



The CCAMLR-2000 Krill Synoptic Survey of Area 48

Sampling Protocols – RMT8

Net Sampling

Experience gained through participation in other international programmes like BIOMASS has shown that standardization of equipment and methods is one of the most crucial steps for any successful work during the field sampling period and later analytical work. The following net sampling protocols set out the procedures to be adopted so that participants carrying out the CCAMLR Synoptic Survey 2000 can collect comparable high quality data sets that will facilitate the establishment of a uniform and valuable database.

Objectives

There are two primary objectives for the net sampling programme:

- to validate and identify acoustic targets, confirming which targets can be considered as krill and obtaining krill length frequency data for Target Strength estimation
- to describe krill demography and large scale distribution patterns of size groups and maturity stages as well as regional recruitment indices.

These two objectives require two different sampling strategies which will be outlined below

Standard Gear

The CCAMLR Working Group recommend the use of a standard type of net to avoid potential variation in catchability and selectivity of nets. The most appropriate type of net presently available is the RMT8+1 (Rectangular Midwater Trawl ; Baker et al. 1973). It was agreed at WG-EMM-99 that this net shall be used as the standard net for target and random hauls. Alternative gear, such as an equivalent IKMT type of net of 8 to 10 m² mouth opening, shall only be used if the RMT net is lost or damaged to such a degree that it cannot be repaired. The net should preferably have a mesh size of 3 to 4

mm. The net shall be equipped with a flowmeter to estimate the filtered water volume as accurately as possible, and a real-time time-depth-recorder (TDR) to follow the track of the net.

This page details the protocol for the RMT8 sampling. There are also separate details for processing the zooplankton from the RMT1.

Sampling strategy will be depend on whether a ship has an opening/closing RMT or not.

- Ships with an opening and closing RMT8 system will undertake a station net haul at around local midnight, during the day these ships will undertake a targeted net haul if suitable targets are detected.
- Ships without an opening and closing RMT8 system will undertake a station net haul at around local midday and at around local midnight. Station net hauls

Station net tows shall be carried out in the dark period of each day (around local midnight). The timing of the midnight sample is constrained by the period of darkness. A table of sampling times that take account of the changes in length and time of the hours of darkness (due to variation in date and position) will be produced for each ship. A midday station net haul may also be carried out if target fishing has not taken place since daybreak (see Target net haul protocol)

At each station a quantitative standard double oblique tow will be conducted from the surface down to 200 m (or to within 10 m of the bottom at stations shallower than 200 m). Such a depth range is considered to be the best compromise between the time available for sampling and the likely vertical depth range of krill. During the hauls a constant ship's speed of 2.5 ± 0.5 knots is suggested. It is recommended to maintain a wire speed of 0.7 to 0.8 m/sec (42 to 48 m/min) during paying out and of 0.3 m/sec (18 m/min) during hauling. The net mouth angle is remarkably constant during hauling within the speed ranges given above. When the net reaches maximum depth, the winch should be stopped for about 30 seconds to allow the net to stabilize before starting to retrieve the net. If the net is hauled from the stern of the ship then the propeller of the ship should be stopped when the net reaches a depth of 15 to 20 m; this is to minimize the effects of the propeller action on the net operation and avoids damage of the samples. The total time of the net haul from surface to bottom to surface should be 40 minutes.

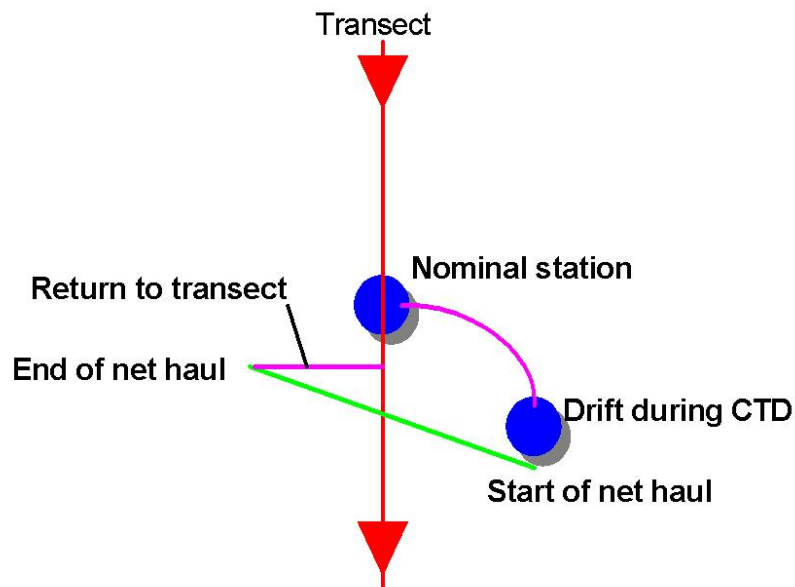
The use of a real-time TDR is essential to maintain a smooth net trajectory and control the maximum fishing depth. Calibrated flowmeters will be used to give a measure of net speed during the haul as well as the total distance travelled. The flowmeter should be mounted outside the net opening to avoid clogging which may reduce the efficiency. The dependence of mouth angle to the vertical of net speed has been investigated for the RMT system. The formula of Pommeranz et al. (1982) should be used to calculate the filtered water volume for oblique hauls. (If horizontal hauls are used then the formulas of Roe et al., 1980, should be used).

