# Research Vessel Survey Report: RV Cefas Endeavour CEND17A/22

## Clean Seas Environmental Monitoring Programme (CSEMP)

## English Channel, Celtic and Irish Sea

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## Contents

# Survey Aims

The information generated during this survey will be used to meet UK's obligations for reporting of contaminant, eutrophication and marine litter data to MERMAN and the ICES database and for subsequent assessments for OSPAR and Good Environmental Status (GES descriptors 5, 8, & 10) assessment as part of the 25-year Environmental Plan H4 indicator. After discussions with the Environment Agency (EA) and National Resources Wales (NRW) colleagues a coordinated approach is being taken to help deliver additional dab samples to meet EQSD requirements for these agencies.

## Primary aims

1. To collect samples of demersal fish for chemical analysis from the North Sea, and English Channel (Table 1; Figure 1) in support of the Clean Seas Environmental Monitoring Programme (CSEMP) (OSPAR Common indicator and UK specific Indicator assessments).

2. To collect fish samples at CSEMP sites for fish disease, biochemical markers (e.g. EROD and bile metabolites analysis and AChE) (UK specific Indicator Assessments).

3. To sample representative CSEMP stations (Table 1; Figure 1) using day grab, for polycyclic aromatic hydrocarbons (PAHs), trace metal contaminants, organic contaminants (PCBs, PBDEs), sediment particle size analysis (PSA) and marine litter (OSPAR Common indicator and UK specific Indicator assessments).

4. To conduct marine litter surveys of seafloor macrolitter (following the ICES guidelines) and microplastics in sediment and biota, to gather data towards the OSPAR Commission Common Indicator and UK Evidence Group marine litter indicators.

5. To conduct marine litter surveys (OSPAR Common indicator and UK specific Indicator assessments) by collecting benthic litter information from collecting sediment samples for litter analysis.

6. To conduct manta trawl sampling of surface waters for microplastics, to gather data and evidence towards method and indicator assessment developments, supported by the Ocean Country Partnership Programme (OCPP).

7. To conduct opportunistic sampling of seafloor macro litter for Non-Native Species (NNS) research and development under the Clean Atlantic 2 programme.

8. Dab stomach content analysis to feed into the dabstats database to assess benthic community changes over time.

## Secondary Aims

1. To collect water conductivity, temperature, nutrient, and depth information, and Plankton community information to provide additional knowledge on Eutrophication levels (OSPAR Common indicator and UK specific Indicator assessments). Calibration exercise at Liverpool Bay ( 53.5333, -3.35) using CTD Rosette.

2. To collect additional fish for the EA and NRW to analyse as part of their Water Framework Regulations remit. EA require 9 fish from stations 534, 584, 706, 715, 769, 796 and Liverpool Bay trend. NRW require up to 9 Dab from Welsh stations 616, 649, 654 and 776.

3. To collect mackerel and sediment from four stations (English Channel, Celtic Sea, Cardigan Bay, and Irish Sea) following a request via the Working Group on Marine Chemistry (MCWG). Samples will be collected as close as possible to complementary fishing and sediment stations. Samples will used to investigate the distribution of a specific mackerel parasite as part of a large international study.

## Tertiary Aims

1. To collect sediment samples using a day grab to detect rapid toxicity within sediments samples using the Microtox® rapid test methodology.

## Survey Team

Our survey team consisted of skilled staff members from both Weymouth and Lowestoft, including histopathologists, chemists, ecotoxicologists, research scientists, fisheries scientists, and marine litter scientists (Figure 1). Staff were split into 12-hour shift patterns, with the majority on day working. Two staff members worked night shift to accommodate grabbing and water sampling. Two marine litter scientists worked opposite shifts on a 12-12 watch. Shift pattens reflected the requirement for carrying out critical training due to staff shortages. AWSM crew included a bridge team (Figure 2) of four, and two back to back deck crew teams working 12-12 shifts (Figure 3,Figure 4) and the engine team (Figure 5).

| Name | Role |
|---|---|
| Freya Goodsir | SIC |
| Manuel Nicolaus | 2SIC |
| Matt Green | Deck master; FD |
| Stuart Ross | Deck master; FD |
| Isobel Lake | Water, fish data (CSEMP Data manager) |
| Joanna Uzyczak | Sediment & Water |
| Peter Hamstead | Sediment & Water |
| Danja Hoehn | Water, litter |
| Michelle Stone | FD |
| Josh Davison | Ecotoxicology, Micro tox |
| Stuart Ross | FD |
| Richard Humphreys | Stomach, Otolith |
| Peter Randall | Water, litter |
| Karen Vanstaen | Data, fish sorting |

**Figure 1: CSEMP Survey Team**


**Figure 2: Bridge Team**


**Figure 3: Deck crew day shift**

**Figure 4: Deck crew night shift**

**Figure 5: Engine Room Crew**

# Survey particulars

**DURATION:** 12th November from Portland (06:00 Pilot) – 21st November in Liverpool (05:00).

**LOCATION:** English Channel, Celtic and Irish Sea

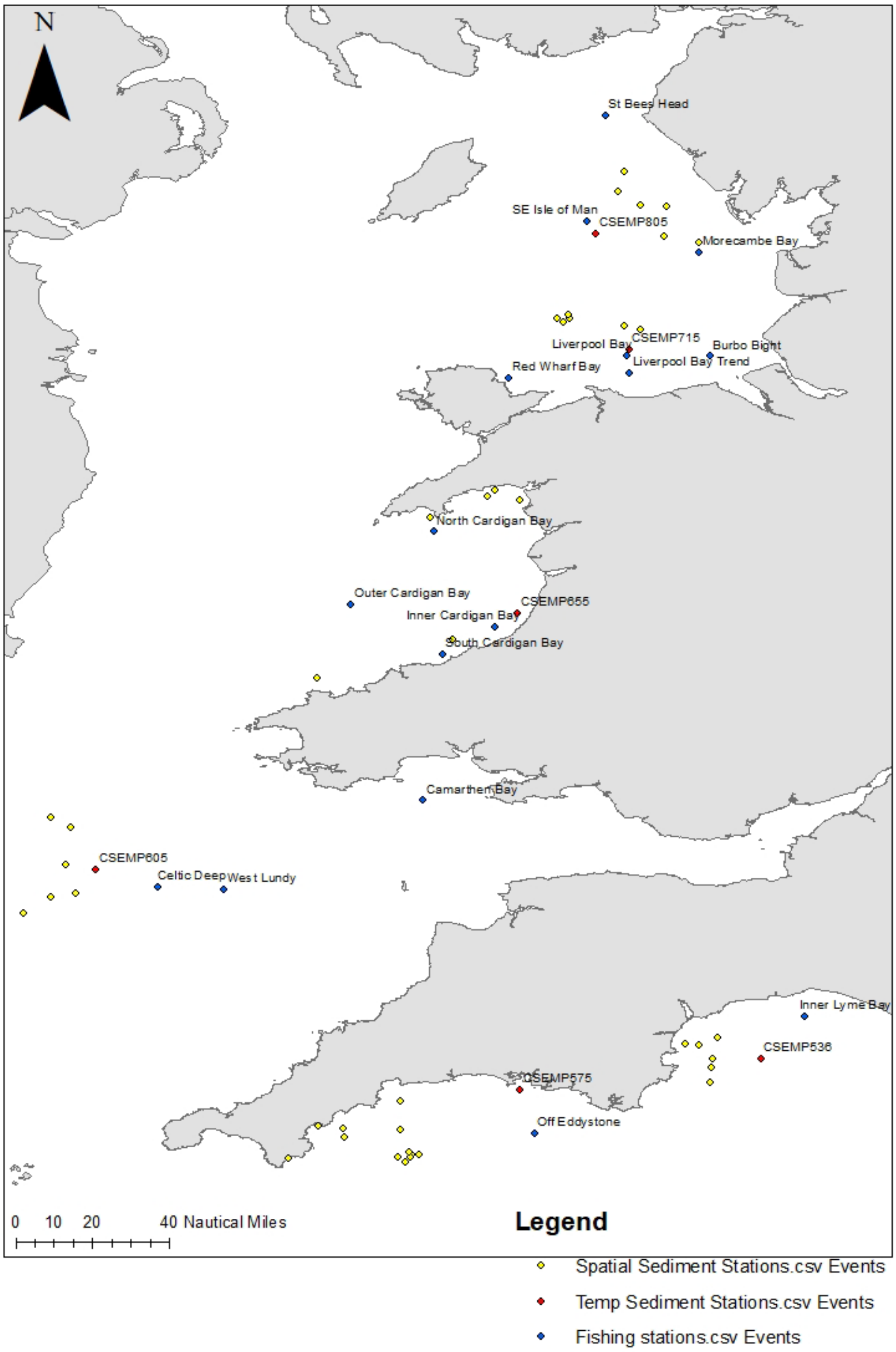



**Figure 6: CSEMP fishing and temporal/spatial sediment stations.**

## Stations

The survey plan included the following stations for sampling. Note, the sediment stations marked priority 4, 5 and 6 (coloured green) in Table 3 are alternative stations to be visited only if stations marked priority 1, 2 and 3 (coloured blue) couldn't be sampled.

**Table 1: CSEMP fishing stations positions**

Additional 9 fish collected per site for the EA. Additional 9 fish collected per site for NRW.

| CSEMP Number | Location | Mid tow Lat. Long. |
|---|---|---|
| 534 | Inner Lyme Bay | 50 43.86 N 02 55.82 W |
| 584 | Off Eddystone | 50 06.44 N 04 06.06 W |
| New | West Lundy | 51 09.79 N 05 26.67 W |
| 605 | Celtic Deep | 51 10.29 N 05 43.75 W |
| 616 | Camarthen Bay | 51 32.82 N 04 35.13 W |
| 649 | North Cardigan Bay | 52 42.44 N 04 32.29 W |
| 654 | South Cardigan Bay | 52 10.90 N 04 29.87 W |
| 706 | Burbo Bight | 53 28.24 N 03 20.47 W |
| 715 | Liverpool Bay | 53 28.32 N 03 41.91 W |
| Trend_Liv | Liverpool Bay Trend | 53 23.76 N 03 41.50 W |
| 769 | St Bees Head | 54 30.71 N 03 47.63 W |
| 776 | Red Wharf Bay | 53 22.46 N 04 12.84 W |
| 796 | Morecambe Bay | 53 55.31 N 03 23.23 W |
| 805 | SE Isle of Man | 54 03.36 N 03 52.47 W |

2 replicates for metals and Particle Size Analysis (PSA), and organics, and one for microplastics at the temporal grabbing stations, and 1 replicate for metals and PSA, and organics at the spatial grabbing stations.

**Table 2: CSEMP temporal sediment grabbing stations**

| Temporal Stations | CSEMP | Latitude | Longitude |
|---|---|---|---|
| CSEMP536 | 536 | 50.43 | -3.1217 |
| CSEMP575 | 575 | 50.295 | -4.1622 |
| CSEMP605 | 605 | 51.25 | -6 |
| CSEMP655 | 655 | 52.3583 | -4.175 |
| CSEMP715 | 715 | 53.5 | -3.6917 |
| CSEMP805 | 805 | 54 | -3.8333 |

