



Centre for Marine and Coastal Studies

Field Survey Report – Benthic Sampling using Beam Trawls, Otter Trawls and Day Grabs in the Thames Estuary during 2003 and 2004

A report to
E.ON Renewables UK

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1. Introduction

This report presents the data obtained from a series of trawl surveys and benthic grab surveys as part of the support for the application for a license to construct an offshore windfarm in the outer Thames estuary.

These surveys were designed and carried out by the Centre for Marine and Coastal Studies Ltd.

2. Trawl surveys

2.1. Methods and survey dates

Trawl surveys were completed during the following periods

April 21 - 27 2003

July 7 - 15 2003

December 6 - 11 2003

February 20 - 26 2004

On each occasion trawls were carried out at forty-three locations around the study area (as proposed at the time) and seventeen locations along the cable route options (as proposed at the time the surveys were designed) (Figure 1). Surveys were undertaken from the inshore fishing vessel “Ina K” (Skipper K. Knapp). In each case a 2m Beam trawl was deployed at 55 locations and a 4.6m Otter trawl used at 5 locations in and around the study area. The Otter trawl was used in addition to the Beam trawl to provide a better assessment of commercial fish species within the area (see Figure 1 for location of Beam and Otter trawls).

Sites 8, 18, 24, 31, 33 were otter trawl sites whilst the others were all beam trawl sites.

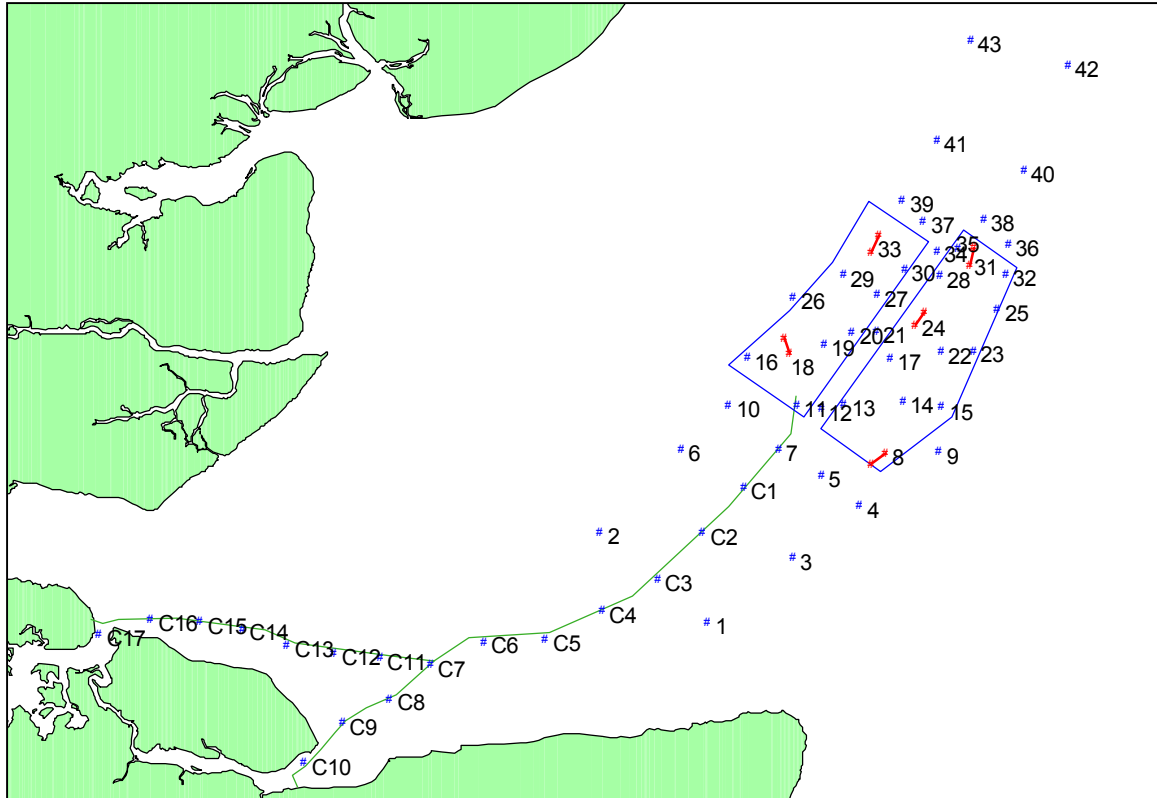


Figure 1 Beam trawl (blue dots) and Otter trawl (red line) locations in relation to proposed turbine (blue boxes) and cable route (green line) locations as understood at the time the surveys were planned.

