The CCAMLR 2000 krill synoptic survey

Welcome to the CCAMLR krill synoptic survey web site. This web site has been created to provide detailed information about the planning, the conduct and the analysis of the CCAMLR 2000 Synoptic Survey Cruises. After a brief introduction you will see that the site is divided into 3 main areas. These relate to:

- planning information used by participants of the survey.
- details of the actual cruises undertaken by the participating ships
- post-cruise data analyses

Information placed on this site may be modified to reflect the latest status of the analysis process. To help you keep up to date with changes each page or table shows when it was last modified. A contents page summarizes all the updates on the site, the navigation bar at the bottom of the page allows you to quickly move between the major sets of pages. Contact Jon Watkins , Synoptic Survey Coordinator (my email), if you require further information on the synoptic survey or have any comments about this site.

New Information

Follow the links to find the latest additions to the site

Introduction

An estimate of krill biomass (B_O) and its variance is used in the CCAMLR krill yield model to estimate the precautionary catch limit of krill for Area 48. At the present time the estimate of biomass is derived from the FIBEX (First International BIOMASS Experiment) synoptic survey which took place in 1980. Over the last 5 years there has been a recognition that more up to date estimates of krill biomass are required (SC-CAMLR-XII, paragraphs 2.38 to 2.43). For instance, in 1996 the CCAMLR Scientific Committee recognized the urgent need for a synoptic survey in Area 48 and noted that management advice for Area 48 could not be updated until such a survey had been conducted (SC-CAMLR-XV, paragraph 4.28). Since then plans to carry out a CCAMLR krill synoptic survey have progressed steadily

(SC-CAMLR-XVI, paragraphs 5.13 to 5.19).

Overview

The synoptic survey took place in January 2000. The survey concentrated its efforts in Subareas 48.1, 48.2, 48.3 and 48.4. The survey was multi-national in character, involving the participation of the research vessels *RV Kaiyo Maru* (Japan), *MV Atlantida* (Russia), *RRS James Clark Ross* (UK) and *MV Yuzhmorgeologiya* (USA) plus the participation of experts from other CCAMLR nations. The main objective was to improve estimates of B_O (pre-exploitation biomass) used in the krill yield model to estimate sustainable yield for Area 48 (WG-EMM-98, paragraph 9.51). Much of the survey was planned at a meeting in Cambridge in March 1999 and by using this website. The cruises were carried out to a set of agreed protocols to ensure that data from the participating nations is as comparable as possible. An estimate of and its variance was obtained at an analysis workshop in La Jolla in May/June 2000.

Following the workshop to estimate krill biomass (B_O) procedures were set in place to analyse the other data sets collected during the survey. A workshop was held in Cambridge in June 2001. Work is presently continuing on a set of multinational papers that will be published together in a peer-reviewed journal. A password protected area (Post-cruise analyses) provides details of the current status of these analyses.

Follow the main links below to get to key areas of the CCAMLR 2000 Synoptic Survey Web Site

Synoptic Survey Pre-cruise preparations, plans, protocols and meetings

RRS James Clark Ross Cruise (UK)

MV Yuzhmorgeologiya cruise (USA)

RV Kaiyo Maru cruise (Japan)

MV Atlantida cruise (Russia)

Post-cruise analyses

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British Antarctic Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL

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Page was last updated on 1 October 2001; Site was last updated on 24 January 2003

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The CCAMLR krill synoptic survey

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Background papers

1. Paragraphs from WG-EMM-98
2.

Paragraphs from WG-EMM-98 in Cochin

Plans for a Synoptic Krill Survey in Area 48

9.49 At previous meetings of the Working Group and the Scientific Committee a number of documents and recommendations specifically directed at planning for a synoptic survey in Area 48 had been produced. All of these discussions and recommendations were summarised in WG-EMM-98/24.
9.50 In addition, members of the synoptic survey steering committee and task groups who were present at the Workshop on Area 48 (La Jolla, USA, June 1998) met briefly to discuss progress of plans for the survey. A report of these deliberations and tasks carried out immediately following that meeting is presented in WG-EMM-98/25.
9.51 The primary objective of the synoptic survey is to improve estimates of B_0 (pre exploitation biomass) used in the krill yield model to estimate sustainable yield for Area 48 (SC-CAMLR-XII, paragraphs 2.39 and 2.41 to 2.47).
9.52 The Working Group considered the implications of interpreting the results from a single large-scale synoptic survey on estimating a long-term annual yield. The Working Group agreed that the krill yield model was robust with respect to interannual variability in krill biomass and will be able to use the B0 estimate directly in its calculations.
9.53 The Working Group noted that the smaller-scale regional surveys could be used to monitor for long-term trends in krill biomass. However, the relationship between these surveys and the biomass throughout Area 48 needs to be determined. In this respect it would be advantageous to ensure that the regular regional surveys (such as the US AMLR survey (USA) and the BAS Core Program (UK)) could

be linked to the large-scale synoptic survey in time and space so that the temporal variations observed in the regional surveys may be interpreted in respect of the larger area.

Survey Design

9.54 A number of documents specifically addressing the subject of survey design have been submitted to WG-Krill and WG-EMM over a number of years (summarised in WG EMM 98/24) and a number of general survey designs had been proposed.

9.55 At the Workshop on Area 48 , survey design was discussed in general terms and it was agreed that a randomised design coupled to a design-based analysis would produce the most statistically defensible result (WG-EMM-98/25, Appendix 1; see also conclusions from WG Krill-94/20 which is presented as Appendix 10 in WG-EMM-98/24).

9.56 The Working Group considered the set of four draft survey plans (WG EMM 98/44 and 98/53) which were drawn up at the request of the Area 48 synoptic survey planning meeting. All plans considered alternative ways of interleaving the tracklines of three ships that each had 30 days of time available to carry out the entire survey (including associated logistic costs).

(i) Plan 1 comprised a stratified random design with four strata. Three separate strata were placed around the South Shetland Islands, South Orkney Islands and South Georgia. The fourth strata covered the remaining oceanic regions of Area 48.

(ii) Plan 2 was an adaptive survey design utilising the same large-scale grid as plan 1 but directing additional survey effort into a series of survey cells (2 latitude x 2 longitude) that were shown to have above-average levels of biomass from the first pass through the area.

(iii) Plan 3 comprised a random transect design where all the effort for the three ships was put into conducting a series of large-scale transects across the area.

(iv) Plan 4 was an adaptive survey design where a series of small scale surveys were carried out each time a ship passed through an area where there was a high biomass of krill.

9.57 The Working Group first considered the relative merits of an adaptive survey design against a pre-planned survey design (plans 2 and 4 versus plans 1 and 3). It was agreed that an adaptive survey design could offer increased understanding of the structure of the system, through a more detailed description of the distribution of krill within high density areas. However, the Working Group felt that the advantages of an adaptive approach,
particularly as outlined in plan 4, in terms of improving the CV of the biomass estimate were less obvious. Indeed such techniques appeared to introduce increased complexity in terms of the design, execution and subsequent analysis of the survey.

9.58 The Working Group agreed that a model simulation of the relative merits of the adaptive and pre-planned surveys would be required to quantify the advantages of the two approaches. However, considerable concern was expressed both over the time-scale of such a simulation and the conclusiveness of the outcome.

9.59 The Working Group was also in agreement that a decision on the overall survey design had to be taken at this meeting. The Working Group agreed therefore that, given the concerns expressed above, the more conservative approach of utilising a pre-planned survey should be the preferred approach. This approach had been widely used in the past (for instance FIBEX) and was statistically robust and defensible.

9.60 The Working Group then considered the relative merits of a stratified versus unstratified design (plan 1 versus plan 3). It was pointed out that if krill were distributed in similar quantities both in the open ocean and in the shelf areas then a design which gives a uniform density of sampling across the whole area should be used (plan 3). However, if krill are concentrated in particular predictable areas, then a stratified sample design which takes account of this is likely to produce a lower overall CV. Note, however, that such a design will not change the expected estimate of mean biomass.
9.61 The Working Group was unable to agree on the relative importance of krill occurring on the shelves around the coast of the Antarctic Peninsula and the islands in Area 48. A variety of datasets and published papers (cf. WG-EMM-98/18 and 98/32) illustrate the complexity of the system.
9.62 The Working Group finally agreed that a modification of plan 3 would be adopted. Such a modification seeks to maximise the coverage provided by a series of large scale transects carried out across the Scotia Sea by the three ships undertaking the survey. However, in order to reduce the CV of the biomass estimate, within three regions (north coast of South Georgia, north coast of the South Orkneys and offshore from the South Shetlands) there will be an additional transect between each of the large-scale transects (see Figure 2), in effect doubling the transect density in the three regions described above relative to the rest of the survey area. For analytical purposes, this allocation of survey effort would provide data from two distinct strata (one being more densely sampled than the other).
9.63 To supplement the core survey as described above the Working Group also agreed that:
(i) if a fourth or fifth ship was able to contribute time within the period January 2000 then a series of extra transects would be interleaved within the existing large-scale transects;
(ii) the length of the transects would be tuned to the latitudinal boundaries of the krill distribution; and
(iii) participants would be encouraged to carry out their standard regional surveys either prior to or after the main synoptic survey. This was extremely important because it is necessary to link the temporal sequence of regional surveys with the wide spatial coverage of the synoptic survey.

Methods

Acoustics

9.64 The general philosophy for the acoustic methodology and equipment had been discussed previously. All participants were using Simrad EK500 systems and it was therefore possible to ensure a high level of standardisation. A preliminary proposal suggesting standard sampling protocols had been submitted (WG-EMM-98/47). The Working Group agreed with the general philosophy of the paper; that is whenever possible exact equipment, software and settings should be dictated. When exact matches were not possible, pertinent comparative information should be specified.
9.65 These protocols which cover (i) instrument settings, (ii) data logging, (iii) system calibration including multifrequency TS calibrations, intership calibrations and characterisation of system noise, (iv) survey operations and (v) additional recommendations should be agreed by the acousticians of the participating nations.
9.66 Multifrequency acoustics (38, 120, 200 kHz frequencies) would be available on the three ships carrying out the core transects. However, if additional ships were able to contribute to the survey effort (see paragraph 9.63) then such data would be a valuable addition to the dataset even if only 38 and 120 kHz data could be provided.

Net Sampling

9.67 The Working Group agreed that the main priority for the net sampling program was the determination of krill population structure demography. The requirements for estimates of net density and target identification were of secondary importance given that much information on krill identification would come from multifrequency acoustics.
9.68 There was considerable discussion of the sampling strategy used in the draft plans submitted in papers WG-EMM-98/44 and 98/53. In this case, a single night-time period was allocated for both net sampling and oceanographic sampling.
9.69 Given that the priority was to obtain a good coverage of samples for estimating the population structure, the Working Group agreed that a net sample should be taken around midnight and midday on each day of the survey. The timing of the midnight sample was constrained by the period of darkness. However, the timing of the midday sample was more flexible and the Working Group agreed that consideration should be given to allowing the time of this sample to shift as necessary to maintain a more regular pattern of sampling stations.
9.70 The Working Group considered that given the theoretical variation in catchability and selectivity of nets (see WG-EMM-98/20) it was highly desirable to standardise on the type of net used for krill sampling. At present the following nets were available:

Country	Net	Mesh Size (mm)	Mouth Area (m2)
Japan	KYMT	3.4	9.0
UK	RMT8	4.0	8.0
USA	IKMT	0.5	2.5
Russia	IKMT	6.0	6.0
Korea	IKMT	0.5	4.5

9.71 The Working Group felt that the most appropriate net in terms of catchability was the RMT8. However, they recognised also the financial implications of standardising on a single design and size of net.
9.72 Therefore the Working Group made two recommendations to achieve the best possible compromise with regard to net standardisation:
(i) to investigate the possibility of obtaining RMT8 systems from other CCAMLR Members which were not able to contribute ship time to the survey or any other sources; and
(ii) if the above was not possible then to allow the use of any of the above nets which had a mouth area of between 8 and 10 m2 and a mesh size of between 3.0 and 4.0 mm.
9.73 The Working Group agreed that representative samples of krill would be measured on board ship and results would be entered onto computer prior to the end of each cruise. Detailed protocols must be established as soon as possible.

Environmental Sampling

9.74 The Working Group considered that each ship should undertake a CTD to a depth of 1 000 m at each midnight and midday station. A detailed protocol including the use of water bottle samples for CTD calibration must be produced as soon as possible and the time implications assessed.

Other Sampling

9.75 The Working Group agreed that the acoustic transects, net sampling for population structure and CTD conducted at the midnight and midday stations would form the core of the sampling program and must be undertaken to standard protocols by all ships participating in the survey.
9.76 There were likely to be a number of other variables that participating countries would normally collect (for instance phytoplankton fluorescence, macro-zooplankton species composition, underway data such as obtained by pumped seawater supply or undulator). Such measurements were encouraged by the Working Group. It was emphasised, however, that such measurements must not compromise the collection of the core datasets.
9.77 The Working Group felt that it was appropriate that protocols and arrangements could be discussed between countries intending to collect similar data through the respective cruise leaders.
9.78 Appendix 8 of WG-EMM-98/25 presented a proposal from the IWC to send whale observers to participate on synoptic survey ships. Plans for such participation would be discussed at an IWC workshop at St Andrews, Scotland in March 1999. The Working Group felt that such a proposal was a valuable contribution to the synoptic survey. However, considerable concern was expressed about the number of observers traditionally used on such sighting surveys (six to eight persons per ship).
9.79 Although it was not possible to detail exactly how many spaces would be available on each participating ship it was thought that Japan and Russia would most likely only have room for one observer on each ship, UK was also tightly constrained but might be able to offer two berths while the USA thought it likely that they would be able to accommodate four to six observers.
9.80 The UK felt that independent estimates of whale numbers and incidental bird numbers would make a valuable comparison with the continuous bird and at-sea mammal observations that they conduct on their standard core program cruises and which are likely to be a component part of the synoptic survey.

Data Analysis and Storage

9.81 The Working Group agreed that the core datasets (i.e. acoustic data, krill length frequency data and CTD data) should be analysed in the first instance within a CCAMLR workshop by all survey participants. Such a workshop should be timed to take place as soon after the cruise as practical and in any event prior to the 2000 meeting of WG-EMM.
9.82 Further the Working Group agreed that the initial dissemination and publication of these core data results should take place as a joint undertaking.
9.83 A copy of all core data and appropriate meta-data must be deposited with the CCAMLR data centre. The Working Group agreed that the appropriate data storage formats would need to be addressed prior to the cruise.

Coordination of Planning after Meeting of WG-EMM-98

9.84 The Working Group agreed that there was an urgent requirement to appoint a survey coordinator who would undertake the following tasks:

(i) serve as a focal point between CCAMLR and cruise participants, and among cruise participants, for all matters relating to the survey planning, conduct and analysis;

(ii) organise a planning workshop. This would include defining all tasks to be accomplished at the workshop, coordinating the preparation of cruise protocols and ensuring such cruise methodologies are uniformly applied;

(iii) coordinate cruise plans and preparations amongst participants prior to the beginning of the survey. This would include coordinating the participation and interchange of key experts;

(iv) serve as the at-sea coordinator;

(v) ensure that data are supplied to CCAMLR and participants;

(vi) organise data analysis workshop for survey participants; and

(vii) coordinate report generation.

9.85 The Working Group agreed that the planning workshop should take place in mid- to late March 1999.

9.86 The Working Group also agreed that each participating country should provide a summary of any additional activities relevant to the synoptic survey that they would be undertaking during the 1999/2000 season.

9.87 Such summaries, all protocols and preliminary cruise plans must be completed and circulated to participants one month prior to this planning meeting.

9.88 The Working Group asked Dr Watkins to act as coordinator. In addition Drs Hewitt, M. Naganobu (Japan) and Watkins were appointed principal contacts for participating nations.

9.89 Any other countries wishing to participate should give a firm commitment prior to the planning meeting and supply the coordinator with a principal point of contact as soon as possible, but in any event no later than 15 March 1999.

9.90 Finally, the Working Group agreed that to facilitate planning it was important to nominate a definite start date as soon as possible. As a matter of priority all participants should confirm their ability to arrive at South Georgia in the first week of January 2000 to start the first calibration.

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Sampling Protocols

The synoptic survey will consist of a series of core (acoustic, net sampling, CTD casts) activities that will each be described by a detailed protocol. It is important that the protocols for the core activities are followed by all survey participants. In addition there will be a series of secondary activities (for instance predator observations, phytoplankton measurements) that will be described in some detail and we encourage every participant to undertake as many of these secondary activities as they can.

Core Activities

- Acoustic measurements of mean volume backscattering strength
- Net sampling for krill length frequency
- CTD sampling for water characterisation and geostrophic flow

Secondary Activities

- ADCP current measurements
- Predator observations (birds and seals)
- Observations on nutrients
- Observations on phytoplankton

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New Information Follow the links to find the latest additions to the site
Page on RMT1 sample preservation Page on post-cruise workshop analysis and data submission Itinerary for UK ship updated for new departure and extra work Latest positions of the ships during the cruise

Introduction

An estimate of krill biomass (B_O) and its variance is used in the CCAMLR krill yield model to estimate the precautionary catch limit of krill for Area 48. At the present time the estimate of biomass is derived from the FIBEX (First International BIOMASS Experiment) synoptic survey which took place in 1980. Over the last 5 years there has been a recognition that more up to date estimates of krill biomass are required (SC-CAMLR-XII, paragraphs 2.38 to 2.43). For instance, in 1996 the CCAMLR Scientific Committee recognized the urgent need for a synoptic survey in Area 48 and noted that management advice for Area 48 could not be updated until such a survey had been conducted (SC-CAMLR-XV, paragraph 4.28). Since then plans to carry out a CCAMLR krill synoptic survey have progressed steadily (SC-CAMLR-XVI, paragraphs 5.13 to 5.19).

Overview

The synoptic survey will take place in January 2000. The survey will concentrate its efforts in Subareas 48.1, 48.2, 48.3 and 48.4. The survey will be multi-national in character, involving the participation of 4 research vessels from different nations plus the participation of experts from other CCAMLR nations. The main objective will be to improve estimates of B_O (pre-exploitation biomass) used in the krill yield model to estimate sustainable yield for Area 48 (WG-EMM-98, paragraph 9.51). The survey will be carried out to set of agreed protocols to ensure that data from the participating nations is as comparable as possible. A cruise planning meeting will be held in March 1999 to finalize cruise tracks and protocols.

Draft cruise plans for the nations taking part in the synoptic survey are now being produced (UK, USA, Japan, Russia).

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British Antarctic Survey

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RRS James Clark Ross Synoptic Survey Cruise

Introduction

Introduction	Cruise narrative	Oceanography	Acoustics	Krill biology	Zooplankton biology	Predator observations	Appendices	Contents

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Survey Participants

UK

Name	Specialization	Institute	Contact
Jon Watkins	Scientist in Charge	British Antarctic Survey	j.watkins@bas.ac.uk
Doug Bone	Gear Development and Support	British Antarctic Survey	d.bone@bas.ac.uk
Mark Brandon	Oceanography	British Antarctic Survey / Open University	
Richard Bridgeman	Electronic Engineer	British Antarctic Survey	
Andy Brierley	Zooplankton acoustics	British Antarctic Survey	
Richard Cable	Computing/software Engineer		
Olga Crighton	Phytoplankton		
Geoff Cripps	Organic chemistry	British Antarctic Survey	g.cripps@bas.ac.uk
Bettina Fach	Oceanography	Old Dominion University	
Michael Force	Marine mammal observations	International Whaling Commission	
Keith Gillon	Bird observations	Sea Birds at Sea	
Cathy Goss	Acoustics	British Antarctic Survey	c.goss@bas.ac.uk
Sharon Grant	Oceanography & data	British Antarctic Survey	s.grant@bas.ac.uk
Elizabeth Hawker	Oceanography	British Antarctic Survey	

Sharon Hedley	Marine mammal observations	IWC & St. Andrews	
Russell Leaper	Marine mammal observations & whale acoustics	IWC	
Julian Priddle	Phytoplankton biology	British Antarctic Survey	j.priddle@bas.ac.uk
Todd Pusser	Marine mammal observations	IWC	
Jeremy Robst	Computing/software Engineer	British Antarctic Survey	
Rachel Shreeve	Zooplankton ecology	British Antarctic Survey	
Volker Siegel	Krill ecology	Institut fur Seefischerei	
Pauline Smith	Zooplankton ecology		
Phil Trathan	Oceanography & data	British Antarctic Survey	
Pete Ward	Zooplankton ecology	British Antarctic Survey	
Richard White	Bird observations	Sea Birds at Sea	

USA

Roger Hewitt (USA Scientist in Charge)
David Demer (Acoustics)
Valerie Loeb (krill demography)(email)
Wes Armstrong (krill demography)(email)

Japan

Mikio Naganobu (Japanese Scientist in Charge)
So Kawaguchi (krill biology)

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Itinerary for 3 ship survey

The table below details the timing for the 4 ships.
The following assumptions have been made

- UK ship starts from Falkland Islands
- USA ship starts from Punta Arenas
- Japanese ship starts from Buenos Aires and finishes in Valparaiso
- Russian ship will call at Falkland Islands and timings have been started from that point
- Each ship steams transects between civil dawn and civil dusk apart from a 2 hour period around local midday when CTD and net sampling take place
- Speed on transects is 10.5 knots and between transects is 12 knots
- The UK, USA, Japanese and Russian ships will calibrate at Stromness Harbour (South Georgia) prior to the start of the survey
- The UK, USA and Japanese ships will calibrate at King George Island (South Shetlands) after the end of the survey. The Russian ship will calibrate at Stromness Harbour (South Georgia) after the end of the survey.
- The UK ship undertakes two stations (MEB19 & MEB22) prior to arriving at Stromness
- The UK ship undertakes the WOCE CTD transect from Elephant Island to Burdwood Bank

Activities		UK		USA		Japan		Russia	
		start	end	start	end	start	end	start	end
Passage to South Georgia		12 Jan 09:00	15 Jan 15:21	8 Jan 09:00	12 Jan 20:37	4 Jan 09:00	8 Jan 06:00	9 Jan 09:00	12 Jan 06:00
Calibration at Stromness		15 Jan 15:21	16 Jan 15:21	12 Jan 20:37	13 Jan 20:37	8 Jan 06:00	10 Jan 06:00	12 Jan 06:00	14 Jan 06:00
Passage to survey start		16 Jan 15:21	17 Jan 09:58	13 Jan 20:37	14 Jan 01:22	10 Jan 06:00	10 Jan 14:20	14 Jan 06:00	15 Jan 11:00
	South Georgia box			14 Jan 06:10	15 Jan 19:59				
	South Sandwich box							15 Jan 13:21	18 Jan 20:39
First transect		17 Jan 09:58	20 Jan 12:35	16 Jan 21:00	19 Jan 20:30	10 Jan 14:20	13 Jan 22:12	19 Jan 19:00	22 Jan 22:55

Second transect		21 Jan 09:06	24 Jan 18:27	20 Jan 15:13	23 Jan 18:36	14 Jan 15:49	17 Jan 18:39	23 Jan 08:30	26 Jan 19:27
Third transect		25 Jan 11:22	28 Jan 20:38	24 Jan 16:33	27 Jan 13:15	18 Jan 18:11	21 Jan 10:13	27 Jan 02:46	30 Jan 16:05
	South Orkney box			28 Jan 04:08	29 Jan 23:44				
Fourth transect		29 Jan 12:48	31 Jan 00:48	30 Jan 14:09	31 Jan 11:10	21 Jan 14:39	23 Jan 00:13		
Fifth transect		1 Feb 11:53	2 Feb 19:53	1 Feb 05:46	2 Feb 05:50	23 Jan 19:31	24 Jan 23:10		
Sixth transect		3 Feb 12:40	4 Feb 20:21	2 Feb 23:26	4 Feb 08:43	25 Jan 20:34	27 Jan 12:17		
Seventh transect		5 Feb 19:37	7 Feb 21:22						
	South Shetland box					29 Jan 01:00	2 Feb 08:44		
Passage to King George		7 Feb 21:22	9 Feb 05:16	4 Feb 08:45	5 Feb 08:11	2 Feb 08:44	3 Feb 11:40	30 Jan 16:44*	1 Feb 11:37
Calibration at King George		9 Feb 05:16	10 Feb 05:16	5 Feb 08:10	6 Feb 08:10	3 Feb 11:40	4 Feb 11:40	1 Feb 11:40*	2 Feb 11:40
Passage from King George		10 Feb 05:16	15 Feb 04:10	6 Feb 08:10	8 Feb 19:30	4 Feb 11:40	11 Feb 03:00		
	Total days (port to port)		33.8		31.4		37.8		
	Total days (calibration to calibration)		25.6		24.5		27.1		21.2

The transects run by each ship can be seen here UK, USA, Japan, Russia

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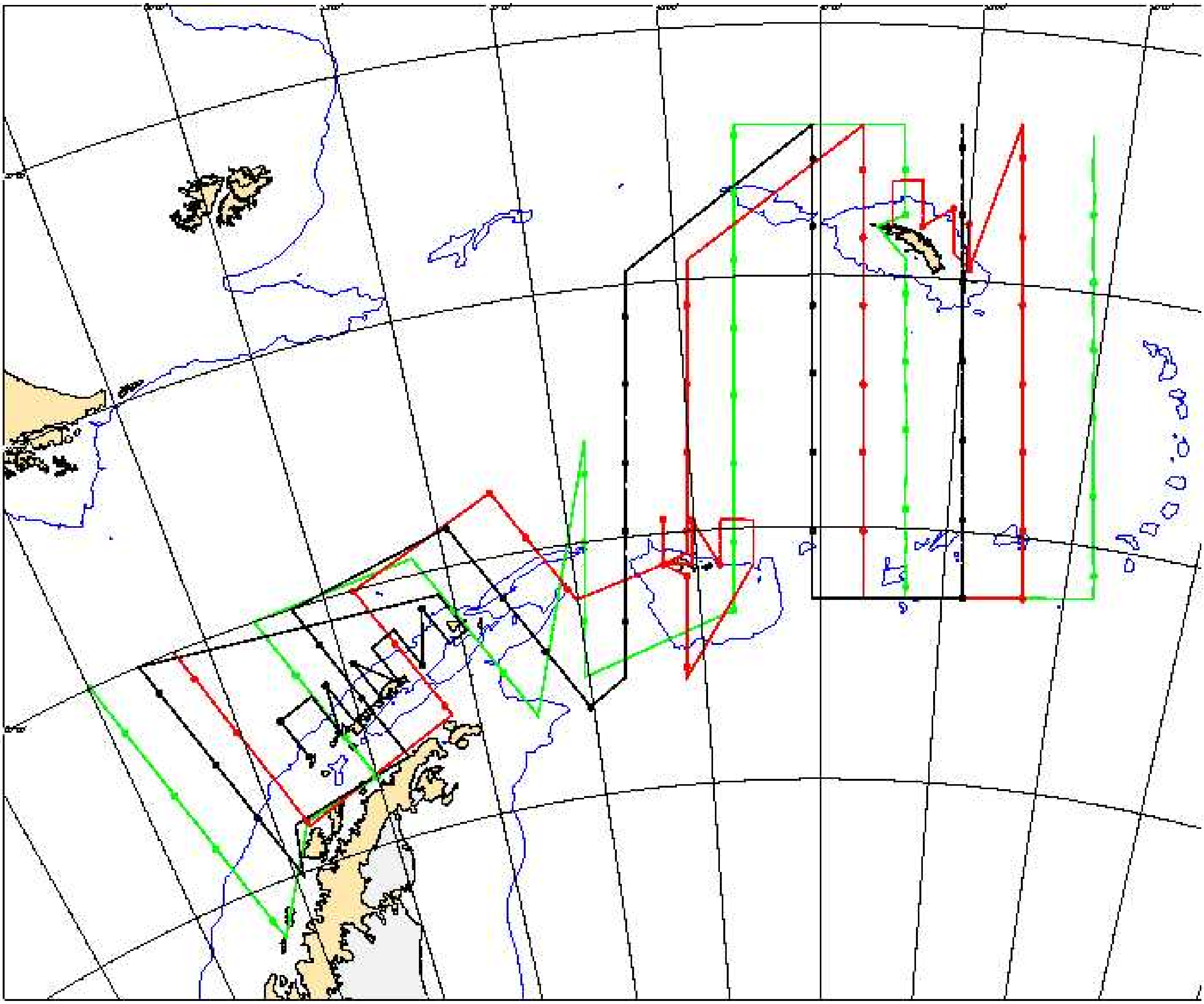
Station positions for 4 ships

The station positions for 4 ships have been calculated in a QuattroPro spreadsheets to allow the calculation of distance and steaming times for different plans. The actual provisional positions are now available. In addition the Waypoints for Ship 1, Waypoints for Ship 2 , Waypoints for Ship 3 and Waypoints for Ship 4 are finally available

At present there is an overall cruise track plot which shows how the interleaving transects will be arranged. The station plot below is calculated on the assumption that each ship stops at midnight and midday to undertake an RMT and a CTD. Two hours have been allowed for each daytime station. The time allocated to the nighttime stations vary according to the length of darkness; this depends on the position and date. Daylight times are provided here. The speed between stations on the north/south transects is 10.5 knots. On the transect heads the ships do not stop to sample and the speed has been increased to 12 knots. On the present plan the green ship (UK) carries out 34 stations, the red ship (USA) carries out 36 stations in the survey, the black ship (Japan) carries out 35.

During the meso-scale surveys (USA and Japan) acoustic transects will be steamed using the same protocol as the large scale sampling ie the ship will not survey during the night but will stop during the day for a 2 hour net sampling period around local midnight. NB this is a significant change to the previous version of the website. The Waypoints and Station Positions are being recalculated at present and can be recognized by bearing an October date at the foot of the relevant pages.

Station positions for 3 ships



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The CCAMLR krill synoptic survey

Survey track for 4 ships

The survey will be carried out by four ships (UK,USA, Japan and Russia).

The first three ships will steam an interleaved survey design which stretches across the Scotia Sea from South Georgia to the South Shetland Islands (covering Subareas 48.1, 48.2 and 48.3). The fourth ship (Russia) will steam a set of transects in Subarea 48.4. The survey tracks that will be steamed by UK, USA and Japan are shown below. All three ships will start at South Georgia and finish at the Antarctic Peninsula. The track for the Russian ship can be viewed here.

The survey design is a stratified, random design. The tracks for all ships have been plotted in QuattroPro spreadsheets to allow the calculation of distance and steaming times for different plans. Steaming times for these tracks are available in the latest itinerary (updated on 15 October 1999). Calculations have been carried out assuming that:

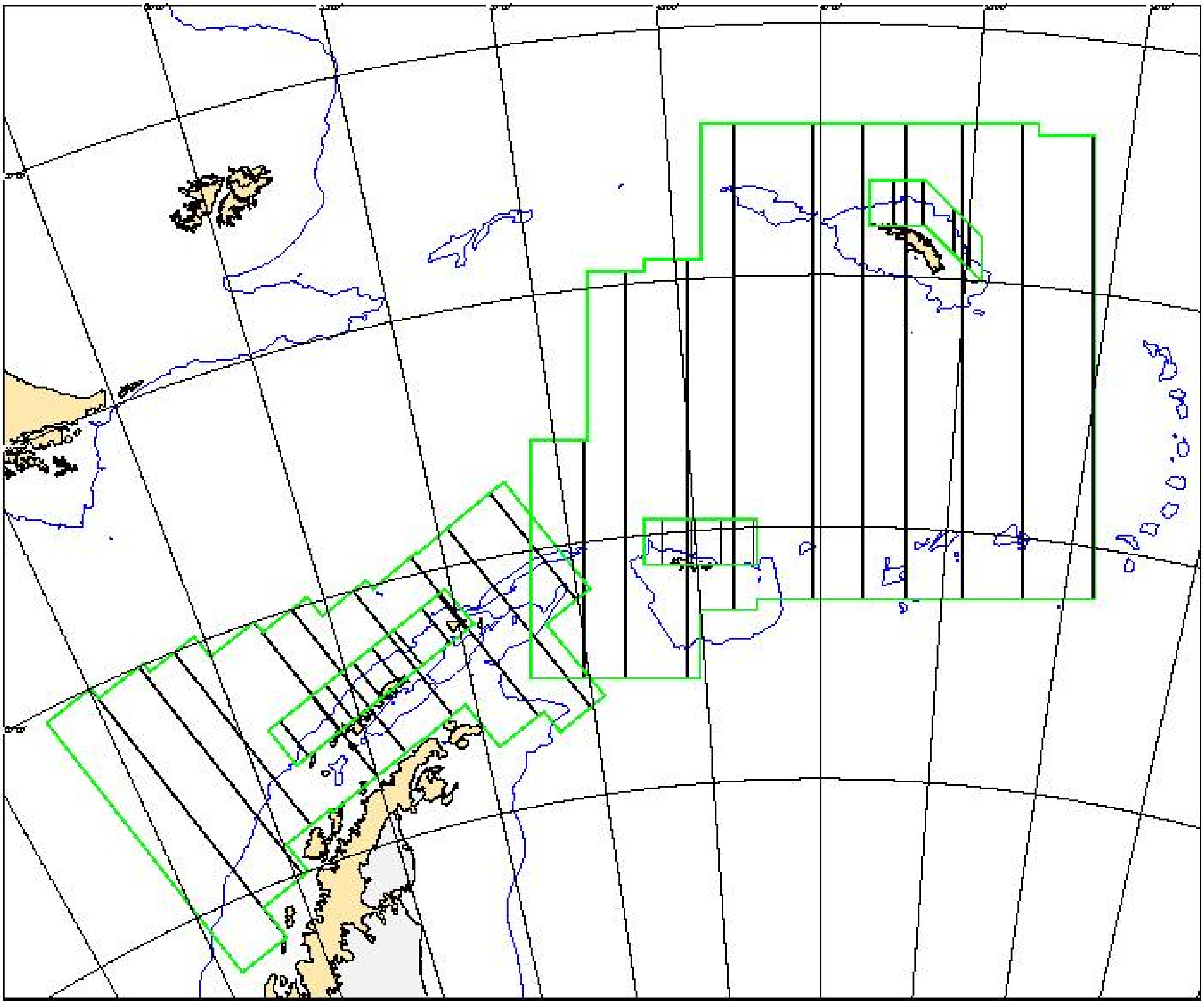
- the UK ship steams transects 1, 4, 7, 10, 13, 16 & 19;
- the USA ship steams transects 2, 5, 8, 11, 14, 17 & the small-scale surveys around South Georgia and South Orkney Islands;
- the Japanese ship steams transects 3, 6, 9, 12, 15, 18 & the small-scale survey around the South Shetland Islands
- the Russian ship will steam transects A, B & C in Subarea 48.4 plus the small-scale survey around the South Sandwich Islands

It has also been assumed that each ship spends up to 18 hours per day steaming transects. Each ship will carry out a daytime station around local midday (this will last for 2 hours). The period between dusk and dawn will be used for CTD and net sampling. The actual length of time between dusk and dawn depends on the location and date. In this plot the transects have been randomized. The actual theory and methods used to generate this plot can be viewed here.

