Natural England Commissioned Report NECR309

Thanet Coast MCZ 2017/18 Survey Report

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Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

Following designation, Natural England started a baseline monitoring programme across all marine protected areas.

This report was commissioned as part of an inshore benthic marine survey of the Thanet Coast MCZ.

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Further information
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Thanet Coast MCZ 2017/18 Survey Report

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Thanet Coast MCZ
2017/18 Survey Report

Project Code: MB0129

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N. Balmond-Atchison	Natural England Marine and Coastal Advisor
L. Browning	Natural England Marine Environmental Specialist
M. Curtis	Cefas Benthic Ecologist
A. Downie	Cefas Senior Habitat Mapper
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1. Introduction

Following the introduction of the Marine and Coastal Access Act in 2009, the UK Government is creating an ecologically coherent network of Marine Conservation Zones (MCZs) in British waters. The MCZ network will exist alongside other Marine Protected Areas (MPAs), including Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs) and Ramsar sites to help conserve marine biodiversity, in particular habitats and species of national importance.

The Thanet Coast MCZ site has been designated to protect a variety of features found within the southeast region (Table 1), in particular an area of subtidal chalk that extends seawards from the chalk cliffs. The chalk seabed is the longest continuous stretch of coastal chalk in the UK. The Thanet Coast MCZ is also the only MCZ designated to protect the Stalked jellyfish, *Lucernariopsis cruxmelitensis* (Natural England, 2013).

Following designation, Natural England started a baseline monitoring programme across all MCZs, specifically targeting the designated features present both inside and outside each site boundary. The initial datasets gathered are used to inform future monitoring and management of the sites.

*Natural England and the Joint Nature Conservation Committee (JNCC)

1.1 Site Description

The Thanet Coast MCZ (Figure 3) is an inshore area on the Kent coast, stretching from east of Herne Bay to the northern wall of Ramsgate Harbour (Thanet Coast MCZ Factsheet; Natural England, 2013). The site encompasses 64 km^2 and overlaps with the Thanet Coast Special Area of Conservation (SAC) which is designated for the 'Reefs' Annex I habitat. The site also overlaps with the Kent North coastal WFD Water Body. Detailed site information can be found in the Thanet Coast MCZ Factsheet (Natural England, 2013).

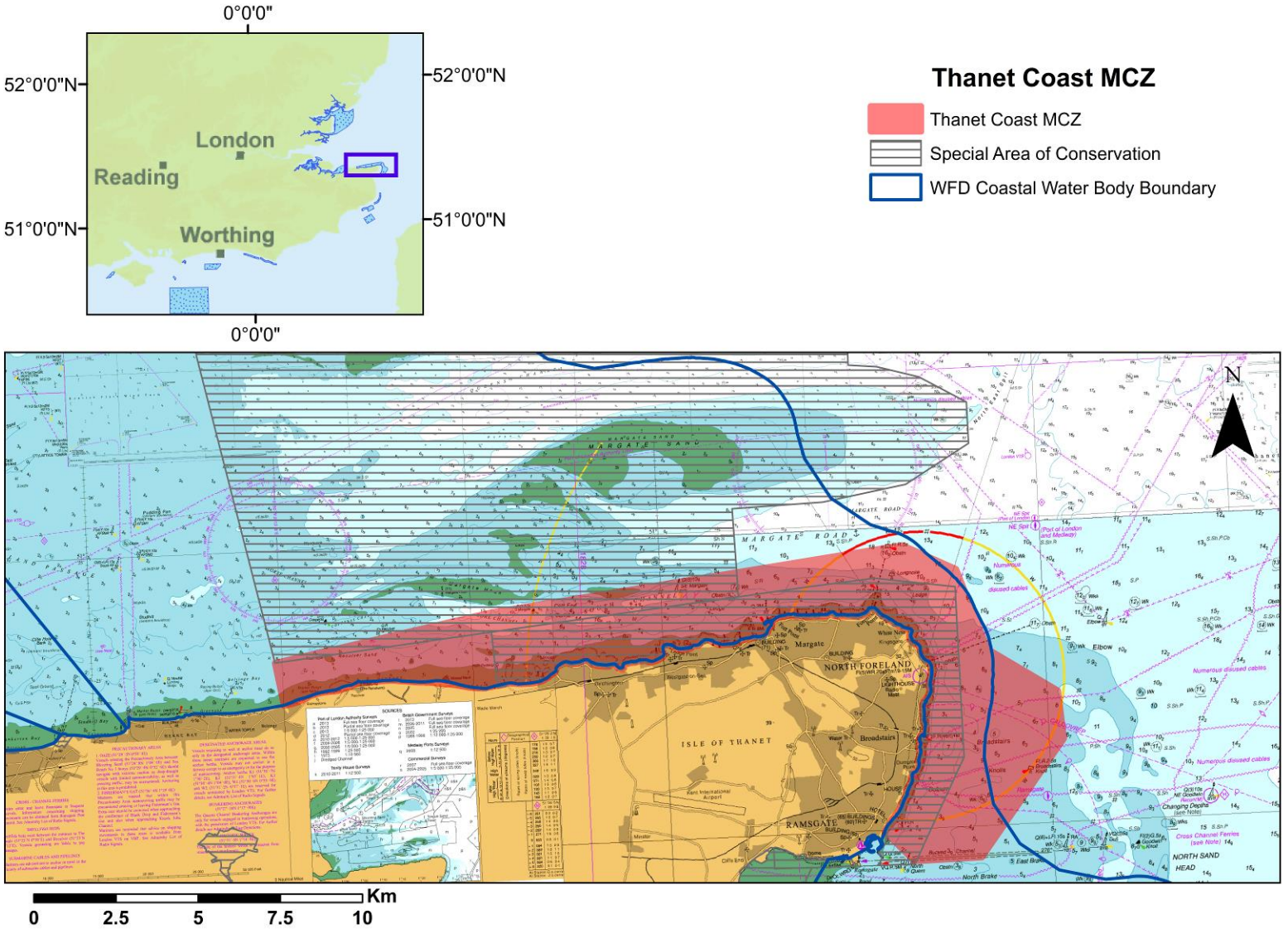

Figure 1. Location of the Thanet Coast Marine Conservation Zone (MCZ) in the context of other MCZs off the southeast coast.

The subtidal features protected under the Thanet Coast MCZ designation order are presented in Table 2 alongside the current general management approach. The chalk seabed present within the MCZ boundary forms part of the longest continuous stretch of coastal chalk in the UK. It is also the only designated MCZ protecting a species of Stalked jellyfish (*Lucernariopsis cruxmelitensis*). The MCZ also includes other Features of Conservation Importance (FOCI) such as Blue mussel (*Mytilus edulis*) beds and Ross worm (*Sabellaria spinulosa*) reefs that form complex intertidal biogenic reefs. These reefs play an important role within the ecosystem, stabilising mobile sediment and creating habitats that support a range of species. Reefs also play an important role in protecting our coastlines, by reducing the energy of incoming waves and improving water quality through water filtration processes (Natural England, 2013).

The use of bottom-towed fishing gear is currently prohibited throughout the entire SAC, but not in the area of the MCZ outside of the SAC boundary. The presence of MCZ designated habitat features both inside and outside the closed area boundary would offer an opportunity to assess the effects of current management measures (KEIFCA, 2018).

Table 1. General Management Approach (GMA) for the features of conservation importance present in the Thanet Coast Marine Conservation Zone. The monitoring survey planned here will focus on those features indicated by blue shading.

Feature type	Feature Name	General Management Approach
Broadscale Habitat	Subtidal coarse sediment	Maintain
	Subtidal mixed sediments	Maintain
	Subtidal sand	Maintain
	Moderate energy infralittoral rock	Maintain
	Moderate energy circalittoral rock	Maintain
Habitat FOCI	Blue mussel (*Mytilus edulis*) beds	Maintain
	Peat and clay exposures	Maintain
	Ross worm (*Sabellaria spinulosa*)	Recover
	Subtidal chalk	Maintain
Species FOCI	Stalked jellyfish (*Haliclystus auricular*)	Maintain
	Stalked jellyfish (*Lucernariopsis cruxmelitensis*)	Maintain

1.2 Survey Aim and Objectives

Overall Survey Aim

To undertake a characterisation survey of the Thanet Coast MCZ to assess the relative extent, distribution and community composition of the sediment and rock protected features based on a Type 1 monitoring survey design.

Survey objectives

1. To collect sediment grab and underwater video data to investigate the structure, function and distribution of biological communities of selected features in the MCZ (Table 1).

The data acquired will:

- provide data for a monitoring time series;
- improve understanding of the distribution of MCZ features across the site;
- provide information for condition assessment of the broadscale habitats; and
- set a baseline for the distribution of the non-native species, particularly the Carpet sea squirt *Didemnum vexillum,* within the MCZ.

2. To provide point records of the designated habitat and species features of conservation interest that inhabit the site, within the confines of the survey approach and platform utilised.

1.3 Survey Team

The Thanet Coast MCZ was surveyed between the 13th of June 2017 and the 13th of January 2018 using the coastal survey vessels *Thames Guardian* (Figure 1, Annex 7.1) and *Humber Guardian* (Figure 2, Annex 7.1), staffed and operated by Briggs Marine. The survey team comprised of a collaboration of marine monitoring specialists from the five organisations listed below (Table 2).

Table 2. Survey personnel

Environment Agency Estuarine and Coastal Monitoring & Assessment Service Survey Officers Marine Technical Specialists
Cefas Marine Specialist
Kent and Essex IFCA Marine Specialist
Natural England Marine Specialist
Seastar Survey Ltd. Freshwater Camera Surveyors

Figure 2. Coastal survey vessel *Thames Guardian*, operated by Briggs Marine.

Figure 3. Coastal survey vessel *Humber Guardian*, operated by Briggs Marine.

2. Survey Design and Methods

2.1 Survey Design and Planning Phase

Recent acoustic data were available up to 1 nm from the shore to aid survey planning (UK Hydrographic Office HI1340, Ramsgate to Minnis Bay 2011; HI1438, Swale to Minnis Bay 2013). No acoustically-derived habitat map was available, although interpreted habitat maps from existing evidence have been created by Natural England. No MCZ verification survey was undertaken for this site, but there was a small drop-down video survey of the Thanet Coast SAC focusing on chalk reef habitats undertaken for Natural England in 2013 (Sheehan *et a*l., 2015) which provided limited evidence of biotope distribution. No existing infauna data were available.

The MCZ encompasses a major headland (North Foreland), with the Swale Estuary MCZ to the west, Goodwin Sands rMCZ to the southeast and the deeper Outer Thames channel to the north. No comparable area of seabed were considered to be within a reasonable distance of the site, and that a Before-After, Control-Impact (BACI) style survey was deemed unsuitable. Instead, a Type 1 style survey method was chosen to provide as much information as possible on the distribution of broadscale habitats across the site. Using available habitat information and outputs from the 2011 and 2013 bathymetric surveys, 100 Drop Down Video (DDV) stations were plotted using a 750 m triangular lattice distributed evenly across the site (Figure 4). For vessel safety and to avoid disturbed areas of seabed, sample stations were not placed within 500 m of undersea cables at North Foreland and Broadstairs, in the Ramsgate dredged channel or in the spoil ground off Ramsgate Sands.

Following a preliminary assessment of the video data, stations for follow up ground-truthing were selected, together with stations for sediment contaminants monitoring (heavy metals, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, tributyltin; Section 2.2.3) based on the presence of suitable habitat for sampling.

The Carpet sea squirt *Didemnum vexillum* is difficult to identify using traditional taxonomic methods. Therefore, to confirm its presence within the site, any ascidians suspected to be *D. vexillum* were collected to confirm identification by subsequent DNA barcoding techniques.

A ‘Notification of an exempt activity form’ for the removal of sediment (samples) was submitted to the Marine Management Organisation prior to the survey being carried out.