**Table 3: CSEMP spatial sediment grabbing stations**

| CSEMP Number | Station | Latitude | Longitude | Priority |
|---|---|---|---|---|
| 536 | 536_1 | 50.4864 | -3.3907 | 1 |
| 536 | 536_2 | 50.5218 | -3.30898 | 2 |
| 536 | 536_3 | 50.4299 | -3.32708 | 3 |
| 536 | 536_4 | 50.3272 | -3.33851 | 4 |
| 536 | 536_5 | 50.3933 | -3.33663 | 5 |
| 536 | 536_6 | 50.4943 | -3.45004 | 6 |
| 575 | 575_1 | 50.0888 | -4.9246 | 1 |
| 575 | 575_2 | 50.12356 | -4.68269 | 2 |

| | | | | |
|---|---|---|---|---|
| 575 | 575_3 | 50.24813 | -4.68251 | 3 |
| 575 | 575_4 | 50.1255 | -4.92969 | 4 |
| 575 | 575_5 | 49.99683 | -5.16373 | 5 |
| 575 | 575_6 | 50.13646 | -5.03488 | 6 |
| 585 | 585_1 | 50.01662 | -4.59983 | 1 |
| 585 | 585_2 | 50.00329 | -4.69439 | 2 |
| 585 | 585_3 | 50.01404 | -4.63349 | 3 |
| 585 | 585_4 | 50.00215 | -4.63919 | 4 |
| 585 | 585_5 | 50.02585 | -4.64413 | 5 |
| 585 | 585_6 | 49.98106 | -4.66021 | 6 |
| 605 | 605_1 | 51.1465 | -6.08697 | 1 |
| 605 | 605_2 | 51.1288 | -6.19617 | 2 |
| 605 | 605_3 | 51.4325 | -6.10676 | 3 |
| 605 | 605_4 | 51.2704 | -6.133 | 4 |
| 605 | 605_5 | 51.4758 | -6.19402 | 5 |
| 605 | 605_6 | 51.0597 | -6.31596 | 6 |
| 655 | 655_1 | 52.077 | -5.04296 | 1 |
| 655 | 655_2 | 52.8658 | -4.30277 | 2 |
| 655 | 655_3 | 52.24582 | -4.45463 | 3 |
| 655 | 655_4 | 52.8925 | -4.27252 | 4 |
| 655 | 655_5 | 52.77188 | -4.55319 | 5 |

| | | | | |
|---|---|---|---|---|
| 655 | 655_6 | 52.8457 | -4.16649 | 6 |
| 715 | 715_1 | 53.6356 | -3.94896 | 1 |
| 715 | 715_2 | 53.61827 | -3.97566 | 2 |
| 715 | 715_3 | 53.60327 | -3.7108 | 3 |
| 715 | 715_4 | 53.58369 | -3.64351 | 4 |
| 715 | 715_5 | 53.65081 | -3.95627 | 5 |
| 715 | 715_6 | 53.63252 | -4.00441 | 6 |
| 805 | 805_1 | 53.9611 | -3.39075 | 1 |
| 805 | 805_2 | 54.1232 | -3.64093 | 2 |
| 805 | 805_3 | 54.2669 | -3.70927 | 3 |
| 805 | 805_4 | 54.1846 | -3.73993 | 4 |
| 805 | 805_5 | 53.9868 | -3.54159 | 5 |
| 805 | 805_6 | 54.1191 | -3.5275 | 6 |

**Table 4: CTD Calibration sample and plankton net at Liverpool Bay Smart Buoy**

| Station name | Latitude (Decimal degrees) | Longitude (Decimal degrees) |
|---|---|---|
| Liverpool Bay Smart Buoy | 53.533 | -3.35 |

# Survey Narrative

**10th November**

Scientific staff from Lowestoft joined the *RV CEFAS ENDEAVOUR* at 19:00.

**11th November**

Scientific staff from Weymouth arrived at the vessel for 08:00. A visual risk assessment was carried out before the sampling equipment from Weymouth was unloaded from the vans to the dockside. All staff carried out an induction of the vessel at 09:00, this was followed by fire drill and a muster exercise. The vessel was then mobbed with all scientific equipment and chemicals. A toolbox talk was carried out on the deck with crew and Cefas staff, to go through standard operating procedures (SOPs) of all equipment deployed from the vessel, this included covering side and stern gantry deployments (day grab, plastic pump, manta trawl, CTD rosette, zooplankton net and granton trawl). A sailing time was agreed between the Master and SICs this was influenced by staff shortages for pilots at Portland port with a slightly later sailing time.

**12th November**

The vessel sailed at 06:26 from Portland via pilot and made its way west towards the first CSEMP fishing station Lyme Bay. The wet lab was set up ready for processing (Table 7).

**Figure 7: Tank set up on deck and wet lab**

Arrived at Lyme Bay at 09:52, a line was run for static gear, due to fishing vessels in the area. A CTD and two fishing tows were carried out for this station, for the third tow, the manta trawl was deployed in parallel and recovered successfully. A fourth tow was performed and then the station concluded with deployment of the plastic pump. Target species were limited at site; however, all other aims were completed. Finally, the day completed with day grabbing at Lyme Bay with six successful grabs in Lyme Bay (Figure 8 Figure 9).

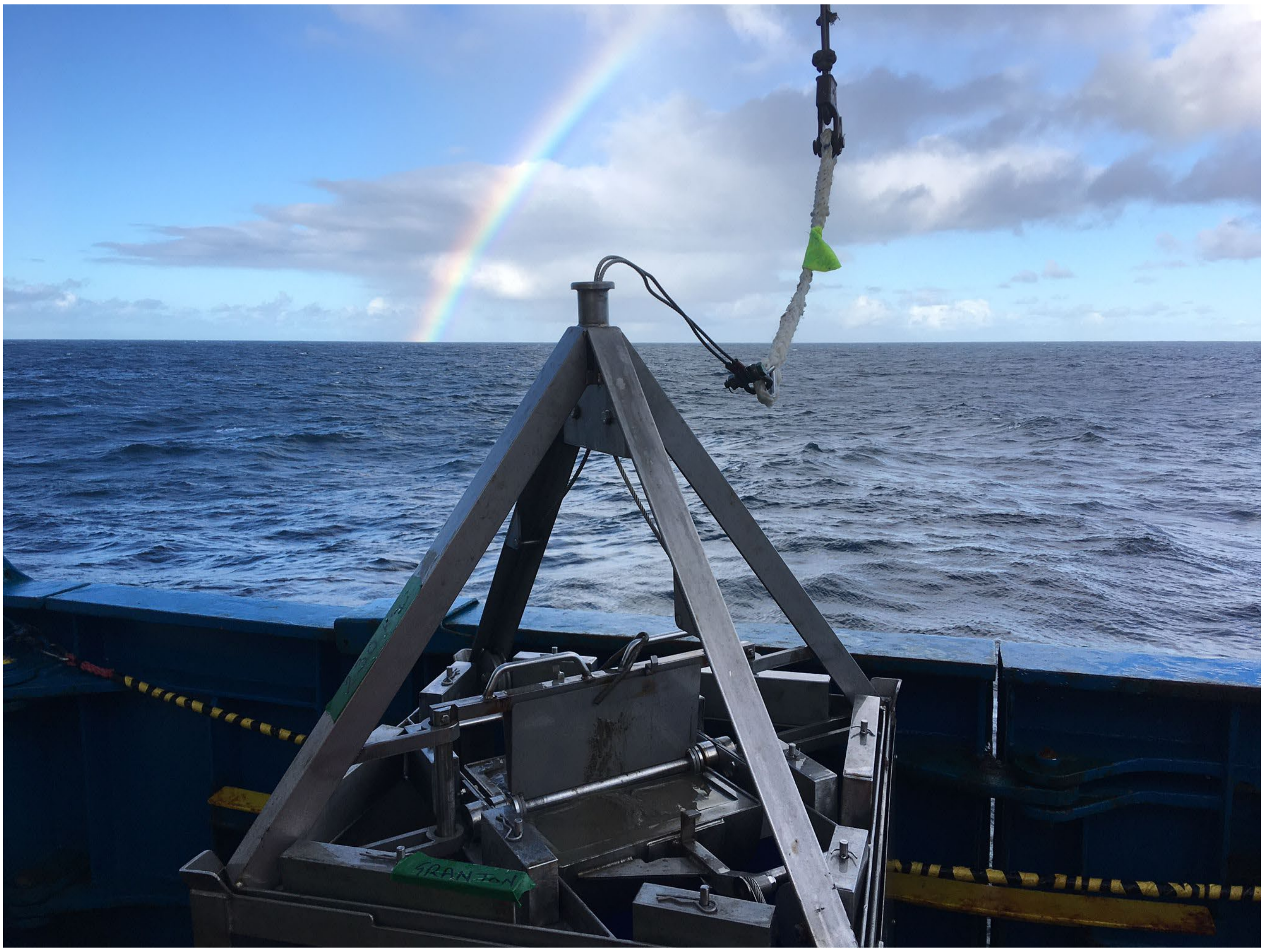


**Figure 8: The Day grab on the side gantry ready to be sampled.**

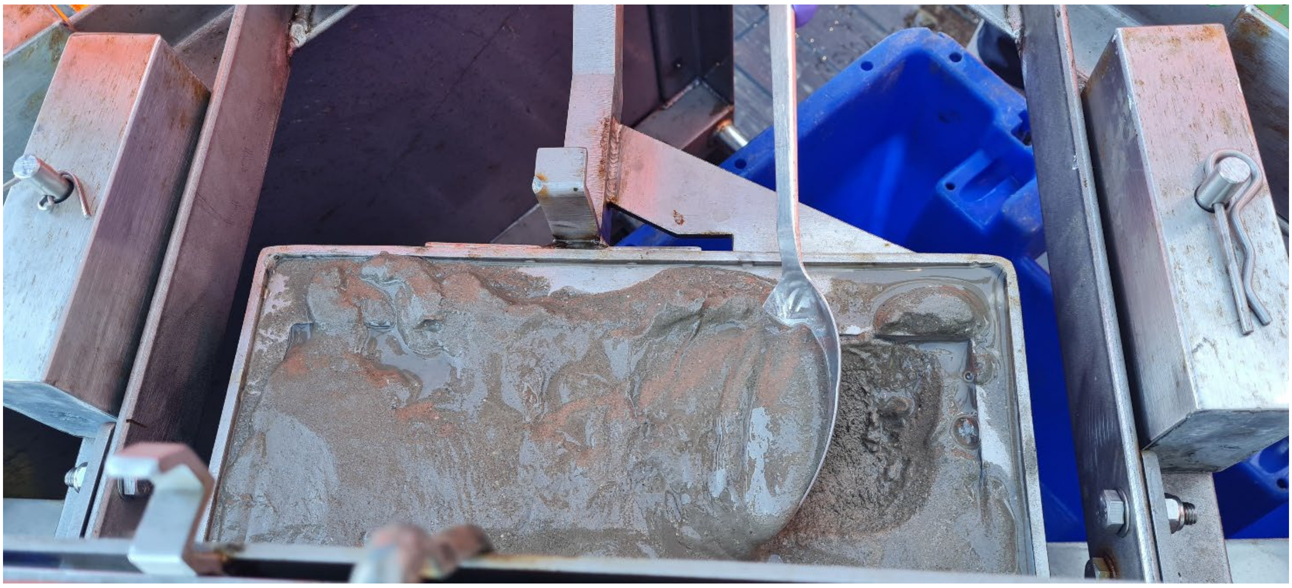


**Figure 9: Day grab contaminants sampling.**

**14th November**

The vessel transited from Lyme Bay to Off Eddystone, to CSEMP temporal sediment station 575, grabbing continued through the early morning with three successful grabs at CSEMP 575. The vessel transited to Off Eddystone (Figure 10), during the transit the manta trawl and litter pump were successfully deployed during the approach to the fishing station. A CTD and four successful fishing tows were carried out. Fishing at Eddystone was successful with all primary and secondary aims completed. It was noted that the fishing at this station was better than previous years.

Grabbing continued in Eddystone areas picking up spatial station clusters at 585 and 575. During this time the officers noted an issue with the steering gear where the steering was locked into starboard, with 40 minutes of downtime. Operations re-commenced shortly after, before transiting overnight to Celtic Deep.

**Figure 10: Vessel steaming to Eddystone fishing station**

**14th November**

At 06:30 we were notified that the officers were concerned about deployment of the fishing gear, with the current steering issues. During this time, the vessel awaited further advice from shoreside AWSM. It was agreed that we could continue to carry out side gantry operations which included sediment grabbing, which was one of the primary aims for the survey. Grabbing continued throughout the day picking up temporal (605) and spatial station around Celtic Deep. The weather deteriorated over the course of the day and there was no further response from shoreside regarding advice around commencing fishing operations and so it was agreed we would continue with side gantry operations in Cardigan Bay. Due to the weather conditions, we could not carry out a CTD rosette, microplastic pump or Manta trawl deployment at Carmarthen Bay.

**15th November**

Operations continued picking up primary and secondary aims in South Cardigan Bay, with no fishing activities. Focus was placed on picking up microplastic case studies using the Manta trawl and the microplastic pump. Our case study area for the 15th November was Cardigan Bay. Water samples for microplastics were collected in 1-hour intervals while steaming through Cardigan Bay to the different sediment stations. Water samples were collected from near the seafloor and the surface to measure the oxygen concentrations, salinity, water temperature and nutrients.

**Figure 11: Common Dolphin spotting off Cardigan Bay.**

**16th November**

Steamed along the Welsh coast and collected 2 hourly water samples and carried out some manta tows on route to the Liverpool Bay sediment stations. We collected all the priority sediment samples around Liverpool Bay.

**17th November**

Sampling continued in Liverpool Bay and Burbo Bight areas. Samples were collected for sediment contaminant analysis, water samples for microplastics, nutrients, salinity, and dissolved oxygen (Figure 12). The vessel side gantry experienced a hydraulic leak, coming from the hydraulic pipe which resulted in 3 hours and 20 minutes of downtime for the vessel. The vessel then transited towards the Liverpool smart buoy where a calibration exercise was performed. This included taking water samples for Chlorophyll (Figure 13), turbidity, suspended particle matter, salinity, nutrients and bottom oxygen. A plankton ring net was also deployed to collect samples for zooplankton (Figure 14).


