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**REVISED METHODS MANUAL**



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## 1 Introduction

This manual details the methods of the EU-project MAFCONS (Managing Fisheries to Conserve Groundfish and Benthic Invertebrate Species diversity). It outlines sampling procedures for epibenthic invertebrates and infauna during the national groundfish surveys, sample processing onboard and in the laboratory, the recording of data and the requests for fish data from the actual groundfish surveys.

## 2 Location of sampling station

Benthos sampling takes place during the 3<sup>rd</sup> quarter International Bottom Trawl Survey (IBTS) of each European partner. Benthos samples must be taken at the location of a groundfish survey trawl, as information on the fish and benthic communities will be linked in the data analyses for each station.

Sampling areas of priority have been designated, covering three of the main epibenthic assemblages (Figure 1, Callaway *et al.* 2002). Inside each of the areas, the level of fishing effort has varied spatially in the past (Callaway *et al.* 2002). Assuming that these variations still occur at present this would allow comparisons between the diversity and productivity of benthic assemblages under different fishing pressure. Every project partner is asked to sample as many stations in these areas as possible. However, ultimately the scientists in charge of the groundfish surveys will allocate time and location of the benthos sampling in order to minimise disruption of the fish survey.

All institutes are recommended to sample as many stations as possible, optimally 25-30 stations per survey, whether inside or outside the priority areas. A station can only be included in the data analyses if the entire suite of samples is taken: One beamtrawl sample for epifauna and fish, five grab samples for infauna and five sediment samples (box-corer samples are optional). Data on the demersal fish fauna are obtained from the IBTS for the relevant trawl samples. In the unlikely circumstance that a groundfish IBTS trawl crosses the boundary of 2 neighbouring ICES rectangles, the station must be discounted as invalid for the MAFCONS project. At every station, relevant abiotic, hydrographic and station specific information has to be recorded

(Sheet 1 and/or EXCEL worksheet ENV– see Section 10 & Appendix 5) Appendix 1 lists the criteria required to fill in each field of the forms.

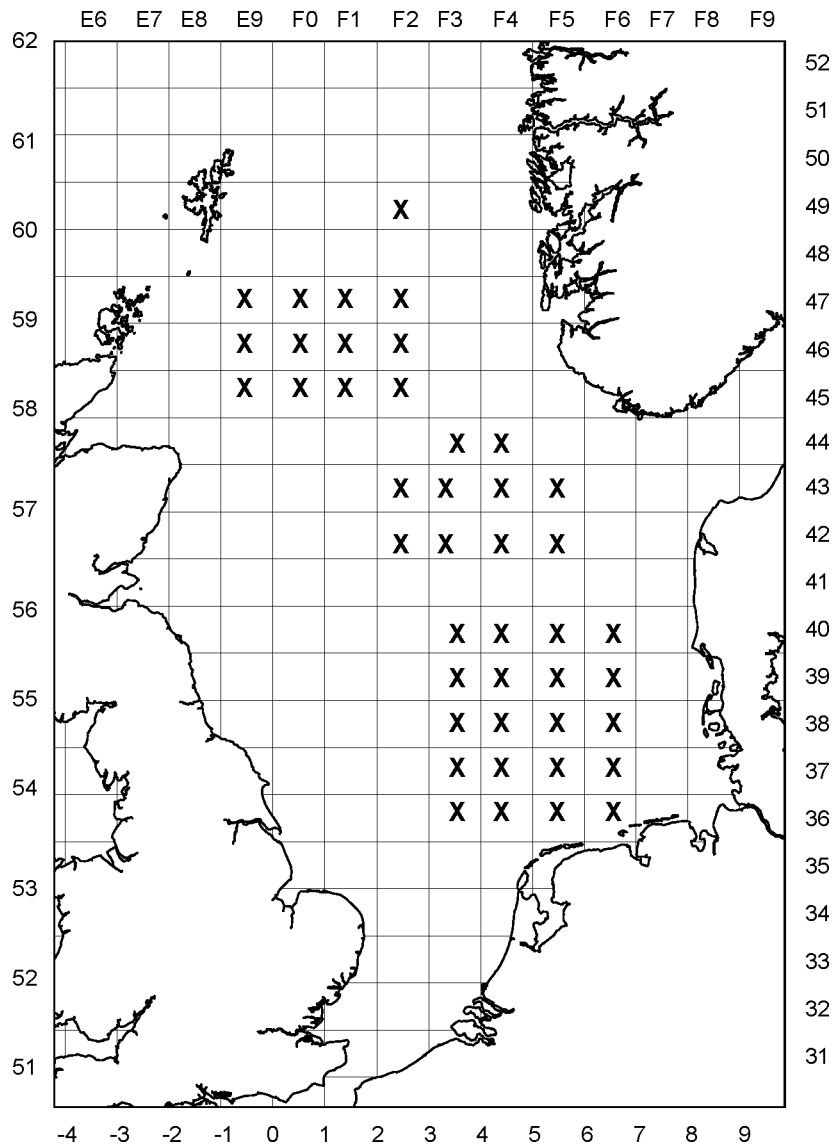


Figure 1. Areas of sampling priority. The areas cover three of the main epibenthic community types in the North Sea with both high and low fishing effort within the same area (Callaway *et al.* 2002).

### 3 Epifauna

Epifauna comprises a large range of different sized sessile and motile species. It will be sampled with a 2m-beamtrawl, which performs reliably on soft and coarse grounds. Whether or not quantities of individuals are sampled reliably with this equipment is still under debate. Generally 2m-beamtrawl samples are described as semi-quantitative ('Guidelines for the conduct of benthic studies at aggregate dredging sites', DTLR 2002). For the purpose of the MAFCONS study, epifauna is defined as ALL animals caught in the 2m-beam trawl and retained in the 5mm sieve. Animals are also retained from a 2mm-sieve to examine whether only retaining animals in the 5mm sieve is missing an important component of the benthic faunal production. The 2mm fraction of the epibenthos sample underestimates the smaller epibenthic fauna because the mesh of the beamtrawl is 4mm stretched, allowing animals <4mm to escape. However, the animals retained in the 2mm sieve will give an indication of the hyperbenthos, even if it is not a representative sample.

#### 3.1 Equipment

- **2m-beamtrawl** (galvanised steel) (Figure 2).

Dimensions of the shoes, the net and the chain mat are specified in Jennings *et al.* (1999). Additional information about the individual beamtrawls used in each of the surveys is recorded in the 2m-beamtrawl-haul information sheet (Sheet 2 and/or 2BTHI); a video camera or a stills camera may be attached to the trawl. Increasing the weight of the trawl by attaching extra weights should be avoided unless absolutely necessary, in order to keep it on the seabed. If extra weight is added, the weight attached should be recorded in the 2m-beamtrawl-haul information sheet (Sheet 2 and/or 2BTHI).

- 20 mm mesh (10 mm knot to knot)
- 4 mm knotless mesh liner (2 mm 'knot to knot')
- Chainmat
- Towing warp: Ideally the towing warp should be standardised to 14 mm, 6/19 construction. However, some vessels use 12mm or 16 mm warp. This potentially affects the performance of the beamtrawl on the ground. It is therefore important to note the warp diameter in the 2m-beamtrawl-haul information sheet (Sheet 2 and/or 2BTHI).

- Gardline Autosiever
- Sieves: 5mm and 2mm (woven mesh)
- Buffered 4% formaldehyde solution (see Appendix 2).
- Storage bottles and waterproof labels for all 2mm sieve fractions and for specimens from the 5mm-sieve fraction that need further examination in the laboratory. All samples should be stored in containers labelled internally and externally.



Figure 2. 2m beamtrawl.

## 3.2 Sampling procedure

Every time a beamtrawl is taken at a station, the EXCEL worksheet '2m-beamtrawl-haul information' (Sheet 2 and/or EXCEL worksheet 2BTHI, Appendix 5) must be filled in. This worksheet is applicable to each of the 2m-beamtrawl samples taken, but some of the fields will be constant throughout the survey (e.g. country, ship, warp diameter). Appendix 1 lists the criteria required to fill in each field of the sheet. Explanation of some of the fields is given below.

- Warp length 2.5 – 3.5: 1. As a general rule the warp length/ depth ratio should be 3: 1, never more than 3.5: 1 and in shallower water no less than 2.5: 1. The speed of the vessel and warp-out speed should be almost synchronised, maintaining a slight forward motion to keep the trawl stable in the water. A 1.5-knot speed and warp payout of 50m/min will achieve this.
- When deploying the beamtrawl it is suggested that two ropes are used to steady it, one either side. This will help to keep the beamtrawl stable and reduce the risk of it turning upside down.
- For each tow, an average towing speed of 1.5 knots (average speed over ground – see Sheet 2) should be maintained for a tow duration of 5 minutes. As some vessels will have little control at such slow speeds, tow speeds between 1-2 knots will be deemed acceptable.
- Haul out speed/procedure. Initially, half the warp should be recovered as fast as possible – this is to ensure the beam trawl lifts off the seabed quickly and cleanly. Thereafter a recovery rate of 70-100m /sec<sup>-1</sup> should ensure minimal damage to the animals in the codend.
- Wherever possible Scanmar should be attached to the beamtrawl showing whether the beamtrawl has been in close vicinity to the seabed. Alternatively, on retrieving the trawl, shiny beamtrawl shoes have been shown to indicate evidence that the trawl has maintained bottom contact. Another method may be to apply spraypaint or pen marks before launching the beamtrawl and to then examine for their presence after the haul. This will indicate whether the trawl has been on the bottom and whether it has been the right way up (Sheet 2 and/or EXCEL worksheet 2BTHI).
- Partners should wash out the codend after each tow. If the net needs washing, it should be towed behind the vessel with an open codend.



During the period that the beamtrawl is towing on the seafloor, towing direction, ground speed, depth and position of the beamtrawl are entered into the haul information sheet (Sheet 2 and/or EXCEL worksheet 2BTHI). Where possible these data are recorded at 1-minute intervals throughout the tow. This will allow for a more accurate calculation of area covered by the beamtrawl. If this is not possible, the data must, as a minimum, be recorded at the Start and Stop fishing times (see Sheet 2).

The first readings are taken after the trawl has landed on the bottom (as indicated by Scanmar), and starts to be towed (Start) – i.e. at the point when the winches are blocked up (end of warp payout). Stop (fishing end) should be recorded as the time that the trawl leaves the bottom, as indicated by Scanmar. For those partners operating without Scanmar, ‘Stop’ is taken to be at 5 minutes and thus the readings for 5 minutes and ‘Stop’ in EXCEL worksheet 2BTHI (Time Stop Fishing) and Sheet 2 are the same. At a later date, the Scottish partner will apply a conversion factor to account for the underestimation of area for the data provided by those partners not using Scanmar.

### **3.3 Sample processing**

For the animals retained in the 5mm sieve fraction, data are required for analyses of species diversity and also for the estimation of production of the community based on the method described by Brey (1990, 1999, 2001) and modified by Jennings *et al.* (2001). This method of estimating community production requires individual weights of the fauna and so all animals from the beamtrawl 5mm-sieve fraction will be identified to species, measured and weighed. However, for the 2mm fraction production will be calculated from mean individual weights and the fauna will be identified to a lower taxonomic level (see section 3.3.2)

For each beamtrawl taken all of the material (organic and non-organic) is removed from the codend and washed through the 5mm and 2mm woven mesh sieves. All invertebrate fauna and fish in the sieved fractions are then retained for processing.

### 3.3.1 5mm sieve fraction

The vast majority of species from the beamtrawl occur in low abundance and for the 5mm-sieve fraction they will have to be identified to species level, measured and weighed individually. However, higher abundance species will be processed in slightly different ways than low abundance species. Therefore, this section first gives some general rules for processing the 5mm-sieve fraction and then specifies procedures for low, moderately abundant and highly abundant species. For a worked example of how the processing of the entire beamtrawl sample can be done see Appendix 6.

- All animals are identified to species level. Many larger species can be identified from photographs taken during previous cruises and the species identification database (SID). However, this method bears the risk of misidentification and the majority of species will have to be identified from published identification keys (see Appendix 3). Any specimens that cannot be identified at sea, or are too small to be weighed at sea ( $< 0.3\text{g}$ ), must be preserved and stored in well-labelled containers to be returned to the laboratory for further examination.
- The majority of animals will have to be measured and weighed. As a general rule, measurements should be recorded in millimetres [mm] and weights in grams [g]. All weights should be taken as the blotted wet weight, where the excess water is removed by placing the animal(s) on absorbent paper, such as filter paper, before taking the weight (following the method described in Rumohr, 1999). Size measurements should be recorded to the nearest mm below, weight measurements to the nearest 0.1g below. If a different level of precision is applied, this must be noted in the relevant forms (Sheet 4 and/or EXCEL worksheet 2BTLW and Sheet 5 and/or 2BTLFD). Most callipers, for example, measure to a precision of at least 0.1mm; hence size measurements could be made to the nearest 0.1mm below, which would have to be noted in the field 'Precision-L' in the worksheet 2BTLW (see Appendix 1).
- Animals weighing  $< 0.3\text{g}$  should be preserved and retained to be measured to a higher resolution in the laboratory (0.01- 0.0001g). In the 5mm fraction several species such as *Anapagurus laevis*, amphipods and polychaetes fall into this category and have to be dealt with in the laboratory. The size and weight of these

animals will have to be measured to a greater precision, e.g. the nearest 0.001g below, which has to be recorded in the relevant forms.

#### ***Low Abundance species***

- For each species, total number of individuals and total weight are recorded in the 2m-beamtrawl haul summary sheet (Sheet 3 and/or EXCEL worksheet 2BTHS). This process is started at sea and completed back in the laboratory for animals that cannot be dealt with onboard (e.g. cannot be identified, too small to be weighed).
- Each individual animal of each species is then measured and weighed according to specifications in the species list (see Appendix 4). The specifications were agreed on as practice has shown that project partners carry out the size-weight measurements in different ways, depending on numbers of staff, availability of technical equipment or habit. Measurements may be entered into Sheet 4, directly into the EXCEL worksheet 2BTLW, into a self-prepared computer worksheet, or into a database that is automatically produced by the measuring equipment. All methods are allowed, but eventually the measurements must be transferred into the EXCEL worksheet 2BTLW for data transfer to the Scottish partner.
- No size frequency sheets need to be filled in here, as all individuals of the low abundance species are recorded in the length-weight sheet (Sheet 4 and/or EXCEL worksheet 2BTLW) and size frequency data can thus be extracted for them from this sheet.

#### ***Moderately abundant species***

For these species it will not be possible to weigh and measure every individual. Past surveys showed that only about 2-5 species per cruise fall into this category.

- Total weight is recorded in the 2m-beamtrawl haul summary sheet (Sheet 3 and/or EXCEL worksheet 2BTHS).
- A number of different methods may then be used to establish and record the size frequency distribution. Appendix 6 outlines the procedure used by the Scottish partner and this may be followed as a guide. Sheet 5 can then be used when following the procedure. If other partners determine their size frequency distributions differently, they must ensure that the appropriate data is still produced in order to complete EXCEL worksheet 2BTLFD.

- The size classes should be in 1mm steps. If different size classes are used, this has to be noted in the worksheet 2BTLFD.
- For each species, the number of individuals per size category is then entered directly into the data entry worksheet 5 (2BTLFD).
- For size-weight relationships, 5 individuals should be weighed per size class and entered in the 2m-beamtrawl-length-weight relationships sheet (Sheet 4 and or EXCEL worksheet 2BTLW).
- When the size frequency distribution has been completed for a species, it is important to make sure that 'I' is entered into the 'LFDComp' column on 2BTLW (Sheet 4) (see Appendix 1).