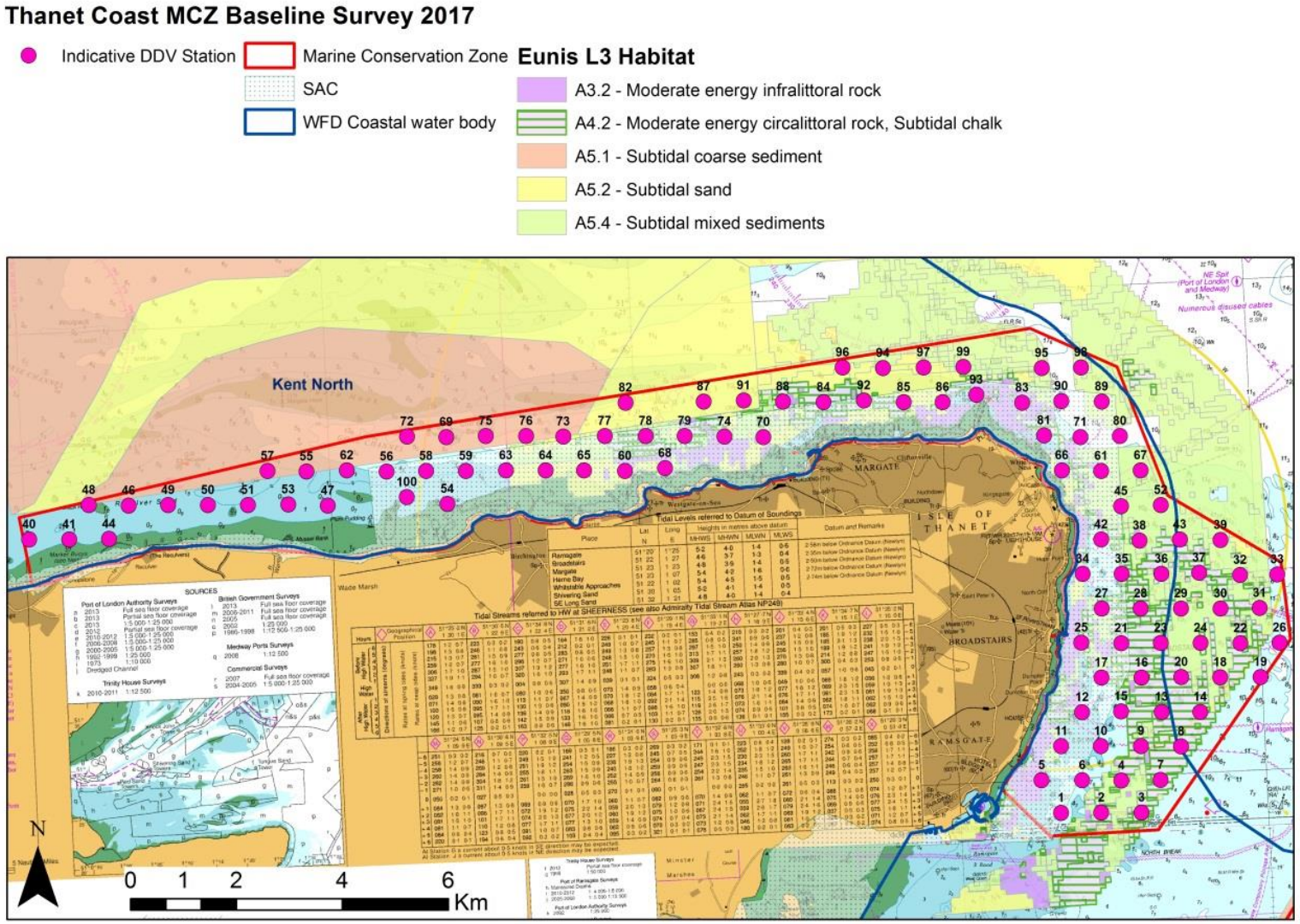

Figure 4. Thanet Coast MCZ Spring 2017 Characterisation Survey; 100 planned DDV Stations, mapped over the interpreted broadscale habitat map (UKHO HI1340, Ramsgate to Minnis Bay 2011; HI1438, Swale to Minnis Bay 2013)

2.2 Sample Collection Methodology

2.2.1 Habitat Characterisation and In-situ Benthic Epifauna Identification

Initial plans for the Thanet Coast MCZ were for drop down video camera equipment (Annex 7.2.2) to be deployed in accordance with the MESH 'recommended operating guidelines (ROG) for underwater video and photographic imaging techniques' (Coggan et al., 2007). The Subsea Technology Rentals (STR) SeaSpyder camera system was deployed from the stern of the survey vessel, as shown in Figure 5. Real time navigation data acquisition and manual position fixing (when the gear contacted the seabed) were captured via Trimble® HYDRO*pro*™ software and logged by the survey officer. The mid-point of the vessel's stern gantry was used as the default offset for position fixing (see Annex 7.2.1 for further details). Video files and digital still images were transmitted *via* the sea cable to be captured and saved directly to a hard drive in the survey cabin. The video footage was annotated with time and position using a GPS (SIMRAD MX512 DGPS) referenced video overlay (uncorrected position data). Still images of the seabed were to be captured approximately every 10 to 15 m over a distance of >150 m. Extra photographs would be taken in heterogeneous areas of BSHs and/or if particular habitat/species FOCI were observed. Where a BSH habitat boundary was observed towards the end of a video tow, the camera deployment was to be extended to allow confirmation of the habitat change. The camera depth was controlled by a winch operator who received direct instructions from the survey cabin. For further deployment details please see the 'EA underwater video procedure_version 2.4' in Annex 7.3.

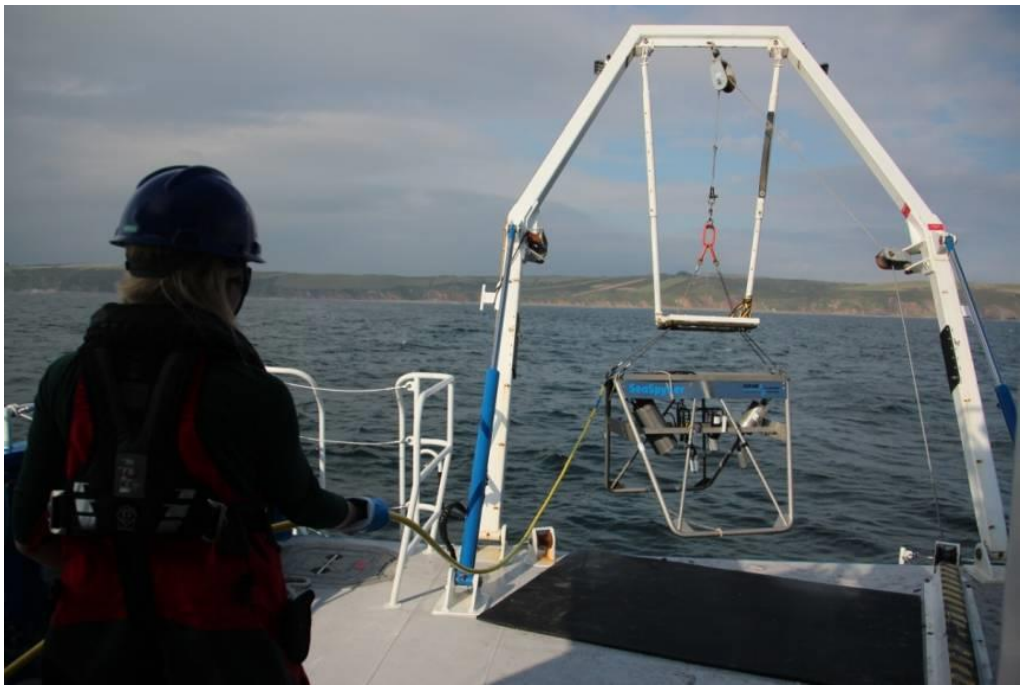

Figure 5. STR SeaSpyder drop camera system being deployed from the stern of the coastal survey vessel.

During each drop camera deployment, a member of the survey team would continuously monitor the real-time video feed and record general station notes, habitat information and faunal observations (see Annex 7.5 for a worked example of the video logsheet).

As the STR SeaSpyder camera system was unable to return usable imagery from the low visibility conditions encountered in the Thanet Coast MCZ a Seastar Survey Ltd. video camera with freshwater lens (Figure 6) was mobilised to complete the video element of the survey plan. The freshwater lens system was deployed from the stern of the vessel largely as described above. The different camera systems however do require slight changes to survey methodology. In order to facilitate landing the freshwater lens system on the seabed to capture the short video segments the vessel was maintained in position by stemming the tide rather than drifting with it. The camera frame was lowered slowly to the seabed and gently landed to minimise disturbance of the fine silt which would obscure the field of view. A series of 'hops' were carried out in order to as far as possible replicate the stills that would be recorded from a 'standard' video tow. Between 30 to 60 sec of high definition video was recorded at each station / 'hop'. The data cable was taped to the winch wire every two to three metres to minimise the risk of any slack becoming entangled in the propellers. The position fixing offset for the camera was 2 m beyond the mid-point of the stern gantry to allow for vessel movement whilst the frame was landed (see Annex 7.2.1.).

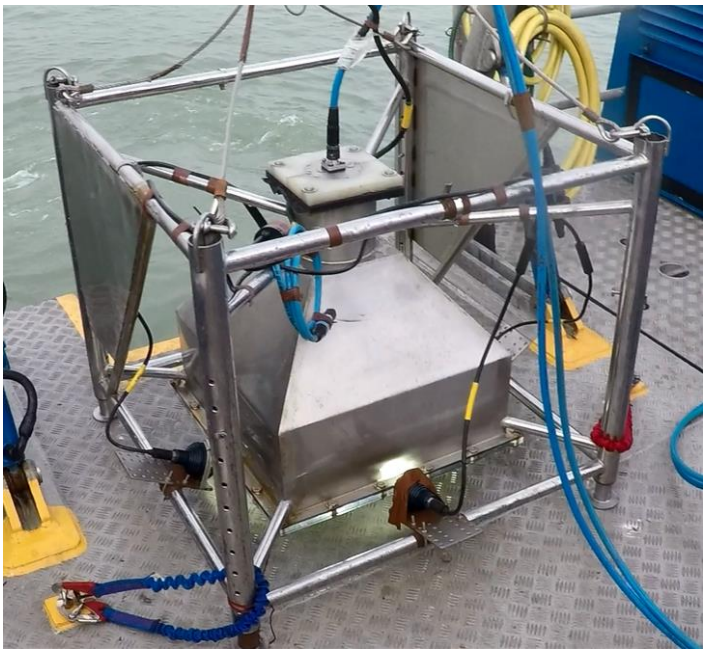

Figure 6. Seastar Survey Ltd. video camera system with freshwater lens.

2.2.2 Broadscale Habitat Ground truthing

A mini-Hamon grab (Figure 7), with a sampling area of 0.1 m^2, was deployed from the stern gantry of the vessel to collect sediment from the seabed, as described by Ware and Kenny (2011). Sampling positions were recorded (fixed) using Hydropro data acquisition software when the gear contacted the seabed, with the mid-point of the vessel's stern gantry being used as the default offset for position fixing (see Annex 7.2.1 for further details).

Once recovered, the sample was emptied into a suitable container, photographed, and the sample volume measured. Three attempts were made at each station to obtain a valid grab sample before the station was abandoned. A sample volume of 5 L was required to qualify as a valid sample. Samples of <5 L were ordinarily discarded. However, when it was difficult to obtain a valid sample, a sample with <5 L of material was retained at the discretion of the lead scientist if it was deemed representative of the habitat. For valid samples, a small scoop was used to remove a representative sub-sample (approx. 0.5 L) of sediment for particle size

analysis (PSA). The remaining sample was washed over a 1 mm sieve to retain the faunal fraction (Figure 7), photographed and preserved with a buffered 4 % formaldehyde solution for transfer ashore to a specialist laboratory for analysis.

Where the volume of sediment collected at a station was insufficient for faunal analysis in all grab attempts, a photograph was taken of the largest sample and, if possible, material removed for PSA. The station was then abandoned.

2.2.3 Sediment Contaminants

At four stations, additional grabs were collected to retrieve material for contaminant analyses using a Day grab (Figure 8) following the methodology detailed in the Environment Agency operational instruction 10_01 (2007). Surficial sediments were removed from each grab to a maximum depth of 1 cm (avoiding the anoxic layer). A metal scoop was used to collect material for organic contaminant analyses and a plastic scoop for heavy metals. The remaining material was then discarded. The top 1 cm was used as its sediments represent the most recent contaminant levels deposited in the sediment. All samples for contaminants assessment were stored frozen at -20 °C immediately after collection.

2.2.4 Non-native species DNA sampling

The contents of each macrofaunal grab were visually inspected for the invasive non-native Carpet sea squirt (*Didemnum vexillum*). If an ascidian was found matching the description of *D. vexillum*, approximately 1 g of its tissue was removed and submersed in a container of 100 % ethanol. Samples were transported to the Cefas laboratory in Weymouth for analysis by Polymerase Chain Reaction (PCR) to confirm species identification.

In addition, supernatant water samples were collected from all grab samples. To do this, three 50 ml water aliquots were taken from each grab and fixed in 100% ethanol. Each water sample was tested for the presence of DNA of the following non-native species for which primer sets have been developed: *Eriocheir sinensis*, *Crassostrea gigas*, *Crepidula fornicata*, *Styela clava*, *Didemnum vexillum*, *Bugula neritina*, *Hemigrapsus takanoi*, *Hemigrapsus sanguineus*, *Homarus americanus* and *Caprella mutica*.

To limit cross contamination between samples, the grab was washed down with sea water as normal, then with a 1 % sodium hypochlorite solution. Immediately before the next grab deployment the sodium hypochlorite was rinsed off. A flow diagram of the survey method used is given in Annex 7.6**.**

Figure 7. Mini-Hamon grab (left), and equipment for sieving benthic faunal samples (right)

Figure 8. Day grab being deployed from the stern of the vessel.

3. Survey Narrative

The Thanet Coast MCZ 2017/18 characterisation survey was carried out between the 12th of June 2017 and 13th of January 2018. The DDV survey was attempted from the 12th to 16th of June 2017 on *Thames Guardian.* The mini-Hamon grab (MHM) survey was conducted between the 19th and 23rd of June 2017 on *Humber Guardian* and the Day grab survey for contaminants was completed on the 8th of July 2017 on the *Thames Guardian.* The freshwater lens camera survey was conducted between the 9th and 13th of January 2018. Full details of the surveys are provided below.

