RESEARCH VESSEL SURVEY REPORT

RV CEFAS ENDEAVOUR
Survey: C END 01 - 2017.

STAFF:

Name	Role	Name	Role
Joanna Murray	SIC	Hayden Close	Plankton ecologist
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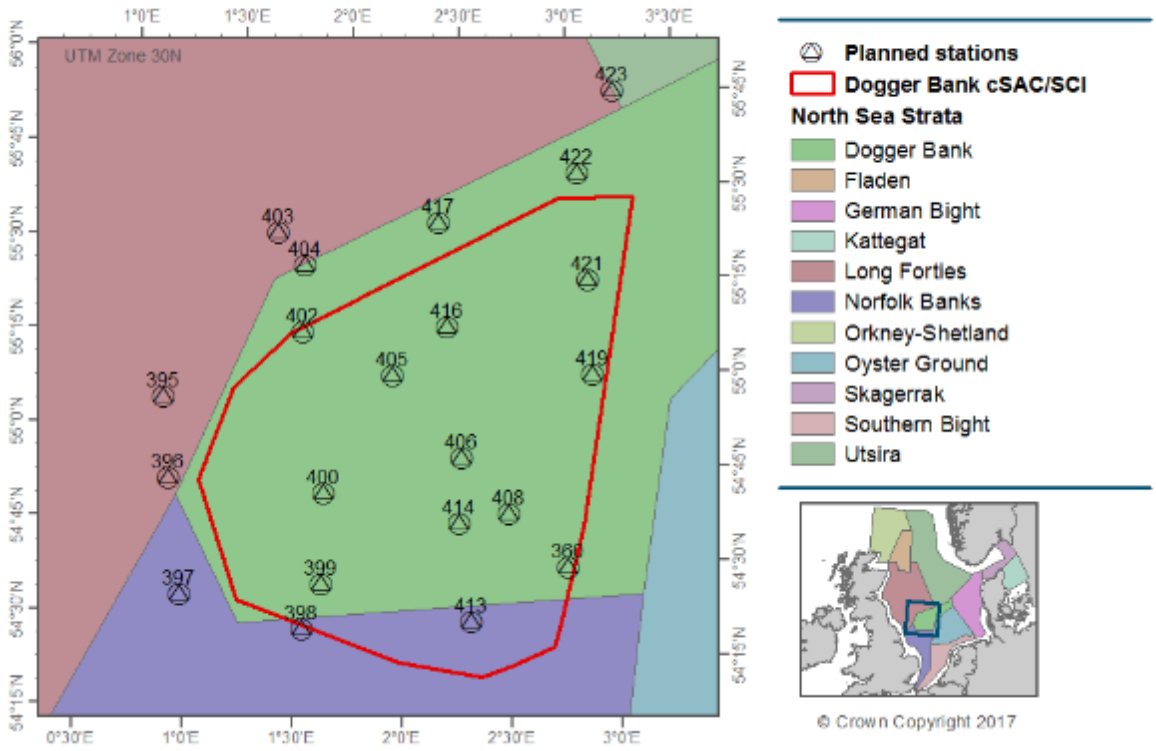
David Clare	Benthic ecologist	Dave Sivyer	Biogeochemist
James Pettigrew	Plankton ecologist	Chris Firmin	Shellfish scientist

DURATION: Twelve days between the 5th January and the 17th January 2017.

LOCATION: The Dogger Bank WKPIMP stratum located in the centre of the North Sea (Figure 1).



AIMS:

Overall aim: Integrating data collection within the UK portion of the Dogger Bank WKPIMP Strata to understand ecosystem processes in the North Sea, thereby informing the development of the UK marine monitoring programme.

<u>High level hypotheses (Priority 1)</u>

- There is no difference in the fish communities sampled at fixed stations within the Dogger Bank Stratum between Q1 (January) and Q3 (July).
- There is no difference in the epifaunal species present at fixed stations within the Dogger Bank Stratum between Q1 (January) and Q3 (July).
- There is no difference in water column parameters (temperature, salinity and depth) at fixed stations within the Dogger Bank stratum between Q1 (January) and Q3 (July).
- Within Q1, there is no spatial variability in environmental characteristics and water quality parameters (temperature, salinity, alkalinity, dissolved inorganic carbon (DIC), nutrients) and biological communities/key trophic groups (fish, plankton, epifauna and infauna) within the Dogger Bank Strata.

