
CRUISE REPORT

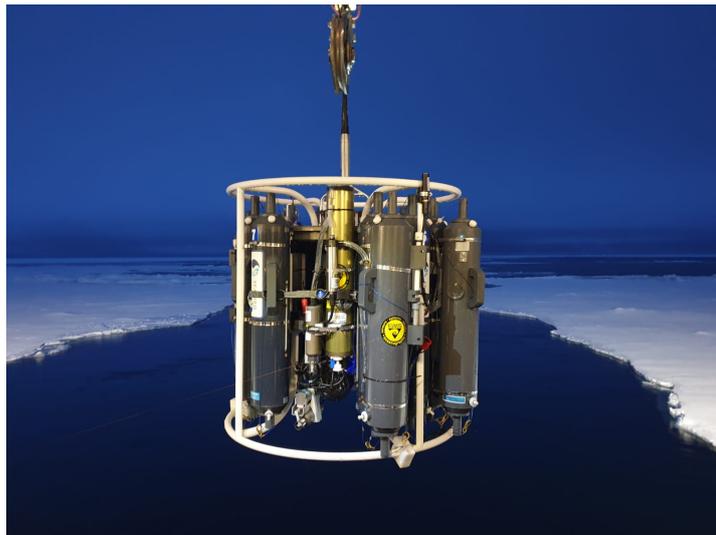
CHARCOT II

*An oceanographic snapshot in the CHanging ARctiC passing
thrOugh The “North Pole” II*

Le Commandant Charcot, Cruise No. CC050925,

September 5th 2025 – September 25th 2025

Longyearbyen (Svalbard Islands) - Nome (Alaska)



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Summary

The Arctic region's rapid warming during the past decades has led to substantial perturbations of atmospheric, ice and ocean physics including a reduction in sea-ice extent and an increase in river discharge. The impact of such changes on physical and mechanical sea-ice properties, ecosystems and biogeochemical cycles remains profoundly understudied especially in the difficult-to-reach central Arctic. Large changes taking place at the central Arctic's ice/ocean/air interface, where water masses and ocean life interact across a range of temporal and spatial scales, are currently poorly documented.

CHARCOT II project aimed to document the current state and ongoing changes of the physical, chemical, biological and biogeochemical systems of the Arctic Ocean. Emphasis of the project was devoted to understanding the major ongoing transformations in water masses, sea-ice and marine ecosystems.

The scientists of the CHARCOT II project embarked on an extraordinary Transarctic polar expedition aboard the specialized vessel "Le Commandant Charcot" (September 05 2025 – September 25 2025) which was designed to navigate the challenging route across the Arctic Ocean from the Svalbard Island to Alaska. The oceanographic expedition involved traversing dynamic ice floe landscapes, providing an opportunity for in-depth study of polar environments of the High Arctic and allowing the collection of unique samples of water and sea ice, as well as the sighting of marine mammals.

1. Participants

No.	Name	Early career (Y/N)	Gender	Affiliation	On-board tasks
1	Maurizio Azzaro	N	M	ISP-CNR	Principal Investigator, Water samples collection, CTD, Nutrients, Microbial respiration, Microbial diversity, Chlorophyll,
2	Francesco Filiciotto	N	M	ISP-CNR	Water samples collection, CTD, DNA, Mammal observations

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2. Research Programme/Objectives

CHARCOT II's overarching goal (Figure 1) is contributing to the evaluation of the current state and major ongoing transformations in water masses (thermohaline and biogeochemical properties), sea-ice and marine ecosystems from Svalbard Islands to Alaska across the entire Arctic Ocean (Figure 1). To achieve these goals, CHARCOT II has pursued 2 key foci: A) physical and biogeochemical state; B) biota diversity and ecosystem functioning. The specific objectives of the focal areas are A1) characterize the thermo-aline properties and the

biogeochemistry of water masses and sea-ice; B1) evaluate biota abundances and diversity, their distribution and stability; B2) monitor Arctic mammal populations to assess their conservation status.