**Figure 12: Water samples, including dissolved oxygen samples, being collected from the CTD Rosette from the Smartbuoy site.**


**Figure 13: Filtering rig used for filtering out suspended particulate matter and Chlorophyll**

**Figure 14: Zooplankton ring net being deployed off the side gantry.**

Manta trawls were deployed between stations to collect microplastics in the water column. Wind and swell conditions increased during the day which meant the manta trawl and plastic pump deployments could not continue. The day completed with grab stations around Morecombe Bay (CSEMP805).

**18th November**

Water sampling continued in St Bees, starting with water collection using the CTD and microplastics sampling (Figure 15). A clear thermocline and halocline were seen during deployment of the CTD at St Bees, demonstrating a stratified water column (Figure 16).


**Figure 15: Scientist recording data from CTD deployment**

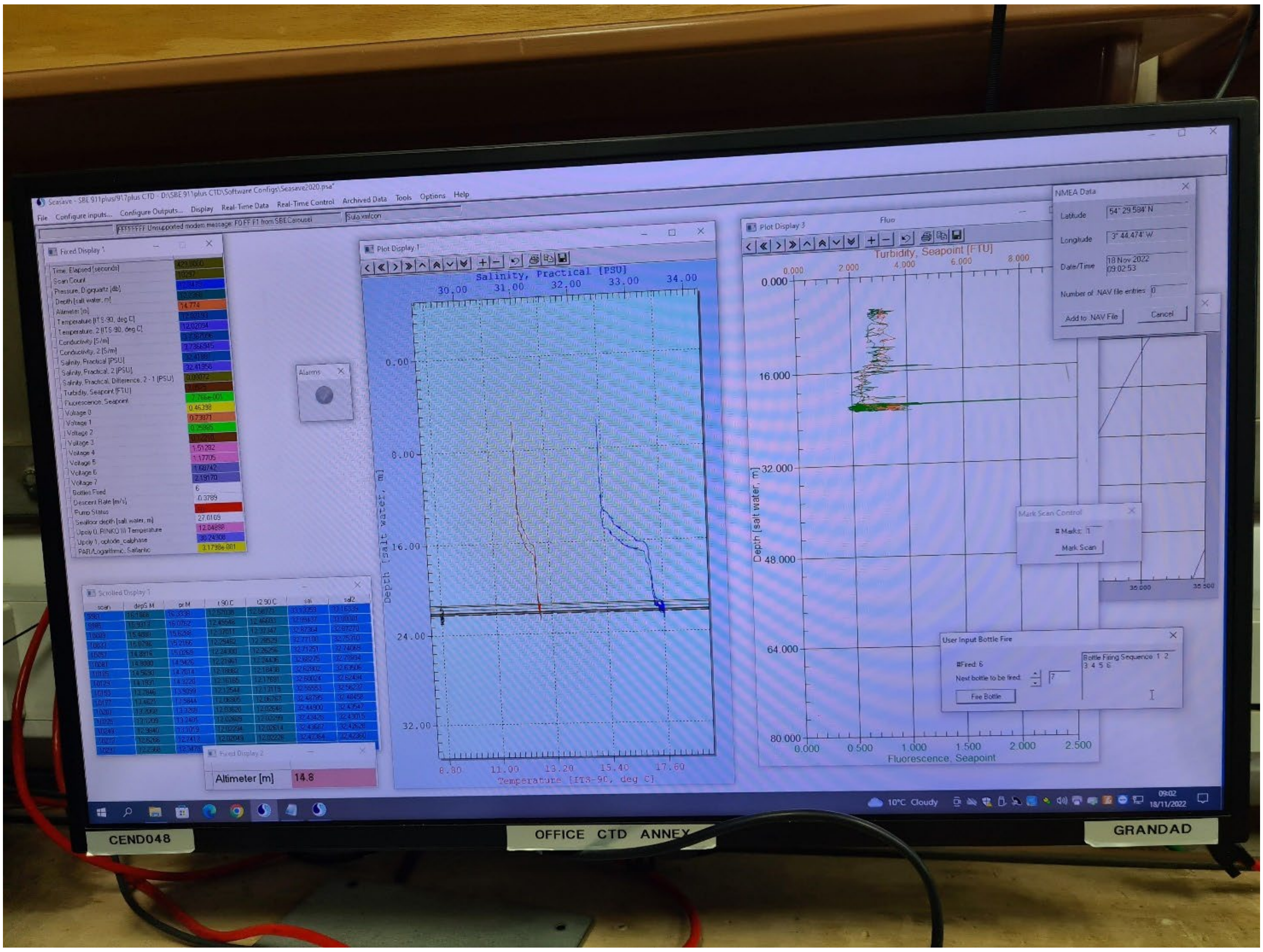


**Figure 16: Thermocline and halocline from St Bees CTD deployment**

The plastic pump (Figure 17) was also deployed to collect plastic from the surface. Due to weather conditions the manta trawl could not be deployed at this time. Transited to South East Isle of Man for CTD and further water sampling throughout the day. The day finished with Day grabs at CSEMP 805 with six deployments completing one of our primary survey aims.

**Figure 17: Marine plastics pump left: on deck, right:  Being deployed from the side gantry.**

**19th November**

Over the last 24 hours we brought the nightshift back to daytime hours by giving staff the night off. We completed packing up most of the survey equipment while still collecting microplastic samples using the Manta trawl, microplastic pump and CALPS filtration system. Engine trials were also carried out to test all 3 engines.

**Figure 18: Sun setting on last day of survey**

**20th November**

The survey finished with the completion of water sampling techniques for microplastics on the way to Liverpool port (Figure 17). Packing of calicos and last cleaning schedule ready for demobbing.

**21st November**

Scientific crew demobbed all CSEMP equipment and left the vessel to return home to Lowestoft and Weymouth.

# Results

## Fishing stations

Out of the fourteen fishing stations, two fishing stations were completed successfully (Table 5), before a decision on the steering gear was made that it was no longer safe to deploy fishing gear. Four tows were performed at Lyme Bay in good sea conditions. The site did not fish well for target species, however eighteen dab of different size ranges were collected for chemistry analysis. Target species for microplastics were collected, this included 25 plaice, 25 whiting and 25 mackerel.

Four successful tows were completed at Off Eddystone, this station fished better than in previous years. Twenty dab were sampled for biomarkers in the correct size range and a further 60 dab were sampled for fish disease, including recording of stomach contents (Table 6). At this site, disease levels were low with the main occurrence being skins ulcers (Table 7). A Further 50 dab were taken for chemistry, with a further 9 collected for the EA in target size ranges. Target fish species for microplastics were also collected, these included 25 plaice, 25 mackerel, 25 whiting, 25 dab.

**Table 5: Fished Stations and number of fish caught for specific analysis**

| Date | Location | CSEMP code | Mid tow Lat. decimal | Mid tow Lon. decimal | time shot | time haul | Fish numbers for Chemical analysis | Dab numbers for Biomarker analysis; Fish Disease (FD) | Environment Agency | Microplastics |
|---|---|---|---|---|---|---|---|---|---|---|
| 12/11/22 | Lyme Bay | CSEMP 534 | 50.5970875 | -2.9092875 | 10:47 | 11:17 | 1 x 18 (various size ranges) | None | NA | Plaice, Mackerel, Whiting |
| 13/11/22 | Off Eddystone | CSEMP 584 | 50.10310833 | -4.15152083 | 07:19 | 07:49 | 2 x 25 (17-20 cm) | 20 biomarkers and 60 additional FD | 9 fish | Plaice, Mackerel, Whiting, Dab |

**Table 6: Stomach content of 20 sampled dab** at **Off Eddystone** on 13th November 20, 2022

| CSEMP ST. NO. | Length (cm 1dp) | Weight (g) | SEX | STOMACH ANALYSIS |
|---|---|---|---|---|
| **584** | 21.2 | 91.3 | M | BRITTLE STAR, FULLNESS 1 |
| **584** | 23.5 | 127.2 | M | EMPTY |
| **584** | 21.6 | 95.1 | M | HYDROIDS, SMALL SWIMMING CRAB, FULLNESS 2 |
| **584** | 22.3 | 110.1 | M | BRITTLE STAR, FULLNESS 1 |
| **584** | 20.8 | 83.6 | M | HYDROID, FULLNESS 1 |
| **584** | 23.4 | 134.1 | M | EMPTY |
| **584** | 21.5 | 93.4 | M | EMPTY |
| **584** | 24 | 129.9 | M | SAND, FULLNESS 1 |
| **584** | 20 | 77.4 | F | EMPTY |
| **584** | 22.8 | 118.8 | F | EMPTY |
| **584** | 22.5 | 108.5 | M | HYDROIDS, FULLNESS 1 |
| **584** | 20.9 | 85.6 | M | EMPTY |
| **584** | 23.2 | 123.7 | F | HYDROID, SMALL QUEEN SCALLOP, BIVALVES, FULLNESS 3 |
| **584** | 24 | 149.1 | F | MACROPODIA X 2, FULLNESS 4 |
| **584** | 21.6 | 107.9 | F | EMPTY |
| **584** | 23.5 | 139.4 | F | SMALL QUEEN SCALLOPS X2, FULLNESS 1 |
| **584** | 22.8 | 122.1 | F | HYDROID, SAND, FULLNESS 2 |
| **584** | 24 | 147.3 | F | HYDROIDS, SAND, FULLNESS 2 |

| CSEMP ST. NO. | Length (cm 1dp) | Weight (g) | SEX | STOMACH ANALYSIS |
|---|---|---|---|---|
| **584** | 24.1 | 141.6 | F | QUEEN SCALLOPS X3, FULLNESS 1 |
| **584** | 23 | 116.4 | F | HYDROID, FULLNESS 1 |
| | | | | |

**Table 7: Observed occurrences of the fourteen recorded external and internal fish diseases**

| Lymphocystis | Skin Ulcer | epidermal hyperplasia/papilloma | hyperpigmentation | liver disease - nodule/tumour | X-cell gill lesions | Stephanostomum sp | Lepeophtheirus sp. | Acanthochondria sp. | Nematodes | Glugea sp | Lateral lipoidosis | Skeletal deformity | fin rot/erosion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | **8** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |

## CTD profiles

Prior to each fishing station, a CTD rosette was deployed to establish a full water profile of salinity, temperature, oxygen, fluorescence and turbidity. Water samples were collected from surface waters (~4m) for salinity and chlorophyll. A summary of the CTD stations can be found in Table 8.

**Table 8: CTD rosette samples collected.**

| Station Information | | | Sample Information | | | Grab Information | | |
|---|---|---|---|---|---|---|---|---|
| Station Number | Station Code | Analysis Type | Replicate Attempt | Water Depth (m) | Date | Time | Lat DD | Long DD |
| 2 | CSEMP534 | Nutrients/Salinity/ Oxygen | A1 | 35 | 12/11/2022 | 10:02 | 50.59206 | -2.9212 |
| 12 | CSEMP584 | Nutrients/Salinity/ Oxygen | A1 | 72 | 13/11/2022 | 06:36 | 50.11011 | -4.07883 |
| 24 | 605 Celtic deep | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A1 | 95 | 14/11/2022 | 13:41 | 51.24678 | -6.00751 |
| 32 | CSEMP655 | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A2 | 26 | 15/11/2022 | 10:31 | 52.36401 | -4.16862 |
| 36 | CARDIGAN BAY | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A1 | 79 | 15/11/2022 | 15:12 | 52.49833 | -4.9925 |
| 55 | CSEMP715 | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A1 | 38 | 16/11/2022 | 19:59 | 53.50067 | -3.69777 |
| 58 | CSEMP776 | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A1 | 35 | 17/11/2022 | 00:46 | 53.42494 | -4.00912 |
| 61 | CSEMPLBT | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A1 | 22 | 17/11/2022 | 05:10 | 53.41551 | -3.65371 |
| 69 | CSEMPBBT | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A1 | 20 | 17/11/2022 | 12:36 | 53.46429 | -3.38537 |
| 72 | CSEMPLBSB | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A1 | 30 | 17/11/2022 | 14:50 | 53.52606 | -3.37616 |
| 75 | CSEMP796 | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A1 | 22 | 17/11/2022 | 20:10 | 53.92694 | -3.36449 |
| 82 | CSEMP796 | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A1 | 28 | 18/11/2022 | 09:01 | 54.49334 | -3.74205 |
| 84 | CSEMPSEIM | Chlorophyll/Nutrients/Salinity/SPM/Oxygen | A1 | 53 | 18/11/2022 | 13:38 | 54.05799 | -3.86641 |

## Sediment stations

## CSEMP contaminants

Sediment samples were collected for polycyclic aromatic hydrocarbons (PAHs), trace metal contaminants, organic contaminants (PCBs, PBDEs) and sediment particle size analysis (PSA), marine litter (microplastics), porosity, and rapids fines assessment (RFA) from temporal stations CSEMP536, CSEMP575, CSEMP605, CSEMP655, CSEMP715, CSEMP805. Sediment was also collected from all spatial stations, at least 3 replicates were collected from each of the stations. The breakdown of what was collected for which analysis is shown in Figure 19. Table 10 also shows the separate images of the sediments in the Day grab to assess the sediment type.