<u>High Level Hypotheses-(Priority 2)</u>

- There are no differences in epifaunal samples collected using the Grande Overture Verticale (GOV) and the 2m beam trawl.
- There are no differences in plankton samples collected using a 200 µm and a 80 µm ring net.
- There are no differences in plankton samples collected using the Cefas Automated Litter and Plankton Sampler (CALPS) and a 80 µm ring net.
- There are no differences in infaunal samples collected using a 0.1 m2 Hamon grab and a NIOZ core.

Operational aims

1) To collect hydrographic information, including:

   - Full depth, conductivity and temperature profiles at each trawl station alongside surface and near-bottom water samples using a Niskin water sampler with ESM2 logger;
   - To collect water column alkalinity, dissolved inorganic carbon (DIC), suspended particulate matter (SPM), oxygen and nutrient samples; and
   - Continuously logged sub-surface (~3 m depth) salinity, temperature, fluorometry and other environmental data using the 'Ferrybox'.

2) Collect information on seabed substrata, including:

   - Distribution of sedimentary habitats (including biogeochemical parameters; sediment particle size analysis (PSA) and organic carbon (OCN), Porosity/Chlorophyll, O2/pH, Rapid Fines Assessment (RFA) and microplastics);

   - Distribution of macrobenthos (infaunal and epifaunal).

3) To collect plankton community and biodiversity data (ichthyoplankton, macro and gelatinous zooplankton).

4) To collect fish, cephalopod and invertebrate community and biodiversity data.

   Catches from the trawls (GOV and 2 m beam trawl) will be processed according to International Bottom Trawl Survey (IBTS) protocols as appropriate to obtain information on:

   - Distribution, size composition and relative abundance of fish, cephalopods, and epibenthic species;

   - Age-length distribution, biological parameters and stomach contents of plaice (*Pleuronectes platessa*), lemon sole (*Microstomus kitt*) and haddock (*Melanogrammus aeglefinus*).

5) Collect information on:
   - Distribution and classification of anthropogenic litter/debris and microplastics (according to the protocol provided in Annex 3); and

   - Presence and distribution of non-indigenous species (NIS) (according to the protocol provided in Annex 4).

6) To opportunistically record surface sightings of any marine mammals, sea turtles and large pelagic fish and record observations of jellyfish aggregations.

7) To develop and test novel technologies and approaches for monitoring:

   - Cefas Automated Litter and Plankton Sampler (CALPS).

NARRATIVE:

The RV Cefas Endeavour departed Lowestoft at 00:42 on the 6th January 2017 and transited north towards the North Sea Dogger Bank strata. The vessel arrived at the selected multibeam echosounder calibration site, situated two hours to the south of the Dogger Bank survey site, at 13:00. We first ran across the charted location of the wreck to confirm its position before commencing a Sound Velocity Profile (SVP) dip. Five lines were run in total. On completion of the calibration we continued the transit north and arrived at the Dogger Bank survey site at 17:45pm on the 6th January 2017.
The first deployment of the survey was carried out at station DGRB413 in the south east of the site. A SVP was deployed prior to a multibeam echosounder line which was run into the tide (to ensure it would coincide with the orientation of the GOV tow transect). The acquired multibeam echosounder data were processed before a habitat mapper carried out a segmentation on the processed data to identify acoustically distinguishable facies within the line of multibeam. Only one acoustic facie was identified for the first station sampled, due to a technical problem with the multibeam echosounder receiver unit. Environmental sampling continued from the station's centroid (50 m diameter bullring). First a water sample, comprising a 30 l Niskin bottle and linked ESM2 logger was deployed, followed by two plankton net deployments, the first with two 0.5 m ring nets (one 200 µm mesh and one 80 µm mesh) each with a flowmeter mounted in the centre of the net. Operations then moved to the stern gantry for a 15 minute camera sledge tow (at ~0.3 knots) followed by a 5 minute 2 m beam trawl tow (5 knots). Triplicate 0.1 m2 Hamon grab deployments for sediment PSA and macrofauna community analysis were collected, followed by two NIOZ core deployments; the first for PSA, OCN, porosity and chlorophyll, sediment O2 and pH profiling, RFA and microplastics and the second NIOZ core for pore water. Environmental sampling was completed at station DGRB413 at 03:30am on the 7th January 2017 after which, RV Cefas Endeavour moved on to the second station.