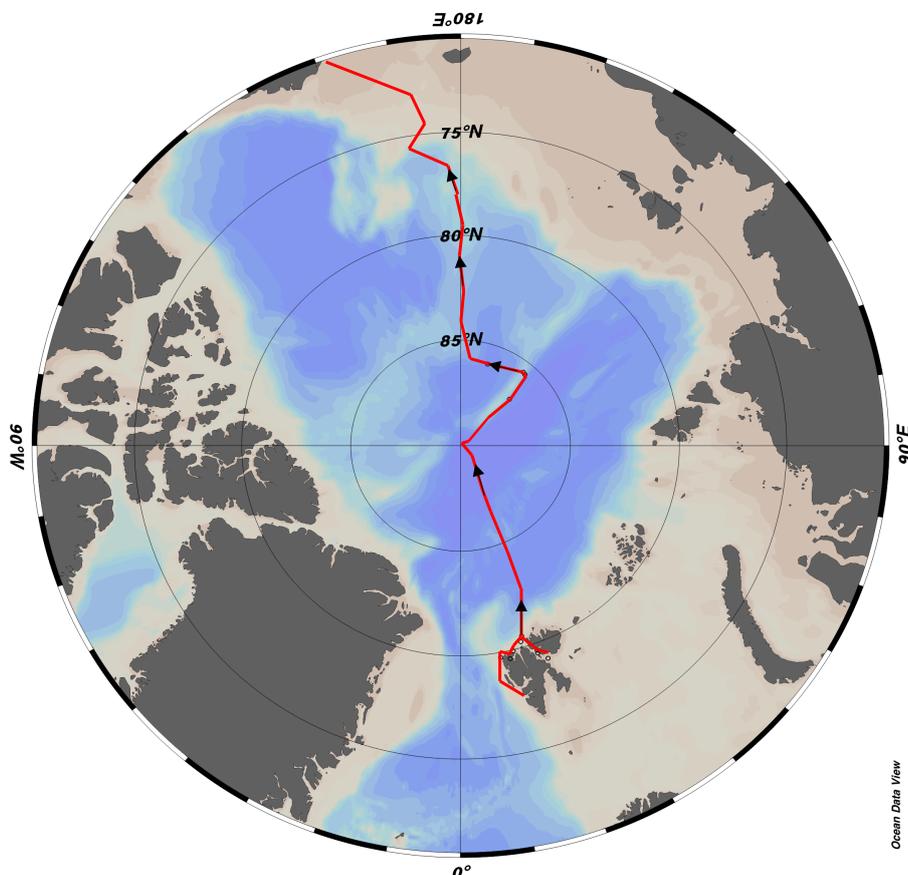


Figure 1. Working area and track chart of R/V LE COMMANDANT CHARCOT.

3. Narrative of the Cruise

September 5th 2025

The CHARCOT II team boarded the vessel on September 5th 2025, at 11:00 (CEST) from the harbour of Longyearbyen. In the afternoon, safety protocols and briefings on emergency procedures took place. Personal protective equipment was distributed and the presence on board the ship was confirmed. A comprehensive safety training session followed, covering evacuation procedures and guidelines for polar conditions. On September 5, 2025, the ship set sail from the harbour of Longyearbyen at 19:00 PM (CEST).

September 6th 2025

In the morning, the CHARCOT II team prepared scientific and sampling equipment. Calibration and inspection were meticulously performed to ensure optimal functionality under polar conditions. Then team then proceeded to setup the laboratory (Wet Lab). Scientific sampling protocols included seawater collection of water

from hydrological stations, seawater sampling from the vessel's peristaltic pump (9 m depth; Ferrybox, on-board equipment) and sea ice sampling.

