Burnham Laboratory
Benthos Function

Standard Operating Procedure

SOP number 1385

Issue number 1

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Processing 2-metre beam trawl samples.

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Issue and Validation

Production summary

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Author(s)	Roger Coggan	15/07/2005
Bench tested By	Suzanne Ware	25/07/2005
Issue Authorisation	Roger Coggan	18/10/2005
Position	Benthic Ecologist	
Seen by QA		
Issue Approved		

Distribution of copies

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History of Procedure

Issue	Date Issued	Changes
1	18/10/2005	
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Processing 2-metre beam trawl samples: Issue 1

Introduction

A 2m-beam trawl is an effective gear for sampling epibenthic megafauna from discrete sites, and is usually used as part of a suite of sampling gears (including grabs, dredges and larger 'commercial' sized trawls) for assessing marine benthos. It is not suitable for targeting small- and medium-bodied demersal fish, which are better sampled using a 4m-beam trawl (see separate SOP). Several species of invertebrates are sampled effectively by both 2- and 4-metre beam trawls so it is desirable to have compatible SOPs for these gears.

2 Scope

This SOP describes the procedure for processing a sample from a 2-metre beam trawl on a Cefas vessel. This includes the recording of metadata about the trawling event and the use of sub-sampling. This SOP covers procedures for obtaining quantitative and semi-quantitative data on abundance and biomass for taxa sampled in a 2-metre beam trawl. This SOP does not cover the recording of morphometric data for certain nominated species, which may be required by some projects. Protocols for recording such morphometric data are detailed in the SOP for 4-metre beam trawls.

3 Training (Identify any specific training linked to the SOP)

This procedure may only be carried out by staff who have received training in this SOP. On-the-job training onboard ship is considered suitable, and should be conducted by someone experienced in using this SOP. Training records must be maintained and archived accordingly.

4 Safety Precautions

Before performing this procedure staff should have read and understood the following COSHH & risk assessments. Additionally, staff should be aware that certain species captured in trawl nets present a physical or chemical hazard. Physical hazards cover species that may bite (e.g. some fish) or pinch (e.g. crabs). Chemical hazards cover poisonous species, such as weever fish (e.g. *Echiichthys vipera*) and jelly fish. Some people's skin can also become sensitised to certain taxa (e.g. echinoderms, fish slime). Staff should be briefed on these likely hazards during training and provided with personal protective clothing (e.g. suitable gloves and barrier creams).

4.1 COSHH

Sea_cosh_01 – Storage of 30% formaldehyde solution, dilution of 30% formaldehyde solution to 10% and use of 10% formaldehyde for preservation of benthos samples

4.2 Risk Assessments

G03 – Participation in research cruises on Cefas owned and managed ships.

5 References/Associated documents

5.1 Trawl design

Jennings, S., Lancaster, J., Woolmer, A. & J. Cotter. 1999. Distribution, diversity and abundance of epibenthic fauna in the North Sea. Journal of the Marine Biological Association of the United Kingdom. Vol 79: 385-399.

6 Equipment /Apparatus

6.1 A 2m-beam trawl should be used for sampling epibenthic megafauna. The one illustrated follows the design detailed in Jennings et al (1999) for work in the North Sea and has been used as standard by Cefas for sampling epibenthic fauna on coarse substrates. It has the advantage of being robust, easy to deploy, and producing manageable sample volumes. The design includes a heavy-duty steel beam, a chain mat to prevent the collection of large boulders, and chafers to limit net damage. In 'softer' sediments (uncompacted sands; mud), the chain mat should be removed as it tends to cause the net to fill with sediment. A 4 mm knotless mesh liner is used in the cod-end to retain smaller organisms.

6.2 Permission to use a fine mesh liner, and to catch and retain undersize fish, should be requested from Defra and a letter of dispensation taken on board during all field sampling.

6.3 All operation of ship's equipment should be undertaken by ship's personnel. Scientific staff should only assist in the deployment and retrieval of the trawl when directed to do so by the Scientist in Charge (SIC).