***Very high abundance species - Sub-sampling***

At a few stations several thousand individuals of one species will be caught in a single haul, e.g. *Ophiura albida* in the southern North Sea or *Echinus* spp. in the north. In those cases sub-sampling may be necessary.

- Once the haul has been sieved and sorted, the abundant species to be sub-sampled are separated from the other fauna. For each species the total weight of the individuals is then recorded in the 2m-beamtrawl haul summary sheet (Sheet 3 and/or EXCEL worksheet 2BTHS). A representative sub-sample of the species is then taken and the fraction sampled by weight recorded on sheet 5 (size frequency data) (there is no field for this in EXCEL worksheet 2BTLFD in 2BTLFD). Total weight and weight of the sub-sample must be recorded, as these are necessary to calculate the raising factor, which has to be entered in EXCEL worksheet 2BTLFD.
- All animals of the sub-sample are measured individually and a size frequency distribution is thus built up (example in Appendix 6). Total numbers per size class will then be calculated automatically in the EXCEL worksheet 2BTLFD, by entering the numbers of individuals per size class of the sub-sample and the raising factor for that size class. Summing up the raised numbers of all size classes gives the total number of the sub-sampled species, which is then entered into EXCEL worksheet 2BTHS.

- For size-weight relationships, 5 individuals should be weighed per size class and entered in the 2m-beamtrawl-size-weight relationships sheet (Sheet 4 and/or EXCEL worksheet 2BTLW).

### **3.3.2 2mm sieve fraction**

As mentioned before, the 2mm sieve fraction of the beamtrawl sample will only be used as an indication of the hyperbenthos present at each station. All processing of the 2mm-sieve fraction will be done in the laboratory, and so each sample must be bottled, fixed and preserved (4% formaldehyde solution) and labelled clearly at sea to be returned to the laboratory.

The methodology that will be used to estimate production from this sieve fraction (Edgar, 1990, a & b), uses allometric relationships based on the relationship between production and mean individual weight at a given temperature. Mean individual weights are calculated per size class (based on sieve size denominations) at the Taxon Group level (see ‘List of taxonomic groups’, section 4.1.4).

- Each sample is split into taxon groups and the total number of individuals and total weight are recorded in the epibenthos production sheet (Sheet 3 and/or EXCEL worksheet 2BTHS). From this data mean weight per taxon group can be calculated per sample.

No further analysis of this fraction will be necessary at this time. Each partner is however requested to retain the preserved 2mm-sieve fraction from each of the stations sampled. If required, this will allow for identification to a finer taxonomic resolution and calculation of individual sizes and weights. This may be necessary to explore the use of different methods for calculating productivity. Partners are not, however, committed to undertaking the further processing themselves, only to retaining the preserved sample.

Appendix 6 gives a detailed example of how to work up an entire epifaunal sample (both sieve fractions). This is only an example, and partners do not have to follow the procedure, as long as they collect all the data required for the EXCEL worksheets 2BTHS, 2BTLW, 2BTLFD and for the 2mm sieve fraction 2BTHS.

### **3.4 Hyperbenthos**

It would be advantageous if project partners with access to a hyperbenthos sledge could take samples with this equipment in addition to those taken by the 2m-beamtrawl. The 2m-beamtrawl is likely to miss the majority of the hyperbenthos and estimates of hyperbenthos from the sledge samples would allow for the evaluation of the catchability of hyperbenthos in the 2m-beamtrawl.

## **4 Infauna (macrobenthos)**

At every station infauna samples are taken with a Van Veen grab, and if available and time allows, with a Box corer. The Van Veen grab is one of the most common tools for collecting quantitative infauna samples in the North Sea (Figure 3). Using this type of grab will allow comparisons of this survey with previous studies. However, the downwardly directed jaws of the grab are vulnerable to incomplete closure due to the presence of stones. In areas with coarse ground it may be difficult and time consuming to gain the desired number of valid samples. Partners should persevere to attempt to collect 5 valid grabs at each station. However, due to sampling constraints time is often limited, and so, as a guideline, when on grounds that are difficult to sample, sampling should only continue if 3 samples in the first 5 grab attempts are successful. Sampling should then be abandoned if following the first 5 grabs there are 3 void attempts in a row.

Box-corers (Figure 4) penetrate further into the sediment than grabs and hence sample deeper dwelling benthic infauna. Although the majority of infaunal species live in the upper centimetres of the seabed, deeper dwelling animals are often relatively large and contribute considerably to the standing biomass.



Figure 3. Van Veen grab of the Senckenberg Institute, Germany



Figure 4. Box corer of FRS Marine Laboratory



Figure 5. Gardline Autosiever



## **4.1 Van Veen grab samples**

### **4.1.1 Equipment**

- Van Veen grab, 0.1m<sup>2</sup> (measure and record the individual grab dimensions in Sheet 6 and/or InFHI)
- Container to measure volume of grab sample (in case the penetration depth can not be measured with a ruler in the centre of the grab)
- Gardline Autosiever (Figure 5)
- Sieves: 4mm, 2mm, 1mm, 0.5mm
- Buffered 4% formaldehyde solution
- Storage bottles and waterproof labels for all sieve fractions. All samples should be stored in containers labelled internally and externally.
- Corer for sediment samples (25-mm diameter cores to 10cm depth).

### **4.1.2 Sampling procedure**

At every station an 'Infaunal sampler information sheet' (Sheet 6 and/ or EXCEL worksheet InFHI) is filled in. All fields must be completed for each time that a grab is deployed, which is why there is a deployment number (DEP NO on Sheet 6 and InFHI). Appendix 1 lists the criteria required to fill in each field of the Sheet.

- Each individual grab used on the survey must have a specific ID, which is recorded in the Infaunal sampler information sheet every time a sample is taken. The specific dimensions of each grab ID (to calculate individual grab areas) must be recorded and supplied to the Scottish partner after the cruise. If the same grab is used throughout the survey the sampler ID will always be the same (e.g. VVG1).
- At each station five Van Veen grab samples are taken. During retrieval of the gear from the seabed, the first 5 metres of warp should be hauled slowly to maximise sampling efficiency. The grab can then be hauled to the surface at a faster rate.
- Each individual grab is checked to see that it is a valid sample. Validity is based on the criteria outlined by Rumohr (1999), which include:
  - less than 5 litres of sample volume obtained in soft sediments and less than 2.5 litres in hard-packed sand;
  - incomplete closure of the grab;
  - obvious uneven bite;

- spillage during transfer of samples onboard.
- On gaining a valid grab, penetration depth is measured in the grab (deepest point of the sediment) before sediment samples are taken. If the design of the grab does not allow for a measurement of penetration depth, the volume of the sampled material has to be recorded. This can be achieved by emptying the sediment of the grab into a container with litre markings. The penetration depth can later be calculated from the volume measures. Penetration depth is recorded in the Infaunal sampler information sheet (Sheet 6 and/or EXCEL worksheet InFHI).
- Sediment samples are taken from each of the five grabs. A record of when sediment samples have been taken is made in the Infaunal sampler information sheet (Sheet 6 and/or EXCEL worksheet InFHI)(for details see chapter on abiotic parameters).

#### **4.1.3 Sample processing at sea**

- Once onboard individual grab samples are washed through a series of sieves (4mm, 2mm, 1mm and 0.5mm) using the Gardline Autosiever (Figure 5). It is advisable to undertake all of the sieving at sea, but if samples cannot be sieved through the entire set of sieves onboard, e.g. due to weather conditions or time constraints, the samples may be sieved through the 1mm and 0.5mm sieves or even only through the 0.5mm sieve. Sieving through the other sieves may then be carried out later in the laboratory. If the sample cannot be sieved at all at sea, the whole sample must be preserved in at least 4% buffered formaldehyde solution and sieved and processed later in the laboratory. It is important to note in the Infaunal sampler information sheet (Sheet 6 and/or EXCEL worksheet InFHI), whether the sample was preserved rather than fresh when sieved. This will help to establish whether the number of animals retained in the sieve is affected by the preservation procedure.
- Sieved fractions are individually preserved in buffered 4% formaldehyde solution and stored in well-labelled containers. Labels should include the station number, haul number, date, country and sieve size. Samples are then returned to the laboratory for sorting and identification, enumeration and analysis.

#### **4.1.4 Sample processing in the laboratory**

For the animals retained in the 4, 2 and 1mm sieve fractions, data are required for the analysis of species diversity and also for the estimation of production of the community based on the method described by Edgar (1990a & b). Only production data are required from the 0.5mm sieve fraction. Edgar's method for estimating production avoids the need to weigh individuals but retains an element of size structuring in the calculation of production, by using the structuring of size classes based on sieve sizes.

Ultimately, estimation of secondary production for the MAFCONS model will be based on separate estimates for the three benthic components: epifauna (all fauna retained in the 5mm sieve fraction of the beamtrawl, using the Jennings *et al.*, (2001) modification of Brey (1990,1999)); infaunal macrofauna (all fauna retained in the 1, 2 & 4mm sieve fractions and as far as available the 0.5mm fraction of the grab samples, using a modified Edgar (1990a&b) method).

#### **Transferring samples from formalin into ethanol**

Samples can be sorted directly from being preserved in formalin, or they can be transferred to ethanol before further processing. If they remain in formalin the samples are immersed in water and are sorted under a fume-absorbing hose. Samples preserved in ethanol should also be rinsed in water and can then be sorted with or without a fume- absorbing hose. However, the different procedures may result in different weight loss of animals. Hence, procedures should be documented in order to be taken into account during data analyses. The duration samples stay in formalin and ethanol should also be documented.

#### **Sorting of preserved material**

For each sieve fraction of each sample, the preserved material needs to be sorted and the fauna removed. It is important to note that all organic matter should be picked out for processing, as the estimation of production is based on a method that size structures animals by the sieving procedure (Edgar, 1990). Even if groups such as Nematodes may have previously been disregarded in other macrofaunal studies, they must be included in the production estimates.

To facilitate sorting it is recommended that the sample be stained with Rose Bengal. Samples may be stained at the time of fixation by adding 4g Rose Bengal per  $\text{dm}^{-3}$  40% formaldehyde, before dilution and buffering of the formaldehyde. There is a risk here however of overstaining and Rumohr (1999) describes a more successful method as described below (if overstaining does occur Rumohr (1999) suggests the addition of alkaline fluids (pH 9) for destaining).

Just before the sorting procedure is about to take place, the sample is washed free of the preservation fluid over a sieve with a smaller mesh size than the fraction being processed. The sieve is then allowed to stand in Rose Bengal stain (1g per  $\text{dm}^{-3}$  of tap water plus 5g of phenol for adjustment to pH 4-5) for 20 minutes with the sample well covered. The sample is then washed in the sieve until the tap water is no longer coloured. Animals such as bivalves or amphipods may float on the surface and do not stain well. During the sorting process attention should be paid to these unstained animals. Partners should make a record of whether or not they have used staining in the sorting process as if there is a discrepancy data can be checked for the effect of staining.

During the sorting procedure it is recommended that a magnification aid be used (e.g. magnification lamp or stereomicroscope). Magnification has to be used for the 1mm and the 0.5mm fraction. If there is a lot of sediment in the 4mm and 2mm fractions, magnifications should also be used for these fractions, at least a table magnification lens. Big animals can be sorted without magnification.

### **Quality control**

Partners are requested to sort through some of the sample material twice, preferably by two different people.

### **Taxon Groups**

The method to be used for estimation of production does not require the measurement of individual weights. Instead the community is size structured by the sieving process and mean individual weights of taxon groups are then used to estimate production of a particular sieve size category of that taxon group, at a given temperature. In the

original work by Edgar (1990a) fauna were mainly split at the Phyla level when producing mean individual weights, but on splitting the Crustacea into 2 taxon groups, Edgar found a significant difference in the relationships with mean individual weight. For the purpose of this study it was decided that some Phyla would be split into a number of taxon groups to represent those that share more similar body shape and thus mean weights. Also this method should more appropriately group taxa within Phyla that are likely to behave similarly in the sieving process.

The criteria used to determine the groups were; (1) The ease to separate out animals into these groups during the sorting process (i.e. no requirement for use of keys; obvious at first sight); (2) the likelihood of the groups within Phyla having different morphologies and different behaviours in the sieving process. An initial list of 38 Taxon Groups is given below as a guideline. Partners should work as far as possible to separate the fauna into these 38 groups. It is recognised that many of these groups will only appear rarely, if at all, in the sieve fraction samples.

### **List of Taxon Groups**

1. Annelids into 3 groups

Oligochaetes, Polychaetes –Errantia, Polychaetes – Sedentaria

2. Crustacea into 8 groups

Amphipods, Isopods, Decapods – Natantia, Decapods – Reptantia, Mysids, Cumaceans, Euphausids, Cirripeds

3. Echinoderms into 6 groups

Asteroids, Echinoids – regular, Echinoids – irregular, Ophiuroids, Holothuroids, Crinoids

4. Molluscs into 5 groups

Bivalves, Gastropods, Nudibranchs, Chitons, Cephalopods

5. Another 13 miscellaneous groups

Actinarians, Ascidiars, Bryozoans, Chaetognaths, Echiurans, Nemerteans, Nematodes, Porifera, Platyhelminths, Priapulids, Pycnogonids, Sipunculids, Ostracods

6. 1 group for fish

7. 1 group for ‘Other organic matter’

8. 1 group for ‘Eggs’

### **Modification of Taxon groups**

As this is an adaptation of the Edgar method and it is therefore a method under development, it is recognised that these guidelines for use of Taxon Groups may need to be modified as experience is gained. It is likely that animals will be found that do not easily fit into any of these groups. When this happens, Partners should follow 3 steps in assigning the material to a group: (1) If the animal(s) is from an easily distinguishable group, a new group should be added to the list; (2) If the animal(s) is from one of the Phyla listed, but does not fit into an obvious taxon group, a group for 'Others' for that Phylum should be added, e.g. 'Other Molluscs'; (3) If the material is indistinguishable as any particular Taxon group it should be added to the group 'Other organic matter'.

It is also likely that the ability to separate animals into taxon groups will decrease as their size decreases. Thus, it will be much harder to separate animals in the smallest sieve sizes. In this case Partners may need to join up groups for practical purposes. For example, errant and sedentary Polychaetes may be easy to separate in sieve sizes greater than 1mm, but below this they may need to be grouped as 'Polychaetes-All'. Another example is the Sipunculids, Echiurans and Priapulids. In this case in the smaller sieve fractions these may all need to be grouped as 'Unsegmented worms'. Where partners choose to join up particular taxon groups, it is important that they supply a record of what is included in an amalgamated group.

### **4, 2 & 1mm sieve fractions**

For the 4, 2 and 1mm fractions, data are required for species diversity and community structure analyses (total number of individuals and total weight per species), and for estimation of community production based on mean individual weights at the taxon group level (derived from total number of individuals and total weight per taxon group).

- Sieved fractions are sorted following the procedures outlined above and all fauna are split into the relevant taxon groups.
- At this stage 1 of 2 procedures can then be followed. The first procedure involves the animals being weighed twice, once for total weight per taxon group and once

for total weight per species. Using the second procedure, animals are identified to species straight away and taxon group level data is extracted from the species diversity database by summing the total weights and total numbers of all species in a taxon group. Partners can use either procedure as long as the instructions outlined below are followed. Ideally Procedure One will be used.