During the afternoon, the ship will dock in Ny-Ålesund, and we will offload the boxes containing scientific equipment that won't be used during the cruise activities. We will leave the boxes at the Italian base, "Dirigibile Italia," to be shipped directly to Italy later. Furthermore, maintenance was carried out on the coastal thalassographic buoy positioned in the port, together with the setting and positioning of a hydrophone on it.

All the scientific teams convened for an evening briefing, engaging in discussions about the day's activities and collaborative planning for the next. Challenges and adjustments were addressed collaboratively, with seamless coordination among the CHARCOT II team, the other scientific teams onboard and the onboard scientific personnel. This was repeated every day, ensuring a harmonious integration of scientific efforts, maximizing the effectiveness of data collection and research activities throughout the expedition.

September 7th 2025

The first sampling of seawater was carried out from the Ferrybox on July 8th 2025 at 12:00 UTC (2:00am CEST) to analyze DNA, chlorophyll and ETS (Electron Transport System), and included the continuous acquisition of hydrographic parameters (Temperature, Salinity, Oxygen, CO₂) at a depth of 9 meters (Table 2). The seawater was immediately filtered after sampling, and two DNA replicates, one chlorophyll and three of ETS replicates were stored at -20°C to be analyzed in Italy. For each sampling carried out during the oceanographic cruise the same procedure was repeated.

At 10:00am, the team attended – along with all the cruise guests – the AECO (arctic regulation) mandatory briefing in the theatre (deck 5). A second seawater sampling (Ferrybox) was carried out at 23:54 UTC (Table 2 and Figure 3).

September 8th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3)

September 9th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). In addition, the team delivered a presentation to the passengers illustrating the CHARCOT II project and the work to be done onboard of *Le Commandant Charcot*. The presentation took place in the theater at 14:30 CEST. Finally, today 2 specimens of Humpback Whale and 1 of bearded seal were sighted.

September 10th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). Today 2 specimens of Polar Bear were sighted.

September 11th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). Today, the team carried out one hydrological station (CTD, Rosette) up to a depth of 1000m (CHII-CTD1) (Table 1 and Figure 2). Finally, Polar Bear was sighted.

September 12th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). Today, the team carried out one hydrological station (CTD, Rosette) up to a depth of 500m (CHII-CTD2) (Table 1 and Figure 2).

September 13th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). In addition, the vessel reached the geographic north pole and the team carried out one hydrological station (CTD, Rosette) up to a depth of 1000m (CHII-CTD3) (Table 1 and Figure 2).

September 14th 2025

On this day, one seawater sampling (Ferrybox) were carried out (Table 2 and Figure 3). The vessel is at geographic north pole and the team carried out three ice core samplings (Table 3).

September 15th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). In addition, the team carried out one hydrological station (CTD, Rosette) up to a depth of 1000m (CHII-CTD4) (Table 1 and Figure 2).

September 16th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). In addition, the team carried out one hydrological station (CTD, Rosette) up to a depth of 1000m (CHII-CTD5) (Table 1 and Figure 2).

September 17th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). In addition, the team carried out one hydrological station (CTD, Rosette) up to a depth of 1000m (CHII-CTD6) (Table 1 and Figure 2).

September 18th 2025

On this day, no seawater samplings (Ferrybox) were carried out because we are at the same point of the day before (North Pole of Inaccessibility)

September 19th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). In addition, the team carried out one hydrological station (CTD, Rosette) up to a depth of 1000m (CHII-CTD7) (Table 1 and Figure 2).

September 20th 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). In addition, the team carried out one hydrological station (CTD, Rosette) up to a depth of 1000m (CHII-CTD8) (Table 1 and Figure 2). Today, Polar Bear was sighted.

September 21st 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). In addition, the team carried out one hydrological station (CTD, Rosette) up to a depth of 1000m (CHII-CTD9) (Table 1 and Figure 2). Finally, Polar Bear was sighted.

September 22nd 2025

On this day, two seawater samplings (Ferrybox) were carried out (Table 2 and Figure 3). In addition, the team carried out one hydrological station (CTD, Rosette) up to a depth of 1000m (CHII-CTD9) (Table 1 and Figure 2).

