



Research Vessel Survey Report: RV Cefas Endeavour CEND06/21

Clean Seas Environmental Monitoring Programme (CSEMP)



Eastern Channel, North Sea

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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. After discussions with the Environment Agency (EA) and National Resources Wales (NRW) colleagues a coordinated approach is being taken to help deliver additional 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 and HBCD), sediment particle size analysis (PSA) and marine litter (OSPAR Common indicator and UK specific Indicator assessments).

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

5. To sample representative stations using a Shipek or a Day grab from 11 stations within and around the Inner Tees dredged material disposal site. Samples will be assessed for sediment contaminants concentrations (organohalogens) and carbon. This is funded by the MMO and the results will be reported in a report which is publicly available on the Defra.gov.uk site and via the MMO. The results are used by the MMO to aid decisions regarding dredged material disposal applications and the suitability of the screening process for contaminants concentrations.

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 West Gabbard (51.95458333, 2.1096) smart Buoy location, using CTD Rosette. Daily chlorophyll sample (night time hours of dark for SLA25).

2. To collect additional fish for the Environment Agency (EA) for a comparison study of whole fish, and fish muscle and liver in the quantity of contaminants). EA require 9 fish from stations 244, 345,294,377,387,486, and 494.

Tertiary Aims

- 1. To collect sediment samples using a day grab to detect rapid toxicity within sediments samples using the Microtox® rapid test methodology.
- 2. To collect sediment samples using the Day grab for the Defra R&D projects Advancing integrated understanding of the seabed (C8116, C8335) and NCEA carbon sequestration service observations (C8357).

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. Staff were split into two 12 hour shifts working 12:00 to 00:00 and 00:00 to 12:00. Fishing, water sampling and grabbing operations were carried out throughout both shifts. 24 hrs working was essential to ensure all survey met to time and budget.

Name	Role
Freya Goodsir	SIC
Richard Humphreys	2SIC
John Bignell	Deck master; FD
Caroline Daumich	Deck master; FD
Paul Nelson	Water, fish data (CSEMP Data manager)
Briony Silburn	Sediment & litter
Paula Millikin	Sediment & litter
Isobel Lake	Water, fish data
Andy Smith	FD
Marta Assuncao	Ecotoxicology
Chris Martin	Ecotoxicology

Charlotte Reeve	Stomach, Otolith
Peter Randall	Stomach, Otolith
Richard Hazelgrove	FD

Survey particulars

DURATION: 22nd April from Lowestoft (06:00 High Tide) – 1st May in Lowestoft 13:30.

LOCATION: Eastern Channel, North Sea



Figure 1: CSEMP fishing and temporal/spatial sediment stations, plus Tees dredge disposal sediment stations.

Stations

CSEMP fishing stations positions

Additional 9 Fish collected per site for the EA.

		Latitude	Longitude
CSEMP Number	Location Name	(Decimal Degrees)	(Decimal Degrees)
243	Farne	55.4952	-1.1263
<mark>244</mark>	Amble	<mark>55.2967</mark>	<mark>-1.255</mark>
283	North Dogger 1 (East)	55.3023	2.8972
284	North Dogger 2	55.068	2.09
286	West Dogger	54.8333	1.255
287	Dogger Central	54.5152	2.6905
<mark>294</mark>	Tees Bay	<mark>54.7597</mark>	<mark>-1.1397</mark>
344	Flamborough	54.2417	0.4883
346	Off Humber	54.0633	1.79
<mark>377</mark>	Outer Humber	<mark>53.3167</mark>	<mark>0.4283</mark>
378	Indefatigable Bank	53.5567	2.082
<mark>387</mark>	Inner Wash	<mark>53.1417</mark>	<mark>0.555</mark>
475	Thames (Gabbard)	52	2.3333
<mark>486</mark>	Rye Bay	<mark>50.8667</mark>	<mark>0.8083</mark>
<mark>494</mark>	Off Newhaven	<mark>50.7598</mark>	0
Altern. Smith's Knoll	Altern. Smith's Knoll	52.7318	2.4585

CSEMP sediment grabbing stations: 2 replicas for metals, PSA and organics and one for microplastics at the highlighted yellow stations, and 1 replica for metals, PSA and organics at the other stations.

	Latitude	Longitude		Number of
Site name	(Decimal Degrees)	(Decimal Degrees)	Priority	grabs
CSEMP245	55.00830	-1.13330	1	3
CSEMP295	54.73330	-0.88330	1	3
CSEMP285	54.83330	1.33330	1	3
CSEMP345	54.00000	2.00000	1	3
CSEMP376	53.33330	0.58330	1	3
CSEMP386	52.98300	0.33470	1	3
CSEMP475	52.00000	2.33330	1	3
CSEMP466	51.49670	1.00000	1	3
CSEMP484	50.98330	1.01670	1	3
CSEMP536	50.43000	-3.12170	1	3
245_295_44	55.2462	-0.787874	1	1
East245_177	55.1291	-0.246732	2	1
East245_170	55.129	-0.230436	3	1

East245_171	55.0356	-0.327743	4	1
East245_178	55.0904	-0.27961	5	1
East245_175	55.126	-0.312064	6	1
NorthWest285_50	54.9354	0.37793	1	1
NorthWest285_47_2	55.125	0.709716	2	1
NorthWest285_58_3	55.0627	0.656282	3	1
NorthWest285_49	54.8743	0.6205	4	1
NorthWest285_48_5	55.1686	0.401025	5	1
NorthWest285_46	55.0427	0.381492	6	1
345_16	54.1823	2.578489	1	1
West345_63	54.2432	-0.116967	2	1
West345_72	54.304	-0.169926	3	1
345_18	54.0957	1.749935	4	1
345_22	54.1321	2.44809	5	1
345_17	54.0671	1.733577	6	1
376_386_78	53.4215	0.661557	1	1
OffLowestoft_94	52.6843	2.308214	2	1
OffLowestoft_101	52.7156	2.317874	3	1
376_386_85	53.3103	0.670742	4	1
376_386_89	53.1351	0.509363	5	1
OffLowestoft_100	52.7391	2.314633	6	1
SouthWest475_111	51.8395	1.772073	1	1
SouthWest475_107	51.7648	1.68813	2	1
SouthWest475_117	51.8306	1.702045	3	1
West475_133	52.224	1.721424	4	1
SouthWest475_108	51.8443	1.728404	5	1
SouthWest475_112	51.7829	1.799927	6	1
484_194	50.9871	1.038996	1	1
484_188	50.9609	1.025903	2	1
484_183	50.9971	1.040335	3	1
South484_197	50.8648	0.816498	4	1
484_182	50.9699	1.036962	5	1
484_184	50.9953	1.029736	6	1
East536_235	50.5197	-2.191676	1	1
536_222	50.5812	-3.052021	2	1
536_223	50.2763	-3.390848	3	1
East536_238	50.1814	-2.482858	4	1
East536_239	50.1318	-2.405141	5	1
East536_233	50.2917	-2.273809	6	1

TEES sediment grabbing stations: 1 replica for contaminants.

	Latitude	Longitude	
Station code	(Decimal degrees)	(Decimal degrees)	Priority
IND2	54.6815	-1.03483	1
IND5	54.683	-1.01383	1
IT1	54.7	-1.06	1
IT3	54.68	-1.08	1
IT4	54.68	-1.05	1
IT5	54.68717	-1.03233	1
IT7	54.6735	-1.02617	1
IT8	54.67	-0.99	1
IT10	54.67167	-0.88167	1
OT1	54.69417	-0.9985	1
IND1	54.67967	-1.05783	2

CTD Calibration sample and plankton net at Outer Gabbard

Station name	Latitude (Decimal degrees)	Longitude (Decimal degrees)
West Gabbard smart		
buoy	51.95458	2.1096

Survey Narrative

19th April

Scientific staff from Weymouth plus the 2SIC arrived at the RV *Cefas Endeavour* on the 19th of April at 17:00. A visual risk assessment was carried out before the sampling equipment from Weymouth was unloaded from the van into collies in the quay store. The staff then proceeded to sign on board, had temperatures taken and then proceeded for COVID testing. Essential documents for sailing (Passport, ENG1, PST and Security awareness certificate) were shown to the 2SIC, and items for PAT testing were left in the quay store, before the staff then made their way to cabins and isolated. All tests were delivered to cabins for the staff to complete and left outside cabin doors for collection.

20th April

All other scientific staff boarded the RV *Cefas Endeavour* during the morning between 08:00 and 09:30. Staff had their essential documents checked by the SIC on the quayside and left their items for PAT testing in the quay store, before entering the quay store one at a time where they were signed on board, had temperatures taken and completed a COVID test. The staff then proceeded to join the vessel and isolate in cabins. All scientific staff remained in their cabins throughout isolation, with meals provided from the Galley to scientists' rooms.