Environmental sampling began at the second station DGRB360 at 05:00 (7th January 2017) with multibeam echosounder acquisition and followed the same sampling sequence described above until 11:30am on the same day when GOV sampling commenced at the second station. On completion of the first GOV trawl, RV Cefas Endeavour transited to the third station DGRB406. An SVP was undertaken on arrival but on initiation of the multibeam system, it failed to operate with a suspected failure in the receiver unit, an issue which was unresolvable during the remainder of the survey. The decision was made to continue environmental sampling without running the multibeam echosounder line for habitat mapping, and environmental sampling commenced according to the established order at 18:50 on the 7th January 2017, with completion at 24:00. At 01:00 on 8th January 2017, RV Cefas Endeavour arrived at the fourth sampling station, DGRB414, and began environmental sampling. On completion at 08:30 on the same day, GOV sampling commenced for daylight hours' fishing operations with stations DGRB414, DGRB360 and DGRB406 acquired before sunset. At 18:00, environmental sampling was completed at DGRB419 and initiated at DGRB421 at 23:40. All environmental sampling was complete at DGRB421 by 03:10 on the 9thJanuary 2017 with sampling at the next station DGRB416 beginning at 05:30 on the same day. All environmental sampling was completed at DGRB416 by 11:00, after which a GOV trawl was acquired to complete all sampling operations at DGRB416. Environmental

sampling was completed at DGRB402 by 20:45 and initated at 22:50 at DGRB405. On the 10th January 2017, environmental sampling at DGRB405 was complete by 04:45 and then completed at DGRB400 by 10:30. During daylight hours, a GOV trawl was acquired at station DGRB400 and DGRB405.

Environmental sampling resumed at station DGRB399 at 18:00 on the 10th January 2017 and was initiated at 22:41 at station DGRB398. By 03:30 on the 11th January 2017, weather conditions had worsened with westerly winds blowing 40 knots and sampling operations were stopped when the vessel could no longer hold station. The decision was made to transit towards the coast at Flamborough Head to seek shelter from the developing storm. Conditions on site did not improve until 15:00 on the 14th January 2017 when RV Cefas Endeavour began a slow transit towards site for a timed arrival when conditions were safe for survey operations to commence. The vessel arrived on site at station DGRB419 at 11:20 on the 15th January 2017 with conditions suitable for GOV deployment. During daylight hours on the 15th January 2017 we were also able to complete GOV sampling at station DBRB421 before transiting to station DGRB422 to begin environmental sampling at 16:45 on the same day. Environmental operations were completed at station DGRB422 at 21:30 after which, RV Cefas Endeavour transited to station DGRB417 to initiate environmental sampling at 23:45. Environmental sampling, with the exception of triplicate Hamon grabs, was completed at station DGRB417 at 03:00 on the 16th January 2017 at which time, the transit to station DGRB399 began to ensure arrival in daylight hours to collect the final GOV sample (completed at 10:00 on the same day). RV Cefas Endeavour then began the transit back to Lowestoft for a timed arrival to meet the pilot at 22:00. By 23:00 hours on the 16th January 2017, RV Cefas Endeavour was alongside in her home port of Lowestoft. Cefas scientists demobilised the vessel during the morning of the 17thJanuary 2017.

RESULTS:

A total of ten stations were sampled in full including water and plankton samples, a camera sledge transect, a 2 m beam trawl tow, triplicate mini-Hamon grab samples, duplicate NIOZ core samples and a valid GOV sample. A subset of the planned environmental sampling was completed at an additional four stations (Table 1). The location of stations where all sampling (environmental and GOV trawl) were completed is shown in Figure 2 and stations where only a subset of environmental sampling was completed are shown in Figure 3.

Table 1. Summary sample metadata including station positions.

Station	Water	Plankton	Camera sledge	2m beam	Hamon grab	NIOZ core	GOV
DGRB360	✓	✓	✓	✓	✓	✓	✓
DGRB398	✓	✓	✓	✓	✓	✖	✖
DGRB399	✓	✓	✓	✖	✓	✓	✓
DGRB400	✓	✓	✓	✓	✓	✓	✓
DGRB402	✓	✓	✓	✓	✓	✓	✖
DGRB405	✓	✓	✓	✓	✓	✓	✓
DGRB406	✓	✓	✓	✓	✓	✓	✓
DGRB413	✓	✓	✓	✓	✓	✓	✓
DGRB414	✓	✓	✓	✓	✓	✓	✓
DGRB416	✓	✓	✓	✓	✓	✓	✓
DGRB417	✓	✓	✓	✓	✖	✓	✖
DGRB419	✓	✓	✓	✓	✓	✓	✓
DGRB421	✓	✓	✓	✓	✓	✓	✓
DGRB422	✓	✓	✓	✓	✓	✓	✖