At 9:30 pm, scientific talk at the theatre, Exchange between guests, Lucia (Naturalist) and Maurizio and German team. Finally, Beluga whales and 2 Polar Bears were sighted.

September 23rd 2025

Today, the final seawater sampling (Ferrybox) was conducted (Table 2 and Figure 3). On this day, the scientific equipment was packed, and the samples that needed to be returned to Italy were prepared for transport.

September 24th 2025

On this day, Dr. Maurizio Azzaro illustrated in the Vessel's theater the activities carried out during the cruise period as part of the CHARCOT II project.

September 25th 2025

The vessel arrived at Nome (Alaska) harbour. The Charcot II team landed at 9:30 am CEST.

4. Station List

The hydrological stations (Rosette, CTD) conducted during the cruise for the analysis of DNA, chlorophyll and ETS (Electron Transport System) are listed below in Tables 1 and Figure 2:

TABLE 1

Station No.	Date	Time	Latitude	Longitude	Water Depth	Gear	Remarks/Recovery
	2025	[UTC]	[°N]	[°W]	[m]		
CHII-CTD1	11.9.	11:04	82°18'23.85"N	21°19'34.22"E	2405	ROS/CTD	1000-900-750-600-500-400-300-200-100-60-20-1 m
CHII-CTD2	12.9.	15:00	86°53'29.32"N	21°45'50.95"E	4343	ROS/CTD	500-400-300-200-100-40-20-1 m
CHII-CTD3	13.09.	22:30	89°55'2.90"N	176°31'52.50"W	4334	ROS/CTD	1000-900-750-600-500-400-300-200-100-40-20-1 m
CHII-CTD4	15.09.	09:53	88°6'27.68"N	136°29'43.02"E	3937	ROS/CTD	1000-900-750-600-500-400-300-200-40-20-1 m
CHII-CTD5	16.09.	10:40	85°32'14.47"N	138°41'40.59"E	N.A.	ROS/CTD	1000-900-750-600-500-400-300-200-100-40-20-1 m
CHII-CTD6	17.09.	08:00	85°51.721'N	173°34.482'E	N.A.	ROS/CTD	1000-900-750-600-500-400-300-200-40-20-1 m
CHII-CTD7	19.09.	14:10	82°59'55.90"N	179°3'10.44"W	2500	ROS/CTD	1000-900-750-600-500-400-300-200-100-60-20-1 m
CHII-CTD8	20.09.	13:30	80°44'25.11"N	178°45'51.96"W	N.A.	ROS/CTD	1000-900-750-600-500-400-300-200-100-40-20-1 m
CHII-CTD9	21.09.	23:15	76°19'48.69"N	176°4'9.11"W	N.A.	ROS/CTD	1000-900-750-600-500-400-300-200-100-40-20-1 m