6.4 Equipment, either required to undertake this SOP is listed below

- Fish boxes or similar large containers
- Benthos sorting/sieving table with internal 5 mm mesh grid
- Sheet steel sorting bench or table.
- Graduated buckets (5 and 10 litre size, 1 litre graduations)
- Spade & scoop for handling and mixing catch
- Sets of forceps
- Personal protective clothing (including 'Marigold' type gloves and barrier cream)
- Camera (preferably digital, otherwise film-based)
- Hammer (for cracking hermit crab shells)
- Set of about 20 sorting pots (500 ml tupperware will suffice) and buckets (2.5, 5 & 10 litre size)
- Tally counters (useful, not essential)
- Several sets of forceps.
- Motion compensated balances: 1 small (to ~300 g with precision of 0.1 g), 1 medium (to ~3 kg, precision 1 g), 1 large (to ~30 kg, precision 10 g).
- Calibration weights for balances
- Series of relevant field identification guides.
- Binocular microscope with lighting
- Monocular microscope with lighting
- Clipboards & general stationery (including waterproof pens)
- Sample storage buckets with sealing lids (2.5, 5 and 10 litre).
- Internal and external labels (waterproof) for sample buckets.

7 Ingredients/Reagents/Media

Formaldehyde stock solution (4% buffered)

8 Procedure

8.1 TRAWLING

8.1.1 All tows should be in a straight line, against the tide (whenever practical), over a nominal distance of 150 metres over ground (approx 5 minutes duration at 1 knot). A leeway of +/- 50 metres distance is allowable to accommodate operational difficulties (i.e. minimum tow distance ~ 100 m, maximum ~ 200 m). Tow distance is measured from the time that the warp has ceased paying out to the time that hauling

begins. The amount of warp paid out should be ~3 times the water depth.

8.1.2 Tow speed should be maintained between 1.0 and 1.5 knots (SOG).

8.1.3 Detailed records should be kept of fishing operations. These should include the time and position of shooting the net, and the time, position and depth at the start and end of tows (as defined above), as well as the tow speed and distance covered over ground. Whenever practical, additional meta-data about the tow and towing conditions should be collected and noted on the log-sheet, including gross seabed topography (noted from single beam echo sounder trace), information on sea state and weather conditions (e.g. swell height, wind speed), and water temperature at the seabed.

8.1.4 If, on appearing at the surface, it is evident that the cod-end is full of mud or sand, the net should be cleaned by gentle towing behind the vessel prior to bringing on-board.

8.1.5 When the net is retrieved, it should be inspected for signs of gear damage. If there is significant damage that could have affected the catch composition, then that station should be declared invalid, the gear repaired and the station repeated.

8.2 EMPTYING THE NET

8.2.1 Once on deck, the cod end should be emptied. Small catches (<~20 litres) can be placed directly into a suitable container (e.g. a fish box). For larger catches, the cod-end should be emptied onto the deck, the catch thoroughly mixed using spades (to ensure unbiased sub-sampling), and then shovelled into fish boxes. To prevent cross-contamination between samples, the net itself should be turned inside-out and any organisms trapped in the meshes removed and placed with the rest of the catch.

8.2.2 If required, the emptied net should be washed to remove dirt or trash (e.g. parts of small organisms), using a deck-hose or by towing the open net astern of the vessel.

8.3 SORTING THE CATCH

8.3.1 The catch should be transferred to the designated sorting area on deck, labelled with the station details (Cruise Identifier, Station Number, Station Code), and photographed.

8.3.2 The volume of the catch should be measured (in whole litres) and entered onto the log sheet. There is no minimum acceptable volume,

but if a catch is less than 5 litres, the tow should be repeated to ensure that the low volume did not result from the net not fishing properly. The volume of the catch is an important measure in itself, and a critical piece of data used in the sub-sampling procedure (see later).

8.3.3 **The entire catch is to be sorted** in order to ensure that rarer species are properly accounted for. The aim is to obtain abundance data (and biomass, when required) for each taxa in the catch. As the trawl is relatively small and towed over a short distance, it usually returns moderately sized samples that can be processed in a single batch. However, occasionally catches are quite large, and/or contain some species that are highly numerous (e.g. small ophiuroids). In such cases, the sample is sorted in a series of aliquots, following the sub-sampling protocol described below. This is a time-saving device that ensures the whole catch is sorted. Operators should be made explicitly aware that it is not acceptable to discard any portion of the catch that has not been sorted.

Sub-sampling protocol

The purpose of sub-sampling is to obtain an accurate estimate of abundance for each of the highly numerous species in the catch. This is achieved by fully sorting one or more sub-samples of known volume until the cumulative number of individuals ***exceeds*** a set target. This target is usually set at 100 individuals. The total abundance (and weight) of the species in question can then be accurately estimated by simple calculation (a process known as 'raising'). Once this reliable estimate has been obtained, the species in question does not have to be 'picked' from the subsequent aliquots or sub-samples. This can provide a significant time saving, as the highly abundant taxa are usually dealt with in the first few sub-samples. The principal is best illustrated by following a worked example, given below.

