: Adrift station to sample the Loire River output off the coast of Noirmoutier (Isla de la patata). Some wind (about 20 nodes) and cloudy weather. Chlorophyll concentration was rather low DC: Windy and wavy weather; nets are done drifting at about 2 knots. The location of the station was changed more south to be closer to the route of tara and also the pume of the loire is usually there. Start of Soraya's incubation experiment.
83	SC: Anchored station within the Gironde estuary with beautiful warm and sunny weather (31C!). Water with rather low salinity from 21 to 31 mg/L and heavily charged in fine sediments (likely limestone). Few single-cell plankton but many small fishes and gelatinous in the plankton nets. DC: Water very turbid, we see patches of sediment resuspension on the surface. Very hot and sunny day. The 200 and 680 nets were done after the reversion of the tide, at 1-2 knots, at anchor. Lots of zooplakton in the 200 µm and 680 µm, but not much phyto in the 20 µm (mainly debris and organic matter). Cténaires, fishes, shrimps, etc.
84	SC: Anchored station at the mouth of the Gironde estuary with beautiful warm and sunny weather. Joint sampling with the land team was performed on Plage naturiste de la Lède. Water with higher salinity and still charged with fine sediments. Low biomass of single-cell organisms but relatively higher biomass of larger organisms. DC: Started with the bow pole. The 1st regent net was done just before the reversion of the tide, so we had to wait the reversion and more current to do the 2nd regent net. Not a lot of organisms, but quite diverse with zooplankton. We did a CONTROL of FSW water by filtering about 1.5 L on a PC 0.2 µm 47mm filter in the Slab (Soraya did), because i saw some particules in the flowcam. Very hot day again.
85	SC: Anchored station offshores the Gironde estuary with cloudy/sunny weather and some winds (15-20 nodes). This station was move slightly closer to the coast to target an area richer in Chl-a identified using the Ocean Data Lab from ESA (https://ovl.oceandatalab.com/) and daily data (October 3rd) from the OLCI Sentinel-3 satellite (ESA, ODL). Higher single-cell planktonic diversity and biomass was observed including dinoflagellates and diatoms. DC: More clear water, but rough sea today, boat is moving a lot. We are at anchor. Not enough current for the nets so we tow them drifting at 2 knots, from the back of the boat. Nice diversity in the nets (phyto and zoo). Lots of salps in the 2nd régent net. Sorata started her 2nd set of incubation.
86	SC: Anchored (super-site) station just in front of Mundaka (world famous surf spot! But no swell) for a joint sampling with the land team. Beautiful sunny weather, HTSRB was deployed at this station. Relatively low biomass but many diatoms. DC: SERIVE SITE // Very calm and sunny weather, perfect sea conditions. Just when we did the profile the local boat came to visit us, we waited a bit to tigger the niskin bottles. The water transfer happened at 13:30 utc as planned. Nice phytoplankton cells (diatoms) in the 20 µm and also a lot of zooplancton in the other nets. Michel flores is onboard for the 24h cycle. We had to tow the nets, did the bow pole meanwhile. Anau did the Htsrb before the station.

87	SC: Adrift (super-site) station offshore Mundaka with beautiful weather. Very low biomass station with a Secchi disk measured at 26m! But a high diversity of plankton with some dinoflagellates and radiolarians. DC: Very nice and suny day, low swell, little wind, drifting at 0.5 knots. Local boat picked up the water to transfer at 08h30, after we did a synchronised 20 µm net deployment. Water very poor in biomass, but very rich in diversity, in all the size fraction : diatoms, dinoflagelates, radiolaires, apendiculaires, siphonophores, copepods, apendiculaires, chaetognates... Very nice to observe !!
88	SC: Anchored (super-site) station in front of Plentzia marine station with sunny weather and light wind. HTSRB was deployed at this station but the data was not recorded due to a connection problem. Higher biomass than at station 87 with many diatoms. DC: At anchor, very nice and sunny day, almost now wind. Lots of boats around us, come to see us. The AML did their 20 µm net just before us (10 mn before). We towed the ther nets. Water transfer at 09:00 UTC. Arnau tried to do a htsrb but the electric connection failed, had to redo it.
89	SC: Adrift (super-site) station offshore Bilbao with beautiful weather. Very low biomass with dinoflagellates, some diatoms and radiolarians, and a Secchi disk measured at 28m! DC: Lost connection with the rosette during the profile, at about 30m depth. Had to bring it back on deck to check, and then deploy it only on the surface to trigger manually the niskins with someone in the water . Transfer of water at 08:30 UTC as planned. We couldn't do the 20 µm net together. We were drifting at 1.5 knots during most of the station with around 10 knots of wind, but it dropped for the nets, so we had to tow them. Very low biomass (1:20 for the 20µm net, 15mn for the 200 µm and 20mn and 25mn for the 680 µm). No htrsb because Arnau is working on redoing the terminaison of the rosette.
90	SC: Anchored (super-site) station in front of La Arena (next to Bilbao harbour) for a final joint sampling with the land team under sunny and calm weather. Relatively low biomass for a coastal site. DC: Good weather, little wind. We are in a little bay that seems very polluted (oil raffinery on the coast, huge harbour on the side...). Fishing boat on operation just around us. At 08:30UTC the kiwi did the water transfer. NO AML today. Lots of diatoms in the water. Towed the nets and did the bow pole at the same time. Aliens done that day.