Environment Agency and Cefas personnel mobilised to the survey vessel *Thames Guardian* berthed at Chatham Marina on the 12th of June 2017 where the SeaSpyder camera system was assembled and tested. Following a safety briefing for the scientific staff on the 13th of June, the vessel departed Chatham Marina at 07:30 UTC and steamed to the MCZ survey area. The vessel arrived at the first location at 09:45 UTC and the camera was deployed. DDV attempts were made at 27 stations but due to poor visibility it was not possible to obtain viable data. Weather conditions on site were variable between Force 3 and 4 from a south westerly direction, becoming mainly easterly Force 4 in the afternoon. The vessel left the survey area at 15:00 UTC and returned to Ramsgate Marina. The following day, the vessel departed at 08:00 UTC. DDV operations were carried out between 08:15 UTC and 13:45 UTC. During this time 37 stations were attempted but visibility was too poor to retrieve usable images. Due to deteriorating weather conditions and poor underwater visibility the vessel left the survey area and returned to Ramsgate. The *Thames Guardian* remained alongside on the 15th of June due to continuing poor conditions at sea.

Operations resumed on the 16th of June at 08:00 UTC when the *Thames Guardian* departed Ramsgate Marina to return to the survey area. The DDV camera was deployed at 08:15 UTC and 12 stations were attempted before poor visibility ceased operations at 10:15 UTC. The decision was made to return to Chatham and demobilise the camera equipment due to continuing poor visibility (see Figure 10 for a representative image) and commence benthic grabbing.

Figure 9. Example still image of typical poor visibility encountered during the initial drop down video camera survey.

Due to the lack of viable underwater video footage, the survey team opted to move straight in to the groundtruthing phase of the survey. Grab stations were based on the original 100 DDV stations and broadscale habitat map. For vessel safety reasons some stations were discarded due to underwater cables and spoil ground, which resulted in a total of 88 indicative benthic stations.

Mini-Hamon grab (MHM) sampling operations commenced on the 20th of June 2017 on board the *Humber Guardian*. After conducting a vessel safety brief for joining scientists from the Environment Agency and Cefas, the vessel left Ramsgate Marina at 05:10 UTC. A toolbox talk was conducted once on site and the first grab deployed at 06:05 UTC. Survey activity continued until 13:25 UTC when the vessel left the survey area to return to the Marina and refuel. A total of 88 MHM drops were made at 31 stations. The vessel left the following day at 07:05 UTC and grab operations continued between 08:30 UTC and 14:40 UTC. During this time 79 Hamon grab drops were made, completing a further 32 stations. On the 22nd of June 2017 the *Humber Guardian* left Ramsgate at 07:20 UTC and commenced grab operations at 08:20 UTC. Seventeen drops were made at seven stations before deteriorating weather conditions halted survey activity at 10:20 UTC. The vessel left the survey area and returned to Ramsgate. The vessel departed at 05:00 UTC on the 23rd of June 2017 to complete the final 18 MHM stations. Operations began at 05:15 UTC and were completed by 08:50 UTC. Fifty five drops were made in order to complete the remaining 18 stations. The vessel returned to the Marina for the survey equipment and samples to be off-loaded.

The remaining grab programme for the Thanet Coast MCZ was completed on the 8th July 2017 on board the *Thames Guardian* using a Day grab (DG) for sediment contaminants sampling. Survey personnel and crew joined the vessel in Chatham and after carrying out routine water sampling, arrived on station to commence grabbing at 07:45 UTC. Three contaminant stations were sampled between 07:45 UTC and 08:45 UTC before the vessel recommenced water sampling. The final sediment contaminant sample was collected between 09:30 UTC and 09:45 UTC, at which point the grab survey was completed. The vessel continued with water sampling before transiting to Ramsgate for demobilisation of the survey equipment.

Camera operations recommenced with a Seastar Survey Ltd. system (comprising a freshwater lens) on the 9th of January 2018. The equipment was delivered to the *Thames Guardian* berthed in Ramsgate Marina. Set up and testing was carried out by Seastar Survey Ltd. personnel on the 9th and 10th of January. At 08:20 UTC on the 11th January the *Thames Guardian* left Ramsgate Marina and transited to the first station. Camera operations continued until dusk at 16:30 UTC. Fifteen stations were attempted; poor visibility was encountered at two stations. The following day the vessel left Ramsgate at 08:20 UTC and began camera operations at 08:45 UTC. A further 15 stations were completed before the vessel left the survey area at 16:30 UTC. On the 13th of January the *Thames Guardian* departed the marina at 08:20 UTC and arrived at the first station at 09:20 UTC. The remaining stations were completed and those where poor visibility was encountered during the previous two days were re-visited to acquire better video data. The vessel left the survey area for demobilisation at 13:00 UTC and arrived at Ramsgate Marina at 13:40 UTC for demobilisation.

Between the 12th of June 2017 and the 13th of January 2018, the Thanet Coast MCZ characterisation survey took 14 ‘on-task’ days to complete. Progress reports for each survey day are available on request.

4. Data Acquisition

4.1 Seabed Images

Due to the poor visibility encountered during the initial SeaSpyder DDV survey, a high definition freshwater lens camera system designed and operated by Seastar Survey Ltd. was brought in to survey the area. High definition video footage was successfully acquired at 35 stations inside the Thanet Coast MCZ boundary using this system. Figure 11 provides an overview of the underwater video survey data collected for broadscale habitat characterisation.

4.2 Sediment Samples

Grab samples were collected at 88 stations using a mini-Hamon grab. Samples with sufficient sediment for infaunal and particle size analyses were collected at 29 stations, while the quantity of sediment collected being sufficient only for particle size analysis was taken at a further 32 stations. Water (grab supernatant) samples for eDNA analysis were taken at 86 stations. None of the stations selected for groundtruthing were discarded. Four stations were also successfully sampled for sediment contaminant analyses using a Day Grab. The samples were photographed before and after the on-board processing phase. Figure 12 shows the results of the grab survey.

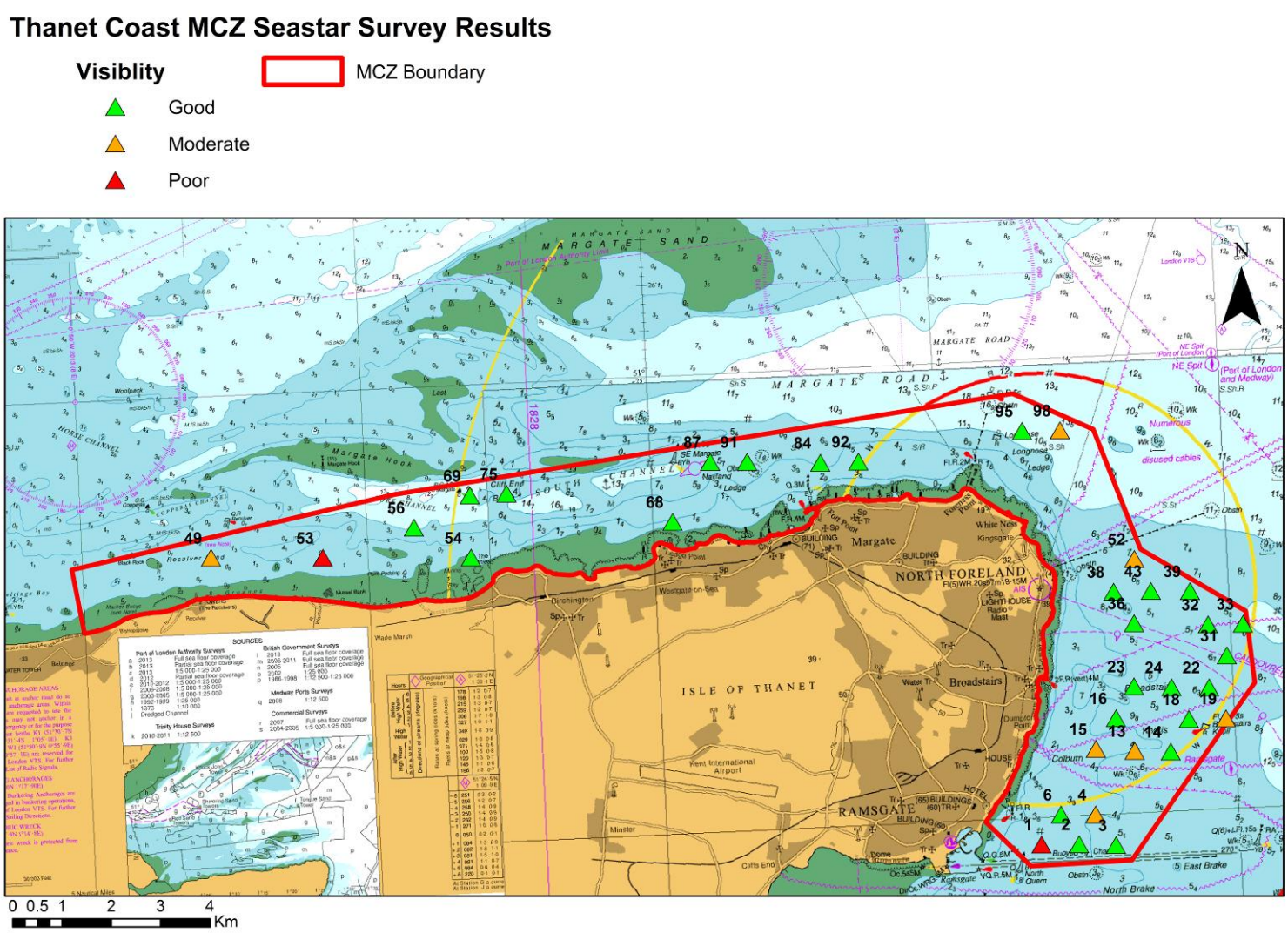

Figure 10. Underwater visibility encountered during the Thanet Coast MCZ 2017/18 survey.

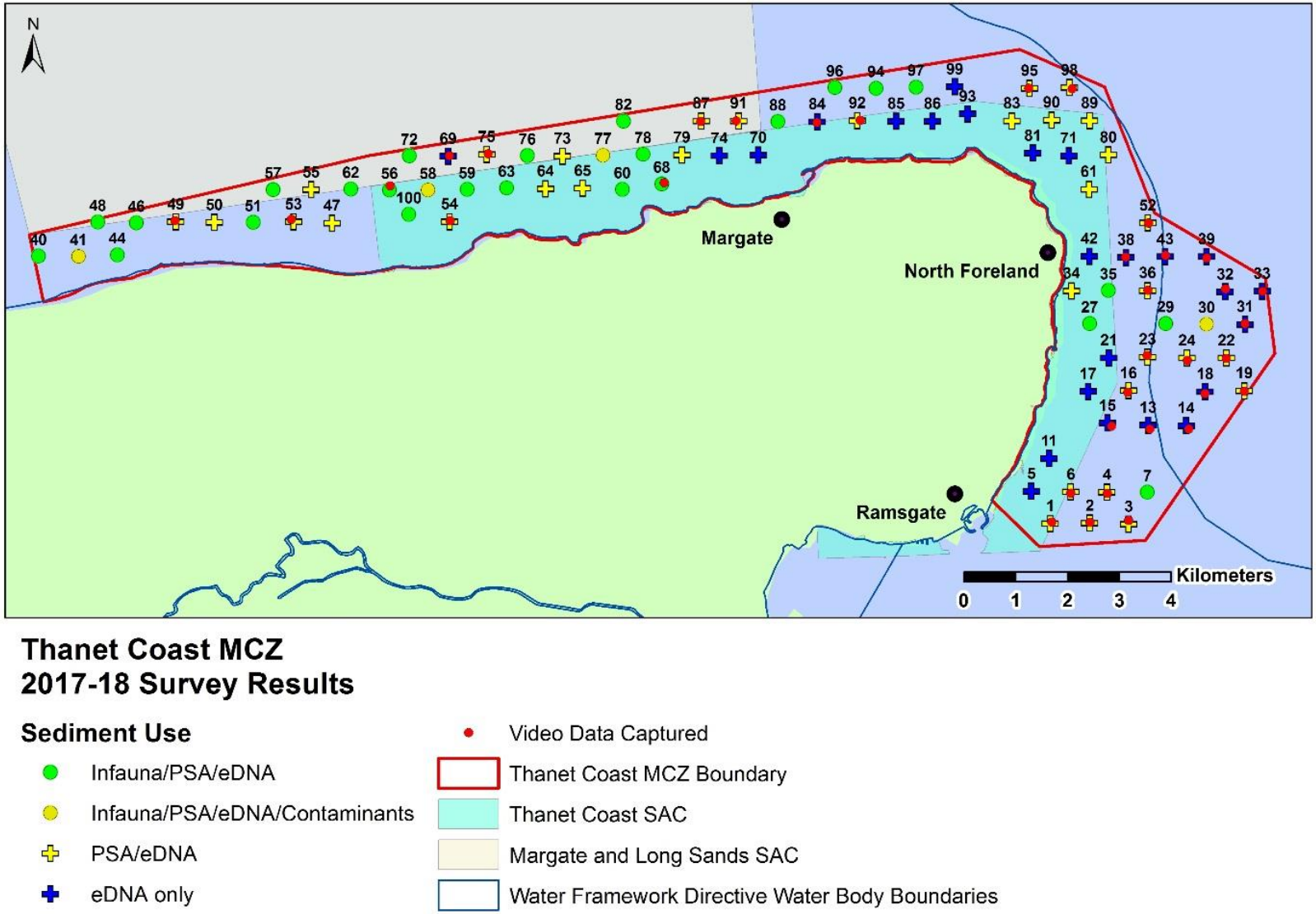

Figure 11. Thanet Coast MCZ 2017/18 grab survey results.