## Rapid fines assessment

The Rapid Fines Assessment (RFA) is a quick, cheap and easy technique designed to calculate percentage fines by volume. It can be used in the field to pinpoint where more targeted sampling is needed and alongside complementary biogeochemical analysis. It is a natural extension of existing sediment techniques, such as PSA, but allows the nature of packing and volume of silt flocculates to be determined.

Sediment is tumbled, left to settle, and then photographed.  Image analysis of the tubes is performed in Adobe Photoshop. The mud layer depth is measured in pixels and then calculated as a percentage of the total depth. Sediment samples for RFA were collected alongside organic contaminant samples, these samples were photographed and logged on board the vessel (Figure 11).

## Porosity

Porosity is a measure of the void space in the sediment mixture. Porosity sediment samples were collected alongside organic sediment samples. This was collected to compare porosity measured from the organic sediment contaminant sample.

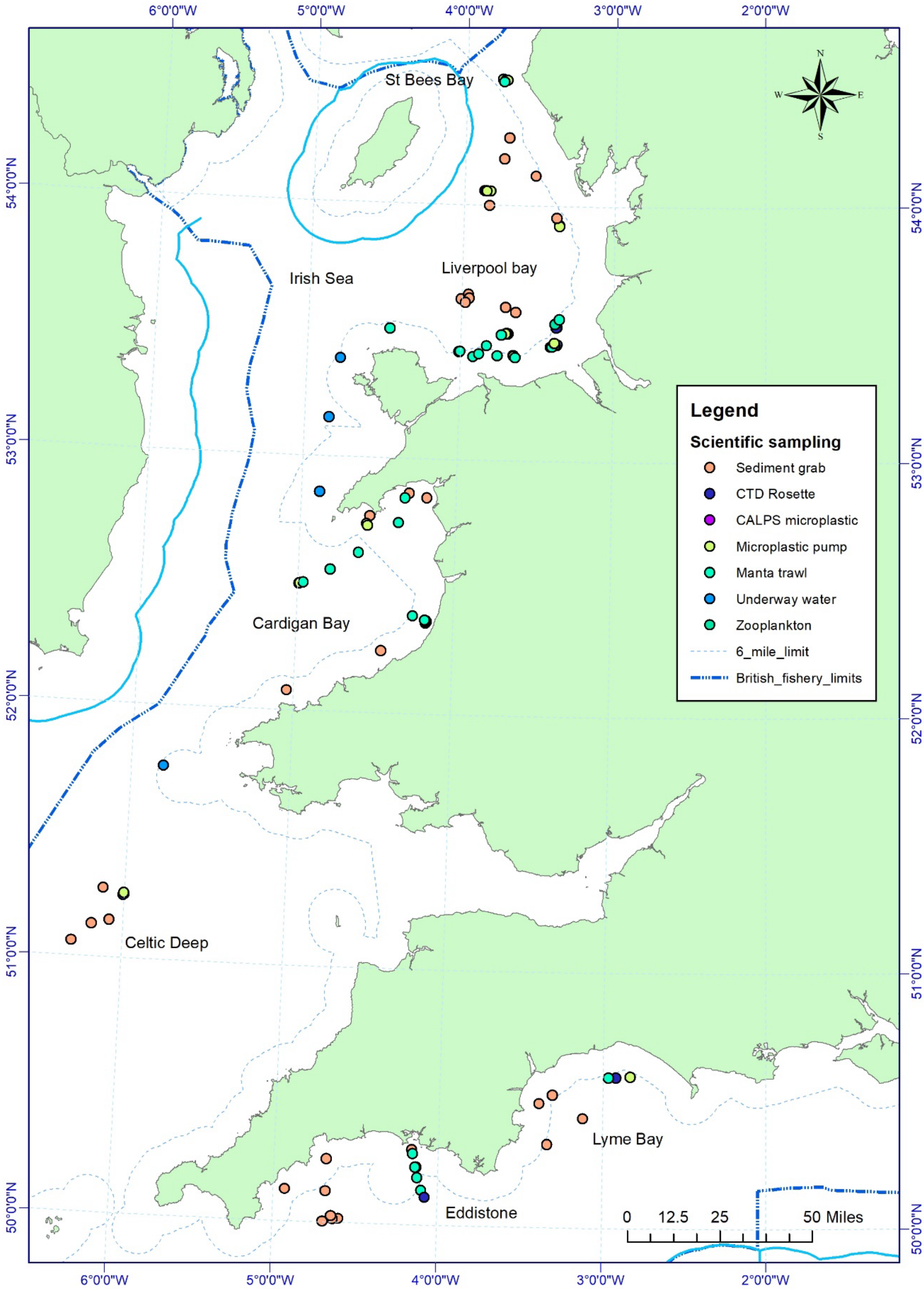



**Figure 19: Survey maps showing stations sampled for sediments, microplastics and water.**

**Table 9: Sampled sediment stations metadata**

| Station Information | | | Sample Information | | | Grab Information | | |
|---|---|---|---|---|---|---|---|---|
| Station Number | Station Code | Analysis Type | Replicate Attempt | Water Depth (m) | Date | Time | Lat DD | Long DD |
| 5 | CSEMP536 | PSA/Metals/Organics/RFA/Microtox/Porosity/MCWG | A2 | 52 | 12/11/2022 | 18:33 | 50.43012 | -3.12182 |
| 5 | CSEMP536 | PSA/Metals/Organics/RFA/Microtox/Porosity/MCWG | B1 | 52 | 12/11/2022 | 18:46 | 50.4301 | -3.12184 |
| 6 | CSEMP536_2 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 28 | 12/11/2022 | 19:57 | 50.5219 | -3.30902 |
| 7 | CSEMP536_1 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 29 | 12/11/2022 | 20:37 | 50.48648 | -3.39053 |
| 8 | CSEMP536_4 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 58 | 12/11/2022 | 21:57 | 50.32741 | -3.33857 |
| 9 | CSEMP575 | PSA/Metals/Organics/RFA/Microtox/Porosity/MCWG | A2 | 40 | 13/11/2022 | 01:39 | 50.29503 | -4.16227 |
| 9 | CSEMP575 | PSA/Metals/Organics/RFA/Microtox/Porosity/MCWG | B1 | 40 | 13/11/2022 | 01:57 | 50.295 | -4.16213 |
| 13 | CSEMP585_1 | PSA/Metals/Organics/RFA/Microtox/Porosity | A2 | 75 | 13/11/2022 | 14:10 | 50.01657 | -4.59996 |
| 15 | CSEMP585_5 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 76 | 13/11/2022 | 15:47 | 50.02593 | -4.64416 |
| 16 | CSEMP585_2 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 79 | 13/11/2022 | 16:33 | 50.00329 | -4.69439 |
| 17 | CSEMP575_2 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 71 | 13/11/2022 | 17:37 | 50.12362 | -4.68277 |
| 18 | CSEMP575_3 | PSA/Metals/Organics/RFA/Microtox/Porosity/MCWG | A1 | 50 | 13/11/2022 | 18:43 | 50.24898 | -4.6818 |

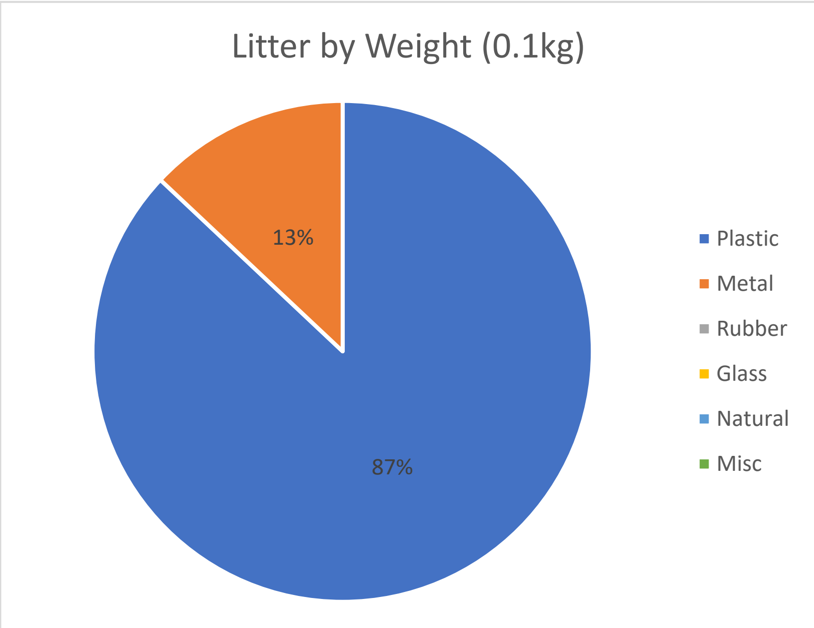
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 19 | CSEMP575_4 | PSA/Metals/Organics/RFA/Microtox/Porosity/MCWG | A2 | 59 | 13/11/2022 | 20:12 | 50.1256 | -4.92974 |
| 20 | CSEMP605 | PSA/Metals/Organics/RFA/Microtox/Porosity/MCWG | A2 | 98 | 14/11/2022 | 08:20 | 51.25008 | -5.99983 |
| 20 | CSEMP605 | PSA/Metals/Organics/RFA/Microtox/Porosity/MCWG | B1 | 98 | 14/11/2022 | 08:35 | 51.25012 | -5.99982 |
| 21 | CSEMP605_1 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 102 | 14/11/2022 | 10:02 | 51.14652 | -6.08693 |
| 22 | CSEMP605_2 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 106 | 14/11/2022 | 10:53 | 51.12906 | -6.19578 |
| 23 | CSEMP605_6 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 103 | 14/11/2022 | 11:49 | 51.06 | -6.31555 |
| 26 | CSEMP605_4 | PSA/Metals/Organics/RFA/Microtox/Porosity | A3 | 104 | 14/11/2022 | 17:05 | 51.2706 | -6.13299 |
| 30 | CSEMP655 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 25 | 15/11/2022 | 08:28 | 52.35792 | -4.17484 |
| 30 | CSEMP655 | PSA/Metals/Organics/RFA/Microtox/Porosity | B1 | 25 | 15/11/2022 | 08:46 | 52.35804 | -4.17491 |
| 39 | CSEMP655_6 | PSA/Metals/Organics/RFA/Microtox/Porosity | A2 | 17 | 16/11/2022 | 00:31 | 52.84919 | -4.18779 |
| 40 | CSEMP655_2 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 21 | 16/11/2022 | 01:11 | 52.86566 | -4.30257 |
| 48 | CSEMP715_6 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 48 | 16/11/2022 | 14:58 | 53.63242 | -4.00478 |
| 49 | CSEMP715_5 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 45 | 16/11/2022 | 15:26 | 53.65075 | -3.95673 |
| 50 | CSEMP715_1 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 47 | 16/11/2022 | 15:43 | 53.63541 | -3.94927 |
| 52 | CSEMP715_3 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 41 | 16/11/2022 | 17:37 | 53.60314 | -3.71127 |
| 53 | CSEMP715_4 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 43 | 16/11/2022 | 18:13 | 53.58368 | -3.64362 |