21st April

All scientific staff received their negative test results by 09:00. Mobbing of the vessel for scientific equipment commenced at 09:30 and was completed by 11:00. Inductions were held on the bridge by the safety officer between 13:00 and 14:00, with staff attending in 2 groups for 15 minutes. Here we discussed the safe and best practises on the vessel, including the Covid restrictions of the vessel. A brief (10 minute) pre-survey meeting was held in the dining room, to discuss the daily running of the ship as well as any safety issues or covid protocols that scientific staff needed to be made aware of. This was immediately followed by an emergency muster drill and life boat deployment demonstration. An issue was identified by scientific staff during mobbing, that an inadequate solution for the lack of goose-neck pourers for the top of the pentane bottles for rinsing the Day grab. Through communication with the Lowestoft laboratory, a solution was identified and left in the post room for MOS staff to bring to the vessel. MOS staff attended the vessel, following lateral

flow testing and maintained social distance from scientific staff, to drop off the requested Pentane rinsing solution, as well as spare printer cartridges for the new printer in the dry lab, fix the multibeam sounder and finish the re-installation of the Tower PC, ensuring everything was working correctly before departing the vessel. Scientific staff on day shift concluded setting up the wet lab, dry lab and garage, allowing the night shift staff to get some down time to get into shift patterns.

22nd April

We departed from the Lowestoft quay shortly after 6am and immediately began transiting to our first fishing station, Thames Gabbard.



Figure 2: Departing from Lowestoft harbour, with the pilot boat following behind.

At 08:45, night shift staff held tool box talks on the bridge, with the navigator, deck crew and the captain, covering the deployment of the CTD, the Day grab and the fishing activities. Following this, night shift staff conducted a toolbox talk in the wet lab on activities to take place during sorting and processing of the catch. On arrival at the Thames Gabbard site at 09:30 a CTD rosette was deployed, performing a full profile, with bottles fired at the surface to collect water. The start of the fishing activities were slightly delayed due to static gear in the area. After communication with the fishing vessel SUE ANN LT1, safe fishing tow lines were identified, and fishing was able to commence. A tool box talk was carried out by the

desk master in the wet lab which commenced at 12:00. This toolbox talked around the safety of the wet lab, using sharps, liquid nitrogen, chemical safety first aid station. After four tows with the Granton trawl were completed, only enough Dab were collected to sample two bags of 25 for chemistry, and so we began the transit to the West Gabbard Smartbuoy site.



Figure 3: CTD rosette begin deployed from the side gantry.

The CTD rosette was deployed to complete a water calibration CTD, taking a full profile of the water column and collecting water from bottom and surface. A Plankton net was also deployed, collecting a full water column profile sample. Following this, we transited to the temporal grab station CSEMP 475 arriving at 17:00. The Day grab was successfully deployed 3 times, collecting samples for PSA/Metals, Organics and Microplastics. After a 4.5 hour transit to the Alternative Smith's Knoll fishing site, the CTD rosette was deployed

at 23:00. Fishing activities were put on hold until after midnight due to not enough deck crew being available to deploy the net, as some Day shift crew had had to knock-off early due to hours of rest.

23rd April

At midnight, the fishing activities commenced at Alternative Smith's Knoll. After 3 tows, the fishing activities were discontinued around 04:00, as there were low numbers of Dab in the correct size ranges. Only 10 Dab, and 5 plaice were collected for chemistry and 10 Bib were processed for miscellaneous biomarker analysis. We then transited to the spatial sediment stations 376_386_2, 376_386_3 and 376_386_7 to complete a single drop of the Day grab at each station between 04:30 and 06:30, collecting a sample for Metals/PSA and Organics from each station.



Figure 4: The Day grab on the side gantry in the sunrise.

This was followed by a 5 hour transit to the Indefatigable Bank fishing station. Upon arrival at 12:00, the CTD rosette was deployed before fishing activities commenced. The fishing was good and the number of Dab required were met quickly, with 50 Dab collected for chemistry and 80 Dab processed for biomarkers and fish disease, so after 3 tows of the Granton trawl the station was completed. A small tear in the net occurred after the second tow, but was quickly and easily repaired before being redeployed. After the fishing was

completed, we transited to the Temporal grab station CSEMP 345, arriving at 19:30, where 3 deployments of the Day grab were completed. After a short transit to the next fishing station, Off Humber, a CTD rosette was deployed at 21:30 before the fishing activities commenced, continuing through to midnight and into the early hours of the 24th.

24th April

Fishing activities continued at Off Humber until 02:30, with 4 tows completed, resulting in 50 Dab collected for chemistry and 20 Dab sampled for biomarkers. We then transited for 3 hours to the spatial grabbing station 345_1. One deployment of the Day grab was successfully completed at 05:30, before transiting for a further 2 hours to the Central Dogger fishing station.



Figure 5: Granton trawl being recovered onto the back deck.

The CTD rosette was deployed at the Central Dogger finishing station at 08:30 before fishing activities commenced and continued through to 13:15. Five tows were completed, with 50 Dab collected for chemistry and 60 Dab processed for biomarkers and fish disease. Following this, we transited for 5 hours to the North Dogger East fishing station, where the CTD rosette was deployed at 18:00. Fishing activities followed until 20:00, with three tows completed, sampling enough fish to collect 50 Dab for chemistry and 80 Dab for biomarkers and fish disease. Then we began the transit to North Dogger fishing station, which continued through to midnight.

25th April

We arrived at the North Dogger fishing station just after midnight and the CTD rosette was immediately deployed. Fishing activities commenced and continued through to 05:00. Following three successful tows, collecting 50 Dab for chemistry and 80 Dab for biomarkers and fish disease, we transited for 2.5 hours to the next fishing station, West Dogger.



Figure 6: Flounder in the wet laboratory aquarium.

The CTD rosette was deployed at the West Dogger fishing station at 07:15 before fishing activities commenced and continued through to 13:00. After five tows at West Dogger fishing station, collecting 25 Dab for chemistry and 80 Dab for biomarkers and fish disease, we transited to the Temporal grab station CSEMP 285. Three successful deployments of the Day grab were completed by 14:00, collecting samples for PSA/Metals, Organics and Microplastics. Following this, grabbing continued through to midnight at 8 Spatial stations: 285_2; 285_3; 285_1; 245_295_4; 245-295_5; 245_295_3; 245_295_2; and 245_295_6. A single successful deployment of the Day grab at each station collected sediment for PSA/Metals and Organics.

26th April

Day grabbing activities continued on from the 25th, with a single successful deployment of the day grab at the spatial sediment station 245_295_1. We then transited for 2 hours to the next fishing station, Farne. On arrival at Farne at 04:30, a CTD rosette was deployed, followed by the commencement of the fishing activities until 07:00. Fishing at Farne demonstrated very low numbers of under sized dab and therefore, only two tows were carried out and only 25 Dab were collected for chemistry. We then transited for 1 hour to the Amble fishing station, deploying the CTD rosette on arrival at 08:00. Following this, fishing activities commenced and continued through until 14:30, with five tows sampling enough Dab for 50 for chemistry, 50 for biomarkers and fish disease, and 9 fish collected for the EA. We then transited for 2 hours to the Temporal sediment station CSEMP 245 arriving at 16:45. The day grab was successfully deployed 3 times at CSEMP 245, before beginning the 2 hour transit to the Tees Bay fishing station. On arrival at Tees Bay, static gear was spotted and so a quick check on the line was carried out, and the static gear was marked on TRANAS to guide our fishing lines. The CTD rosette was deployed at 19:00, before fishing commenced through to early morning of the 27th. When the fishing operations commenced, tow locations were limited due to wrecks being either side of the tow lines.



Figure 7: A Baleen plate caught in the Granton trawl at Tees Bay

27th April

Fishing at Tees Bay continued until 12:45, when after 5 tows 50 Dab collected for chemistry, 50 sampled for biomarkers and fish disease, and 9 Dab collected for the EA were achieved. We then transited to the Inner Tees sediment sampling stations for the dredge disposal site monitoring, arriving just after 01:00. At the first station, IT3, the Day grab was deployed 3 times unsuccessfully, coming up each time with a rock holding the jaw open. Due to the course sediment, the decision was made to swap to the Shipek grab and try again. A toolbox talk was held on the side deck with deck crew and scientific staff and with bridge crew over the radio. Using the Shipek grab, a successful grab was collected at IT3, which was sampled for contaminants, and the decision was made to continue using the Shipek for the remainder of the Inner Tees dredge disposal sites. A successful Shipek grab was collected at each of the subsequent stations: IT1; IND1; IT4; IND2; IT5; IT7; IND5; OT1; IT8; and IT10.



Figure 8: The Shipek grab with the white cliffs of Beachy Head in the distance.