The actual waypoints (calculated at 25 km intervals along each transect) are now available for Ship 1, Ship 2 & Ship 3

The survey tracks can also be viewed in relation to some other data sets:

- where the commercial fishery takes place
- the FAO statistical areas
- the positions of the major oceanic frontal regions
- provisional stations
- the 25 km grid for the Scotia Sea
- the 25 km grid for the Antarctic Peninsula



Introduction	Itinerary	Station positions	Cruise tracks	Planning Meeting	Sampling Protocols	Participants	Background papers	Contents

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The CCAMLR Krill Synoptic Survey

Planning meeting

A planning meeting was held at the British Antarctic Survey in Cambridge (UK) from 8-12 March 1999. Cruise leaders from all participating nations and experts in disciplines to be undertaken during the survey were invited to attend. A formal invitation to participate was sent out from CCAMLR. The meeting agenda , the meeting report and a list of tasks to be carried out (Appendix II) are now available. A photo of some of the workshop participants can be viewed here.

Meeting objectives

- Finalize cruise tracks for participating nations
- Finalize protocols for all activities to be undertaken during survey
- Coordinate participation and allocation of key experts
- Establish data entry requirements for cruise
- Produce timetable for data analysis
- Plan data analysis workshop

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The CCAMLR krill synoptic survey

Acoustic Sampling Protocols

The following protocols are set for the purpose of standardizing acoustic data collection and archival from multiple-ships during the multi-national effort to synoptically survey the entirety of FAO area 48 during the austral summer of 1999/2000. Methods for data analysis are not considered here, rather the primary objective of these protocols is to make the data collections as comprehensive and uniform as possible across all research platforms. Whenever possible, exact equipment, software, and settings have been dictated. In the cases where exact matches are not possible, pertinent comparative information has been specified.

Echosounder:

Simrad EK500 scientific Echosounder, Modified Firmware V5.3 (Modified for 1 ms 200 kHz pulse duration)

Transducers

The following transducer models are strongly preferred:

- 38 kHz: Simrad split-beam ES38-B
- 120 kHz: Simrad split-beam ES120-7
- 200 kHz: Simrad single-beam 200-28

Suboptimal optional models include:

- 38 kHz: Simrad split-beam ES38-12
- 120 kHz: Simrad split-beam ES120-9

- All of the preferred transducer models have 7° conical beamwidths that allow approximately equivalent insonified volumes. This will be an advantageous for employing multi-frequency methods for taxa delineation.
- The transducer mounting configuration should be documented. Record should be made of blister, trunk, or towed-body dimensions and location on hull or location of tow-point; the window material and acoustic properties; and the transducer depths, dimensions and relative locations.
- The transducers should be mounted in the same blister, well, or towed-body if possible. This will be advantageous for employing multi-frequency methods for in-situ target strength measurements.

Transceivers

- TX1: 38 kHz split beam
- TX2: 120 kHz split-beam
- TX3: 200 kHz single-beam

Settings

- EK500 settings files should be agreed upon and used by all survey participants for the survey, calibration, and noise measurement operations; only settings determined by individual system calibrations might differ (eg. TS gain, Sv gain, beam angles, transducer depth, etc.).
- Following the initial calibration experiments, the settings files (see Appendices A-Survey; B-Calibration; and C-Noise Settings) should be updated for the system specific settings (eg. TS gain, Sv gain, beam angles, transducer depth, etc.), and written to CD-ROM for retained integrity ("CD-master files"). In this way, no changes will be made to the settings after the initial or pre-survey calibration experiments.
- The system specific settings files should be downloaded to the echosounder using EchoConfig at the beginning of each survey day, and each calibration and noise experiment.

- After each time the settings files are downloaded to the echosounder, the echosounder settings will be queried and checked for differences from the CD master file.
- Particularly Notable Settings:
    - A pulse repetition rate of 2.0 seconds will be used for survey, calibration, and noise measurements.
    - The Noise Margin will be set to 0 dB.
    - Pulse durations of 1.0 ms will be transmitted at all three frequencies.
    - Bandwidths will be wide, narrow and narrow for 38, 120, and 200 kHz, respectively.
    - The transducer depths will be set to the nominal mounting depths for each transducer.
    - A mean sound speed profile and mean absorption coefficients will be estimated for the entire survey area using CTD data from previous years; all echosounders will be set with the same profile settings.
    - Record Sv and TS for each ping and frequency from 0 to 500m.
    - The time-varied gain will be set to 20logR for Sv and 40LogR for TS measurements.
    - TS and Sv thresholds will be set to the minimum values of -100 dB.
    - TS-Detection settings (Min. TS = -100 dB; Min./Max. Echo length = 0.8/2.5; Max. beam compensation = 6 dB; and Max. phase jitter = 2 steps.)
- EK500 time should be reset to correspond with logging PC/GPS time at the start of each day's survey.
- The Log Menu/Distance will be set only once to 0.0 n.mi. at the end of the initial calibration.

Data Logging:

- Data will be logged over an ethernet link with SonarData EchoLogEK and viewed and processed using SonarData EchoView software.
- For redundancy, the software will be run on two NT V4.0 Workstations with the following minimum configurations: 200 MHz Pentium II; 128 MB RAM; two 9 GB HDD; 4X CDROM writer.
- Data will be logged continuously on both workstations from the beginning of the first calibration to the end of the second calibration.
- On workstation No. 1, data collection will be viewed in real-time with SonarData EchoView software and written to CD at the end of each survey day.
- On workstation No. 2, data processing will be performed with SonarData EchoView software; at the end of the entire cruise, the entire data set will be written to a second set of CDs.

System Calibration

Standard sphere calibrations

- System calibrations will be performed at all three frequencies immediately before and after the survey in Stromness Bay, South Georgia (pre-cruise) and Admiralty Bay, King George Island (post-cruise).
- If at all possible, the transducer faces must be cleaned of debris and bio-fouling immediately prior to the initial calibration.
- Record must be made of the calibration: date; time; location; sea state (swell, wind, currents, ice); water temperature profile; salinity profile; sound speed profile; bottom depth; calibration apparatus; and ship's mooring configuration.
- The 38.1 mm WC sphere will be used as the standard target; all spheres will be purchased from a single production lot and each will be modified with small sputtered holes into which a single loop of monofilament attachment line will be glued.
- Theoretical TS=f(bandwidth and sound speed) will be obtained from Appendix D (theoretical TS values calculated for various anticipated sound speeds and for nomimal EK500 bandwidths).
- On-axis TS and Sa measurements will be made for each frequency at a range of 30m (see Simrad Calibration of the EK500 /EY500 - P2260/859-043867/4AA011, pp 1-36).
- The EK500 transceiver gain settings will be set to the calibrated Sv and TS gains.
- The EK500 transducer beamwidths should be set to the transducer calibration specifications provided by Simrad, as adjusted for sound speed (see Appendix D).
- The EK500 transducer off-axis angles should be set to 0.0 degrees.
- During the entirety of both pre- and post-survey calibration experiments, all acoustic data will be logged using EchoLogEK.
- Lobe files will also be logged whilst the TS gain is determined for the 38 and 120 kHz split-beam subsystems.

Multi-frequency Target Strength Calibrations

- The effectiveness of a split-beam echosounder system to reject echoes from unresolvable scatterers, thereby improving the measurements of *in-situ* target strengths (TS) of individuals, is dramatically enhanced by combining synchronized signals from two or more adjacent split-beam transducers of different frequencies. By utilizing the angular positional information from one of the split-beam transducers, additional corresponding TS measurements were shown to be obtainable from a juxtaposed single-beam transducer. Multi-frequency TS measurements provided information about

the identity of constituents in a mixed species assemblage.
- To determine the positional transform equations for each transducer, three-frequency TS measurements should be made of the 38.1 mm WC sphere as it is moved throughout the beams of the three transducers; all echo-trace data from this exercise should be logged using EchoLogEK.
- To check the system calibrations, to determine positional transform equations for each transducer, and to demonstrate the TS versus scatter size relationships, TS measurements should also be made of 13.7, 23.0, and 60.0 mm Cu spheres at each of the three frequencies as they are moved throughout the beams.
- During the entirety of these calibration experiments, all acoustic data will be logged using EchoLogEK.

Inter-ship Calibration Comparisons

- Selected shallow water survey transects in both Stromness Bay (start-end positions) and Admiralty Bay (start-end positions) should be repeated by each vessel; the seafloor scattering can thereby be used as the standard for comparisons. Sea state and ship speed and direction should be concurrently recorded with these measurements.

Characterization of System Noise

- Acoustic noise perceived by each of the three transducer/transceiver systems will be routinely monitored. Immediately following the conclusion of each day's acoustic survey effort, the Noise settings file (Appendix C) will be downloaded to the EK500 and for 10 minutes the ship will transit under survey conditions (survey course and speed). A separate Noise file will be logged using EchoLogEK. Concurrent observations of vessel speed, sea state, and ship's course relative to the wind and swell conditions will be recorded.

- With a Sv echogram threshold = -75 dB, banding free ranges (observed TVG rainbow effect) will be determined for each vessel under benign sea and weather conditions, at a ship speed of 10 knots - degradation of these "noise-free" observation ranges in excess of 10% will trigger remedial action (e.g. slowing ship speed, locating and eliminating noise source, etc.).

Survey Operations

- Whenever possible, survey at a constant speed of 10 knots; decreasing speed to reduce noise or increasing speed to maintain schedule as needed(provided noise level is acceptable).
- Survey during daylight hours only (recording data both day and night).

Additional Recommendations

- At least one person from each participating nation should be aboard another country's survey vessel during both the calibration and survey operations. This observer/participant should be knowledgeable about bioacoustic equipment and surveys and have familiarity with the adopted protocols.
- Nations not providing a vessel might participate in the surveys by providing one or more persons knowledgeable about bioacoustic equipment and surveys.
- Every effort should be made to have or obtain redundancy in "mission critical" equipment (e.g. spare EK500, circuit boards, logging computer, gps, etc.).

Necessary Preliminary Investigations

- Bench test EK500 using chosen settings and logging options.
- Identify mean sound speed and absorption coefficients to be used throughout the survey (estimate uncertainty in choosing mean values opposed to changing values frequently throughout the survey).

References

D.A. Demer, M.A. Soule and R.P. Hewitt, "A multiple-frequency method for potentially improving the accuracy and precision of *in-situ* target strength measurements," J. Acoust. Soc. Am., in press.

K.G. Foote, "Maintaining precision calibrations with optimal copper spheres," *J. Acoust. Soc. Am.* **73**, 1054-1063 **(1983)**.

K.G. Foote, "Spheres for calibrating an eleven-frequency acoustic measurement system," *ICES J. Mar Sci.* **46**:284-286 **(1990)**.

D.G.M. Miller, "Suggested outline for the design and implementation of future near-synoptic krill surveys., WG-Krill-94/20

W.D. Tesler, "The preparation of recommendations and standard procedures for krill acoustic surveys, WG-KRILL-93/5

This protocol has been developed by D.A. Demer (U.S.A.), Andrew Brierley (U.K.) and Tim Pauly (Australia)
Page last updated on 17 March 1999

The CCAMLR krill synoptic survey

Sampling Protocols

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 programmme:

- 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 m^2 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 targetted 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.

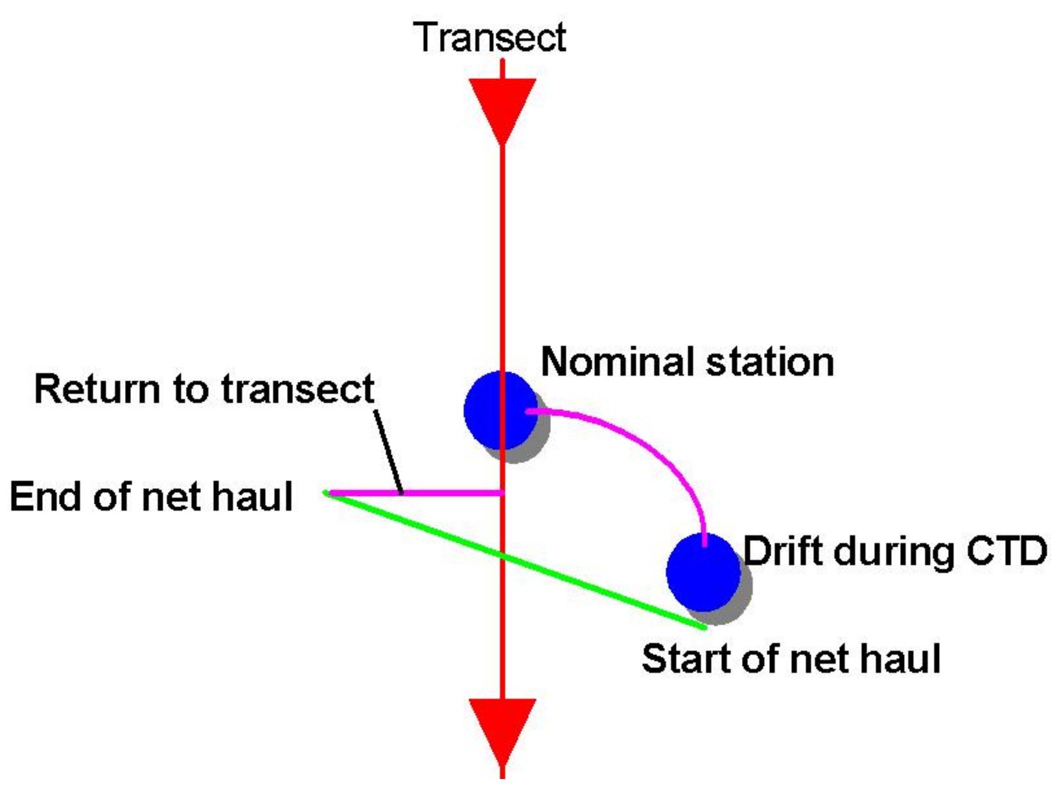
The use of a real-time TDR is essential to maintain a smooth net trajectory and control the maximum fishing depth. Calibrated flowmeters will be used to give a measure of net speed during the haul as well as the total distance travelled. The flowmeter should be mounted outside the net opening to avoid 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 be used to calculated 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 targetted 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)

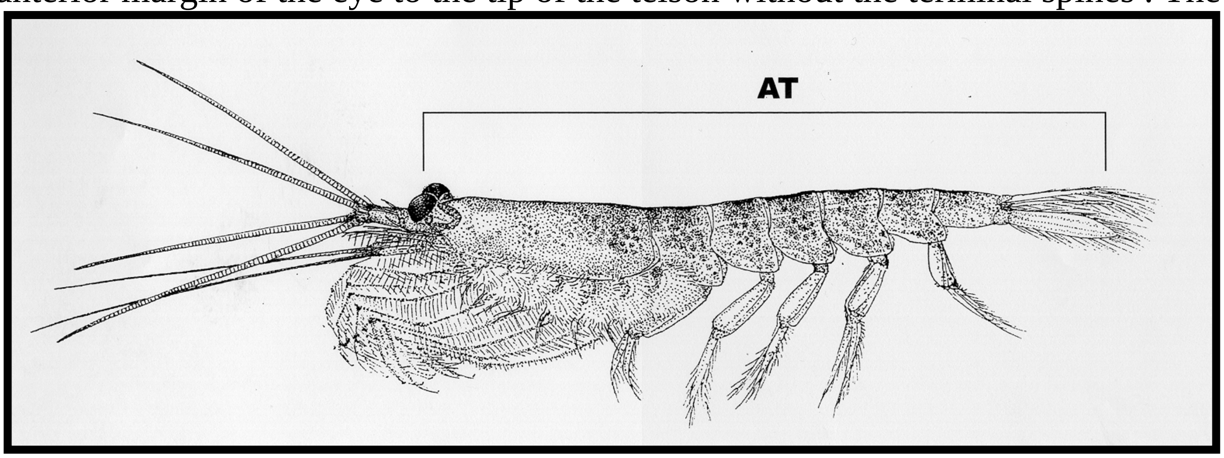
Volume and Weight

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



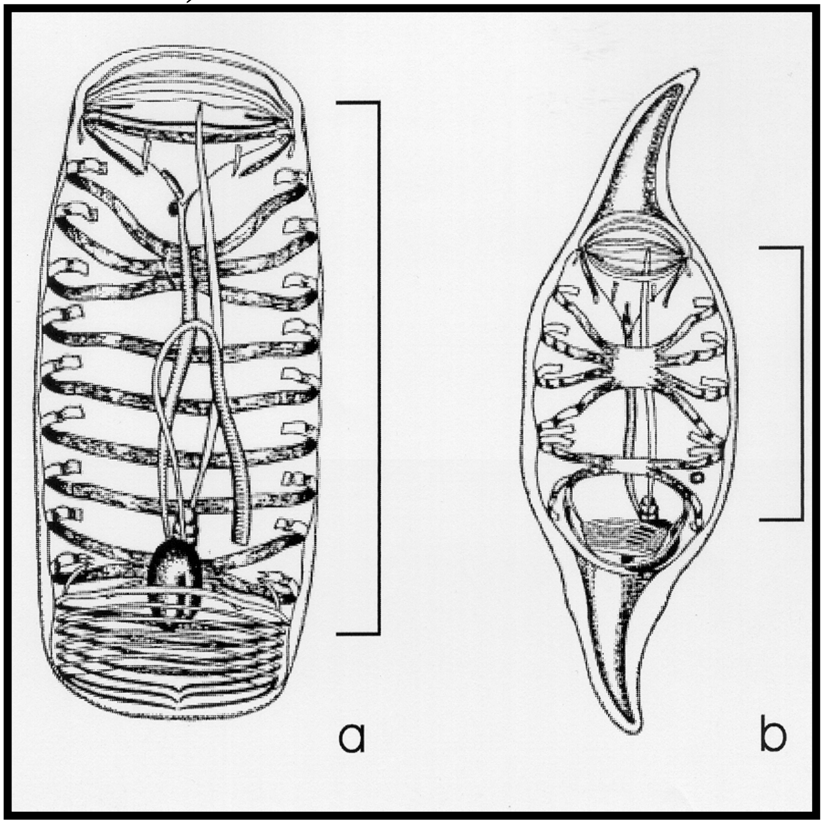
in mm below , with an accuracy of 1 mm size classes. All measurement on each vessel should be done by one person to remove observer variation (see Watkins et al. 1986). Samples which contain less than 150 krill are used in total for length measurements and maturity stage identification. For larger krill 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. Electronic data sheets that look like this will be provided.

This page is being developed by Jon Watkins , Volker Siegel and So Kawaguchi

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Page last updated on 17 November 1999

The CCAMLR krill synoptic survey

CTD sampling protocol

Introduction

These draft protocols are posted prior to agreement in order that their development will attract constructive criticism and input from qualified individuals.
It is recognized that the survey should collect data to World Ocean Circulation Experiment (WOCE) standards, however it is acknowledged that this may not be feasible for all participants. Notwithstanding this standard is recommended where possible. Participants are therefore directed towards the WOCE internet web site http://whpo.ucsd.edu/manuals.htm, in particular the pointers to CTD methods.

Objectives

The main objective of sampling with a conductivity-temperature-depth (CTD) package is to identify environmental characteristics of the survey area, in particular the water masses which influence krill distribution and transport. A further objective of the survey is to identify the approximate geographic location of important fronts and to estimate geostrophic currents.

Equipment

Standard CTD

The preferred CTD unit for the CCAMLR Synoptic Survey is a Sea-Bird 911 plus. The nations (Japan, UK and the USA) currently participating in the survey each possess CTDs of this type. This CTD has three sensors; a series 410K-105 Digiquartz pressure transducer, a SBE 3 plus temperature sensor, and a SBE 4C conductivity sensor. In the standard configuration of the Sea-Bird 911 plus the SBE 3 plus and the SBE 4C sensors are connected to a SBE 5 T submersible high-speed pump.

The preferred mounting orientation of the CTD is horizontal, this is so that the flow of water within the rosette frame is as good as possible on both the down-cast and the up-cast.

Accessory instrumentation

It is highly desirable that the CTD package carry a suitable means of independently verifying water temperatures at standard water bottle sampling depths, for example reversing thermometers or an SBE 35 Reference Temperature Sensor. For stations where the bottom of the cast is likely to be near the sea bed, a suitable means of detecting the bottom is required, for example an acoustic pinger (Japan and UK), or an altimeter (USA).

Such additional equipment, together with any other ancillary equipment mounted on the frame should not compromise water flow over the CTD sensors.

This CTD package should be fitted with adequate ballast to ease deployment in heavy seas.

Water sampling equipment

The CTD should be mounted within a suitable carousel water sampler capable of carrying sufficient suitably sized sampling bottles. The bottles themselves should have external closure mechanisms, or internal Teflon-coated springs.

Data acquisition

The CTD data should be logged via the SBE 11 plus deck unit to a suitable PC (Pentium or high-level 486) running Seasoft Data Acquisition Software (Sea-Bird Electronics Inc.).The preferred version is Seasoft version 4.221, or later, for DOS. Problems have been reported with Seasoft for Windows, though these may now have been fixed.

It is recognised that it is not possible to standardise the post processing software. Japan currently uses CONT3D (NRIFSF, Shimizu), the USA uses Ocean Data View version 4 (AWI, Bremerhaven) and the UK uses PEXEC (IOS, Southampton). Japan is currently considering changing to Ocean Data View.

Auxiliary equipment

A suitable laboratory salinometer is required for determining water bottle salinities. Each of the participating nations (Japan, UK and USA) currently possesses a Guildline Autosal 8400B.

Pre-cruise sensor calibration

All sensors on the CTD and on accessary, or auxiliary equipment should be laboratory calibrated both prior to, and following the cruise. The calibrations should be carried out by a professional laboratory appropriate to the task. Details of the calibrations should be archived for future reference. Any spare sensors should also be calibrated.

Pre-survey software setup

Prior to the survey the current sensor calibration parameters should be set within the Seasoft SEASAVE module. This will only need to be carried out once, unless the sensors on the CTD are changed during the survey.

Various other SEASAVE options should also be set prior to data acquisition. It is recommended that the recording rate should be set to the maximum 24 scans for each channel per second. The header data should be kept to a minimum, but should include vessel name and cruise number. It is also suggested that the PC status line variables should be set to display pump status, pressure, temperature (IPTS-90), salinity, and density (?0), and that the display type should be set to be overlaid X-Y plots. It is recommended that the display should include pressure (Y-axis) versus each of temperature (IPTS-90), salinity, and density (?0) (X-axis). It is likely that the scale for these X-Y plots will require alteration throughout the cruise.

Test deployment

A test deployment should be carried out prior to the main survey. This cast should be treated on a par with all survey stations. The test deployment should be to a depth equivalent to the deepest planned deployment in the survey. Water samples should be taken at pre-planned depths.

Station protocol

Pre-station preparations

Immediately prior to arriving on station, the water sampling bottles should be cocked and the CTD readied for launch. The depth to the sea bed should be monitored to see if it is necessary to use an acoustic pinger or altimeter. Communication should be established between the winch driver, the deck operators and the CTD laboratory.

Prior to data acquisition the PC clock should be synchronised with GMT. Local times and the time zone should also be noted.

The Seasoft module SEASAVE should be executed in preparation for data acquisition. Appropriate files should be setup in readiness for the cast. Although a common file naming convention is desirable, it is unlikely to be achieved, given the existing protocols on board each vessel. It is therefore paramount that station identification is possible from each national convention.

On-station deployment

When the ship is settled on the station the CTD may be deployed. The exact latitude and longitude should be noted. The water depth and time (GMT) should also be recorded. As the CTD is deployed the SBE 11 deck unit should be turned on and the rosette firing mechanism should be armed. As the package enters the water the winch cable metering system should be zeroed, or the amount of cable out recorded. The CTD package should be halted at approximately 8 metres depth, where it should be left to equilibrate. During this period the status of the SBE 5 T pump should be monitored to ensure that it switches on. After the equilibration period (dependent upon instrument load) the CTD package should be hauled to the surface after which the main deployment should commence. The depth and time (GMT) at the start of the main descent should again be recorded.

The down-cast

The CTD package should be veered at a rate not exceeding 70 m min-1. Near the surface, this rate may be less to reduce problems associated with the heave of the ship. The CTD should be lowered to the desires depth and for stations where the cast will approach near-bottom the acoustic pinger or altimeter should be monitored. The CTD package should be lowered at the full speed until the sensors (wire-out, ships sounder, CTD pressure sensor, altimeter, acoustic pinger) indicate that the package is approximately 30 m above the bottom. At this point the veering speed should be reduced and the winch finally stopped with the CTD a safe height above bottom. The distance above the sea-bed will depend upon bottom topography, current speed, weather conditions, wire out, and a range of other factors specific to each deployment and platform. The maximum depth of each cast will depend upon one of two criteria: firstly, the available ocean depth, and secondly the default depth agreed for the survey (1000 m).

At maximum depth

At the maximum depth the exact latitude and longitude should be noted, as should the time (GMT), depth and the amount of wire out. The first bottle should also be triggered. The package should remain stationary before and after the bottle is triggered, depending upon the thermal response time and the sampling period of any accessory temperature recording equipment.

Whilst at maximum depth any wire-washing equipment should be switched on.

The up-cast

The CTD package should be hauled at a rate not exceeding 70 m min-1. All subsequent water sampling bottles are tripped during the upcast. Water should be sampled from pre-determined depths in order to allow independent salinity determination. Water should be sampled in regions of little vertical gradient, yet the samples should span the depth and salinity range of the water column. As other protocols (primary production, nutrient analysis etc.) may dictate that water is sampled from particular levels, care should be taken to ensure adequate samples are taken for salinity determination; these salinity samples should not be compromised.

End of cast

After the last bottle is tripped the CTD should be brought on deck without stopping at the surface (although conditions may dictate that the winch operators require to stop at some point). The package should not be re-covered with bottles still cocked as they may trip accidentally during recovery.

As the package leaves the water the exact latitude and longitude should be noted, as should the time (GMT), depth and the amount of wire out. The SBE 11 deckunit should be turned off after noting instrument status.

Post processing

Salinity Samples

Salinity samples should be taken from all CTD casts at the bottle depths prescribed. The salinity samples should be taken in 200 ml glass medicine bottles (or suitable equivalent), with each bottle being rinsed three times before being filled to just below the neck. The rim of the bottle should be wiped dry with chlorine-free tissue, a plastic seal inserted and the screw cap replaced. The salinity samples should then be placed near to the salinometer for at least 24 hours before measurement. This will allow the sample temperatures to equalise with that of the salinometer.

The salinometer should be located in a room where through traffic will not cause disturbance to the ambient temperature, thereby ensuring a stable room temperature. The temperature of the room should be monitored and recorded.

The salinity samples should be analysed using standard seawater; the batch number should be recorded. One vial of standard seawater should be run through the salinometer at the beginning and end of each set of samples to enable a calibration offset to be derived and to check the stability of the salinometer.

Reference temperatures

Where reference temperatures are available, for example from reversing thermometers or from a SBE 35 Reference Temperature Sensor, they should be used in the post-processing of the CTD data.

The quality of the conductivity calibration

After applying the calibration coefficients and adjusting for the residual offset, the salinity of the bottle sample should be differenced with the derived CTD salinity. After rejecting outlying samples, the mean of the remaining samples and the standard deviation should be documented The residual offset applied to each cast after calibration should be documented.

Data processing

It is recognised that CTD data are processed differently on each vessel. The downcast should be used as the principal data record. Initial processing will make use of Seasoft, however more detailed analysis is likely to require access to other software such as CONT3D (Japan), Ocean Data View (USA) pr PEXEC (UK). However, CTD data should be bin-averaged to 1 dbar. Data files should include all raw data such as conductivity, temperature (IPTS-90) and pressure, as well as derived data.

Hard copy data (log sheets, downcast plots and salinometer sample details) should be archived.

Station sampling

Proposed station sampling depths

It is proposed that CTD casts over continental self areas should sample to the near-bottom, that is within 10 m of the sea bed (depending upon conditions). A shelf station is arbitrarily defined as any station where the water depth is less than 1000 m.

It is proposed that CTD casts over the open ocean should sample to 1000 m. An open ocean station is arbitrarily defined as any station where the water depth is greater than 1000 m.

Proposed depths for water bottle salinity sampling

In order to sample the water column for salinity calibration, the water sampling rosette should be triggered at the bottom of the cast, at 800 m, 600, 400 m, 200 m, 150 m, 100 m and at 30 m. Where additional depths are sampled (for accessory sensors) salinity samples may also be taken. Not all of the sampling depths will be possible over shelf areas.

Proposed bottom depth

One of the principal water masses of the Antarctic Circumpolar Current (ACC) is Circumpolar Deep Water (CDW). This is divided into Upper CDW (UCDW) and Lower CDW (LCDW). UCDW has recently been shown to be an important defining factor in the southern extent of the ACC (Orsi et al., 1995). Consequently, sampling to encompass UCDW would be advantageous. It is suggested that the climatological level of UCDW should therefore be examined, so that the time overhead can be determined should sampling to these levels be agreed. A preliminary literature search (Peterson and Whitworth, 1989; Orsi et al., 1995) suggests that this overhead will be minimal.

References

Peterson, R. G., and T. Whitworth III (1989). The Subantarctic and Polar Fronts in relation to deep water masses through the southwestern Atlantic. J. Geophys. Res., 94, 10817-10838.

Orsi, A. H., T. Whitworth III, and W. D. Nowlin (1995). On the meridional extent and fronts of the Antarctic Circumpolar Current. Deep-Sea Res., 42, 641-673.

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The CCAMLR krill synoptic survey

Zooplankton sampling protocols for Synoptic Survey

RMT1 Samples

Preservation of samples

• Upon retrieval of the gear ensure that all zooplankton adhering to the net is washed down with seawater into the cod end liner.
• Once cod end liner has been brought into laboratory gently invert the cod-end liner over a tray or bucket and wash out the contents. Concentrate the catch by filtration through a sieve of mesh size smaller than the net mesh (ie <330 ?m).
• A measure of displacement volume for the whole catch is required. This can be achieved by placing the drained catch contents in a known volume of sea-water and noting the increase equivalent to the displacement volume of the catch.
• Place catch or appropriate sub-sample into a jar and preserve with 10% (v:v) formaldehyde solution. Ensure that enough preservative is used to fix the catch. As a guide we have found that a ratio of 3-4:1, preservative:catch, is generally adequate to ensure the good condition of most taxa in the sample, at least in the short-term. Do not use less preservative than this.
• Make out a record of the following station and catch details in pencil on a waterproof paper label:

Date, Start Time, End Time (GMT),
Position (Lat Long)
Station, Transect Number (Event Number), Sample Volume
Fraction preserved if subsample

Flow reading (Volume swept.)

Place label IN the sample jar and store safely.

Ancillary Information on hauls

We know that the RMT1+8 presents a variable mouth area dependent on speed through the water (Pommeranz et al. 1982). Accordingly a log should be kept of wire-out against time and also of distance travelled by the ship.

Sorting on board and preserving samples

Notwithstanding decisions as to whether samples are sorted onboard ship or back in the home laboratory we need to ensure that the same degree of taxonomic rigour is applied to the samples by all participating nations. We can generate a sample sorting list of those species that we expect to encounter but if identification problems are experienced then examples of those representative taxa should be set aside for general examination/opinion of other workers. Even if samples are sorted onboard ship then it is still vitally important that the samples (or representative subsamples) are preserved for later examination.

Introduction	Itinerary	Station positions	Cruise tracks	Planning Meeting	Sampling Protocols	Participants	Background papers	Contents

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The CCAMLR krill synoptic survey

Post-cruise analysis workshop

The WG-EMM meeting in Tenerife (WG-EMM-1999) recommended that a two-week data analysis workshop should be held in La Jolla sometime during May/June 2000. The aim of the meeting would be to estimate B_0 and its variance for Area 48.

The Working Group recommended that all core data sets to be considered at this workshop should be submitted to Dr Hewitt in electronic format no later than one month prior to the workshop so that they can be posted on a data server and linked to the web site with secure access. In this manner all contributors will have access to the common data sets for the purposes of validation and cross-checking prior to the workshop. It was also recommended that ancillary data sets which may assist in the interpretation of the core data sets be sumitted in summary form ahead of the workshop.

Analytical methods to be used at the workshop can be found in the report of WG-EMM-1999.