Total catch volume: 23 litres

Sub-sample volumes: 1st ..5 litres, 2nd…4 litres , 3rd …….

Taxon	Count	Volume sampled (l)	Raised count
Turritella communis	117	5	538
Ophiura ophiura	109	5 + 4 = 9	279
Asterias rubens	72	ALL	72
Liocarcinus holsatus	5	ALL	5

Here, the total catch had a volume of 23 litres and it was noticed that two species, *Turritella communis* and *Ophiura ophiura* were quite abundant, so sorting began on a 5-litre sub-sample. This first sub-

sample contained 117 *T. communis*, 46 *O. ophiura*, 20 *Asterias rubens* and 2 *Liocarcinus holsatus*. As the number of *T. communis* exceeds the set target of 100, a reliable estimate can be made of their total abundance in the whole catch, (117 ÷ 5) x 23 = 538, and this species can be ignored in any further sub-samples. For all the other species, there were fewer than 100 individuals in the first sub-sample, so you must continue to pick all of these species from the second sub-sample.

The second sub-sample had a volume of 4 litres. This was sorted ignoring any *Turritella communis*. After sorting this second sub-sample, the cumulative number of *Ophiura ophiura* had increased to 109 individuals, and the cumulative volume processed had increased to 9 litres (5+4). As the number of *O. ophiura* now exceeds the target of 100 individuals, a reliable estimate of their total abundance can be calculated as (109 ÷ 9) x 23 = 279, and they can be ignored in subsequent sub-samples. No other species exceeded the target of 100 individuals, so all species except *T. communis* and *O. ophiura* must be picked from the next sub-sample. It so happened that none of the remaining species were very numerous, so the remainder of the catch was sorted in one go. Once the whole catch had been sorted, the abundance of the remaining species was counted directly, and a note made that this number came from sorting ALL of the catch (i.e. the whole 23 litres).

8.3.4 For each whole catch, or sub-sample, do the following. Empty the material into a benthos sorting table containing a 5 mm mesh grid and gently wash away any sediment with a sea-water hose. Material retained on the grid should then be transferred to a suitable flat table for sorting. A series of small pots should be arranged around the table for storing individual taxa prior to counting.

8.3.5 Thoroughly sort individual taxa into separate pots. Ideally, each pot should contain a different species, if field ID is unequivocal (e.g. *Asterias rubens*). However, it may be more convenient to temporarily sort taxa by higher taxonomic groups, such as a Genus (e.g. Mocropodia spp.), Family (e.g. Paguridae – hermit crabs), Order (e.g. Octopoda – octopuses), Class (e.g. Bivalvia – bivalves), Phylum (e.g. Bryozoa) etc. These can then be taken into the wet-lab for more rigorous ID once sorting is complete. You may also need to use some pots to store particular substrate types, such as dead shells or cobbles, to which life-forms are attached (see the section on ‘Special Considerations’ later).

8.4 RECORDING THE CATCH & MAKING A REFERENCE COLLECTION

8.4.1 When the entire catch has been sorted, each taxa should be identified to the most precise taxonomic level practicable in the field (usually

species level), where necessary referring to the identification texts that are routinely taken on the ship (e.g. Hayward & Ryland, Tibble, Wheeler etc).

8.4.2 The identity, abundance (and weight) of each taxa should be recorded on the logsheet (NB weight should be the blotted wet weight). One person should act as 'scribe' when completing the logsheet. It is the responsibility of the scribe to ensure that all the required data fields on the logsheet are properly completed and that all calculations are correct. They must then 'sign-off' the completed logsheet. If the logsheet is subsequently found to be in error (during the QA checks), it will be returned to the scribe for correction. See the Special Considerations section below for instructions on dealing with hermit crabs and colonial / attached taxa.

8.4.3 For QA purposes, a **reference collection** is to be kept for each trawl sample (preserved in formalin, and kept in an appropriately labelled bucket). The collection must contain at least one example of each taxon/species (except where the ID is unequivocal – e.g. *Asterias rubens*). The reference collection will be processed on return to shore to verify field identification. Some taxa are not easily separated by rapid assessment in the field (e.g. Macropodia sp., Inachus sp., Ebalia sp., Galathea sp., Nucula sp., Abra sp., Pandalids etc). If pressure to complete the processing of samples is such that time is not available to adequately identify/separate such taxa to species level, then the entire catch (or sub-sample) of these taxa should be placed in the reference collection for later ID (and weighing) in the shore laboratory.