#### Procedure One

- Once the fraction has been sorted into taxon groups, production data is extracted at the taxon group level.
- The number of individuals and total weight per taxon group are recorded in the Infaunal Production data collection sheet (Sheet 7 and/or EXCEL worksheet InFProd). Again, total weight should be recorded as blotted wet weight. Precision of the weight measurement should always be recorded in the data entry (see Appendix 1, field 98).
- For the 4mm sieve fractions only, any large individual animals (i.e. diameter/length greater than 1cm) are weighed separately to account for the bias that large animals give to the mean individual weight (Edgar 1990 a & b). These are not included in the total weight for their taxon group. A separate total weight and total number of individuals should be recorded for the large individuals of a taxon group (e.g. 'Bivalves-large').
- This is carried out for all three sieve fractions, of each grab, at each station sampled. Once the production data has been extracted from a sample, animals are stored in preservative in suitably labelled containers (e.g. vials or small jars) until species diversity data is extracted. All data required to estimate production from these size fractions will then be available in EXCEL worksheet InFProd.
- On completion of sample processing for the production data, the individuals from each taxon group are re-examined and identified to species level using the appropriate published identification guides (see Appendix 3).
- Total number of individuals and total weight per species is then entered into Sheet 8 and/or EXCEL worksheet InFSpDiv. The taxon group of each species should also be entered so that the data can be cross-referenced with the production data from EXCEL worksheet InFProd.

- It is important at this stage to fill in the column ‘ProdDataExtra’ with Y for ‘yes’ as this shows that Procedure One has been followed and that the production data are available separately in the InFProd EXCEL worksheet.

#### Procedure Two

- Once the fraction has been sorted into taxon groups, all animals that can be, are immediately identified to species level. Using this procedure all data are entered into Sheet 8 and/or EXCEL worksheet InFSpDiv and data that are required for the taxon group level production estimates, can then be extracted later using a database link list.
- Total numbers of individuals and total weight per species are entered into Sheet 8 (and/or EXCEL worksheet InFSpDiv). Again, total weight should be recorded as blotted wet weight. Precision of the weight measurement should always be recorded in the data entry (see Appendix 1, field 98).
- For any animals or organic matter that cannot be identified to species level, total number of individuals and total weight is recorded at the taxon group level in Sheet 8 (and/or EXCEL worksheet InFSpDiv) (e.g. ‘Other organic matter’ for unidentifiable organic matter, or ‘Other-Polychaetes’ for unidentifiable bits of polychaete worms). These data will be required for the production estimates.
- For samples from the 4mm sieve fractions, all large animals (>1cm in diameter/length) of a species must be given separate totals. For example, hypothetically, you may need total number of individuals and total weights for both ‘*Abra alba*-large’ and ‘*Abra alba*-small’. This is for extraction of data for the production estimates. For species diversity analyses data for large and small components of a species will be added together.
- It is important at this stage to fill in the column ‘ProdDataExtra’ with N for ‘no’ as this shows that Procedure Two has been followed and that the production data must be extracted from this worksheet (InFSpDiv), as there will be no data for these sieve fractions in worksheet InFProd.



### **0.5mm sieve fraction**

Animals from the 0.5mm sieve fraction will only be used for the productivity calculations and thus animals are only identified to taxon group level.

- Only one replicate of the 0.5mm fraction should be processed per station, preferably the 0.5mm fraction of the first replicate.
- In the 0.5mm fraction there is a higher probability of single individuals representing taxonomic groups which may be lighter than 0.001g. This may cause weighing problems and, hence, animals should be grouped into phyla, rather than taxonomic groups in order to have more individuals in the group to be weighed.
- For each phyla, total number of individuals and total weight are recorded in the Infaunal production sheet (Sheet 7 and/or EXCEL worksheet InFProd). Again, total weight should be recorded as blotted wet weight.
- No further analysis of these fractions will be necessary at this time. Each partner is however requested to retain the preserved 0.5mm fraction from each of the stations sampled. If required, this will allow for identification to a finer taxonomic resolution and calculation of individual sizes and weights. This may be necessary to explore the use of different methods for calculating productivity. Partners are not, however, committed to undertaking the further processing themselves, only to retaining the preserved sample.

#### **4.1.5 Sub-sampling**

Sub-sampling of grab samples may be necessary in areas with coarse sediment where almost the entire sample is retained in the 0.5mm sieve. The 4, 2 & 1mm sieve fractions should all be possible to process and analyse entirely. However, in the case of the 0.5mm sieve fraction, sub-sampling may be required.

## **4.2 Box-corer samples**

### **4.2.1 Equipment**

- Box corer (0.25m<sup>2</sup> or 0.1m<sup>2</sup>)
- Gardline Autosiever
- Sieve: 4mm, 1mm

- Buffered 4% formaldehyde solution
- Storage bottles and waterproof labels for both sieve fractions. All samples
- Storage bottles and waterproof labels for both sieve fractions. All samples should be stored in containers labelled internally and externally.

#### **4.2.2 Sampling procedure**

Every time a Box Core is taken at a station, the ‘Infaunal sampler information sheet’ (Sheet 6 and/or EXCEL worksheet InFHI) must be filled in (one sheet per station includes records for both replicates). The sheets are applicable to each of the cores taken, but some of the fields will be constant throughout the survey (e.g. Gear, Year). Appendix 1 lists the criteria required to fill in each field of the Sheet. Some further explanation of the sampling procedure is given below.

- At each station where the Box Core is deployed, two samples are taken.
- Penetration depth of the deepest point of the sediment within the sampler is recorded in the Infaunal sampler information sheet (Sheet 6 and/or EXCEL worksheet InFHI).
- Any sediment samples are taken from the undisturbed sediment surface, preserved, and stored in well-labelled containers.

#### **4.2.3 Sample processing at sea**

- Samples are washed through a 4mm and 1mm sieve using the Gardline Autosiever.
- The sieved fractions are then preserved separately in buffered 4% formaldehyde solution and stored in well-labelled containers. Samples are returned to the laboratory for sorting, identification, enumeration and analysis.

#### **4.2.4 Sample processing in the laboratory**

##### ***4mm sieve fraction***

The 4mm-sieve fraction will be used for comparison with the 4mm fraction of the Van Veen grabs. This will be processed in exactly the same way as that of a 4mm-sieve fraction taken with a grab. Again, either Procedure One or Two can be used as long as all of the data for species diversity and estimation of production is provided (see Section 1.5.4).

- ‘Gear type’ should be recorded as BCO for Box Core samples.

### ***1mm sieve fraction***

The 1mm sieve fraction can be stored and processed later if time allows. This may be necessary when comparing results with the 1mm and above fraction of the Van Veen samples.

### **4.2.5 Sub-sampling**

Due to the difficulty of handling the box core, sub-sampling would only be possible from the sieved material. Sub-sampling sieved, unprocessed material is invalid because the sieving process may start sorting the animals or stratifies the material.

## **5 Groundfish surveys (GOV or 8m-beamtrawl sample)**

Groundfish surveys of the countries involved in the MAFCONS project are either undertaken with a GOV trawl or an 8m-beamtrawl. Each partner will provide fish data from the groundfish survey of their country. As a minimum, the partners will obtain and supply the GFS data for stations that are valid for MAFCONS (see paragraph below). If partners can however provide GFS data for the entire cruise, this is recommended, as the project will then also have more detailed and complete information on the distribution, abundance and diversity of the North Sea fish fauna. The data will not be requested from ICES initially, as the experience of some partners has been that retrieval of data is often delayed and regarded as unreliable. The Scottish partner will however request access to the ICES database at a later date for comparison purposes. This may also prove important to help account for the data of non-partner countries and to fill in information where partners have not been able to supply data for each haul of the cruise.

### **Validity of a GFS haul**

Although the groundfish surveys are standardised in the framework of the IBTS, there are national differences in terms of sub-sampling. This has implications for the species richness and diversity estimates. At stations chosen for benthos sampling it is important to check whether the entire catch has been sorted for different species or

whether sub-samples were taken ('Other remarks' section on the GOV/8m beamtrawl information sheets (Sheets 10 & 11)). If possible, at stations where the entire groundfish catch has not been checked for rare species, or there is no clear record of the sub-sampling method, benthic sampling should be avoided and the groundfish haul will be discounted as invalid for MAFCONS (Sheets 10 & 11 – GOV/8m-beamtrawl information sheets).

## **5.1 Sampling procedure**

Every time a groundfish trawl is taken at a station to be sampled for benthos, the GOV/8m-beamtrawl information sheets (Sheets 10 & 11 and/or EXCEL worksheets GOVHI & 8BTHI) must be filled in. These sheets are applicable to each of the groundfish samples taken at stations where the full complement of benthic samples will also be taken. Some of the fields will be constant throughout the survey (e.g. country, ship, warp diameter). Appendix 1 lists the criteria required to fill in each field of the sheets.

Where possible, during the groundfish tow further information is entered into the GOV/8m-beamtrawl information sheet. This includes the towing direction, ground speed, depth and position of the gear. If it is possible these data should be recorded at 5-minute intervals throughout the tow and at the very least at the 'Start' and 'Stop' fishing times. This will allow for a more accurate calculation of the area covered by the gear. Access to these data will depend on the co-operation of the GFS Chief Scientist.

## **5.2 Sample processing**

Processing of the groundfish samples will not be directly undertaken by the MAFCONS partners and there is therefore limited potential for the partners to influence how the original data is collected. The standard data recorded at each station for the IBTS are:

1. GFS Haul summary (Sheet 12 and/or EXCEL worksheet GFSHS).

For each species, total number of individuals and total weight are recorded in the GFS haul summary sheet.

2. GFS Size-weight relationships (Sheet 13 and/or EXCEL worksheet GFSLW).

For each species, individual size-weight data are entered into the GFS Size-weight relationships sheet. It is possible that only a number of species will be examined for this.

3. GFS Size frequency data (Sheet 14 and/or EXCEL worksheet GFSLFD)

For each species, the number of fish per size category is recorded in the GFS Size Frequency sheet. It is important that raising factors have been recorded where sub-samples are taken.

Partners should complete Sheet 12 and Sheets 13/14 (where available) for each valid haul taken with the GOV/8m-beamtrawl. If additional data, such as size-at-age are recorded, these can also be collected separately (there are no provided data collection sheets for these however).

## **6 Abiotic parameters**

In order to explain spatial and temporal diversity patterns and changes in community structure, as many abiotic parameters as possible should be measured. Both surface and bottom temperature and salinity will be measured during the GFS and are entered at each station on the Environmental sheet (Sheet 1 and/or EXCEL worksheet ENV). Depth is recorded separately for each sampling type (e.g. groundfish, epifauna and infauna) on the relevant sampler information sheets. Depth should be recorded as actual depth rather than depth below keel (DBK). Partners are thus requested to check the settings on the ship's sounder to verify whether DBK is the default. Depth of the keel can then be added as a correction factor.

Many other abiotic factors influence changes in benthic community structure and so, where possible, individual institutes should supply data for the relevant areas sampled. This may, for example, include winter bottom temperature, or the difference between winter and summer bottom temperatures. Data on sediment composition can be partly extracted from literature and maps of the BGS, but the partners will also undertake sediment sampling at each station (see below). Partners are also encouraged to access any remote bottom sensing data (e.g. RoxAnn, QT.), where possible.

### ***Sediment***

Sediment samples are taken from intact Van Veen grab samples. They are taken with a 25mm diameter corer, one from each of the five grabs, to a depth of 10cm, or to the deepest penetration depth if <10cm. All samples are labelled with the station, haul and grab number, and date and country, and immediately frozen or fixed in ethanol. In the laboratory all samples should preferentially be gently dried in the air or in an oven (60°C or less), or freeze-dried in order not to cake the sediment. The Belgian project partner will carry out sample processing.

In terms of sediment analyses the grain size distribution will be determined. The remains of the sediment samples after grain-size analyses will be stored in order to potentially carry out other analyses, e.g. organic matter or carbon content.

## **7 Voucher specimen collection**

Each project partner should keep individual specimens of each identified species preserved in a voucher specimen collection. This allows comparisons of species between institutes and will help to solve potential identification problems. Additionally, individuals of species should be preserved for a collection of all species found during the project. It is suggested that this collection be established at the University of Wales Swansea, where the voucher specimen collection of previous North Sea benthos surveys is also kept. For the collection, 5-10 carefully preserved intact individuals with the location and date of sampling should be provided. Name of the captor, as well as information of water depth and substratum type at the location of capture would also be useful. Provision of photographs of the live specimens would also be helpful and allow for the species inclusion in the SID. It is thus important to have extra sample containers for the collection of voucher specimens from the 5mm-sieve beamtrawl samples at sea.

## **8 Relaxing, fixation and preservation**

All infauna samples and parts of the epifauna samples will be preserved at sea for storage and later processing in the laboratory. Formaldehyde and alcohol will be the main preservatives used. Samples to be stored and processed after collection will always be fixed and preserved, but in some cases it may also be advisable to relax specimens first. Relaxation helps to maintain the features important for its subsequent identification. It is however unlikely that partners will have enough time to apply this to every potential specimen, but where possible relaxation of difficult groups such as Actinians is encouraged. It may also be possible to minimise numbers by selecting voucher specimens for specific species. A list of possible substances to be used for the relaxation, fixation and preservation of specimens is given in Appendix 2.

## **9 Data exchange**

The Scottish partner will provide the original data collection sheets (Appendix 5) and data entry EXCEL files to all other partners before they go to sea. Partners do not have to use the data collection sheets (see Sheets 1-14 in Appendix 5) if it is easier for them to just update their own systems. However, the data must be supplied in the EXCEL data entry files, and therefore partners are responsible for ensuring that they collect all data required by the EXCEL worksheets at each station. It will be possible to enter some of the data into the data worksheets at sea (e.g. Environmental information for each station), but some of the data will not be entered until after the samples have been processed in the laboratory. Once the individual EXCEL databases have been completed by each partner, copies are sent to the Scottish partner who will then enter them into the master Microsoft ACCESS databases (backed up in standard ASCII format). All partners are requested to maintain backed up versions of the EXCEL survey data worksheets throughout the project.

### **DATA COLLECTION SHEETS**

The data collection sheets (Sheets 1-14) are found in Appendix 5. As explained above, these do not have to be used, but they show all the data that is required to be collected for the MAFCONS analyses. As far as possible partners should try to collect the data

for all fields of each sheet, as these are the fields (as agreed by the partners) that will be required for future analysis. Appendix 1 lists the criteria for completing each of the boxes (fields) on each sheet.

#### DATA ENTRY WORKSHEETS

Fourteen corresponding data entry worksheets are also provided to each of the partners before going to sea. This allows for straightforward entry of data from data collection sheets 1-14 (or alternative data collection methods as preferred by the partners) into an EXCEL database format.

The Scottish partner will provide each partner with an EXCEL workbook that contains all of the data entry worksheets. For each of the worksheets, databases are only provided initially with room for 33 records. This was to minimise the size of the file for exchange. When partners receive the workbook they should then follow the instruction given on each worksheet to extend the number of available records where necessary.

**ALL INSTRUCTIONS GIVEN ON THE EXCEL WORKSHEETS MUST BE READ BEFORE ANY DATA IS ENTERED.**

Table 1: Corresponding data collection (Appendix 5) and data entry (EXCEL workbook) sheets, with a summary of their content.

Data collection Sheet (Appendix 5)	Data entry worksheet (EXCEL file)	Summary
1. Environmental sheet	1. ENV	Abiotic, hydrographic and station-specific info. for each valid MAFCONS station.
2. 2M Beamtrawl haul information	2. 2BTHI	All info. Specific to the sampling procedure. Completed for each haul.
3. 2M Beamtrawl haul summary	3. 2BTHS	Catch composition data for each sample taken, with total numbers and weights for each species caught.
4. 2M Beamtrawl size-	4. 2BTLW	Individual size-weight measurements for each



weight relationships			species.
5. 2M Beamtrawl size-frequency data	5. 2BTLFD		Size frequency data for abundant species. Recorded for each species on data collection sheet 5. Individual species-specific data, by size class, then entered into a size frequency data worksheet (2BTLFD) for all species of a haul.
6. Infaunal sampler haul information	6. InFHI		All info. specific to the sampling procedure. Completed for each sample.
7. Infaunal production data	7. InFProd		Total numbers and total weight per taxon group.
8. Infaunal species diversity data	8. InFSpDiv		Total numbers and total weight per species.
9. <i>Possibly add Infaunal length-weights sheet later?</i>			
10. GOV haul information	10. GOVHI		All info. specific to the sampling procedure. Completed for each sample.
11. 8M Beamtrawl haul information	11. 8BTHI		All info. specific to the sampling procedure. Completed for each sample.
12. GFS haul summary	12. GFSHS		Catch composition data for each groundfish trawl, with total numbers and weights for each species caught.
13. GFS size-weight relationships	13. GFSLW		Individual size-weight measurements for each species recorded.
14. GFS size frequency data	14. GFSLFD		Size frequency data for each species by size category.