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The CCAMLR krill synoptic survey

Draft plans for BAS marine biological cruises in 1999/2000

The RRS "James Clark Ross" will undertake two cruises for BAS Marine Life Sciences Division (MLSD) in the 1999/2000 field season. The first cruise will be the fifth and final cruise of the MLSD Core Programme. The second cruise will be the UK contribution to the CCAMLR synoptic survey which is an international multi-ship cruise taking place in January and February 2000. Both these cruises will start from and return to Stanley in the Falkland Islands. The period between the cruises will be used for a crew change-over.

Core Programme cruise V

The BAS Core Programme was set up to study interannual variability around South Georgia, in particular variability in abundance, distribution and population structure of Antarctic krill. The cruise consists of two major elements. The first is a standard oceanographic transect from the Maurice Ewing Bank (north of the Antarctic Polar Front) to Bird Island (at the western end of South Georgia). The second is an acoustic survey of two 80 x 100 km boxes located at the eastern and western ends of South Georgia.

The Maurice Ewing Bank (MEB) transect consists of 23 standard stations (spacing 35 km). At each station a CTD cast and vertical zooplankton sample (using Bongo nets) are taken. Between the stations underway data are collected with ADCP, Simard EK500 scientific echo-sounder and suite of measurements from the pumped 6 m non-toxic sea water supply.

After the MEB transect the ship will call at Stromness to undertake an acoustic calibration. Following calibration the eastern core box will be surveyed.
Each day a pair of 80 km transects are surveyed using ADCP, EK500 and towed UOR. These transects are arranged to take place in the hours of daylight to avoid problems of krill migrating to near the sea surface at night. After the transects, time is available for net sampling for acoustic validation.
During the night the ship returns along the second transect of the day stopping at 2 stations to undertake a CTD cast and a RMT8 net sample. The ship is then ready to start another acoustic transect pair the following morning. After 5 days of sampling in the eastern box the ship relocates to sample the western core box. Therefore at the end of the survey within each box 5 pairs of acoustic transects and 4 pairs of stations will have been sampled.

Synoptic Survey cruise

This cruise is part of the CCAMLR multi-ship survey of the Scotia Sea. The main CCAMLR objective is to carry out an acoustic survey to estimate the instantaneous standing stock of Antarctic krill (*Euphausia superba*) in the Scotia Sea region. In addition, the surveys will provide data on krill population structure in the region. Thirty days have been allocated for the entire cruise which includes mobilization and demobilization in Stanley. The ship will sail from Stanley direct to South Georgia where an acoustic calibration will be carried out in Stromness Harbour. The ship will then proceed to the start point of the survey grid. The final survey tracks are still to be approved by the CCAMLR survey planning group but the basic plan will be as shown on the synoptic survey web site. The survey is a randomized transect design with two levels of stratification. For the BAS cruise the more detailed second stratum will be positioned off the north coast of South Georgia. Some of the survey tracks in this stratum will pass through the core programme survey boxes.

The cruise will collect the core measurements proposed by CCAMLR (krill acoustics, station net hauls and CTD's). The cruise track provides an excellent opportunity to gather information about large-scale processes across the Scotia Sea. Therefore the BAS cruise will undertake additional measurements to estimate the krill transport rates, aspects of energetics and growth of krill, predation pressure on krill and detailed characterization of the upper 150 m of the water column using a towed undulator.

Transect measurements

The following data will be collected while the ship is steaming at 10 knots along each transect:

- acoustic measurements at three frequencies (38, 120 and 200 kHz)
- observations of marine mammals and birds
- continuous measurements of sea surface temperature, salinity, chlorophyll biomass from in vivo fluorometry, light levels and meterology
- ADCP measurements
- subsurface measurements (10-150 m) of salinity, temperature, light levels, particle counts, and fluorescence
- bathymetric measurements

Station measurements

The ship will carry out sampling at about 38 standard stations. The positions of these stations will essentially be decided by the location of the ship at
midday and midnight. At each station the following activities will be carried out:

- CTD cast to 1000 m
- ADCP measurements
- chlorophyll fluorescence profile
- RMT8 net haul between 10 and 200 m. A surface net will be deployed during the RMT haul to characterize the neuston and to collect live krill for experiments

Experimental activities

In addition there will be a series of experimental activities that are carried out during the cruise:

- instantaneous estimates of krill growth
- krill feeding studies, including characterization of the food supply

Cruise timing

The timing of both cruises is interlinked and dependent on the logistic commitments of the ship. The current time table is shown below.

Activity	Start	End	Duration (h)
CORE PROGRAMME			
Mobilization Stanley	22/12/1999 09:00	24/12/1999 09:00	48
Passage to MEB	24/12/1999 09:00	26/12/1999 21:00	60

Morris Ewing Bank Transect	26/12/1999 21:00	31/12/1999 11:35	111
Calibration Stromness	31/12/1999 19:35	01/01/2000 19:35	24
Eastern Core Box	02/01/2000 03:50	06/01/2000 12:50	105
Western Core Box	07/01/2000 03:50	11/01/2000 12:50	105
Passage to Stanley	11/01/2000 12:50	14/01/2000 10:50	70
Change over in Stanley	14/01/2000 10:50	17/01/2000 07:25	69
SYNOPTIC SURVEY			
Passage to Stromness	17/01/2000 07:25	20/01/2000 07:25	72
Calibration Stromness	20/01/2000 07:25	21/01/2000 07:25	24
Passage to start large scale survey	21/01/2000 07:25	22/01/2000 04:03	21
Large scale survey	22/01/2000 04:03	12/02/2000 04:39	505
Passage to King George calibration site	12/02/2000 04:47	13/02/2000 05:39	25
Calibration King George	13/02/2000 05:39	14/02/2000 05:39	24
Passage to Stanley	14/02/2000 05:39	16/02/2000 07:42	50
Demobilization Stanley	16/02/2000 07:42	17/02/2000 07:42	24
	total time (days)	57	

Cruise participants (synoptic survey)

Scientist-in-charge Watkins

Underway instrumentation

- Acoustics Brierley, Goss
- Undulator Trathan, Grant, Bone
- ADCP Oceanographer
- Bird & seal obs Reid (plus 2)
- Whale obs IWC (2-4)
- Phytoplankton Priddle and Assistant

Station sampling

- Net hauls Siegel, Anderson, Watkins
- CTD/ADCP Oceanographer plus ETS

Data logging

- Logging Grant
- Analysis Murray, Trathan, Oceanographer

Maintenance and support

- Computing ITS 1 & 2
- Electronic ETS
- Gear Bone

BAS projects

- Krill feeding studies Cripps, Priddle
- Krill growth rates Watkins, Assistant 1

International Experts

- Siegel?
- Miller?

Total scientific personnel = 22 (24)

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RRS James Clark Ross Synoptic Survey Cruise

Oceanography

During the synoptic survey cruise oceanographic data was collected according to the synoptic survey protocols for CTD casts. Some of the data obtained during the survey can be viewed here

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Introduction	Cruise narrative	Oceanography	Acoustics	Krill biology	Zooplankton biology	Predator observations	Appendices	Contents

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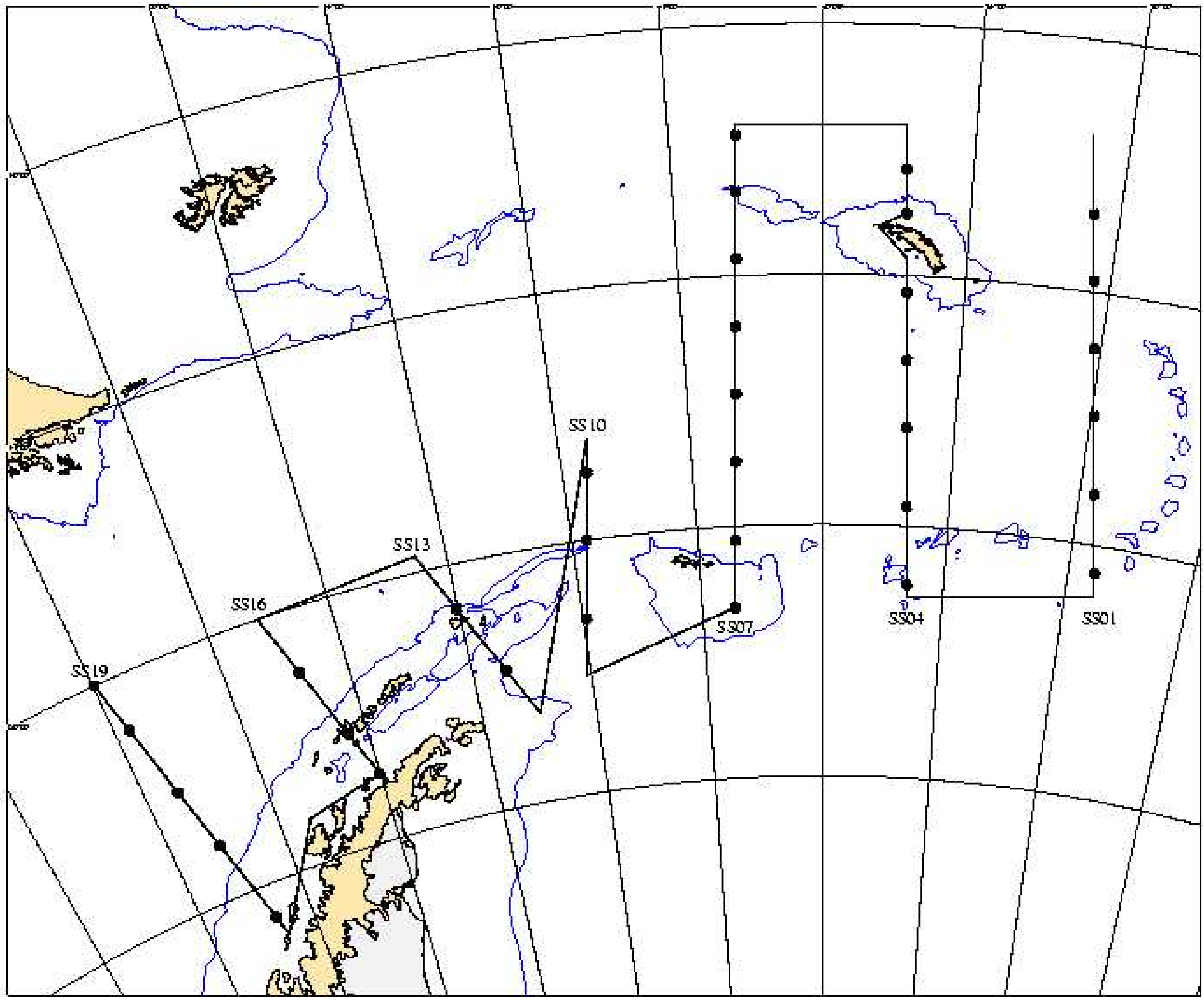
The CCAMLR krill synoptic survey

Cruise track and sampling stations for ship 1 (UK)



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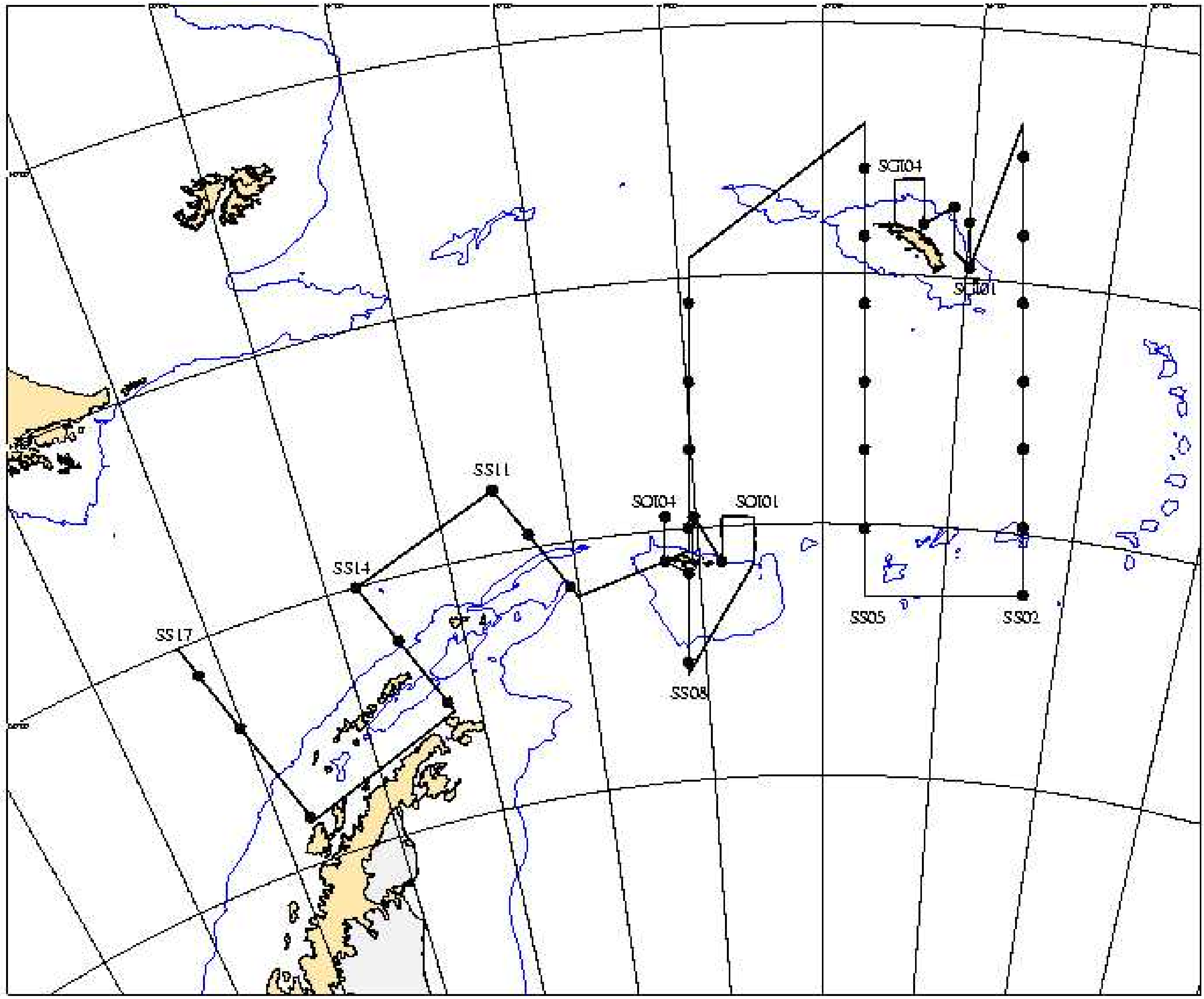
The CCAMLR krill synoptic survey

Cruise track and sampling stations for ship 2 (USA)



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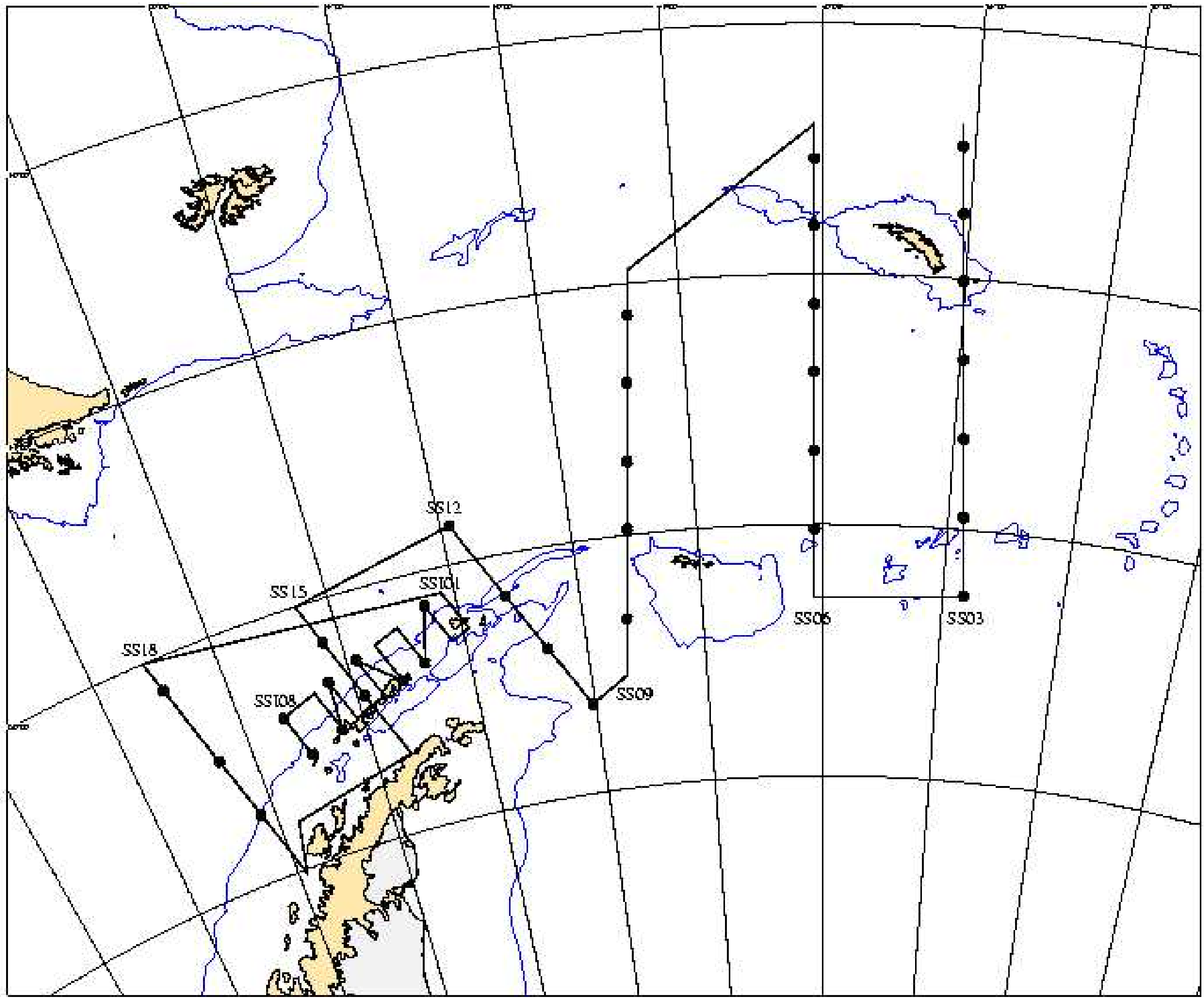
The CCAMLR krill synoptic survey

Cruise track and sampling stations for ship 3 (Japan)



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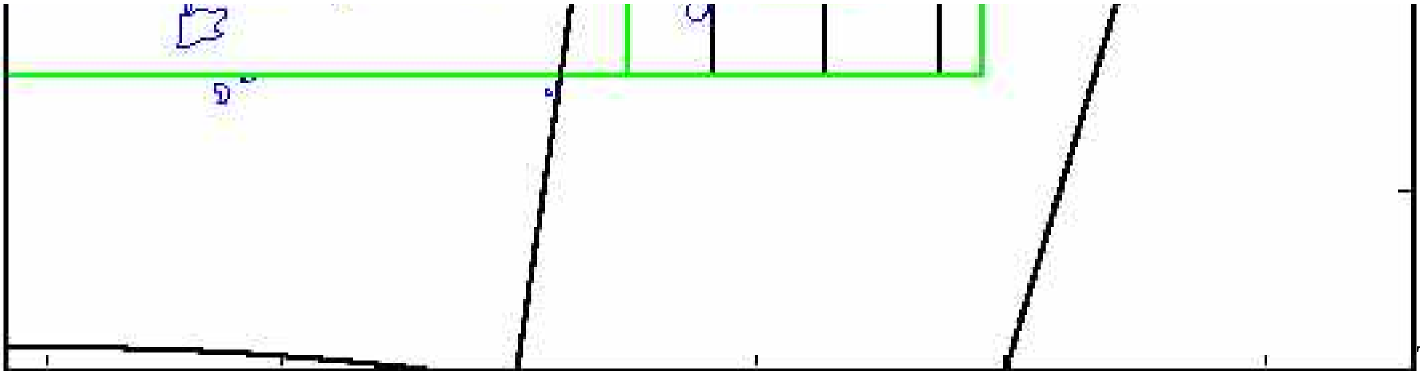
Transects for ship 4 (Russia)



The survey will start with the meso-scale survey around the South Sandwich Islands. The ship will start at the northeastern end of the meso-scale box and proceed down the eastern side of the island chain. It will then pass up the western side of the island chain. Once the meso-scale survey has been run the ship will start the large scale survey of Subarea 48. The ship will start from the north eastern corner and run the most easterly transect (transect A) in a north to south direction. The middle transect will then be run from south to north (the ship will follow one of the meso-scale transect lines through the meso-scale area). Finally the westerly long transect will be run from north to south.

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The CCAMLR krill synoptic survey

Provisional station positions

Transect way points will soon be available for ship 1, ship 2 and ship 3.

Station positions for ship 1 (UK)

The station positions provided below assume that the ship starts the first transect at 14:37 on 20 Jan 2000. Further details of timing can be found in the itinerary. Note that the position of the stations will be subject to change depending on start time and progress around survey grid.

Station	Transect	Waypoint	Longitude	Latitude	Date & time
1	SS01	8	-30.8837	-53.4453	20 Jan 23:32
2	SS01	14	-30.5734	-54.7801	21 Jan 13:33
3	SS01	20	-30.2413	-56.1149	21 Jan 23:12
4	SS01	26	-29.8852	-57.4489	22 Jan 12:33
5	SS01	33	-29.4357	-59.0032	22 Jan 23:29
6	SS01	40	-28.9448	-60.5540	23 Jan 13:08
7	SS04	42	-36.5109	-61.1744	24 Jan 13:29
8	SS04	35	-36.6692	-59.6071	25 Jan 00:24
9	SS04	28	-36.8137	-58.0372	25 Jan 14:11
10	SS04	22	-36.9280	-56.6905	25 Jan 23:51
11	SS04	16	-37.0344	-55.3436	26 Jan 13:23

12	SS04	9	-37.1495	-53.7729	27 Jan 02:36
13	SS04	5	-37.2114	-52.8761	27 Jan 14:09
14	SS07	2	-42.8096	-52.2023	28 Jan 15:26
15	SS07	7	-42.8866	-53.3227	28 Jan 23:49
16	SS07	13	-42.9849	-54.6685	29 Jan 14:25
17	SS07	19	-43.0901	-56.0152	30 Jan 00:04
18	SS07	25	-43.2029	-57.3620	30 Jan 14:04
19	SS07	31	-43.3242	-58.7083	30 Jan 23:43
20	SS07	38	-43.4780	-60.2772	31 Jan 14:13
21	SS07	44	-43.6216	-61.6195	31 Jan 23:51
22	SS10	17	-49.8668	-61.5496	02 Feb 00:22
23	SS10	10	-49.4155	-59.9966	02 Feb 14:19
24	SS10	4	-49.0601	-58.6623	02 Feb 23:58
25	AP13	14	-53.5832	-62.2921	05 Feb 00:53
26	AP13	7	-55.0723	-60.8894	05 Feb 14:50
27	AP16	7	-62.0074	-61.2721	07 Feb 00:54
28	AP16	14	-60.8325	-62.7437	07 Feb 15:25
29	AP16	19	-60.0261	-63.6703	07 Feb 23:05
30	AP19	27	-66.7579	-65.6520	09 Feb 00:47
31	AP19	19	-67.8720	-63.9227	09 Feb 15:20
32	AP19	13	-68.6227	-62.6191	10 Feb 01:00
33	AP19	6	-69.4196	-61.0931	10 Feb 15:26
34	AP19	1	-69.9429	-60.0005	10 Feb 23:48

Provisional station positions for ship 2 (USA)

The station positions provided below assume that the ship starts the first transect at 01:22 on 14 Jan 2000. Further details of timing can be found in the itinerary. Note that the position of the stations will be subject to change depending on start time and progress around survey grid.

Transect	Waypoint	Longitude	Latitude	Date & time
SG 3 bottom	5	-36.5551	-53.9814	14 Jan 19:17
SG 2 top	1	-35.5553	-53.6031	15 Jan 04:46

SG 1 top	1	-35.0060	-53.8866	15 Jan 17:07
SG 1 bottom	0	-34.8924	-54.7824	16 Jan 03:35
SS02	4	-33.4295	-52.4934	16 Jan 22:40
SS02	11	-33.1729	-54.0565	17 Jan 13:50
SS02	17	-32.9365	-55.3972	17 Jan 23:29
SS02	24	-32.6393	-56.9614	18 Jan 13:58
SS02	30	-32.3639	-58.3014	18 Jan 23:38
SS02	37	-32.0155	-59.8625	19 Jan 13:03
SS02	43	-31.6907	-61.1978	19 Jan 22:42
SS05	37	-38.3117	-60.0865	21 Jan 01:15
SS05	30	-38.3860	-58.5159	21 Jan 14:20
SS05	24	-38.4446	-57.1683	22 Jan 00:00
SS05	17	-38.5079	-55.5957	22 Jan 14:11
SS05	11	-38.5581	-54.2482	22 Jan 23:51
SS05	5	-38.6051	-52.9019	23 Jan 13:32
SS08	5	-44.6999	-55.5132	24 Jan 23:41
SS08	12	-44.8985	-57.0823	25 Jan 14:36
SS08	18	-45.0826	-58.4267	26 Jan 00:16
SS08	25	-45.3157	-59.9933	26 Jan 14:23
SS08	29	-45.4587	-60.8873	27 Jan 00:11
SS08	37	-45.7690	-62.6711	27 Jan 14:36
SO 2 bottom	5	-44.0864	-60.7096	28 Jan 20:02
SO 3 top	1	-45.0948	-59.7768	29 Jan 01:18
SO 4 top	1	-46.2158	-59.7299	29 Jan 19:29
SO 4 bottom	0	-46.3817	-60.6231	29 Jan 23:57
AP11	12	-50.3436	-60.8879	30 Jan 15:40
AP11	6	-51.6909	-59.7185	31 Jan 00:22
AP11	1	-52.7420	-58.7345	31 Jan 11:23
AP14	1	-58.8057	-60.0060	01 Feb 05:59
AP14	7	-57.7186	-61.2427	01 Feb 14:41
AP14	14	-56.3368	-62.6736	02 Feb 00:30
AP17	20	-63.6028	-64.0762	03 Feb 00:08

AP17	10	-65.1266	-61.9409	03 Feb 15:28
AP17	4	-65.9425	-60.6521	04 Feb 00:10

Provisional station positions for ship 3 (Japan)

The station positions provided below assume that the ship starts the first transect at 06:25 on 14 Jan 2000. Further details of timing can be found in the itinerary. Note that the position of the stations will be subject to change depending on start time and progress around survey grid.

station	Transect	Waypoint	Longitude	Latitude	Date & time
1	SS03	3	-35.3969	-52.3671	14 Jan 13:46
2	SS03	9	-35.2440	-53.7099	14 Jan 23:25
3	SS03	15	-35.0806	-55.05392	15 Jan 12:52
4	SS03	22	-34.8752	-56.6226	15 Jan 23:49
5	SS03	29	-34.6521	-58.1907	16 Jan 13:46
6	SS03	36	-34.4086	-59.7572	17 Jan 00:42
7	SS03	43	-34.1419	-61.3207	17 Jan 13:11
8	SS06	37	-40.3234	-60.0965	18 Jan 13:35
9	SS06	30	-40.3091	-58.5255	19 Jan 00:31
10	SS06	23	-40.2961	-56.9529	19 Jan 14:00
11	SS06	17	-40.2858	-55.6046	19 Jan 23:40
12	SS06	10	-40.2746	-54.0323	20 Jan 14:08
13	SS06	4	-40.2657	-52.6859	20 Jan 23:47
14	SS09	5	-46.9069	-55.6322	22 Jan 14:32
15	SS09	11	-47.1562	-56.9734	23 Jan 00:12
16	SS09	18	-47.4706	-58.5370	23 Jan 14:33
17	SS09	24	-47.7629	-59.8754	24 Jan 00:12
18	SS09	32	-48.1900	-61.6558	24 Jan 14:45
19	AP12	22	-50.1248	-63.251	25 Jan 03:32
20	AP12	15	-51.6568	-62.0233	25 Jan 14:34
21	AP12	9	-53.0033	-60.8403	26 Jan 00:13
22	AP12	1	-54.6487	-59.2442	26 Jan 14:39
23	AP15	5	-60.7156	-60.8449	27 Jan 15:03

24	AP15	11	-59.6764	-62.0971	28 Jan 00:42
25	AP18	18	-65.6257	-63.6743	29 Jan 15:18
26	AP18	12	-66.4672	-62.3828	30 Jan 00:57
27	AP18	4	-67.4827	-60.6532	30 Jan 15:20
28	SS 2 top	1	-56.3241	-60.6831	01 Feb 20:11
29	SS 3 bottom	5	-56.8563	-61.7915	02 Feb 08:51
30	SS 4 bottom	5	-57.9514	-62.0227	02 Feb 21:52
31	SS 5 top	1	-59.6069	-61.3797	03 Feb 09:54
32	SS 6 top	1	-60.9750	-61.6381	03 Feb 23:36
33	SS 7 bottom	5	-61.0057	-62.6053	04 Feb 11:25
34	SS 8 bottom	5	-62.6133	-62.8770	05 Feb 01:31
35	SS 8 top	1	-63.2521	-62.0290	05 Feb 12:59

Introduction	Itinerary	Station positions	Cruise tracks	Planning Meeting	Sampling Protocols	Participants	Background papers	Contents

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The CCAMLR krill synoptic survey

Transect waypoints for ship 1 (UK)

This table provides the waypoints at 25 km intervals along each transect for ship 1. Distance is shown in km, and represents the distance between each waypoint. The Journey time is the time (in days) to get from preceding waypoint to current waypoint. The Arrival time is the time of arrival at each waypoint (all times are expressed as GMT). Civil dawn and dusk are the stop and start times for each day (see daylight times for more details). The time of local midnight is the GMT time for the mid-point of the dark period. The column 'stations' has 3 codes: 1 indicates the daytime station, 2 indicates the night-time station and 0 indicates no station. The station time indicates the time period (hours) of the station, night-time stations extend for the period of darkness.