CHII-CTD10	22.09.	17:20	74°44'23.22"N	171°37'9.84"W	295	ROS/CTD	291-200-100-40-20-1 m
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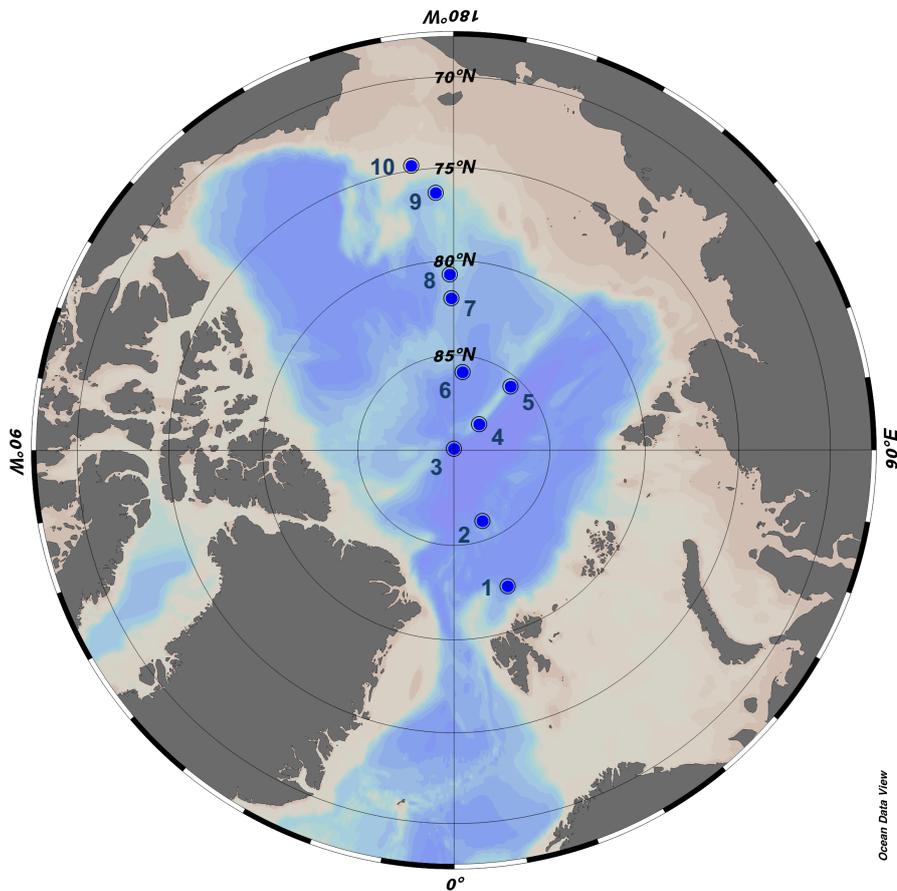


Figure 2. Map showing the points with the stations the hydrological stations (Rosette, CTD)

The stations of surface samples (9 m depth) taken with peristaltic pump (Ferrybox) for the analysis of microbial community are listed below in Table 2 and showed in Figure 3:

TABLE 2

Station No.	Date	Time Start [UTC]	Latitude	Longitude
CHII-ETS1	07.09.25	12:00	79°45'47,29" N	10°22'10,33"E
CHII-ETS2	07.09.25	23:54	79°55'44,45" N	13°54'16,37"E
CHII-ETS3	08.09.25	11:59	79°36'28,53" N	12°44'2,20"E
CHII-ETS4	08.09.25	23:58	80°3'12,81" N	17°10'32,94"E
CHII-ETS5	09.09.25	11:55	79°6'53,85" N	21°40'29,29"E
CHII-ETS6	09.09.25	23:55	79°31'22,78" N	19°40'16,66"E
CHII-ETS7	10.09.25	11:58	79°39'7,61" N	19°49'37,50"E
CHII-ETS8	10.09.25	23:54	79°39'7,61" N	19°49'37,50"E
CHII-ETS9	11.09.25	11:56	82°30'54,84" N	21°30'55,51"E
CHII-ETS10	11.09.25	23:52	84°26'24,97" N	22°6'37,08"E
CHII-ETS11	12.09.25	12:01	86°31'21,32" N	21°38'57,99"E