Following completion of the Inner Tees sampling at 06:00, we transited to the Temporal sediment station CSEMP 295 and switched back over to the Day grab. The Day grab was successfully deployed three times, collecting samples for PSA/Metals, Organics and Microplastics. We then transited for 3 hours to the Spatial stations 345_3 and 345_2, completing a single deployment of the Day grab at each location between 11:00 and 12:00. We then transited the short distance to the Off Flamborough fishing station and deployed

the CTD rosette before commencing fishing activities at 12:30. Five tows of the Granton trawl collected 50 Dab for chemistry and 20 for biomarkers. After completion of the fishing activities at 21:30 we began transiting to the next fishing station, Outer Humber.

28th April

We continued transiting into the early hours of the 28th, arriving at Outer Humber fishing station at 03:00. The CTD rosette was deployed to collect a full water column profile and surface water samples, before the fishing activities commenced.



Figure 9: The CTD rosette in the sunrise.

A maximum of 4 tows were conducted, as dictated by the fishing permissions, collecting 25 Dab for chemistry, 50 Dab for biomarkers and chemistry and 9 Dab collected for the EA. All fishing activities were completed by 09:00 and transited to the Temporal grab station CSEMP 376. Three deployments of the Day grab were completed, collecting samples for PSA/Metals, Organics and Microplastics. We then transited an hour to the Spatial grabbing station 376_386_1, arriving at 10:30 to complete a single deployment of the Day grab, followed by 376_386_4 at 11:30. At the subsequent Spatial grabbing station 376_386_5, grabbing was called off due to the vessel struggling to hold location on Dynamic Positioning. We then moved on to the Inner Wash fishing station, completing a CTD rosette at 14:30 before fishing for a single tow line to collect 50 Dab for chemistry, and 9 Dab for the EA. Historically, we do not sample for biomarkers or fish disease at this location, therefore the single tow was sufficient. Following this we transited to the Temporal grab station CSEMP 386, arriving at 17:30 and deploying the Day grab three times to collect samples for PSA/Metals, Organics and Microplastics. To replace the earlier aborted Spatial grab station, we the transited for an hour, arriving at 19:00, to the Spatial grab station 376 386 10, completing a single deployment of the Day grab. Following this, we started transiting to the spatial grabbing stations in the Outer Thames area, with the 11 hour steam continuing into the early hours of the 29th.

29th April

We continued transiting to the Spatial grab stations at the Outer Thames area, arriving at the first station at 06:00. The Day grab was successfully deployed for a single dip at 466_475_5, 466_475_3, 466_475_2, 466_475_6 and 466_475_1 to collect a sample for PSA/Metals and Organics. However, at Spatial station 466_475_8 a sample was not achieved after three deployments of the grab. Therefore, an alternative Spatial grab station will be sampled on transit back to Lowestoft. During the grab sampling, issues arose with the Tower logging system, preventing scientific staff from being able to 'fix' a sample location from the dry lab. After a toolbox talk on the process of information relaying, a scientific staff member was posted to the bridge to control Tower from the primary PC location, while relaying information over the radio to a second member of scientific staff who would record the information on the logs and maintain communication with the scientific sampler on deck. We then transited for 3.5 hours to the Temporal grab station CSEMP 466, arriving at 13:00 to completed three successful deployments of the Day grab. Following this, we transited for 5 hours to the Spatial sediment stations 484_3 and 484_1, however, on arrival it was

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deemed that the water depth was too shallow at low tide to safely sample. Therefore, the grab stations were postponed until the next high tide and we proceeded to our next planned fishing station, Rye Bay. On arrival at Rye Bay at 20:30 the CTD rosette was deployed, followed by the commencement of the fishing tows, which continued into the early hours of the 30th.



Figure 10: Sunset as we trawl with the Granton.

30th April

Fishing at Rye Bay continued until 01:00, with three tows completed, at which point we needed to leave site in order to transit back to the grabbing stations for high tide. We arrived at the first Spatial grabbing station, 484_2 at 02:00 and successfully deployed the Day grab for a single deployment. Following this, we moved on to the Temporal grab station CSEMP 484, where we deployed the Day grab three times, collecting replicate samples for PSA/Metals and Organics and a sample for Microplastics. We then completed a single deployment of the Day grab at the Spatial stations 484_1 and 484_3, completing the

operations at 03:30. Following completion of the grab stations, we transited back to the Rye Bay fishing station, arriving at 05:00 to complete a fourth tow to collect additional dab. After this, we began transiting to the Off Newhaven fishing station, deploying the CTD rosette on arrival at 08:30 before commencing fishing activities. After five tows, 50 Dab were successfully collected for chemistry, 50 sampled for biomarkers and fish disease and 9 Dab collected for The EA. With fishing activities completed at Off New Haven at 14:00, the decision was made to return to Rye Bay to conduct a fifth tow. We arrived at Rye Bay at 17:00 and completed the tow by 17:30. In total at Rye Bay 50 Dab were collected for chemistry, 60 for biomarkers and fish disease and 9 Dab collected for the EA. With all fishing activities completed store to the tow by 17:30.



Figure 11: An item of marine litter picked up in the trawl at Off New Haven.

1st May

The vessel made its way through the Eastern Channel and up the Southern North Sea, heading towards Lowestoft. On the way we picked up the final Spatial grab station 466_475_4, completing a single deployment of the Day grab at 07:00 to collect a single sample for PSA/Metals and Organics. We continued the transit home to meet the Pilot outside Lowestoft at 11:30 and we docked in Lowestoft on the afternoon tide arriving at 12:00 on the 1st of May. All scientific gear was de-mobbed and all samples were transported to the Lowestoft laboratory or to Weymouth.

Results

CSEMP fishing stations

Out of the sixteen fishing stations, all sixteen sites were completed successfully (Table 1). Overall, it was noted that numbers of dab were a lot lower than that of 2019, this may have been due to the time of year, usually the CSEMP survey is carried out in June/July, however this year it was carried out in April. As noted in December 2020, there were varying sizes and state of maturity. Dab tended to be a lot smaller overall, with some of the larger size ranges showing a higher maturity state. Due to the lower numbers of dab across the majority of stations, it was difficult to achieve the full requirements of the survey for chemistry (50 dab) and fish disease (twenty dab plus). However, a minimum of twenty-five dab for chemical analysis was collected from all trawled stations. At least 20 fish were sampled for biomarkers from twelve stations, and at ten of these stations additional fish were taken for fish disease (Table 1). As part of our secondary survey aims, nine additional dab were collected from specific stations for the EA as part of a collaboration exercise.

In total, we sampled 680 dab for 14 different fish diseases that can be detected by visual examination. The most abundant occurrence was hyperpigmentation (280 times) and Nematodes (142 times). A breakdown of the fish disease observations can be seen in Table 4. Stomach contents analysis was also carried out as part of our analysis. Twenty stomach contents were collected for each of the fishing stations. Table 5 provides an overview of the 240 dab from 16 stations that were assessed for stomach content.

CSEMP sediment stations

Sediment samples were collected for polycyclic aromatic hydrocarbons (PAHs), trace metal contaminants, organic contaminants (PCBs, PBDEs and HBCD), sediment particle size analysis (PSA) and marine litter (microplastics) from temporal stations CSEMP245, CSEMP285, CSEMP295, CSEMP345, CSEMP376, CSEMP386, CSEMP466, CSEMP475 and CSEMP484. Sediment was also collected from all spatial stations, apart from 466_475_8 where no sample was achieved due to hard bottom substrate. However, the alternative spatial station 466_475_4 was sample instead. The exact breakdown of what was collected for which analysis is shown in Table 2. Table 3 also shows the separate images of the sediments in the Day grab to assess the sediment type.

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 6.

Seafloor litter

During our trawling activities, and as part of our survey objectives, we conducted analysis of any collected seafloor litter. In total 173 litter items were collected over 62 trawls, weighing a total of 123.2 kg. Of these litter items, 139 items were plastics accounting for 80.3%. The highest litter station was Indefatigable Bank where we collected 29 litter items (in three tows) from this station. Table 9 shows a break down of all litter collected by count and weight, split my material type.

Inner Tees dredge disposal monitoring

Using the Shipek grab, sediment samples were collected from 11 stations within and around the Inner Tees dredged material disposal site. Samples will be assessed for sediment contaminants concentrations and particle size analysis (PSA). The survey is funded by the MMO and the results will be reported in a report which is publicly available on the Defra.gov.uk site and via the MMO. The results will be used by the MMO to aid decisions regarding dredged material disposal applications and the suitability of the screening process for contaminants concentrations. A breakdown of what was collected is shown in Table 7. Table 8 also shows the separate images of the sediments in the Shipek grab to assess the sediment type.

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 μ l added to each test vial. The light output from bacteria in these vials (time zero) is recorded. 900 μ l 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. In the attached chart, we have nominally indicated samples showing between 10 and 15% decrease as amber, and those showing more than 15% decrease as red.

The data is indicating that most samples are not toxic using this method, but that a few are having an inhibitory impact. Consideration of the chemical analysis data for these sites might reveal what is driving that toxic effect. Table 10 shows preliminary results.