## 10 References

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**Appendix 1. Criteria for completing the fields in each of the data collection sheets (Sheets 1-13).**

Numbers refer to the field numbers found in each box of each Sheet.

1	COUNTRY	ICES alpha code for countries (GFR, NED, ENG, SCO, NOR). Belgium is not included in the system; I suggest BEL.
2	SHIP	Walter Herwig (WAH, Walter Herwig III (WAH3), Tridens old (TRI), Tridens new (TRI2), Michael Sars (MIC), Endeavour (END), Scotia old (SCO), Scotia new (SCO2)
3	GEAR	GOV (Grand Ouverture Verticale), HOB (High Opening Bottom Trawl), 2m Beam Trawl (2BT), 8m Beam trawl (8BT), Van Veen Grab (VVG), Box Core (BCO)
4	GROUND GEAR	Type of ground gear on the GOV (A-D)
5	KITE	Is a kite used on the GOV? Y = Yes, N = No
6	WARP DIAMETER	Diameter of trawl warps (mm)
7	DEPLOYMENT NUMBER (DepNo)	Van Veen or Box Core deployment (replicate) number. This may be the same as Haul number for some partners.
8	STATION NUMBER	The station number identifies the geographic locations at which all sampling is done. The station number should be the same as the haul number of the GOV or 8BT
9	HAUL NUMBER	The Haul Number identifies the particular samples at each station
10	YEAR	2003, 2004
11	MONTH	1 – 12
12	DAY	1 – 28/29/30/31
14	TIME START FISHING	The time when the gear is on the bottom and has started fishing; 0000 – 2400 (GMT).
15	TIME STOP FISHING	The time when the gear has lifted off the bottom; 0000 – 2400 (GMT). For the 2m Beamtrawl, simply add recorded Haul Duration (16) to Time Start Fishing (14) (in Hours, minutes and seconds). For GOV/8m Beamtrawl record time hauled (Hour & minutes).
16	HAUL DURATION	Duration of time that the gear was on the bottom and fishing. Time should be recorded in minutes and seconds for the 2m Beamtrawl, and minutes only for the GOV/8m Beamtrawl.
22	E/W	East (E) or West (W)
29	ICES RECTANGLE	ICES statistical rectangle code

30	HAUL VALIDITY	Is the particular haul (GOV, 8BT, 2BT, VVG, BCO) valid? V = Valid, I = Invalid
31	WARP LENGTH	Length of warp out (m)
32	SCANMAR USED	Has a Scanmar unit been used on the gear; Y = Yes, N = No
33	PAY OUT SPEED	Speed at which the warp was deployed (metres per minute)
34	TOWING DIRECTION	1-360 (north), (ships heading)
35	GROUND SPEED	Average speed in knots (2 decimal places where available)
36	SPEED THROUGH WATER	Boat speed through the water in knots
39	SEDIMENT SAMPLE	Was a sediment sample taken from the grab? Y = Yes, N = No. If Y, enter depth of sediment core taken (e.g. 10cm) instead of Y.
41	DEPTH	Actual depth in meters, rather than depth below the keel (m)
42	SURFACE CURRENT DIRECTION	1 – 360 (north) 0 = slack water
43	SURFACE CURRENT SPEED	Meters per second
44	BOTTOM CURRENT DIRECTION	1 – 360 (north) 0 = slack water
45	WIND DIRECTION	0 – 360
46	WIND SPEED	Meters per second
47	SWELL DIRECTION	0 – 360
48	SWELL HEIGHT	Swell height in meters
49	SURFACE TEMPERATURE (°C)	Surface water temperature (°C) from CTD measurements. NB. This data may not be available at sea.
50	BOTTOM TEMPERATURE (°C)	Bottom water temperature (°C) from CTD measurements. NB. This data may not be available at sea.
51	SURFACE SALINITY	Surface salinity from CTD measurements. NB. This data may not be available at sea.
52	BOTTOM SALINITY	Bottom salinity from CTD measurements. NB. This data may not be available at sea.
53	MARKS ON SHOES	Was spray paint used to mark the Beam Trawl shoes to check the Beam trawl had been fishing on the bottom? Y = if spray paint rubbed off, N = if spray paint was not rubbed of and N/A if spray paint was not used.
54	OTHER REMARKS	Any other remarks about the station or sample

55	RECORD TYPE	Fixed values. ST = station data, 2BTHS = 2m Beam Trawl Haul Summary etc.
56	TIME	Times during the haul when information needs to be recorded.
57	LAT (DEG)	Haul position. Degrees latitude
58	LAT (MIN)	Haul position. Minutes latitude
59	LONG (DEG)	Haul position. Degrees longitude
60	LONG (MIN)	Haul position. Minutes longitude
61	SIEVE	Sieve size in mm.
62	SPECIES NAME	Scientific name with genus and species name or name of other taxonomic level. Scientific name with genus and species name for the 4, 2 and 1mm sieve, family or genus for the 0.5mm sieves for the infauna.
63	SPECIES CODE	Species code as in Howson and Picton. Where countries use their own laboratory codes, they must provide a translation Sheet when data are exchanged. In the case of groundfish the official NODC code should be used.
64	TOTAL NO COUNTED	Number of animals counted in the sample. In the case of the groundfish this will be the number of fish caught per 30 minutes.
65	TOTAL WEIGHT	Total weight (g) of all the animals of a particular species caught in a sample to one decimal place
69	PRECISION –L	5, 1, 0.1 indicates whether measurements were taken to the nearest 5, 1 or 0.1mm below. In the case of infauna this may go down to the nearest 0.01 or even 0.001.
70	LENGTH	Size of an animal in mm
71	WEIGHT	Weight of animal in g
72	WEIGHT ADDED TO BEAM TRAWL	How much extra weight has been added to the beam trawl in Kg. 0 if no weight has been added.
73	GPS DATUM	What geographic referencing system (eg WGS84) does the vessel use?
74	HEIGHT	Height of the trawl opening (m)
75	WING	Width of the trawl wings (m)
76	DOORS	Width of the trawl doors (m)
77	NO	Number of animals
78	SEDIMENT TYPE	Brief description of the sediment type in each of the grabs (e.g. mud, sand, gravel etc.)
79	CONTAINER (Con Type)	Indicate here whether there is a separate record of the containers used for that station. This is just to help

		with storage and identification of samples at the laboratory. R = recorded in separate inventory
80	HAUL VALID	Is the Box Core/Van Veen a valid sample? V = Valid, I = Invalid
81	PROP. CATCH SORT	Proportion of the catch that was sorted. If there is no record of this for the GFS data, the haul should be discounted as Invalid for MAFCONS. This will also indicate whether the total number counted and total weight for the GFS data are raised or 'real' totals.
82	LENGTH CAT	Size of animal (cm)
83	START	When the gear is on the bottom and has just started fishing
84	STOP	When the gear has just come off the bottom and stopped fishing
85	BEAM TRAWL ID	Beam trawl ID. If partners have multiple beam trawls they should all be given an individual ID number (e.g. SCOTIA-1, SCOTIA-2) and the heights and width for the individual beam trawls recorded.
86	BEAM HEIGHT	Height of the beam trawl opening (m)
87	BEAM WIDTH	Width of the beam trawl opening (m)
88	INFAUNAL SAMPLER ID	Infaunal sampler ID. If partners have multiple Van Veen's/Box Corers, they should all be given an individual ID number.
89	INFAUNAL SAMPLER AREA	Area sampled by the infaunal sampler, this can be calculated from the sampler dimensions (Different Van Veen's/Box core's may have slightly different dimensions)
90	PENETRATION DEPTH	The depth of the deepest sediment in the sampler (mm)
91	PRESERVEDED BEFORE SIEVING	Was the sample preserved before it was sieved? Y = Yes, N = No
92	STATION VALIDITY	Is the station valid for the MAFCONS project? To be a valid sample it must have fish, epifauna and infauna. V = Valid, I = Invalid
93	INFAUNAL SAMPLER VALIDITY	There must be 5 valid grabs to make the infaunal sampling valid. V = Valid, I = Invalid
94	LFDCComp	Are all individuals of the species recorded in the Length-Weight Sheet? If they are not the species will also have a length frequency distribution sheet (Sheet 5). Complete = C, Incomplete =I
95	NO MES.	Total number of individuals measured in that size category.
96	R TOT	Raised total number of individuals in that size category for the whole sample of that species.
97	BOTTOM CURRENT SPEED	Meters per second

98	PRECISION-W	1, 0.1 & 0.01 indicates whether weights were taken to the nearest 1, 0.1 or 0.01 grams. At sea this will almost always be 0.1, but in the case of infauna this may go down to the nearest 0.01 or even 0.001.
99	TAXON GROUP	The taxonomic group that an animal is assigned to for estimation of production data (see list and details in Section 1.5.4)
100	PROD DATA EXTRA	This field identifies whether a break down of production data has been supplied with the species diversity data. InFProd worksheet supplied = Y, Only InFSpDiv supplied = N.
101	SKIPPER'S DISTANCE TRAWLED	This field is optional. It is to be used as a reference to check against the database-calculated distance trawled.

## **Appendix 2. A list of possible relaxants, fixatives and preservatives to be used in the MAFCONS project**

These chemicals should be used if species need to be fixed and preserved, if species need special treatment before they can be identified and if specimens are kept for the voucher specimen collection.

### **Fixatives, narcotics and preservatives**

#### **Formaldehyde (Fixative and preservative)**

Formaldehyde is the best fixative and preservative available. However, it is a toxin, a carcinogen and irritant and it therefore has to be handled with extreme caution. The concentration should be 4-5% in samples for effective fixation. Since formaldehyde tends to become acidic during storage, a buffering agent should be added as this will help to prevent the dissolution of any calcareous material. A commonly used buffer is Borax (Sodium tetraborate).

#### **Alcohol (Fixative and preservative)**

Alcohol (70% ethanol/ IMS) is often used for later preservation of samples. It may be an adequate fixative for small animals, but tends to become diluted by body fluids of larger animals. However, if long-term preservation of samples is anticipated, specimens can be transferred to alcohol after fixation with formaldehyde. Disadvantages associated with alcohol as a preservative are its tendency to evaporate from most sealed jars. It also dissolves colour pigments and dehydrates body tissue making it hard and inflexible. Furthermore it is flammable and expensive.

#### **Propylene phenoxetol (Narcotic and preservative)**

Propylene phenoxetol cannot be used as a fixative, but it is a good preservative at 1.5%. It can also be used as an anaesthetic/relaxant at 0.15%. It is difficult to dissolve and it is advised to make up a 1.5% stock solution, which will keep. It can be used directly as a preservative and can be diluted in 10 parts seawater as a narcotic. It is the best preservative for worker and specimen as it is unlikely to evaporate, has better colour retention and is less harmful to the operative.



**Magnesium Chloride, MgCl<sub>2</sub> (Narcotic only)**

8% solution in seawater.

For most marine groups animals can be immersed slowly into an 8% solution. Alternatively the seawater that the animal is in can slowly be replaced with an 8% solution. Relaxation can take from several minutes to several hours.

**Magnesium Sulphate, MgSO<sub>4</sub> (Narcotic only)**

15 to 30% solution in seawater.

This is used in the same way as Magnesium Chloride. Additionally the tip of a muslin bag containing MgSO<sub>4</sub> crystals can be immersed into the water containing the animal.

**Carbon Dioxide as soda water (Narcotic only)**

The animal is allowed to relax in seawater, before adding soda water until it is at 30 to 50% by volume.

**Menthol crystals (Narcotic only)**

The animal is allowed to relax in seawater, before a few menthol crystals are scattered (number dependent on size of animal) onto the surface of the water containing the animal.

**A range of alternative narcotics are also available e.g.:**

Chloral hydrate, 0.2% solution in seawater

Chloretone, add a few crystals to water containing animal

Clove oil, add a few drops to water containing animal

Ethane disulphonate, 0.25% solution in seawater

Ethanol, add drop by drop to water containing animal

Ethyl Carbamate (urethane) as 10% solution in seawater

Formaldehyde, add drop by drop to water containing animal

Temperature change, either slow chilling or warming

Tobacco smoke, bubbled through water containing animal

## **Relaxants**

### **Recommendation for relaxants for use on the groundfish survey**

An 8% solution of Magnesium Chloride, a tub of Menthol Crystals and some bottles of soda water should cover most eventualities and avoid toxic or otherwise harmful chemicals.

### **Recommended treatments for main marine groups:**

**Sponges:** Fix and preserve in 5% formaldehyde. Calcareous sponges should be preserved in 75% ethanol as formaldehyde can decalcify the specimens.

**Hydroids:** Relax in 8% MgCl<sub>2</sub> (or 15% MgSO<sub>4</sub> or Menthol crystals). Fix in 5% formaldehyde for at least 24 hours; transfer to 75% ethanol for preservation

**\*Actinians:** Allow to relax in seawater then narcotise by replacing slowly with either 8% MgCl<sub>2</sub> or Soda water to 50% (or 10% MgSO<sub>4</sub> plus 1 or 2 drops of formaldehyde every 15 minutes)

**Nemerteans:** Relax in 8% MgCl<sub>2</sub> or add Menthol crystals to water

**\*Polychaetes:** Relax in 8% MgCl<sub>2</sub> (or gradual addition of 70% ethanol, or 20% MgSO<sub>4</sub>, or 0.15% propylene phenoxetol to water). Fix in 5% formaldehyde for 24 hours then transfer to 1.5% propylene phenoxetol (this preserves colour, but if unavailable 75% ethanol will do). Ideally, don't fix in ethanol and don't leave in formaldehyde.

**\*Priapulids, sipunculans, echiurans:** Relax using menthol crystals with a few drops of alcohol added after an hour (or put straight into 8% MgCl<sub>2</sub>)

**Small Crustaceans:** Relax in soda water (or add a few drops of 70% ethanol to water or use 0.15% propylene phenoxetol).

**\*Opisthobranchs:** Relax in 8% MgCl<sub>2</sub>, fix and preserve in 5% formaldehyde or transfer to propylene phenoxetol after fixation.

**Bryozoans:** Calcified bryozoans fix and preserve in 75% ethanol, fleshy or membranous ctenostomes fix in 5% formaldehyde for 24 hours then transfer to propylene phenoxetol for preservation

**Echinoderms:** Fix in excess 75% alcohol, replace after a few days due to dilution from body fluids. Do not preserve long term in formaldehyde as the acid can dissolve the calcareous ossicles and plates, which are essential for identification, particularly of holothurians.

\***Ascidians**: Relax using Menthol crystals (or immerse in 8% MgCl<sub>2</sub>). Fix in 5% formaldehyde. They can be preserved in propylene phenoxetol, or left in formaldehyde.