2.1.1. Detailed methods – Beam trawl

For the fifty-five beam trawl sites a 2m beam trawl with a 4mm square cod end mesh was used with a chain matrix between the beam and the foot rope. The trawl was deployed behind the boat and towed for a length of 300m at a speed of 2 knots for a period of 5 minutes with sufficient warp to allow the gear to fish the bottom properly.

After tow completion all trawl contents were emptied into a fish box and photographed. All fish and non-colonial organisms were identified and recorded and the majority of commercial fish species were measured using a graduated fish board. When a large volume of catch was obtained it was often necessary to apply sub-sampling. The same process was applied as for the previous three surveys whereby the catch was first sorted in its entirety in order to remove, count and (if appropriate) measure all fish and more obvious organisms found. The remaining material, containing mainly very small or very numerous organisms, was then sub-sampled by an appropriate amount and all organisms recorded. Estimates of numbers of organisms from the sub-samples (numbers found multiplied by the appropriate sub-sampling factor) were then added to the counts from the entire sample.

Abundance of colonial organisms which could not be counted was estimated visually according to the following scale.

<10g	RARE
10-100g	OCCASIONAL
100-1000g	FREQUENT
1-10 KG	COMMON
>10KG	ABUNDANT

2.1.2. Detailed methods – Otter trawl

For the five otter trawl sites a standard commercial “6 fathom” otter trawl was used. This comprised of 4 inch rubber discs on the ground rope, and a 15 ft (4.6m) mouth when deployed, with the addition of a non standard 10mm square mesh sleeve in the cod end. Otter trawls were fished into the current for 25 minutes at a speed of approximately 1.6 knots for 1.2 km over the ground.

After tow completion all trawl contents were emptied into a fish box and photographed. All fish and non-colonial organisms were counted and recorded with the majority of commercial fish species being measured using a graduated fish board. Sub-sampling was not required for the otter trawl samples.

3. Grab surveys

3.1. Methods

A comprehensive grab sampling survey, refined after consultation with English Nature, CEFAS and the Kent and Essex Sea Fisheries Committee, was carried out during the summer

of 2004. The survey design was based as far as possible around preliminary results of seabed features, together with British Geological Survey maps and Admiralty charts, in order to ensure coverage of a variety of different seabed types. For this reason the coverage was not spread evenly over the area, but was more concentrated where a variety of seabed types were expected within a small area and more widely spread where the seabed was expected to be more uniform over a broad area. Sampling locations were also placed outside the proposed array area, particularly to the north east and south west within approximately one tidal excursion, estimated from Admiralty charts as approximately 14 km, since this is the line along which predominant currents might be expected to carry any effects such as sediment plumes.

At approximately 10% of locations, three separate faunal samples were taken in order to investigate replicability over small scales.

At forty-two locations, additional samples were obtained in order to analyse sediments for possible chemical contaminants. On two occasions these samples were obtained but it then proved impossible to obtain desired faunal samples from the same site. This is of no importance, however, since the only reason that the faunal and contamination samples were generally obtained from the same locations was for convenience of sampling.

Due to the nature of the project, the proposed array area was changed during and after sampling period, but the broad sampling objectives were still met. Other minor changes to the proposed sampling regime occurred when it proved impossible to obtain any samples at all at certain sites; or when a single sample was obtained but it then proved impossible to obtain desired further samples for replicates;

At a few sites, beam trawl surveys indicated the presence of aggregations of Ross worm *Sabellaria spinulosa* in December 2003 and/or February 2004, (though none were found during the April or July 2003 surveys at the same sites). Some grab sampling stations in this survey were positioned directly over the centre of those beam trawl sites where the main aggregations were found.