		CSEMP	Mid tow Lat	Mid tow lon	time	time	Dab numbers for Biomarker analysis; FishFish numbers for ChemicalDab numbers for Chemical		Environment Agency	Microplastics
Date	Location	code	decimal	decimal	shot	haul	analysis	Disease (FD)		
26/04/21	Farne	CSEMP 243	55.483	0.8965875	03:59	04:29	1 x 25 (17-20 undersized)	None	NA	NA
26/04/21	Amble	CSEMP 244	55.26405	-1.267164583	08:40	09:10	2 x 25 (17-20 cm)	20 biomarkers and 30 additional FD	9 fish	NA
24/04/21	North Dogger East	CSEMP 283	55.28331389	2.902308333	17:50	18:20	50 (20-23 cm)	20 biomarkers and additional 60 FD	NA	NA
24/04/21	North Dogger	CSEMP 284	55.05872917	2.071158333	00:57	01:27	50 (20-23 cm)	20 biomarkers and 60 additional FD	NA	NA
25/04/21	West Dogger	CSEMP 286	54.77354333	1.299506667	08:02	08:32	25 (19-22 cm undersized)	20 biomarkers and 60 additional FD	NA	1 x 25 plaice, 1 x 25 whiting
24/04/21	Central Dogger	CSEMP 287	54.53119667	2.6825	08:25	08:55	50 (18-22 cm undersized)	20 biomarkers and additional 40 FD	NA	NA
24/04/21	Tees Bay	CSEMP 294	54.75154167	0.861789583	19:19	19:49	50 (18-25 cm undersized)	20 biomarkers and additional 30 FD	9 fish	1 x 25 plaice, 1 x 25 whiting
27/04/21	Flamborough	CSEMP 344	54.22750167	0.538709028	14:47	15:27	2 x 25 (19-22 cm)	20 biomarkers	NA	NA
23/04/21	Off Humber	CSEMP 346	54.06235417	1.813339583	22:16	22:46	2 x 25(18-22 cm)	20 biomarkers	NA	1 x 25 plaice, 1 x 25 whiting, 1 x 2 mackerel
28/04/21	Outer Humber	CSEMP 377	53.27524167	0.45123125	03:49	04:23	1 x 25(21-27 cm)	20 biomarkers and 30 additional FD	9 fish	1 x 25 whiting
23/04/21	Indefatigable Bank	CSEMP 378	53.56005833	2.082402778	11:51	12:21	2 x 25 (19-22 cm)	20 biomarkers and 60 additional FD	NA	NA
28/04/21	Inner Wash	CSEMP 387	53.156325	0.584425	14:37	15:07	2 x 25 (21-24 cm)	None	NA	none
22/04/21	Thames (Gabbard)	CSEMP 475	52.03155	2.104061667	10:52	11:22	2 x 25 (19-22 cm)	None	NA	1 x 13 plaice, 1 x 25 whiting, 1 x 23 Mackerel

Table 1: Fished Stations and number of fish caught for specific analysis (aims 1 and 2)

								Dab numbers for	Environment	Microplastics
								Biomarker	Agency	
		CSEMP	Mid tow Lat	Mid tow lon	time	time	Fish numbers for Chemical	analysis; Fish		
Date	Location	code	decimal	decimal	shot	haul	analysis	Disease (FD)		
									9 fish	1 x 25 plaice, 1
		CSEMP	50.81311333	0.804116667				20 biomarkers		x 25 whiting, 1 x
29/04/21	Rye Bay	486			20:56	21:26	2 x 25 (18-22 cm)	and 40 FD		3 Mackerel
								20 biomarkers	9 fish	NA
	Off	CSEMP	50.75092222	0.025106944				and 30		
30/04/21	Newhaven	494			08:49	09:19	2 x 25 (18-21 cm)	additional FD		
	Alternative		52 74605922	2 472209222			1 x 10 Dab, 1 x 5 Plaice (lower		NA	NA
23/04/21	smiths knoll		32.74003833	2.475208555	00:25	00:56	group sizes)	None		

Table 2: Sampled sediment stations metadata (aim 3)

Station Inf	ormation		Sample In	formation		Grab Information		
				Water				
Event	Station	Analysis	Replicate	Depth		Time	Latitude	Longitude
Number	Code	Туре	Attempt	(m)	Date	Sampled	DD	DD
5	CSEMP475	No Sample	A1	49	22/04/2021	17:20	51.9998838	2.3334206
5	CSEMP475	Organics	A2	49	22/04/2021	17:24	51.9998924	2.3333778
5	CSEMP475	PSA/Metals	A2	49	22/04/2021	17:24	51.9998924	2.3333778
5	CSEMP475	Organics	B1	49	22/04/2021	17:33	51.9998952	2.3332903
5	CSEMP475	PSA/Metals	B1	49	22/04/2021	17:33	51.9998952	2.3332903
5	CSEMP475	Microplastic	C1	49	22/04/2021	17:39	51.9998991	2.3332747
9	376_386_2	No Sample	A1	47	23/04/2021	03:52	52.6842136	2.308331
9	376_386_2	Organics	A2	47	23/04/2021	03:56	52.6842323	2.3083206
9	376_386_2	PSA/Metals	A2	47	23/04/2021	03:56	52.6842323	2.3083206
10	376_386_3	Organics	B1	53	23/04/2021	04:28	52.7154799	2.3177202
10	376_386_3	PSA/Metals	B1	53	23/04/2021	04:28	52.7154799	2.3177202

Station Inf	ormation		Sample In	formation		Grab Info	rmation	
				Water				
Event	Station	Analysis	Replicate	Depth		Time	Latitude	Longitude
Number	Code	Туре	Attempt	(m)	Date	Sampled	DD	DD
11	376_386_7	Organics	C1	48	23/04/2021	05:09	52.7625165	2.3284588
11	376_386_7	PSA/Metals	C1	48	23/04/2021	05:09	52.7625165	2.3284588
14	CSEMP345	Organics	A1	74	23/04/2021	18:37	53.9999932	2.0000756
14	CSEMP345	PSA/Metals	A1	74	23/04/2021	18:37	53.9999932	2.0000756
14	CSEMP345	Organics	B1	74	23/04/2021	18:47	54.0000453	2.0000272
14	CSEMP345	PSA/Metals	B1	74	23/04/2021	18:47	54.0000453	2.0000272
14	CSEMP345	Microplastic	C1	74	23/04/2021	18:55	54.000064	1.9999889
18	345_1	Organics	A1	55	24/04/2021	04:52	54.1823573	2.5788567
18	345_1	PSA/Metals	A1	55	24/04/2021	04:52	54.1823573	2.5788567
27	CSEMP285	Organics	A1	30	25/04/2021	12:50	54.8355413	1.3333791
27	CSEMP285	PSA/Metals	A1	30	25/04/2021	12:50	54.8355413	1.3333791
27	CSEMP285	Organics	B1	30	25/04/2021	12:54	54.8355714	1.3333593
27	CSEMP285	PSA/Metals	B1	30	25/04/2021	12:54	54.8355714	1.3333593
27	CSEMP285	Microplastic	C1	30	25/04/2021	13:04	54.8355554	1.3333979
28	285_2	Organics	A1	82	25/04/2021	16:16	55.1250502	0.7097899
28	285_2	PSA/Metals	A1	82	25/04/2021	16:16	55.1250502	0.7097899
29	285_3	Organics	A1	78	25/04/2021	16:57	55.0626515	0.6564685
29	285_3	PSA/Metals	A1	78	25/04/2021	16:57	55.0626515	0.6564685
30	285_1	Organics	A1	82	25/04/2021	18:17	54.935338	0.3776873
30	285_1	PSA/Metals	A1	82	25/04/2021	18:17	54.935338	0.3776873
31	245_295_4	Organics	A1	80	25/04/2021	20:37	55.035603	-0.3277383
31	245_295_4	PSA/Metals	A1	80	25/04/2021	20:37	55.035603	-0.3277383
32	245_295_5	Organics	A1	84	25/04/2021	21:28	55.0903717	-0.2796029
32	245_295_5	PSA/Metals	A1	84	25/04/2021	21:28	55.0903717	-0.2796029