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6. General List of Abbreviations

BSH	Broadscale Habitat
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CHP	Civil Hydrography Programme
CS	Camera Sledge
CSV	Coastal Survey Vessel
DC	Drop Video Camera
Defra	Department for Environment, Food and Rural Affairs
DG	Day Grab
EA	Environment Agency
ECMAS	Estuarine and Coastal Monitoring & Assessment Service
ENG	Ecological Network Guidance
FOCI	Features Of Conservation Importance
IFCA	Inshore Fisheries and Conservation Authority
MCZ	Marine Conservation Zone
MESH	Mapping European Seabed Habitats
MHM	Mini-Hamon Grab
mSNCI	marine Sites of Nature Conservation Importance
PSA	Particle Size Analysis
REC	Regional Environmental Characterisation
rMCZ	recommended Marine Conservation Zone
RSG	Regional Stakeholder Group
SAC	Special Area of Conservation
SAD	Site Assessment Document
SNCB	Statutory Nature Conservation Body
SOP	Standard Operating Procedure
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
UTC	Coordinated Universal Time

7. Annexes

7.1 Coastal Survey Vessel General Information

Briggs Marine and Environmental Services Ltd.
Seaforth House, Seaforth Place, Burtisland, Fife, KY3 9AX.
Tel: +44(0)1592 872939
Email: marketing@briggsmarine.com

Humber Guardian

General Information	Main Equipment
Length: 18.3 m	**Main Engines:** 2 x Volvo D9-MH 261 bkW @ 2200 rpm. Twin Disc MGX-5075 integral vee-drive
Beam: 6.3 m	**Crew:** 2
Draft (baseline): 1.15 m	**Scientific Officers:** Up to 10
Draught (skegs): 1.65 m	**Accommodation:** 3 x twin cabins and mess
Displacement (light ship): 22 T	Data network to share information around vessel
Displacement (full load): 30 T	Wet lab/bench for processing water, sediment and ecology samples
Service Speed: 16 knots	Fridge/freezer for sample storage
Maximum Speed: 18 knots	Dry lab space for two computers and data processing
	Large aft deck working area
	A frame – 2 T SWL
	Double Independent Drum Trawl Winch – 2 T SWL
	Hydraulic crane

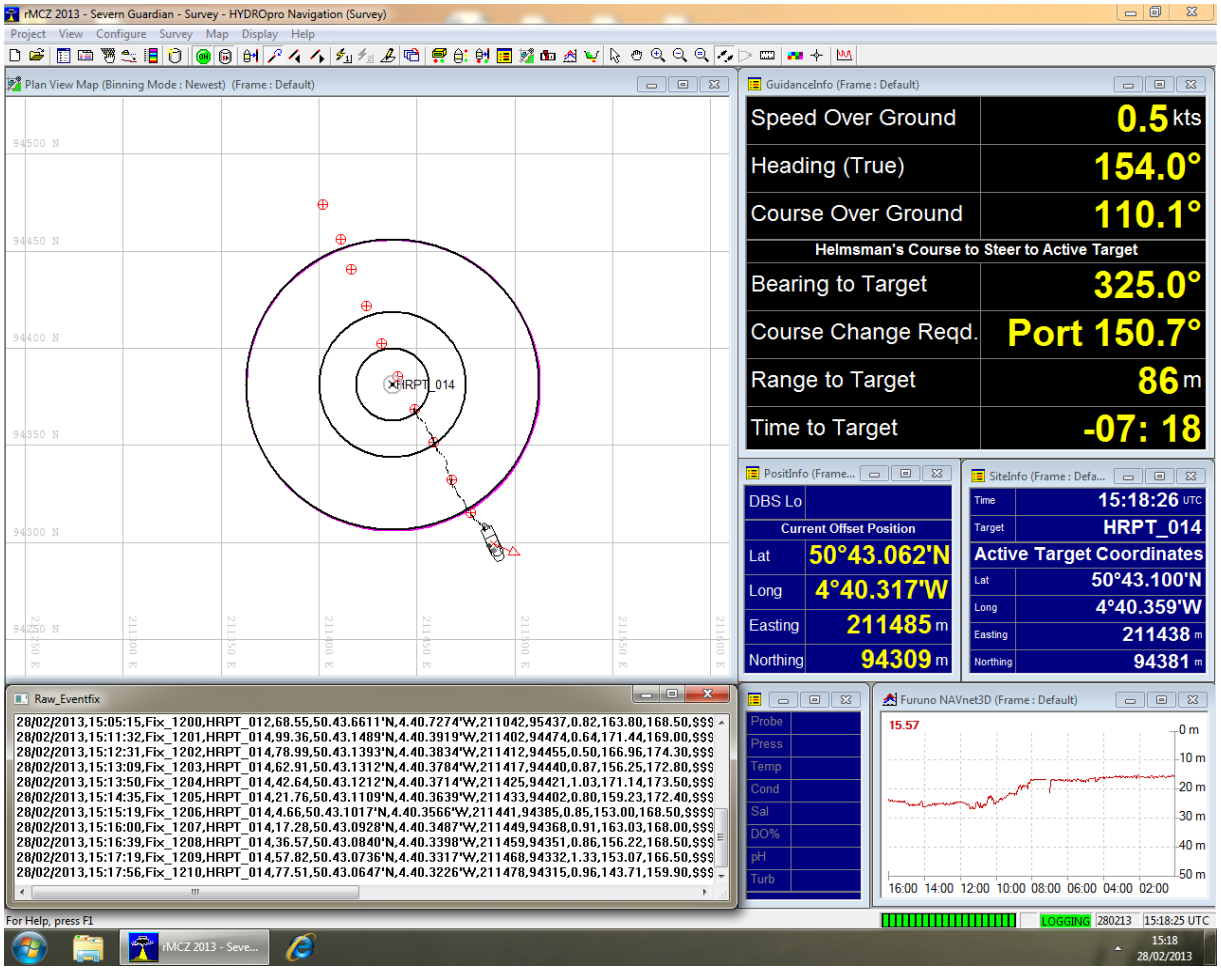
Thames Guardian

General Information	Main Equipment
Length: 14.5 m	**Main Engines:** 2 x Yanmar 6LYT-STE@ 420HP
Beam: 4.7 m	**Crew:** 2
Draft (baseline): 1.15 m	**Scientific Officers:** Up to 6
Draught (skegs): 1.30 m	**Survey Specifications:**
Displacement (light ship): 13 T	Data network to share information around vessel
Service Speed: 18 knots	Wet lab/bench for processing water, sediment and ecology samples
Maximum Speed: 25 knots	Fridge/freezer for sample storage
	Space for two computers and data processing
	Large aft deck working area
	A frame
	Winch

7.2 Survey Equipment

7.2.1 Navigation and Positioning

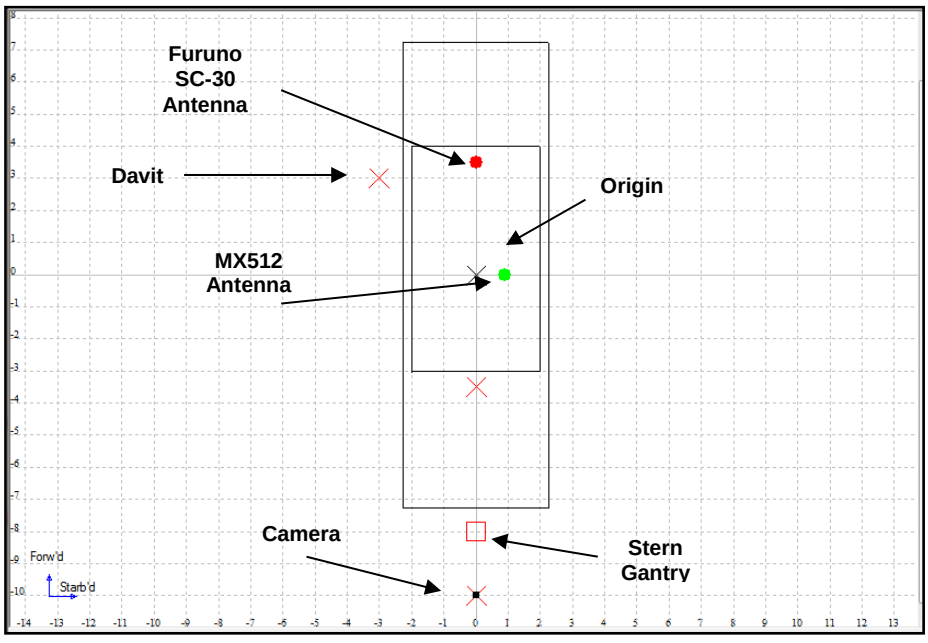
Trimble® HYDRO*pro*™ software is utilised for real-time navigation and survey data acquisition.



Trimble® HYDRO*pro*™ software screen grab displaying real-time navigation and survey data acquisition for a MCZ drop camera survey line.

Navigational and survey equipment offsets on the Coastal Survey Vessel *Thames Guardian* (Environment Agency Estuarine and Coastal Monitoring & Assessment Service).

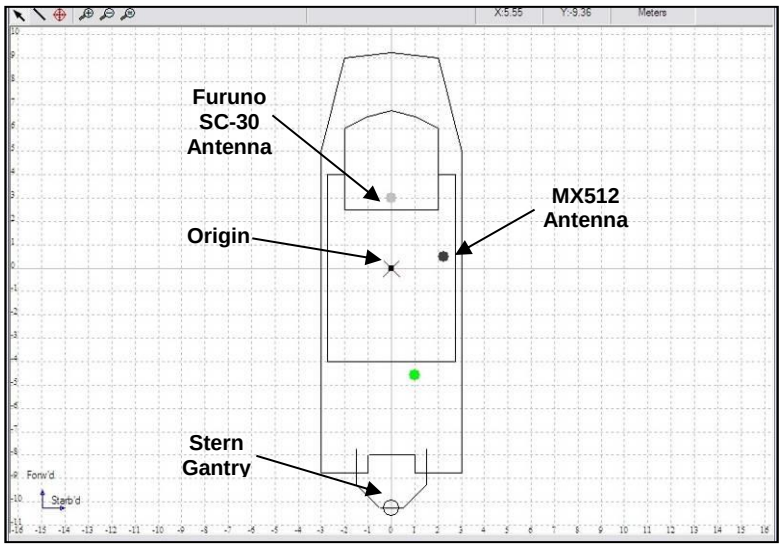
NMEA Device	*Make/Model*	*Offset Name*	*Offset (m)*		
			X (Starb'd)	*Y (Forw'd)*	*Z +ve (Up)*
Origin	*n/a*	*Origin*	*0.0*	*0.0*	*0.0*
Navigation GPS (Secondary)	*Furuno SC-30 DGPS*	*Furuno SC-30 Antenna*	*0.0*	*3.5*	*0.0*
Survey GPS (Primary)	*SIMRAD MX512 DGPS*	*MX512 Antenna*	*0.9*	*0.0*	*0.0*
n/a	*n/a*	*Sediment Grab (Stern Gantry)*	*0.0*	*-8.0*	*0.0*
n/a	*n/a*	*Camera*	*0.0*	*-10.0*	*0.0*
n/a	*n/a*	*Davit (Idronaut)*	*-3.0*	*3.0*	*0.0*



Trimble® HYDROpro™ vessel editor screen showing *Thames Guardian* survey equipment offsets from the origin (Environment Agency Estuarine and Coastal Monitoring & Assessment Service).

Navigational and survey equipment offsets on the Coastal Survey Vessel 'Humber Guardian' (Environment Agency Marine Monitoring Service).

NMEA Device	*Make/Model*	*Offset Name*	*Offset (m)*		
			X (Starb'd)	*Y (Forw'd)*	*Z +ve (Up)*
Gyrocompass	*Simrad Robertson RGC50*	*n/a*	*-*	*-*	*-*
Navigation Echosounder	*Furuno DFF1, 525ST-MSD transducer*	*n/a*	*-*	*-*	*-*
Survey Echosounder	*Kongsberg EA400*	*n/a*	*-*	*-*	*-*
Origin	*n/a*	*Origin*	*0.0*	*0.0*	*0.0*
Navigation GPS (Secondary)	*Furuno SC-30 DGPS*	*Furuno SC-30 Antenna*	*0.0*	*3.0*	*0.0*
Survey GPS (Primary)	*SIMRAD MX512 DGPS*	*MX512 Antenna*	*2.25*	*0.5*	*0.0*
n/a	*n/a*	*Sediment Grab (Stern Gantry)*	*0.0*	*-10.25*	*0.0*



Trimble® HYDROpro™ vessel editor screen showing survey equipment offsets from the origin (Environment Agency Marine Monitoring Service).