\***IMPORTANT to relax these groups BEFORE fixation if need to identify later**

### **Appendix 3. Identification literature**

#### **General**

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**Appendix 4. List of species with appropriate weighing and measuring techniques.**

	counting	measuring	weighing
<b>Porifera</b>			
Porifera should be counted and the total weight taken. If counting is impossible presence must be recorded. Specimens should be water logged when weighed.			
<i>Axinella dissimilis</i>	Count	-	Total weight
<i>Axinella infundibuliformis</i>	Count	-	Total weight
<i>Dysidea fragilis</i>	present	-	Total weight
<i>Halichondria bowerbanki</i>	present	-	Total weight
<i>Halichondria panicea</i>	present	-	Total weight
<i>Phakellia ventilabrum</i>	Count	-	Total weight
<i>Scypha ciliata</i>	count	-	Total weight
<i>Stelligera stuposa</i>	Count	-	Total weight
<i>Suberites ficus</i>	Count	-	Total weight
<i>Suberites pagurorum</i>	Count	-	Individual weight
<i>Tetilla cranium</i>	count	-	Total weight
<b>Cnidaria</b>			
Branching hydroids should be recorded as present and total weight recorded; Encrusting hydrozoans should be recorded as present only.			
<i>Abietinaria abietina</i>	Present	-	Total weight
<i>Abietinaria filicula</i>	Present	-	Total weight
<i>Actinauge richardi</i>	Count	-	Total weight
<i>Adamsia carciniopados</i>	Count	-	Total weight (remove crab and shell)
<i>Aglaoophenia acacia</i>	Present	-	Total weight
<i>Alcyonium digitatum</i>	Present	-	Total weight
<i>Bolocera tuediae</i>	Count	-	Total weight
<i>Bougainvillia britannica</i>	Present	-	Total weight
<i>Bougainvillia ramosa</i>	Present	-	Total weight
<i>Calliactis parasitica</i>	Count	-	Total weight
<i>Campanularia volubilis</i>	Present	-	Total weight
<i>Caryophyllia smithii</i>	Count	-	Total weight
<i>Clytia hemisphaerica</i>	Present	-	-
<i>Cyanea capillata</i>	Count	-	Total weight
<i>Cyanea lamarckii</i>	Count	-	Total weight
<i>Dicoryne conferta</i>	Present	-	-
<i>Diphasia alata</i>	Present	-	Total weight
<i>Diphasia attenuata</i>	Present	-	Total weight
<i>Diphasia pinaster</i>	Present	-	Total weight
<i>Epizoanthus incrustatus (=E. papillosus)</i>	Count	-	Total weight (take out Pagurus sp.)
<i>Eudendrium rameum</i>	Present	-	Total weight
<i>Eudendrium ramosum</i>	Present	-	Total weight
<i>Filellum serpens</i>	Present	-	-
<i>Flabellum macandrewi</i>	Present	-	-
<i>Gonothyraea loveni</i>	Present	-	Total weight
<i>Grammaria abietina</i>	Present	-	-
<i>Halecium beanii</i>	Present	-	Total weight
<i>Halecium halecinum</i>	Present	-	Total weight

## Sessile species

<i>Halecium muricatum</i>	Present	-	Total weight
<i>Halecium sessile</i>	Present	-	Total weight
<i>Halopteris catharina</i>	Present	-	Total weight
<i>Hormathia digitata</i>	Count	-	Total weight (remove from substratum)
<i>Hydractinia echinata</i>	Present	-	-
<i>Hydrallmania falcata</i>	Present	-	Total weight
<i>Lafoea dumosa</i>	Present	-	Total weight
<i>Lafoea fruticosa</i>	Present	-	Total weight
<i>Laomedea flexuosa</i>	Present	-	Total weight
<i>Lytocarpia myriophyllum</i>	Present	-	Total weight
<i>Metridium senile</i>	Count	-	Total weight
<i>Nemertesia antennina</i>	Present	-	Total weight
<i>Nemertesia ramosa</i>	Present	-	Total weight
<i>Obelia bidentata</i>	Present	-	Total weight
<i>Obelia dichotoma</i>	Present	-	Total weight
<i>Obelia geniculata</i>	Present	-	Total weight
<i>Obelia longissima</i>	Present	-	Total weight
<i>Pennatula phosphorea</i>	Count	Length	Individual weight
<i>Plumularia setacea</i>	Present	-	Total weight
<i>Polyplumaria frutescens</i>	Present	-	Total weight
<i>Rhizocaulus verticillatus</i>	Present	-	Total weight
<i>Sagartia elegans</i>	Count	-	Total weight
<i>Sagartia troglodytes</i>	Count	-	Total weight
<i>Selaginopsis fusca</i>	Present	-	-
<i>Sertularella gayi</i>	Present	-	Total weight
<i>Sertularella polyzonias</i>	Present	-	Total weight
<i>Sertularella rugosa</i>	Present	-	Total weight
<i>Sertularella tenella</i>	Present	-	Total weight
<i>Sertularia argentea</i>	Present	-	Total weight
<i>Sertularia cupressina</i>	Present	-	Total weight
<i>Stomphia coccinea</i>	Count	-	Total weight
<i>Tamarisca tamarisca</i>	Present	-	Total weight
<i>Thuiaria articulata</i>	Present	-	Total weight
<i>Thuiaria thuja</i>	Count	-	Total weight
<i>Tubularia indivisa</i>	Present	-	Total weight
<i>Urticina eques</i>	Count	-	Total weight
<i>Urticina felina</i>	Count	-	Total weight
<i>Ventromma halecioides</i>	Present	-	Total weight
<i>Virgularia mirabilis</i>	Count	Length	Individual weight
<b>Sipuncula &amp; Echiura</b>			
<i>Echiurus echiurus</i>	Count	-	Individual weight
<i>Phascolion strombus</i>	Count	-	-
<b>Annelida</b>			
Generally they should be counted, the thorax width should be measured to the 0.1mm below and animals weighed individually. Tubeworms should be left in the tube if the tube was produced by themselves, but removed if other material such as sand was used.			
<i>Ampharete grubei</i>	Count	-	Individual weight
<i>Amphictene auricoma</i>	Count	-	Total weight in tube
<i>Ditrupa arietina</i>	Count	-	Total weight with tube
<i>Filograna implexa</i>	Present	-	Total weight with tube

## Sessile species

<i>Hydroides norvegica</i>	Present	-	-
<i>Lagis koreni</i>	Count	-	Individual weight, take out of tube
<i>Lanice conchilega</i>	Count tube fringe	-	Individual weight
<i>Lygdamis muratus</i>	Count	-	Individual weight, take out of tube
<i>Neoamphitrite figulus</i>	Count	-	Total weight
<i>Owenia fusiformis</i>	Count	-	Total weight, check if tube occupied, weigh in tube
<i>Polyphysia crassa</i>	Count	-	Individual weight
<i>Pomatoceros lamarcki</i>	Present	-	-
<i>Pomatoceros triqueter</i>	Present	-	-
<i>Sabellaria alveolata</i>	present	-	Total weight
<i>Serpula vermicularis</i>	Present	-	-
<i>Terebellides stroemi</i>	Count	-	Individual weight
<i>Thelepus cincinnatus</i>	Count	Individual width	Total weight with tube (subsample Flustra if necessary)
<b>Crustacea</b>			
<i>Balanus balanus</i>	Count	-	Remove some and take total weight
<i>Balanus crenatus</i>	Count	-	Remove some and take total weight
<i>Scalpellum scalpellum</i>	Count	Length of individual capitulum	Total weight
<i>Verruca stroemia</i>	Count	-	-
<b>Mollusca</b>			
<i>Crepidula fornicata</i>	Count	-	Total weight
<i>Anomia ephippium</i>	Count	-	-
<i>Hiatella arctica</i>	Count	Measure longest axis	Individual weight
<i>Pododesmus patelliformis</i>	Count	-	-
<b>Brachiopoda</b>			
<i>Macandrevia cranium</i>	Count	Longest axis	Individual weight
<b>Bryozoa</b>			
General rule: take total weight of branching bryozoans; record encrusting ones as present.			
<i>Alcyonidium diaphanum</i>	Present	-	Total weight
<i>Alcyonidium gelatinosum</i>	Present	-	-
<i>Alcyonidium parasiticum</i>	Present	-	-
<i>Alderina imbellis</i>	Present	-	-
<i>Amphiblestrum auritum</i>	Present	-	-
<i>Amphiblestrum flemingii</i>	Present	-	-
<i>Aspidelectra melolontha</i>	Present	-	-
<i>Bicellariella ciliata</i>	Present	-	-
<i>Bicellarina alderi</i>	Present	-	-
<i>Bowerbankia gracilis</i>	Present	-	Total weight
<i>Bugula flabellata</i>	Present	-	Total weight
<i>Bugula plumosa</i>	Present	-	Total weight

## Sessile species

<i>Buskea dichotoma</i>	Present	-	-
<i>Callopora craticula</i>	Present	-	-
<i>Callopora dumerilii</i>	Present	-	-
<i>Cellaria fistulosa</i>	Present	-	-
<i>Cellepora pumicosa</i>	Present	-	-
<i>Conopeum reticulum</i>	Present	-	-
<i>Crisia aculeata</i>	Present	-	-
<i>Crisia eburnea</i>	Present	-	-
<i>Dendrobeatia fruticosa</i>	Present	-	Total weight
<i>Dendrobeatia murrayana</i>	Present	-	Total weight
<i>Electra pilosa</i>	Present	-	-
<i>Escharella immersa</i>	Present	-	Total weight
<i>Escharoides coccinea</i>	Present	-	-
<i>Escharoides mamillata</i>	Present	-	-
<i>Eucratea loricata</i>	Present	-	Total weight
<i>Flustra foliacea</i>	Present	-	Total weight
<i>Hornera lichenoides</i>	Present	-	-
<i>Lichenoporidae</i>	Present	-	-
<i>Membranipora membranacea</i>	Present	-	-
<i>Omalosecosa ramulosa</i>	Present	-	-
<i>Palmiskenea skenei</i>	Present	-	-
<i>Parasmittina trispinosa</i>	Present	-	-
<i>Porella compressa</i>	Present	-	-
<i>Porella laevis</i>	Present	-	-
<i>Pyripora catenularia</i>	Present	-	-
<i>Reptadeonella violacea</i>	Present	-	-
<i>Reteporella beaniana</i>	Present	-	-
<i>Reteporella septentrionalis</i>	Present	-	-
<i>Schizomavella linearis</i>	Present	-	-
<i>Schizoporella patula</i>	Present	-	-
<i>Scrupocellaria reptans</i>	Present	-	-
<i>Scrupocellaria scrupea</i>	Present	-	-
<i>Scrupocellaria scrupea</i>	Present	-	-
<i>Securiflustra securifrons</i>	Present	-	Total weight
<i>Tegella unicornis</i>	Present	-	-
<i>Tricellaria peachii</i>	Present	-	Total weight
<i>Tricellaria ternata</i>	Present	-	-
<i>Triticella pedicellata</i>	Present	-	-
<i>Tubulipora liliacea</i>	Present	-	Total weight
<i>Tubulipora phalangea</i>	Present	-	Total weight
<i>Turbicellepora avicularis</i>	Present	-	-
<i>Turbicellepora boreale</i>	Present	-	-
<i>Vesicularia spinosa</i>	Present	-	Total weight
<b>Tunicata</b>			
Solitary ascidians should be counted, measured along the longest axis and weighed individually. Make sure that they are water logged. Colonial ascidians should be recorded as present and the total weight taken, if possible.			
<i>Aplidium pallidum</i>	Present	-	Total weight
<i>Ascidia conchilega</i>	Count	Longest axis	Individual weight
<i>Ascidia mentula</i>	Count	Longest axis	Individual weight
<i>Ascidia virginea</i>	Count	Longest axis	Individual weight
<i>Ascidella aspersa</i>	Count	Longest axis	Individual weight

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Sessile species

	Count	Longest axis	Individual weight
<i>Asciidiella scabra</i>	Count	Longest axis	Individual weight
<i>Botrylloides leachi</i>	Present	-	-
<i>Ciona intestinalis</i>	Count	Longest axis	Individual weight
<i>Corella parallelogramma</i>	Count	Longest axis	Individual weight
<i>Molgula citrina</i>	Count	Longest axis	Individual weight
<i>Molgula occulta</i>	Count	Longest axis	Individual weight
<i>Polycarpa pomaria</i>	Count	Longest axis	Individual weight
<i>Styela clava</i>	Count	Longest axis	Individual weight

## Motile species

	counting	measuring	weighing
<b>Nemertea</b>	Present	-	-
<b>Polychaeta</b>			
<i>Anaitides maculata</i>	Count	Thorax width	Individual weight
<i>Aphrodita aculeata</i>	Count	Length to the closest 1mm below	Individual weight
<i>Eumida bahusiensis</i>	Count	Thorax width	Individual weight
<i>Eunice harassii</i>	Count	Thorax width	Individual weight
<i>Eunice norvegica</i>	Count	Thorax width	Individual weight
<i>Eunoe nodosa</i>	Count	Thorax width	Individual weight
<i>Gattyana cirrosa</i>	Count	Thorax width	Individual weight
<i>Glycera alba</i>	Count	Thorax width	Individual weight
<i>Harmothoe extenuata</i>	Count	Thorax width	Individual weight
<i>Harmothoe glabra</i>	Count	Thorax width	Individual weight
<i>Harmothoe lunulata</i>	Count	Thorax width	Individual weight
<i>Hyalinoecia tubicola</i>	Count	Thorax width ; if whole worm is available, measure length	Total weight in tube; individual weight without tube
<i>Laetmonice filicornis</i>	Count	Length to the closest 1mm below	Individual weight
<i>Lepidonotus clava</i>	Count	Thorax width	Individual weight
<i>Lepidonotus squamatus</i>	Count	Thorax width	Individual weight
<i>Maldane</i>	Count	Thorax width	Individual weight
<i>Neanthes fucata</i>	Count	Thorax width	Individual weight
<i>Neanthes virens</i>	Count	Thorax width	Individual weight
<i>Nephtys</i>	Count	Thorax width	Individual weight
<i>Nephtys assimilis</i>	Count	Thorax width	Individual weight
<i>Nephtys caeca</i>	Count	Thorax width	Individual weight
<i>Nephtys cirrosa</i>	Count	Thorax width	Individual weight
<i>Nephtys hombergii</i>	Count	Thorax width	Individual weight
<i>Nephtys incisa</i>	Count	Thorax width	Individual weight
<i>Nephtys longosetosa</i>	Count	Thorax width	Individual weight
<i>Nereis pelagica</i>	Count	Thorax width	Individual weight
<i>Nereis zonata</i>	Count	Thorax width	Individual weight
<i>Nothria conchylega</i>	Count	Thorax width	Individual weight
<i>Ophelia limacina</i>	Count	Thorax width	Individual weight
<i>Ophelina</i>	Count	Thorax width	Individual weight
<i>Ophelina acuminata</i>	Count	Thorax width	Individual weight
<i>Ophelina norvegica</i>	Count	Thorax width	Individual weight
<i>Perinereis cultrifera</i>	Count	Thorax width	Individual weight
<i>Polynoidae</i>	Count	Thorax width	Individual weight
<i>Sigalionidae</i>	Count	Thorax width	Individual weight
<b>Pycnogonida</b>			
<i>Nymphon brevistrore</i>	Count	Total length including proboscis	Individual weight
<i>Nymphon gracile</i>	Count	Total length including proboscis	Individual weight
<i>Nymphon stroemi</i>	Count	Total length including proboscis	Individual weight
<i>Pycnogonum littorale</i>	Count	Total length including	Individual weight