Transect	Wpt	Longitude	Latitude	Distance	Journey time	Arrival time	civil dusk	civil dawn	Local midnight	stations	station time	station number
SS01	1	-31.2210	-51.8891		0.00	20 Jan 14:37	22:52	05:40	02:16	0	00:00	
SS01	2	-31.1743	-52.1113	24.9	0.05	20 Jan 15:53	22:54	05:36	02:15	0	00:00	
SS01	3	-31.1272	-52.3336	24.9	0.05	20 Jan 17:10	22:56	05:34	02:15	0	00:00	
SS01	4	-31.0795	-52.5559	24.9	0.05	20 Jan 18:26	22:57	05:32	02:15	0	00:00	
SS01	5	-31.0314	-52.7782	24.9	0.05	20 Jan 19:43	22:59	05:30	02:14	0	00:00	
SS01	6	-30.9827	-53.0005	24.9	0.05	20 Jan 20:59	23:00	05:28	02:14	0	00:00	
SS01	7	-30.9334	-53.2229	24.9	0.05	20 Jan 22:16	23:02	05:26	02:14	0	00:00	
SS01	8	-30.8837	-53.4453	24.9	0.05	20 Jan 23:32	23:03	05:24	02:14	2	06:21	1
SS01	9	-30.8334	-53.6678	24.9	0.05	21 Jan 07:10	23:05	05:22	02:13	0	00:00	
SS01	10	-30.7825	-53.8902	24.9	0.05	21 Jan 08:26	23:06	05:20	02:13	0	00:00	
SS01	11	-30.7311	-54.1127	24.9	0.05	21 Jan 09:43	23:08	05:19	02:13	0	00:00	
SS01	12	-30.6791	-54.3351	25.0	0.05	21 Jan 10:59	23:09	05:17	02:13	0	00:00	
SS01	13	-30.6265	-54.5576	25.0	0.05	21 Jan 12:16	23:10	05:15	02:13	0	00:00	
SS01	14	-30.5734	-54.7801	25.0	0.05	21 Jan 13:33	23:12	05:13	02:12	1	02:00	2

SS01	15	-30.5196	-55.0026	25.0	0.05	21 Jan 16:49	23:13	05:11	02:12	0	00:00	
SS01	16	-30.4652	-55.2251	25.0	0.05	21 Jan 18:06	23:15	05:09	02:12	0	00:00	
SS01	17	-30.4102	-55.4476	25.0	0.05	21 Jan 19:22	23:16	05:07	02:12	0	00:00	
SS01	18	-30.3546	-55.6700	25.0	0.05	21 Jan 20:39	23:18	05:05	02:11	0	00:00	
SS01	19	-30.2983	-55.8925	25.0	0.05	21 Jan 21:56	23:19	05:03	02:11	0	00:00	
SS01	20	-30.2413	-56.1149	25.0	0.05	21 Jan 23:12	23:21	05:01	02:11	2	05:40	3
SS01	21	-30.1837	-56.3373	25.0	0.05	22 Jan 06:10	23:22	04:59	02:11	0	00:00	
SS01	22	-30.1254	-56.5597	25.0	0.05	22 Jan 07:26	23:24	04:58	02:11	0	00:00	
SS01	23	-30.0664	-56.7821	25.0	0.05	22 Jan 08:43	23:26	04:55	02:10	0	00:00	
SS01	24	-30.0068	-57.0044	25.0	0.05	22 Jan 10:00	23:28	04:53	02:10	0	00:00	
SS01	25	-29.9464	-57.2267	25.0	0.05	22 Jan 11:16	23:30	04:50	02:10	0	00:00	
SS01	26	-29.8852	-57.4489	25.0	0.05	22 Jan 12:33	23:32	04:48	02:10	1	02:00	4
SS01	27	-29.8233	-57.6712	25.0	0.05	22 Jan 15:49	23:34	04:45	02:10	0	00:00	
SS01	28	-29.7607	-57.8933	25.0	0.05	22 Jan 17:06	23:36	04:43	02:09	0	00:00	
SS01	29	-29.6973	-58.1154	25.0	0.05	22 Jan 18:23	23:38	04:40	02:09	0	00:00	
SS01	30	-29.6331	-58.3375	25.0	0.05	22 Jan 19:39	23:40	04:38	02:09	0	00:00	
SS01	31	-29.5681	-58.5595	25.0	0.05	22 Jan 20:56	23:42	04:35	02:09	0	00:00	
SS01	32	-29.5023	-58.7814	25.0	0.05	22 Jan 22:12	23:45	04:33	02:09	0	00:00	
SS01	33	-29.4357	-59.0032	24.9	0.05	22 Jan 23:29	23:47	04:30	02:08	2	04:43	5
SS01	34	-29.3683	-59.2250	24.9	0.05	23 Jan 05:29	23:49	04:28	02:08	0	00:00	
SS01	35	-29.2999	-59.4467	24.9	0.05	23 Jan 06:45	23:51	04:25	02:08	0	00:00	
SS01	36	-29.2307	-59.6684	24.9	0.05	23 Jan 08:02	23:53	04:23	02:08	0	00:00	
SS01	37	-29.1606	-59.8899	24.9	0.05	23 Jan 09:18	23:55	04:20	02:08	0	00:00	
SS01	38	-29.0896	-60.1114	24.9	0.05	23 Jan 10:35	23:57	04:18	02:07	0	00:00	
SS01	39	-29.0177	-60.3327	24.9	0.05	23 Jan 11:51	23:59	04:15	02:07	0	00:00	
SS01	40	-28.9448	-60.5540	24.9	0.05	23 Jan 13:08	00:01	04:13	02:07	1	02:00	6
SS01	41	-28.8709	-60.7752	24.9	0.05	23 Jan 16:24	00:03	04:10	02:07	0	00:00	
SS01	42	-28.7961	-60.9962	24.9	0.05	23 Jan 17:41	00:06	04:08	02:07	0	00:00	
SS04	43	-36.4871	-61.3981	413.9	0.77	24 Jan 12:12	00:32	04:46	02:39	0	00:00	
SS04	42	-36.5109	-61.1745	24.9	0.05	24 Jan 13:29	00:29	04:48	02:39	1	02:00	7
SS04	41	-36.5344	-60.9508	24.9	0.05	24 Jan 16:45	00:27	04:50	02:39	0	00:00	

SS04	40	-36.5577	-60.7270	24.9	0.05	24 Jan 18:01	00:25	04:53	02:39	0	00:00	
SS04	39	-36.5806	-60.5031	24.9	0.05	24 Jan 19:18	00:22	04:55	02:39	0	00:00	
SS04	38	-36.6032	-60.2792	24.9	0.05	24 Jan 20:34	00:20	04:57	02:39	0	00:00	
SS04	37	-36.6255	-60.0552	24.9	0.05	24 Jan 21:51	00:18	05:00	02:39	0	00:00	
SS04	36	-36.6475	-59.8312	24.9	0.05	24 Jan 23:07	00:15	05:02	02:39	0	00:00	
SS04	35	-36.6692	-59.6071	24.9	0.05	25 Jan 00:24	00:13	05:04	02:39	2	04:51	8
SS04	34	-36.6906	-59.3830	24.9	0.05	25 Jan 06:32	00:11	05:07	02:39	0	00:00	
SS04	33	-36.7118	-59.1588	24.9	0.05	25 Jan 07:48	00:08	05:09	02:39	0	00:00	
SS04	32	-36.7327	-58.9345	24.9	0.05	25 Jan 09:05	00:06	05:11	02:39	0	00:00	
SS04	31	-36.7533	-58.7103	25.0	0.05	25 Jan 10:21	00:04	05:14	02:39	0	00:00	
SS04	30	-36.7737	-58.4859	25.0	0.05	25 Jan 11:38	00:01	05:16	02:39	0	00:00	
SS04	29	-36.7939	-58.2616	25.0	0.05	25 Jan 12:54	23:59	05:18	02:39	0	00:00	
SS04	28	-36.8137	-58.0372	25.0	0.05	25 Jan 14:11	23:57	05:21	02:39	1	02:00	9
SS04	27	-36.8334	-57.8128	25.0	0.05	25 Jan 17:28	23:54	05:23	02:39	0	00:00	
SS04	26	-36.8528	-57.5884	25.0	0.05	25 Jan 18:44	23:52	05:25	02:39	0	00:00	
SS04	25	-36.8719	-57.3639	25.0	0.05	25 Jan 20:01	23:50	05:28	02:39	0	00:00	
SS04	24	-36.8908	-57.1395	25.0	0.05	25 Jan 21:17	23:47	05:30	02:39	0	00:00	
SS04	23	-36.9095	-56.9150	25.0	0.05	25 Jan 22:34	23:45	05:32	02:39	0	00:00	
SS04	22	-36.9280	-56.6905	25.0	0.05	25 Jan 23:51	23:43	05:35	02:39	2	05:52	10
SS04	21	-36.9463	-56.4660	25.0	0.05	26 Jan 06:59	23:41	05:36	02:39	0	00:00	
SS04	20	-36.9643	-56.2415	25.0	0.05	26 Jan 08:16	23:40	05:37	02:39	0	00:00	
SS04	19	-36.9821	-56.0170	25.0	0.05	26 Jan 09:33	23:39	05:39	02:39	0	00:00	
SS04	18	-36.9997	-55.7925	25.0	0.05	26 Jan 10:49	23:37	05:40	02:39	0	00:00	
SS04	17	-37.0172	-55.5680	25.0	0.05	26 Jan 12:06	23:36	05:42	02:39	0	00:00	
SS04	16	-37.0344	-55.3436	25.0	0.05	26 Jan 13:23	23:35	05:43	02:39	1	02:00	11
SS04	15	-37.0514	-55.1191	25.0	0.05	26 Jan 16:39	23:34	05:45	02:39	0	00:00	
SS04	14	-37.0682	-54.8947	25.0	0.05	26 Jan 17:56	23:32	05:46	02:39	0	00:00	
SS04	13	-37.0848	-54.6703	25.0	0.05	26 Jan 19:12	23:31	05:47	02:39	0	00:00	
Diversion BI		-38.0935	-54.0169	97.7	0.18	26 Jan 23:35	23:14	06:06	02:40	0	00:00	
SS04	9	-37.1495	-53.7729	67.5	0.13	27 Jan 02:36	23:26	05:53	02:39	2	06:27	12
SS04	8	-37.1652	-53.5486	24.9	0.05	27 Jan 10:20	23:25	05:55	02:40	0	00:00	

SS04	7	-37.1808	-53.3244	24.9	0.05	27 Jan 11:36	23:23	05:56	02:40	0	00:00	
SS04	6	-37.1962	-53.1002	24.9	0.05	27 Jan 12:53	23:22	05:57	02:40	0	00:00	
SS04	5	-37.2114	-52.8761	24.9	0.05	27 Jan 14:09	23:21	05:59	02:40	1	02:00	13
SS04	4	-37.2264	-52.6520	24.9	0.05	27 Jan 17:26	23:19	06:00	02:40	0	00:00	
SS04	3	-37.2413	-52.4279	24.9	0.05	27 Jan 18:42	23:18	06:02	02:40	0	00:00	
SS04	2	-37.2561	-52.2040	24.9	0.05	27 Jan 19:59	23:17	06:03	02:40	0	00:00	
SS04	1	-37.2706	-51.9801	24.9	0.05	27 Jan 21:15	23:16	06:05	02:40	0	00:00	
SS07	1	-42.7946	-51.9784	378.0	0.70	28 Jan 14:10	23:21	06:36	02:58	0	00:00	
SS07	2	-42.8095	-52.2023	24.9	0.05	28 Jan 15:26	23:22	06:34	02:58	1	02:00	14
SS07	3	-42.8246	-52.4263	24.9	0.05	28 Jan 18:43	23:24	06:33	02:59	0	00:00	
SS07	4	-42.8399	-52.6503	24.9	0.05	28 Jan 19:59	23:26	06:32	02:59	0	00:00	
SS07	5	-42.8553	-52.8744	24.9	0.05	28 Jan 21:16	23:28	06:31	02:59	0	00:00	
SS07	6	-42.8709	-53.0985	24.9	0.05	28 Jan 22:32	23:30	06:30	03:00	0	00:00	
SS07	7	-42.8866	-53.3227	24.9	0.05	28 Jan 23:49	23:32	06:28	03:00	2	06:56	15
SS07	8	-42.9025	-53.5469	24.9	0.05	29 Jan 08:02	23:34	06:27	03:01	0	00:00	
SS07	9	-42.9186	-53.7712	24.9	0.05	29 Jan 09:18	23:36	06:26	03:01	0	00:00	
SS07	10	-42.9349	-53.9954	24.9	0.05	29 Jan 10:35	23:38	06:25	03:01	0	00:00	
SS07	11	-42.9514	-54.2198	25.0	0.05	29 Jan 11:52	23:40	06:24	03:02	0	00:00	
SS07	12	-42.9680	-54.4441	25.0	0.05	29 Jan 13:08	23:42	06:23	03:02	0	00:00	
SS07	13	-42.9849	-54.6685	25.0	0.05	29 Jan 14:25	23:43	06:21	03:02	1	02:00	16
SS07	14	-43.0019	-54.8929	25.0	0.05	29 Jan 17:41	23:45	06:20	03:03	0	00:00	
SS07	15	-43.0191	-55.1173	25.0	0.05	29 Jan 18:58	23:47	06:19	03:03	0	00:00	
SS07	16	-43.0365	-55.3418	25.0	0.05	29 Jan 20:14	23:49	06:18	03:03	0	00:00	
SS07	17	-43.0541	-55.5662	25.0	0.05	29 Jan 21:31	23:51	06:17	03:04	0	00:00	
SS07	18	-43.0720	-55.7907	25.0	0.05	29 Jan 22:48	23:53	06:15	03:04	0	00:00	
SS07	19	-43.0900	-56.0152	25.0	0.05	30 Jan 00:04	23:55	06:14	03:05	2	06:19	17
SS07	20	-43.1083	-56.2397	25.0	0.05	30 Jan 07:40	23:57	06:13	03:05	0	00:00	
SS07	21	-43.1267	-56.4642	25.0	0.05	30 Jan 08:57	23:59	06:12	03:05	0	00:00	
SS07	22	-43.1454	-56.6886	25.0	0.05	30 Jan 10:14	00:01	06:11	03:06	0	00:00	
SS07	23	-43.1643	-56.9131	25.0	0.05	30 Jan 11:30	00:03	06:10	03:06	0	00:00	
SS07	24	-43.1835	-57.1376	25.0	0.05	30 Jan 12:47	00:05	06:08	03:06	0	00:00	

SS07	25	-43.2029	-57.3620	25.0	0.05	30 Jan 14:04	00:07	06:06	03:06	1	02:00	18
SS07	26	-43.2225	-57.5865	25.0	0.05	30 Jan 17:20	00:09	06:04	03:06	0	00:00	
SS07	27	-43.2423	-57.8109	25.0	0.05	30 Jan 18:37	00:11	06:02	03:06	0	00:00	
SS07	28	-43.2624	-58.0353	25.0	0.05	30 Jan 19:53	00:13	06:00	03:06	0	00:00	
SS07	29	-43.2828	-58.2597	25.0	0.05	30 Jan 21:10	00:15	05:58	03:07	0	00:00	
SS07	30	-43.3034	-58.4840	25.0	0.05	30 Jan 22:27	00:18	05:56	03:07	0	00:00	
SS07	31	-43.3242	-58.7083	25.0	0.05	30 Jan 23:43	00:20	05:54	03:07	2	05:34	19
SS07	32	-43.3454	-58.9326	25.0	0.05	31 Jan 06:34	00:22	05:52	03:07	0	00:00	
SS07	33	-43.3668	-59.1568	24.9	0.05	31 Jan 07:51	00:24	05:50	03:07	0	00:00	
SS07	34	-43.3884	-59.3810	24.9	0.05	31 Jan 09:07	00:26	05:48	03:07	0	00:00	
SS07	35	-43.4104	-59.6051	24.9	0.05	31 Jan 10:24	00:28	05:46	03:07	0	00:00	
SS07	36	-43.4326	-59.8292	24.9	0.05	31 Jan 11:40	00:30	05:44	03:07	0	00:00	
SS07	37	-43.4552	-60.0532	24.9	0.05	31 Jan 12:57	00:33	05:42	03:07	0	00:00	
SS07	38	-43.4780	-60.2772	24.9	0.05	31 Jan 14:13	00:35	05:40	03:07	1	02:00	20
SS07	39	-43.5012	-60.5011	24.9	0.05	31 Jan 17:30	00:37	05:38	03:08	0	00:00	
SS07	40	-43.5246	-60.7249	24.9	0.05	31 Jan 18:46	00:39	05:36	03:08	0	00:00	
SS07	41	-43.5484	-60.9487	24.9	0.05	31 Jan 20:02	00:41	05:34	03:08	0	00:00	
SS07	42	-43.5724	-61.1724	24.9	0.05	31 Jan 21:19	00:43	05:32	03:08	0	00:00	
SS07	43	-43.5969	-61.3960	24.9	0.05	31 Jan 22:35	00:45	05:30	03:08	0	00:00	
SS07	44	-43.6216	-61.6195	24.9	0.05	31 Jan 23:51	00:48	05:29	03:08	1	02:00	21
SS10	22	-50.2164	-62.6555	361.1	0.67	01 Feb 18:01	01:15	05:55	03:35	0	00:00	
SS10	21	-50.1445	-62.4346	24.8	0.05	01 Feb 19:17	01:12	05:56	03:34	0	00:00	
SS10	20	-50.0736	-62.2135	24.8	0.05	01 Feb 20:34	01:10	05:58	03:34	0	00:00	
SS10	19	-50.0037	-61.9923	24.8	0.05	01 Feb 21:50	01:07	06:00	03:34	0	00:00	
SS10	18	-49.9348	-61.7710	24.9	0.05	01 Feb 23:06	01:05	06:02	03:33	0	00:00	
SS10	17	-49.8668	-61.5496	24.9	0.05	02 Feb 00:22	01:02	06:04	03:33	2	05:02	22
SS10	16	-49.7997	-61.3280	24.9	0.05	02 Feb 06:41	01:00	06:06	03:33	0	00:00	
SS10	15	-49.7335	-61.1064	24.9	0.05	02 Feb 07:57	00:57	06:08	03:32	0	00:00	
SS10	14	-49.6682	-60.8846	24.9	0.05	02 Feb 09:13	00:55	06:10	03:32	0	00:00	
SS10	13	-49.6038	-60.6628	24.9	0.05	02 Feb 10:30	00:52	06:12	03:32	0	00:00	
SS10	12	-49.5402	-60.4408	24.9	0.05	02 Feb 11:46	00:50	06:14	03:32	0	00:00	

SS10	11	-49.4775	-60.2188	24.9	0.05	02 Feb 13:03	00:48	06:15	03:31	0	00:00	
SS10	10	-49.4155	-59.9966	24.9	0.05	02 Feb 14:19	00:46	06:16	03:31	1	02:00	23
SS10	9	-49.3544	-59.7744	24.9	0.05	02 Feb 17:36	00:44	06:18	03:31	0	00:00	
SS10	8	-49.2940	-59.5521	24.9	0.05	02 Feb 18:52	00:42	06:19	03:31	0	00:00	
SS10	7	-49.2344	-59.3298	24.9	0.05	02 Feb 20:09	00:40	06:21	03:30	0	00:00	
SS10	6	-49.1756	-59.1074	24.9	0.05	02 Feb 21:25	00:38	06:22	03:30	0	00:00	
SS10	5	-49.1175	-58.8849	24.9	0.05	02 Feb 22:42	00:36	06:24	03:30	0	00:00	
SS10	4	-49.0601	-58.6623	25.0	0.05	02 Feb 23:58	00:34	06:25	03:30	2	05:50	24
SS10	3	-49.0035	-58.4397	25.0	0.05	03 Feb 07:06	00:32	06:27	03:29	0	00:00	
SS10	2	-48.9475	-58.2170	25.0	0.05	03 Feb 08:23	00:30	06:28	03:29	0	00:00	
SS10	1	-48.8923	-57.9943	25.0	0.05	03 Feb 09:39	00:29	06:30	03:29	0	00:00	
AP13	19	-52.4721	-63.2502	615.7	1.38	04 Feb 18:43	01:23	06:05	03:44	0	00:00	
AP13	18	-52.6688	-63.0857	20.8	0.04	04 Feb 19:47	01:22	06:07	03:44	0	00:00	
AP13	17	-52.9020	-62.8879	24.9	0.05	04 Feb 21:04	01:21	06:10	03:45	0	00:00	
AP13	16	-53.1321	-62.6897	24.9	0.05	04 Feb 22:20	01:20	06:13	03:46	0	00:00	
AP13	15	-53.3591	-62.4910	24.9	0.05	04 Feb 23:37	01:19	06:16	03:47	0	00:00	
AP13	14	-53.5832	-62.2921	24.9	0.05	05 Feb 00:53	01:18	06:18	03:48	2	05:00	25
AP13	13	-53.8043	-62.0927	24.9	0.05	05 Feb 07:11	01:17	06:21	03:49	0	00:00	
AP13	12	-54.0226	-61.8930	24.9	0.05	05 Feb 08:27	01:16	06:24	03:50	0	00:00	
AP13	11	-54.2380	-61.6929	24.9	0.05	05 Feb 09:44	01:15	06:27	03:51	0	00:00	
AP13	10	-54.4506	-61.4926	24.9	0.05	05 Feb 11:00	01:14	06:30	03:52	0	00:00	
AP13	9	-54.6605	-61.2918	25.0	0.05	05 Feb 12:17	01:12	06:32	03:52	0	00:00	
AP13	8	-54.8677	-61.0908	24.9	0.05	05 Feb 13:33	01:11	06:35	03:53	0	00:00	
AP13	7	-55.0723	-60.8894	24.9	0.05	05 Feb 14:50	01:10	06:38	03:54	1	02:00	26
AP13	6	-55.2743	-60.6878	24.9	0.05	05 Feb 18:06	01:09	06:41	03:55	0	00:00	
AP13	5	-55.4738	-60.4858	24.9	0.05	05 Feb 19:23	01:08	06:43	03:56	0	00:00	
AP13	4	-55.6707	-60.2836	24.9	0.05	05 Feb 20:39	01:07	06:46	03:57	0	00:00	
AP13	3	-55.8652	-60.0811	24.9	0.05	05 Feb 21:56	01:06	06:49	03:57	0	00:00	
AP13	2	-56.0572	-59.8783	24.9	0.05	05 Feb 23:13	01:05	06:52	03:58	0	00:00	
AP13	1	-56.2469	-59.6753	24.9	0.05	06 Feb 00:29	01:04	06:55	03:59	0	00:00	
AP16	1	-62.9295	-60.0034	374.7	0.70	06 Feb 17:15	01:27	07:26	04:26	0	00:00	

AP16	2	-62.7809	-60.2153	24.9	0.05	06 Feb 18:32	01:28	07:23	04:25	0	00:00	
AP16	3	-62.6303	-60.4270	24.9	0.05	06 Feb 19:48	01:29	07:20	04:25	0	00:00	
AP16	4	-62.4777	-60.6385	24.9	0.05	06 Feb 21:05	01:31	07:18	04:24	0	00:00	
AP16	5	-62.3230	-60.8499	24.9	0.05	06 Feb 22:21	01:32	07:15	04:23	0	00:00	
AP16	6	-62.1663	-61.0611	24.9	0.05	06 Feb 23:38	01:33	07:12	04:23	0	00:00	
AP16	7	-62.0074	-61.2721	24.9	0.05	07 Feb 00:54	01:35	07:10	04:22	2	05:35	27
AP16	8	-61.8464	-61.4830	25.0	0.05	07 Feb 07:46	01:36	07:07	04:21	0	00:00	
AP16	9	-61.6832	-61.6936	24.9	0.05	07 Feb 09:03	01:37	07:04	04:21	0	00:00	
AP16	10	-61.5177	-61.9041	25.0	0.05	07 Feb 10:19	01:39	07:02	04:20	0	00:00	
AP16	11	-61.3500	-62.1143	24.9	0.05	07 Feb 11:36	01:40	06:59	04:19	0	00:00	
AP16	12	-61.1799	-62.3243	24.9	0.05	07 Feb 12:52	01:41	06:57	04:19	0	00:00	
AP16	13	-61.0074	-62.5341	24.9	0.05	07 Feb 14:09	01:42	06:54	04:18	0	00:00	
AP16	14	-60.8325	-62.7437	24.9	0.05	07 Feb 15:25	01:43	06:52	04:18	1	02:00	28
AP16	15	-60.6551	-62.9531	24.9	0.05	07 Feb 18:42	01:45	06:49	04:17	0	00:00	
AP16	16	-60.4752	-63.1622	24.9	0.05	07 Feb 19:58	01:46	06:47	04:16	0	00:00	
AP16	17	-60.2927	-63.3710	24.9	0.05	07 Feb 21:15	01:47	06:44	04:16	0	00:00	
AP16	18	-60.1076	-63.5796	24.9	0.05	07 Feb 22:32	01:48	06:42	04:15	0	00:00	
AP16	19	-60.0261	-63.6703	10.9	0.02	07 Feb 23:05	01:50	06:40	04:15	1	02:00	29
Diversion WPT		-63.6028	-64.0762	180.7	0.40	08 Feb 10:47	23:13	06:54	03:04	0	00:00	
AP19	29	-66.4704	-66.0630	258.4	0.48	08 Feb 22:21	02:35	06:47	04:41	0	00:00	
AP19	28	-66.6084	-65.8674	22.6	0.05	08 Feb 23:30	02:33	06:50	04:41	0	00:00	
AP19	27	-66.7579	-65.6520	24.9	0.05	09 Feb 00:47	02:31	06:53	04:42	2	04:22	30
AP19	26	-66.9049	-65.4365	24.9	0.05	09 Feb 06:25	02:29	06:56	04:42	0	00:00	
AP19	25	-67.0497	-65.2208	24.9	0.05	09 Feb 07:42	02:27	06:59	04:43	0	00:00	
AP19	24	-67.1921	-65.0048	24.9	0.05	09 Feb 08:58	02:25	07:02	04:43	0	00:00	
AP19	23	-67.3324	-64.7887	24.9	0.05	09 Feb 10:14	02:23	07:05	04:44	0	00:00	
AP19	22	-67.4704	-64.5725	24.9	0.05	09 Feb 11:31	02:21	07:08	04:44	0	00:00	
AP19	21	-67.6063	-64.3560	24.9	0.05	09 Feb 12:47	02:19	07:11	04:45	0	00:00	
AP19	20	-67.7402	-64.1394	24.9	0.05	09 Feb 14:04	02:17	07:14	04:45	0	00:00	
AP19	19	-67.8720	-63.9227	24.9	0.05	09 Feb 15:20	02:15	07:17	04:46	1	02:00	31
AP19	18	-68.0019	-63.7058	24.9	0.05	09 Feb 18:37	02:13	07:20	04:46	0	00:00	

AP19	17	-68.1297	-63.4887	24.9	0.05	09 Feb 19:53	02:11	07:23	04:47	0	00:00	
AP19	16	-68.2557	-63.2715	24.9	0.05	09 Feb 21:10	02:09	07:26	04:47	0	00:00	
AP19	15	-68.3799	-63.0542	24.9	0.05	09 Feb 22:26	02:07	07:30	04:48	0	00:00	
AP19	14	-68.5022	-62.8367	24.9	0.05	09 Feb 23:43	02:05	07:32	04:48	0	00:00	
AP19	13	-68.6227	-62.6191	24.9	0.05	10 Feb 01:00	02:04	07:34	04:49	2	05:30	32
AP19	12	-68.7415	-62.4014	24.9	0.05	10 Feb 07:46	02:02	07:36	04:49	0	00:00	
AP19	11	-68.8586	-62.1836	24.9	0.05	10 Feb 09:03	02:01	07:38	04:50	0	00:00	
AP19	10	-68.9740	-61.9657	24.9	0.05	10 Feb 10:19	02:00	07:41	04:50	0	00:00	
AP19	9	-69.0878	-61.7477	24.9	0.05	10 Feb 11:36	01:58	07:43	04:51	0	00:00	
AP19	8	-69.1999	-61.5296	24.9	0.05	10 Feb 12:52	01:57	07:45	04:51	0	00:00	
AP19	7	-69.3105	-61.3114	24.9	0.05	10 Feb 14:09	01:56	07:47	04:51	0	00:00	
AP19	6	-69.4196	-61.0931	25.0	0.05	10 Feb 15:26	01:54	07:49	04:52	1	02:00	33
AP19	5	-69.5271	-60.8747	25.0	0.05	10 Feb 18:42	01:53	07:52	04:52	0	00:00	
AP19	4	-69.6332	-60.6563	24.9	0.05	10 Feb 19:59	01:52	07:54	04:53	0	00:00	
AP19	3	-69.7379	-60.4378	24.9	0.05	10 Feb 21:15	01:50	07:56	04:53	0	00:00	
AP19	2	-69.8411	-60.2192	24.9	0.05	10 Feb 22:32	01:49	07:58	04:54	0	00:00	
AP19	1	-69.9429	-60.0005	24.9	0.05	10 Feb 23:48	01:48	08:01	04:54	1	02:00	34

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The CCAMLR krill synoptic survey

Transect waypoints for ship 2 (USA)

This table provides the waypoints at 25 km intervals along each transect for ship 2. Distance is shown in km, and represents the distance between each waypoint. The Journey time is the time (in days) to get from preceding waypoint to current waypoint. The Arrival time is the time of arrival at each waypoint (all times are expressed as GMT). Civil dawn and dusk are the stop and start times for each day (see daylight times for more details). The time of local midnight is the GMT time for the mid-point of the dark period. The column 'stations' has 3 codes: 1 indicates the daytime station, 2 indicates the night-time station and 0 indicates no station. The station time indicates the time period (hours) of the station, night-time stations extend for the period of darkness.

Transect	Wpt	Longitude	Latitude	Distance	Journey time	Arrival time	civil dusk	civil dawn	Local midnight	stations	station time	station number
SG 4 bottom	5	-37.5487	-54.0067		0.00	14 Jan 06:10	23:39	05:38	02:38	0	00:00	
0	4	-37.5623	-53.7823	24.9	0.05	14 Jan 07:27	23:39	05:38	02:38	0	00:00	
0	3	-37.5758	-53.5580	24.9	0.05	14 Jan 08:43	23:39	05:38	02:38	0	00:00	
0	2	-37.5891	-53.3337	24.9	0.05	14 Jan 10:00	23:39	05:38	02:38	0	00:00	
SG 4 top	1	-37.6022	-53.1095	24.9	0.05	14 Jan 11:16	23:39	05:38	02:38	0	00:00	
SG 3 top	1	-36.6303	-53.0848	64.9	0.12	14 Jan 14:10	23:39	05:38	02:38	0	00:00	
0	2	-36.6118	-53.3089	24.9	0.05	14 Jan 15:27	23:39	05:38	02:38	0	00:00	
0	3	-36.5931	-53.5330	24.9	0.05	14 Jan 16:43	23:39	05:38	02:38	0	00:00	
0	4	-36.5742	-53.7572	24.9	0.05	14 Jan 18:00	23:39	05:38	02:38	0	00:00	
SG 3 bottom	5	-36.5551	-53.9814	24.9	0.05	14 Jan 19:17	23:39	05:38	02:38	1	06:00	1
SG 2 top	1	-35.5553	-53.6031	77.9	0.15	15 Jan 04:46	23:39	05:38	02:38	0	00:00	2
0	2	-35.5307	-53.8271	24.9	0.05	15 Jan 06:02	23:39	05:38	02:38	0	00:00	
0	3	-35.5057	-54.0511	24.9	0.05	15 Jan 07:19	23:39	05:38	02:38	0	00:00	

0	4	-35.4805	-54.2752	25.0	0.05	15 Jan 08:36	23:39	05:38	02:38	0	00:00	
SG 2 bottom	5	-35.4550	-54.4993	25.0	0.05	15 Jan 09:52	23:39	05:38	02:38	0	00:00	
SG 1 bottom	5	-34.8924	-54.7824	47.9	0.09	15 Jan 12:01	23:39	05:38	02:38	0	00:00	
0	4	-34.9213	-54.5584	25.0	0.05	15 Jan 13:17	23:39	05:38	02:38	0	00:00	
0	3	-34.9498	-54.3345	25.0	0.05	15 Jan 14:34	23:39	05:38	02:38	0	00:00	
0	2	-34.9781	-54.1105	25.0	0.05	15 Jan 15:51	23:39	05:38	02:38	0	00:00	
SG 1 top	1	-35.0060	-53.8866	24.9	0.05	15 Jan 17:07	23:39	05:38	02:38	1	06:00	3
SG 1 bottom		-34.8924	-54.7824	99.8	0.19	16 Jan 03:35	23:39	05:38	02:38	0	00:00	4
SS02	1	-33.5337	-51.8242	340.9	0.64	16 Jan 18:51	23:11	05:35	02:23	0	00:00	
SS02	2	-33.4993	-52.0472	24.9	0.05	16 Jan 20:07	23:12	05:33	02:23	0	00:00	
SS02	3	-33.4646	-52.2703	24.9	0.05	16 Jan 21:23	23:14	05:31	02:23	0	00:00	
SS02	4	-33.4295	-52.4934	24.9	0.05	16 Jan 22:40	23:16	05:30	02:23	2	06:14	5
SS02	5	-33.3941	-52.7166	24.9	0.05	17 Jan 06:11	23:17	05:28	02:23	0	00:00	
SS02	6	-33.3582	-52.9399	24.9	0.05	17 Jan 07:27	23:19	05:27	02:23	0	00:00	
SS02	7	-33.3219	-53.1631	24.9	0.05	17 Jan 08:44	23:21	05:25	02:23	0	00:00	
SS02	8	-33.2853	-53.3864	24.9	0.05	17 Jan 10:00	23:22	05:24	02:23	0	00:00	
SS02	9	-33.2483	-53.6098	24.9	0.05	17 Jan 11:17	23:24	05:22	02:23	0	00:00	
SS02	10	-33.2108	-53.8331	24.9	0.05	17 Jan 12:33	23:26	05:20	02:23	0	00:00	
SS02	11	-33.1729	-54.0565	24.9	0.05	17 Jan 13:50	23:27	05:19	02:23	1	02:00	6
SS02	12	-33.1346	-54.2799	25.0	0.05	17 Jan 17:06	23:29	05:17	02:23	0	00:00	
SS02	13	-33.0959	-54.5034	25.0	0.05	17 Jan 18:23	23:31	05:16	02:23	0	00:00	
SS02	14	-33.0567	-54.7268	25.0	0.05	17 Jan 19:39	23:32	05:14	02:23	0	00:00	
SS02	15	-33.0171	-54.9503	25.0	0.05	17 Jan 20:56	23:34	05:13	02:23	0	00:00	
SS02	16	-32.9771	-55.1738	25.0	0.05	17 Jan 22:13	23:36	05:11	02:23	0	00:00	
SS02	17	-32.9365	-55.3972	25.0	0.05	17 Jan 23:29	23:37	05:09	02:23	2	05:32	7
SS02	18	-32.8955	-55.6207	25.0	0.05	18 Jan 06:18	23:39	05:08	02:23	0	00:00	
SS02	19	-32.8541	-55.8442	25.0	0.05	18 Jan 07:35	23:41	05:06	02:23	0	00:00	
SS02	20	-32.8121	-56.0677	25.0	0.05	18 Jan 08:51	23:42	05:05	02:23	0	00:00	
SS02	21	-32.7697	-56.2911	25.0	0.05	18 Jan 10:08	23:44	05:03	02:23	0	00:00	
SS02	22	-32.7267	-56.5146	25.0	0.05	18 Jan 11:25	23:46	05:02	02:24	0	00:00	