Target net hauls

Directed or targeted net sampling effort will be necessary to reduce the uncertainty associated with the delineation of krill in the acoustic data record (see planning meeting report para 10). This sampling would be directed at a variety of “acoustic morphs”, some presumed to be krill and some presumed not to be krill. During the daytime acoustic survey period the following target fishing strategy should be adopted by those ships that have an opening and closing RMT8 net system:

1. From the time of local apparent sunrise to local apparent noon conduct a directed tow if an acoustic morph of interest is detected and a reasonable chance of sampling it exists
2. If the directed tow is conducted between local apparent sunrise and three hours before local apparent noon, delay the CTD cast until local apparent noon
3. If a directed tow is conducted in the three hour period before local apparent noon, conduct the CTD cast at the same locale
4. If no suitable acoustic morphs are detected by local apparent noon, conduct a standard oblique tow in conjunction with a CTD cast at the midday station.

After the net haul the vessel will return directly by the shortest route to the acoustic transect line and continue the acoustic transect.



Laboratory Sampling

Subsampling

Samples from RMT can range from a few grams to several kilograms in weight. The total volume of the net catch should be measured (total drained sample volume). For catches with a total volume of less than 1 litre all the sample should be sorted. The minimum requirement is that all the krill and salp specimens shall be counted and measured immediately after the catch. If at all possible then the rest of the zooplankton either should be identified to the species level and counted, or stored in 10% buffered formalin solution for later analyses.

Samples that are too large to be sorted completely are subsampled volumetrically immediately after the catch. Due to differences in catch composition, subsampling must be carried out differently :

- if the sample size is larger than 1 litre and the sample mainly consists of krill: first the total drained sample volume has to be determined and recorded, afterwards a 1 litre subsample is taken randomly from the total samples and all krill and salp specimens are counted from this subsample (for measurements see below). For the remaining zooplankton fraction see above.
- if the sample size is larger than 1 litre and the sample mainly consists of salps: first the total drained sample volume has to be determined and recorded, afterwards all krill have to be sorted from the total sample, counted and measured (for measurements see below). Finally a 1 litre subsample is taken randomly from the total samples and all salp specimens are counted from this subsample. For the remaining zooplankton fraction see above.

Subsampling of catches should be undertaken on samples suspended in sufficient seawater to ensure mixing. Total volume of sample and seawater should be recorded, the sample should then be well mixed and a known volume of sample/seawater mixture withdrawn rapidly. The subsample volume should be recorded and the ratio of sample to subsample calculated and recorded.

Measurements of krill

Numeric

The reductions in sample size have to be recorded properly to allow the extrapolation from the subsample to the total sample size for each of the sample components (krill, salps, zooplankton). These data together with information on fishing depth and filtered water volume will allow the necessary standardization of krill densities and length density data (per m^2 or per $1000 m^3$)

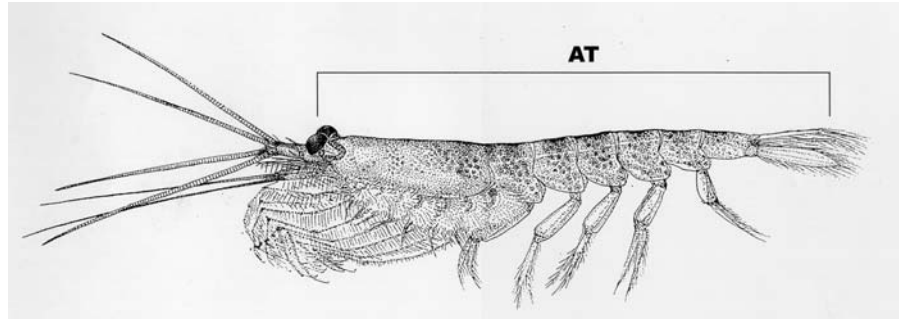
Volume and Weight

Total volume of krill in the sample (or subsample) should be measured. Participants should use a displacement volume or a wet weight with an accuracy of 0.1 grams. The method should be consistent throughout the cruise.