Grab sampling locations are shown in Figure 2.

A standard 0.1 m² Day Grab was used for almost all of the samples. At a very small number of sites in the aggregate extraction area to the north of the proposed array area, the seabed was too coarse for the Day grab and a very similar, but slightly modified, grab was used. The modified grab still has two jaws identical to the standard grab, but uses an action more similar to the “scooping” action of the Hamon grab. Thus, after sampling the jaws are held at an angle so that sediment cannot fall between the jaws if they are held apart by stones, shells etc. This Grab takes an almost identical size and shape of “bite” from the seabed as the Day Grab.

Digital photographs of each sample and written descriptions of visual appearance of sediments were taken at the time of sampling. The position of each sample location was recorded using DGPS.

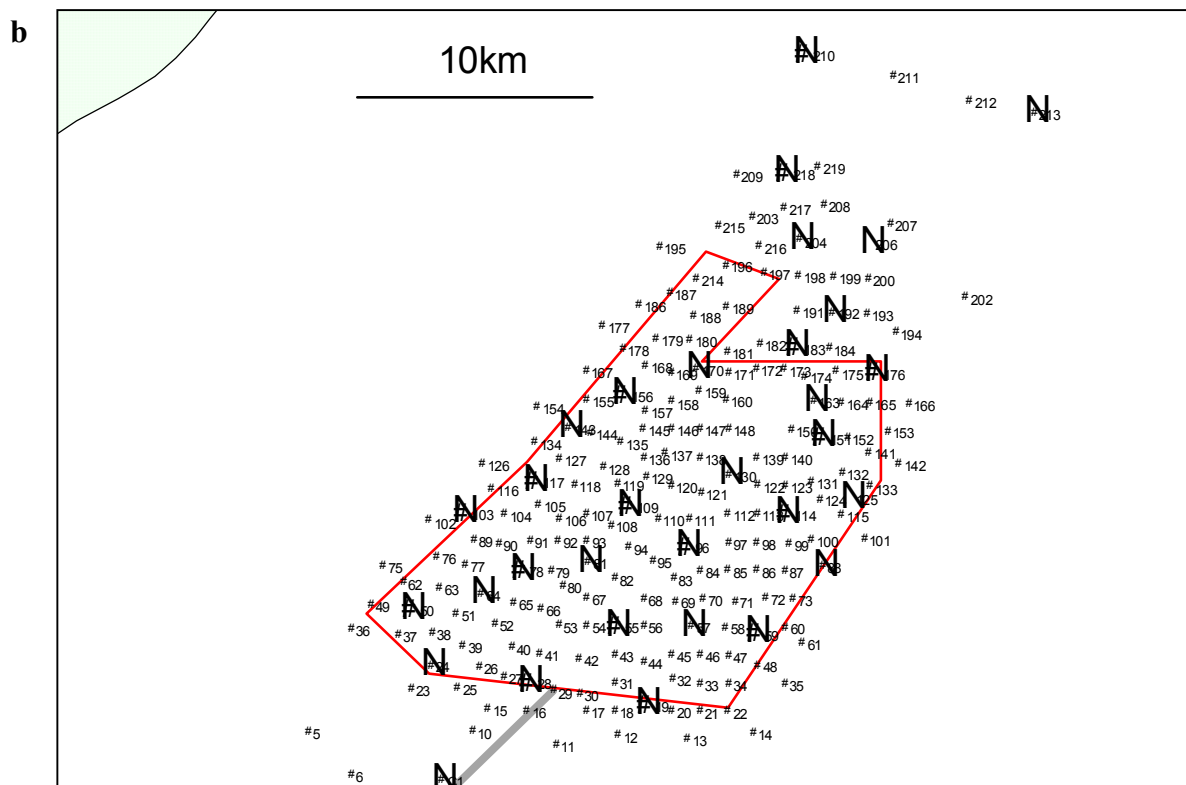
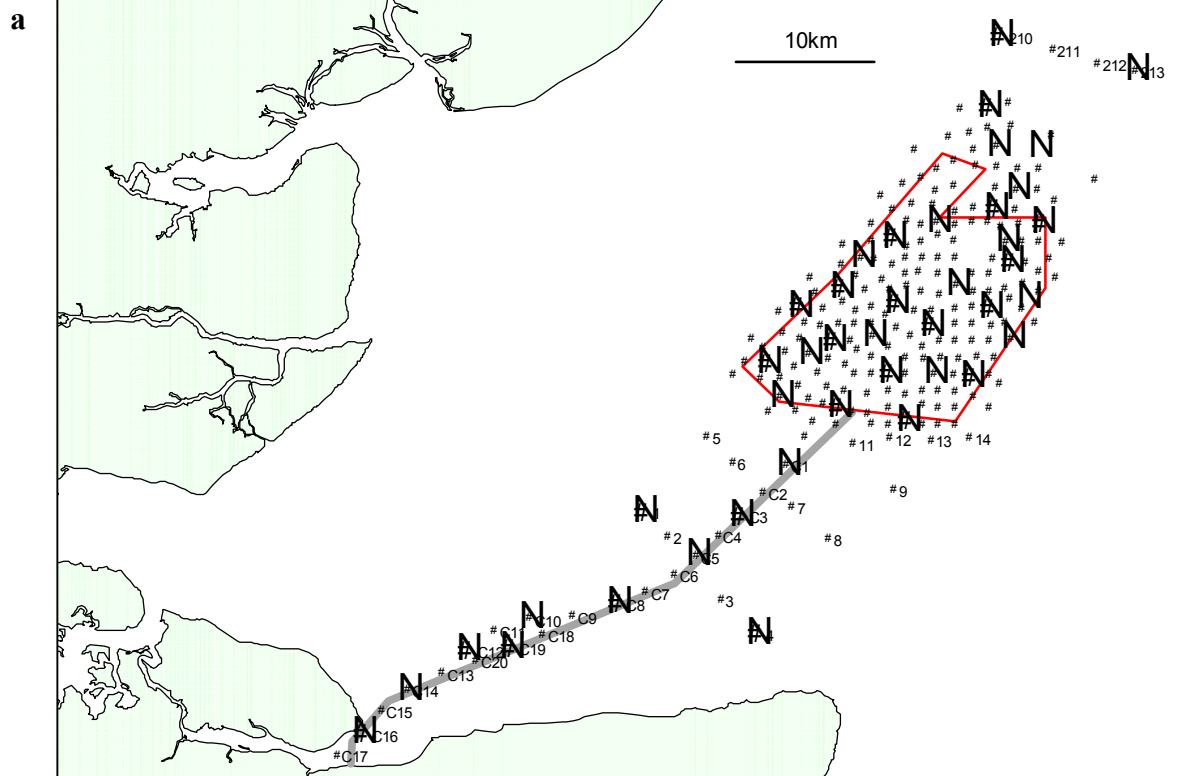