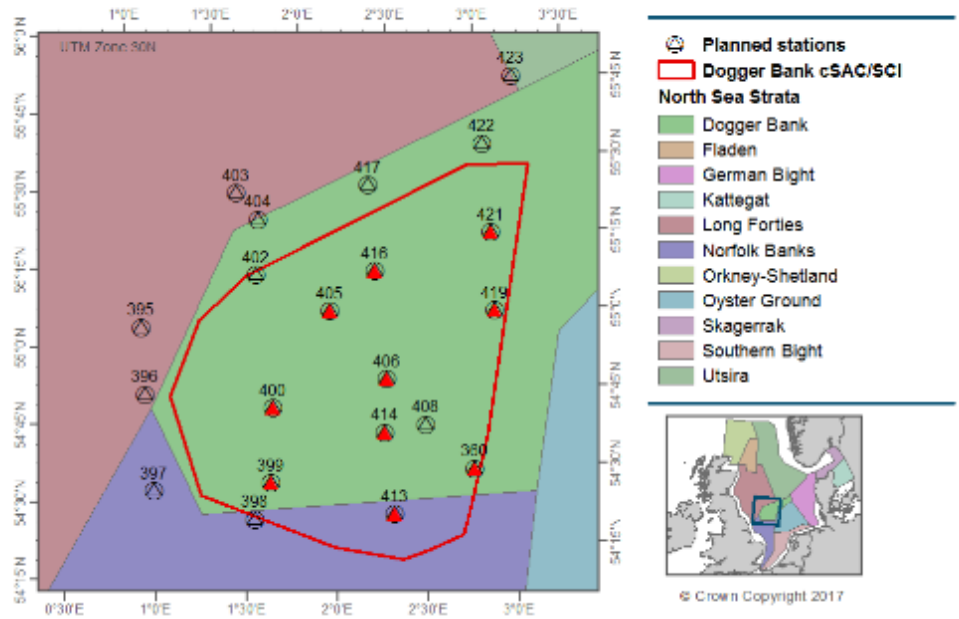


Figure 2. Location of stations at which all sampling, including environmental and GOV trawls were completed.

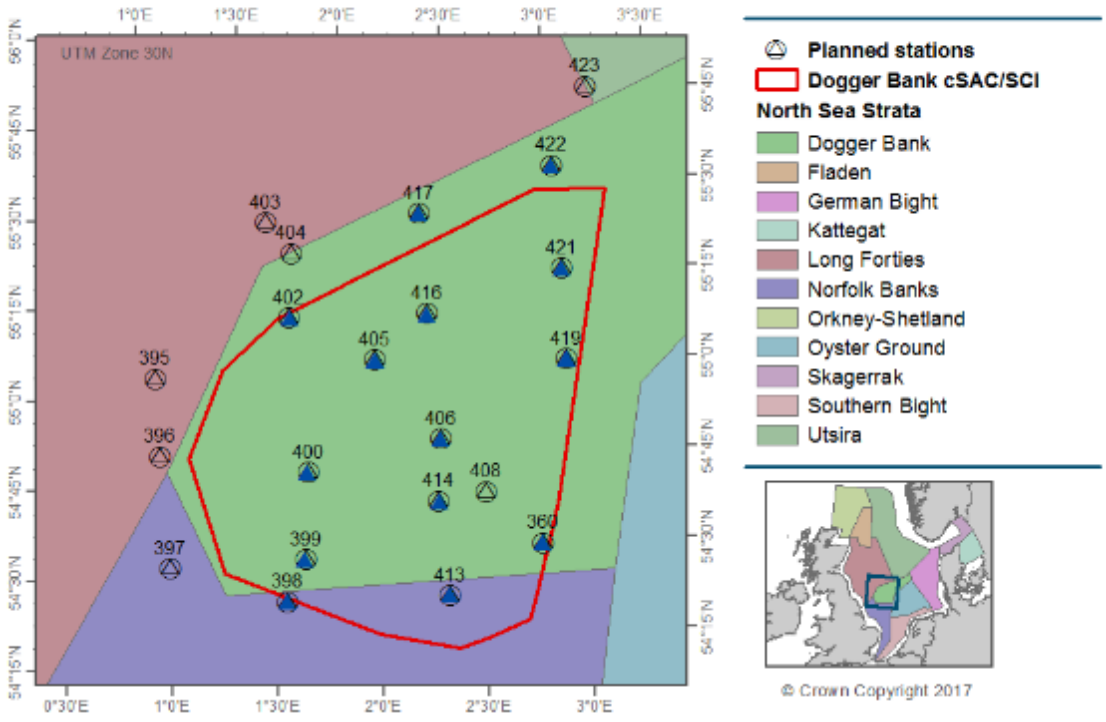


Figure 3. Location of stations where a subset of environmental sampling was completed.

Joanna Murray
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