SS02	23	-32.6832	-56.7380	25.0	0.05	18 Jan 12:41	23:48	04:58	02:23	0	00:00	
SS02	24	-32.6393	-56.9614	25.0	0.05	18 Jan 13:58	23:51	04:55	02:23	1	02:00	8
SS02	25	-32.5947	-57.1848	25.0	0.05	18 Jan 17:15	23:53	04:52	02:23	0	00:00	
SS02	26	-32.5497	-57.4082	25.0	0.05	18 Jan 18:31	23:56	04:49	02:22	0	00:00	
SS02	27	-32.5041	-57.6316	25.0	0.05	18 Jan 19:48	23:58	04:45	02:22	0	00:00	
SS02	28	-32.4579	-57.8549	25.0	0.05	18 Jan 21:04	00:01	04:42	02:22	0	00:00	
SS02	29	-32.4112	-58.0781	25.0	0.05	18 Jan 22:21	00:04	04:39	02:21	0	00:00	
SS02	30	-32.3639	-58.3014	25.0	0.05	18 Jan 23:38	00:06	04:36	02:21	2	04:29	9
SS02	31	-32.3160	-58.5245	25.0	0.05	19 Jan 05:24	00:09	04:32	02:21	0	00:00	
SS02	32	-32.2675	-58.7477	25.0	0.05	19 Jan 06:40	00:11	04:29	02:20	0	00:00	
SS02	33	-32.2184	-58.9708	24.9	0.05	19 Jan 07:57	00:14	04:26	02:20	0	00:00	
SS02	34	-32.1686	-59.1938	24.9	0.05	19 Jan 09:13	00:16	04:23	02:20	0	00:00	
SS02	35	-32.1182	-59.4167	24.9	0.05	19 Jan 10:30	00:19	04:19	02:19	0	00:00	
SS02	36	-32.0672	-59.6396	24.9	0.05	19 Jan 11:46	00:22	04:16	02:19	0	00:00	
SS02	37	-32.0155	-59.8625	24.9	0.05	19 Jan 13:03	00:24	04:13	02:19	1	02:00	10
SS02	38	-31.9631	-60.0852	24.9	0.05	19 Jan 16:19	00:27	04:10	02:18	0	00:00	
SS02	39	-31.9101	-60.3079	24.9	0.05	19 Jan 17:36	00:29	04:06	02:18	0	00:00	
SS02	40	-31.8563	-60.5305	24.9	0.05	19 Jan 18:52	00:32	04:03	02:18	0	00:00	
SS02	41	-31.8018	-60.7530	24.9	0.05	19 Jan 20:09	00:34	04:00	02:17	0	00:00	
SS02	42	-31.7466	-60.9755	24.9	0.05	19 Jan 21:25	00:37	03:57	02:17	0	00:00	
SS02	43	-31.6907	-61.1978	24.9	0.05	19 Jan 22:42	00:40	03:54	02:17	2	03:14	11
SS05	43	-38.2424	-61.4306	350.3	0.65	20 Jan 17:36	00:55	04:35	02:45	0	00:00	
SS05	42	-38.2543	-61.2067	24.9	0.05	20 Jan 18:52	00:52	04:37	02:45	0	00:00	
SS05	41	-38.2661	-60.9828	24.9	0.05	20 Jan 20:09	00:50	04:40	02:45	0	00:00	
SS05	40	-38.2777	-60.7588	24.9	0.05	20 Jan 21:25	00:47	04:42	02:45	0	00:00	
SS05	39	-38.2892	-60.5348	24.9	0.05	20 Jan 22:42	00:45	04:45	02:45	0	00:00	
SS05	38	-38.3005	-60.3107	24.9	0.05	20 Jan 23:58	00:42	04:47	02:45	0	00:00	
SS05	37	-38.3117	-60.0865	24.9	0.05	21 Jan 01:15	00:40	04:50	02:45	2	04:10	12
SS05	36	-38.3227	-59.8623	24.9	0.05	21 Jan 06:41	00:37	04:52	02:45	0	00:00	
SS05	35	-38.3336	-59.6380	24.9	0.05	21 Jan 07:58	00:35	04:55	02:45	0	00:00	

SS05	34	-38.3443	-59.4136	24.9	0.05	21 Jan 09:14	00:32	04:57	02:45	0	00:00	
SS05	33	-38.3550	-59.1893	24.9	0.05	21 Jan 10:31	00:30	05:00	02:45	0	00:00	
SS05	32	-38.3654	-58.9648	24.9	0.05	21 Jan 11:47	00:27	05:02	02:45	0	00:00	
SS05	31	-38.3758	-58.7404	24.9	0.05	21 Jan 13:04	00:25	05:05	02:45	0	00:00	
SS05	30	-38.3860	-58.5159	25.0	0.05	21 Jan 14:20	00:22	05:07	02:45	1	02:00	13
SS05	29	-38.3960	-58.2913	25.0	0.05	21 Jan 17:37	00:20	05:10	02:45	0	00:00	
SS05	28	-38.4060	-58.0668	25.0	0.05	21 Jan 18:54	00:17	05:12	02:45	0	00:00	
SS05	27	-38.4158	-57.8422	25.0	0.05	21 Jan 20:10	00:15	05:15	02:45	0	00:00	
SS05	26	-38.4255	-57.6176	25.0	0.05	21 Jan 21:27	00:12	05:17	02:45	0	00:00	
SS05	25	-38.4351	-57.3929	25.0	0.05	21 Jan 22:43	00:10	05:20	02:45	0	00:00	
SS05	24	-38.4446	-57.1683	25.0	0.05	22 Jan 00:00	00:07	05:22	02:45	2	05:15	14
SS05	23	-38.4540	-56.9437	25.0	0.05	22 Jan 06:32	00:05	05:25	02:45	0	00:00	
SS05	22	-38.4632	-56.7190	25.0	0.05	22 Jan 07:48	00:03	05:28	02:45	0	00:00	
SS05	21	-38.4724	-56.4943	25.0	0.05	22 Jan 09:05	00:01	05:29	02:45	0	00:00	
SS05	20	-38.4814	-56.2697	25.0	0.05	22 Jan 10:22	23:59	05:31	02:45	0	00:00	
SS05	19	-38.4903	-56.0450	25.0	0.05	22 Jan 11:38	23:57	05:32	02:45	0	00:00	
SS05	18	-38.4991	-55.8204	25.0	0.05	22 Jan 12:55	23:56	05:34	02:45	0	00:00	
SS05	17	-38.5079	-55.5957	25.0	0.05	22 Jan 14:11	23:54	05:36	02:45	1	02:00	15
SS05	16	-38.5165	-55.3711	25.0	0.05	22 Jan 17:28	23:52	05:37	02:45	0	00:00	
SS05	15	-38.5250	-55.1465	25.0	0.05	22 Jan 18:45	23:51	05:39	02:45	0	00:00	
SS05	14	-38.5334	-54.9219	25.0	0.05	22 Jan 20:01	23:49	05:40	02:45	0	00:00	
SS05	13	-38.5418	-54.6973	25.0	0.05	22 Jan 21:18	23:47	05:42	02:45	0	00:00	
SS05	12	-38.5500	-54.4727	25.0	0.05	22 Jan 22:35	23:45	05:44	02:45	0	00:00	
SS05	11	-38.5581	-54.2482	25.0	0.05	22 Jan 23:51	23:44	05:45	02:44	2	06:01	16
SS05	10	-38.5662	-54.0237	25.0	0.05	23 Jan 07:09	23:42	05:47	02:44	0	00:00	
SS05	9	-38.5741	-53.7993	24.9	0.05	23 Jan 08:26	23:40	05:49	02:44	0	00:00	
SS05	8	-38.5820	-53.5749	24.9	0.05	23 Jan 09:42	23:39	05:50	02:44	0	00:00	
SS05	7	-38.5898	-53.3505	24.9	0.05	23 Jan 10:59	23:37	05:52	02:44	0	00:00	
SS05	6	-38.5975	-53.1262	24.9	0.05	23 Jan 12:15	23:35	05:53	02:44	0	00:00	
SS05	5	-38.6051	-52.9019	24.9	0.05	23 Jan 13:32	23:33	05:55	02:44	1	02:00	17

SS05	4	-38.6126	-52.6777	24.9	0.05	23 Jan 16:48	23:32	05:57	02:44	0	00:00	
SS05	3	-38.6201	-52.4535	24.9	0.05	23 Jan 18:05	23:30	05:58	02:44	0	00:00	
SS05	2	-38.6275	-52.2294	24.9	0.05	23 Jan 19:21	23:28	06:00	02:44	0	00:00	
SS05	1	-38.6348	-52.0053	24.9	0.05	23 Jan 20:38	23:27	06:02	02:44	0	00:00	
SS08	1	-44.5934	-54.6167	490.4	0.91	24 Jan 18:35	00:04	06:17	03:10	0	00:00	
SS08	2	-44.6196	-54.8408	25.0	0.05	24 Jan 19:51	00:05	06:15	03:10	0	00:00	
SS08	3	-44.6461	-55.0649	25.0	0.05	24 Jan 21:08	00:07	06:13	03:10	0	00:00	
SS08	4	-44.6728	-55.2891	25.0	0.05	24 Jan 22:24	00:09	06:11	03:10	0	00:00	
SS08	5	-44.6999	-55.5132	25.0	0.05	24 Jan 23:41	00:11	06:10	03:11	2	05:58	18
SS08	6	-44.7273	-55.7374	25.0	0.05	25 Jan 06:56	00:13	06:08	03:11	0	00:00	
SS08	7	-44.7550	-55.9615	25.0	0.05	25 Jan 08:13	00:15	06:06	03:11	0	00:00	
SS08	8	-44.7830	-56.1857	25.0	0.05	25 Jan 09:29	00:17	06:05	03:11	0	00:00	
SS08	9	-44.8114	-56.4099	25.0	0.05	25 Jan 10:46	00:19	06:03	03:11	0	00:00	
SS08	10	-44.8401	-56.6340	25.0	0.05	25 Jan 12:03	00:21	06:01	03:11	0	00:00	
SS08	11	-44.8691	-56.8582	25.0	0.05	25 Jan 13:19	00:23	06:00	03:11	0	00:00	
SS08	12	-44.8985	-57.0823	25.0	0.05	25 Jan 14:36	00:25	05:58	03:11	1	02:00	19
SS08	13	-44.9283	-57.3064	25.0	0.05	25 Jan 17:52	00:27	05:56	03:12	0	00:00	
SS08	14	-44.9584	-57.5305	25.0	0.05	25 Jan 19:09	00:29	05:55	03:12	0	00:00	
SS08	15	-44.9889	-57.7546	25.0	0.05	25 Jan 20:26	00:31	05:53	03:12	0	00:00	
SS08	16	-45.0197	-57.9787	25.0	0.05	25 Jan 21:42	00:33	05:51	03:12	0	00:00	
SS08	17	-45.0510	-58.2027	25.0	0.05	25 Jan 22:59	00:35	05:50	03:12	0	00:00	
SS08	18	-45.0826	-58.4267	25.0	0.05	26 Jan 00:16	00:37	05:48	03:12	2	05:11	20
SS08	19	-45.1147	-58.6506	25.0	0.05	26 Jan 06:43	00:39	05:46	03:12	0	00:00	
SS08	20	-45.1471	-58.8745	25.0	0.05	26 Jan 08:00	00:41	05:45	03:13	0	00:00	
SS08	21	-45.1800	-59.0984	24.9	0.05	26 Jan 09:17	00:43	05:42	03:13	0	00:00	
SS08	22	-45.2132	-59.3222	24.9	0.05	26 Jan 10:33	00:46	05:39	03:13	0	00:00	
SS08	23	-45.2469	-59.5460	24.9	0.05	26 Jan 11:50	00:49	05:37	03:13	0	00:00	
SS08	24	-45.2811	-59.7697	24.9	0.05	26 Jan 13:06	00:52	05:34	03:13	0	00:00	
SS08	25	-45.3157	-59.9933	24.9	0.05	26 Jan 14:23	00:55	05:32	03:13	1	02:00	21
SS08	26	-45.3507	-60.2169	24.9	0.05	26 Jan 17:39	00:58	05:29	03:14	0	00:00	

SS08	27	-45.3862	-60.4404	24.9	0.05	26 Jan 18:56	01:01	05:27	03:14	0	00:00	
Diversion SOI	28	-46.3953	-60.6225	58.8	0.11	26 Jan 21:33	01:04	05:24	03:14	0	00:00	
SS08	29	-45.4587	-60.8873	58.7	0.11	27 Jan 00:11	01:07	05:22	03:14	2	04:14	22
SS08	30	-45.4956	-61.1106	24.9	0.05	27 Jan 05:42	01:10	05:19	03:14	0	00:00	
SS08	31	-45.5331	-61.3338	24.9	0.05	27 Jan 06:58	01:13	05:16	03:15	0	00:00	
SS08	32	-45.5711	-61.5569	24.9	0.05	27 Jan 08:15	01:16	05:14	03:15	0	00:00	
SS08	33	-45.6095	-61.7799	24.9	0.05	27 Jan 09:31	01:19	05:11	03:15	0	00:00	
SS08	34	-45.6486	-62.0029	24.9	0.05	27 Jan 10:47	01:22	05:09	03:15	0	00:00	
SS08	35	-45.6882	-62.2257	24.8	0.05	27 Jan 12:04	01:25	05:06	03:15	0	00:00	
SS08	36	-45.7283	-62.4484	24.8	0.05	27 Jan 13:20	01:28	05:04	03:16	0	00:00	
SS08	37	-45.7690	-62.6711	24.8	0.05	27 Jan 14:36	01:31	05:01	03:16	1	02:00	23
SS08	38	-45.8103	-62.8936	24.8	0.05	27 Jan 17:43	01:34	04:59	03:16	0	00:00	
SO 1 bottom	5	-42.7520	-60.7423	287.9	0.54	28 Jan 06:36	00:43	05:53	03:18	0	00:00	
0	4	-42.7337	-60.5184	24.9	0.05	28 Jan 07:52	00:43	05:53	03:18	0	00:00	
0	3	-42.7156	-60.2944	24.9	0.05	28 Jan 09:08	00:43	05:53	03:18	0	00:00	
0	2	-42.6977	-60.0703	24.9	0.05	28 Jan 10:25	00:43	05:53	03:18	0	00:00	
SO 1 top	1	-42.6801	-59.8462	24.9	0.05	28 Jan 11:41	00:43	05:53	03:18	0	00:00	
SO 2 top	1	-43.9798	-59.8142	72.7	0.14	28 Jan 14:57	00:43	05:53	03:18	0	00:00	
0	2	-44.0059	-60.0382	24.9	0.05	28 Jan 16:13	00:43	05:53	03:18	0	00:00	
0	3	-44.0324	-60.2620	24.9	0.05	28 Jan 17:30	00:43	05:53	03:18	0	00:00	
0	4	-44.0592	-60.4858	24.9	0.05	28 Jan 18:46	00:43	05:53	03:18	0	00:00	
SO 2 bottom	5	-44.0864	-60.7096	24.9	0.05	28 Jan 20:02	00:43	05:53	03:18	0	00:00	24
SO 3 top	1	-45.0948	-59.7768	117.6	0.22	29 Jan 01:18	00:43	05:53	03:18	2	05:10	25
0	2	-45.1281	-60.0005	24.9	0.05	29 Jan 07:45	00:43	05:53	03:18	0	00:00	
0	3	-45.1620	-60.2242	24.9	0.05	29 Jan 09:01	00:43	05:53	03:18	0	00:00	
0	4	-45.1962	-60.4477	24.9	0.05	29 Jan 10:18	00:43	05:53	03:18	0	00:00	
SO 3 bottom	5	-45.2309	-60.6712	24.9	0.05	29 Jan 11:34	00:43	05:53	03:18	0	00:00	
SO 4 bottom	5	-46.3817	-60.6231	62.9	0.12	29 Jan 14:23	00:43	05:53	03:18	0	00:00	
0	4	-46.3394	-60.3999	24.9	0.05	29 Jan 15:39	00:43	05:53	03:18	0	00:00	
0	3	-46.2977	-60.1766	24.9	0.05	29 Jan 16:56	00:43	05:53	03:18	0	00:00	

0	2	-46.2565	-59.9533	24.9	0.05	29 Jan 18:12	00:43	05:53	03:18	0	00:00	
SO 4 top	1	-46.2158	-59.7299	24.9	0.05	29 Jan 19:29	00:43	05:53	03:18	0	00:00	26
SO 4 bottom		-46.3817	-60.6231	99.7	0.19	29 Jan 23:57	00:43	05:53	03:18	2	05:10	27
AP11	14	-50.0763	-61.1085	207.0	0.39	30 Jan 14:22	00:43	05:53	03:18	0	00:00	
AP11	13	-50.1093	-61.0815	3.5	0.01	30 Jan 14:33	00:44	05:56	03:20	0	00:00	
AP11	12	-50.3436	-60.8879	24.9	0.05	30 Jan 15:40	00:45	05:59	03:22	1	02:00	28
AP11	11	-50.5750	-60.6940	24.9	0.05	30 Jan 18:47	00:46	06:02	03:24	0	00:00	
AP11	10	-50.8036	-60.4996	24.9	0.05	30 Jan 19:54	00:47	06:05	03:26	0	00:00	
AP11	9	-51.0295	-60.3049	24.9	0.05	30 Jan 21:01	00:48	06:08	03:28	0	00:00	
AP11	8	-51.2526	-60.1098	24.9	0.05	30 Jan 22:08	00:49	06:11	03:30	0	00:00	
AP11	7	-51.4731	-59.9144	24.9	0.05	30 Jan 23:15	00:50	06:14	03:32	0	00:00	
AP11	6	-51.6909	-59.7185	24.9	0.05	31 Jan 00:22	00:51	06:17	03:34	2	05:26	29
AP11	5	-51.9061	-59.5224	24.9	0.05	31 Jan 06:55	00:52	06:20	03:36	0	00:00	
AP11	4	-52.1188	-59.3259	24.9	0.05	31 Jan 08:02	00:53	06:23	03:38	0	00:00	
AP11	3	-52.3290	-59.1291	24.9	0.05	31 Jan 09:09	00:54	06:26	03:40	0	00:00	
AP11	2	-52.5367	-58.9319	24.9	0.05	31 Jan 10:16	00:55	06:29	03:42	0	00:00	
AP11	1	-52.7420	-58.7345	24.9	0.05	31 Jan 11:23	00:56	06:33	03:44	1	02:00	30
AP14	1	-58.8057	-60.0060	371.1	0.69	01 Feb 05:59	01:30	06:48	04:09	1	02:00	31
AP14	2	-58.6303	-60.2127	24.9	0.05	01 Feb 09:06	01:31	06:45	04:08	0	00:00	
AP14	3	-58.4526	-60.4192	24.9	0.05	01 Feb 10:13	01:32	06:43	04:07	0	00:00	
AP14	4	-58.2727	-60.6254	24.9	0.05	01 Feb 11:20	01:33	06:40	04:06	0	00:00	
AP14	5	-58.0904	-60.8315	25.0	0.05	01 Feb 12:27	01:34	06:38	04:06	0	00:00	
AP14	6	-57.9057	-61.0372	24.9	0.05	01 Feb 13:34	01:35	06:35	04:05	0	00:00	
AP14	7	-57.7186	-61.2427	24.9	0.05	01 Feb 14:41	01:36	06:33	04:04	1	02:00	32
AP14	8	-57.5290	-61.4480	24.9	0.05	01 Feb 17:48	01:37	06:31	04:04	0	00:00	
AP14	9	-57.3369	-61.6530	24.9	0.05	01 Feb 18:55	01:38	06:27	04:03	0	00:00	
AP14	10	-57.1422	-61.8577	24.9	0.05	01 Feb 20:02	01:40	06:24	04:02	0	00:00	
AP14	11	-56.9449	-62.0621	24.9	0.05	01 Feb 21:09	01:42	06:21	04:01	0	00:00	
AP14	12	-56.7449	-62.2662	24.9	0.05	01 Feb 22:16	01:44	06:18	04:01	0	00:00	
AP14	13	-56.5422	-62.4701	24.9	0.05	01 Feb 23:23	01:45	06:15	04:00	0	00:00	

AP14	14	-56.3368	-62.6736	24.9	0.05	02 Feb 00:30	01:47	06:12	03:59	2	04:24	33
AP14	15	-56.1285	-62.8768	24.9	0.05	02 Feb 06:02	01:49	06:09	03:59	0	00:00	
AP14	16	-56.1264	-62.8788	0.2	0.00	02 Feb 06:03	01:51	06:06	03:58	0	00:00	
AP17	21	-63.5331	-64.1662	393.6	0.73	02 Feb 23:39	02:25	06:31	04:28	0	00:00	
AP17	20	-63.6028	-64.0762	10.6	0.02	03 Feb 00:08	02:23	06:34	04:28	2	04:10	34
AP17	19	-63.7654	-63.8635	24.9	0.05	03 Feb 05:25	02:21	06:37	04:29	0	00:00	
AP17	18	-63.9256	-63.6506	24.9	0.05	03 Feb 06:32	02:19	06:40	04:29	0	00:00	
AP17	17	-64.0834	-63.4375	24.9	0.05	03 Feb 07:39	02:18	06:43	04:30	0	00:00	
AP17	16	-64.2390	-63.2243	24.9	0.05	03 Feb 08:46	02:16	06:46	04:31	0	00:00	
AP17	15	-64.3923	-63.0108	24.9	0.05	03 Feb 09:53	02:14	06:49	04:31	0	00:00	
AP17	14	-64.5434	-62.7972	24.9	0.05	03 Feb 11:00	02:13	06:52	04:32	0	00:00	
AP17	13	-64.6923	-62.5834	24.9	0.05	03 Feb 12:07	02:11	06:55	04:33	0	00:00	
AP17	12	-64.8391	-62.3694	24.9	0.05	03 Feb 13:14	02:09	06:58	04:33	0	00:00	
AP17	11	-64.9839	-62.1552	25.0	0.05	03 Feb 14:21	02:08	07:01	04:34	0	00:00	
AP17	10	-65.1266	-61.9409	24.9	0.05	03 Feb 15:28	02:06	07:03	04:34	1	02:00	35
AP17	9	-65.2673	-61.7264	25.0	0.05	03 Feb 18:35	02:05	07:05	04:35	0	00:00	
AP17	8	-65.4061	-61.5118	24.9	0.05	03 Feb 19:42	02:03	07:08	04:35	0	00:00	
AP17	7	-65.5429	-61.2971	24.9	0.05	03 Feb 20:49	02:02	07:10	04:36	0	00:00	
AP17	6	-65.6779	-61.0822	24.9	0.05	03 Feb 21:56	02:00	07:13	04:36	0	00:00	
AP17	5	-65.8111	-60.8672	24.9	0.05	03 Feb 23:03	01:59	07:15	04:37	0	00:00	
AP17	4	-65.9425	-60.6521	24.9	0.05	04 Feb 00:10	01:57	07:17	04:37	2	05:20	36
AP17	3	-66.0721	-60.4368	25.0	0.05	04 Feb 06:37	01:56	07:20	04:38	0	00:00	
AP17	2	-66.2000	-60.2215	24.9	0.05	04 Feb 07:44	01:54	07:22	04:38	0	00:00	
AP17	1	-66.3261	-60.0060	24.9	0.05	04 Feb 08:51	01:53	07:25	04:39	0	00:00	

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Page last updated on 7 July 1999

The CCAMLR krill synoptic survey

Transect waypoints for ship 3 (Japan)

This table provides the waypoints at 25 km intervals along each transect for ship 3. Distance is shown in km, and represents the distance between each waypoint. The Journey time is the time (in days) to get from preceding waypoint to current waypoint. The Arrival time is the time of arrival at each waypoint (all times are expressed as GMT). Civil dawn and dusk are the stop and start times for each day (see daylight times for more details). The time of local midnight is the GMT time for the mid-point of the dark period. The column 'stations' has 3 codes: 1 indicates the daytime station, 2 indicates the night-time station and 0 indicates no station. The station time indicates the time period (hours) of the station, night-time stations extend for the period of darkness.

Note that this page contains the latest (15 October 1999) recalculation of the waypoints and stations

Transect	Wpt	Longitude	Latitude	Distance	Journey time	Arrival time	civil dusk	civil dawn	Local midnight	stations	station time	station number
SS03	1	-35.45	-51.92		0.00	10 Jan 19:08	23:22	05:38	02:30	0	00:00	
SS03	2	-35.42	-52.14	24.9	0.05	10 Jan 20:24	23:23	05:36	02:29	0	00:00	
SS03	3	-35.40	-52.37	24.9	0.05	10 Jan 21:40	23:25	05:34	02:29	0	00:00	
SS03	4	-35.37	-52.59	24.9	0.05	10 Jan 22:57	23:27	05:32	02:29	2	06:05	1
SS03	5	-35.35	-52.81	24.9	0.05	11 Jan 06:19	23:28	05:30	02:29	0	00:00	
SS03	6	-35.32	-53.04	24.9	0.05	11 Jan 07:35	23:30	05:28	02:29	0	00:00	
SS03	7	-35.30	-53.26	24.9	0.05	11 Jan 08:52	23:32	05:26	02:29	0	00:00	
SS03	8	-35.27	-53.49	24.9	0.05	11 Jan 10:08	23:33	05:24	02:29	0	00:00	
SS03	9	-35.24	-53.71	24.9	0.05	11 Jan 11:25	23:35	05:22	02:29	0	00:00	
SS03	10	-35.22	-53.93	24.9	0.05	11 Jan 12:41	23:37	05:20	02:28	0	00:00	
SS03	11	-35.19	-54.16	24.9	0.05	11 Jan 13:58	23:38	05:18	02:28	1	02:00	2

SS03	12	-35.16	-54.38	25.0	0.05	11 Jan 17:14	23:40	05:17	02:28	0	00:00	
SS03	13	-35.14	-54.61	25.0	0.05	11 Jan 18:31	23:42	05:15	02:28	0	00:00	
SS03	14	-35.11	-54.83	25.0	0.05	11 Jan 19:48	23:43	05:13	02:28	0	00:00	
SS03	15	-35.08	-55.05	25.0	0.05	11 Jan 21:04	23:45	05:11	02:28	0	00:00	
SS03	16	-35.05	-55.28	25.0	0.05	11 Jan 22:21	23:47	05:09	02:28	0	00:00	
SS03	17	-35.02	-55.50	25.0	0.05	11 Jan 23:37	23:48	05:07	02:28	2	05:18	3
SS03	18	-34.99	-55.73	25.0	0.05	12 Jan 06:13	23:50	05:05	02:27	0	00:00	
SS03	19	-34.97	-55.95	25.0	0.05	12 Jan 07:29	23:52	05:03	02:27	0	00:00	
SS03	20	-34.94	-56.17	25.0	0.05	12 Jan 08:46	23:53	05:01	02:27	0	00:00	
SS03	21	-34.91	-56.40	25.0	0.05	12 Jan 10:03	23:55	04:59	02:27	0	00:00	
SS03	22	-34.88	-56.62	25.0	0.05	12 Jan 11:19	23:57	04:58	02:27	0	00:00	
SS03	23	-34.84	-56.85	25.0	0.05	12 Jan 12:36	00:00	04:54	02:27	0	00:00	
SS03	24	-34.81	-57.07	25.0	0.05	12 Jan 13:53	00:03	04:51	02:27	1	02:00	4
SS03	25	-34.78	-57.29	25.0	0.05	12 Jan 17:09	00:06	04:48	02:27	0	00:00	
SS03	26	-34.75	-57.52	25.0	0.05	12 Jan 18:26	00:09	04:45	02:27	0	00:00	
SS03	27	-34.72	-57.74	25.0	0.05	12 Jan 19:42	00:12	04:42	02:27	0	00:00	
SS03	28	-34.69	-57.97	25.0	0.05	12 Jan 20:59	00:15	04:39	02:27	0	00:00	
SS03	29	-34.65	-58.19	25.0	0.05	12 Jan 22:16	00:18	04:36	02:27	0	00:00	
SS03	30	-34.62	-58.41	25.0	0.05	12 Jan 23:32	00:21	04:32	02:27	0	00:00	
SS03	31	-34.58	-58.64	25.0	0.05	13 Jan 00:49	00:24	04:29	02:27	2	04:05	5
SS03	32	-34.55	-58.86	25.0	0.05	13 Jan 06:11	00:27	04:26	02:27	0	00:00	
SS03	33	-34.52	-59.09	24.9	0.05	13 Jan 07:27	00:30	04:23	02:26	0	00:00	
SS03	34	-34.48	-59.31	24.9	0.05	13 Jan 08:44	00:33	04:20	02:26	0	00:00	
SS03	35	-34.44	-59.53	24.9	0.05	13 Jan 10:00	00:36	04:17	02:26	0	00:00	
SS03	36	-34.41	-59.76	24.9	0.05	13 Jan 11:17	00:39	04:14	02:26	0	00:00	
SS03	37	-34.37	-59.98	24.9	0.05	13 Jan 12:33	00:42	04:10	02:26	0	00:00	
SS03	38	-34.33	-60.20	24.9	0.05	13 Jan 13:50	00:45	04:07	02:26	1	02:00	6
SS03	39	-34.30	-60.43	24.9	0.05	13 Jan 17:06	00:48	04:04	02:26	0	00:00	
SS03	40	-34.26	-60.65	24.9	0.05	13 Jan 18:23	00:51	04:01	02:26	0	00:00	
SS03	41	-34.22	-60.87	24.9	0.05	13 Jan 19:39	00:54	03:58	02:26	0	00:00	

SS03	42	-34.18	-61.10	24.9	0.05	13 Jan 20:56	00:57	03:55	02:26	0	00:00	
SS03	43	-34.14	-61.32	24.9	0.05	13 Jan 22:12	01:01	03:52	02:26	2	02:51	7
SS06	43	-40.34	-61.44	329.9	0.62	14 Jan 15:49	01:11	04:34	02:52	0	00:00	
SS06	42	-40.33	-61.22	24.9	0.05	14 Jan 17:05	01:08	04:36	02:52	0	00:00	
SS06	41	-40.33	-60.99	24.9	0.05	14 Jan 18:21	01:05	04:39	02:52	0	00:00	
SS06	40	-40.33	-60.77	24.9	0.05	14 Jan 19:38	01:02	04:41	02:52	0	00:00	
SS06	39	-40.33	-60.54	24.9	0.05	14 Jan 20:54	01:00	04:44	02:52	0	00:00	
SS06	38	-40.33	-60.32	24.9	0.05	14 Jan 22:11	00:57	04:47	02:52	0	00:00	
SS06	37	-40.32	-60.10	24.9	0.05	14 Jan 23:27	00:54	04:49	02:52	0	00:00	
SS06	36	-40.32	-59.87	24.9	0.05	15 Jan 00:44	00:52	04:52	02:52	2	04:00	8
SS06	35	-40.32	-59.65	24.9	0.05	15 Jan 06:01	00:49	04:54	02:52	0	00:00	
SS06	34	-40.32	-59.42	24.9	0.05	15 Jan 07:17	00:46	04:57	02:52	0	00:00	
SS06	33	-40.32	-59.20	24.9	0.05	15 Jan 08:34	00:43	05:00	02:52	0	00:00	
SS06	32	-40.31	-58.97	24.9	0.05	15 Jan 09:50	00:41	05:02	02:51	0	00:00	
SS06	31	-40.31	-58.75	24.9	0.05	15 Jan 11:07	00:38	05:05	02:51	0	00:00	
SS06	30	-40.31	-58.53	25.0	0.05	15 Jan 12:23	00:35	05:08	02:51	0	00:00	
SS06	29	-40.31	-58.30	25.0	0.05	15 Jan 13:40	00:33	05:10	02:51	1	02:00	9
SS06	28	-40.31	-58.08	25.0	0.05	15 Jan 16:56	00:30	05:13	02:51	0	00:00	
SS06	27	-40.30	-57.85	25.0	0.05	15 Jan 18:13	00:27	05:15	02:51	0	00:00	
SS06	26	-40.30	-57.63	25.0	0.05	15 Jan 19:30	00:24	05:18	02:51	0	00:00	
SS06	25	-40.30	-57.40	25.0	0.05	15 Jan 20:46	00:22	05:21	02:51	0	00:00	
SS06	24	-40.30	-57.18	25.0	0.05	15 Jan 22:03	00:19	05:23	02:51	0	00:00	
SS06	23	-40.30	-56.95	25.0	0.05	15 Jan 23:20	00:16	05:26	02:51	0	00:00	
SS06	22	-40.29	-56.73	25.0	0.05	16 Jan 00:36	00:14	05:29	02:51	2	05:15	10
SS06	21	-40.29	-56.50	25.0	0.05	16 Jan 07:08	00:12	05:30	02:51	0	00:00	
SS06	20	-40.29	-56.28	25.0	0.05	16 Jan 08:24	00:10	05:32	02:51	0	00:00	
SS06	19	-40.29	-56.05	25.0	0.05	16 Jan 09:41	00:08	05:34	02:51	0	00:00	
SS06	18	-40.29	-55.83	25.0	0.05	16 Jan 10:58	00:06	05:35	02:51	0	00:00	
SS06	17	-40.29	-55.60	25.0	0.05	16 Jan 12:14	00:05	05:37	02:51	0	00:00	
SS06	16	-40.28	-55.38	25.0	0.05	16 Jan 13:31	00:03	05:39	02:51	1	02:00	11

SS06	15	-40.28	-55.16	25.0	0.05	16 Jan 16:48	00:01	05:41	02:51	0	00:00	
SS06	14	-40.28	-54.93	25.0	0.05	16 Jan 18:04	23:59	05:42	02:51	0	00:00	
SS06	13	-40.28	-54.71	25.0	0.05	16 Jan 19:21	23:58	05:44	02:51	0	00:00	
SS06	12	-40.28	-54.48	25.0	0.05	16 Jan 20:37	23:56	05:46	02:51	0	00:00	
SS06	11	-40.28	-54.26	25.0	0.05	16 Jan 21:54	23:54	05:47	02:51	0	00:00	
SS06	10	-40.27	-54.03	25.0	0.05	16 Jan 23:11	23:52	05:49	02:51	0	00:00	
SS06	9	-40.27	-53.81	24.9	0.05	17 Jan 00:27	23:51	05:51	02:51	2	06:00	12
SS06	8	-40.27	-53.58	24.9	0.05	17 Jan 07:44	23:49	05:53	02:51	0	00:00	
SS06	7	-40.27	-53.36	24.9	0.05	17 Jan 09:00	23:47	05:54	02:51	0	00:00	
SS06	6	-40.27	-53.13	24.9	0.05	17 Jan 10:17	23:45	05:56	02:51	0	00:00	
SS06	5	-40.27	-52.91	24.9	0.05	17 Jan 11:33	23:44	05:58	02:51	0	00:00	
SS06	4	-40.27	-52.69	24.9	0.05	17 Jan 12:50	23:42	05:59	02:51	0	00:00	
SS06	3	-40.26	-52.46	24.9	0.05	17 Jan 14:06	23:40	06:01	02:51	1	02:00	13
SS06	2	-40.26	-52.24	24.9	0.05	17 Jan 17:23	23:38	06:03	02:51	0	00:00	
SS06	1	-40.26	-52.01	24.9	0.05	17 Jan 18:39	23:37	06:05	02:51	0	00:00	
SS09	1	-46.75	-54.74	525.7	0.98	18 Jan 18:11	00:17	06:20	03:18	0	00:00	
SS09	2	-46.79	-54.96	25.0	0.05	18 Jan 19:27	00:19	06:18	03:18	0	00:00	
SS09	3	-46.83	-55.19	25.0	0.05	18 Jan 20:44	00:21	06:16	03:18	0	00:00	
SS09	4	-46.87	-55.41	25.0	0.05	18 Jan 22:01	00:23	06:14	03:19	0	00:00	
SS09	5	-46.91	-55.63	25.0	0.05	18 Jan 23:17	00:25	06:13	03:19	0	00:00	
SS09	6	-46.95	-55.86	25.0	0.05	19 Jan 00:34	00:27	06:11	03:19	2	05:43	14
SS09	7	-46.99	-56.08	25.0	0.05	19 Jan 07:34	00:29	06:09	03:19	0	00:00	
SS09	8	-47.03	-56.30	25.0	0.05	19 Jan 08:51	00:31	06:07	03:19	0	00:00	
SS09	9	-47.07	-56.53	25.0	0.05	19 Jan 10:08	00:33	06:06	03:20	0	00:00	
SS09	10	-47.11	-56.75	25.0	0.05	19 Jan 11:24	00:36	06:04	03:20	0	00:00	
SS09	11	-47.16	-56.97	25.0	0.05	19 Jan 12:41	00:38	06:02	03:20	0	00:00	
SS09	12	-47.20	-57.20	25.0	0.05	19 Jan 13:58	00:40	06:01	03:20	1	02:00	15
SS09	13	-47.24	-57.42	25.0	0.05	19 Jan 17:14	00:42	05:59	03:20	0	00:00	
SS09	14	-47.29	-57.64	25.0	0.05	19 Jan 18:31	00:44	05:57	03:21	0	00:00	
SS09	15	-47.33	-57.87	25.0	0.05	19 Jan 19:47	00:46	05:55	03:21	0	00:00	