8.5 SPECIAL CONSIDERATIONS

8.5.1 **Hermit crabs** should be removed from their shells prior to weighing. Shells are usually removed by cracking with a hammer and using forceps to extract the individual.

8.5.2 **Unattached 'colonial' taxa** (including, *inter alia*, hydroids and bryozoans) can not be quantitatively enumerated. Once identified, their presence can be recorded in a manner suitable to the goals of the project. If the project only requires their presence/absence to be recorded, then presence is signified by a 'P' recorded in the 'count' column of the logsheet. If a semi-quantitative estimate of numbers is required then the following procedure should be followed. If there are <=10 colonies then record the actual number of colonies; otherwise estimate the number of colonies using a log scale (10^1, 10^2, 10^3) and note this in the 'count' column of the logsheet using the words 'tens', 'hundreds' or 'thousands' (to avoid confusion with truly numeric data).

8.5.3 **Taxa attached to boulders or cobbles**. General notes should be made to describe the fauna associated with any cobbles that may occur in the catch (e.g. cobbles encrusted with several types of sponge, hydroid colonies and a few barnacles). Erect forms such as large hydroids should be removed from the hard substrate and added to the sorted sample. Errant forms that normally live attached to, or burrowing in, hard substrates (e.g. Chitons, boring bivalves) should be removed and counted (& weighed). Remember, all other taxa have been washed over a 5 mm sieve, so it is not required to record individuals with dimensions < 5mm. Encrusting forms such as barnacles and spirorbid worms should be treated as for unattached colonial taxa, i.e. noted as 'present', or a semi quantitative estimate of abundance made using the tens, hundreds and thousands scale. Samples of all taxa should be kept in the reference collection for later ID in the shore laboratory.

8.5.4 **Taxa attached to biogenic surfaces**. Occasionally, trawls can contain a significant proportion of biogenic materials, such as dead oyster shells, that provide a substrate for the attachment of sedentary organisms, such as anemones and sea-squirts. It can be very time consuming to inspect all of this shell material for attached taxa. Instead you should sub-sample the shell fraction in the same way that you sub-sample the highly numerous taxa while sorting the catch. In other words, pick out these large shells from consecutive sub-samples until you have exceeded the target number of 100 shells. This sub-sample of the shell fraction can then be rigorously scrutinised to identify and enumerate the attached life-forms, and the abundance of these life-forms estimated by the 'raising process'. So, if in the worked example above you had collected 143 shells from the first two sub-samples (cumulative volume of 9 litres), you would count all the organisms attached to these shells. Say there were 256 *Anomia* on these shells, this would have been from a 9 litre sub-sample, so the raised count would be (256 ÷ 9) x 23 = 654.

8.5.5 **Miscellaneous material**. The presence of any miscellaneous material, such as egg cases, marine litter, wood and peat, should be noted on the logsheet, along with any other informative notes that help to characterise the catch or the substrate on which it was collected (e.g. rocks, shell debris).

8.5.6 **Morphometric measurements.** Where the project requirements specify that morphometric measurements should be collected for certain taxa or species, specific additional instructions should be provided by the Project Manager. Alternatively, reference should be made to the SOP for 4-metre beam trawls which details procedures to be followed for recording morphometric data from a variety of fish and shellfish taxa.

9 Review

This procedure will be reviewed on an annual basis. A record of the review will be made on a separate Review / Amendment Sheet which will be added to the Master Copy file of this SOP. Any amendments arising from such review or from operating requirements will result in the issue of the entire amended procedure as a new Issue.