## Motile species

		proboscis	
<b>Crustacea</b> ; if eggs are attached include them in weight measurement; carapace length should be measured down the centre line; if there are spines on the carapace, measure widest point from just anterior to spine for width measurements; eye measurements are from the posterior edge of eye socket.			
<i>Ampelisca brevicornis</i>	Count	Eye to tip of telson	Individual weight
<i>Ampelisca macrocephala</i>	Count	Eye to tip of telson	Individual weight
<i>Anapagurus laevis</i>	Count	Carapace length	Individual weight
<i>Astacilla longicornis</i>	Count	Eye to tip of telson	Individual weight
<i>Atelecyclus rotundatus</i>	Count	Width of carapace	Individual weight
<i>Byblis gaimardii</i>	Count	Eye to tip of telson	Individual weight
<i>Calocaris macandreae</i>	Count	Carapace length	Individual weight
<i>Cancer bellianus</i>	Count	Width of carapace	Individual weight
<i>Cancer pagurus</i>	Count	Width of carapace	Individual weight
<i>Carcinus maenas</i>	Count	Width of carapace	Individual weight
<i>Caridion gordonii</i>	Count	Eye to tip of telson	Individual weight
<i>Cirolana borealis</i>	Count	Eye to tip of telson	Individual weight
<i>Cirolana cranchii</i>	Count	Eye to tip of telson	Individual weight
<i>Corystes cassivelaunus</i>	Count	Width of carapace	Individual weight
<i>Crangon allmanni</i>	Count	Eye to tip of telson	Individual weight
<i>Crangon crangon</i>	Count	Eye to tip of telson	Individual weight
<i>Diastylis rathkei</i>	Count	Eye to tip of telson	Individual weight
<i>Dichelopandalus bonnierii</i>	Count	Eye to tip of telson	Individual weight
<i>Dorhynchus thomsoni</i>	Count	Width of carapace	Individual weight
<i>Ebalia cranchii</i>	Count	Width of carapace	Individual weight
<i>Ebalia granulosa</i>	Count	Width of carapace	Individual weight
<i>Ebalia tuberosa</i>	Count	Width of carapace	Individual weight
<i>Ebalia tumefacta</i>	Count	Width of carapace	Individual weight
<i>Epimeria cornigera</i>	Count	Eye to tip of telson	Individual weight
<i>Eualus gaimardii</i>	Count	Eye to tip of telson	Individual weight
<i>Eurynome aspera</i>	Count	Width of carapace	Individual weight
<i>Eusirus longipes</i>	Count	Eye to tip of telson	Individual weight
<i>Galathea</i>	Count	Carapace length to base of rostrum	Individual weight
<i>Galathea dispersa</i>	Count	Carapace length to base of rostrum	Individual weight
<i>Galathea intermedia</i>	Count	Carapace length to base of rostrum	Individual weight
<i>Galathea nexa</i>	Count	Carapace length to base of rostrum	Individual weight
<i>Galathea squamifera</i>	Count	Carapace length to base of rostrum	Individual weight
<i>Galathea strigosa</i>	Count	Carapace length to base of rostrum	Individual weight
<i>Gammarus locusta</i>	Count	Eye to tip of telson	Individual weight
<i>Geryon trispinosus</i>	Count	Width of carapace (in front of spines)	Individual weight
<i>Goneplax rhomboides</i>	Count	Width of carapace	Individual weight
<i>Hippolyte varians</i>	Count	Eye to tip of telson	Individual weight
<i>Hippomedon denticulatus</i>	Count	Eye to tip of telson	Individual weight
<i>Hyas araneus</i>	Count	Width of carapace	Individual weight
<i>Hyas coarctatus</i>	Count	Width of carapace	Individual weight
<i>Hyperia galba</i>	Count	Eye to tip of telson	Individual weight

## Motile species

<i>Inachus dorsettensis</i>	Count	Width of carapace	Individual weight
<i>Inachus leptochirus</i>	Count	Width of carapace	Individual weight
<i>Inachus phalangium</i>	Count	Width of carapace	Individual weight
<i>Iphimedia obesa</i>	Count	Eye to tip of telson	Individual weight
<i>Iphinoe trispinosa</i>	Count	Eye to tip of telson	Individual weight
<i>Leucothoe spinicarpa</i>	Count	Eye to tip of telson	Individual weight
<i>Liocarcinus arcuatus</i>	Count	Width of carapace	Individual weight
<i>Liocarcinus depurator</i>	Count	Width of carapace	Individual weight
<i>Liocarcinus holsatus</i>	Count	Width of carapace	Individual weight
<i>Liocarcinus marmoreus</i>	Count	Width of carapace	Individual weight
<i>Liocarcinus pusillus</i>	Count	Width of carapace	Individual weight
<i>Lithodes maia</i>	Count	Carapace width	Individual weight
<i>Macropipus tuberculatus</i>	Count	Width of carapace (in front of spines)	Individual weight
<i>Macropodia deflexa</i>	Count	Width of carapace	Individual weight
<i>Macropodia rostrata</i>	Count	Width of carapace	Individual weight
<i>Macropodia tenuirostris</i>	Count	Width of carapace	Individual weight
<i>Maera loveni</i>	Count	Eye to tip of telson	Individual weight
<i>Munida rugosa</i>	Count	Eye to base of rostrum	Individual weight
<i>Munida sarsi</i>	Count	Eye to base of rostrum	Individual weight
<i>Mysidopsis angusta</i>	Count	Eye to tip of telson	Individual weight
<i>Necora puber</i>	Count	Width of carapace	Individual weight
<i>Nephrops norvegicus</i>	Count	Carapace length	Individual weight
<i>Pagurus alatus</i>	Count	Width of chela	Individual weight
<i>Pagurus bernhardus</i>	Count	Width of chela	Individual weight
<i>Pagurus cuanensis</i>	Count	Width of chela	Individual weight
<i>Pagurus prideaux</i>	Count	Width of chela	Individual weight
<i>Pagurus pubescens</i>	Count	Width of chela	Individual weight
<i>Palaemon elegans</i>	Count	Eye to tip of telson	Individual weight
<i>Pandalina brevisrostris</i>	Count	Eye to tip of telson	Individual weight
<i>Pandalus borealis</i>	Count	Eye to tip of telson	Individual weight
<i>Pandalus montagui</i>	Count	Eye to tip of telson	Individual weight
<i>Philoceras echinulatus</i>	Count	Eye to tip of telson	Individual weight
<i>Philoceras trispinosus</i>	Count	Eye to tip of telson	Individual weight
<i>Pilumnus hirtellus</i>	Count	Width of carapace	Individual weight
<i>Pirimela denticulata</i>	Count	Width of carapace	Individual weight
<i>Pisa tetraodon</i>	Count	Width of carapace	Individual weight
<i>Pisidia longicornis</i>	Count	Width of carapace	Individual weight
<i>Pontophilus norvegicus</i>	Count	Eye to tip of telson	Individual weight
<i>Pontophilus spinosus</i>	Count	Eye to tip of telson	Individual weight
<i>Porcellanidae</i>	Count	Width of carapace	Individual weight
<i>Portumnus latipes</i>	Count	Width of carapace	Individual weight
<i>Processa canaliculata</i>	Count	Eye to tip of telson	Individual weight
<i>Processa edulis crassipes</i>	Count	Eye to tip of telson	Individual weight
<i>Processa noveli</i>	Count	Eye to tip of telson	Individual weight
<i>Processa noveli holthuisi</i>	Count	Eye to tip of telson	Individual weight
<i>Processa parva</i>	Count	Eye to tip of telson	Individual weight
<i>Sabinea sarsi</i>	Count	Eye to tip of telson	Individual weight
<i>Spirontocaris lilljeborgi</i>	Count	Eye to tip of telson	Individual weight
<i>Spirontocaris spinus</i>	Count	Eye to tip of telson	Individual weight
<i>Thia scutellata</i>	Count	Width of carapace	Individual weight



## Motile species

<i>Thoralus cranchii</i>	Count	Eye to tip of telson	Individual weight
<i>Tmetonyx cicada</i>	Count	Eye to tip of telson	Individual weight
<i>Xantho pilipes</i>	Count	Width of carapace	Individual weight
<b>Mollusca</b> ; gastropods: spire tip to bottom of whorl or siphon if present; bivalves: longest axis ignoring ears when present.			
<i>Abra alba</i>	Count	Longest axis	Individual weight
<i>Abra nitida</i>	Count	Longest axis	Individual weight
<i>Abra prismatica</i>	Count	Longest axis	Individual weight
<i>Acanthocardia echinata</i>	Count	Longest axis	Individual weight
<i>Acanthodoris pilosa</i>	Count	Total length	Individual weight
<i>Acteon tornatilis</i>	Count	Shell length	Individual weight
<i>Adalaria proxima</i>	Count	Total length	Individual weight
<i>Aeolidia papillosa</i>	Count	Total length	Individual weight
<i>Aequipecten opercularis</i>	Count	Longest axis	Individual weight
<i>Akera bullata</i>	Count	Total length	Individual weight
<i>Alloteuthis subulata</i>	Count	Mantle length	Individual weight
<i>Antalis entalis</i>	Count	Total length	Individual weight
<i>Antalis vulgaris</i>	Count	Total length	Individual weight
<i>Aporrhais pespelecani</i>	Count	Longest vertical axis	Individual weight
<i>Aporrhais serresianus</i>	Count	Longest vertical axis	Individual weight
<i>Archidoris pseudoargus</i>	Count	Total length, if possible	Individual weight
<i>Arctica islandica</i>	Count	Longest axis	Individual weight
<i>Armina loveni</i>	Count	Total length	Individual weight
<i>Astarte sulcata</i>	Count	Longest axis	Individual weight
<i>Beringius turtoni</i>	Count	Longest vertical axis	Individual weight
<i>Buccinum humphreysianum</i>	Count	Longest vertical axis	Individual weight
<i>Buccinum undatum</i>	Count	Longest vertical axis	Individual weight
<i>Calliostoma formosum</i>	Count	Longest vertical axis	Individual weight
<i>Calliostoma zizyphinum</i>	Count	Longest vertical axis	Individual weight
<i>Capulus ungaricus</i>	Count	Longest vertical axis	Individual weight
<i>Chamelea gallina</i>	Count	Longest axis	Individual weight
<i>Chlamys distorta</i>	Count	Longest axis	Individual weight
<i>Clausinella fasciata</i>	Count	Longest axis	Individual weight
<i>Colus gracilis</i>	Count	Longest vertical axis	Individual weight
<i>Colus islandicus</i>	Count	Longest vertical axis	Individual weight
<i>Colus jeffreysianus</i>	Count	Longest vertical axis	Individual weight
<i>Corbula gibba</i>	Count	Longest axis	Individual weight
<i>Coryphella browni</i>	Count	Total length	Individual weight
<i>Cuspidaria cuspidata</i>	Count	Longest axis	Individual weight
<i>Cuspidaria rostrata</i>	Count	Longest axis	Individual weight
<i>Delectopecten</i>	Count	Longest axis	Individual weight
<i>Dendronotus frondosus</i>	Count	Total length	Individual weight
<i>Diplodonta rotundata</i>	Count	Longest axis	Individual weight
<i>Discodoris millegrana</i>	Count	Total length	Individual weight
<i>Donax variegatus</i>	Count	Longest axis	Individual weight
<i>Donax vittatus</i>	Count	Longest axis	Individual weight
<i>Eledone cirrhosa</i>	Count	Mantle length	Individual weight
<i>Ensis americanus</i>	Count	Longest axis	Individual weight
<i>Ensis arcuatus</i>	Count	Longest axis	Individual weight
<i>Ensis ensis</i>	Count	Longest axis	Individual weight
<i>Ensis siliqua</i>	Count	Longest axis	Individual weight

## Motile species

<i>Epitonium clathratulum</i>	Count	Longest vertical axis	Individual weight
<i>Epitonium clathrus</i>	Count	Longest vertical axis	Individual weight
<i>Euspira catena</i>	Count	Longest vertical axis	Individual weight
<i>Euspira pallida</i>	Count	Longest vertical axis	Individual weight
<i>Facelina bostoniensis</i>	Count	Total length	Individual weight
<i>Flabellina pellucida</i>	Count	Total length	Individual weight
<i>Gari fervensis</i>	Count	Longest axis	Individual weight
<i>Gibbula cineraria</i>	Count	Longest vertical axis	Individual weight
<i>Gibbula tumida</i>	Count	Longest vertical axis	Individual weight
<i>Jujubinus miliaris</i>	Count	Longest vertical axis	Individual weight
<i>Jupiteria minuta</i>	Count	Longest axis	Individual weight
<i>Lacuna crassior</i>	Count	Longest vertical axis	Individual weight
<i>Lepidochitona cinerea</i>	Count	Length	Individual weight
<i>Littorina saxatilis tenebrosa</i>	Count	Longest vertical axis	Individual weight
<i>Loligo forbesii</i>	Count	Mantle length	Individual weight
<i>Lucinoma borealis</i>	Count	Longest axis	Individual weight
<i>Lutraria lutraria</i>	Count	Longest axis	Individual weight
<i>Lyonsia norwegica</i>	Count	Longest axis	Individual weight
<i>Mactra stultorum</i>	Count	Longest axis	Individual weight
<i>Modiolarca tumida</i>	Count	Longest axis	Individual weight
<i>Modiolula phaseolina</i>	Count	Longest axis	Individual weight
<i>Modiolus barbatus</i>	Count	Longest axis	Individual weight
<i>Modiolus modiolus</i>	Count	Longest axis	Individual weight
<i>Musculus discors</i>	Count	Longest axis	Individual weight
<i>Mysia undata</i>	Count	Longest axis	Individual weight
<i>Mytilus galloprovincialis</i>	Count	Longest axis	Individual weight
<i>Neptunea antiqua</i>	Count	Longest vertical axis	Individual weight
<i>Nucula hanleyi</i>	Count	Longest axis	Individual weight
<i>Nucula nitidosa</i>	Count	Longest axis	Individual weight
<i>Nucula nucleus</i>	Count	Longest axis	Individual weight
<i>Okenia elegans</i>	Count	Total length	Individual weight
<i>Onchidoris muricata</i>	Count	Total length	Individual weight
<i>Palliolum tigerinum</i>	Count	Longest axis	Individual weight
<i>Parvicardium ovale</i>	Count	Longest axis	Individual weight
<i>Parvicardium scabrum</i>	Count	Longest axis	Individual weight
<i>Phaxas pellucidus</i>	Count	Longest axis	Individual weight
<i>Plagiocardium papillosum</i>	Count	Longest axis	Individual weight
<i>Polinices fuscus</i>	Count	Longest vertical axis	Individual weight
<i>Polinices montagui</i>	Count	Longest vertical axis	Individual weight
<i>Polinices pulchellus</i>	Count	Longest vertical axis	Individual weight
<i>Propilidium exiguum</i>	Count	Longest vertical axis	Individual weight
<i>Pseudamussium septemradiatum</i>	Count	Longest axis	Individual weight
<i>Puncturella noachina</i>	Count	Length	Individual weight
<i>Raphitoma echinata</i>	Count	Longest vertical axis	Individual weight
<i>Rossia macrosoma</i>	Count	Mantle length	Individual weight
<i>Scaphander lignarius</i>	Count	Shell length	Individual weight
<i>Sepiola atlantica</i>	Count	Mantle length	Individual weight
<i>Spisula elliptica</i>	Count	Longest axis	Individual weight
<i>Spisula solida</i>	Count	Longest axis	Individual weight
<i>Spisula subtruncata</i>	Count	Longest axis	Individual weight
<i>Tectura testudinalis</i>	Count	Longest vertical axis	Individual weight
<i>Tectura virginea</i>	Count	Longest vertical axis	Individual weight