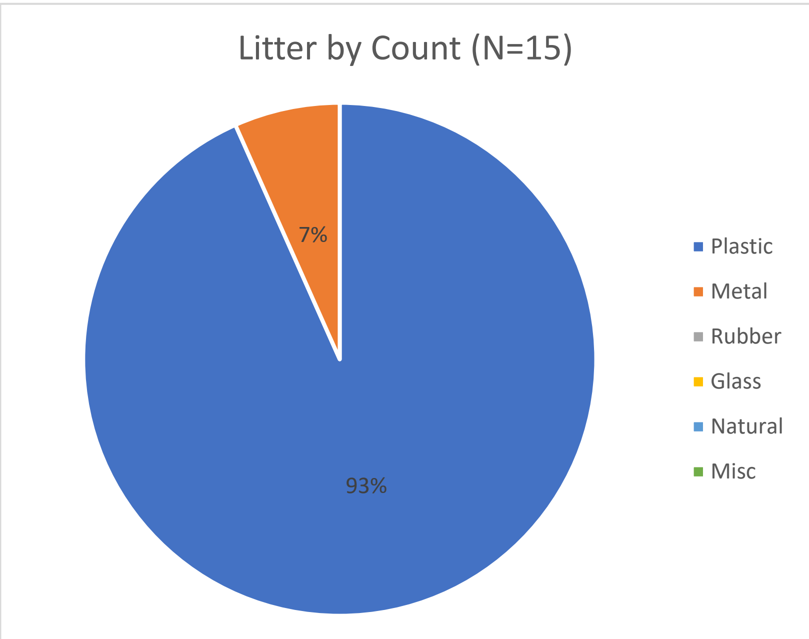
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 54 | CSEMP715 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 37 | 16/11/2022 | 19:15 | 53.49988 | -3.69191 |
| 54 | CSEMP715 | PSA/Metals/Organics/RFA/Microtox/Porosity | B1 | 37 | 16/11/2022 | 19:24 | 53.49992 | -3.69189 |
| 54 | CSEMP715 | PSA/Metals/Organics/RFA/Microtox/Porosity | D1 | 37 | 16/11/2022 | 19:38 | 53.49988 | -3.69215 |
| 77 | CSEMP_805_1_v2 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 23 | 17/11/2022 | 21:28 | 53.95599 | -3.38342 |
| 78 | CSEMP_805_6 | PSA/Metals/Organics/RFA/Microtox/Porosity/eDNA | A1 | 26 | 17/11/2022 | 23:31 | 54.1188 | -3.52721 |
| 79 | CSEMP_805_4 | PSA/Metals/Organics/RFA/Microtox/Porosity/eDNA | A1 | 30 | 18/11/2022 | 00:49 | 54.18453 | -3.7393 |
| 80 | CSEMP_805_3 | PSA/Metals/Organics/RFA/Microtox/Porosity/eDNA | A1 | 39 | 18/11/2022 | 01:40 | 54.26688 | -3.70928 |
| 88 | CSEMP_805 | PSA/Metals/Organics/RFA/Microtox/Porosity | A1 | 40 | 18/11/2022 | 16:35 | 54.0000 | -3.83321 |

## Seafloor litter

During our trawling activities, and as part of our survey objectives, we conducted analysis of any collected seafloor litter. In total, 15 litter items were collected over 2 trawls, weighing a total of 100.041 g. Off these litter items, 13 items were plastics accounting for 87%. The highest litter station was Off Eddystone where we collected 10 litter items. Figure 20 shows a breakdown of all litter collected by count and weight, split my material type.

**Figure 20: Pie charts showing marine litter composition (%) by count and weight.**



## Surface Microplastics collection

Microplastics in surface waters were sampled during CSEMP using three different methods including the ‘manta’ trawl, the microplastic pump and the CALPS (flowthrough system) on the RV Endeavour. In total 30 manta trawl, 27 microplastic pump and 56 CALP samples were collected on the west coast, from the English Channel to Liverpool Bay (Figure 19).

This comparison study will contribute to the development of standardised methods for the monitoring of microplastics in surface waters and benefit the development of a monitoring programme. Furthermore, these findings will give some insights of how microplastics transfer from the surface to the sediment through the water column.

## Microtox analysis

Microtox® rapid toxicity detection is an *in vitro* test system. It uses the bioluminescent bacteria *Alliivibrio fishcheri* for the detection of toxicity and is used as a screening system to detect the relative toxicity of environmental samples. It responds to chemicals or combinations of chemicals that are toxic to cells or reduce their speed of replication.

The field method followed for this study was the Modern Water Microtox® 81.9% B-tox test for low toxicity samples. The test procedure is described in full in the Deltatox® II User's Manual (01/2013) and follows similar principles to ISO11348-3 (2007). It comprises a highly sensitive luminometer, liquid reagents and freeze-dried bacterial reagents. An aliquot of *A. fischeri* culture is reactivated and 100 µl added to each test vial. The light output from bacteria in these vials (time zero) is recorded. 900 µl of sample or control media is added to the vials and they are left to incubate for 30 minutes at ambient temperature, after which time the light output is read again. The luminosity change in the control over this time period is considered to represent 100% of that expected for the combination of temperature and time used. The luminosity change in each sample is then measured and compared to the luminosity of the control, with the difference expressed as a positive or negative percentage difference from the control.

Sediment samples are expected to contain a mixture of known and unknown chemicals at various concentrations. The Microtox technique is an investigative step using one test species to start the process of understanding how the environment might be reacting to these contaminant mixtures. If the mixture present in the sample has an overall inhibitory effect, leading to less growth of the *A. fischeri* bacteria, then this will lead to reduced luminescence which will be reported as a light loss compared to the control. This can be considered as inhibition of growth. Samples showing an increase compared to the control might be experiencing enhanced nutrient levels with no inhibitory effects from toxic chemicals.

3 (±0.1) g of sediment weighed into 40ml plastic pots within 24 hours of sampling where possible. 7ml natural seawater added with pipette, samples were shaken by hand for 30 seconds and left to settle until clear (settling time between 115 and 260 min dependent on sediment type and sea state). Clear overlying water was extracted with a Pasteur pipette. Same 81.5% tox method as previous report. See (Figure 20) for laboratory set up.


**Figure 21: Microtox set up in annex on Cefas Endeavour (top), close up of sediment samples ready for analysis (bottom)**

37 sediment samples were analysed in total, from 30 individual sites along the south-west and western English nearshore seabed. Multiple replicates were taken from 6 stations, averages are presented for these stations. Results are presented in Figure 16, which demonstrated >85% expected luminescence are highlighted in green and indicate no toxicity. Up to 15% luminescence inhibition is expected within the test resulting from inherent variation. For those stations where averages are presented, no individual sample demonstrated >15% inhibition. A number of sites demonstrated enhanced luminosity, this is likely due to the effects of nutrients in the sediment enhancing bacterial growth or from turbidity in the sample interfering with luminescence readings.

Samples from Celtic Deep (Stn. 805) demonstrated the highest enhancement of luminescence (Figure 22). Samples from stations in coastal waters off the southern coast of Devon / Cornwall (536, 575 & 585) demonstrated the highest inhibition of luminescence, suggesting possible differences due to the proximity to sources of anthropogenic pollution. However, all results were within the variance of the test and can also be attributed to failure of sediments to settle sufficiently or variation in bacterial activity.

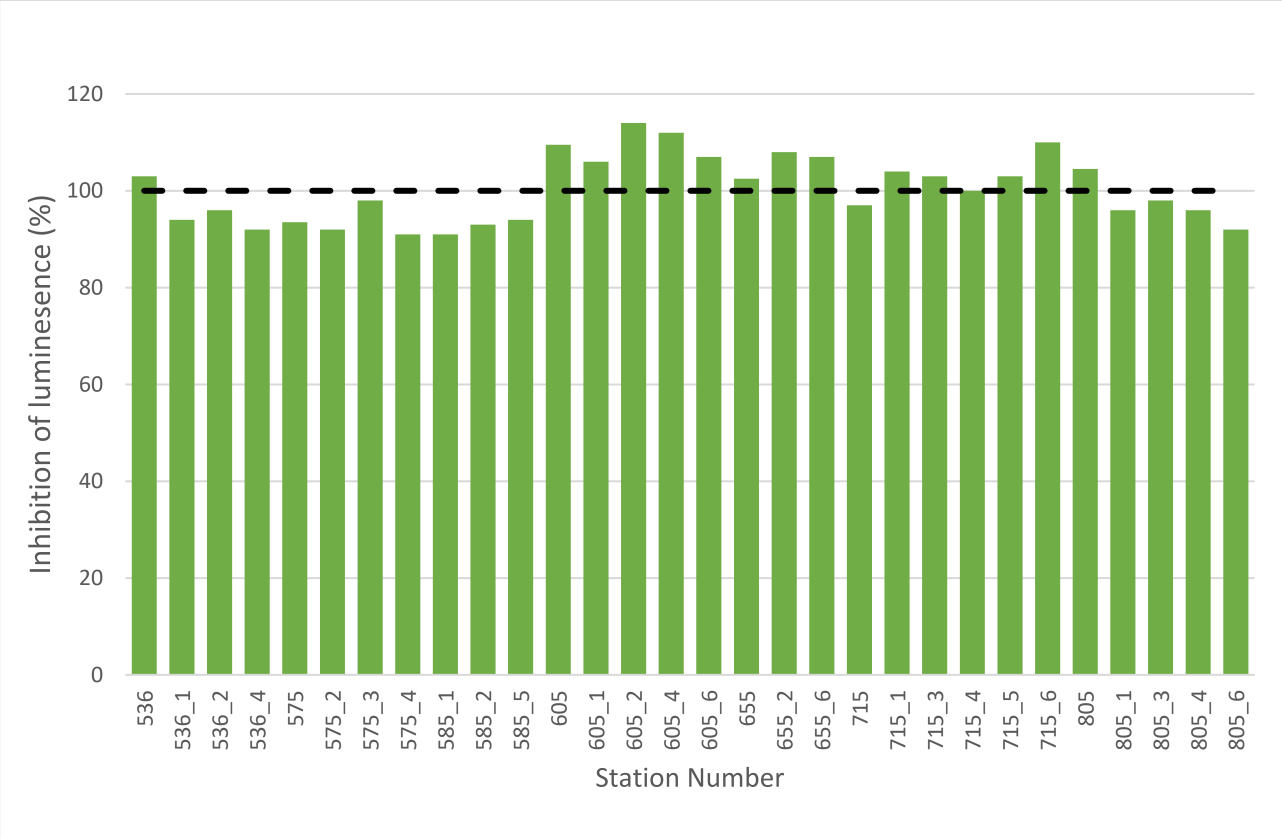
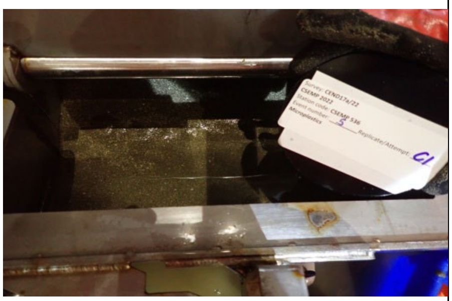
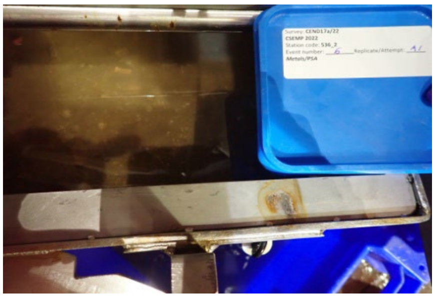
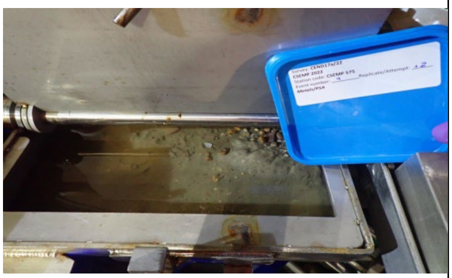


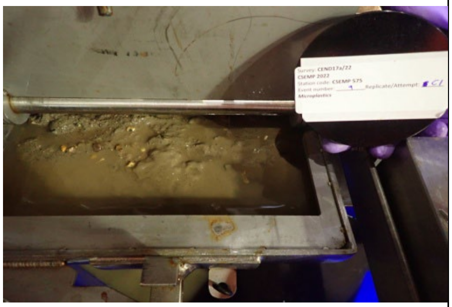
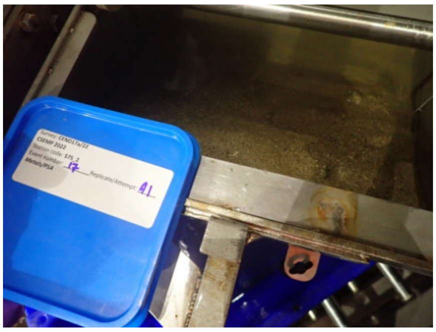

**Figure 22: Microtox levels in sediment grab samples. Black line indicates the theoretical zero ('normal' luminescence), green bars are good (x>-10%).**