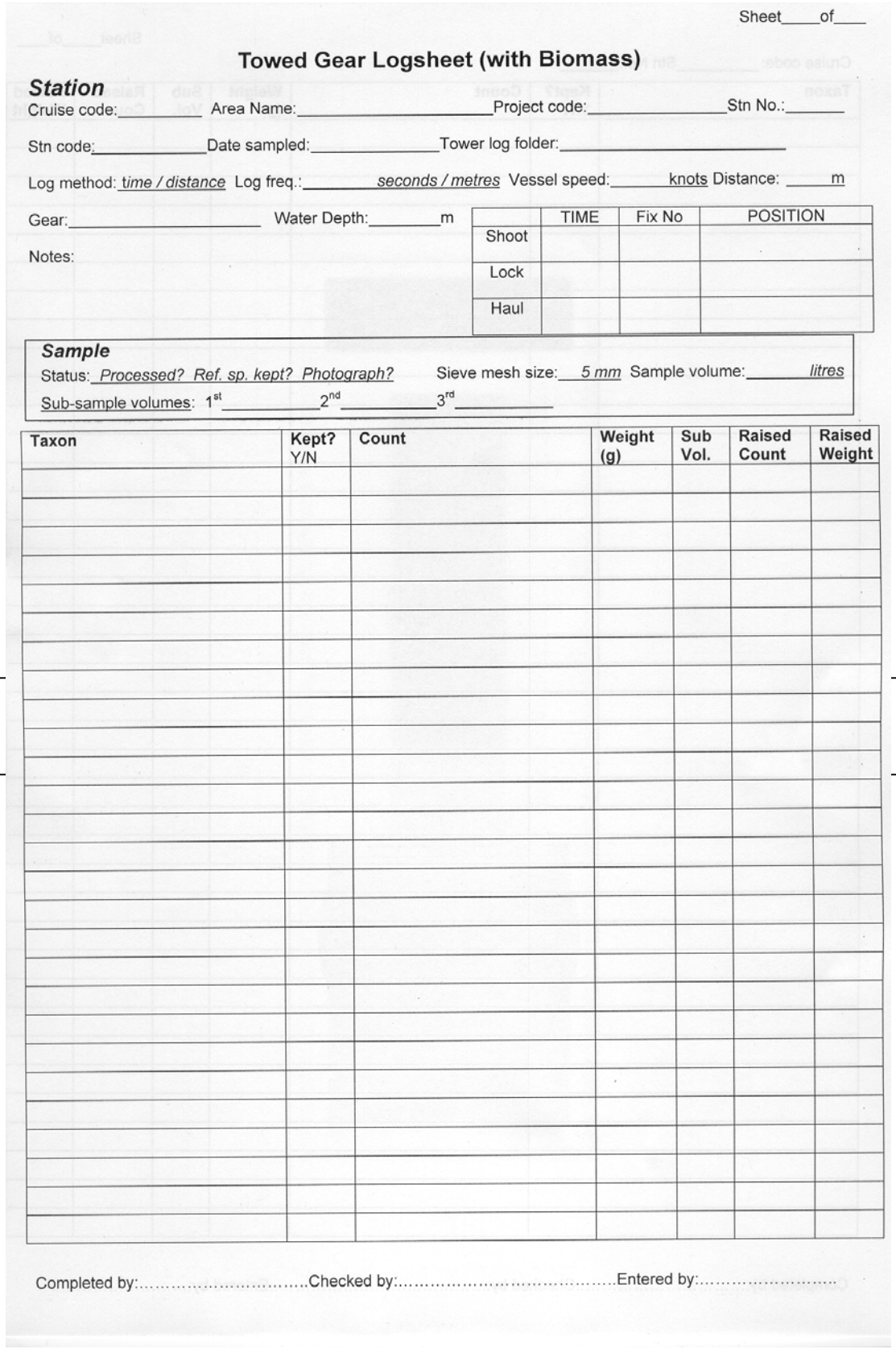
10 Records

This procedure, its review sheets and its subsequent revisions constitute records in themselves and each master copy will be retained in a file as arranged by the Quality Manager.

Field data records (i.e. the logsheets) resulting from using this SOP will be retained for a minimum of five years.

Data from the logsheets will be transcribed into a suitable electronic record system (spreadsheet or database) and retained for a minimum of five years

Example logsheet (variants are permissible).



Sheet____of____

Towed Gear Logsheet (with Biomass)

Station

Cruise code:_____ Area Name:_____Project code:_____Stn No.:_____

Stn code:_____Date sampled:_____Tower log folder:_____

Log method: *time / distance* Log freq.:_____ *seconds / metres* Vessel speed:_____ knots Distance: _____m

Gear:_____ Water Depth:_____m

Notes:

	TIME	Fix No	POSITION
Shoot			
Lock			
Haul			

Sample

Status: *Processed? Ref. sp. kept? Photograph?* Sieve mesh size: *5 mm* Sample volume:_____ *litres*

Sub-sample volumes: 1st_____2nd_____3rd_____

Taxon	Kept? Y/N	Count	Weight (g)	Sub Vol.	Raised Count	Raised Weight

Completed by:.....Checked by:.....Entered by:.....