## Motile species

<i>Tellimya ferruginosa</i>	Count	Longest axis	Individual weight
<i>Tergipedidae</i>	Count	Total length	Individual weight
<i>Timoclea ovata</i>	Count	Longest axis	Individual weight
<i>Tridonta elliptica</i>	Count	Longest axis	Individual weight
<i>Tridonta montagui</i>	Count	Longest axis	Individual weight
<i>Tritonia hombergii</i>	Count	Total length	Individual weight
<i>Trivia arctica</i>	Count	Longest vertical axis	Individual weight
<i>Trophon muricatus</i>	Count	Longest vertical axis	Individual weight
<i>Trophon truncatus</i>	Count	Longest vertical axis	Individual weight
<i>Turritella communis</i>	Count	Longest vertical axis	Individual weight
<i>Typhlomangelia nivalis</i>	Count	Longest vertical axis	Individual weight
<i>Velutina velutina</i>	Count	Longest vertical axis	Individual weight
<i>Volutopsius norwegicus</i>	Count	Longest vertical axis	Individual weight
<b>Echinodermata</b>			
<i>Amphiura brachiata</i>	Count	Width of disc	Individual weight
<i>Amphiura chiajei</i>	Count	Width of disc	Individual weight
<i>Amphiura filiformis</i>	Count	Width of disc	Individual weight
<i>Anseropoda placenta</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Asterias rubens</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Asterina gibbosa</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Astropecten irregularis</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Brissopsis lyrifera</i>	Count	Longest axis	Individual weight
<i>Cidaris cidaris</i>	Count	Diameter of disc	Individual weight
<i>Crossaster papposus</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Cucumaria frondosa</i>	Count	Longest axis	Individual weight
<i>Echinocardium cordatum</i>	Count	Longest axis	Individual weight
<i>Echinocardium flavescens</i>	Count	Longest axis	Individual weight
<i>Echinocyamus pusillus</i>	Count	Longest axis	Individual weight
<i>Echinus</i>	Count	Longest axis	Individual weight
<i>Echinus esculentus</i>	Count	Longest axis	Individual weight
<i>Henricia oculata</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Henricia sanguinolenta</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Hippasteria phrygiana</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Leptasterias muelleri</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Leptopentacta elongata</i>	Count	Longest axis	Individual weight
<i>Leptosynapta inhaerens</i>	Count	Longest axis	Individual weight
<i>Luidia ciliaris</i>	Count	Diameter of disc	Individual weight
<i>Luidia sarsi</i>	Count	Diameter of disc	Individual weight
<i>Ocnus lacteus</i>	Count	Longest axis	Individual weight
<i>Ophiomyxa pentagona</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Ophiopholis aculeata</i>	Count	Diameter of disc	Individual weight
<i>Ophiothrix fragilis</i>	Count	Diameter of disc	Individual weight
<i>Ophiura affinis</i>	Count	Diameter of disc	Individual weight

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Motile species

<i>Ophiura albida</i>	Count	Diameter of disc	Individual weight
<i>Ophiura ophiura</i>	Count	Diameter of disc	Individual weight
<i>Ophiura sarsi</i>	Count	Diameter of disc	Individual weight
<i>Parastichopus tremulus</i>	Count	Longest axis (weigh immediately!) Individual weight	Individual weight
<i>Plutonaster bifrons</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Pontaster tenuispinus</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Porania pulvillus</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Poraniomorpha hispida</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Psammechinus miliaris</i>	Count	Longest axis	Individual weight
<i>Pseudarchaster parelii</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Pseudothyone raphanus</i>	Count	Longest axis	Individual weight
<i>Psolus phantapus</i>	Count	Longest axis	Individual weight
<i>Psolus squamatus</i>	Count	Longest axis	Individual weight
<i>Pteraster militaris</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Spatangus purpureus</i>	Count	Longest axis	Individual weight
<i>Stichastrella rosea</i>	Count	Longest arm to opposite edge of disc	Individual weight
<i>Strongylocentrotus droebachiensis</i>	Count	Longest axis	Individual weight
<i>Thyone roscovita</i>	Count	Longest axis	Individual weight

**Fish**

Fish should be counted, measured head to tail to the nearest 0.5cm below and weighed individually to the nearest gram.

## **Appendix 5. Data collection sheets 1-13 to be completed by all partners**

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# 1. ENVIRONMENTAL SHEET (ENV)

STATION VALIDITY <sup>(92)</sup>	COUNTRY <sup>(1)</sup>			STATION NUMBER <sup>(8)</sup>
RECORD TYPE <sup>(65)</sup> <b>ST</b>	SHIP <sup>(2)</sup>			ICES RECTANGLE <sup>(29)</sup>
	DAY <sup>(12)</sup>	MONTH <sup>(11)</sup>	YEAR <sup>(10)</sup>	GPS DATUM <sup>(73)</sup>
SURFACE CURRENT DIRECTION <sup>(42)</sup>	SURFACE TEMPERATURE (°C) <sup>(49)</sup>			WIND DIRECTION <sup>(45)</sup>
SURFACE CURRENT SPEED <sup>(43)</sup>	BOTTOM TEMPERATURE (°C) <sup>(50)</sup>			WIND SPEED <sup>(46)</sup>
BOTTOM CURRENT DIRECTION <sup>(44)</sup>	SURFACE SALINITY <sup>(51)</sup>			SWELL DIRECTION <sup>(47)</sup>
BOTTOM CURRENT SPEED <sup>(97)</sup>	BOTTOM SALINITY <sup>(52)</sup>			SWELL HEIGHT <sup>(48)</sup>
OTHER REMARKS <sup>(54)</sup>				

**2. 2M BEAM TRAWL HAUL INFORMATION (2BTHI)**

GEAR <sup>(3)</sup> <b>2BT</b>		WARP PAY OUT SPEED <sup>(33)</sup>		TIME START FISHING <sup>(14)</sup>		SHIP <sup>(2)</sup>		HAUL VALIDITY <sup>(30)</sup>	
WARP DIAMETER <sup>(6)</sup>		WEIGHT ADDED TO BEAM TRAWL <sup>(72)</sup>		TIME STOP FISHING <sup>(15)</sup>		COUNTRY <sup>(1)</sup>		STATION NUMBER <sup>(8)</sup>	
WARP LENGTH <sup>(51)</sup>		MARKS ON SHOES <sup>(53)</sup>		HAUL DURATION <sup>(16)</sup>		DAY <sup>(12)</sup>	MONTH <sup>(11)</sup>	YEAR <sup>(10)</sup>	HAUL NUMBER <sup>(9)</sup>
POSITION at each time interval				SCANMAR USED <sup>(32)</sup>	BEAM TRAWL ID <sup>(85)</sup>	BEAM HEIGHT <sup>(86)</sup>		BEAM WIDTH <sup>(87)</sup>	
TIME <sup>(56)</sup>	LATITUDE (DEG) <sup>(57)</sup>	LATITUDE (MIN) <sup>(58)</sup>	LONGITUDE (DEG) <sup>(59)</sup>	LONGITUDE (MIN) <sup>(60)</sup>	E/W <sup>(22)</sup>	DEPTH <sup>(41)</sup>	TOW DIR <sup>(34)</sup>	GROUND SPEED <sup>(35)</sup>	
START <sup>(83)</sup>									
1									
2									
3									
4									
5									
STOP <sup>(84)</sup>									
OTHER REMARKS <sup>(54)</sup>							SKIPPER'S DISTANCE TRAWLED <sup>(101)</sup>		







**5. 2M BEAM TRAWL LENGTH FREQUENCY - BY SPECIES (2BTLFD)**

COUNTRY <sup>(1)</sup>		SHIP <sup>(2)</sup>		HAUL VALIDITY <sup>(30)</sup>	HAUL NUMBER <sup>(9)</sup>	STATION NUMBER <sup>(8)</sup>
GEAR <sup>(3)</sup>	DAY <sup>(12)</sup>	MONTH <sup>(11)</sup>	YEAR <sup>(10)</sup>	SPECIES NAME <sup>(62)</sup>		SPECIES CODE <sup>(63)</sup>

SIZE	LW					NO MES. <sup>(95)</sup>	R TOT <sup>(96)</sup>	SIZE	LW					NO MES. <sup>(95)</sup>	R TOT <sup>(96)</sup>
0								0							
1								1							
2								2							
3								3							
4								4							
5								5							
6								6							
7								7							
8								8							
9								9							
0								0							
1								1							
2								2							
3								3							
4								4							
5								5							
6								6							
7								7							
8								8							
9								9							
0								0							
1								1							
2								2							
3								3							
4								4							
5								5							
6								6							
7								7							
8								8							
9								9							
0								0							
1								1							
2								2							
3								3							
4								4							
5								5							
6								6							
7								7							
8								8							
9								9							
						TOTAL								TOTAL	

	1ST SAMPLE	2ND SAMPLE	3RD SAMPLE
COUNTED (NOT MEASURED)			
SIZE RANGE			
FRACTION SAMPLED			
RAISING FACTOR			

**6. INFAUNAL SAMPLER INFORMATION (InFHI)**

N.B. 1 page per station						GEAR <sup>(3)</sup>		SHIP <sup>(2)</sup>			INFAUNAL SAMPLING VALIDITY <sup>(93)</sup>					
						INFAUNAL SAMPLER ID <sup>(88)</sup>				COUNTRY <sup>(1)</sup>			STATION NUMBER <sup>(8)</sup>			
						INFAUNAL SAMPLER AREA <sup>(89)</sup>				DAY <sup>(12)</sup>	MONTH <sup>(11)</sup>	YEAR <sup>(10)</sup>				
RECORD OF GRABS AT EACH STATION																
DEP NO <sup>(7)</sup>	HAUL NO <sup>(9)</sup>	LATDEG <sup>(57)</sup>	LATMIN <sup>(58)</sup>	LONGDEG <sup>(59)</sup>	LONGMIN <sup>(60)</sup>	E/W <sup>(22)</sup>	DEPTH <sup>(41)</sup>	HAUL VALID <sup>(80)</sup>	PEN DEP <sup>(90)</sup>	SED <sup>(39)</sup>	MEIO <sup>(40)</sup>	SED TYPE <sup>(78)</sup>	PRES <sup>(91)</sup>	CON TYPE <sup>(79)</sup>		
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																





### 10. GOV TRAWL INFORMATION (GOVHI)

GEAR <sup>(3)</sup> <b>GOV</b>		WARP DIAMETER <sup>(6)</sup>		TIME START FISHING <sup>(14)</sup>		SHIP <sup>(2)</sup>			HAUL VALIDITY <sup>(30)</sup>		
GROUNDGEAR <sup>(4)</sup>		WARP LENGTH <sup>(31)</sup>		TIME STOP FISHING <sup>(15)</sup>		COUNTRY <sup>(1)</sup>			STATION NUMBER <sup>(8)</sup>		
KITE <sup>(5)</sup>		WARP PAY OUT SPEED <sup>(33)</sup>		HAUL DURATION <sup>(18)</sup>		DAY <sup>(12)</sup>	MONTH <sup>(11)</sup>	YEAR <sup>(10)</sup>	HAUL NUMBER <sup>(9)</sup>		
POSITION AND NET GEOMETRY at each time interval									SCANMAR USED <sup>(32)</sup>		
TIME <sup>(56)</sup>	LATDEG <sup>(57)</sup>	LATMIN <sup>(58)</sup>	LONGDEG <sup>(59)</sup>	LONGMIN <sup>(60)</sup>	E/W <sup>(22)</sup>	DEPTH <sup>(41)</sup>	HEIGHT <sup>(74)</sup>	WING <sup>(75)</sup>	DOORS <sup>(76)</sup>	TOW DIR <sup>(34)</sup>	SPEED <sup>(35)</sup>
START <sup>(83)</sup>											
5											
10											
15											
20											
25											
STOP <sup>(84)</sup>											
OTHER REMARKS <sup>(54)</sup>									SKIPPER'S DISTANCE TRAWLED <sup>(101)</sup>		

11. 8M BEAM TRAWL INFORMATION (8BTHI)											
GEAR <sup>(3)</sup> <b>8BT</b>		WARP PAY OUT SPEED <sup>(33)</sup>			TIME START FISHING <sup>(14)</sup>		SHIP <sup>(2)</sup>		HAUL VALIDITY <sup>(30)</sup>		
WARP DIAMETER <sup>(6)</sup>		WEIGHT ADDED TO BEAM TRAWL <sup>(72)</sup>			TIME STOP FISHING <sup>(15)</sup>		COUNTRY <sup>(1)</sup> <b>NED</b>		STATION NUMBER <sup>(8)</sup>		
WARP LENGTH <sup>(31)</sup>		MARKS ON SHOES <sup>(53)</sup>			HAUL DURATION <sup>(16)</sup>		DAY <sup>(12)</sup>	MONTH <sup>(11)</sup>	YEAR <sup>(10)</sup>	HAUL NUMBER <sup>(9)</sup>	
POSITION at each time interval					SCANMAR USED <sup>(32)</sup>		BEAM HEIGHT <sup>(86)</sup>		BEAM WIDTH <sup>(87)</sup>		
TIME <sup>(56)</sup>	LATITUDE (DEG) <sup>(57)</sup>	LATITUDE (MIN) <sup>(58)</sup>	LONGITUDE (DEG) <sup>(59)</sup>	LONGITUDE (MIN) <sup>(60)</sup>	E/W <sup>(22)</sup>	DEPTH <sup>(41)</sup>	TOW DIR <sup>(34)</sup>	GROUND SPEED <sup>(35)</sup>			
START <sup>(83)</sup>											
5											
10											
15											
20											
25											
STOP <sup>(84)</sup>											
OTHER REMARKS <sup>(54)</sup>							SKIPPER'S DISTANCE TRAWLED <sup>(101)</sup>				









## Appendix 6. EXAMPLE - Processing a 2m Epibenthic beam trawl catch.

Figure A6.1 shows schematically how each 2m epibenthic beam trawl catch could be worked up. The catch is initially washed through a sieve tower consisting of a 5mm sieve on top of a 2mm sieve. All the material retained in the 2mm sieve is immediately put into preservative for analysis in the laboratory. The material retained in the 5mm sieve is partially processed on board the vessel. Biological material is separated from the inorganic seabed debris and sorted into species. Organisms too small to weigh at sea (eg. <0.3g), or which cannot be adequately identified, are preserved for analysis on return to the laboratory. This leaves the material, grouped into species A to N in figure A6.1, to be worked up on board the vessel.

For species of low abundance (A to G in Figure A6.1), **ALL** individuals will be both measured and weighed. A total count and total weight of each species is first obtained. These data are recorded on Form 3, the 2m Epibenthic Beam Trawl Haul Summary Form, and entered into Worksheet 3 of the same name (2BTHS). Each individual of each species is then measured and weighed and the data recorded on Form 4, the 2m Epibenthic Beam Trawl Size-Weight Relationships Form, and entered into Worksheet 4 of the same name (2BTLW). This is all that needs be done for these species. The database developed from worksheet 4 can be queried to determine the required size frequency distribution information at a later date, thus this table contains “complete” Size frequency Distribution information. It is therefore not necessary to enter the data for these species in Form 5 or Worksheet 5. For this to be the case, however, it is critical that field “LFDComp” in Form/Worksheet 4 (2BTLW) is therefore filled correctly; C (for complete LFD information) for scarce species where all individuals have been measured and weighed, and I (for incomplete LFD information) for abundant species. For abundant species, this LFD information will be recorded on Form 5 and entered on Worksheet 5 (2BTLFD) (see below).

The more abundant species, H to N in figure A6.1, will be too numerous to measure and weigh every individual in the catch. For species of intermediate abundance, H to

L in figure A6.1, weigh the entire catch of each species, record the values on Form 3 and enter the data into worksheet 3 (2BTHS). Start measuring individuals of each species and record the data on the Size Frequency form. The first five individuals of each size (preferably in reasonable condition) are recorded in the LW column and kept aside in their size-category groups for later weighing. Continue measuring until satisfied that the recorded size frequency distribution is representative of the sample (may require 200 or more individuals if 10 or more size categories are present). Figure

A6.2 shows an example of the form at the point at which we decide that we have an adequate size frequency distribution. At this point a total of 107 individuals have been measured. We see that for size classes 7 to 14 we have the required 5 individuals kept aside for weighing, so we set this size range as our 2<sup>nd</sup> sample. Our 1<sup>st</sup> sample therefore comprises animals of less than 7mm, while our third sample consists of animals greater than 14mm. Of the 107 animals so far measured, 102 of these fall into our 2<sup>nd</sup> sample. This is therefore the number measured for the 2<sup>nd</sup> sample.