Figure 2. Positions of grab samples in relation to the proposed LAL array area and cable routes: a) overall view and b) close up of proposed array area.

3.1.1. Survey dates

Due to a combination of unusually poor weather, logistical problems and the extremely large scale of the surveys, they were carried out over the period from 3rd June until 26th October 2004.

3.1.2. Detailed methods – faunal samples

Following the DTLR guidelines for sampling of benthos for aggregate sampling, a sub-sample of sediment, of approximately 400g, was taken from each faunal sample prior to sieving for particle size analysis by dry sieving, and total organic content of dry sediment by loss on ignition at 450C after drying at 60C.

Sieving took place on board the vessel over a 1mm mesh and samples were preserved in formalin at a final dilution of c 5% in phosphate buffered seawater. All macrofauna were subsequently identified to species and counted wherever possible. A labelled reference collection was prepared and all faunal samples subsequently stored in alcohol.

The following details of quality control procedures used for sample collection and specimen sorting and identification were agreed with CEFAS and English Nature prior to survey.

All sorting to be carried out by experienced operatives with low power microscopes available for use. A proportion of samples (minimum 10%) (typically one sample randomly selected from each batch of ten recently sorted samples) to be re-sorted by an experienced sorter other than the person who carried out the original sorting. In the case that the number of animals found in the original sorting was less than 95% of the total found (sorting plus re-sorting) all of the other samples in the appropriate batch sorted by that person would have to be re-sorted.

All identification to be carried out by experienced marine invertebrate taxonomists using appropriate up to date identification guides and papers, appropriate range of stereo and monocular microscopes etc. Nomenclature to follow MCS species directory unless more up to date names exist. A labelled reference collection of all taxa found will be preserved in alcohol.

Systems must be in place to ensure correct labelling of all samples throughout the process.

Sediment residues to be kept for a period of up to five years in phosphate buffered formalin unless a further QC check (for example, resorting by a company different to that doing the original sorting) has been carried out and accepted by the client.

3.1.3. Detailed methods – sediment chemistry

At 42 sites additional sediment samples of 1-2 kg were taken for chemical analysis. In the main these were at the same sites. Samples were frozen as quickly as possible and delivered to a UKAS accredited laboratory for analysis of contaminants in the <1 mm fraction. Determinands analysed, analytical methods and limits of detection are given in table 1.

Table 1 The determinands, outline methods and limits of detection used for chemical analysis of sediments.

Determinand and method	Limits of Detection (mg/kg)
PAHs EPA 16 speciated by GC-MS	0.001
PAHs Total EPA 16 by EZ Flash	10
PCBs - ICES 7 Congeners by GC-MS	0.001
Organochlorine Suite including pp-DDE, pp-DDD, pp-DDT, op-DDD, A-HCH, B-HCH, G-HCH, Aldrin, Endrin, Dieldrin, HCB (Hexachlorobenzene) by GC-MS	0.001
Metals: Cu, Cd, Pb, Zn, Ni, Cr, As and Hg by ICP-OES Aqua Regis Digest	1
TBT and DBT by GCMS	0.01

Details of quality control procedures used for sample collection were agreed with CEFAS prior to survey and are as follows:

Day grab to have stainless steel jaws. Grab to be thoroughly rinsed with clean seawater between samples. Use of oils on winch wires and associated equipment avoided so as to avoid contamination. Good housekeeping on board boat to avoid contamination.

Sample containers will be clearly marked with date, sample id and project name.

Cleaned (using an appropriate solvent e.g. hexane, pentane, dichloromethane) stainless steel sampling spoons will be used for all samples for organic analysis and plastic spoons for metals analysis (Sufficient number of sampling spoons for each days survey to be prepared previously and wrapped in foil; chemicals not to be taken on board boat). Appropriately prepared glass sample containers for organics to be provided by UKAS accredited laboratory. Samples for metals analysis to be taken with plastic sampling spoon and stored in clean plastic containers.

4. Results

The results are provided in electronic format as follows:

In the case of both trawls and grabs, where the site number is prefixed with “C” this indicates that the site lies along a proposed cable route.

Trawl surveys

Contents	File or folder name
Numbers of all organisms found in trawls (1 worksheet); Lengths of those fish measured, together with sex of each elasmobranchs (4 worksheets, one for each survey).	LAL Thames trawl results 03&04.xls
Otter trawl locations start and end points WGS84	LAL Thames otter trawl positions 03&04.xls
Beam trawl location midpoints WGS84	LAL Thames beam trawl positions 03&04.xls
Field notes made on board the vessel	LAL Thames Trawl site notes 03&04.doc
Photographs of trawl contents	Individually named JPEG files

Grab surveys

Contents	File or folder name
Numbers of all organisms found in each grab (2 worksheets due to size limitations of Excel)	LAL Thames grabs fauna 2004.xls
Grab locations including sample times, field notes	LAL Thames Fieldnotes and Fixes 2004.xls
Sediment contamination results	LAL 2004 chemical summary.xls
psa information – dates, sample locations, psa results including raw data	Final LAL sedsummary 04.xls
Sediment psa graphs Word document	Final LAL 2004 sed graphs.doc
Photographs of faunal samples	279 individually named JPEG files

5. Appendix 1

QA procedures for proposed London Array grab sampling programme on behalf of London Array Consortium CMACS Ltd

This is an addendum to sampling protocols submitted, and was agreed with CEFAS and EN via the DTI in May 2004.