				c				
Station Info	ormation		Sample In	formation	1	Grab Info	rmation	
				Water				
Event	Station	Analysis	Replicate	Depth		Time	Latitude	Longitude
Number	Code	Туре	Attempt	(m)	Date	Sampled	DD	DD
33	245_295_3	Organics	A1	81	25/04/2021	22:00	55.1290944	-0.2306565
33	245_295_3	PSA/Metals	A1	81	25/04/2021	22:00	55.1290944	-0.2306565
34	245_295_2	Organics	A1	81	25/04/2021	22:21	55.1290497	-0.2473361
34	245_295_2	PSA/Metals	A1	81	25/04/2021	22:21	55.1290497	-0.2473361
35	245_295_6	Organics	A1	84	25/04/2021	22:46	55.1259866	-0.3121213
35	245_295_6	PSA/Metals	A1	84	25/04/2021	22:46	55.1259866	-0.3121213
36	245_295_1	Organics	A1	84	26/04/2021	00:36	55.2460448	-0.7877626
36	245_295_1	PSA/Metals	A1	84	26/04/2021	00:36	55.2460448	-0.7877626
41	CSEMP245	Organics	A1	74	26/04/2021	15:44	55.0082027	-1.1327076
41	CSEMP245	PSA/Metals	A1	74	26/04/2021	15:44	55.0082027	-1.1327076
41	CSEMP245	Organics	B1	74	26/04/2021	15:50	55.0081469	-1.1329169
41	CSEMP245	PSA/Metals	B1	74	26/04/2021	15:50	55.0081469	-1.1329169
41	CSEMP285	Microplastic	C1	74	26/04/2021	15:56	55.0081875	-1.1329516
56	CSEMP295	No Sample	A1	56	27/04/2021	06:29	54.7306676	-0.8821457
56	CSEMP295	No Sample	A2	56	27/04/2021	06:32	54.7306664	-0.8821955
56	CSEMP295	Organics	A3	56	27/04/2021	06:38	54.7306588	-0.8823034
56	CSEMP295	PSA/Metals	A3	56	27/04/2021	06:38	54.7306588	-0.8823034
56	CSEMP295	Organics	B1	56	27/04/2021	06:44	54.7306409	-0.8823049
56	CSEMP295	PSA/Metals	B1	56	27/04/2021	06:44	54.7306409	-0.8823049
56	CSEMP295	Microplastic	C1	56	27/04/2021	06:50	54.7306568	-0.882307
57	345_03	Organics	A1	52	27/04/2021	11:09	54.3040111	-0.1699481
57	345_03	PSA/Metals	A1	52	27/04/2021	11:09	54.3040111	-0.1699481
58	345_02	Organics	A1	52	27/04/2021	11:50	54.2432304	-0.1169629
58	345_02	PSA/Metals	A1	52	27/04/2021	11:50	54.2432304	-0.1169629

				c				
Station Info	ormation		Sample In	formation		Grab Info	rmation	[
				Water				
Event	Station	Analysis	Replicate	Depth		Time	Latitude	Longitude
Number	Code	Туре	Attempt	(m)	Date	Sampled	DD	DD
64	CSEMP376	Organics	A1	25	28/04/2021	08:32	53.3334317	0.5829929
64	CSEMP376	PSA/Metals	A1	25	28/04/2021	08:32	53.3334317	0.5829929
64	CSEMP376	Organics	A1	25	28/04/2021	08:38	53.333385	0.5830299
64	CSEMP376	PSA/Metals	A1	25	28/04/2021	08:38	53.333385	0.5830299
64	CSEMP376	Microplastic	A1	25	28/04/2021	08:43	53.3333808	0.5829795
65	376_386_1	PSA/Metals	A1	75	28/04/2021	09:24	53.4214891	0.6612647
65	376_386_1	Organics	A1	75	28/04/2021	09:24	53.4214891	0.6612647
66	376_386_4	No Sample	A1	25	28/04/2021	10:36	53.310403	0.6707423
66	376_386_4	No Sample	A2	25	28/04/2021	10:38	53.3103997	0.6707343
66	376_386_4	PSA/Metals	A3	25	28/04/2021	10:41	53.3103804	0.6706295
66	376_386_4	Organics	A3	25	28/04/2021	10:41	53.3103804	0.6706295
67	376_386_5	No Sample	A1	16	28/04/2021	12:30	53.136253	0.5092391
69	CSEMP386	No Sample	A1	30	28/04/2021	16:40	52.9829674	0.3345144
69	CSEMP386	PSA/Metals	A2	30	28/04/2021	16:46	52.9829743	0.3345946
69	CSEMP386	Organics	A2	30	28/04/2021	16:46	52.9829743	0.3345946
69	CSEMP386	No Sample	B1	30	28/04/2021	16:52	52.9829608	0.3345442
69	CSEMP386	PSA/Metals	B2	30	28/04/2021	16:56	52.9830174	0.3346398
69	CSEMP386	Organics	B2	30	28/04/2021	16:56	52.9830174	0.3346398
69	CSEMP386	Microplastic	C1	30	28/04/2021	17:02	52.9829103	0.334543
70	376_386_10	PSA/Metals	A1	20	28/04/2021	17:53	53.0506608	0.4088032
70	376_386_10	Organics	A1	20	28/04/2021	17:53	53.0506608	0.4088032
71	466_475_5	PSA/Metals	A1	34	29/04/2021	05:05	51.844384	1.7284335
71	466_475_5	Organics	A1	34	29/04/2021	05:05	51.844384	1.7284335
72	466_475_3	PSA/Metals	A1	31	29/04/2021	05:34	51.8306458	1.7023056

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Station Inf	ormation		Sample Information			Grab Info	rmation	
				Water				
Event	Station	Analysis	Replicate	Depth		Time	Latitude	Longitude
Number	Code	Туре	Attempt	(m)	Date	Sampled	DD	DD
72	466_475_3	Organics	A1	31	29/04/2021	05:34	51.8306458	1.7023056
73	466_475_2	PSA/Metals	A1	26	29/04/2021	06:14	51.7648631	1.6884916
73	466_475_2	Organics	A1	26	29/04/2021	06:14	51.7648631	1.6884916
74	466_475_6	PSA/Metals	A1	29	29/04/2021	06:54	51.7828106	1.8002015
74	466_475_6	Organics	A1	29	29/04/2021	06:54	51.7828106	1.8002015
75	466_475_8	No Sample	A1	27	29/04/2021	07:52	51.8234367	1.8741255
75	466_475_8	No Sample	A2	27	29/04/2021	07:55	51.8234783	1.8740654
75	466_475_8	No Sample	A3	27	29/04/2021	07:58	51.8234957	1.8740493
76	466_475_1	PSA/Metals	A1	47	29/04/2021	08:44	51.8393956	1.7716819
76	466_475_1	Organics	A1	47	29/04/2021	08:44	51.8393956	1.7716819
77	CSEMP376	Organics	A1	25	29/04/2021	12:22	51.4966475	1.0001155
77	CSEMP376	PSA/Metals	A1	25	29/04/2021	12:22	51.4966475	1.0001155
77	CSEMP376	Organics	B1	25	29/04/2021	12:28	51.4966452	1.0001196
77	CSEMP376	PSA/Metals	B1	25	29/04/2021	12:28	51.4966452	1.0001196
77	CSEMP376	Microplastic	C1	25	29/04/2021	12:33	51.4966368	1.0001013
80	484_2	PSA/Metals	A1	23	30/04/2021	00:56	50.9610254	1.0259444
80	484_2	Organics	A1	23	30/04/2021	00:56	50.9610254	1.0259444
81	CSEMP484	Organics	A1	14	30/04/2021	01:35	50.9832326	1.0168821
81	CSEMP484	PSA/Metals	A1	14	30/04/2021	01:35	50.9832326	1.0168821
81	CSEMP484	Organics	B1	14	30/04/2021	01:40	50.9832363	1.0168897
81	CSEMP484	PSA/Metals	B1	14	30/04/2021	01:40	50.9832363	1.0168897
81	CSEMP484	Microplastic	C1	14	30/04/2021	01:44	50.9832226	1.0168838
82	484_1	PSA/Metals	A1	20	30/04/2021	02:08	50.9873743	1.038906
82	484_1	Organics	A1	20	30/04/2021	02:08	50.9873743	1.038906

Station Information			Sample Information			Grab Information		
Event	Station	Analysis –	Replicate	Water Depth		Time	Latitude	Longitude
Number	Code	Туре	Attempt	(m)	Date	Sampled	DD	DD
83	484_3	PSA/Metals	A1	18	30/04/2021	02:26	50.9972799	1.0402952
83	484_3	Organics	A1	18	30/04/2021	02:26	50.9972799	1.0402952
90	466_475_4	PSA/Metals	A1	23	01/05/2021	05:56	52.2240493	1.7215207
90	466_475_4	Organics	A1	23	01/05/2021	05:56	52.2240493	1.7215207

Table 3. Sampled sediment stations for chemical analysis as part of the CSEMP with preliminary sediment description and sample depth (aim 3)

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_CSEMP475_STN_005_A2	and a constant of the second o	Slightly shelly sand	12
CEND0621_CSEMP475_STN_005_B1		Slightly shelly sand	12
CEND0621_CSEMP475_STN_005_C1		Slightly shelly sand	10
CEND0621_376_386_2_STN_009_A2		Slightly sandy mud	15

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_376_386_3_STN_010_A1	ter ensold Terre total and Terre total	Muddy sand with shell	12
CEND0621_376_386_7_STN_011_A1		Muddy gravelly sand	7
CEND0621_CSEMP345_STN_014_A1	Normal Andrew Parks	Mud	12
CEND0621_CSEMP345_STN_014_B1	entre entre entre entre	Mud	14