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CHII-ETS12	13.09.25	00:27	87°39'2,78" N	22°24'22,08"E
CHII-ETS13	13.09.25	11:56	89°20'55,71" N	38°54'32,91"E
CHII-ETS14	13.09.25	23:50	89°54'56,69" N	176°23'40,86"W
CHII-ETS15	14.09.25	00:12	89°46'41,84" N	123°15'29,60"E
CHII-ETS16	15.09.25	12:11	88°10'8,72" N	137°2'37,05"E
CHII-ETS17	15.09.25	00:13	86°52'29,36" N	134°36'48,52"E
CHII-ETS18	16.09.25	12:54	85°32'16,78" N	138°43'1,45"E
CHII-ETS19	16.09.25	00:29	85°30'51.88" N	140°3'11.65"E
CHII-ETS20	17.09.25	12:06	85°57'6.05" N	162°15'55.97"E
CHII-ETS21	17.09.25	00:03	85°49'19.52" N	175°47'29.24"E
CHII-ETS22	19.09.25	11:55	83°58'1.87" N	178°32'13.81"W
CHII-ETS23	19.09.25	00:09	82°34'51.38" N	179°51'34.79"W
CHII-ETS24	20.09.25	11:51	80°48'15.96" N	178°41'57.84"W
CHII-ETS25	20.09.25	00:14	79°19'58.55" N	179°59'43.13"W
CHII-ETS26	21.09.25	12:12	77°49'53.80" N	178°16'28.87"W
CHII-ETS27	21.09.25	23:40	76°19'51.98" N	176°4'5.21"W
CHII-ETS28	22.09.25	11:57	75°14'31.27" N	169°32'41.55"W
CHII-ETS29	22.09.25	23:56	74°7'37.47" N	173°17'1.78"W
CHII-ETS30	23.09.25	11:55	72°35'9.51" N	171°24'46.50"W

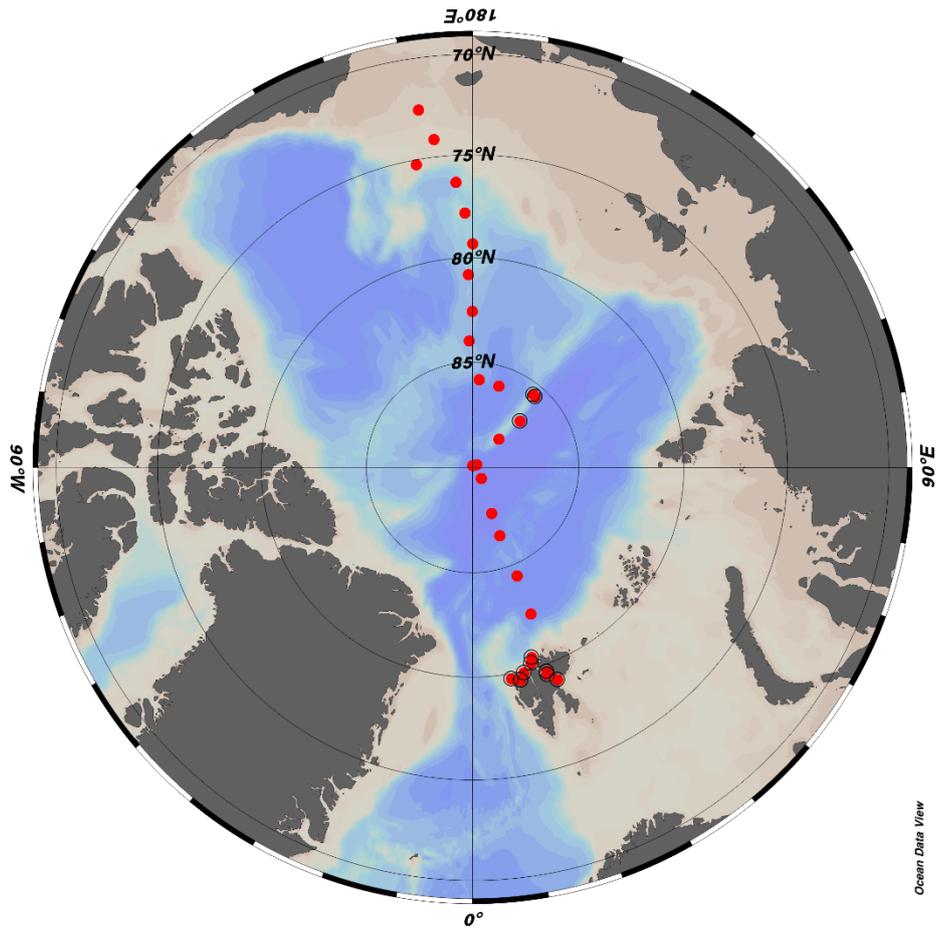


Figure 3: Geographical distribution of the stations with water samples taken with peristaltic pump (Ferrybox).