Field sampling

Fauna / particle size analysis / toc

Digital photographs will be taken of all samples.

DGPS derived locations will be provided for all sample locations.

Visual descriptions of sediment type will be made at the time of sampling, together with estimates of sample volume (as a measure of sampler efficiency). Sample containers will be clearly marked externally with date, sample id and project name. There will also be an internal plastic tag carrying the same information, marked using a suitable material.

Samples will be rejected where objects such as stones or shells are suspected to have kept the jaws open or where for any other reason loss of finer fractions of the sediment is suspected.

Samples will be rejected where depth of sediment is less than 5cm unless the sediment is very hard and/or coarse and it is clear that better samples can not be obtained.

Where the first three samples are rejected the site will be moved at least 50m and further attempts made to obtain samples.

PSA/TOC samples will be taken as a subsample of the faunal sample in each case in line with DTLR guidelines for the conduct of benthic studies at aggregate dredging sites.

Magnesium chloride solution at 7% w/v may be used as a relaxant typically for a minimum of two hours before fixation.

Fixation will be by addition of sufficient 10% formalin in seawater to the sample achieve a minimum final formalin concentration of 5%.

Sediments

Day grab to have stainless steel jaws. Grab to be thoroughly rinsed with clean seawater between samples. Use of oils on winch wires and associated equipment avoided so as to avoid contamination. Good housekeeping on board boat to avoid contamination.

Sample containers will be clearly marked with date, sample id and project name.

Cleaned (using an appropriate solvent e.g. hexane, pentane, dichloromethane) stainless steel sampling spoons will be used for all samples for organic analysis and plastic spoons for metals analysis (Sufficient number of sampling spoons for each days survey to be prepared previously and wrapped in foil; chemicals not to be taken on board boat). Appropriately prepared glass sample containers for organics to be provided by UKAS accredited laboratory. Samples for metals analysis to be taken with plastic sampling spoon and stored in clean plastic containers.

Laboratory analysis

Fauna

All sorting to be carried out by experienced operatives with low power microscopes available for use. A proportion of samples (minimum 10%) (typically one sample randomly selected from each batch of ten recently sorted samples) to be re-sorted by an experienced sorter other than the person who carried out the original sorting. In the case that the number of animals found in the original sorting was less than 95% of the total found (sorting plus re-sorting) all of the other samples in the appropriate batch sorted by that person would have to be re-sorted.

All identification to be carried out by experienced marine invertebrate taxonomists using appropriate up to date identification guides and papers, appropriate range of stereo and monocular microscopes etc. Nomenclature to follow MCS species directory unless more up to date names exist. A labelled reference collection of all taxa found will be preserved in alcohol.

Systems must be in place to ensure correct labelling of all samples throughout the process.

Sediment residues to be kept for a period of up to five years in phosphate buffered formalin unless a further QC check (for example, resorting by a company different to that doing the original sorting) has been carried out and accepted by the client.

Sediments

Particle size analysis will be carried out by dry sieving after drying at a temperature not exceeding 80C using a UKAS accredited or NMBAQC participating laboratory.

TOC will be analysed by a UKAS accredited or NMBAQC participating laboratory.

Chemical contaminants will be analysed by a UKAS accredited laboratory. Contaminants in sediments will generally be analysed in the <1mm fraction.

The following determinands, outline methods and limits of detection will be used.

Determinand and method	Limits of Detection
PAHs EPA 16 speciated by GC-MS	0.001
PAHs Total EPA 16 by EZ Flash	10
PCBs - ICES 7 Congeners by GC-MS	0.001
Organochlorine Suite including pp-DDE, pp-DDD, pp-DDT, op-DDD, A-HCH, B-HCH, G-HCH, Aldrin, Endrin, Dieldrin, HCB (Hexachlorobenzene) by GC-MS	0.001
Metals: Cu, Cd, Pb, Zn, Ni, Cr, As and Hg by ICP-OES Aqua Regis Digest	1
TBT and DBT by GCMS	0.01