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_CSEMP345_STN_014_C1	eroseparate erose	Mud	14
CEND0621_345_1_STN_018_A1		Sandy mud	9
CEND0621_CSEMP285_STN_027_A1		Shelly sand	5
CEND0621_CSEMP285_STN_027_B1		Shelly sand	5

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_CSEMP285_STN_027_C1	and a state of the	Shelly sand	6
CEND0621_285_2_STN_028_A1	terretaria	Sandy mud	11
CEND0621_285_3_STN_029_A1		Slightly sandy mud	7
CEND0621_285_1_STN_030_A1	Furner (HNDB/JH Martin Cale 20.1 sender Andrea Martin Frances Martin France	Sandy mud	8
CEND0621_245_295_4_STN_031_A1	And a	Slightly sandy mud	12

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_245_295_5_STN_032_A1	Merce response. Marce response	Slightly sandy mud	10
CEND0621_245_295_3_STN_033_A1	The second	Slightly sandy mud	10
CEND0621_245_295_2_STN_034_A1	Burk CATAOAT Bartan Ban	Slightly sandy mud	11
CEND0621_245_295_6_STN_035_A1	A REAL PROVIDE A REAL PROVIDA REAL PROVIDA REAL PROVIDA REAL PROVIDE A REAL PROVIDE A REAL PROVIDA REAL PR	Slightly sandy mud	12
CEND0621_245_295_1_STN_036_A1	r STNEPS673 Wirche 20 39 31 Burber 36 Teplicitu/Attempt Mir 1954	Sandy mud	11

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_CSEMP245_STN_041_A1		Mud	15
CEND0621_CSEMP245_STN_041_B1	Professional Annual Annua	Mud	14
CEND0621_CSEMP245_STN_041_C1	Clark 213 support	Mud	14
CEND0621_CSEMP295_STN_056_A3	AT CARGAN THE THE THE THE THE THE THE THE THE THE	Muddy sand	8

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_CSEMP295_STN_056_B1	CINERAL BASIN TRANSPORTED TRAN	Muddy sand	6
CEND0621_CSEMP295_STN_056_C1	No Photo	Muddy sand	6
CEND0621_345_03_STN_057_A1	Henry EMOURT Brain Manuar All Andrews (Street All Henry Street All Andrews (Street All Henry Street All Andrews (Street All An	Gravelly sand	6
CEND0621_345_02_STN_058_A1		Slightly muddy gravelly sand	5
CEND0621_CSEMP376_STN_064_A1		Muddy gravelly sand with Sabellaria	7

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_CSEMP376_STN_064_B1	And	Muddy gravelly sand with Sabellaria	7
CEND0621_CSEMP376_STN_064_C1	21 HEMP 375 Blonk Blonk	Muddy gravelly sand with Sabellaria	8
CEND0621_376_386_1_STN_065_A1	N/31 DF6 58.1 DF6 100 INUTA/NEEPO: AT	Muddy gravelly sand	4
CEND0621_376_386_4_STN_066_A3	ENERGIE Partis Tarrier Tarrier Tarrier	Gravelly sand with Sabellaria	4

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_CSEMP386_STN_069_A2	Prever (EMDRA/21: EMP 28: Prever (EMDRA/21:	Shelly gravelly muddy sand	6
CEND0621_CSEMP386_STN_069_B2	en e	Shelly gravelly muddy sand	6
CEND0621_CSEMP386_STN_069_C1	Nitrie Change Change	Shelly gravelly muddy sand	10
CEND0621_376_386_10_STN_070_A1	and the second sec	Shelly muddy sand	10

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_466_475_5_STN_071_A1		Slightly muddy gravelly sand	8
CEND0621_466_475_3_STN_072_A1	Perset Streets Perset	Sandy mud	13
CEND0621_466_475_2_STN_073_A1	Inter 1300011 Desta 101 Desta 1	Muddy sand	8
CEND0621_466_475_6_STN_074_A1	ter internet ter internet te	Gravelly mud	5
CEND0621_466_475_1_STN_076_A1	Party (CEDDO/21 CHART 2005 - CEATOR 1 Party CEDDO/21 Party	Muddy gravel	5

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_CSEMP466_STN_077_A1	termination of the second seco	Muddy sand and shell	10
CEND0621_CSEMP466_STN_077_B1	Parener CHUDOK/24 CHUD 2021 BAllon rode: CHUP 466 Berghander:	Muddy sand and shell	11
CEND0621_CSEMP466_STN_077_C1	CEND06/21 2021 code: CENIP 466 number _ 27 _ Repicate/Attrop: CL Hostis	Muddy sand and shell	12
CEND0621_484_2_STN_080_A1		Sandy mud	12

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_CSEMP484_STN_081_A1	En case Maria	Muddy sand	13
CEND0621_CSEMP484_STN_081_B1	The second	Muddy sand	14
CEND0621_CSEMP484_STN_081_C1	ST21 S CSEMP A84 Aret:	Muddy sand	14
CEND0621_484_1_STN_082_A1	Perger (Ellowa): Berner all Bernard (Barger B) Bernard (Barger B	Mud	15

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_484_3_STN_083_A1	Area and a second	Mud	15
CEND_466_475_4_STN_090_A1	Area (1906/A) 2013 2013 2014 2015 20	Mud	7



Table 4: Observed occurrences of the fourteen recorded external and internal fish diseases

Table 5. Stomach content of up to 20 sampled dab per station

SEMP ST. NO.	ngth (cm 1dp)	Weight (g)		
ö	Le		SEX	STOMACH ANALYSIS
378	22.0	84.3	М	Broken shell, bit of rock, 2
378	21.6	85.8	М	~10cm fish remains, 4
378	21.9	87.5	М	Fish remains, 4 x bivalve shells, 4
378	21.0	68.8	М	5 x bivalve shells, 1 x concical (snail) shell, 4
378	22.1	95.5	F	2 x bivalve shells, fish remains, broken shell, 4
378	21.5	85.2	F	2 x bivalve shells, broken shell, 1 x conical (snail) shell, 4
378	23.2	107.8	F	3 x bivalve shells, broken shell, 4
378	22.0	97.8	F	7 x bivalve shell, Broken shell, 4
378	23.6	126.9	F	8 x bivalve shells, broken shell, fish remains, 4
378	22.4	101.1	F	4 x bivalve shells, broken shell, fish remains, 4
378	23.2	96.2	F	3 x bivalve shell, broken shell, fish remains, 4
378	18.5	55.0	М	5 x bivalve shells, broken shells, 3
378	19.4	65.3	М	fish remains, broken shell, 2
378	19.1	65.3	М	fish remains, broken shell, 1
378	19.0	63.5	М	Empty, 0
378	18.2	51.2	М	fish remains, bivalve shell, broken shell, 1
378	19.1	56.4	М	bivalve shell, broken shell, sand, 1
378	21.0	85.6	F	bivalve shell, broken shell, 1
378	21.5	90.5	F	3 x bivalve shell, 3 x fish remains, starfish x 1, 4
378	20.2	81.2	F	6 x fish remains, 1 x crustacean (crab), 4
346	21.0	68.1	F	Bivalve fragments, 1*tiny cockle, 1
346	21.1	82.7	М	Crustacean limbs, 1
346	20.8	95.4	F	1*Tellina sp, 1*crab, 1
346	19.1	54.3	М	Unidentifiable matter, 1
346	20.3	66.7	F	Unidentifiable matter, 1
346	18.5	48.9	М	Unidentifiable matter, 1
346	21.1	72.2	F	Urchin fragments, 1
346	19.8	64.5	М	Empty, 0
346	18.9	51.3	М	Unidentifiable matter, 1
346	20.9	94.5	F	Pagurus sp., Ophuiroidea, Anemone, 4
346	18.8	52.4	М	Unidentifiable matter, 1
346	20.9	73.3	F	Bivalve fragments, 3
346	20.2	75.5	F	Pagurus sp.; 1*Chaela, 3*leg, 3
346	18.2	42.1	M	Ophuroidea sp. Fragments, 1
346	20.6	68.7	F	Pagurus sp.; 1*Chaela, 1*leg, 2
346	18.5	51.8	M	1*small Tellina, unidentifiable matter, 1
346	18.9	50.5	M	Shell fragments, 1
346	18.4	47.9		Unidentifiable matter, 1
346	19.0	50.4	F _	Empty, 0
346	20.4	54.7	F _	Ophuroidea sp. Fragments, 1
287	20.7	82.9	F _	unidentifiable matter, 1
287	20.5	71.8	F _	bivalves, unidentifiable matter, nemetodes (paracitic) tellina, 2
287	22.3	99.0	F	Pagarus sp., 1