7.2.2 SeaSpyder Drop Camera System

STR
SUBSEA TECHNOLOGY & RENTALS

SEASPYDER DROP CAMERA SYSTEM

Surface Control Unit & Processor

The SeaSpyder Underwater Drop Camera System is part of a family of field proven camera systems manufactured by STR for the marine survey and environmental communities. The SeaSpyder is ideally suited for operation in shallow-medium water depths with the standard system having a working depth range of 500m. For applications demanding a deeper rating, a "telemetry" model is offered which operates over longer cable lengths for operation down to 1000m. Both models are fitted with a new generation digital SLR Camera offering high resolution digital stills and HD Video for the highest imagery detail. The high specification digital SLR Camera offers an impressive 18.0 mega pixels resolution and both manual and automatic focus for achieving the sharpest images. The captured digital stills are framed with the aid of dedicated real-time video and can be transferred to the topside 'on the fly' for rapid online review.

A 19" rack mount Surface Control Unit and powerful topside processor give full remote control of the camera via the easy to use SeaView GUI software. As standard, the purpose designed camera deployment frame is fitted with a subsea electronics and camera housing, high power underwater flash, an array of four high intensity LED lamps and dual scaling laser pointers to provide accurate imagery scaling. There is the option to install additional sensors with the availability of three user defined serial interfaces with optional power.

SYSTEM FEATURES

- Latest generation 18 Mega Pixels Digital SLR Camera
- Full remote control of camera functions including automatic and manual focus control
- 'On-the-fly' image download
- Real time HD Video
- High Intensity LED Lamps
- Dual lasers for precise imagery scaling
- High speed digital telemetry link to camera and sensors
- Additional user defined RS232 ports and 24VDC power interfaces

SEASPYDER SHALLOW WATER CAMERA SYSTEM

SEASPYDER RACK MOUNT PROCESSOR

Hardware: Standard 19" Rack Mountable
Processor: Intel I5 3.1GHz Quad-Core
Memory: 4GB DDR3 RAM
Storage: 500GB hard drive
Interface: DVD-RW, 2 x 1 GigE, 6 x USB, 4 x RS232
Display: 2 x 22" LED HDMI Monitor
Power: 110/240 VAC, 50 Hz (900W)
Dimensions: 19" 3U rack mountable 550 mm (L) x 485 mm (W) x 132mm (H)

SEASPYDER SEAVIEW SOFTWARE

Key Features:

- Remote control of SeaSpyder Digital Stills Camera
- Digital stills and video capture
- "On-the-fly" image download
- External overlay functions
- Realtime composite video
- HD video capture
- Remote control of lights, scaling lasers and additional sensors

SEASPYDER SURFACE CONTROL UNIT

ELECTRICAL

Power Input: 85 – 264 VAC (47 – 63 Hz) ≈ 500 W max
Cable Power: +/- 48VDC Nominal (≈ 400W max.) with built in electrical leakage detector

SIGNAL INTERFACE

Cable Interface #1: High bandwidth VDSL2
Cable Interface #2: Differential Colour Composite Video with automatic cable length compensation

MECHANICAL

Dimensions: 19" 2U rack mountable 550 mm (L) 485 mm (W), 88 mm (H)

SEASPYDER SUBSEA ELECTRONICS

ELECTRICAL

Power Output: 24VDC Output (200 W Max Subsea Power)
Interface: 1 x SeaSpyder Camera & Underwater Flash
4 x 24VDC LED Lamps
2 x RS232 Ports with 24VDC
1 x RS232 Port with 12 VDC/ 24VDC
1 x Dual Scaling Lasers

MECHANICAL

Diameter: 200mm
Length: 409mm
Standard Housing: Hard Anodised Aluminium
Depth Rating: 500m

SEASPYDER 18 MEGA PIXELS UNDERWATER DIGITAL STILLS CAMERA

ELECTRICAL

Image Size: JPEG (720 x 480) to (5184 x 3456)
Image Size: RAW (5184 x 3456)
Video: Full HD (1920 x 1080)
ISO Sensitivity: Auto (100 – 6400), 100 – 12800
Sensor Type: 22.3 x 14.9mm CMOS
Aspect Ratio: 3:2
Shutter Speed: 30 – 1/4000 Sec
Interface: Ethernet

OPTICAL

Standard Lens: 10 – 24mm
Macro Mode: F/3.5 – 4.5
Zoom: Fixed
Focus: Manual & Automatic mode
Angle of View: ≈65° in water
Vertical View: ≈1m²@ 80cm in water

SEASPYDER COLOUR VIDEO CAMERA

ELECTRICAL

Image Resolution: 600 TV lines
Video Format: PAL Composite Colour Video
Sensitivity: 0.01 Lux
Sensor Type: 1/3 Sony Super HAD CCD
Frame Rate: 50 FPS
Video Output: ≈1.3Vpp into 75Ω

OPTICAL

Lens Type: 3.6 mm Wide Angle

SEASPYDER HIGH POWER CAMERA FLASH

ELECTRICAL

Control: TTL control via digital stills camera
Power Input: Power supply via stills camera

MECHANICAL

Diameter: 150mm
Length: 230mm
Weight in Air: 7.6kg
Weight in Water: 3.54kg
Standard Housing: Hard Anodised Aluminium
Depth Rating: 3000 m

SEASPYDER 20W LED LIGHT

ELECTRICAL

Lighting: LED Lamp
Luminous Flux: 1500Lm
Wavelength: Neutral White
Power Input: 24 VDC @ 1.1 A (Built in thermal protection)

MECHANICAL

Diameter: 70mm
Length: 110mm
Weight in Air: 1kg
Weight in Water: 0.58kg
Standard Housing: Hard Anodised Aluminium
Depth Rating: 3000m

SEASPYDER DUAL SCALING SUBSEA LASERS

ELECTRICAL

Power Input: 8 V – 30VDC; 60 m A @ 24VDC

LASER

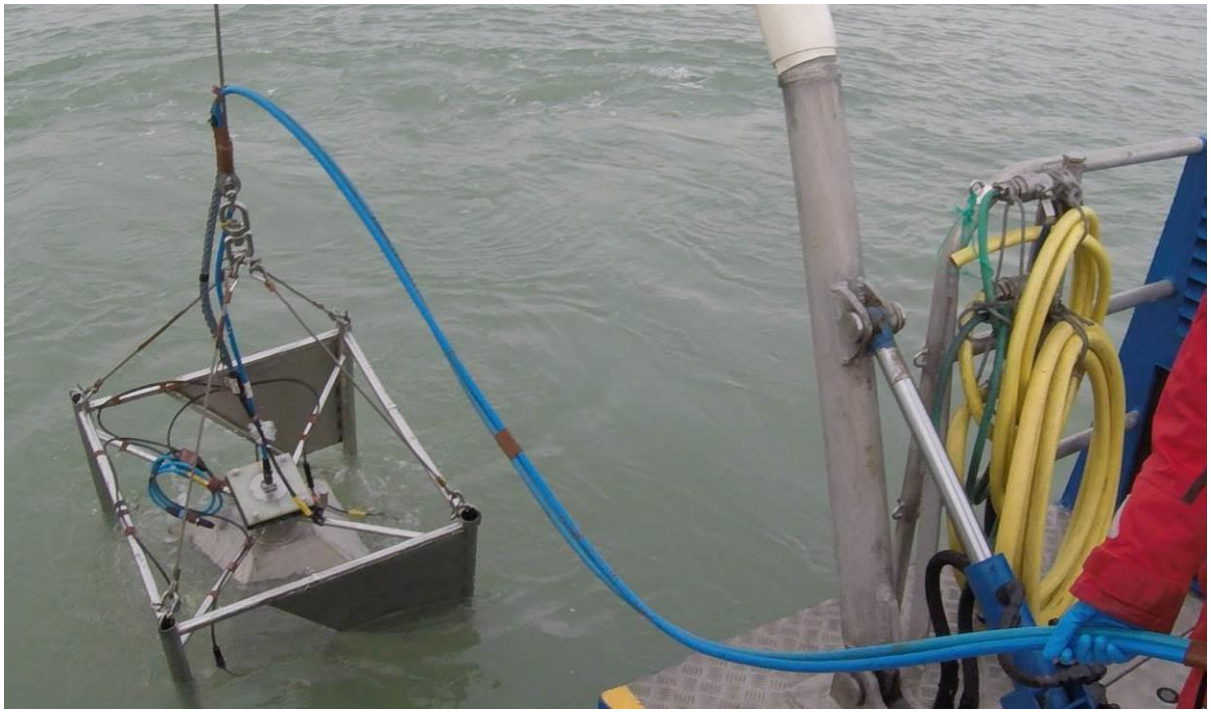
Type: 2 X Class II Safety Classification (<1 milliwatt output)
Beam Shape: Elliptical (Approx 6 mm Red Dot output)
Beam Divergence: - 0.75mrad
Wavelength: 650nm
Temperature Range: -10°C to 40°C

SEASPYDER DROP CAMERA FRAME

MECHANICAL

Length: 2.21m
Width: 1.43m
Height: 1.40m
Weight in Air: 125kg (Inc sensors)

7.2.3 Seastar Survey Ltd Camera System with Freshwater Lens



7.3 EA underwater video procedure_version 2.4 (STR Systems)

The procedure outlined below has developed through a series of discussions involving the Environment Agency, Cefas and Natural England. Due to the heterogeneous nature of the inshore coastal seabed habitat, strong tidal streams, various underwater hazards and no dynamic positioning system, a flexible approach is recommended for the underwater video camera deployment. The procedure must be used in accordance with the MESH 'recommended operating guidelines (ROG) for underwater video and photographic imaging techniques' (Coggan et al., 2007).

Important points to remember:

- **Select stern gantry offset in Hydropro**
- **Synchronise all survey equipment (camera, laptops, etc.) with primary survey GPS time (UTC).**
- **Ensure the correct date, station code, STN number, time and position are displayed on the video overlay and Clapperboard.**

Overlay Example:

EA ECMAS_2013-0925

WLOB050_STN_25 *(annotate if station has been attempted on a previous occasion)*

UTC: 133014 (*real time feed from survey GPS*)

Lat: 5020.6683N (*real time feed from survey GPS*)

Lon: 00423.5688W (*real time feed from survey GPS*)

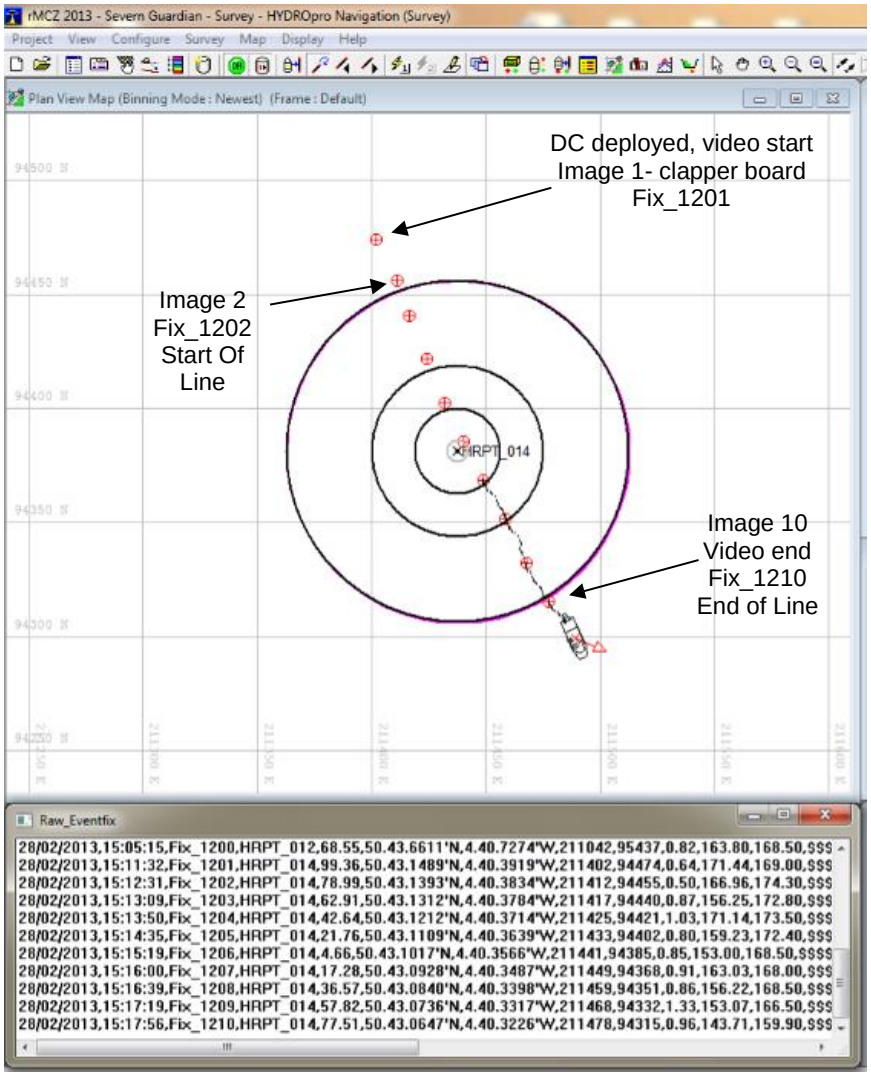
Clapperboard Example:

- **Alter the stills prefix to the correct station code.**

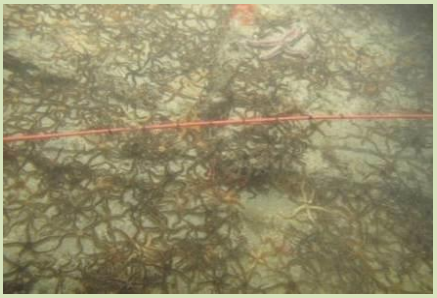
- **The field of view scale bar/laser points should be set up/calibrated prior to the survey commencing. Laser pointers are ineffective in moderate/poor visibility conditions; a rope with a visible scale will be required as a replacement**
- **Set the image resolution to Large Normal (14.7 Mega Pixels, 18 sec upload time)**
- **Check the camera settings are appropriate for the conditions; the LED lights are on if required and ensure the video is recording throughout the deployment.**

- **If a broad-scale habitat (BSH) boundary is detected extend the deployment to gather as much information on habitat extent as possible.**
- **Take extra stills if habitat/species FOCI are observed – note these in the survey log.**
- **If possible, work a downhill seabed profile to avoid slack cable during deployment.**
- **Beware of sudden depth changes when surveying rocky areas.**
- **Abandon the station if survey conditions are hazardous.**

Video Camera Type	Survey Conditions	Deployment
Drop down	Good visibility	*Deploy camera initially working across the Hydropro 75 m radius target area, as shown in the diagram below. Hover/rest camera above/on the seabed; take a still every 15 m. If tide/wind conditions do not allow a survey line to be followed across the bull ring, use the outer circle as a guide to ensure a distance of 150 m is covered (minimum) nearby.
	Poor visibility	Hover/rest camera above/on the seabed, take a still every 15 m. If the visibility is very poor, retrieve the equipment after taking 3-4 stills.



7.4 Underwater Visibility Scale

Example image	Scale	Definition
	Excellent	clear, sharp images - no suspended particulate matter
	Good	seabed features and epifauna clearly discernible
	Moderate	seabed features discernible - epifauna difficult to discern
	Poor	both seabed features and epifauna difficult to discern, low confidence in preliminary habitat assessment
	Very Poor	no seabed features or epifauna visible

7.5 Example MCZ Video logsheet

MCZ Video Logsheet (v1)

Station data

Contract Code: C5433 Vessel: Solent Guardian Date: 09/04/2016

MCZ Name: Mounts Bay Station Code: MNTB071

Nav-Log filename: SW 2016-0409 SL log Sampling Gear: DC Water Depth: 10·5 m

Cable Out: _____ (metres). Speed Over Ground (SOG): 1·0 (knots)

Notes on Station:
(including any times & adjustments to Cable Out)

Position Reference Point: Stern gantry

Sample data

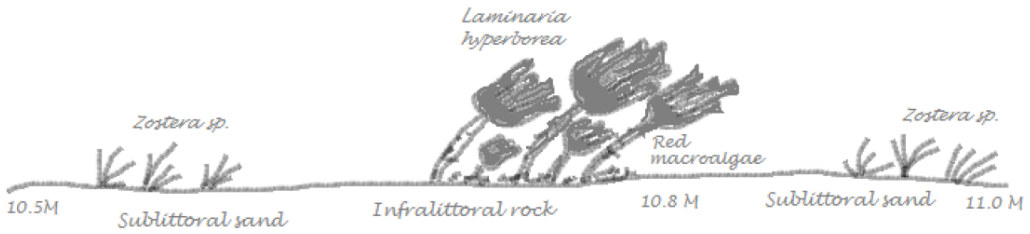
Digital Video Tape label: n/a

Filename on Hard-Drive: MNTB_2GDK70416_GT071_STN_1_A1_153751

No. of camera stills: 14 Stills folder name: GT071_STN_1

	GPS Time hh:mm		Fix No	Position in Lat/Long (WGS84)	DV tape counter Mins	Secs
Start of Video (SOV)	15	40	3862	50° 06·3266' N; 5° 32·2924' W	n/a	n/a
End of Video (EOV)	15	45	3875	50° 06·3893' N; 5° 32·2093' W	n/a	n/a

Visual / Video notes: (ground-type, terrain, visibility, species, FOCI, sketch of transect)

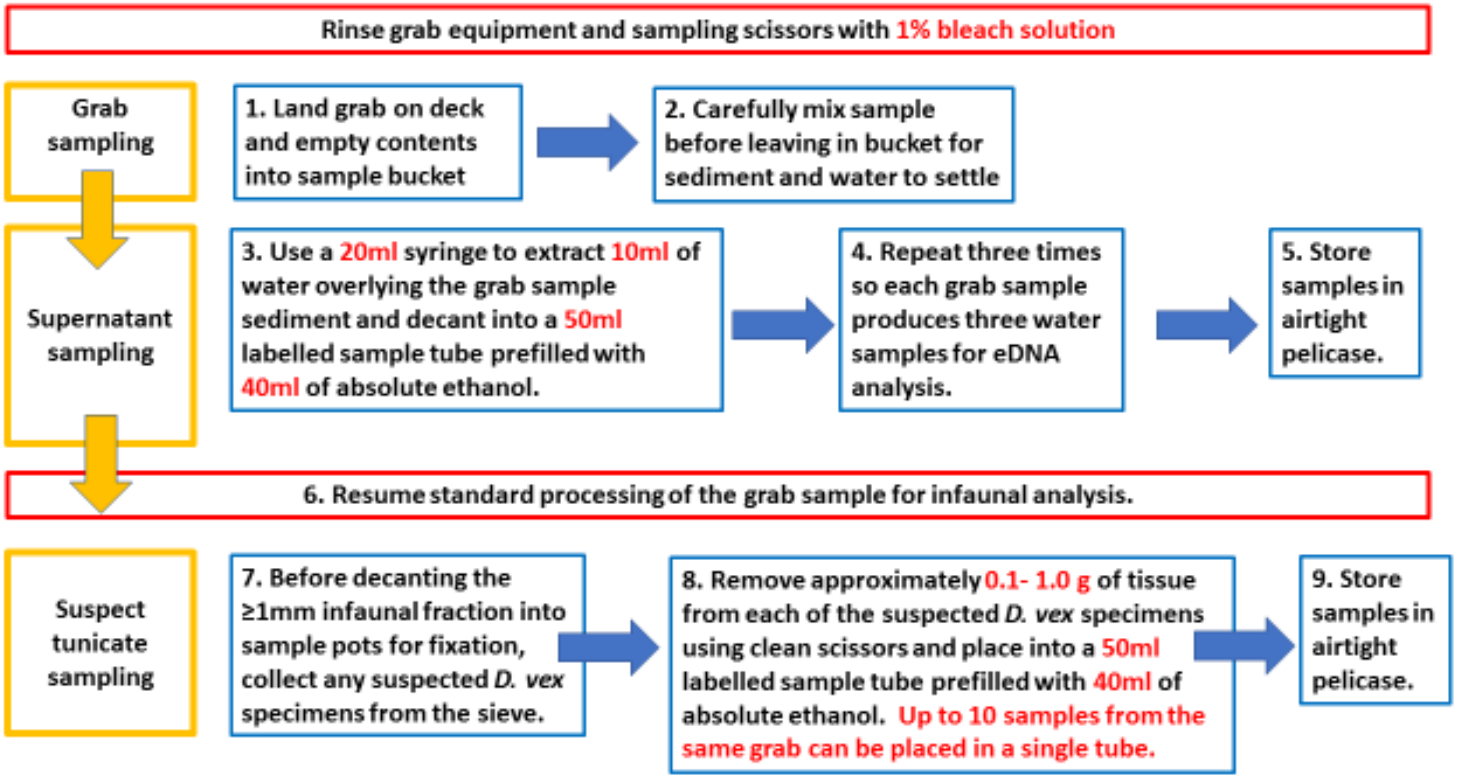


Broad-scale habitats observed

Infralittoral Rock ✓		Circalittoral Rock		Sediment habitats		Others	
high energy		high energy		subtidal mixed		macrophyte dominated sed's	✓
mod.energy		mod.energy		subtidal coarse			
low energy		low energy		subtidal mud		biogenic reef	
				subtidal sand	✓	deep-sea bed	

Completed by: K· Arnold Checked by: N· Godsell Entered by: K· Arnold

7.6 Cefas eDNA Methodology



7.7 Video Survey Metadata

Data is available upon request.

7.8 Grab Survey Metadata

Date	Time UTC	Station Code	WGS84 Latitude DD.DDDDD	WGS84 Longitude DD.DDDDD	STN no.	Hpro fix no.	Water depth (m)	Sediment vol. (litres) calculated	Sediment use
Sampling gear = Mini-Hamon Grab, sieve mesh = 1mm									
20/06/2017	06:08	THNC90	51.39812	1.44681	1	Fix_3607	15.02	-	Grab failed to fire
20/06/2017	06:10	THNC90	51.39786	1.44769	1	Fix_3608	15.41	0.5	Discard
20/06/2017	06:15	THNC90	51.39776	1.44767	1	Fix_3609	15.29	0.5	eDNA
20/06/2017	06:24	THNC90	51.39798	1.44731	1	Fix_3610	15.29	-	Grab failed to fire
20/06/2017	06:25	THNC90	51.39801	1.44778	1	Fix_3611	15.72	1.2	PSA/eDNA
20/06/2017	06:38	THNC71	51.39176	1.45237	2	Fix_3612	14.79	-	Discard
20/06/2017	06:40	THNC71	51.39160	1.45246	2	Fix_3613	14.62	0.5	Discard
20/06/2017	06:45	THNC71	51.39188	1.45224	2	Fix_3614	15.03	-	Grab failed to fire
20/06/2017	06:47	THNC71	51.39170	1.45213	2	Fix_3615	14.60	0.5	eDNA
20/06/2017	07:13	THNC87	51.40065	1.35019	3	Fix_3616	12.32	-	Discard
20/06/2017	07:16	THNC87	51.40070	1.35071	3	Fix_3617	12.86	-	Discard
20/06/2017	07:18	THNC87	51.40068	1.35083	3	Fix_3618	13.12	1.0	PSA/eDNA
20/06/2017	07:25	THNC91	51.40040	1.36161	4	Fix_3619	12.83	-	Tissue sample from probable Didemnid
20/06/2017	07:28	THNC91	51.40039	1.36119	4	Fix_3620	12.74	1.0	PSA/eDNA
20/06/2017	07:35	THNC91	51.40059	1.36136	4	Fix_3621	12.86	0.5	Discard
20/06/2017	07:44	THNC70	51.39413	1.36588	5	Fix_3622	8.31	-	Discard
20/06/2017	07:47	THNC70	51.39427	1.36661	5	Fix_3623	8.39	-	Discard
20/06/2017	07:49	THNC70	51.39431	1.36620	5	Fix_3624	8.45	-	eDNA
20/06/2017	07:55	THNC88	51.40017	1.37196	6	Fix_3625	11.32	-	Discard
20/06/2017	07:59	THNC88	51.39996	1.37202	6	Fix_3626	10.98	4.0	Biota/PSA/eDNA
20/06/2017	08:11	THNC92	51.39948	1.39402	7	Fix_3627	11.43	0.5	PSA/eDNA
20/06/2017	08:14	THNC92	51.39977	1.39413	7	Fix_3628	10.83	-	Discard
20/06/2017	08:17	THNC92	51.39962	1.39409	7	Fix_3629	11.11	-	Discard
20/06/2017	08:25	THNC96	51.40539	1.38827	8	Fix_3630	15.01	4	Biota/PSA/eDNA
20/06/2017	08:36	THNC94	51.40495	1.39965	9	Fix_3631	14.99	6.0	Biota/PSA/eDNA
20/06/2017	08:42	THNC97	51.40481	1.41072	10	Fix_3632	15.04	5.1	Biota/PSA/eDNA
20/06/2017	08:49	THNC86	51.39894	1.41508	11	Fix_3633	9.94	-	Discard
20/06/2017	08:52	THNC86	51.39879	1.41485	11	Fix_3634	9.80	0.5	eDNA
20/06/2017	08:54	THNC86	51.39884	1.41510	11	Fix_3635	9.84	-	Discard
20/06/2017	09:00	THNC99	51.40456	1.42147	12	Fix_3636	15.14	-	eDNA
20/06/2017	09:02	THNC99	51.40445	1.42142	12	Fix_3637	15.31	-	Discard