If time and resources permit data on length-weight relationships should be established for different parts of the survey area (e.g. for each statistical Subarea) and separately for 3 groups of krill (adult males, gravid females and all other krill - see Morris et al., 1988 for further details of this classification). If this is to be conducted on the ship then about 10 specimens per length class should be pooled and weighted. The station number must be recorded for each of the 10-specimen-measurement.

Length Measurements

The standard length measurement is total length as defined by the Discovery method (AT) from the anterior margin of the eye to the tip of the telson without the terminal spines. The standard unit is given in mm below, with an accuracy of 1 mm size classes. All measurement on each vessel should be done by one person to remove observer variation (see Watkins et al. 1986). Samples which contain less than 150 krill are used in total for length measurements and maturity stage identification. For larger krill catches a minimum of 150 krill shall be measured and staged.

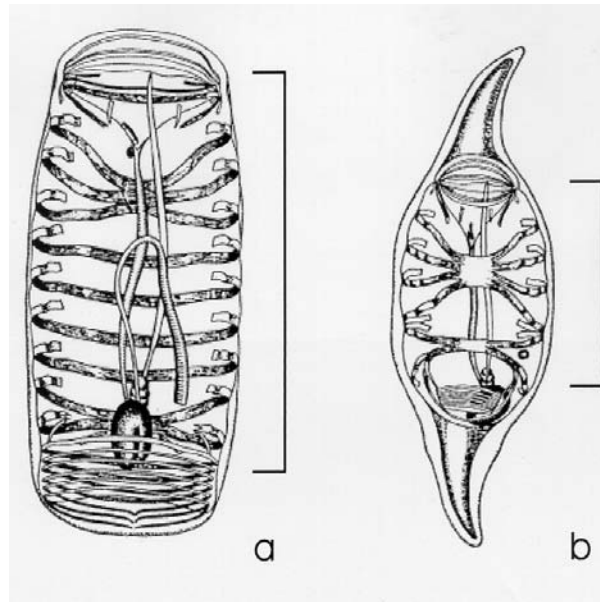


Maturity Stages

Krill sex and maturity stages should be identified using the classification of Makarov and Denys (1981, BIOMASS Handbook)

Measurements of salps

If possible all salps should be removed from samples smaller than 1 litre and counted. From larger samples a random subsample of 1 litre should be taken (see above). Please note the different species *Salpa thompsoni* and *Ihlea racovitzai* as well as the different forms (aggregate/solitary). If possible a minimum of 100 specimens per species should be measured. The internal body length (see figure and Foxton 1966) should be measured to the mm below with an accuracy of 1 mm size classes.



Other zooplankton from the RMT8 samples

If possible all other macro-zooplankton should be identified to the species level, either from fresh material immediately after the catch or from preserved samples. Special attention should be given to other euphausiid species and early life history stages of fish species. After sorting the larger organisms from the sample/subsample, the smaller constituents (e.g. krill larvae) should be sorted using dissecting microscopes. In case of high krill larvae abundance further splitting into subsamples might be necessary.

If possible the sample or subsample of other zooplankton should be preserved.

If possible length measurements should be carried out for key species like *Thysanoessa macrura* (tip of the rostrum to tip of the telson, mm below, 1 mm size class) and other euphausiid or fish species.

Preservation of krill

It is important that samples of krill are preserved for checking or future studies. It is recommended that if sufficient krill are available then the following strategy should be adopted.

1. a sample of 50 krill should be preserved in ethanol for genetic studies. A minimum of 90% ethanol with a volume 10 times the volume of krill is recommended
2. a subsample of krill which have not been processed should be preserved in formalin as a back-up data set
3. the krill that have been measured and staged should be preserved in formalin.

Preservation of other zooplankton

A subsample of other zooplankton should also be preserved in formalin when possible.

Data Entry

All relevant data should be entered onto computer prior to the termination of the cruise. Example electronic data sheets are provided below.

Net haul data entry table

This table will be available in Excel and QuattroPro spreadsheet formats

Cruise :	CCAMLR Survey 2000
Ship name :	aaaaaaaaaaaa
Net Type (RMT8, IKMT):	xxxx
Mesh Size :	x.x (in mm)
SubArea (48.1, 48.2, 48.3):	
Transect Number :	nn
Station Number :	nnn
Event Number (unique identifier):	nnn
Date (yymmdd):	yymmdd
Start Time, net in water (GMT):	hhmm
End Time, net out of water (GMT) :	hhmm
Haul Duration :	mmm (in minutes)
Latitude :	-ddmmss (no decimal point)
Longitude :	-dddmmss (no decimal point)
Type of haul (random or target identification) :	RA ID
Net Track (oblique, double oblique, horizontal) :	OB DO HO
Flowmeter start :	xxxxxx
Flowmeter end :	xxxxxx
Flowmeter distance (m) :	mmmm