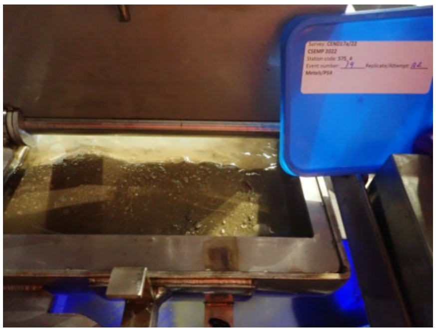
# Annex 1

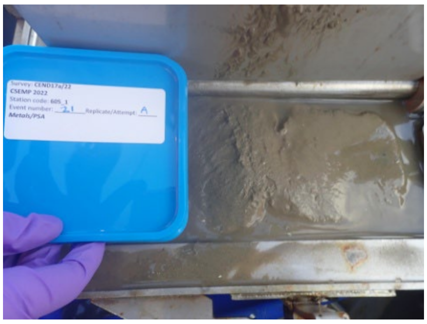
**Table 10: Sampled sediment stations for chemical analysis as part of the CSEMP with preliminary sediment description and sample depth.**

| Station | Picture | Sediment Description | Sediment Depth (cm) |
|---|---|---|---|
| CEND17A22_STN_536_A2 |  | muddy sand | 6 |
| CEND17A22_STN_536_B1 |  | muddy sand | 6.5 |
| CEND17A22_STN_536_C1 |  | muddy sand | 5 |

| | | | |
|---|---|---|---|
| CEND17A22_STN_536_2_A1 |  | sandy shelly gravel | 9 |
| CEND17A22_STN_536_1_A1 |  | sandy mud | 8 |
| CEND17A22_STN_536_4_A1 |  | muddy sand | 11 |
| CEND17A22_STN_575_A2 |  | gravelly mud | 11 |
| CEND17A22_STN_575_B1 |  | gravelly mud | 10.5 |

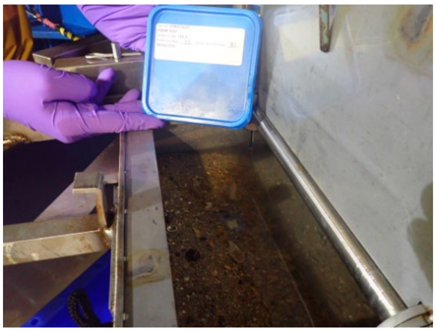
| | | | |
|---|---|---|---|
| CEND17A22_STN_575_C1 |  | sandy mud | 11.5 |
| CEND17A22_STN_585_1_ A2 |  | slightly shelly muddy sand | 5 |
| CEND17A22_STN_585_5_ A1 |  | slightly muddy shelly sand | 5 |
| CEND17A22_STN_585_2_ A1 |  | muddy shelly sand | 6 |
| CEND17A22_STN_575_2_ A1 |  | slightly sandy mud | 5 |

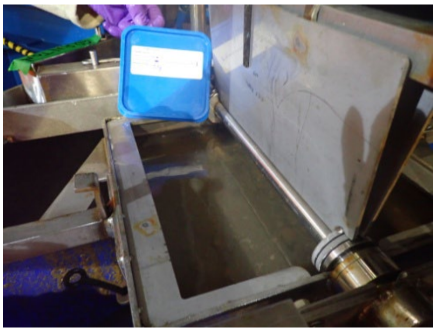
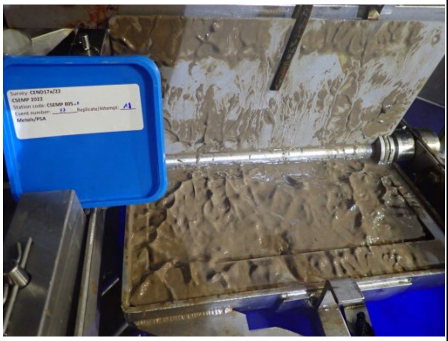
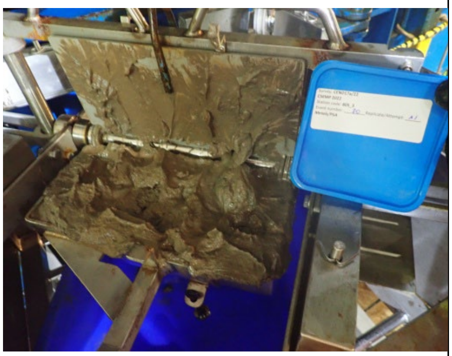
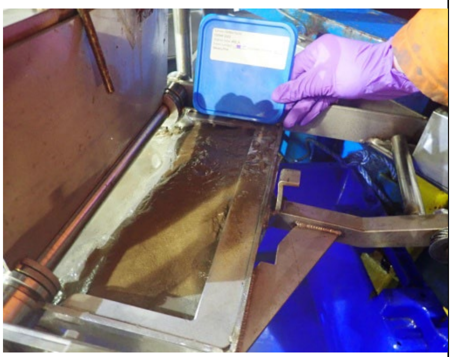
| | | | |
|---|---|---|---|
| CEND17A22_STN_575_3_A1 |  | slightly muddy shelly sand | 11 |
| CEND17A22_STN_575_4_A2 |  | gravelly sand | 8.5 |
| CEND17A22_STN_605_A2 |  | muddy sand | 13 |
| CEND17A22_STN_605_B1 |  | sandy mud | 13 |
| CEND17A22_STN_605_C1 |  | sandy mud | 13 |

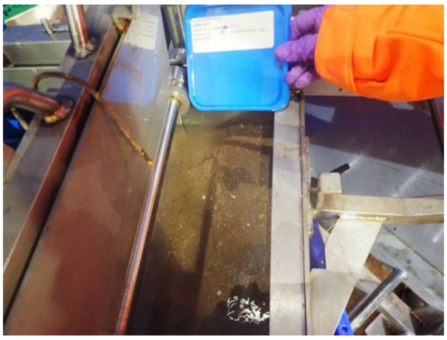
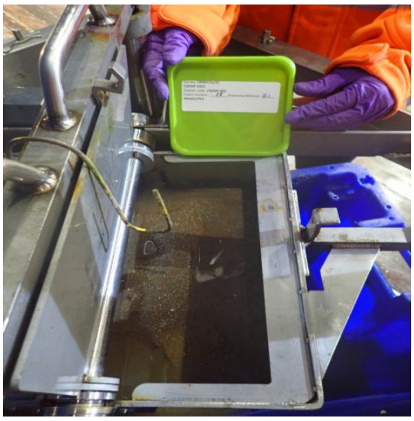
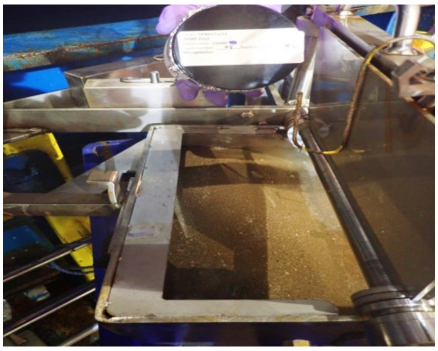
| | | | |
|---|---|---|---|
| CEND17A22_STN_605_1_A1 |  | sandy mud | 14 |
| CEND17A22_STN_605_2_A1 |  | sandy mud | 14.5 |
| CEND17A22_STN_605_6_A1 |  | muddy sand some shell | 8 |
| CEND17A22_STN_605_4_A3 |  | Mud | 14 |
| CEND17A22_STN_655_A1 |  | Sandy mud | 14 |

| | | | |
|---|---|---|---|
| CEND17A22_STN_655_B1 |  | Mud | 14 |
| CEND17A22_STN_655_C1 |  | Shelly muddy sand | 13 |
| CEND17A22_STN_655_D1 |  | Sandy mud | 14 |
| CEND17A22_STN_655_E1 |  | Sandy mud | 14 |

| | | | |
|---|---|---|---|
| CEND17A22_STN_655_F1 |  | Muddy sand | 14 |
| CEND17A22_STN_655_6_A2 |  | mud | 6 |
| CEND17A22_STN_655_2_A1 |  | mud | 14 |
| CEND17A22_STN_715_6_A1 |  | very shelly sand | 8 |
| CEND17A22_STN_715_5_A1 |  | gravelly shelly sand | 6 |

| | | | |
|---|---|---|---|
| CEND17A22_STN_715_1_A1 |  | gravelly shelly sand | 7 |
| CEND17A22_STN_715_3_A1 |  | shelly sand | 6 |
| CEND17A22_STN_715_4_A1 |  | shelly sand | 7 |
| CEND17A22_STN_715_A1 |  | sandy silt | 8 |
| CEND17A22_STN_715_B1 |  | sandy mud | 8 |

| | | | |
|---|---|---|---|
| CEND17A22_STN_715_C1 | no photo taken | sand | 5 |
| CEND17A22_STN_715_D1 |  | sandy gravelly mud | 6 |
| CEND17A22_STN_805_01_A1 |  | Mud | 14 |
| CEND17A22_STN_805_03_A1 |  | Mud | 15 |
| CEND17A22_STN_805_04_A1 |  | Mud | 9 |

| | | | |
|---|---|---|---|
| CEND17A22_STN_805_06_A1 |  | Mud | 14 |
| CEND17A22_STN_805_A1 |  | Slightly shelly sand | 6.5 |
| CEND17A22_STN_805_B1 |  | Slightly shelly sand | 8 |
| CEND17A22_STN_805_C1 |  | Slightly shelly muddy sand | 7 |

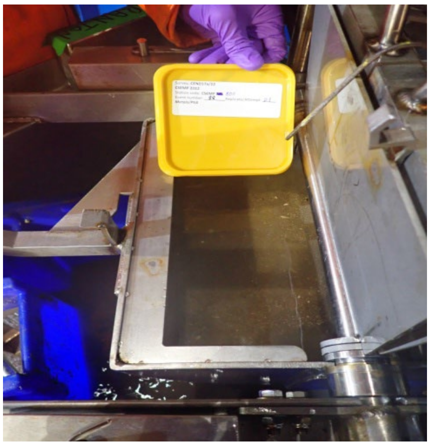
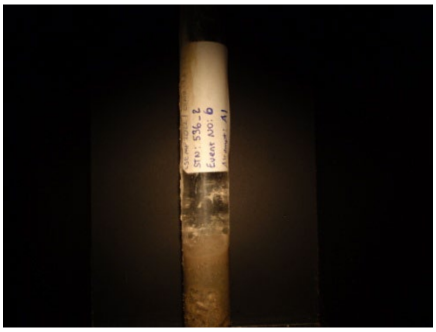
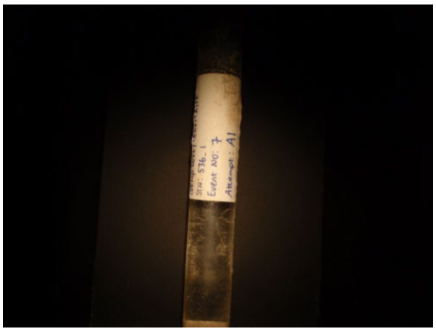
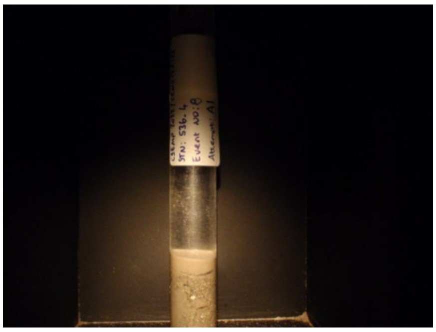
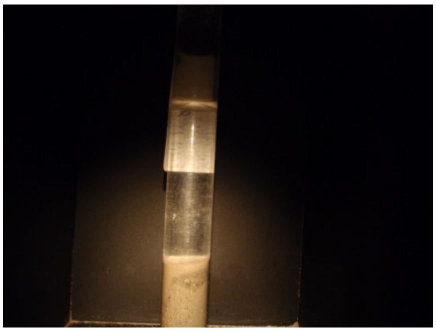
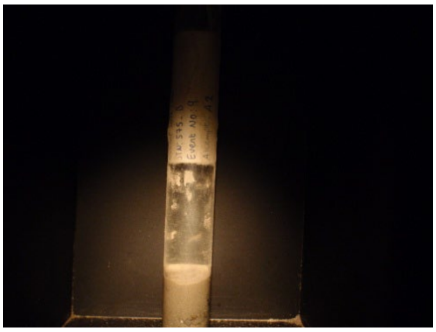
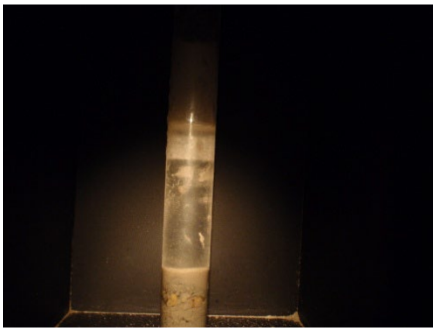
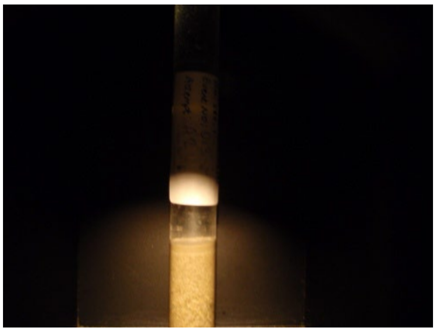
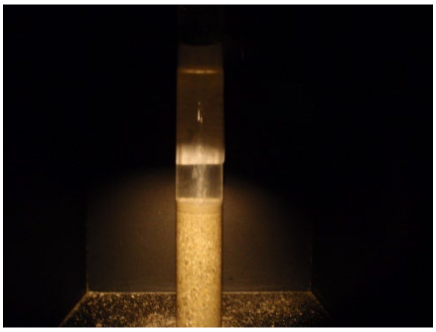
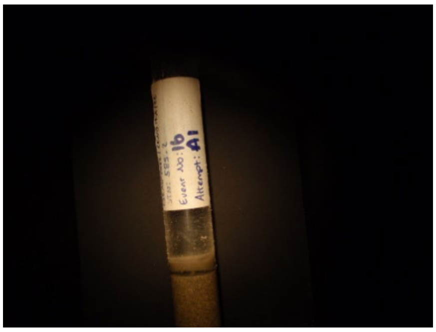
| | | | |
|---|---|---|---|
| CEND17A22_STN_805_D1 |  | Slightly shelly sand | 7 |
| CEND17A22_STN_805_E2 |  | Slightly shelly sand | 8 |
| CEND17A22_STN_805_F1 |  | Slightly shelly muddy sand | 11 |