Date	Time UTC	Station Code	WGS84 Latitude DD.DDDDD	WGS84 Longitude DD.DDDDD	STN no.	Hpro fix no.	Water depth (m)	Sediment vol. (litres) calculated	Sediment use
20/06/2017	09:05	THNC99	51.40441	1.42145	12	Fix_3638	15.25	-	Discard
20/06/2017	09:13	THNC95	51.40370	1.44210	13	Fix_3639	15.92	0.7	PSA/eDNA
20/06/2017	09:16	THNC95	51.40369	1.44257	13	Fix_3640	16.03	-	Discard
20/06/2017	09:19	THNC95	51.40346	1.44223	13	Fix_3641	15.91	-	Discard
20/06/2017	09:24	THNC98	51.40339	1.45307	14	Fix_3642	16.89	-	Discard
20/06/2017	09:27	THNC98	51.40329	1.45290	14	Fix_3643	16.67	-	Discard
20/06/2017	09:30	THNC98	51.40347	1.45315	14	Fix_3644	16.96	2.0	PSA/eDNA
20/06/2017	09:38	THNC80	51.39159	1.46273	15	Fix_3645	16.24	0.5	Discard
20/06/2017	09:42	THNC80	51.39154	1.46306	15	Fix_3646	16.37	0.8	PSA/eDNA
20/06/2017	09:45	THNC80	51.39172	1.46296	15	Fix_3647	16.30	-	Discard
20/06/2017	09:52	THNC61	51.38562	1.45732	16	Fix_3648	12.41	-	Discard
20/06/2017	09:54	THNC61	51.38569	1.45740	16	Fix_3649	12.21	-	Discard
20/06/2017	09:57	THNC61	51.38573	1.45723	16	Fix_3650	12.00	0.5	PSA/eDNA
20/06/2017	10:04	THNC52	51.37962	1.47310	17	Fix_3651	12.94	-	Discard
20/06/2017	10:07	THNC52	51.37955	1.47264	17	Fix_3652	12.10	0.3	Discard
20/06/2017	10:09	THNC52	51.37941	1.47304	17	Fix_3653	11.22	0.6	PSA/eDNA
20/06/2017	10:20	THNC42	51.37395	1.45622	18	Fix_3654	10.28	-	Discard
20/06/2017	10:22	THNC42	51.37409	1.45651	18	Fix_3655	9.92	-	Discard
20/06/2017	10:25	THNC42	51.37414	1.45642	18	Fix_3656	9.92	0.3	eDNA
20/06/2017	10:31	THNC38	51.37307	1.46681	19	Fix_3657	10.85	-	Discard
20/06/2017	10:33	THNC38	51.37379	1.46677	19	Fix_3658	11.11	-	Discard
20/06/2017	10:35	THNC38	51.37364	1.46655	19	Fix_3659	12.62	0.1	eDNA
20/06/2017	10:43	THNC43	51.37321	1.47760	20	Fix_3660	11.86	-	Discard
20/06/2017	10:45	THNC43	51.37350	1.47767	20	Fix_3661	11.91	-	Discard
20/06/2017	10:47	THNC43	51.37344	1.47743	20	Fix_3662	11.85	0.1	eDNA
20/06/2017	10:53	THNC39	51.37314	1.48898	21	Fix_3663	12.49	-	Discard
20/06/2017	10:56	THNC39	51.37306	1.48861	21	Fix_3664	12.29	-	Discard
20/06/2017	10:58	THNC39	51.37309	1.48882	21	Fix_3665	12.40	-	eDNA
20/06/2017	11:45	THNC29	51.36195	1.47701	22	Fix_3666	9.79	-	Discard
20/06/2017	11:47	THNC29	51.36187	1.47668	22	Fix_3667	9.72	6.5	Biota/PSA/eDNA
20/06/2017	11:57	THNC19	51.34960	1.49750	23	Fix_3668	12.50	1.0	PSA/eDNA
20/06/2017	12:00	THNC19	51.34970	1.49798	23	Fix_3669	12.82	-	Discard
20/06/2017	12:02	THNC19	51.34968	1.49779	23	Fix_3670	12.85	-	Discard
20/06/2017	12:08	THNC18	51.34978	1.48673	24	Fix_3671	11.00	-	eDNA
20/06/2017	12:11	THNC18	51.34987	1.48675	24	Fix_3672	11.32	-	Discard

Date	Time UTC	Station Code	WGS84 Latitude DD.DDDDD	WGS84 Longitude DD.DDDDD	STN no.	Hpro fix no.	Water depth (m)	Sediment vol. (litres) calculated	Sediment use
20/06/2017	12:12	THNC18	51.34987	1.48655	24	Fix_3673	10.06	-	Discard
20/06/2017	12:22	THNC17	51.35077	1.45438	25	Fix_3674	8.07	-	eDNA
20/06/2017	12:24	THNC17	51.35076	1.45448	25	Fix_3675	8.04	-	Discard
20/06/2017	12:26	THNC17	51.35082	1.45514	25	Fix_3676	7.82	-	Discard
20/06/2017	12:31	THNC15	51.34436	1.45919	26	Fix_3677	8.10	-	Discard
20/06/2017	12:33	THNC15	51.34492	1.45955	26	Fix_3678	8.37	-	Discard
20/06/2017	12:35	THNC15	51.34514	1.45927	26	Fix_3679	8.99	-	eDNA
20/06/2017	12:42	THNC04	51.33321	1.45827	27	Fix_3680	9.26	-	PSA/eDNA
20/06/2017	12:44	THNC04	51.33332	1.45885	27	Fix_3681	7.90	-	Discard
20/06/2017	12:46	THNC04	51.33311	1.4587	27	Fix_3682	8.59	-	Discard
20/06/2017	12:52	THNC06	51.33328	1.44771	28	Fix_3683	6.84	-	Discard
20/06/2017	12:53	THNC06	51.33351	1.44821	28	Fix_3684	7.71	-	PSA/eDNA
20/06/2017	12:56	THNC06	51.33353	1.44812	28	Fix_3685	7.84	-	Discard
20/06/2017	13:01	THNC11	51.33957	1.44299	29	Fix_3686	6.60	-	Discard (Sabellaria? sample retained)
20/06/2017	13:03	THNC11	51.33955	1.44320	29	Fix_3687	6.78	-	Discard
20/06/2017	13:05	THNC11	51.33949	1.44273	29	Fix_3688	6.72	-	eDNA
20/06/2017	13:11	THNC05	51.33401	1.43704	30	Fix_3689	4.97	-	Discard (Sabellaria? sample retained)
20/06/2017	13:13	THNC05	51.33393	1.43708	30	Fix_3690	4.75	-	Discard (Sabellaria? sample retained)
20/06/2017	13:15	THNC05	51.33395	1.43732	30	Fix_3691	5.48	-	eDNA
20/06/2017	13:20	THNC01	51.32796	1.44189	31	Fix_3692	7.39	-	Discard
20/06/2017	13:22	THNC01	51.32821	1.44216	31	Fix_3693	7.07	-	PSA/eDNA
20/06/2017	13:24	THNC01	51.32803	1.44223	31	Fix_3694	7.45	-	Discard
21/06/2017	08:34	THNC40	51.38242	1.16588	32	Fix_3695	6.13	-	Discard
21/06/2017	08:38	THNC40	51.38238	1.16585	32	Fix_3696	6.15	2.5	Biota/PSA/eDNA
21/06/2017	08:48	THNC41	51.38203	1.17693	33	Fix_3697	5.93	3.5	Biota/PSA/eDNA
21/06/2017	08:53	THNC41	51.38208	1.17674	33	Fix_3698	6.04	-	Discard
21/06/2017	09:01	THNC44	51.38180	1.18772	34	Fix_3699	5.47	-	Discard
21/06/2017	09:03	THNC44	51.38186	1.18748	34	Fix_3700	5.52	-	Discard
21/06/2017	09:05	THNC44	51.38201	1.18769	34	Fix_3701	5.58	3.6	Biota/PSA/eDNA
21/06/2017	09:12	THNC48	51.38788	1.18260	35	Fix_3702	5.45	-	Discard
21/06/2017	09:14	THNC48	51.38782	1.18263	35	Fix_3703	5.58	3.0	Biota/PSA/eDNA
21/06/2017	09:16	THNC48	51.38784	1.18276	35	Fix_3704	5.57	-	Discard
21/06/2017	09:23	THNC46	51.38740	1.19331	36	Fix_3705	5.95	1.5	Biota/PSA/eDNA
21/06/2017	09:25	THNC46	51.38730	1.19340	36	Fix_3706	6.06	-	Didn't fire
21/06/2017	09:27	THNC46	51.38739	1.19337	36	Fix_3707	5.75	-	Discard

Date	Time UTC	Station Code	WGS84 Latitude DD.DDDDD	WGS84 Longitude DD.DDDDD	STN no.	Hpro fix no.	Water depth (m)	Sediment vol. (litres) calculated	Sediment use
21/06/2017	09:29	THNC46	51.38738	1.19339	36	Fix_3708	5.87	-	Discard
21/06/2017	09:40	THNC49	51.38713	1.20398	37	Fix_3709	6.14	-	Discard
21/06/2017	09:42	THNC49	51.38730	1.20424	37	Fix_3710	5.90	1.2	PSA/eDNA
21/06/2017	09:44	THNC49	51.38709	1.20404	37	Fix_3711	5.96	-	Discard
21/06/2017	09:50	THNC50	51.38689	1.21489	38	Fix_3712	6.77	-	Discard
21/06/2017	09:52	THNC50	51.38690	1.21487	38	Fix_3713	6.86	1.8	PSA/eDNA
21/06/2017	09:54	THNC50	51.38694	1.21475	38	Fix_3714	7.01	-	Discard
21/06/2017	10:05	THNC51	51.38670	1.22585	39	Fix_3715	6.31	-	Discard
21/06/2017	10:08	THNC51	51.38659	1.22565	39	Fix_3716	6.22	6.0	Biota/PSA/eDNA
21/06/2017	10:14	THNC57	51.39214	1.23156	40	Fix_3717	6.62	3.6	Biota/PSA/eDNA
21/06/2017	10:17	THNC57	51.39217	1.23156	40	Fix_3718	6.44	-	Discard
21/06/2017	10:23	THNC53	51.38630	1.23676	41	Fix_3719	5.18	-	Discard
21/06/2017	10:25	THNC53	51.38636	1.23696	41	Fix_3720	5.27	-	eDNA
21/06/2017	10:27	THNC53	51.38640	1.23680	41	Fix_3721	5.20	0.5	PSA
21/06/2017	10:32	THNC47	51.38580	1.24740	42	Fix_3722	5.35	-	Discard
21/06/2017	10:34	THNC47	51.38587	1.24752	42	Fix_3723	5.34	-	Didn't fire
21/06/2017	10:36	THNC47	51.38582	1.24732	42	Fix_3724	5.37	-	Discard
21/06/2017	10:40	THNC47	51.38589	1.24751	42	Fix_3725	5.33	1.2	PSA/eDNA
21/06/2017	10:47	THNC55	51.39172	1.24215	43	Fix_3726	6.38	-	Discard
21/06/2017	10:49	THNC55	51.39180	1.24205	43	Fix_3727	6.44	2.0	PSA/eDNA
21/06/2017	10:51	THNC55	51.39176	1.24210	43	Fix_3728	6.37	-	Discard
21/06/2017	10:56	THNC62	51.39161	1.25308	44	Fix_3729	8.35	5.0	Biota/PSA/eDNA
21/06/2017	11:05	THNC100	51.38679	1.26880	45	Fix_3730	4.69	3.0	Biota/PSA/eDNA
21/06/2017	11:13	THNC56	51.39126	1.26377	46	Fix_3731	9.97	-	Discard
21/06/2017	11:16	THNC56	51.39118	1.26378	46	Fix_3732	9.68	-	Discard
21/06/2017	11:19	THNC56	51.39116	1.26370	46	Fix_3733	9.79	3.5	Biota/PSA/eDNA
21/06/2017	11:26	THNC72	51.39690	1.26963	47	Fix_3734	14.68	6.0	Biota/PSA/eDNA
21/06/2017	11:32	THNC69	51.39655	1.28042	48	Fix_3735	11.39	0.5	eDNA
21/06/2017	11:35	THNC69	51.39654	1.28029	48	Fix_3736	11.08	-	Discard
21/06/2017	11:37	THNC69	51.39649	1.28020	48	Fix_3737	11.15	-	Discard
21/06/2017	11:44	THNC58	51.39087	1.27437	49	Fix_3738	7.99	6.0	Biota/PSA/eDNA
21/06/2017	11:50	THNC54	51.38523	1.27995	50	Fix_3739	4.52	0.5	PSA/eDNA
21/06/2017	11:52	THNC54	51.38529	1.27985	50	Fix_3740	4.34	-	Discard
21/06/2017	11:54	THNC54	51.38523	1.27982	50	Fix_3741	4.46	-	Discard
21/06/2017	12:39	THNC59	51.39071	1.28532	51	Fix_3742	6.40	-	Discard