SS09	16	-47.38	-58.09	25.0	0.05	19 Jan 21:04	00:48	05:54	03:21	0	00:00	
SS09	17	-47.42	-58.31	25.0	0.05	19 Jan 22:21	00:50	05:52	03:21	0	00:00	
SS09	18	-47.47	-58.54	25.0	0.05	19 Jan 23:37	00:52	05:50	03:21	0	00:00	
SS09	19	-47.52	-58.76	25.0	0.05	20 Jan 00:54	00:55	05:49	03:22	2	04:54	16
SS09	20	-47.57	-58.98	24.9	0.05	20 Jan 07:04	00:58	05:46	03:22	0	00:00	
SS09	21	-47.61	-59.21	24.9	0.05	20 Jan 08:21	01:01	05:43	03:22	0	00:00	
SS09	22	-47.66	-59.43	24.9	0.05	20 Jan 09:37	01:05	05:40	03:22	0	00:00	
SS09	23	-47.71	-59.65	24.9	0.05	20 Jan 10:54	01:08	05:37	03:22	0	00:00	
SS09	24	-47.76	-59.88	24.9	0.05	20 Jan 12:10	01:12	05:34	03:23	0	00:00	
SS09	25	-47.81	-60.10	24.9	0.05	20 Jan 13:27	01:15	05:31	03:23	0	00:00	
SS09	26	-47.87	-60.32	24.9	0.05	20 Jan 14:43	01:19	05:28	03:23	1	02:00	17
SS09	27	-47.92	-60.54	24.9	0.05	20 Jan 18:00	01:22	05:25	03:23	0	00:00	
SS09	28	-47.97	-60.77	24.9	0.05	20 Jan 19:16	01:26	05:22	03:24	0	00:00	
SS09	29	-48.02	-60.99	24.9	0.05	20 Jan 20:33	01:29	05:19	03:24	0	00:00	
SS09	30	-48.08	-61.21	24.9	0.05	20 Jan 21:49	01:32	05:16	03:24	0	00:00	
SS09	31	-48.13	-61.43	24.9	0.05	20 Jan 23:05	01:36	05:13	03:24	0	00:00	
SS09	32	-48.19	-61.66	24.9	0.05	21 Jan 00:22	01:39	05:10	03:24	2	03:30	18
SS09	33	-48.25	-61.88	24.9	0.05	21 Jan 05:08	01:43	05:07	03:25	0	00:00	
SS09	34	-48.30	-62.10	24.9	0.05	21 Jan 06:24	01:46	05:04	03:25	0	00:00	
SS09	35	-48.36	-62.32	24.8	0.05	21 Jan 07:41	01:50	05:01	03:25	0	00:00	
SS09	36	-48.42	-62.54	24.8	0.05	21 Jan 08:57	01:53	04:58	03:25	0	00:00	
SS09	37	-48.48	-62.77	24.8	0.05	21 Jan 10:13	01:57	04:55	03:26	0	00:00	
AP12	22	-50.12	-63.25	98.9	0.18	21 Jan 14:39	02:04	05:03	03:33	1	02:00	19
AP12	21	-50.20	-63.19	7.6	0.02	21 Jan 17:02	02:01	05:06	03:34	0	00:00	
AP12	20	-50.45	-63.00	24.9	0.05	21 Jan 18:19	01:59	05:10	03:35	0	00:00	
AP12	19	-50.70	-62.80	24.9	0.05	21 Jan 19:35	01:57	05:14	03:36	0	00:00	
AP12	18	-50.94	-62.61	24.9	0.05	21 Jan 20:52	01:55	05:18	03:36	0	00:00	
AP12	17	-51.18	-62.41	24.9	0.05	21 Jan 22:08	01:53	05:22	03:37	0	00:00	
AP12	16	-51.42	-62.22	24.9	0.05	21 Jan 23:25	01:51	05:25	03:38	0	00:00	
AP12	15	-51.66	-62.02	24.9	0.05	22 Jan 00:41	01:49	05:29	03:39	2	03:40	20

AP12	14	-51.89	-61.83	24.9	0.05	22 Jan 05:38	01:47	05:33	03:40	0	00:00	
AP12	13	-52.12	-61.63	24.9	0.05	22 Jan 06:55	01:45	05:37	03:41	0	00:00	
AP12	12	-52.34	-61.43	24.9	0.05	22 Jan 08:11	01:43	05:41	03:42	0	00:00	
AP12	11	-52.57	-61.24	24.9	0.05	22 Jan 09:28	01:41	05:44	03:42	0	00:00	
AP12	10	-52.79	-61.04	24.9	0.05	22 Jan 10:44	01:39	05:47	03:43	0	00:00	
AP12	9	-53.00	-60.84	24.9	0.05	22 Jan 12:01	01:37	05:51	03:44	0	00:00	
AP12	8	-53.22	-60.64	24.9	0.05	22 Jan 13:17	01:35	05:54	03:45	0	00:00	
AP12	7	-53.43	-60.44	24.9	0.05	22 Jan 14:34	01:33	05:58	03:46	1	02:00	21
AP12	6	-53.64	-60.24	24.9	0.05	22 Jan 17:50	01:32	06:01	03:46	0	00:00	
AP12	5	-53.85	-60.04	24.9	0.05	22 Jan 19:07	01:30	06:05	03:47	0	00:00	
AP12	4	-54.05	-59.85	24.9	0.05	22 Jan 20:24	01:28	06:08	03:48	0	00:00	
AP12	3	-54.25	-59.65	24.9	0.05	22 Jan 21:40	01:26	06:12	03:49	0	00:00	
AP12	2	-54.45	-59.44	24.9	0.05	22 Jan 22:57	01:24	06:15	03:50	0	00:00	
AP12	1	-54.65	-59.24	24.9	0.05	23 Jan 00:13	01:23	06:19	03:51	1	02:00	22
AP15	1	-61.36	-60.01	386.5	0.72	23 Jan 19:31	01:53	06:44	04:18	0	00:00	
AP15	2	-61.20	-60.22	24.9	0.05	23 Jan 20:47	01:55	06:40	04:17	0	00:00	
AP15	3	-61.04	-60.43	24.9	0.05	23 Jan 22:04	01:57	06:37	04:17	0	00:00	
AP15	4	-60.88	-60.64	24.9	0.05	23 Jan 23:21	01:59	06:33	04:16	0	00:00	
AP15	5	-60.72	-60.84	24.9	0.05	24 Jan 00:37	02:01	06:30	04:15	2	04:28	23
AP15	6	-60.55	-61.05	24.9	0.05	24 Jan 06:22	02:03	06:26	04:15	0	00:00	
AP15	7	-60.38	-61.26	25.0	0.05	24 Jan 07:39	02:05	06:23	04:14	0	00:00	
AP15	8	-60.21	-61.47	24.9	0.05	24 Jan 08:55	02:07	06:19	04:13	0	00:00	
AP15	9	-60.03	-61.68	24.9	0.05	24 Jan 10:12	02:10	06:16	04:13	0	00:00	
AP15	10	-59.86	-61.89	24.9	0.05	24 Jan 11:28	02:12	06:13	04:12	0	00:00	
AP15	11	-59.68	-62.10	24.9	0.05	24 Jan 12:45	02:14	06:11	04:12	0	00:00	
AP15	12	-59.49	-62.31	24.9	0.05	24 Jan 14:01	02:16	06:08	04:12	0	00:00	
AP15	13	-59.31	-62.51	24.9	0.05	24 Jan 15:18	02:18	06:06	04:12	1	02:00	24
AP15	14	-59.12	-62.72	24.9	0.05	24 Jan 18:35	02:21	06:03	04:12	0	00:00	
AP15	15	-58.93	-62.93	24.9	0.05	24 Jan 19:51	02:23	06:01	04:12	0	00:00	
AP15	16	-58.74	-63.13	24.9	0.05	24 Jan 21:08	02:25	05:58	04:12	0	00:00	

AP15	17	-58.55	-63.34	24.9	0.05	24 Jan 22:24	02:27	05:56	04:12	0	00:00	
AP15	18	-58.43	-63.46	14.8	0.03	24 Jan 23:10	02:30	05:54	04:12	2	03:24	25
Waypoint	1	-64.16	-64.06	289.3	0.54	25 Jan 15:30	02:50	05:17	04:03	0	00:00	
AP18	25	-64.63	-65.06	112.9	0.21	25 Jan 20:34	03:13	05:51	04:32	0	00:00	
AP18	24	-64.71	-64.96	11.5	0.02	25 Jan 21:09	03:09	05:55	04:32	0	00:00	
AP18	23	-64.86	-64.75	24.9	0.05	25 Jan 22:25	03:06	05:59	04:33	0	00:00	
AP18	22	-65.02	-64.53	24.9	0.05	25 Jan 23:42	03:03	06:03	04:33	0	00:00	
AP18	21	-65.18	-64.32	24.9	0.05	26 Jan 00:58	03:00	06:08	04:34	2	03:07	26
AP18	20	-65.33	-64.10	24.9	0.05	26 Jan 05:22	02:57	06:12	04:34	0	00:00	
AP18	19	-65.48	-63.89	24.9	0.05	26 Jan 06:39	02:54	06:16	04:35	0	00:00	
AP18	18	-65.63	-63.67	24.9	0.05	26 Jan 07:55	02:51	06:20	04:36	0	00:00	
AP18	17	-65.77	-63.46	24.9	0.05	26 Jan 09:12	02:48	06:25	04:36	0	00:00	
AP18	16	-65.91	-63.24	24.9	0.05	26 Jan 10:28	02:45	06:29	04:37	0	00:00	
AP18	15	-66.06	-63.03	24.9	0.05	26 Jan 11:45	02:42	06:33	04:37	0	00:00	
AP18	14	-66.19	-62.81	24.9	0.05	26 Jan 13:01	02:39	06:37	04:38	0	00:00	
AP18	13	-66.33	-62.60	24.9	0.05	26 Jan 14:18	02:36	06:42	04:39	0	00:00	
AP18	12	-66.47	-62.38	24.9	0.05	26 Jan 15:34	02:34	06:44	04:39	1	02:00	27
AP18	11	-66.60	-62.17	24.9	0.05	26 Jan 18:51	02:32	06:47	04:39	0	00:00	
AP18	10	-66.73	-61.95	24.9	0.05	26 Jan 20:07	02:30	06:50	04:40	0	00:00	
AP18	9	-66.86	-61.74	24.9	0.05	26 Jan 21:24	02:28	06:53	04:40	0	00:00	
AP18	8	-66.99	-61.52	25.0	0.05	26 Jan 22:41	02:26	06:56	04:41	0	00:00	
AP18	7	-67.12	-61.30	25.0	0.05	26 Jan 23:57	02:24	06:59	04:41	0	00:00	
AP18	6	-67.24	-61.09	24.9	0.05	27 Jan 01:14	02:22	07:02	04:42	2	04:40	28
AP18	5	-67.36	-60.87	24.9	0.05	27 Jan 07:11	02:20	07:05	04:42	0	00:00	
AP18	4	-67.48	-60.65	24.9	0.05	27 Jan 08:27	02:18	07:08	04:43	0	00:00	
AP18	3	-67.60	-60.44	24.9	0.05	27 Jan 09:44	02:16	07:11	04:43	0	00:00	
AP18	2	-67.72	-60.22	24.9	0.05	27 Jan 11:00	02:14	07:14	04:44	0	00:00	
AP18	1	-67.84	-60.00	24.9	0.05	27 Jan 12:17	02:12	07:17	04:44	1	02:00	29
SS 1 top	1	-55.55	-60.50	678.7	1.45	29 Jan 01:00	00:00	07:00	03:30	2	07:00	30
0	2	-55.35	-60.70	24.9	0.05	29 Jan 09:16	00:00	07:00	03:30	0	00:00	

0	3	-55.15	-60.91	24.9	0.05	29 Jan 10:33	00:00	07:00	03:30	0	00:00	
0	4	-54.94	-61.11	24.9	0.05	29 Jan 11:49	00:00	07:00	03:30	0	00:00	
SS 1 bottom	5	-54.74	-61.31	24.9	0.05	29 Jan 13:06	00:00	07:00	03:30	0	00:00	
SS 2 bottom	5	-55.53	-61.49	46.9	0.09	29 Jan 15:12	00:00	07:00	03:30	1	02:00	31
0	4	-55.73	-61.29	24.9	0.05	29 Jan 18:28	00:00	07:00	03:30	0	00:00	
0	3	-55.93	-61.09	24.9	0.05	29 Jan 19:45	00:00	07:00	03:30	0	00:00	
0	2	-56.13	-60.89	24.9	0.05	29 Jan 21:01	00:00	07:00	03:30	0	00:00	
SS 2 top	1	-56.32	-60.68	24.9	0.05	29 Jan 22:18	00:00	07:00	03:30	2	07:00	32
SS 3 top	5	-57.63	-60.97	77.5	0.14	30 Jan 08:46	00:00	07:00	03:30	0	00:00	
0	4	-57.44	-61.18	24.9	0.05	30 Jan 10:02	00:00	07:00	03:30	0	00:00	
0	3	-57.25	-61.38	24.9	0.05	30 Jan 11:19	00:00	07:00	03:30	0	00:00	
0	2	-57.05	-61.59	24.9	0.05	30 Jan 12:36	00:00	07:00	03:30	0	00:00	
SS 3 bottom	1	-56.86	-61.79	24.9	0.05	30 Jan 13:52	00:00	07:00	03:30	1	02:00	33
SS 4 bottom	1	-57.95	-62.02	62.8	0.12	30 Jan 18:41	00:00	07:00	03:30	0	00:00	
0	2	-58.14	-61.82	24.9	0.05	30 Jan 19:57	00:00	07:00	03:30	0	00:00	
0	3	-58.33	-61.61	24.9	0.05	30 Jan 21:14	00:00	07:00	03:30	0	00:00	
0	4	-58.51	-61.40	24.9	0.05	30 Jan 22:30	00:00	07:00	03:30	0	00:00	
SS 4 top	5	-58.70	-61.20	24.9	0.05	30 Jan 23:47	00:00	07:00	03:30	2	07:00	34
SS 5 top	1	-59.61	-61.38	52.6	0.10	31 Jan 09:08	00:00	07:00	03:30	0	00:00	
0	2	-59.43	-61.59	24.9	0.05	31 Jan 10:25	00:00	07:00	03:30	0	00:00	
0	3	-59.25	-61.80	24.9	0.05	31 Jan 11:41	00:00	07:00	03:30	0	00:00	
0	4	-59.07	-62.00	24.9	0.05	31 Jan 12:58	00:00	07:00	03:30	0	00:00	
SS 5 bottom	5	-58.88	-62.21	24.9	0.05	31 Jan 14:14	00:00	07:00	03:30	1	02:00	35
SS 6 bottom	5	-60.28	-62.48	78.0	0.15	31 Jan 19:44	00:00	07:00	03:30	0	00:00	
0	4	-60.46	-62.27	24.9	0.05	31 Jan 21:00	00:00	07:00	03:30	0	00:00	
0	3	-60.63	-62.06	24.9	0.05	31 Jan 22:17	00:00	07:00	03:30	0	00:00	
0	2	-60.81	-61.85	24.9	0.05	31 Jan 23:34	00:00	07:00	03:30	2	07:00	36
SS 6 top	1	-60.98	-61.64	24.9	0.05	01 Feb 07:50	00:00	07:00	03:30	0	00:00	
SS 7 top	5	-61.68	-61.76	39.9	0.07	01 Feb 09:37	00:00	07:00	03:30	0	00:00	
0	4	-61.52	-61.98	24.9	0.05	01 Feb 10:54	00:00	07:00	03:30	0	00:00	

0	3	-61.35	-62.19	24.9	0.05	01 Feb 12:10	00:00	07:00	03:30	0	00:00	
0	2	-61.18	-62.40	24.9	0.05	01 Feb 13:27	00:00	07:00	03:30	0	00:00	
SS 7 bottom	1	-61.01	-62.61	24.9	0.05	01 Feb 14:43	00:00	07:00	03:30	1	02:00	37
SS 8 bottom	1	-62.61	-62.88	87.2	0.16	01 Feb 20:38	00:00	07:00	03:30	0	00:00	
0	2	-62.78	-62.67	24.9	0.05	01 Feb 21:54	00:00	07:00	03:30	0	00:00	
0	3	-62.94	-62.45	24.9	0.05	01 Feb 23:11	00:00	07:00	03:30	0	00:00	
0	4	-63.10	-62.24	24.9	0.05	02 Feb 00:27	00:00	07:00	03:30	2	07:00	38
SS 8 top	5	-63.25	-62.03	24.9	0.05	02 Feb 08:44	00:00	07:00	03:30	0	00:00	

Introduction	Itinerary	Station positions	Cruise tracks	Planning Meeting	Sampling Protocols	Participants	Background papers	Contents

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The CCAMLR krill synoptic survey

Transect waypoints for ship 4 (Russia)

This table provides the waypoints at 25 km intervals along each transect for ship 4. Distance is shown in km, and represents the distance between each waypoint. The Arrival time is the time of arrival at each waypoint (all times are expressed as GMT). Civil dawn and dusk are the stop and start times for each day (see daylight times for more details). The time of local midnight is the GMT time for the mid-point of the dark period. The column 'stations' has 3 codes: 1 indicates the daytime station, 2 indicates the night-time station and 0 indicates no station. The station time indicates the time period (hours) of the station, night-time stations extend for the period of darkness.

Transect	Wpt	Longitude	Latitude	Distance	Arrival time	civil dusk	civil dawn	Local midnight	stations	station time	station number
Sand 1 top	1	-26.8720	-55.3373		15 Jan 13:21	23:13	04:39	01:56	1	02:00	1
0	2	-26.7963	-55.5578	25.0	15 Jan 16:38	23:14	04:37	01:55	0	00:00	
0	3	-26.7197	-55.7783	25.0	15 Jan 17:54	23:16	04:35	01:55	0	00:00	
0	4	-26.6422	-55.9988	25.0	15 Jan 19:11	23:17	04:33	01:55	0	00:00	
Sand 1 bottom	5	-26.5638	-56.2192	25.0	15 Jan 20:28	23:19	04:31	01:55	0	00:00	
Sand 2 top	6	-26.1884	-56.1769	23.7	15 Jan 21:31	23:20	04:30	01:55	0	00:00	
0	7	-26.1071	-56.3970	25.0	15 Jan 22:48	23:22	04:28	01:55	2	05:06	2
0	8	-26.0247	-56.6170	25.0	16 Jan 05:11	23:23	04:26	01:55	0	00:00	
0	9	-25.9414	-56.8370	25.0	16 Jan 06:27	23:25	04:24	01:55	0	00:00	
Sand 2 bottom	10	-25.8571	-57.0570	25.0	16 Jan 07:44	23:26	04:23	01:54	0	00:00	
Sand 3 top	11	-25.8289	-57.0537	1.7	16 Jan 07:49	23:28	04:21	01:54	0	00:00	
0	12	-25.7434	-57.2736	25.0	16 Jan 09:05	23:29	04:19	01:54	0	00:00	
0	13	-25.6569	-57.4934	25.0	16 Jan 10:22	23:31	04:17	01:54	0	00:00	
0	14	-25.5694	-57.7131	25.0	16 Jan 11:38	23:32	04:16	01:54	0	00:00	
Sand 3 bottom	15	-25.4808	-57.9327	25.0	16 Jan 12:55	23:34	04:14	01:54	1	02:00	3
Sand 4 top	16	-25.6667	-57.9539	11.2	16 Jan 15:25	23:35	04:12	01:54	0	00:00	
0	17	-25.5781	-58.1736	25.0	16 Jan 16:42	23:37	04:10	01:54	0	00:00	
0	18	-25.4885	-58.3932	25.0	16 Jan 17:58	23:38	04:09	01:53	0	00:00	
0	19	-25.3977	-58.6127	25.0	16 Jan 19:15	23:40	04:07	01:53	0	00:00	
Sand 4 bottom	20	-25.3058	-58.8321	24.9	16 Jan 20:31	23:41	04:05	01:53	0	00:00	
Sand 5 top	21	-25.4201	-58.8450	6.7	16 Jan 20:50	23:43	04:03	01:53	0	00:00	
0	22	-25.3278	-59.0644	24.9	16 Jan 22:06	23:44	04:02	01:53	0	00:00	
0	23	-25.2342	-59.2836	24.9	16 Jan 23:23	23:46	04:00	01:53	2	04:13	4
0	24	-25.1395	-59.5028	24.9	17 Jan 04:53	23:47	03:58	01:53	0	00:00	
Sand 5 bottom	25	-25.0436	-59.7219	24.9	17 Jan 06:10	23:49	03:56	01:53	0	00:00	
Sand 10 bottom	26	-25.9002	-59.8152	49.0	17 Jan 08:21	23:51	03:55	01:53	0	00:00	
0	27	-25.9909	-59.5956	24.9	17 Jan 09:38	23:49	03:56	01:53	0	00:00	
0	28	-26.0805	-59.3758	24.9	17 Jan 10:54	23:47	03:58	01:53	0	00:00	
0	29	-26.1690	-59.1560	24.9	17 Jan 12:11	23:46	04:00	01:53	0	00:00	

Sand 10 top	30	-26.2563	-58.9360	24.9	17 Jan 13:27	23:44	04:02	01:53	1	02:00	5
Sand 9 bottom	31	-26.5971	-58.9715	19.9	17 Jan 16:21	23:43	04:04	01:53	0	00:00	
0	32	-26.6814	-58.7513	24.9	17 Jan 17:37	23:41	04:06	01:53	0	00:00	
0	33	-26.7646	-58.5309	25.0	17 Jan 18:54	23:39	04:07	01:53	0	00:00	
0	34	-26.8468	-58.3105	25.0	17 Jan 20:11	23:38	04:09	01:54	0	00:00	
Sand 9 top	35	-26.9280	-58.0900	25.0	17 Jan 21:27	23:36	04:11	01:54	0	00:00	
Sand 8 bottom	36	-26.9113	-58.0883	1.0	17 Jan 21:30	23:35	04:13	01:54	0	00:00	
0	37	-26.9916	-57.8678	25.0	17 Jan 22:46	23:33	04:15	01:54	0	00:00	
0	38	-27.0710	-57.6471	25.0	18 Jan 00:03	23:32	04:17	01:54	2	04:45	6
0	39	-27.1493	-57.4264	25.0	18 Jan 06:05	23:30	04:18	01:54	0	00:00	
Sand 8 top	40	-27.2268	-57.2057	25.0	18 Jan 07:21	23:28	04:20	01:54	0	00:00	
Sand 7 bottom	41	-26.9869	-57.1808	14.7	18 Jan 08:01	23:27	04:22	01:54	0	00:00	
0	42	-27.0648	-56.9601	25.0	18 Jan 09:17	23:25	04:24	01:55	0	00:00	
0	43	-27.1418	-56.7394	25.0	18 Jan 10:34	23:24	04:26	01:55	0	00:00	
0	44	-27.2179	-56.5186	25.0	18 Jan 11:51	23:22	04:28	01:55	0	00:00	
Sand 7 top	45	-27.2931	-56.2978	25.0	18 Jan 13:07	23:20	04:29	01:55	1	02:00	7
Sand 6 bottom	46	-27.4441	-56.3135	9.5	18 Jan 15:33	23:19	04:31	01:55	0	00:00	
0	47	-27.5176	-56.0926	25.0	18 Jan 16:49	23:17	04:33	01:55	0	00:00	
0	48	-27.5902	-55.8716	25.0	18 Jan 18:06	23:16	04:35	01:55	0	00:00	
0	49	-27.6620	-55.6506	25.0	18 Jan 19:23	23:14	04:37	01:55	0	00:00	
Sand 6 top	50	-27.7330	-55.4295	25.0	18 Jan 20:39	23:13	04:39	01:56	1	02:00	8
SSA	1	-26.4955	-51.4050	454.7	19 Jan 19:00	22:37	05:15	01:56	0	00:00	
SSA	2	-26.4249	-51.6246	24.9	19 Jan 20:17	22:38	05:13	01:55	0	00:00	
SSA	3	-26.3534	-51.8441	24.9	19 Jan 21:33	22:39	05:11	01:55	0	00:00	
SSA	4	-26.2813	-52.0637	24.9	19 Jan 22:49	22:40	05:10	01:55	2	06:29	9
SSA	5	-26.2083	-52.2833	24.9	20 Jan 06:36	22:41	05:08	01:54	0	00:00	
SSA	6	-26.1347	-52.5029	24.9	20 Jan 07:52	22:42	05:06	01:54	0	00:00	
SSA	7	-26.0602	-52.7225	24.9	20 Jan 09:08	22:43	05:05	01:54	0	00:00	
SSA	8	-25.9849	-52.9421	24.9	20 Jan 10:25	22:44	05:03	01:54	0	00:00	
SSA	9	-25.9089	-53.1617	24.9	20 Jan 11:41	22:45	05:01	01:53	0	00:00	
SSA	10	-25.8320	-53.3813	24.9	20 Jan 12:58	22:46	05:00	01:53	1	02:00	10
SSA	11	-25.7542	-53.6009	24.9	20 Jan 16:14	22:48	04:58	01:53	0	00:00	
SSA	12	-25.6757	-53.8204	24.9	20 Jan 17:31	22:49	04:56	01:52	0	00:00	
SSA	13	-25.5963	-54.0400	24.9	20 Jan 18:48	22:50	04:55	01:52	0	00:00	
SSA	14	-25.5160	-54.2595	24.9	20 Jan 20:04	22:51	04:53	01:52	0	00:00	
SSA	15	-25.4348	-54.4790	25.0	20 Jan 21:21	22:52	04:51	01:52	0	00:00	
SSA	16	-25.3527	-54.6985	25.0	20 Jan 22:37	22:53	04:50	01:51	2	05:56	11
SSA	17	-25.2697	-54.9180	25.0	21 Jan 05:51	22:54	04:48	01:51	0	00:00	
SSA	18	-25.1858	-55.1374	25.0	21 Jan 07:07	22:55	04:46	01:51	0	00:00	
SSA	19	-25.1009	-55.3568	25.0	21 Jan 08:24	22:56	04:45	01:51	0	00:00	
SSA	20	-25.0151	-55.5761	25.0	21 Jan 09:40	22:57	04:43	01:50	0	00:00	
SSA	21	-24.9282	-55.7954	25.0	21 Jan 10:57	22:59	04:42	01:50	0	00:00	
SSA	22	-24.8404	-56.0146	25.0	21 Jan 12:14	23:00	04:39	01:50	1	02:00	12
SSA	23	-24.7516	-56.2338	25.0	21 Jan 15:30	23:02	04:37	01:49	0	00:00	
SSA	24	-24.6617	-56.4529	25.0	21 Jan 16:47	23:04	04:34	01:49	0	00:00	
SSA	25	-24.5708	-56.6719	25.0	21 Jan 18:04	23:05	04:32	01:48	0	00:00	

SSA	26	-24.4789	-56.8909	25.0	21 Jan 19:20	23:07	04:29	01:48	0	00:00	
SSA	27	-24.3858	-57.1098	25.0	21 Jan 20:37	23:09	04:27	01:48	0	00:00	
SSA	28	-24.2917	-57.3286	25.0	21 Jan 21:53	23:10	04:24	01:47	0	00:00	
SSA	29	-24.1964	-57.5473	25.0	21 Jan 23:10	23:12	04:22	01:47	2	05:09	13
SSA	30	-24.1000	-57.7660	25.0	22 Jan 05:36	23:14	04:19	01:46	0	00:00	
SSA	31	-24.0024	-57.9846	25.0	22 Jan 06:53	23:15	04:17	01:46	0	00:00	
SSA	32	-23.9037	-58.2030	25.0	22 Jan 08:10	23:17	04:14	01:46	0	00:00	
SSA	33	-23.8037	-58.4214	25.0	22 Jan 09:26	23:19	04:12	01:45	0	00:00	
SSA	34	-23.7025	-58.6396	25.0	22 Jan 10:43	23:20	04:09	01:45	0	00:00	
SSA	35	-23.6001	-58.8578	24.9	22 Jan 11:59	23:22	04:07	01:44	0	00:00	
SSA	36	-23.4963	-59.0758	24.9	22 Jan 13:16	23:24	04:04	01:44	1	02:00	14
SSA	37	-23.3913	-59.2937	24.9	22 Jan 16:32	23:25	04:02	01:44	0	00:00	
SSA	38	-23.2850	-59.5115	24.9	22 Jan 17:49	23:27	03:59	01:43	0	00:00	
SSA	39	-23.1774	-59.7291	24.9	22 Jan 19:06	23:29	03:57	01:43	0	00:00	
SSA	40	-23.0683	-59.9467	24.9	22 Jan 20:22	23:30	03:54	01:42	0	00:00	
SSA	41	-22.9579	-60.1640	24.9	22 Jan 21:38	23:32	03:52	01:42	0	00:00	
SSA	42	-22.8461	-60.3813	24.9	22 Jan 22:55	23:34	03:50	01:42	2	04:16	15
SSB	42	-24.9589	-60.6315	118.9	23 Jan 08:30	23:46	03:54	01:50	0	00:00	
SSB	41	-25.0579	-60.4127	24.9	23 Jan 09:47	23:43	03:58	01:50	0	00:00	
SSB	40	-25.1557	-60.1938	24.9	23 Jan 11:03	23:40	04:02	01:51	0	00:00	
SSB	39	-25.2522	-59.9748	24.9	23 Jan 12:20	23:37	04:06	01:51	1	02:00	16
Sand 10 bottom	38	-25.9002	-59.8152	40.2	23 Jan 16:08	23:34	04:10	01:52	0	00:00	
0	37	-25.9909	-59.5956	24.9	23 Jan 17:24	23:31	04:14	01:52	0	00:00	
0	36	-26.0805	-59.3758	24.9	23 Jan 18:41	23:28	04:18	01:53	0	00:00	
0	35	-26.1690	-59.1560	24.9	23 Jan 19:57	23:25	04:22	01:53	0	00:00	
Sand 10 top	35	-26.2563	-58.9360	24.9	23 Jan 21:14	23:25	04:22	01:53	0	00:00	
Sand 9 bottom	34	-26.5971	-58.9715	19.9	23 Jan 22:07	23:22	04:26	01:54	0	00:00	
0	33	-26.6814	-58.7513	24.9	23 Jan 23:24	23:19	04:30	01:54	2	05:10	17
0	32	-26.7646	-58.5309	25.0	24 Jan 05:51	23:16	04:34	01:55	0	00:00	
0	31	-26.8468	-58.3105	25.0	24 Jan 07:07	23:13	04:38	01:55	0	00:00	
Sand 9 top	30	-26.9280	-58.0900	25.0	24 Jan 08:24	23:10	04:42	01:56	0	00:00	
Sand 8 bottom	30	-26.9113	-58.0883	1.0	24 Jan 08:27	23:10	04:42	01:56	0	00:00	
0	29	-26.9916	-57.8678	25.0	24 Jan 09:43	23:07	04:46	01:56	0	00:00	
0	28	-27.0710	-57.6471	25.0	24 Jan 11:00	23:04	04:50	01:57	0	00:00	
0	27	-27.1493	-57.4264	25.0	24 Jan 12:16	23:01	04:54	01:57	0	00:00	
Sand 8 top	26	-27.2268	-57.2057	25.0	24 Jan 13:33	22:59	04:58	01:58	1	02:00	18
Sand 7 bottom	26	-26.9869	-57.1808	14.7	24 Jan 16:13	22:59	04:58	01:58	0	00:00	
0	25	-27.0648	-56.9601	25.0	24 Jan 17:29	22:57	04:59	01:58	0	00:00	
0	24	-27.1418	-56.7394	25.0	24 Jan 18:46	22:56	05:01	01:58	0	00:00	
0	23	-27.2179	-56.5186	25.0	24 Jan 20:02	22:55	05:02	01:59	0	00:00	
Sand 7 top	22	-27.2931	-56.2978	25.0	24 Jan 21:19	22:54	05:04	01:59	0	00:00	
Sand 6 bottom	22	-27.4441	-56.3135	9.5	24 Jan 21:44	22:54	05:04	01:59	0	00:00	
0	21	-27.5176	-56.0926	25.0	24 Jan 23:01	22:53	05:05	01:59	2	06:12	19
0	20	-27.5902	-55.8716	25.0	25 Jan 06:30	22:52	05:07	01:59	0	00:00	
0	19	-27.6620	-55.6506	25.0	25 Jan 07:47	22:51	05:08	02:00	0	00:00	
Sand 6 top	18	-27.7330	-55.4295	25.0	25 Jan 09:03	22:50	05:10	02:00	0	00:00	