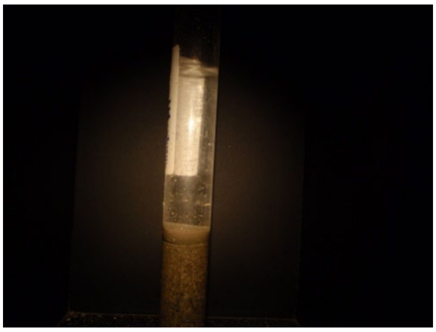
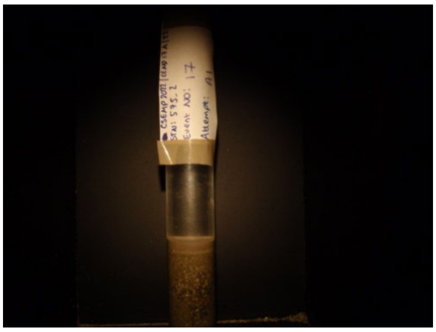
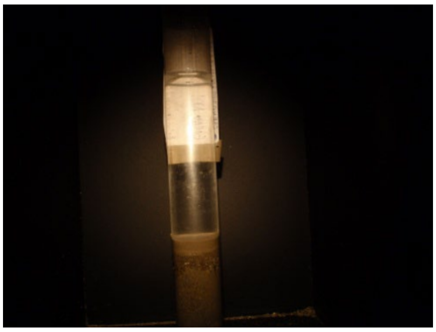
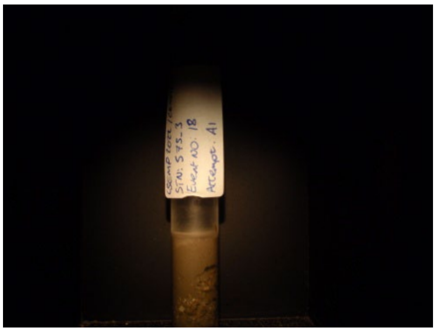
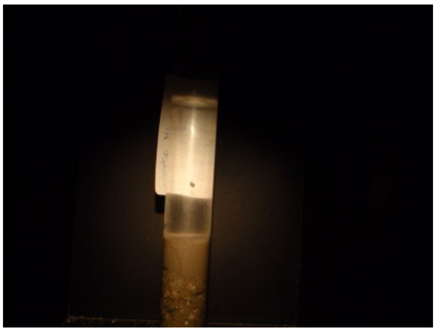
**Table 11: Rapid fines assessment photos for each sediment station**

| Station | Picture | Sediment Description | Sediment Depth (cm) |
|---|---|---|---|
| CEND17A22_STN_536_A2_1 |  | muddy sand | 6 |
| CEND17A22_STN_536_A2_2 |  | muddy sand | 6 |
| CEND17A22_STN_536_B1_1 |  | muddy sand | 6.5 |
| CEND17A22_STN_536_B1_2 |  | muddy sand | 6.5 |

| | | | |
|---|---|---|---|
| CEND17A22_STN_536_2_A1_1 |  | sandy shelly gravel | 9 |
| CEND17A22_STN_536_2_A1_2 |  | sandy shelly gravel | 9 |
| CEND17A22_STN_536_1_A1_1 |  | sandy mud | 8 |
| CEND17A22_STN_536_1_A1_2 |  | sandy mud | 8 |
| CEND17A22_STN_536_4_A1_1 |  | muddy sand | 11 |

| | | | |
|---|---|---|---|
| CEND17A22_STN_536_4_A1_2 |  | muddy sand | 11 |
| CEND17A22_STN_575_A2_1 |  | gravelly mud | 11 |
| CEND17A22_STN_575_A2_2 |  | gravelly mud | 11 |
| CEND17A22_STN_575_B1_1 |  | gravelly mud | 10.5 |
| CEND17A22_STN_575_B1_2 |  | gravelly mud | 10.5 |

| | | | |
|---|---|---|---|
| CEND17A22_STN_585_A2_1 |  | slightly shelly muddy sand | 5 |
| CEND17A22_STN_585_A2_2 |  | slightly shelly muddy sand | 5 |
| CEND17A22_STN_585_5_A1_1 |  | slightly muddy shelly sand | 5 |
| CEND17A22_STN_585_5_A1_2 |  | slightly muddy shelly sand | 5 |
| CEND17A22_STN_585_2_A1_1 |  | muddy shelly sand | 6 |

| | | | |
|---|---|---|---|
| CEND17A22_STN_585_2_ A1_2 |  | muddy shelly sand | 6 |
| CEND17A22_STN_575_2_ A1_1 |   | slightly sandy mud | 5 |
| CEND17A22_STN_575_2_ A1_2 |  | slightly sandy mud | 5 |
| CEND17A22_STN_575_3_ A1_1 |   | slightly muddy shelly sand | 11 |
| CEND17A22_STN_575_3_ A1_2 |  | slightly muddy shelly sand | 11 |

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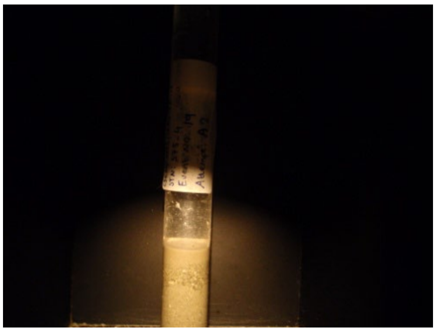
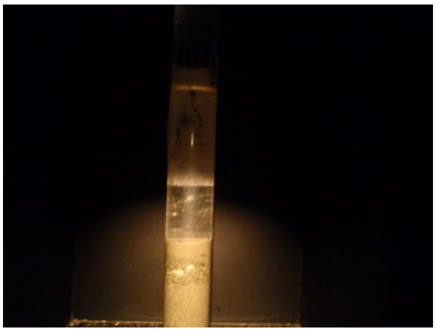
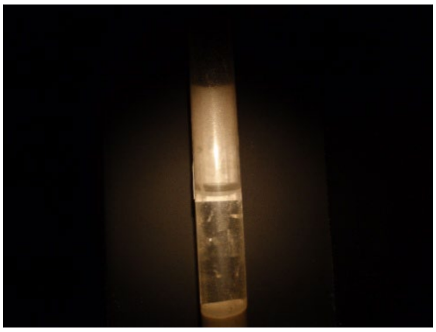
|---|---|---|---|
| CEND17A22_STN_575_4_ A2_1 |  | gravelly sand | 8.5 |
| CEND17A22_STN_575_4_ A2_2 |  | gravelly sand | 8.5 |
| CEND17A22_STN_605_A2 _1 |  | muddy sand | 13 |
| CEND17A22_STN_605_A2 _2 |  | muddy sand | 13 |
| CEND17A22_STN_605_B1 _1 |  | sandy mud | 13 |

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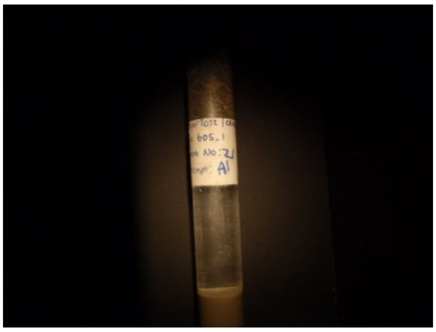
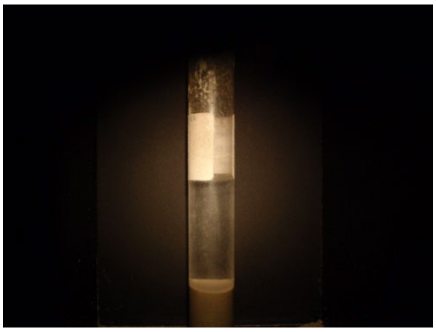
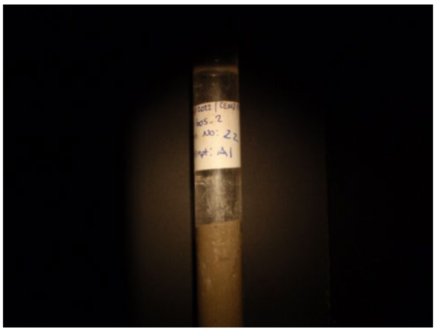
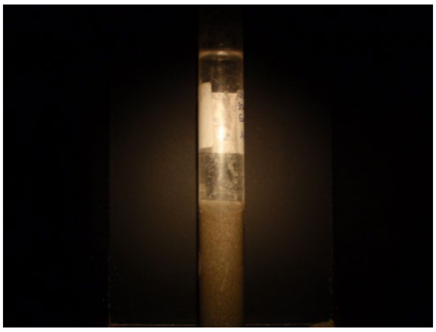
|---|---|---|---|
| CEND17A22_STN_605_B1_2 |  | sandy mud | 13 |
| CEND17A22_STN_605_1_A1_1 |  | sandy mud | 14 |
| CEND17A22_STN_605_1_A1_2 |  | sandy mud | 14 |
| CEND17A22_STN_605_2_A1_1 |  | sandy mud | 14.5 |
| CEND17A22_STN_605_2_A1_2 |  | sandy mud | 14.5 |

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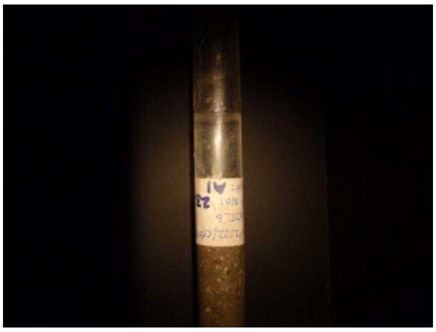
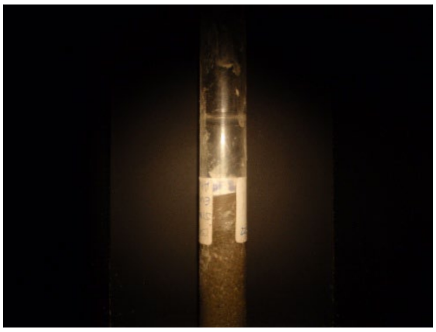
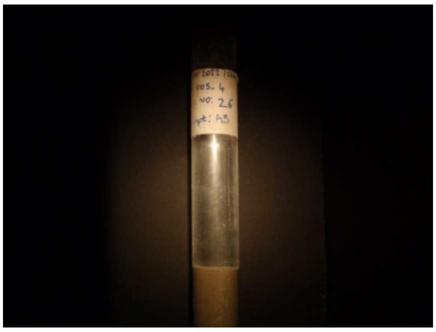
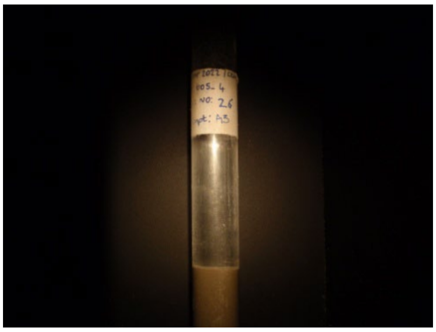
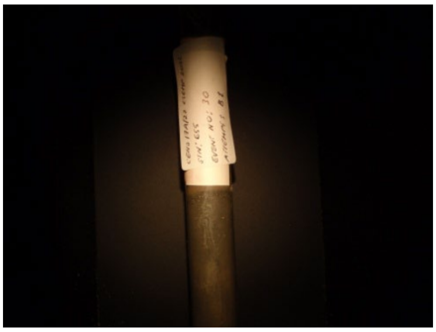
|---|---|---|---|
| CEND17A22_STN_605_6_A1_1 |  | muddy sand some shell | 8 |
| CEND17A22_STN_605_6_A1_2 |  | muddy sand some shell | 8 |
| CEND17A22_STN_605_4_A3_1 |  | mud | 14 |
| CEND17A22_STN_605_4_A3_2 |  | mud | 14 |
| CEND17A22_STN_655_A1_1 |  | sandy mud | 14 |