N. 3 Ice core samplings were collected at the Geographical North Pole (Table 3):

TABLE 3

Station No.	Date	Time Start [UTC]	Latitude	Longitude
CHII-ICE 1	14.09.2025	12:30	89°58'2,58"N	179°7'21,54"W

Mammal sightings protocol

The monitoring of marine mammal sightings provided a overview of the presence and behavior of these species throughout the polar exploration. An observer executed the protocol in passive mode, meaning they did not engage in active and continuous observation but rather relied on marine mammal sightings reported onboard by other operators or crew members to make sightings with the naked eye, occasionally using binoculars for scanning and record sighting data. Sightings reported by crew members, trainee observers, or other non-DO individuals were recorded only if confirmed by the observer. The rear of the route was scanned only occasionally to avoid the risk of double-counting sightings. All data pertaining to the vessel's track (position, speed, and heading) were recorded from the onboard monitors present over all the Decks of the vessel. During sightings, data were collected using the "sight data collection sheet" (Weather; Sightings; Other Species). For each sighting, information on species, number of individuals, possible presence of juveniles, behaviour, and vessel presence were recorded.

When it was possible, photographs were used to confirm sightings and determine species and group size. Unidentified species were registered as "US" followed by the designation "large whale species" (L), "medium cetacean species" (M), or "small dolphin species" (S).

Effort data were analyzed in terms of time (hours) spent and/or distance traveled (nautical miles or kilometers) during observations in good weather conditions (Beaufort ≤ 3). Beaufort scale assessments were based on visual observations and wind speed ranges. Distance traveled was generally preferred for coherence with spatial analysis.

5. Preliminary Results

At present, the samples have not yet arrived in most of the laboratories.

5.1 Water Sampling

Seawater samples were collected from the ship's peristaltic pump, positioned at a depth of 9 meters. Surface water samples were collected twice a day, at 12:00 and 24:00 UTC. In addition, during the cruise seawater samples were taken at 10 stations (Tab.1) at fixed depths up to 1000 m using Niskin bottles (8L capacity) on the Rosette. All the water samples, once taken were pretreated on board for the analysis concerning the project: size-fractionated Chlorophyll *a* (CHL *a*; 0.2-2 μ m; 2-10 μ m; 10-200 μ m; spectrofluorimetric analysis), molecular detection of the prokaryotic phylogenetic composition and metabolic potential (DNA/RNA; next generation sequencing) and Particulate and dissolved organic matter remineralization (ETS). In addition, CTD probe recorded physical-chemical parameters (temperature, conductivity, pressure, oxygen, turbidity). The samples collected are yet to reach the workplace in Italy and will be analyzed upon delivery.

5.2 Ice core Sampling

The ice cores were collected at the Geographical North Pole using an electric corer with a capacity of up to 1.6 meters. Ice samplings were pre-treated as showed below in Table 4 and in Figure 4:

TABLE 4

Name	Section	Total Length (cm)	Section's Length (cm)	Liters filtered (L) X DNA	Salinity (Sal)	Conductivity (microS/cm)	T (°C)
CHII-ICE 1	Total	160		Tot 7,7			
CHII-ICE 1 TOP	Top		53	2,45	0.6	1239	11.9
CHII-ICE 1 MIDDLE	Middle		53	2,55	2.1	4.01	10.4
CHII-ICE 1 BOTTOM	Bottom		53	2,7	3	5.75	8.7
CHII-ICE 2	Total	160		Tot 4,95			
CHII-ICE 2 TOP	Top		53	0,9	0.6	1299	10.2
CHII-ICE 2 MIDDLE	Middle		53	2,3	1.9	3.61	12.4
CHII-ICE 2 BOTTOM	Bottom		53	1,75	3.3	6.18	9
CHII-ICE 3	Total	160		Tot 6,1			
CHII-ICE 3 TOP	Top		53	2,4	0.7	1415	10.4
CHII-ICE 3 MIDDLE	Middle		53	1,35	2	3.89	11.3
CHII-ICE 3 BOTTOM	Bottom		53	2,35	2.9	5.51	11.6