SEMP ST. NO.	ength (cm 1dp)	Weight (g)		
0			SEX	STOMACH ANALYSIS
287	20.6	85.6	F	anemone, bivalve, nemotodes (paracitic), 2
287	20.6	82.2		Pagarus sp., 2
287	22.7	95.0	F	shell fragment x 1, 1
287	20.3	73.8		shell fragment, ophuroides, 1
287	24.0	135.5	F _	ammodytes s.p, shell fragments, crab leg, 3
287	22.9	103.7	-	tiny ammodytes, unidentified matter, 1
287	21.5	80.6		Hydroides, 1
287	20.8	73.8	M	Tish spine (ammodytes), 1
287	20.1	12.1	M	1 X opnuroides, 1
287	20.9	81.7		
287	19.2	64.0		empty, 0
207	19.2	02.0		
287	19.6	65.6 65.4		razor ciam sp., broken snell, 1
207	19.0	62.2		broken shell 1
207	10.0	59 7		proken snell, i
207	10.0	50.7		
201	10.0	111 7		Z x ophuroidoo (OPI storfich) 4
203	22.4	121.6	г с	<i>T</i> x ophicioles (OFT statisti), 4
203	24.0	122.6	- -	urchin worm casing 3
283	21.2	84.6	F	hivalve razor clam sp. 2
283	21.3	83.5	F	fish remains 2
283	22.1	100.3	F	fish remains 4
283	21.4	107.3	F	razor clam sp., shell fragments, jellvfish sp., 4
283	21.0	89.5	F	razor clam sp., shell fragments, 3
283	21.1	83.8	F	empty. 0
283	20.7	78.0	F	razor clam sp., shell fragments, 1
283	21.1	76.8	М	broken shell, 1
283	20.2	80.3	М	fish remains, 2
283	22.2	96.9	М	empty, 1
283	21.0	75.8	М	brittle star arms, 3
283	21.5	84.5	М	urchin, fish eye, 2
283	22.1	97.8	М	nematodes, scallop larvae, 3
283	21.4	80.4	М	fish remains, 3
283	20.6	75.9	М	fish remains, 3
283	20.6	83.3	М	empty, 0
283	21.4	77.1	М	scallop larvae, unidentifed sludge, 1
284	20.5	81.6	М	Aphrodita*1, 2
284	21.0	77.8	М	Ensis sp. *1, 1
284	20.8	66.5	М	Empty, 0
284	20.9	83.0	М	Small shell fragments, Possible Ammodytes, 1
284	20.5	78.5	М	Unidentifiable matter, 1
284	21.2	81.3	М	Ensis fragments, 1
284	20.8	91.8	М	Empty, 0
284	22.6	99.1	М	Liocarcinus*1, 1
284	23.9	127.5	F	Fish*1 (Ammodytes), 2

SEMP ST. NO.	.ength (cm 1dp)	Weight (g)	051	
0			SEX	STOMACH ANALYSIS
284	21.1	86.8	F	Empty, 0
284	20.2	72.0	M	Tiny Ammodytes *2, 1
284	19.9	64.7		Ammodytes *1, 1
284	20.3	95.9	F _	Shell fragments, Hydroides, Unidentified flesh, 3
284	23.9	122.1	-	Unidentifiable matter, 2
284	23.3	128.8	F	
284	23.0	107.3	F F	Empty, 0
204	23.4	124.1		
204	22.7	00.0	г с	Empty, 0
204	21.3	92.0	F	Erisis 1, 1
204	22.2	70.4	F	Bivalve Shell fragments 1
200	20.0	125.0	F	Flongate fish*1_2
286	24.0	81.8	F	Elongate fish*4_2
286	20.0	90.0	F	Linidentifiable flesh 2
286	23.5	113.9	F	Pagarus sp. Tellina sp. 2
286	20.3	61.0	F	Empty 0
286	21.8	100.6	F	Bivalve siphons. 1
286	22.7	107.8	F	Unidentified crab. 1
286	20.5	73.8	F	Empty. 0
286	23.2	111.0	F	Tiny Tellina sp *1, 1
286	21.2	85.5	М	Ammodytes sp. 1*small, 1*Tellina sp., 1
286	19.0	61.5	М	Unidentifiable matter, 1
286	19.5	65.7	М	Ctenophora*1, 1
286	19.8	74.3	М	Tellina sp. *1, shell fragments, 3
286	19.5	66.1	М	Small ammodytes*6, 3
286	20.6	77.6	М	Aphrodita*1, 1
286	19.9	74.9	М	Aphrodita*1, 2
286	21.7	83.5	М	Ctenophora*1, 1
286	19.7	62.6	М	Empty, 0
286	19.3	67.0	М	Ctenophora*1, 1
244	21.7	86.6	М	Empty, 0
244	21.2	82.4	М	Empty , 0
244	22.1	85.0	М	Swimming Crab (sp.), Unidentifed matter, 2
244	20.6	75.4	М	Pagarus sp., 2
244	20.0	70.3	М	Unidentifiable matter, 2
244	22.0	88.2	F	Empty, 1
244	22.5	95.4	F	Nephrops, unidentifable matter, 2
244	21.0	78.8	F	Nephrops x 2, 3
244	22.0	103.5	F	Aphrodite, unidentifable matter, 2
244	20.3	64.8	F	Empty, 0
244	20.2	70.3	F	Empty, 0
244	21.0	78.0	F	Empty, 0
244	21.0	95.0	F _	Sea potato, 1
244	20.0	75.8	F	Swimming crab leg, worm tube, unidentifiable matter, 1
244	19.9	62.0	Μ	Nephrop, 1

SEMP ST. NO.	ength (cm 1dp)	Weight (g)		
C C	Ľ		SEX	STOMACH ANALYSIS
244	19.8	52.4	М	Empty, 0
244	20.9	75.0	М	Brittle star arms x 2, 1
244	19.8	58.4	М	Broken shell, 1
244	19.7	68.5	М	Empty, 0
244	21.5	94.1	F	NO STOMACH, NA
294	24.0	115.1	F	Crab sp., Sea potato, 3
294	20.5	74.8	F	Sea potato fragments, 2*Nephrops Head, 3
294	19.4	57.7	F	Sea potato fragments, 4
294	24.1	123.9	F _	Empty, 0
294	24.1	136.4	F	Sea weed, shell tragments, crab chaela, 2
294	20.1	72.3	-	Nephrops, Sea potato fragments, 2
294	19.0	58.9	F	Brittle star, sea potato fragments, 2
294	19.4	61.2	F	Sea potato fragments, pointy conical shell, 2
294	19.5	60.5	<u>г</u>	See poteto fragmente 1
294	20.0	40.3	Г	Sea polato fragmente 1
294	20.0	55.5	M	Sea polato fragments, 1
294	10.6	55.5 60.5	M	historiality, undertinable matter, 2
294	21.0	61.0	M	Empty 0
294	20.0	69.6	M	Fish remains sea notato fragments 4
294	19.6	62.3	M	Lirchin, brittle star arms, ophidae, 2
294	19.0	60.6	м	worms sea potato fragments brittle star*2 2
294	19.0	59.6	м	Squat lobster, Nohrops, 2
294	20.1	63.5	M	Empty, 0
294	18.9	55.8	M	Macropoda, Hydroidea, 1
344	19.1	57.2	F	Empty. 0
344	20.5	77.4	F	Empty, 0
344	19.6	63.6	F	Bivlave, Crab remains, 1
344	25.2	140.8	F	Empty, 0
344	18.6	49.3	F	Empty, 0
344	19.0	65.0	F	Empty, 0
344	18.5	59.4	F	Bivalve, 1
344	17.5	41.9	F	Empty, 0
344	18.0	44.4	F	Empty, 0
344	19.9	62.0	М	Sea potato, Bivalve, Unidentifiable matter, 3
344	18.3	60.0	М	Empty, 0
344	20.0	60.0	М	Empty, 0
344	18.5	61.7	М	Empty, 0
344	18.7	56.1	М	Crab remains (2 x leg + carapace), 1
344	19.0	62.0	М	unidentified matter, 1
344	19.9	68.6	М	Sea potato fragment, 1
344	18.1	51.2	М	Empty, 0
344	20.1	74.2	М	Empty, 0
344	18.5	52.9	М	Empty, 0
344	19.0	50.7	М	Empty, 0