We then go through the remainder of the sample, counting all the animals belonging to the 2<sup>nd</sup> sample size range, and continuing to measure animals less than 7mm and greater than 14mm in size and recording these on the sheet. Having gone through the remainder of the catch (of eg species H), we have a count of 375 individuals belonging to the 2<sup>nd</sup> sample size range of 7 to 14mm. A further 4 individuals have turned up in the 1<sup>st</sup> sample size range of less than 7mm and these have been measured and recorded on the form (Figure A6.3). In this instance, all these animals have also been retained for weighing since we still have not exceeded the requirement of 5 individuals for any of these size categories. A further 20 animals have turned up in the 3<sup>rd</sup> sample size range of greater than 14mm. Again all these animals have been measured and recorded on the sheet (Figure A6.3), and where required, animals have been put aside in their size category groups, until 5 of each size category are available for weighing.

The Size Frequency form can now be completed. The number of each size category actually measured is tallied up in the “NoMeas” column. For our 1<sup>st</sup> and 3<sup>rd</sup> samples we can now fully establish their size ranges; 4 to 6mm for the 1<sup>st</sup> sample and 15 to 21mm for the 3<sup>rd</sup> sample. For these two samples we have no count – all the individuals in these size ranges were actually measured. The fraction sampled is “ALL” because we have gone through the entire catch, and the Raising Factor is 1, the number measured is what was present in the entire catch. For the 2<sup>nd</sup> sample 102 individuals were actually measured and a further 375 individuals of the same size range were counted. The Fraction sampled is again “ALL” because we went through the entire catch to get these values. The raising factor for the size categories in this size range is calculated by  $\frac{NoMeas + NoCount}{NoMeas}$ . In this case,  $\frac{102 + 375}{102} = 4.67647$ .

This working is shown on the form for later data assurance checking purposes. The Raised Total column (RtotNo) is then completed by multiplying the number measured in each size category by the appropriate raising factor. The completed working for this example is shown in Figure A6.3. (although partners may wish to complete the raised totals on Sheet 5, this does not have to be done, as when the total number per size class and raising factors are supplied to 2BTLFD, the worksheet will automatically calculate raised totals.)

The final steps are then to weigh the (up to) five individuals of each size category, recording these data onto Form 4 and entering them into worksheet 4. The one difference here is that since Form 3 does not hold complete LFD information for these more abundant species, I (for incomplete LFD information) is entered into field “LFDComp”. The total number of individual animals in the catch, 506 in this example, is then recorded in the Total Number field of Form 3, the 2m beam trawl haul summary form, and in the appropriate field in the corresponding worksheet 3 (2BTHS).

Finally, for highly abundant species (eg M and N in figure A6.1), where it is simply not practical to go through the entire catch in the way described above, a weighed sub-sample is taken and processed. First the entire catch is weighed and this data is recorded on form 3 and entered into Worksheet 3 (2BTHS). The sub-sample is then taken and this is also weighed. The Fraction Sampled is then simply calculated as

$\frac{\text{Weight\_of\_sub-sample}}{\text{Weight\_of\_entire\_catch}}$ . Thus if the entire catch weighs 25.3Kg and the sub sample weighs 3.5Kg, the fraction sampled is 3.5/25.3 (=0.13834). The sub-sample is then treated in exactly the same manner as if it was the entire catch of a moderately abundant species, with the size frequency data recorded onto Form 5, and the size-weight relationship data for the (up to) 5 individuals of each size category entered into form 4. The data on these forms then being entered into worksheets 5 (2BTLFD) and 4 (2BTLW) respectively. The only difference now is that the Fraction Sampled values differ at the bottom of the LFD form, affecting the calculations of the three raising factors. Figure A6.4 shows the same data as Figure A6.3, but now assumes that these data had been obtained by processing the sub-sample of 3.5Kg obtained from the total catch of 25.3Kg described above. When the sub sample is fully processed, and the Size Frequency Data form completed, the tally of all the raised numbers at size, 3657 in this example, is then entered into the Total Number fields of the haul summary form and worksheet (No 3, 2BTHS). The groups of 5 individuals at each size category are then weighed and the data recorded on the Size-Weight Relationship Form (No 4) and entered into the corresponding worksheet (2BTLW). Again this sheet does not contain full LFD information so "I" (for incomplete) is entered into the "LFDComp field.

Figure A6.1: Schematic for processing 2m Epi-benthic Beam Trawl catches

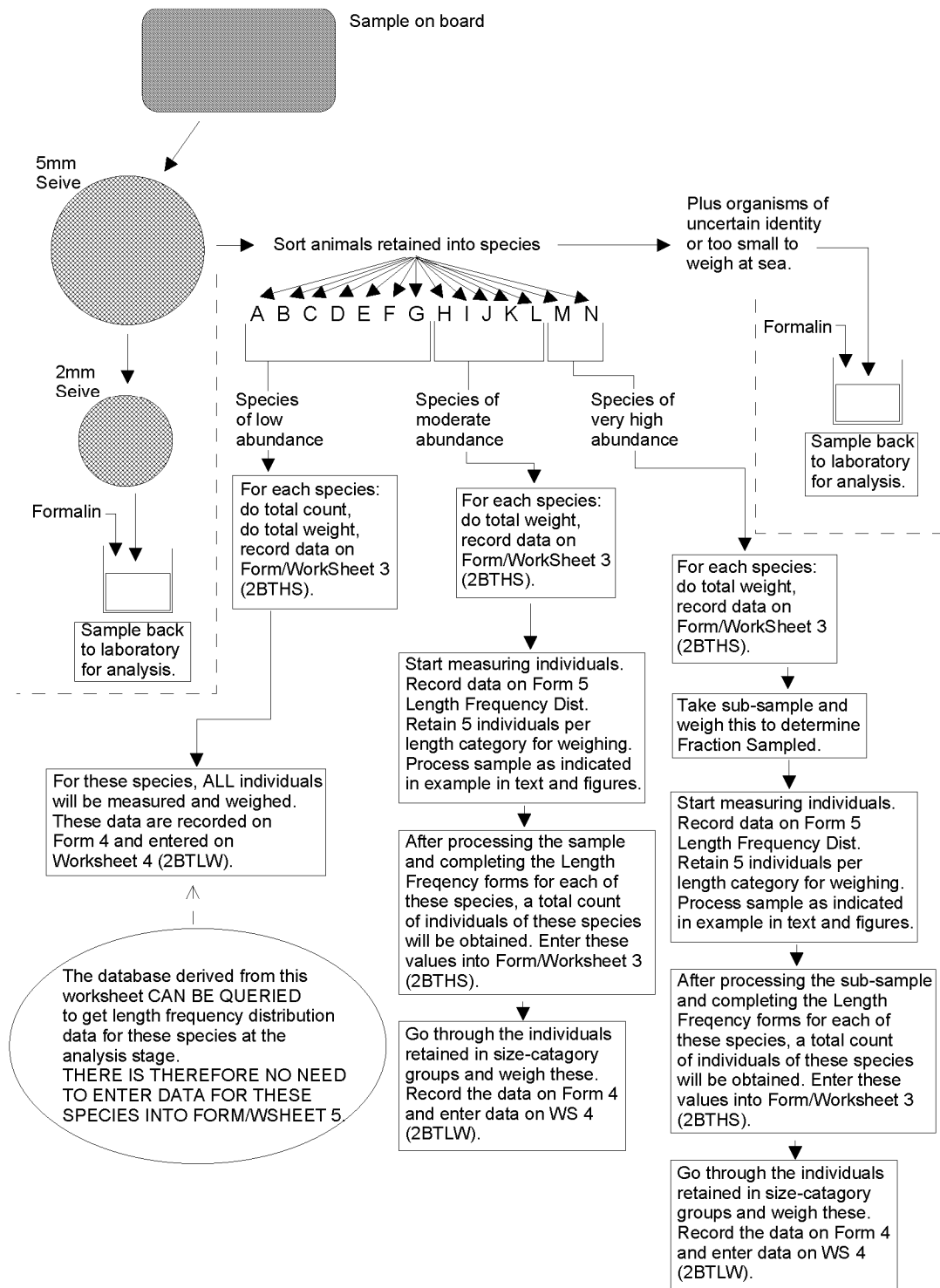


Figure A6.2: Size frequency form at point where the size frequency distribution is deemed to be adequately established.

### 12. LENGTH FREQUENCY

COUNTRY <sup>(1)</sup> <b>SCO</b>	SHIP <sup>(2)</sup> <b>SCO2</b>		HAUL VALIDITY <sup>(30)</sup> <b>V</b>	HAUL NUMBER <sup>(9)</sup> <b>S03/001</b>
GEAR <sup>(3)</sup> <b>2BT</b>	DAY <sup>(12)</sup> <b>1</b>	MONTH <sup>(11)</sup> <b>1</b>	YEAR <sup>(10)</sup> <b>2003</b>	SPECIES NAME <sup>(62)</sup> <i>Echinus sp</i>

SIZE	LW				TOTAL	RT	SIZE	LW				TOTAL	RT
0							0						
1							1						
2							2						
3							3						
4							4						
5							5						
6				1			6						
7					7		7						
8					12		8						
9					16		9						
10					20		0						
1					16		1						
2					14		2						
3					11		3						
4					6		4						
5				2			5						
6				1			6						
7				1			7						
8							8						
9							9						
20							0						
1				5	102		1						
2							2						
3							3						
4							4						
5							5						
6							6						
7							7						
8							8						
9							9						
30							0						
1							1						
2							2						
3							3						
4							4						
5							5						
6							6						
7							7						
8							8						
9							9						
					TOTAL	0						TOTAL	

	1ST SAMPLE	2ND SAMPLE	3RD SAMPLE
COUNTED (NOT MEASURED)			
SIZE RANGE OF ANIMALS COUNTED			
FRACTION SAMPLED			
RAISING FACTOR			

Figure A6.3: Final size frequency form, completed after the whole sample has been processed.

### 12. LENGTH FREQUENCY

COUNTRY <sup>(1)</sup> <b>SCO</b>	SHIP <sup>(2)</sup> <b>SCO2</b>		HAUL VALIDITY <sup>(30)</sup> <b>V</b>	HAUL NUMBER <sup>(9)</sup> <b>S03/001</b>
GEAR <sup>(3)</sup> <b>2BT</b>	DAY <sup>(12)</sup> <b>1</b>	MONTH <sup>(11)</sup> <b>1</b>	YEAR <sup>(10)</sup> <b>2003</b>	SPECIES NAME <sup>(62)</sup> <i>Echinus sp</i>

SIZE	LW				TOTAL	RT	SIZE	LW				TOTAL	RT
0							0						
1							1						
2							2						
3							3						
4					1	1	4						
5					1	1	5						
6					3	3	6						
7					7	7	33	7					
8					12	12	56	8					
9					16	16	75	9					
10					20	20	94	0					
1					16	16	75	1					
2					14	14	65	2					
3					11	11	51	3					
4					6	6	28	4					
5					10	10	10	5					
6					6	6	6	6					
7					3	3	3	7					
8					2	2	2	8					
9					1	1	1	9					
20					1	1	1	0					
1					1	1	1	1					
2								2					
3					131	131		3					
4								4					
5								5					
6								6					
7								7					
8								8					
9								9					
30								0					
1								1					
2								2					
3								3					
4								4					
5								5					
6								6					
7								7					
8								8					
9								9					
					TOTAL	506						TOTAL	

	1ST SAMPLE	2ND SAMPLE	3RD SAMPLE
COUNTED (NOT MEASURED)	0	375	0
SIZE RANGE OF ANIMALS COUNTED	4 TO 6	7 TO 14	15 TO 21
FRACTION SAMPLED	ALL	ALL	ALL
RAISING FACTOR	1	4.67647	1
		(102+375)/102	



Figure A6.4: Final size frequency form, completed after the whole sub-sample taken from the catch of a highly abundant species has been processed, and taking account of the effect of such sub-sampling on the calculation of appropriate raising factors.

### 12. LENGTH FREQUENCY

COUNTRY <sup>(1)</sup> <b>SCO</b>	SHIP <sup>(2)</sup> <b>SCO2</b>		HAUL VALIDITY <sup>(30)</sup> <b>V</b>	HAUL NUMBER <sup>(9)</sup> <b>S03/001</b>
GEAR <sup>(3)</sup> <b>2BT</b>	DAY <sup>(12)</sup> <b>1</b>	MONTH <sup>(11)</sup> <b>1</b>	YEAR <sup>(10)</sup> <b>2003</b>	SPECIES NAME <sup>(62)</sup> <i>Echinus sp</i>

SIZE	LW				TOTAL	RT	SIZE	LW				TOTAL	RT	
0							0							
1							1							
2							2							
3							3							
4					1	1	7	4						
5					1	1	7	5						
6					3	3	22	6						
7					7	7	237	7						
8					12	12	406	8						
9					16	16	541	9						
10					20	20	676	0						
1					16	16	541	1						
2					14	14	473	2						
3					11	11	372	3						
4					6	6	203	4						
5					10	10	72	5						
6					6	6	43	6						
7					3	3	22	7						
8					2	2	14	8						
9					1	1	7	9						
20					1	1	7	0						
1					1	1	7	1						
2								2						
3					131	131		3						
4								4						
5								5						
6								6						
7								7						
8								8						
9								9						
30								0						
1								1						
2								2						
3								3						
4								4						
5								5						
6								6						
7								7						
8								8						
9								9						
					TOTAL	3657						TOTAL		

	1ST SAMPLE	2ND SAMPLE	3RD SAMPLE
COUNTED (NOT MEASURED)	0	375	0
SIZE RANGE OF ANIMALS COUNTED	4 TO 6	7 TO 14	15 TO 21
FRACTION SAMPLED	3.5/25.3	3.5/25.3	3.5/25.3
RAISING FACTOR	7.22857	33.80420	7.22857
	25.3/3.5	$\frac{102+375}{102} * \frac{25.3}{3.5}$	25.3/3.5
	<b>80</b>		

**Appendix 7. Dates and contact numbers for the cruises 2003.**

Country	Cruise dates	Phone	Fax	e-mail
Germany	21.07. – 18.08.2003	00871-1123217	<b>00871-1123221</b>	With attachments: <a href="mailto:herwig@super-hub.com">herwig@super-hub.com</a>  Without attachment: whiii@les-raisting.de
The Netherlands/ Belgium	18.08. – 18.09.2003	+871324403310	+871324403315	tridens@MLNV.seaservices.net
England	06.08. – 06.09.2003	Mobile phone-voice: 0779 977 3456 Mobile phone- data: 0779 977 9023 Satellite Mini M- voice: 00871 763489184	Mobile phone- fax: 0779 977 9022 Satellite Mini M- fax: 00871 6000309716	cefas.endeavour@gtships.com
Scotland	31.07. – 26.08.2003	07775 835 096  Satellite: 00 871 323 497 310	07775 839 122  Satellite: 00 871 323 497 311	<a href="mailto:Scotia@marlab.ac.uk">Scotia@marlab.ac.uk</a> (no large attachments)
Norway	29.09. – 10.10.2003	Mobile: +47 94 55 68 11  Satellite: 00 871 150 325 710	Satellite: 00 871 325 715 012	97082185@mobilpost.com  425715010@inmc.eik.com