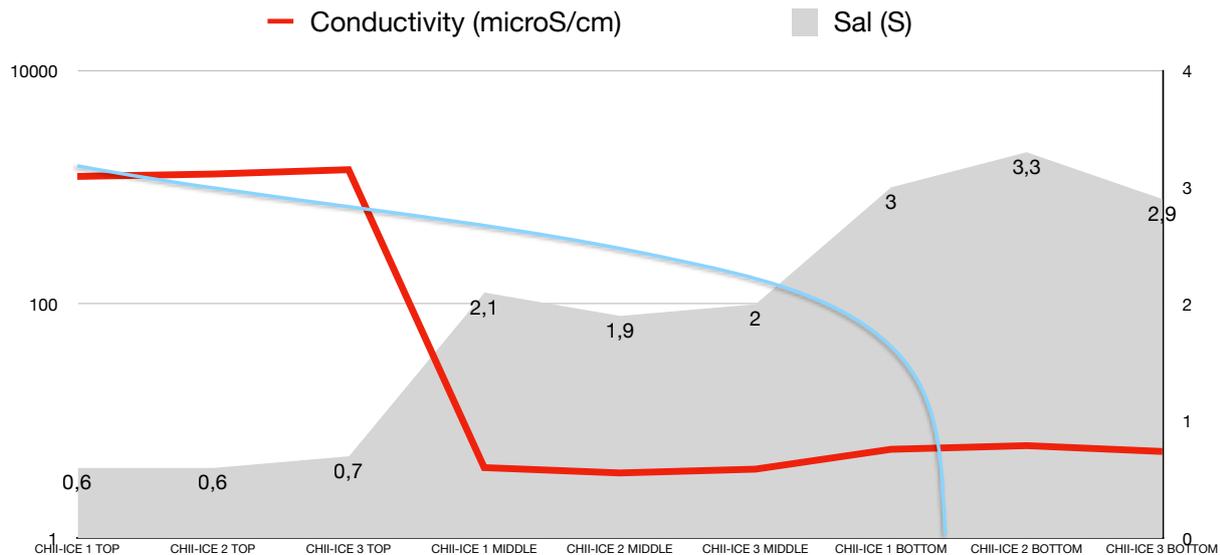


Figure 4. Values and trends of conductivity and salinity in the ice core samples

5.3 Mammals Observation

The sampling effort for this study was primarily concentrated in the time interval available in accordance with the other on board activities and data collection requirements of the campaign.

In total, we recorded 9 sighting events of the following mammal species during the observation effort:

- N. 2 specimens of Humpback Whale (*Megaptera novaeangliae*)
- N. 7 specimens of Polar Bear (*Ursus maritimus*)
- N. 1 specimen of Bearded Seal (*Erignathus barbatus*)
- N. 2 specimens of Beluga (*Delphinapterus leucas*)

In the observed instances, all mammals exhibited travel behavior, consistently refraining from any alterations or adjustments in response to the presence of the ship.

6. Data and Sample Storage / Availability

The data will be made available following what was already described in the design phase.

7. Acknowledgements

“We would like to thank PONANT EXPLORATIONS GROUP, particularly the Ponant Science Program, as well as the crew aboard Le Commandant Charcot, for their support during this research project”. Furthermore, we thank the Captain Patrick Marchesseau and all the crew from Le Commandant Charcot for the ship time and technical support. In particular, heartfelt gratitude is extended to Gwenael Trividic, Alessio Andreani and Eric Brossier for their invaluable scientific, technical, and organizational support.

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