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21/06/2017	12:41	THNC59	51.39072	1.28514	51	Fix_3743	6.20	-	Discard
21/06/2017	12:43	THNC59	51.39066	1.28522	51	Fix_3744	6.48	3.0	Biota/PSA/eDNA
21/06/2017	12:50	THNC75	51.39649	1.29109	52	Fix_3745	8.44	-	Discard
21/06/2017	12:53	THNC75	51.39652	1.29113	52	Fix_3746	8.40	-	Discard
21/06/2017	12:56	THNC75	51.39658	1.29111	52	Fix_3747	8.50	1.8	PSA/eDNA
21/06/2017	13:01	THNC63	51.39039	1.29606	53	Fix_3748	5.72	-	Discard
21/06/2017	13:03	THNC63	51.39060	1.29619	53	Fix_3749	5.79	5.8	Biota/PSA/eDNA
21/06/2017	13:10	THNC76	51.39604	1.30232	54	Fix_3750	15.41	6.0	Biota/PSA/eDNA
21/06/2017	13:17	THNC64	51.39017	1.30694	55	Fix_3751	4.04	2.4	PSA/eDNA
21/06/2017	13:19	THNC64	51.39018	1.30685	55	Fix_3752	4.18	-	Discard
21/06/2017	13:20	THNC64	51.39025	1.30674	55	Fix_3753	4.13	-	Discard
21/06/2017	13:27	THNC73	51.39579	1.31222	56	Fix_3754	13.27	-	Discard
21/06/2017	13:29	THNC73	51.39569	1.31204	56	Fix_3755	13.35	0.8	PSA/eDNA
21/06/2017	13:31	THNC73	51.39579	1.31214	56	Fix_3756	13.32	-	Discard
21/06/2017	13:37	THNC65	51.38987	1.31740	57	Fix_3757	2.21	-	Discard
21/06/2017	13:39	THNC65	51.38994	1.31724	57	Fix_3758	2.71	2.2	PSA/eDNA
21/06/2017	13:42	THNC65	51.39003	1.31739	57	Fix_3759	2.69	-	Discard
21/06/2017	13:48	THNC77	51.39554	1.32335	58	Fix_3760	11.68	-	Discard
21/06/2017	13:50	THNC77	51.39552	1.32328	58	Fix_3761	11.67	6.0	Biota/PSA/eDNA
21/06/2017	13:56	THNC82	51.40125	1.32935	59	Fix_3762	5.34	2.9	Biota/PSA/eDNA
21/06/2017	13:59	THNC82	51.40094	1.32910	59	Fix_3763	5.89	-	Discard
21/06/2017	14:01	THNC82	51.40106	1.32923	59	Fix_3764	6.45	-	Discard
21/06/2017	14:07	THNC78	51.39516	1.33452	60	Fix_3765	8.30	-	Discard
21/06/2017	14:09	THNC78	51.39536	1.33431	60	Fix_3766	8.37	4.5	Biota/PSA/eDNA
21/06/2017	14:16	THNC60	51.38945	1.32820	61	Fix_3767	3.50	6.0	Biota/PSA/eDNA
21/06/2017	14:24	THNC68	51.38998	1.33922	62	Fix_3768	2.12	-	Discard
21/06/2017	14:26	THNC68	51.39009	1.33914	62	Fix_3769	2.26	2.9	Biota/PSA/eDNA
21/06/2017	14:28	THNC68	51.39008	1.33911	62	Fix_3770	2.12	-	Discard
21/06/2017	14:34	THNC79	51.39493	1.34506	63	Fix_3771	7.24	0.8	PSA/eDNA
21/06/2017	14:36	THNC79	51.39489	1.34499	63	Fix_3772	7.10	-	Discard
21/06/2017	14:38	THNC79	51.39500	1.34489	63	Fix_3773	7.14	-	Discard
22/06/2017	08:24	THNC74	51.39454	1.35559	64	Fix_3774	7.19	-	Discard
22/06/2017	08:26	THNC74	51.39453	1.35543	64	Fix_3775	6.85	-	eDNA
22/06/2017	08:27	THNC74	51.39461	1.35563	64	Fix_3776	7.41	-	Discard
22/06/2017	08:37	THNC84	51.39961	1.38295	65	Fix_3777	11.65	-	eDNA

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22/06/2017	08:40	THNC84	51.39964	1.38277	65	Fix_3778	11.28	-	Discard
22/06/2017	08:42	THNC84	51.39959	1.38301	65	Fix_3779	11.83	-	Discard
22/06/2017	08:50	THNC85	51.39894	1.40479	66	Fix_3780	10.30	-	Discard
22/06/2017	08:53	THNC85	51.39900	1.40457	66	Fix_3781	10.42	-	Grab didn't fire
22/06/2017	08:53	THNC85	51.39908	1.40475	66	Fix_3782	10.50	-	eDNA
22/06/2017	08:56	THNC85	51.39904	1.40461	66	Fix_3783	10.52	-	Discard
22/06/2017	09:04	THNC93	51.39975	1.42465	67	Fix_3784	8.33	-	eDNA
22/06/2017	09:20	THNC93	51.39980	1.42461	67	Fix_3785	8.42	-	Discard
22/06/2017	09:23	THNC93	51.39983	1.42455	67	Fix_3786	8.24	-	Discard
22/06/2017	09:30	THNC83	51.39818	1.43681	68	Fix_3787	8.84	-	PSA/eDNA
22/06/2017	09:32	THNC83	51.39820	1.43665	68	Fix_3788	9.37	-	Discard
22/06/2017	09:35	THNC83	51.39802	1.43663	68	Fix_3789	9.26	-	Grab didn't fire
22/06/2017	09:36	THNC83	51.39798	1.43663	68	Fix_3790	8.39	-	Discard
22/06/2017	09:43	THNC81	51.39217	1.44215	69	Fix_3791	9.21	-	Discard
22/06/2017	09:45	THNC81	51.39245	1.44221	69	Fix_3792	9.15	-	eDNA
22/06/2017	09:48	THNC81	51.39234	1.44237	69	Fix_3793	9.08	-	Discard
22/06/2017	10:13	THNC34	51.36853	1.45108	70	Fix_3794	6.71	-	Grab didn't fire
22/06/2017	10:20	THNC34	51.36829	1.45107	70	Fix_3795	8.48	-	PSA/eDNA
23/06/2017	05:19	THNC03	51.32745	1.46375	71	Fix_3796	7.95	-	Discard
23/06/2017	05:21	THNC03	51.32748	1.46380	71	Fix_3797	7.99	1.5	PSA/eDNA
23/06/2017	05:23	THNC03	51.32743	1.46387	71	Fix_3798	8.00	-	Discard
23/06/2017	05:29	THNC07	51.33280	1.46957	72	Fix_3799	8.05	-	Grab didn't fire
23/06/2017	05:31	THNC07	51.33290	1.46918	72	Fix_3800	6.59	-	Discard
23/06/2017	05:33	THNC07	51.33285	1.46942	72	Fix_3801	8.25	2.0	Biota/PSA/eDNA
23/06/2017	05:35	THNC07	51.33285	1.46937	72	Fix_3802	7.26	-	Grab didn't fire
23/06/2017	05:36	THNC07	51.33295	1.46934	72	Fix_3803	8.17	-	Discard
23/06/2017	05:44	THNC14	51.34400	1.48126	73	Fix_3804	8.62	-	Discard
23/06/2017	05:46	THNC14	51.34403	1.48100	73	Fix_3805	8.33	-	eDNA
23/06/2017	05:48	THNC14	51.34414	1.48106	73	Fix_3806	8.42	-	Discard
23/06/2017	05:56	THNC24	51.35574	1.48212	74	Fix_3807	8.95	0.9	PSA/eDNA
23/06/2017	05:58	THNC24	51.35572	1.48204	74	Fix_3808	9.27	-	Discard
23/06/2017	06:00	THNC24	51.35591	1.48201	74	Fix_3809	8.64	-	Discard
23/06/2017	06:05	THNC22	51.35541	1.49304	75	Fix_3810	10.11	-	PSA/eDNA
23/06/2017	06:07	THNC22	51.35541	1.49257	75	Fix_3811	10.15	-	Discard
23/06/2017	06:09	THNC22	51.35547	1.49291	75	Fix_3812	9.50	-	Discard

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23/06/2017	06:14	THNC30	51.36144	1.48798	76	Fix_3813	9.71	5.3	Biota/PSA/eDNA
23/06/2017	06:20	THNC31	51.36107	1.49864	77	Fix_3814	9.58	-	eDNA
23/06/2017	06:22	THNC31	51.36119	1.49828	77	Fix_3815	10.02	-	Discard
23/06/2017	06:24	THNC31	51.36129	1.49853	77	Fix_3816	9.75	-	Discard
23/06/2017	06:29	THNC33	51.36667	1.50380	78	Fix_3817	8.35	-	eDNA
23/06/2017	06:31	THNC33	51.36672	1.50356	78	Fix_3818	9.97	-	Discard
23/06/2017	06:33	THNC33	51.36667	1.50352	78	Fix_3819	10.57	-	Discard
23/06/2017	06:40	THNC32	51.36690	1.49344	79	Fix_3820	12.19	-	Discard
23/06/2017	06:42	THNC32	51.36687	1.49359	79	Fix_3821	12.30	-	eDNA
23/06/2017	06:44	THNC32	51.36686	1.49353	79	Fix_3822	12.33	-	Discard
23/06/2017	07:02	THNC89	51.39743	1.45828	80	Fix_3823	14.60	-	Discard
23/06/2017	07:04	THNC89	51.39734	1.45821	80	Fix_3824	14.34	-	Discard
23/06/2017	07:07	THNC89	51.39760	1.45832	80	Fix_3825	14.90	0.9	PSA/eDNA
23/06/2017	07:21	THNC36	51.36773	1.47210	81	Fix_3826	9.49	0.5	PSA/eDNA
23/06/2017	07:23	THNC36	51.36765	1.47236	81	Fix_3827	9.86	-	Discard
23/06/2017	07:25	THNC36	51.36770	1.47205	81	Fix_3828	9.54	-	Discard
23/06/2017	07:32	THNC35	51.36807	1.46169	82	Fix_3829	9.17	-	Discard
23/06/2017	07:34	THNC35	51.36807	1.46130	82	Fix_3830	10.34	4.2	Biota/PSA/eDNA
23/06/2017	07:36	THNC35	51.36819	1.46179	82	Fix_3831	8.80	-	Discard
23/06/2017	07:41	THNC27	51.36242	1.45586	83	Fix_3832	9.48	-	Discard
23/06/2017	07:43	THNC27	51.36240	1.45531	83	Fix_3833	9.11	-	Grab didn't fire
23/06/2017	07:46	THNC27	51.36247	1.45567	83	Fix_3834	9.38	3.0	Biota/PSA/eDNA
23/06/2017	07:48	THNC27	51.36234	1.45554	83	Fix_3835	9.54	-	Discard
23/06/2017	07:56	THNC21	51.35641	1.46042	84	Fix_3836	9.07	-	Discard
23/06/2017	07:57	THNC21	51.35641	1.46053	84	Fix_3837	9.42	-	eDNA
23/06/2017	08:00	THNC21	51.35628	1.46047	84	Fix_3838	9.55	-	Discard
23/06/2017	08:06	THNC23	51.35610	1.47119	85	Fix_3839	8.36	-	Discard
23/06/2017	08:08	THNC23	51.35626	1.47107	85	Fix_3840	8.25	-	Discard
23/06/2017	08:10	THNC23	51.35622	1.47120	85	Fix_3841	8.49	-	PSA/eDNA
23/06/2017	08:16	THNC16	51.35046	1.46555	86	Fix_3842	10.67	-	Discard
23/06/2017	08:18	THNC16	51.35057	1.46553	86	Fix_3843	10.33	-	PSA/eDNA
23/06/2017	08:20	THNC16	51.35040	1.46572	86	Fix_3844	10.33	-	Discard
23/06/2017	08:26	THNC13	51.34447	1.47061	87	Fix_3845	10.18	-	Discard
23/06/2017	08:28	THNC13	51.34446	1.47059	87	Fix_3846	9.61	-	Discard
23/06/2017	08:31	THNC13	51.34445	1.47052	87	Fix_3847	9.62	-	eDNA

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23/06/2017	08:44	THNC02	51.32796	1.45308	88	Fix_3848	10.89	-	PSA/eDNA
23/06/2017	08:46	THNC02	51.32785	1.45296	88	Fix_3849	11.24	-	Discard
23/06/2017	08:49	THNC02	51.32796	1.45279	88	Fix_3850	11.14	-	Discard
Sampling gear - Day Grab, sieve mesh = NA									
08/07/2017	08:03	THNC41	51.38245	1.17650	89	-	3.64	8.0	Contaminants
08/07/2017	08:07	THNC41	51.38218	1.17664	89	-	3.29	-	Discard
08/07/2017	08:08	THNC41	51.38211	1.17641	89	-	3.43	4.0	Contaminants
08/07/2017	08:29	THNC58	51.39092	1.27382	90	-	7.12	8.0	Contaminants
08/07/2017	08:33	THNC58	51.39116	1.27422	90	-	7.87	10.0	Contaminants
08/07/2017	08:46	THNC77	51.39529	1.32340	91	-	11.76	9.0	Contaminants
08/07/2017	09:33	THNC30	51.36198	1.48818	92	-	12.60	10.0	Contaminants
08/07/2017	09:37	THNC30	51.36158	1.48755	92	-	12.88	-	Contaminants

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