SSB	18	-27.0268	-55.3544	45.3	25 Jan 11:05	22:50	05:10	02:00	0	00:00	
SSB	17	-27.1009	-55.1337	25.0	25 Jan 12:22	22:49	05:12	02:00	0	00:00	
SSB	16	-27.1741	-54.9131	25.0	25 Jan 13:38	22:48	05:13	02:00	1	02:00	20
SSB	15	-27.2465	-54.6924	25.0	25 Jan 16:55	22:47	05:15	02:01	0	00:00	
SSB	14	-27.3181	-54.4716	25.0	25 Jan 18:11	22:46	05:16	02:01	0	00:00	
SSB	13	-27.3889	-54.2509	25.0	25 Jan 19:28	22:44	05:18	02:01	0	00:00	
SSB	12	-27.4589	-54.0302	24.9	25 Jan 20:44	22:43	05:19	02:01	0	00:00	
SSB	11	-27.5281	-53.8094	24.9	25 Jan 22:01	22:42	05:21	02:02	0	00:00	
SSB	10	-27.5966	-53.5887	24.9	25 Jan 23:18	22:41	05:22	02:02	2	06:41	21
SSB	9	-27.6644	-53.3679	24.9	26 Jan 07:15	22:40	05:24	02:02	0	00:00	
SSB	8	-27.7314	-53.1472	24.9	26 Jan 08:32	22:39	05:26	02:02	0	00:00	
SSB	7	-27.7978	-52.9264	24.9	26 Jan 09:48	22:38	05:27	02:03	0	00:00	
SSB	6	-27.8634	-52.7057	24.9	26 Jan 11:05	22:37	05:29	02:03	0	00:00	
SSB	5	-27.9283	-52.4850	24.9	26 Jan 12:21	22:36	05:30	02:03	0	00:00	
SSB	4	-27.9925	-52.2643	24.9	26 Jan 13:38	22:35	05:32	02:03	1	02:00	22
SSB	3	-28.0561	-52.0436	24.9	26 Jan 16:54	22:34	05:33	02:04	0	00:00	
SSB	2	-28.1190	-51.8229	24.9	26 Jan 18:11	22:33	05:35	02:04	0	00:00	
SSB	1	-28.1812	-51.6023	24.9	26 Jan 19:27	22:32	05:37	02:04	1	02:00	23
SSC	1	-29.881609	-51.773548	118.7	27 Jan 02:46	22:40	05:43	02:11	2	07:03	24
SSC	2	-29.828028	-51.995117	24.9	27 Jan 11:05	22:41	05:41	02:11	0	00:00	
SSC	3	-29.77388	-52.216721	24.9	27 Jan 12:21	22:42	05:39	02:11	0	00:00	
SSC	4	-29.719158	-52.438358	24.9	27 Jan 13:38	22:43	05:37	02:10	1	02:00	25
SSC	5	-29.663851	-52.660027	24.9	27 Jan 16:54	22:44	05:36	02:10	0	00:00	
SSC	6	-29.60795	-52.881718	24.9	27 Jan 18:11	22:46	05:34	02:10	0	00:00	
SSC	7	-29.551447	-53.103436	24.9	27 Jan 19:27	22:47	05:32	02:10	0	00:00	
SSC	8	-29.494329	-53.325172	24.9	27 Jan 20:44	22:48	05:31	02:09	0	00:00	
SSC	9	-29.43659	-53.546921	24.9	27 Jan 22:00	22:49	05:29	02:09	0	00:00	
SSC	10	-29.378218	-53.768684	24.9	27 Jan 23:17	22:50	05:27	02:09	2	06:36	26
SSC	11	-29.319202	-53.990456	24.9	28 Jan 07:10	22:52	05:26	02:09	0	00:00	
SSC	12	-29.259533	-54.212234	24.9	28 Jan 08:27	22:53	05:24	02:08	0	00:00	
SSC	13	-29.199198	-54.434013	25.0	28 Jan 09:43	22:54	05:22	02:08	0	00:00	
SSC	14	-29.138187	-54.655788	25.0	28 Jan 11:00	22:55	05:20	02:08	0	00:00	
SSC	15	-29.076488	-54.87756	25.0	28 Jan 12:17	22:56	05:19	02:08	0	00:00	
SSC	16	-29.014091	-55.099319	25.0	28 Jan 13:33	22:58	05:17	02:07	1	02:00	27
SSC	17	-28.950985	-55.321068	25.0	28 Jan 16:50	22:59	05:15	02:07	0	00:00	
SSC	18	-28.887154	-55.542801	25.0	28 Jan 18:06	23:00	05:14	02:07	0	00:00	
SSC	19	-28.822588	-55.764511	25.0	28 Jan 19:23	23:01	05:12	02:07	0	00:00	
SSC	20	-28.757275	-55.986198	25.0	28 Jan 20:40	23:02	05:10	02:06	0	00:00	
SSC	21	-28.6912	-56.207855	25.0	28 Jan 21:56	23:04	05:09	02:06	0	00:00	
SSC	22	-28.624353	-56.429482	25.0	28 Jan 23:13	23:05	05:07	02:06	2	06:01	28
SSC	23	-28.556717	-56.651073	25.0	29 Jan 06:31	23:06	05:05	02:05	0	00:00	
SSC	24	-28.488279	-56.872623	25.0	29 Jan 07:48	23:08	05:03	02:05	0	00:00	
SSC	25	-28.419027	-57.094131	25.0	29 Jan 09:05	23:09	05:01	02:05	0	00:00	
SSC	26	-28.348946	-57.31559	25.0	29 Jan 10:21	23:10	04:59	02:04	0	00:00	
SSC	27	-28.278017	-57.536999	25.0	29 Jan 11:38	23:12	04:57	02:04	0	00:00	
SSC	28	-28.20623	-57.758354	25.0	29 Jan 12:54	23:13	04:55	02:04	1	02:00	29

SSC	29	-28.133566	-57.979645	25.0	29 Jan 16:11	23:14	04:53	02:04	0	00:00	
SSC	30	-28.060011	-58.200874	25.0	29 Jan 17:28	23:16	04:51	02:03	0	00:00	
SSC	31	-27.985546	-58.422039	25.0	29 Jan 18:44	23:17	04:49	02:03	0	00:00	
SSC	32	-27.910158	-58.643127	25.0	29 Jan 20:01	23:18	04:47	02:03	0	00:00	
SSC	33	-27.833828	-58.864143	25.0	29 Jan 21:17	23:20	04:45	02:02	0	00:00	
SSC	34	-27.756538	-59.085075	24.9	29 Jan 22:34	23:21	04:43	02:02	0	00:00	
SSC	35	-27.67827	-59.305923	24.9	29 Jan 23:50	23:22	04:41	02:02	2	05:19	30
SSC	36	-27.599007	-59.526684	24.9	30 Jan 06:26	23:24	04:39	02:01	0	00:00	
SSC	37	-27.518728	-59.747353	24.9	30 Jan 07:42	23:25	04:37	02:01	0	00:00	
SSC	38	-27.437416	-59.967918	24.9	30 Jan 08:59	23:26	04:35	02:01	0	00:00	
SSC	39	-27.355049	-60.188389	24.9	30 Jan 10:15	23:28	04:33	02:00	0	00:00	
SSC	40	-27.271608	-60.408749	24.9	30 Jan 11:32	23:29	04:31	02:00	0	00:00	
SSC	41	-27.187071	-60.628998	24.9	30 Jan 12:48	23:30	04:29	02:00	1	02:00	31
SSC	42	-27.101418	-60.849133	24.9	30 Jan 16:05	23:32	04:28	02:00	0	00:00	

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The CCAMLR krill synoptic survey

Times of dawn and dusk

This table shows the times of dawn and dusk. Sunrise and sunset are the times that the sun rises above or sets below the horizon. Civil dawn and civil dusk are when the sun rises above and sinks below an angle of 6° below the horizon. Nautical dawn and dusk are when the sun rises above and sinks below an angle of 12° below the horizon. For the purposes of the synoptic survey we have used civil dawn and dusk as the time to start and stop acoustic transecting. This is a compromise between maximizing the time for transecting and avoiding the major effects of night-time migration above the depth of the ship-mounted acoustic transducers. Transects SS1 - SS19 refer to those in Subarea 48.2 & 48.3. Transects AP10 - AP19 refer to those in Subarea 48.1. Transects SSA - SSB refer to those in Subarea 48.4

Transect	Waypoint	Date	Sunrise	Sunset	Civil Dawn	Civil Dusk	Nautical Dawn	Nautical Dusk
SS01	1	20-Jan	06:19	22:13	05:40	22:52	04:31	23:58
SS01	22	22-Jan	05:55	22:30	04:58	23:24	03:26	00:58
SS01	42	24-Jan	05:20	22:52	04:08	00:06	na	na
SS02	1	16-Jan	06:20	22:27	05:35	23:11	04:31	00:17
SS02	22	18-Jan	05:57	22:46	05:02	23:46	03:17	01:33
SS02	43	19-Jan	05:16	23:17	03:54	00:40	na	na
SS03	1	14-Jan	06:24	22:37	05:38	23:22	04:32	00:29
SS03	22	15-Jan	05:56	23:01	04:58	23:57	na	na
SS03	43	17-Jan	05:19	23:32	03:52	01:01	na	na
SS04	1	24-Jan	06:48	22:33	06:05	23:16	05:06	00:17
SS04	22	26-Jan	06:27	22:52	05:35	23:43	04:12	01:09
SS04	43	27-Jan	05:56	23:19	04:46	00:32	na	na
SS05	1	20-Jan	06:46	22:44	06:02	23:27	05:00	00:31

SS05	22	21-Jan	06:22	23:07	05:28	00:03	03:50	01:40
SS05	43	23-Jan	05:51	23:36	04:35	00:55	na	na
SS06	1	18-Jan	06:49	22:53	06:05	23:37	05:01	00:42
SS06	22	19-Jan	06:25	23:17	05:29	00:14	03:44	02:00
SS06	43	21-Jan	05:54	23:49	04:34	01:11	na	na
SS07	1	28-Jan	07:17	22:50	06:36	23:31	05:39	00:30
SS07	23	30-Jan	07:00	23:10	06:10	00:03	04:52	01:20
SS07	44	31-Jan	06:35	23:38	05:29	00:48	na	na
SS08	1	24-Jan	07:05	23:15	06:17	00:04	05:06	01:15
SS08	20	25-Jan	06:44	23:40	05:45	00:41	na	na
SS08	38	27-Jan	06:21	00:12	04:59	01:34	na	na
SS09	1	22-Jan	07:09	23:27	06:20	00:17	05:05	01:32
SS09	19	23-Jan	06:49	23:53	05:49	00:55	na	na
SS09	37	24-Jan	06:23	00:30	04:55	01:57	na	na
SS10	1	01-Feb	07:22	23:35	06:30	00:29	05:07	01:51
SS10	12	02-Feb	07:13	23:49	06:14	00:50	04:17	02:47
SS10	22	03-Feb	07:03	00:07	05:55	01:15	na	na
AP11	1	30-Jan	07:28	00:01	06:33	00:56	04:56	02:33
AP11	8	30-Jan	07:13	00:04	06:13	01:04	na	na
AP11	14	31-Jan	07:12	23:54	06:12	00:56	04:07	03:01
AP12	1	25-Jan	07:20	00:22	06:19	01:23	na	na
AP12	12	25-Jan	06:54	00:30	05:41	01:43	na	na
AP12	22	26-Jan	06:31	00:35	05:03	02:04	na	na
AP13	1	04-Feb	07:50	00:09	06:55	01:04	05:23	02:36
AP13	10	04-Feb	07:32	00:13	06:30	01:14	04:07	03:37
AP13	19	05-Feb	07:14	00:14	06:05	01:23	na	na
AP14	1	31-Jan	07:47	00:31	06:48	01:30	04:49	03:29
AP14	8	01-Feb	07:35	00:33	06:31	01:37	na	na
AP14	16	01-Feb	07:19	00:38	06:06	01:51	na	na
AP15	1	27-Jan	07:47	00:50	06:44	01:53	na	na
AP15	9	27-Jan	07:28	00:58	06:16	02:10	na	na
AP15	18	28-Jan	07:09	01:05	05:44	02:30	na	na

AP16	1	06-Feb	08:20	00:32	07:26	01:27	05:56	02:56
AP16	10	06-Feb	08:03	00:38	07:02	01:39	05:08	03:33
AP16	19	07-Feb	07:49	00:41	06:40	01:50	na	na
AP17	1	02-Feb	08:23	00:56	07:25	01:53	05:40	03:38
AP17	11	03-Feb	08:06	01:02	07:01	02:08	na	na
AP17	21	04-Feb	07:48	01:09	06:31	02:25	na	na
AP18	1	29-Jan	08:18	01:11	07:17	02:12	na	na
AP18	13	30-Jan	07:55	01:22	06:42	02:36	na	na
AP18	25	31-Jan	07:29	01:36	05:51	03:13	na	na
AP19	1	08-Feb	08:54	00:55	08:01	01:48	06:37	03:12
AP19	15	09-Feb	08:33	01:03	07:30	02:07	05:03	04:33
AP19	29	10-Feb	08:06	01:15	06:47	02:35	na	na
SSA	1	19 Jan	05:58	21:54	05:15	22:37	04:15	23:37
SSA	21	21 Jan	05:33	22:07	04:42	22:59	03:16	00:26
SSA	42	23 Jan	04:59	22:26	03:50	23:34	na	na
SSB	1	26 Jan	06:18	21:51	05:37	22:32	04:41	23:28
SSB	21	25 Jan	05:48	22:09	04:58	22:59	03:38	00:21
SSB	42	23 Jan	05:05	22:36	03:54	23:46	na	na
SSC	1	27 Jan	06:24	21:59	05:43	22:40	04:46	23:36
SSC	21	28 Jan	05:59	22:14	05:09	23:04	04:00	00:16
SSC	42	30 Jan	05:32	22:30	04:28	23:32	na	na

Periods where the sun never goes as far as 12° below the horizon are shown by 'na' in the table

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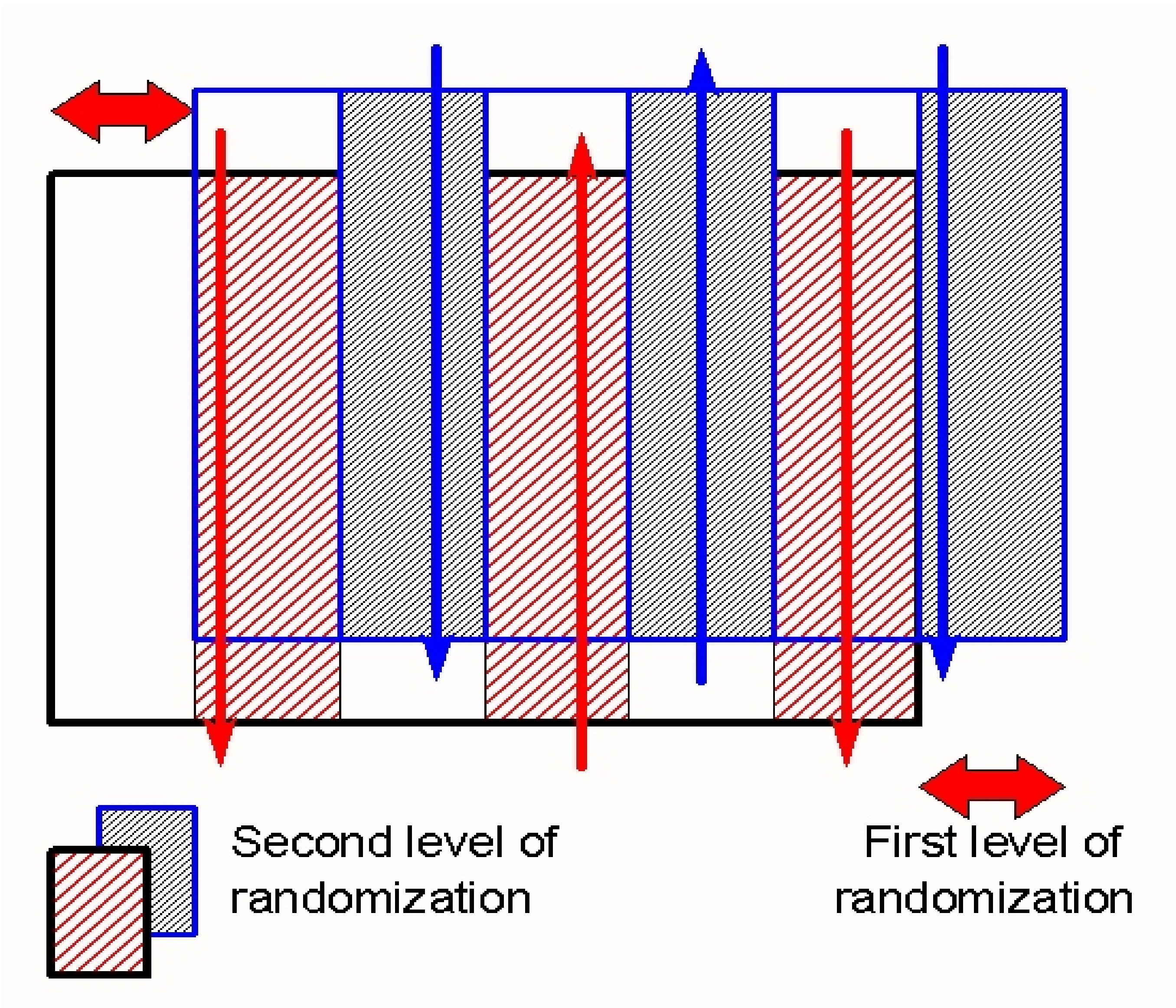
The CCAMLR krill synoptic survey

Sampling strategy



The synoptic survey will be a stratified, randomized parallel transect survey design. The advantage of using such a design is that it will be possible to use both classical design-based statistical analyses (Jolly and Hampton 1990) and model-based geostatistical analyses (Petitgas 1993, Murray 1996). The basic requirement for a randomized survey is that any possible parallel transect line in the survey area shall have an equal probability of being sampled. However, one problem with such a design is that if transect positions are chosen completely at random then it is possible for two adjacent transects to be very close to each other. To overcome this we suggest a two-stage randomization. Such a procedure has been used in previous surveys (see Brierley et al 1997) and the basic principles are shown in the diagram. The survey grid (black box) is split into a series of vertical zones; two zones for each transect in the grid. A transect is randomly placed within alternate zones (the vertical red arrows within the red-shaded zones). The white zones contain no transects and so act to keep transects a minimum distance apart. To comply with the requirement that any transect has an equal probability of being chosen, the location of the entire survey grid can be moved horizontally by the width of the white zone. The actual distance is chosen at random. The effect of moving the survey grid can be seen in the blue grid, where the blue transects are placed at random within the grey shaded zones.

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The CCAMLR krill synoptic survey

The CCAMLR-2000 krill synoptic survey; a description of the rationale and design

P.N. Trathan, J.L. Watkins, A.W. A. Murray, A. Brierley, D. Demer, I. Everson, C. Goss, S. Hedley, R. Hewitt, S. Kawaguchi, S. Kim, M. Naganobu, T. Pauly, J. Priddle, K. Reid and P. Ward

Preamble

The aim of this document is to describe the rationale behind the CCAMLR-2000 synoptic survey and to document in one place the details underlying the survey design. Such a document will be necessary in the future, particularly during the analysis and interpretation of the survey results. Furthermore, detailed descriptions of survey design are relatively rare in the published literature, this document therefore provides an opportunity for CCAMLR to establish a lead in this topic.

At present the CCAMLR-2000 survey design and data protocols have not received final ratification by either WG-EMM, or SC-CAMLR. Therefore the status of this document should be seen as provisional; it is inevitable that it will evolve following future discussions. This document draws heavily from previous planning documents and meetings and work carried out at the Synoptic Survey Planning Meeting held in Cambridge (UK) from 8-12 March 1999. The attendees at that meeting were: A. Brierley, D. Demer, I. Everson, C. Goss, S. Hedley, R. Hewitt, S. Kawaguchi, S. Kim, A Murray, M. Naganobu, T. Pauly, J. Priddle, K. Reid, P. Trathan, P. Ward and J. Watkins (Convenor).

Introduction

Antarctic krill, *Euphausia superba*, are considered to be one of the key species in the Antarctic marine food web being prey to a wide variety of dependent species. In addition to consumption by natural predators, krill are also harvested commercially. Commercial exploitation of krill is managed under the direction of CCAMLR, and is regulated in accordance with a sustainable ecosystem rationale. Such management principles are still developing, however, they require fundamental knowledge about the abundance and distribution of krill.

The CCAMLR methodology for the management of krill relies heavily upon results derived from the CCAMLR generalized yield model (Constable and de la Mare, 1996) and krill yield model (Butterworth et al., 1991, 1994). This model is used to estimate the long-term annual yield of krill in Area 48 and the precautionary catch limit for the fishery (CCAMLR Conservation Measure 32/X, SC-CCAMLR-X, 1991). To run the krill yield model, a number of parameters are required, these include an estimate of the pre-exploitation biomass of krill (B_0) together with an estimate of the associated variance. The current estimate of B_0 used in the model is derived from the First International BIOMASS (Biological Investigation of Marine Antarctic Systems and Stocks) Experiment (FIBEX) synoptic survey which took place in January to March 1981.

Over recent years it has been increasingly recognised by the CCAMLR community that a more up to date estimate of krill biomass is required for B_0 (SC-CAMLR-XII, 1993; paragraphs 2.38 to 2.43). For example, in 1996 the CCAMLR Scientific Committee recognized the urgent need for a synoptic survey in Area 48 and noted that management advice for Area 48 could not be updated until such a survey had been conducted (SC-CAMLR-XV, 1996; paragraph 4.28). Since then, plans to carry out a CCAMLR krill synoptic survey have progressed steadily (SC-CAMLR-XVI, 1997; paragraphs 5.13 to 5.19) and there is now a firm commitment to carry out a survey in the summer of 2000 (between January and February). The primary objective of this survey will be to improve the CCAMLR estimate of B_0 (SC-CAMLR-XII, 1993; paragraphs 2.39 and 2.41 to 2.47); additional survey objectives have been formulated, but these are considered secondary to the estimate of B_0.

The synoptic survey is a community project that will concentrate effort in Subareas 48.1, 48.2 and 48.3. The survey will involve the participation of three (or more) research vessels from different CCAMLR nations. The composition of the scientific parties aboard these vessels will also be multinational and will include relevant experts from outside the CCAMLR community. The planning effort for this multi-ship survey is considerable and complex, therefore it is crucial that all stages of the process are documented. Thus, the primary purpose of this paper is to describe in detail the procedures used to design the synoptic survey.

Sampling strategy

The synoptic survey design was a culmination of numerous decisions. These are reported in a number of separate working documents and reports and are reproduced here in order to provide a single ready source. The major design strategy decisions were:

- whether pre-planned transects positions or adaptive transects positions should be used
- whether transect separation should be regular and systematic or random
- whether the design should be stratified or unstratified
- the definition of survey limits.

(a) Pre-planned or adaptive transect positions

An adaptive survey design would generally offer an increased understanding of the structure of the ecosystem, and improve the coefficient of variation (CV) of the biomass estimate. However, the advantages of a more detailed description of the distribution of krill within high density areas may be out-weighed by the increased complexity in terms of survey design, execution and subsequent analysis. In the light of these concerns, a more conservative approach of utilising a pre-planned survey has been adopted as the preferred approach. Such an approach had been widely used in the past (for instance FIBEX, Anon., 1980) and is statistically robust and defensible.

(b) Systematic or random transect positions

The main objective of the survey is to improve the estimate of B_0 used in the krill yield model. Although an improved estimate could be based upon a wide variety of survey designs, the chosen survey design must be statistically defensible. Modern methods of statistical analysis are continually evolving and are providing new opportunities for improved analysis. However, at present no overall consensus exists with regard to some of the model-based geostatistical methodologies. In the future, an agreed methodology using model-based methods may become available, but until that time the CCAMLR community has agreed that a randomised design coupled to a design-based analysis should produce the most statistically defensible result (CCAMLR, 1998a; 1998b Appendix 1; see also conclusions from Miller, 1994).

To achieve this the survey will follow a design based on randomized, parallel transects. The advantage of using such a design will be that it will be possible to use classical design-based statistical methods (Jolly and Hampton, 1990) without precluding model-based geostatistical methods (e.g. Petitgas, 1993; Murray, 1996) during the survey analysis. In contrast, the use of regular systematic transects would preclude the use of classical design-based statistical methods.

(c) Stratified, or unstratified design

There is still considerable uncertainty within the CCAMLR community regarding the relative abundance of krill in the open ocean compared to that over the continental shelf areas around the Antarctic Peninsular and the islands in Area 48. Although the distribution is complex (illustrated by a variety of datasets and published papers e.g. Ichii et al., 1998; Sushin and Shulgovsky, 1998), it is important that the B_0 estimate is based on a survey that samples all areas where biomass is important. The FIBEX survey was based on the premise that the majority of krill biomass was close to, or over, shelf areas. However, if krill are also distributed in similar quantities in the open ocean, a design which gives a uniform density of sampling across the whole region should be used. In contrast, if krill are concentrated in particular predictable areas, an appropriate stratified sample design is likely to produce a lower overall CV. Though appropriate stratification may improve the overall CV, it will not change the expected estimate of mean biomass.

In view of the debate over the relative importance of shelf and oceanic areas, a compromise survey design was considered appropriate. Thus, the design will allocate extra effort to areas of expected krill concentration.

(d) Definition of survey boundaries

Given the complexity of the marine ecosystem (cf. Ichii et al., 1998; Sushin and Shulgovsky, 1998), natural limits to the survey area are difficult to define. In establishing appropriate boundaries a variety of factors have to be considered. These include the known historical distribution of krill, the oceanographic structure within the region, the distribution of the commercial fishery, and the distribution of the summer pack-ice. However, these ecological boundaries do not necessarily equate to the artificial limits of the Subareas that define the management boundaries.

As estimates of krill biomass may be required for strata that have been defined using either ecological or management-based criteria (for example, the Scotia Sea cf. Subarea 48.1), survey boundaries must be based on a compromise between ecological and management boundaries.

Outline of selected survey design

Considering the factors outlined in the previous section (sampling strategy) the following survey design has been agreed. The ships will undertake a series of randomised transects located within two large-scale strata that cover the Scotia Sea and the area to the north of the Antarctic Peninsular. The first of these strata will cover much of Subarea 48.3 and Subarea 48.2, whereas the second will cover most of Subarea 48.1. In order to lie orthogonal to the main axis of the regional bathymetry, the two strata will be oriented in different directions. Within these large-scale strata three regions are known to have a high abundance of krill and to be of importance to commercial fishing fleets. In these areas additional mesoscale transects will be steamed in order to reduce the CV of the biomass estimate. The first of the mesoscale strata will be to the north of South Georgia, the second will be to the north of the South Orkney Islands, and the third will be to the north of the South Shetland Islands. In the mesoscale strata, the transects will be double the transect density of the large-scale strata. The boundaries of the mesoscale strata will be coincident with the boundaries of selected large-scale sampling units in order to ensure that the survey area is uniformly covered by primary sampling units (transects) for the purposes of randomisation. Details of these cruise tracks will be found in Figures 1, 2 and 3.

Method of randomisation

Within each stratum, transects are randomised. The basic requirement for a truly randomized parallel transect survey is that all potential transect lines in the survey area should have an equal probability of being sampled. However, one problem arising from a simple randomisation procedure is that there is a possibility of transects being very close together; this can result in an inefficient use of available effort. To overcome this we have used a two-stage randomization process (see also Brierley et al., 1997). First, the survey area was divided into a series of parallel zones of equal width separated by alternating parallel inter-zones of the same width. A survey transect was then randomly placed within each of the zones. The inter-zones contain no transects and act to keep the transects a minimum distance apart. To comply with the requirement that any transect has an equal probability of being chosen, the location of the entire survey grid was then moved by a random distance equal to, or less than, the inter-zone width. Thus, using the two stage process, all sampling units have equal probability of being chosen; this gives the necessary condition for the validity of the design-based estimators.

Implementation of survey design

The computer software package used to carry out the survey design was Arc/Info Version 7.1.1 (ESRI). The final design was checked in Arc/Info and then validated using a separate software package (Proj4). The survey design was undertaken in five strata:

- the Scotia Sea large-scale stratum (SS)
- the Antarctic Peninsular large-scale stratum (AP)
- the South Georgia island mesoscale stratum (SGI)
- the South Orkney Islands mesoscale stratum (SOI)
- the South Shetland Islands mesoscale stratum (SSI)

The implementation of the two stage randomisation process was carried out in seven steps:

- generate a regular 25 × 25 km base grid extending beyond the limits of the survey area
- for each stratum identify the sampling zones and inter-zones on the appropriate base grid
- for each transect identify the random shift within each sampling zone
- for each stratum identify the random grid shift for the sampling zones and inter-zones
- for each transect identify the northern and southern limits of sampling
- for each transect identify waypoints at 25 km spacing
- for each transect project the waypoints into geographic coordinates

(a) Generate regular 25 × 25 km base grids

Two regular 25 × 25 km grids that extended beyond the limits of the anticipated survey area were generated, one for the Scotia Sea and one for the Antarctic Peninsular. Each grid was oriented orthogonal to the general axis of the regional bathymetry. Thus, the base grid for the Scotia Sea was designed to lie parallel to the 40W meridian, whereas the grid for the Antarctic Peninsular was designed to lie at 330 to the 50W meridian; this second grid was therefore located parallel to the line between

6500.0S, 5000.0W and 6000.0S, 5546.4W. The limits of the regular base grids are shown in Table 1.

The two base grids were generated using a Lambert Conformal Conic Projection with standard parallels placed approximately 25% from the top and bottom of the anticipated survey areas; with these parallels scale errors should be approximately 1%. The parameters used for the generation of the grids are shown in Table 2.

(b) Identify the survey sampling zones and inter-zones

Following the criteria outlined above, transect sampling zones were generated on the two base grids. The zones were located at equal distances across the anticipated survey area and were separated by inter-zones of the same width. The parameters for setting up the sampling zones are shown in Table 3.

(c) Identify the random transect positions within the sampling zones

In order to assign random transect positions each sampling zone was subdivided into 125 potential positions, this gives a sampling resolution of 0.5 km for the large-scale transects and 0.25 km for the mesoscale transects. Within each sampling zone the actual transect position was determined by randomly selecting one of the potential transect positions. The random shift for each transect within each sampling zone is shown in Table 4.

(d) Identify the random grid shift

The second level of survey randomisation was carried out by subdividing the grid shift inter-zone into 125 potential grid positions, giving a sampling resolution of 0.5 km. The grid shift was chosen by picking one of these potential grid positions at random. The same grid shift was used for both base grids. This provided the second level of randomisation for both the large-scale transects and the mesoscale transects and ensured that even sampling probability was maintained. The random shifts for the grids are shown in Table 4.

(e) Identify the northern and southern limits for each transect

After randomly assigning transect positions on the X-axis of the base grid, Y-axis coordinates for the northern and southern end points of each transect were determined by extending the transects to the limits of the survey strata. The southern transect limits were identified with reference to nearby coastlines and the anticipated northern extent of the summer pack-ice, while the northern limits were identified with reference to the boundaries of Subareas 48.1, 48.2 and 48.3 (Figure 4), the existence of krill in Area 41 (Figure 5), and the frontal structure of the ACC (Figure 6).

(f) Identify waypoints along each transect

As survey transects are parallel and do not follow meridians, transect orientation continually changes. Therefore to aid navigation during the survey, waypoints were created at regular intervals along each transect. These waypoints were generated from north to south at 25 km spacing.

(g) Project the transects into geographic coordinates

The transect waypoints on the base grid were projected from the Lambert Conformal Conic Projection to geographic coordinates using the parameters shown in Table 5.

Implications for the analysis of survey strata

The different orientations of the large-scale grids leads to an overlap of some primary sampling units and a change to the sampling probability to the east of the Antarctic Peninsular. Therefore when estimating B_0 for the Southwest Atlantic, it is important that an *a priori* selection of sampling units is made in the region of overlap. Thus, it is recommended that data collected south of 59 on transect 10 should be omitted to avoid problems in data analysis.

When preparing an estimate of B_0 for the FAO Subareas, other parts of the transects outside the FAO areas will need to be omitted. For these estimates there is no ambiguity about which transect sections to discard.

Allocation of survey effort to participating vessels

Three member nations within the CCAMLR community have arranged to support the synoptic survey with approximately 30 days each of ship time. These nations are Japan, the UK and the USA. Other nations may be able to contribute effort, but at the moment they are not in a position to confirm their commitment.

The transects within the Scotia Sea (SS) and Antarctic Peninsular (AP) large-scale strata were allocated to the three vessels as follows:

Ship 1 (UK): transects SS-1, SS-4, SS-7, SS-10, AP-13, AP-16 and AP-19,
Ship 2 (USA): transects SS-2, SS-5, SS-8, AP-11, AP-14 and AP-17,
Ship 3 (Japan): transects SS-3, SS-6, SS-9, AP-12, AP-15 and AP-18.

The transects within the mesoscale strata were allocated as follows:

Ship 2 (USA): transects SGI-1, SGI-2, SGI-3 and SGI-4,
Ship 2 (USA): transects SOI-1, SOI-2, SOI-3 and SOI-4,

Ship 3 (Japan): transects SSI-1, SSI-2, SSI-3, SSI-4, SSI-5, SSI-6, SSI-7 and SSI-8.