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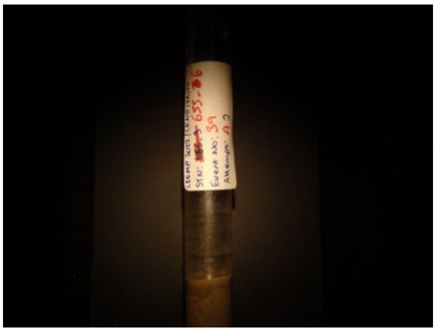
|---|---|---|---|
| CEND17A22_STN_655_A1_2 |  | sandy mud | 14 |
| CEND17A22_STN_655_6_A2_1 |  | mud | 6 |
| CEND17A22_STN_655_6_A2_2 |  | mud | 6 |
| CEND17A22_STN_655_2_A1_1 |  | mud | 14 |
| CEND17A22_STN_655_2_A1_2 |  | mud | 14 |

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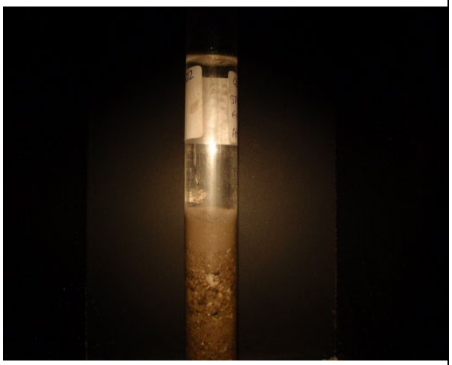
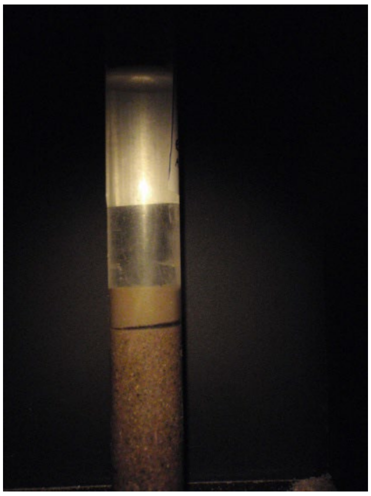
|---|---|---|---|
| CEND17A22_STN_715_6_A1_1 |  | Very shelly sand | 8 |
| CEND17A22_STN_715_6_A1_2 |  | Very shelly sand | 8 |
| CEND17A22_STN_715_5_A1_1 |  | gravelly shelly sand | 6 |
| CEND17A22_STN_715_5_A1_2 |  | gravelly shelly sand | 6 |

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|---|---|---|---|
| CEND17A22_STN_715_1_ A1_1 |  | gravelly shelly sand | 7 |
| CEND17A22_STN_715_1_ A1_2 |  | gravelly shelly sand | 7 |
| CEND17A22_STN_715_3_ A1_1 |  | shelly sand | 6 |

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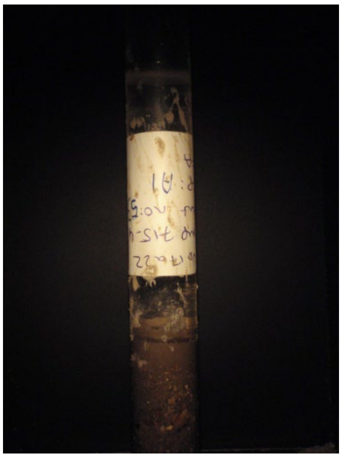
|---|---|---|---|
| CEND17A22_STN_715_3_A1_2 |  | shelly sand | 6 |
| CEND17A22_STN_715_4_A1_1 |  | shelly sand | 7 |
| CEND17A22_STN_715_4_A1_2 |  | shelly sand | 7 |

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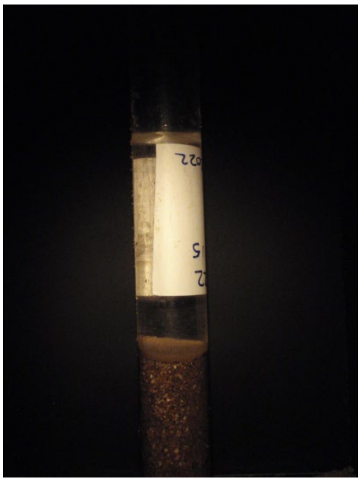
|---|---|---|---|
| CEND17A22_STN_715_A1 _1 |  | sandy silt | 8 |
| CEND17A22_STN_715_A1 _2 |  | sandy silt | 8 |
| CEND17A22_STN_715_B1 _1 |  | sandy mud | 8 |

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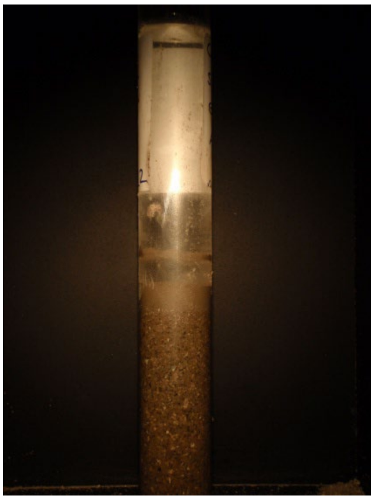
|---|---|---|---|
| CEND17A22_STN_715_B1_2 |  | sandy mud | 8 |
| CEND17A22_STN_715_D1_1 |  | sandy gravelly mud | 6 |
| CEND17A22_STN_715_D1_2 |  | sandy gravelly mud | 6 |

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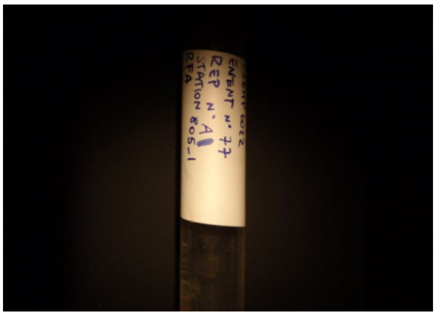
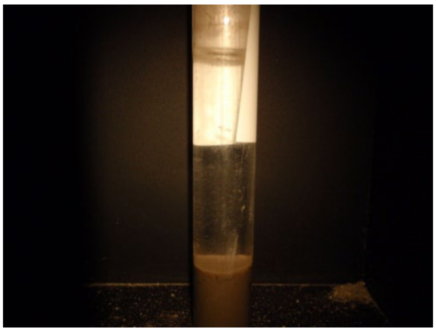
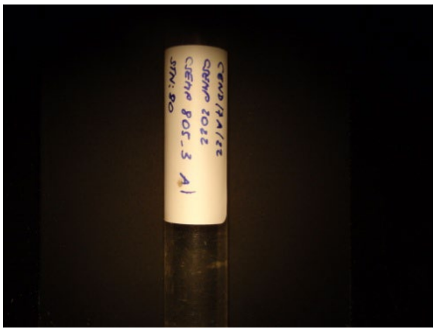
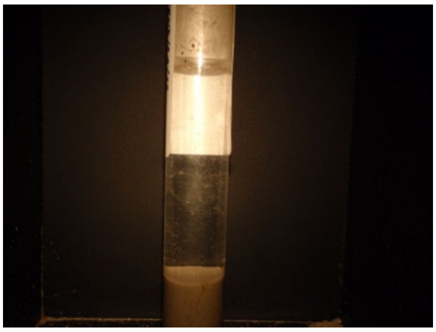
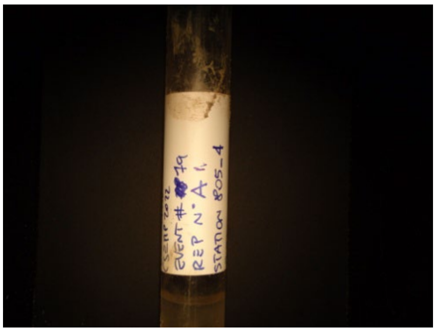
|---|---|---|---|
| CEND17A22_STN_805_01_A1_1 |  | Mud | 14 |
| CEND17A22_STN_805_01_A1_2 |  | Mud | 14 |
| CEND17A22_STN_805_03_A1_1 |  | Mud | 15 |
| CEND17A22_STN_805_03_A1_2 |  | Mud | 15 |
| CEND17A22_STN_805_04_A1_1 |  | Mud | 9 |

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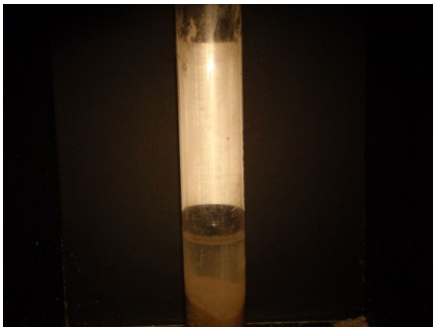
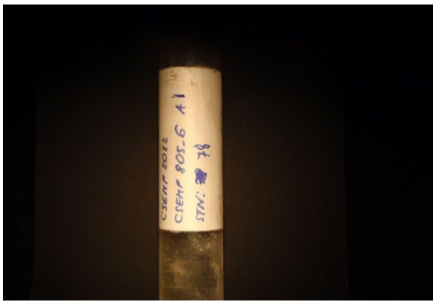
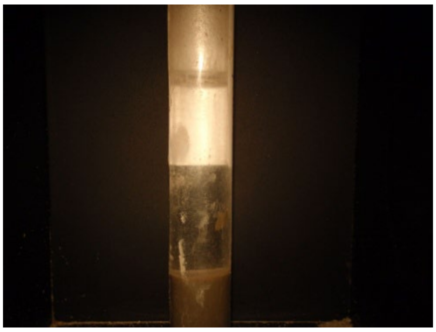
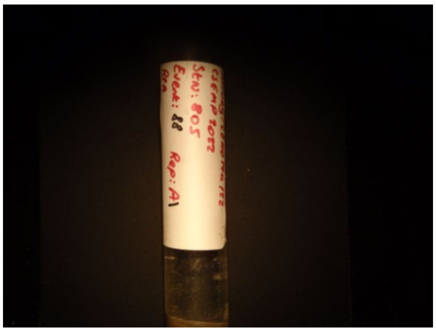
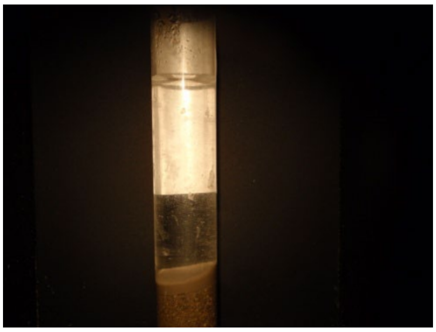
|---|---|---|---|
| CEND17A22_STN_805_04_A1_2 |  | Mud | 9 |
| CEND17A22_STN_805_06_A1_1 |  | Mud | 14 |
| CEND17A22_STN_805_06_A1_2 |  | Mud | 14 |
| CEND17A22_STN_805_A1_1 |  | Slightly shelly sand | 6.5 |
| CEND17A22_STN_805_A1_2 |  | Slightly shelly sand | 6.5 |

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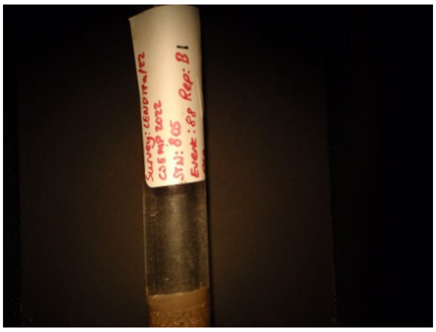
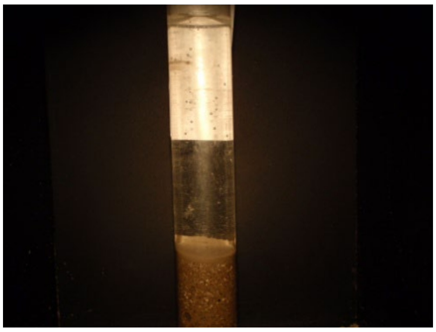
|---|---|---|---|
| CEND17A22_STN_805_B1_1 |  | Slightly shelly sand | 8 |
| CEND17A22_STN_805_B1_2 |  | Slightly shelly sand | 8 |

Freya Goodsir, Manuel Nicolaus

Scientist in Charge, 2SIC

21/11/2022

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