st. NO.	m 1dp)	t (g)		
AP S	h (c	idhi		
SEN	engt	₩.		
ŭ	Le		SEX	STOMACH ANALYSIS
377	21.5	87.6	М	Amphipoda 20+, 1
377	21.7	94.8	М	Amphipoda 100+, 2
377	19.8	60.7	F	Empty, 0
377	20.6	66.7	М	Amphipoda 50+, 2
377	19.2	55.9	М	Amphipoda 50+, 2
377	23.6	104.2	F	Carcinus maenus carapace, 1
377	22.0	89.8	F	Amphipoda 3, Unidentified matter, 1
377	23.5	106.2	F	Amphipoda 5, Hydroidea, 1
377	22.2	89.2	F	Amphipoda 100+, 2
377	20.8	82.5	F	Amphipoda 30+, 2
377	23.8	106.4	F	Amphipoda 100+, 2
377	21.1	80.4	М	Amphipoda 20+, 1
377	22.1	92.2	F	Empty, 0
377	19.0	45.0	M	Empty, 0
377	19.0	49.0	M	Amphipoda 50+, 2
377	17.9	42.4	M	Amphipoda 50+, 2
377	17.6	42.6	M	Amphipoda 100+, 3
377	24.8	78.1	F	Empty, 0
377	17.8	46.0	M	Amphipoda 30+, 1
377	22.1	87.5	F	Empty, 0
486	20.9	94.4	M	Fish Remains, 1
486	23.6	118.7		Fish Remains, 1
486	21.7	85.9	F _	3*Tellina sp., 1*Gastropod shell, 1*Bivalve siphon, 1* worm, 4
486	23.5	108.4	-	5°Bivalve siphon, 1°worm, 1°Tellina sp., 3
486	23.6	110.6		Fish Remains, bivalve shell fragments, 2
486	21.1	82.6		Empty, 0
480	20.7	102.1		Empty, 0
400	22.7	142.7		Empty, 0
400	20.0	72.2	Г	Fish Remains, 5
400	20.1	67.3		Atshelled pagerus 2*telling sp. 2
400	20.0	75.2	F	Rivalve shell fragments 1
400	20.5	02.8	F	Bivalve shell fragments, 1
486	20.4	83.8	F	Unidentified flesh 2
486	20. . r 22.1	93.9	F	Empty 0
486	21.1	82.5	м	Brittlestar arm bivalve shell fragments 2
486	20.6	81.8	M	Fish remains Brittlestar lantern 2
486	20.6	81.7	м	Empty. 0
486	19.8	71	М	Unidentified flesh, 1
486	20.0	75.4	М	Fish Remains, bivalve shell fragments, 2
494	22.5	113.1	М	3 x Ophiuroidea, Hydroidea, 3
494	24.0	123.7	F	Ophiuroidea fragments, Crustacean limb (crab), 4
494	21.9	101.5	М	Ophiuroidea fragments, Hydroidea, 2
494	19.9	74.3	F	Ophiuroidea fragments, Tellina shell fragments, 2
494	23.4	123.3	М	Ophiuroidea fragments, Bivalve shell fragements, 2
494	20.6	84.3	F	Ophiuroidea fragments, Hydroidea, 1

CSEMP ST. NO.	Length (cm 1dp)	Weight (g)	SEX	STOMACH ANALYSIS
494	21.4	88.2	М	Ophiuroidea fragements, 2
494	20.3	72.3	F	Empty, 0
494	20.8	86.5	М	Ophiuroidea fragments, Bivalve shell fragments, 2
494	18.9	56.5	F	Ophiuroidea fragments, 1
494	22.1	101.6	М	Ophiuroidea fragements, hydroidea, 2
494	23.1	129.4	F	Ophiuroidea fragments, Hydroide, Tellina shells, 4
494	20.7	87.4	М	Buccium undatum foot, Crustacea legs, Hydroidea, 3
494	21.8	90.8	F	Ophiuroidea fragments, Bivalve shell fragments, Hydroid, 3
494	20.9	94.4	М	Ophiuroidea fragements, Worm, 2
494	19.0	60.6	F	Empty, 0
494	20.3	73.7	М	1 x Ophiuroidea, 2
494	21.0	88.9	М	Polycheate, Ophiuroidea fragments, 3
494	21.0	79.8	F	Ophiuroidea x 2, 4
494	19.0	61.6	F	Unidentifiable matter, 2

Table 6. CTD rosette samples collected.

Station Information			Sample Information			Grab Information		
			Water					
Event		Analysis	Replicate	Depth		Time	Latitude	Longitude
Number	Station Code	Туре	Attempt	(m)	Date	Sampled	DD	DD
1	CSEMP 475	CTD	A1	41	22/04/2021	08:30	52.0528469	2.0923186
4	West Gabbard	CTD	A1	44	22/04/2021	15:48	51.9447012	2.1068185
7A	Alternate Smith's Knol	CTD	A1	48	22/04/2021	22:11	52.7328155	2.4777391
12	CSEMP 378	CTD	A1	40	23/04/2021	11:00	53.5398021	2.0864162
15	CSEMP 346	CTD	A1	82	23/04/2021	20:41	54.0478495	1.837065
19	CSEMP 287	CTD	A1	27	24/04/2021	06:59	54.4888195	2.7253751
21	CSEMP 283	CTD	A1	33	24/04/2021	16:35	55.256344	2.8997002
23	CSEMP 284	CTD	A1	32	24/04/2021	23:39	55.0761517	2.1220616
25	CSEMP 286	CTD	A1	29	25/04/2021	06:19	54.8149346	1.3282432
37	CSEMP 243	CTD	A1	102	26/04/2021	03:28	55.4522945	-1.0714971
39	CSEMP 244	CTD	A1	70	26/04/2021	07:07	55.3192357	-1.2435989
42	CSEMP 294	CTD	A1	46	26/04/2021	17:48	54.7927056	-1.1319105
59	CSEMP 344	CTD	A1		27/04/2021	13:12	54.2461033	0.4894104
62	CSEMP 377	CTD	A1	15	28/04/2021	01:58	53.3249578	0.4123808
68A	CSEMP 387	CTD	A1	25	28/04/2021	13:16	53.1372132	0.5361839
78	CSEMP 486	CTD	A1	14	29/04/2021	19:35	50.8363424	0.7636406
87	CSEMP 494	CTD	A1	20	30/04/2021	07:24	50.7490805	-0.0043139

Station Information			Sample Information			Grab Information		
				Water				
Event	Station	Analysis	Replicate	Depth		Time	Latitude	Longitude
Number	Code	Туре	Attempt	(m)	Date	Sampled	DD	DD
44	IT3	No Sample	A1	28	27/04/2021	00:26	54.679884	-1.0796569
44	IT3	No Sample	A2	28	27/04/2021	00:27	54.6798918	-1.0797268
44	IT3	No Sample	A3	28	27/04/2021	00:32	54.679954	-1.0797385
45	IT3	Contaminants	A1	29	27/04/2021	00:51	54.6799739	-1.0801264
46	IT1	Contaminants	A1	38	27/04/2021	01:17	54.7000012	-1.0599025
47	IND1	Contaminants	A1	30	27/04/2021	01:43	54.6796858	-1.0577248
48	IT4	Contaminants	A1	23	27/04/2021	02:04	54.6799459	-1.0499598
49	IND2	Contaminants	A1	32	27/04/2021	02:30	54.6815172	-1.0345478
50	IT5	Contaminants	A1	36	27/04/2021	02:52	54.6870921	-1.0321427
51	IT7	Contaminants	A1	34	27/04/2021	03:10	54.6735453	-1.026248
52	IND5	No Sample	A1	38	27/04/2021	03:27	54.6829783	-1.0135437
52	IND5	Contaminants	A2	38	27/04/2021	03:31	54.682998	-1.0135968
53	OT1	Contaminants	A1	40	27/04/2021	03:48	54.6941875	-0.9983141
54	IT8	Contaminants	A1	38	27/04/2021	04:10	54.6698946	-0.9901058
55	IT10	Contaminants	A1	50	27/04/2021	04:45	54.67165	-0.8811438

Table 7: Sampled sediment station metadata (aim 5)

Table 8: Sampled sediment stations for contaminants analysis as part of the Inner Tees dredge disposal monitoring with preliminary sediment description and sample depth (aim 5)

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_Tees_IT3_STN_045_A1	Survey: CEND06/21 TEES 2021 Station code: IT3 Event number: Contaminants	Slightly muddy slightly sandy gravel	3
CEND0621_Tees_IT1_STN_046_A1		Slightly muddy slightly sandy gravel	3
CEND0621_Tees_IND1_STN_047_A1	the contract of the contract o	Sand	3
CEND0621_Tees_IT4_STN_048_A1	A contraction of the second se	Sand	5

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_Tees_IND2_STN_049_A1	terrer etheory. Here Conference in the second seco	Sand	4
CEND0621_Tees_IT5_STN_050_A1	Unit Unit Unit Unit Unit Unit	Sandy mud	4
CEND0621_Tees_IT7_STN_051_A1	Research and the second and the seco	Sandy mud	7
CEND0621_Tees_IND5_STN_052_A2		Sand	5

Station Code	Picture	Sediment Description	Sediment Depth (cm)
CEND0621_Tees_OT1_STN_053_A1		Sand	4
CEND0621_Tees_IT8_STN_054_A1	Part CHORA/2 Table	Sandy mud	4
CEND0621_Tees_IT10_STN_055_A1	Pre ELBOCH/2 Brain Der umber BSS_ Rejuchi/Atterer Cortaminants	Gravelly sand mud	3

Table 9: Pie charts of marine litter percentage composition by count and weight.



Table 10: Microtox levels in sediment grab samples. Green line indicates the theoretical zero ('normal' luminescence), blue bars are good, amber bars and questionable and red bars are of concern.



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Scientist in Charge, 2SIC & SIC in training

04/05/2021

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