The UK vessel (Ship 1) was not allocated any mesoscale sampling effort as it has a larger commitment to contribute effort at the large-scale.

Additional survey effort

The synoptic survey design allows for 3 survey vessels operating within a restricted period of time. However, it is possible that additional survey effort from other CCAMLR member nations will become available in the future. If this occurs, plans will be required to efficiently utilize the additional effort without compromising the validity of the basic survey design. For example, adding additional transects interleaved between existing transects would result in uneven sampling probabilities, which would be unacceptable. However, two feasible options are available, these are:

- to replicate one (or more) of the mesoscale survey areas
- to replicate one (or more) of the large-scale survey areas.

Choosing between these options depends upon the amount of additional effort that becomes available. If a limited amount of effort was to become available (for example 5 or 6 days), it would be most useful if it was used to replicate one of the mesoscale strata. Conversely, if a longer period was available (for example 11 to 15 days), it would be most useful if it was used to replicate one of the large-scale strata.

It is likely that logistic constraints will dictate which strata will be sampled. However if time were unconstrained, additional effort would be used most efficiently if it were used to repeat the complete itinerary of one (or more) vessel. Following a random selection, the vessel itinerary to repeat should be that of Ship 1, followed by that of Ship 2, and then that of Ship 3.

Reduction of survey effort due to lost time

In the Southwest Atlantic it is highly likely that some survey time will be lost due to bad weather; contingency plans for lost time are therefore absolutely necessary. The following guidelines are provided in the event that weather and/or equipment failure causes serious delays. It is suggested that each vessel should check progress against the expected time at each station and make adjustments if necessary according to the following hierarchical scheme:

- increase vessel speed without sacrificing quality of acoustic data; else,
- delete daytime net sampling and conductivity-temperature-depth sensor (CTD) casts.

In addition, a check should be made against the expected time at the approximate mid-point of each major transect (6 or 7 for each ship) and adjustments made according to the following hierarchical scheme:

- curtail the current transect and recommence surveying at the start of the next; else,
- curtail the current transect and recommence surveying at the most adjacent point on the next; else,
- omit an entire transect according to the randomly determined ranking given in Table 6.

Determination of station positions on transects

In addition to undertaking a series of acoustic transects, it was agreed that each ship should undertake a series of net hauls to collect krill and zooplankton, and a series of conductivity-temperature-depth sensor (CTD) casts to characterize water masses. The initial plans were based on the following assumptions:

- that acoustic transects would be run during daylight so that acoustic biomass estimates would not be biased by night-time migrations of krill to the surface (where they would not be sampled by echosounders);
- that 18 hours per day would be spent conducting acoustic transects; and
- that the remaining 6 hours per day would be used to sample two stations. One station would be sampled around local midnight, the other around local midday. At each station a CTD cast to 1000 m and a net haul between 0 m and 200 m would be undertaken.

The major implication of such a sampling regime is that station positions are not fixed locations but rather will depend on the start time of each ship, the time and duration of the dark period and the actual progress the ship makes along each transect.

The provisional position of the stations has been determined in a series of stages:

- determine the approximate dates when each ship will steam each transect
- calculate the times of local dawn and dusk for the given dates for set positions on each transect
- establish the station positions and the cruise plan based on the calculated steaming times

To facilitate cruise planning we have used a PC-based spreadsheet to calculate steaming times around the survey grid. It is hoped that this spreadsheet can be made available to all cruise leaders to help monitor expected progress around the survey transects.

(a) Provisional start date for each vessel

Provisional sampling positions have been calculated assuming that the first transect to be steamed by each ship will be started at the times shown in Table 7.

(b) Times of dawn and dusk for each vessel on each transect

The times of civil twilight (where the sun is more than 6° below the horizon) are shown for each vessel respectively in Tables 8, 9 and 10. Selected positions for each transect are shown in order to provide an estimate of local conditions at different latitudes and longitudes. These set positions were selected at the northern and southern extremity of each transect and close to the middle of each transect. Three positions were considered adequate for initial planning purposes as it was recognised that station times would vary according to weather and equipment failures. The final station positions will need to be recalculated by each cruise leader as each cruise progresses.

Inspection of the twilight times for each position on each transect reveals that many parts of the survey are in areas where the sun is more than 6° below the horizon for between 4 and 6 hours. This means that the nominal 3 hours allocated for a night time station is unrealistic. Several compromises will therefore be required to ensure that the survey transects can be covered in the time available. These compromises are:

- transecting starts at local civil dawn and extends until local civil twilight;
- only 2 hours are allowed for the daytime net and CTD; and
- the ships steam at 10.5 knots along transects and at 12 knots between transects.

If these conditions cannot be met then the survey will take longer than originally anticipated, or the transects will have to be shortened according to the hierarchy discussed in the sampling protocols. Assuming that the compromise conditions will be met, provisional station positions have been calculated.

(c) Provisional station sampling positions

Based on the available transecting time between local civil dawn and local civil twilight, station positions were calculated. The provisional positions for each of the ships are shown in Tables 11, 12 and 13.

Regional support and context for the synoptic survey

The results derived from the CCAMLR-2000 synoptic survey will allow a new estimate of B_0 to be produced. However, the magnitude of this new estimate is likely to differ from that of the existing B_0 estimate derived from the FIBEX results (Trathan et al., 1992). If the difference between these two values is marked, considerable debate is likely to ensue and subsequent synoptic surveys may be required. Given the financial and logistic complexity of multi-ship operations, such future surveys cannot be relied upon.

However, the synoptic survey should be seen in the context of smaller-scale regional surveys that have been undertaken previously or which may be undertaken in the future. Of particular importance will be those smaller-scale surveys that are undertaken close to the time of the synoptic survey; especially those surveys that form part of long-term time series (such as the US AMLR survey (USA), the BAS Core Programme (UK) and the cruises fostered by the CCAMLR Sub-Group on International Coordination). If these regular regional surveys can be linked to the large-scale synoptic survey in time and space, it may be possible to interpret temporal variations observed in the regional surveys, with respect to the larger area. If this proves feasible, it may then become possible to use smaller-scale regional surveys to monitor long-term trends in krill biomass. At present, prior to the synoptic survey, any relationship between the regional surveys and the biomass across Area 48, remains undefined.

References

Anon. 1980. FIBEX Acoustic Survey Design. *BIOMASS Rep. Ser.*, 14: 15.

Brierley, A.S., J.L. Watkins and A.W.A. Murray. 1997. Interannual variability in krill abundance at South Georgia. *Mar. Ecol. Prog. Ser.*, 150: 87-98.

Butterworth, D.S., A.E. Punt and M. Basson. 1991. A simple approach for calculating the potential yield from biomass survey results. In: *Selected Scientific Papers, 1991 (SC-CAMLR-SSP/8)*. CCAMLR, Hobart: 207-215.

Butterworth, D.S., G.R. Gluckman, R.B. Thomson, S. Chalis, K. Hiramatsu, and D.J. Agnew. 1994. Further computations of the consequences of setting the annual krill catch limit to a fixed fraction of the estimate of krill biomass from a survey. *CCAMLR Science.*, 1: 81-106.

CCAMLR. 1997. *Statistical Bulletin*, Vol. 9, CCAMLR, Hobart, Australia.

CCAMLR. 1998a. Hydroacoustic and net krill sampling methods - Area 48 Survey. Document *WG-EMM-98/24*. CCAMLR, Hobart, Australia.

CCAMLR. 1998b. Report from the Steering Committee for the synoptic survey of Area 48. Document *WG-EMM-98/25*. CCAMLR, Hobart, Australia.

Constable, A.J. and W.K. de la Mare. 1996. A generalized model for evaluating yield and the long-term status of fish stocks under conditions of uncertainty. *CCAMLR Science.*, 3: 31-54.

Ichii, T., K. Katayama, N. Obitsu, H. Ishii, and M. Naganobu. 1998. Occurrence of Antarctic krill (*Euphausia superba*) in the vicinity of the South Shetland Islands: relationships to environmental parameters. Document *WG-EMM-98/18*. CCAMLR, Hobart, Australia.

Jolly, G.M., and I. Hampton. 1990. A stratified random transect design for acoustic surveys of fish stocks. *Can. J. Fish. Aquat. Sci.*, 47: 1282-1291.

Miller, D. G. M. 1994. Suggested outline for the design and implementation of future near-synoptic krill surveys. Document *WG-Krill 94/20*. CCAMLR, Hobart, Australia.

Murray, A.W.A. 1996. Comparison of geostatistical and random sample survey analyses of Antarctic krill acoustic data. *ICES J. mar. Sci.*, 53: 415-421.

Orsi, A. H., T. Whitworth III, and W. D. Nowlin Jr. 1995. On the meridional extent of the Antarctic Circumpolar Current. *Deep-Sea Res.*, *42*, 641-673.

Petitgas, P. 1993. Geostatistics for fish stock assessments: a review and an acoustic application. *ICES J. mar. Sci.*, 50: 285-298.

SC-CAMLR-X. 1991. *Report of the Tenth Meeting of the Scientific Committee*, CCAMLR, Hobart, Australia.

SC-CAMLR-XII. 1993. *Report of the Thirteenth Meeting of the Scientific Committee*, CCAMLR, Hobart, Australia.

SC-CAMLR-XV. 1996. *Report of the Fifteenth Meeting of the Scientific Committee*, CCAMLR, Hobart, Australia.

SC-CAMLR-XVI. 1997. *Report of the Sixteenth Meeting of the Scientific Committee*, CCAMLR, Hobart, Australia.

Sushin, V. A., and K. E. Shulgovsky. 1998. Krill distribution in the Western Atlantic Sector of the Southern Ocean during 1983/84, 1984/85 and 1987/88 on the basis of the Soviet mesoscale surveys with Isaacs Kidd midwater trawl. Document *WG-EMM-98/32*. CCAMLR, Hobart, Australia.

Trathan, P. N., D.J. Agnew, D. G. M. Miller, J. L. Watkins, I. Everson, M. R. Thorley, E. J. Murphy, A. W. A. Murray, and C. Goss. 1992. Krill biomass in Area 48 and Area 58: Recalculation of FIBEX data. In: *Selected Scientific Papers*, (*SC-CAMLR-SSP/9*), 157-182, CCAMLR, Hobart, Australia.

Trathan, P. N., M. A. Brandon, and E. J. Murphy.1997. Characterisation of the Antarctic Polar Frontal Zone to the north of South Georgia in summer 1994. *J. Geophys. Res.* 102: C5 10483-10497

Tables

Table 1: Limits of the 25 × 25 km base grids used as the foundation for the survey design. (Back to text)

Stratum	Origin of grid	Rotation of grid	Northern limit	Southern limit	Eastern limit	Western limit

Scotia Sea	62° S, 40° W	0	49° S	62° S	23° W	56° W
Antarctic Peninsular	65° S, 50° W	330	52° S	68° S	40° W	79° W

Table 2: Parameters used for the Lambert Conformal Conic Projections. (Back to text)

Stratum	Spheroid	Units	Standard Parallel 1	Standard Parallel 2	Central Meridian	Origin of Projection	X,Y Shift
Scotia Sea	WGS84	Metres	54°30' S	59°30' S	40° W	62° W	0, 0
Antarctic Peninsular	WGS84	Metres	59°30' S	64°30' S	50° W	65° W	0, 0

Table 3: Parameters used for the determining the transect sampling zones. (Back to text)

Stratum	Start position on base grid* (grid column)	Width of grid shift inter-zone (km)	Number of transects	Width of transect sampling zone (km)	Width of transect sampling inter-zone (km)
Scotia Sea	11	62.50	10	62.50	62.50
Antarctic Peninsular	15	62.50	9	62.50	62.50
South Georgia	21	62.50	4	31.25	31.25
South Orkney Islands	41	62.50	4	31.25	31.25
South Shetland Islands	25	62.50	8	31.25	31.25
* The position with row = 1, column = 1 is at the northeast corner of the grid					

Table 4: Random offsets for transects within the sampling zones and for the grid shift. (Back to text)

Stratum	Random shift within transect sampling zones (km)										Random shift for grid (km)
	T01	T02	T03	T04	T05	T06	T07	T08	T09	T10	
Scotia Sea*	3.00	36.00	43.50	44.50	13.50	0.50	50.00	29.00	41.50	6.50	17.50

Antarctic Peninsular*	40.00	38.50	16.00	37.00	44.50	1.50	57.00	13.00	2.00		17.50
South Georgia+	29.25	0.75	6.50	9.25							17.50
South Orkney Islands+	7.75	18.25	18.50	19.25							17.50
South Shetland Islands+	20.50	5.00	20.25	20.75	11.00	26.75	4.25	29.25			17.50

* Randomisation was carried out with potential transect sampling units separated by 0.50 km

\+ Randomisation was carried out with potential transect sampling units separated by 0.25 km

Table 5: Parameters used for the Geographic Projection. (Back to text)

Stratum	Spheroid	Units	X,Y Shift
Scotia Sea	WGS84	Decimal degrees	0, 0
Antarctic Peninsular	WGS84	Decimal degrees	0, 0

Table 6: Priority for omitting transects following periods of lost time; if a transect has already been surveyed, then the next highest priority transect should be omitted. (Back to text)

Vessel	Priority for omission							
	1	2	3	4	5	6	7	8
Ship 1 (large-scale)	SS-7	AP-13	SS-10	AP-16	SS-1	SS-4	AP-19	
Ship 2 (large-scale)	SS-5	SS-8	AP-14	AP-11	SS-2	AP-17		
Ship 3 (large-scale)	AP-12	SS-3	SS-6	SS-9	AP-15	AP-18		
Ship 2 (mesoscale)	SGI-4	SGI-2	SGI-3	SGI-1				
Ship 2 (mesoscale)	SOI-2	SOI-4	SOI-1	SOI-3				
Ship 3 (mesoscale)	SSI-7	SSI-5	SSI-8	SSI-6	SSI-2	SSI-1	SSI-4	SSI-3

Table 7: Start times for each vessel. (Back to text)

Vessel-id	Nation	Start date & time
Ship 1	UK	20 Jan 2000 14:00
Ship 2	USA	14 Jan 2000 06:00

Ship 3	Japan	14 Jan 2000 11:00

Table 8: Times of civil dawn and civil dusk for each transect undertaken by Ship 1. Times are GMT.
(Back to text)

Transect	Position	Longitude	Latitude	Date	Civil Dawn	Civil Dusk
SS01	north	-31.22	-51.89	20/01/00	05:40	22:52
SS01	middle	-30.13	-56.56	22/01/00	04:58	23:24
SS01	south	-28.80	-61.00	24/01/00	04:08	00:06
SS04	north	-37.27	-51.98	24/01/00	06:05	23:16
SS04	middle	-36.93	-56.69	26/01/00	05:35	23:43
SS04	south	-36.49	-61.40	27/01/00	04:46	00:32
SS07	north	-42.79	-51.98	28/01/00	06:36	23:31
SS07	middle	-43.16	-56.91	30/01/00	06:10	00:03
SS07	south	-43.62	-61.62	31/01/00	05:29	00:48
SS10	north	-48.89	-57.99	01/02/00	06:30	00:29
SS10	middle	-49.54	-60.44	02/02/00	06:14	00:50
SS10	south	-50.22	-62.66	03/02/00	05:55	01:15
AP13	north	-56.25	-59.68	04/02/00	06:55	01:04
AP13	middle	-54.45	-61.49	04/02/00	06:30	01:14
AP13	south	-52.47	-63.25	05/02/00	06:05	01:23
AP16	north	-62.93	-60.00	06/02/00	07:26	01:27
AP16	middle	-61.52	-61.90	06/02/00	07:02	01:39
AP16	south	-60.03	-63.67	07/02/00	06:40	01:50
AP19	north	-69.94	-60.00	08/02/00	08:01	01:48
AP19	middle	-68.38	-63.05	09/02/00	07:30	02:07
AP19	south	-66.47	-66.06	10/02/00	06:47	02:35

Table 9: Times of civil dawn and civil dusk for each transect undertaken by Ship 2. Times are GMT.
(Back to text)

Transect	Position	Longitude	Latitude	Date	Civil Dawn	Civil Dusk
SS02	north	-33.53	-51.82	16/01/00	05:35	23:11

SS02	middle	-32.73	-56.15	18/01/00	05:02	23:46
SS02	south	-31.69	-61.20	19/01/00	03:54	00:40
SS05	north	-38.63	-52.01	20/01/00	06:02	23:27
SS05	middle	-38.46	-56.72	21/01/00	05:28	00:03
SS05	south	-38.24	-61.43	23/01/00	04:35	00:55
SS08	north	-44.59	-54.62	24/01/00	06:17	00:04
SS08	middle	-45.15	-58.87	25/01/00	05:45	00:41
SS08	south	-45.81	-62.89	27/01/00	04:59	01:34
AP11	north	-52.74	-58.73	30/01/00	06:33	00:56
AP11	middle	-51.25	-60.11	30/01/00	06:13	01:04
AP11	south	-50.08	-61.11	31/01/00	06:12	00:56
AP14	north	-58.81	-60.01	31/01/00	06:48	01:30
AP14	middle	-57.53	-61.45	01/02/00	06:31	01:37
AP14	south	-56.13	-62.88	01/02/00	06:06	01:51
AP17	north	-66.33	-60.01	02/02/00	07:25	01:53
AP17	middle	-64.98	-62.16	03/02/00	07:01	02:08
AP17	south	-63.53	-64.17	04/02/00	06:31	02:25
SGI01	south	-34.89	-54.78	15/01/00	05:16	23:40
SGI04	north	-37.60	-53.11	14/01/00	05:38	23:39
SOI01	south	-42.75	-60.74	28/01/00	05:24	00:44
SOI04	north	-46.22	-59.73	29/01/00	05:53	00:43

Table 10: Times of civil dawn and civil dusk for each transect undertaken by Ship 3. Times are GMT.
(Back to text)

Transect	Position	Longitude	Latitude	Date	Civil Dawn	Civil Dusk
SS03	north	-35.45	-51.92	14/01/00	05:38	23:22
SS03	middle	-34.88	-56.62	15/01/00	04:58	23:57
SS03	south	-34.14	-61.32	17/01/00	03:52	01:01
SS06	north	-40.26	-52.01	18/01/00	06:05	23:37
SS06	middle	-40.29	-56.73	19/01/00	05:29	00:14
SS06	south	-40.34	-61.44	21/01/00	04:34	01:11

SS09	north	-46.75	-54.74	22/01/00	06:20	00:17
SS09	middle	-47.52	-58.76	23/01/00	05:49	00:55
SS09	south	-48.48	-62.77	24/01/00	04:55	01:57
AP12	north	-54.65	-59.24	25/01/00	06:19	01:23
AP12	middle	-52.34	-61.43	25/01/00	05:41	01:43
AP12	south	-50.12	-63.25	26/01/00	05:03	02:04
AP15	north	-61.36	-60.01	27/01/00	06:44	01:53
AP15	middle	-60.03	-61.68	27/01/00	06:16	02:10
AP15	south	-58.43	-63.46	28/01/00	05:44	02:30
AP18	north	-67.84	-60.00	29/01/00	07:17	02:12
AP18	middle	-66.33	-62.60	30/01/00	06:42	02:36
AP18	south	-64.63	-65.06	31/01/00	05:51	03:13
SSI01	north	-55.55	-60.50	01/02/00	06:34	01:19
SSI08	south	-62.61	-62.88	05/02/00	06:51	01:59

Table 11: Provisional positions for net and CTD sampling stations for Ship 1. Times are GMT. (Back to text)

Station	Station-id	Transect	Longitude	Latitude	Date & time
1	SS0101	SS01	-30.8837	-53.4453	20 Jan 23:32
2	SS0102	SS01	-30.5734	-54.7801	21 Jan 13:33
3	SS0103	SS01	-30.2413	-56.1149	21 Jan 23:12
4	SS0104	SS01	-29.8852	-57.4489	22 Jan 12:33
5	SS0105	SS01	-29.4357	-59.0032	22 Jan 23:29
6	SS0106	SS01	-28.9448	-60.5540	23 Jan 13:08
7	SS0401	SS04	-36.5109	-61.1745	24 Jan 13:29
8	SS0402	SS04	-36.6692	-59.6071	25 Jan 00:24
9	SS0403	SS04	-36.8137	-58.0372	25 Jan 14:11
10	SS0404	SS04	-36.9280	-56.6905	25 Jan 23:51
11	SS0405	SS04	-37.0344	-55.3436	26 Jan 13:23
12	SS0406	SS04	-37.1495	-53.7729	27 Jan 02:36
13	SS0407	SS04	-37.2114	-52.8761	27 Jan 14:09

14	SS0701	SS07	-42.8095	-52.2023	28 Jan 15:26
15	SS0702	SS07	-42.8866	-53.3227	28 Jan 23:49
16	SS0703	SS07	-42.9849	-54.6685	29 Jan 14:25
17	SS0704	SS07	-43.0900	-56.0152	30 Jan 00:04
18	SS0705	SS07	-43.2029	-57.3620	30 Jan 14:04
19	SS0706	SS07	-43.3242	-58.7083	30 Jan 23:43
20	SS0707	SS07	-43.4780	-60.2772	31 Jan 14:13
21	SS0708	SS07	-43.6216	-61.6195	31 Jan 23:51
22	SS1001	SS10	-49.8668	-61.5496	02 Feb 00:22
23	SS1002	SS10	-49.4155	-59.9966	02 Feb 14:19
24	SS1003	SS10	-49.0601	-58.6623	02 Feb 23:58
25	AP1301	AP13	-53.5832	-62.2921	05 Feb 00:53
26	AP1302	AP13	-55.0723	-60.8894	05 Feb 14:50
27	AP1601	AP16	-62.0074	-61.2721	07 Feb 00:54
28	AP1602	AP16	-60.8325	-62.7437	07 Feb 15:25
29	AP1603	AP16	-60.0261	-63.6703	07 Feb 23:05
30	AP1901	AP19	-66.7579	-65.6520	09 Feb 00:47
31	AP1902	AP19	-67.8720	-63.9227	09 Feb 15:20
32	AP1903	AP19	-68.6227	-62.6191	10 Feb 01:00
33	AP1904	AP19	-69.4196	-61.0931	10 Feb 15:26
34	AP1905	AP19	-69.9429	-60.0005	10 Feb 23:48

Table 12: Provisional positions for net and CTD sampling stations for Ship 2. Times are GMT. (Back to text)

Station	Station-id	Transect	Longitude	Latitude	Date & time
1	SGI0301	SGI03	-36.5551	-53.9814	14 Jan 19:17
2	SGI0201	SGI02	-35.5553	-53.6031	15 Jan 04:46
3	SGI0101	SGI01	-35.0060	-53.8866	15 Jan 17:07
4	SGI0102	SGI01	-34.8924	-54.7824	16 Jan 03:35
5	SS0201	SS02	-33.4295	-52.4934	16 Jan 22:40
6	SS0202	SS02	-33.1729	-54.0565	17 Jan 13:50

7	SS0203	SS02	-32.9365	-55.3972	17 Jan 23:29
8	SS0204	SS02	-32.6393	-56.9614	18 Jan 13:58
9	SS0205	SS02	-32.3639	-58.3014	18 Jan 23:38
10	SS0206	SS02	-32.0155	-59.8625	19 Jan 13:03
11	SS0207	SS02	-31.6907	-61.1978	19 Jan 22:42
12	SS0501	SS05	-38.3117	-60.0865	21 Jan 01:15
13	SS0502	SS05	-38.3860	-58.5159	21 Jan 14:20
14	SS0503	SS05	-38.4446	-57.1683	22 Jan 00:00
15	SS0504	SS05	-38.5079	-55.5957	22 Jan 14:11
16	SS0505	SS05	-38.5581	-54.2482	22 Jan 23:51
17	SS0506	SS05	-38.6051	-52.9019	23 Jan 13:32
18	SS0801	SS08	-44.6999	-55.5132	24 Jan 23:41
19	SS0802	SS08	-44.8985	-57.0823	25 Jan 14:36
20	SS0803	SS08	-45.0826	-58.4267	26 Jan 00:16
21	SS0804	SS08	-45.3157	-59.9933	26 Jan 14:23
22	SS0805	SS08	-45.4587	-60.8873	27 Jan 00:11
23	SS0806	SS08	-45.7690	-62.6711	27 Jan 14:36
24	SOI0201	SOI02	-44.0864	-60.7096	28 Jan 20:02
25	SOI0301	SOI03	-45.0948	-59.7768	29 Jan 01:18
26	SOI0401	SOI04	-46.2158	-59.7299	29 Jan 19:29
27	SOI0402	SOI04	-46.3817	-60.6231	29 Jan 23:57
28	AP1101	AP11	-50.3436	-60.8879	30 Jan 15:40
29	AP1102	AP11	-51.6909	-59.7185	31 Jan 00:22
30	AP1103	AP11	-52.7420	-58.7345	31 Jan 11:23
31	AP1401	AP14	-58.8057	-60.0060	01 Feb 05:59
32	AP1402	AP14	-57.7186	-61.2427	01 Feb 14:41
33	AP1403	AP14	-56.3368	-62.6736	02 Feb 00:30
34	AP1701	AP17	-63.6028	-64.0762	03 Feb 00:08
35	AP1702	AP17	-65.1266	-61.9409	03 Feb 15:28
36	AP1703	AP17	-65.9425	-60.6521	04 Feb 00:10

Table 13: Provisional positions for net and CTD sampling stations for Ship 3. Times are GMT. (Back to

text)

Station	Station-id	Transect	Longitude	Latitude	Date & time
1	SS0301	SS03	-35.3969	-52.3671	14 Jan 13:46
2	SS0302	SS03	-35.2440	-53.7099	14 Jan 23:25
3	SS0303	SS03	-35.0806	-55.0539	15 Jan 12:52
4	SS0304	SS03	-34.8753	-56.6226	15 Jan 23:49
5	SS0305	SS03	-34.6521	-58.1907	16 Jan 13:46
6	SS0306	SS03	-34.4086	-59.7572	17 Jan 00:42
7	SS0307	SS03	-34.1419	-61.3207	17 Jan 13:11
8	SS0601	SS06	-40.3234	-60.0965	18 Jan 13:35
9	SS0602	SS06	-40.3091	-58.5255	19 Jan 00:31
10	SS0603	SS06	-40.2961	-56.9529	19 Jan 14:00
11	SS0604	SS06	-40.2858	-55.6046	19 Jan 23:40
12	SS0605	SS06	-40.2746	-54.0323	20 Jan 14:08
13	SS0606	SS06	-40.2657	-52.6859	20 Jan 23:47
14	SS0901	SS09	-46.9069	-55.6322	22 Jan 14:32
15	SS0902	SS09	-47.1562	-56.9734	23 Jan 00:12
16	SS0903	SS09	-47.4706	-58.5370	23 Jan 14:33
17	SS0904	SS09	-47.7629	-59.8754	24 Jan 00:12
18	SS0905	SS09	-48.1900	-61.6558	24 Jan 14:45
19	AP1201	AP12	-50.1248	-63.2510	25 Jan 03:32
20	AP1202	AP12	-51.6568	-62.0233	25 Jan 14:34
21	AP1203	AP12	-53.0033	-60.8403	26 Jan 00:13
22	AP1204	AP12	-54.6487	-59.2442	26 Jan 14:39
23	AP1501	AP15	-60.7156	-60.8449	27 Jan 15:03
24	AP1502	AP15	-59.6764	-62.0971	28 Jan 00:42
25	AP1801	AP18	-65.6257	-63.6743	29 Jan 15:18
26	AP1802	AP18	-66.4672	-62.3828	30 Jan 00:57
27	AP1803	AP18	-67.4827	-60.6532	30 Jan 15:20
28	SSI0201	SSI02	-56.3241	-60.6831	01 Feb 20:11
29	SSI0301	SSI03	-56.8563	-61.7915	02 Feb 08:51

30	SSI0401	SSI04	-57.9514	-62.0227	02 Feb 21:52
31	SSI0501	SSI05	-59.6069	-61.3797	03 Feb 09:54
32	SSI0601	SSI06	-60.9750	-61.6381	03 Feb 23:36
33	SSI0701	SSI07	-61.0057	-62.6053	04 Feb 11:25
34	SSI0801	SSI08	-62.6133	-62.8770	05 Feb 01:31
35	SSI0802	SSI08	-63.2521	-62.0290	05 Feb 12:59

Figures

Figure 1. CCAMLR-2000 synoptic survey cruise track for Ship 1 (UK vessel).

Figure 2. CCAMLR-2000 synoptic survey cruise track for Ship 2 (USA vessel).

Figure 3. CCAMLR-2000 synoptic survey cruise track for Ship 3 (Japanese vessel).

Figure 4. CCAMLR-2000 synoptic survey cruise tracks with the boundaries shown for Subarea 48.1, 48.2 and 48.3.

Figure 5. CCAMLR-2000 synoptic survey cruise tracks with positions where krill catches have been reported during the period 1986 to 1992 (CCAMLR, 1997).

Figure 6. CCAMLR-2000 synoptic survey cruise tracks with climatic positions of the major fronts in the Antarctic Circumpolar Current. SAF - Subantarctic Front; PF - Polar Front; SACCf - Southern ACC Front; SACCb - Southern ACC boundary. Positions of fronts after Orsi et al. (1995), with the Polar Front modified after Trathan et al. (1997).

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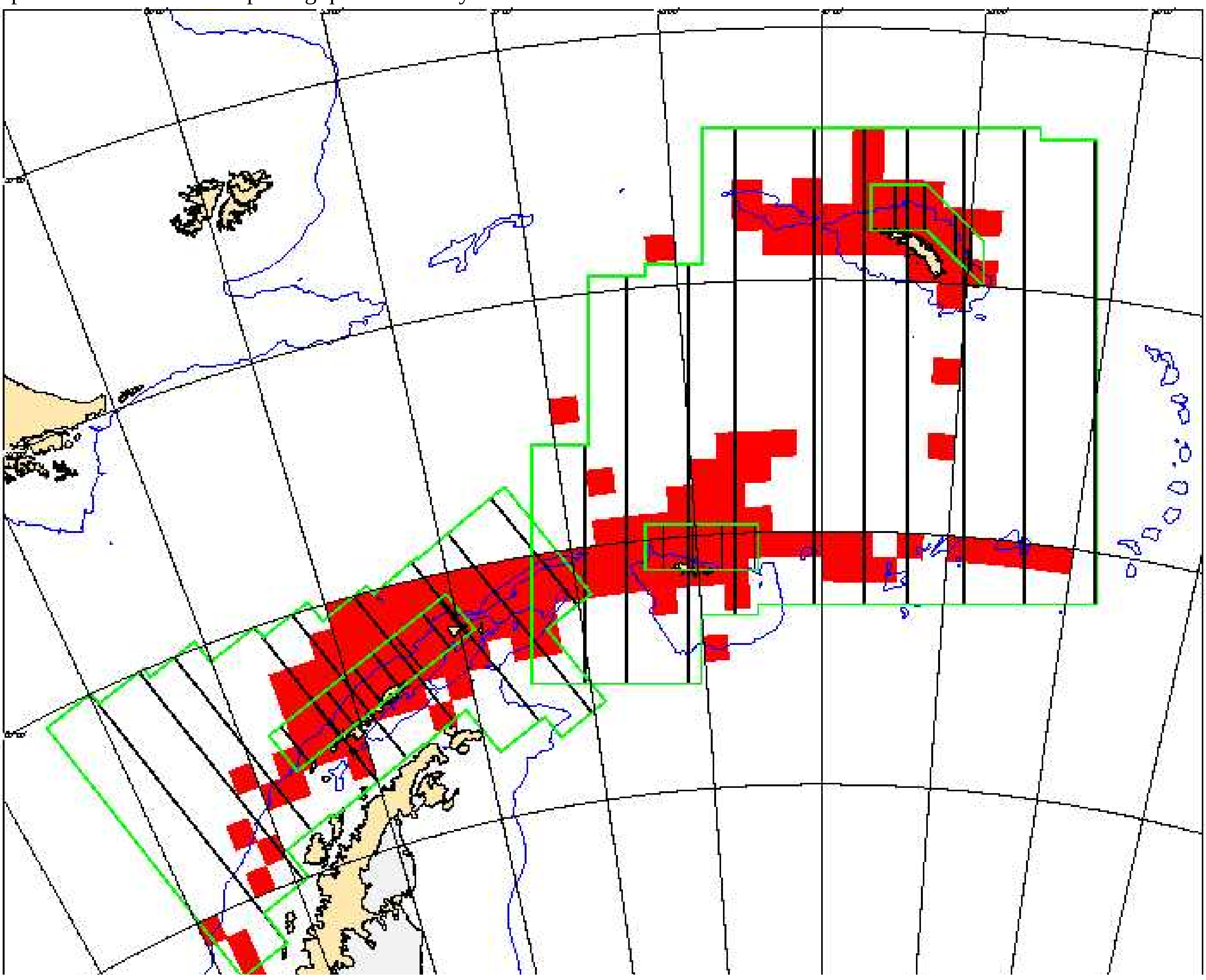
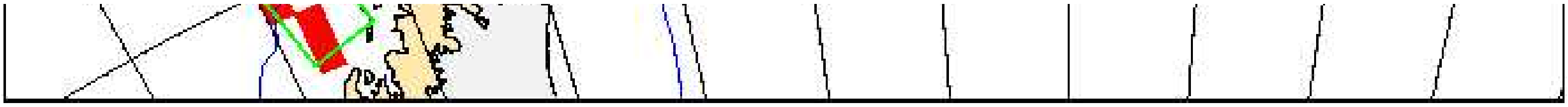
The CCAMLR krill synoptic survey

Transects in relation to areas where the commercial fishery has operated

Red grid squares (half degree longitude by one degree latitude) show where the catches greater than 4 tonnes have been reported in a CCAMLR reporting quarter of the year on at least one occasion between 1986 and 1992.





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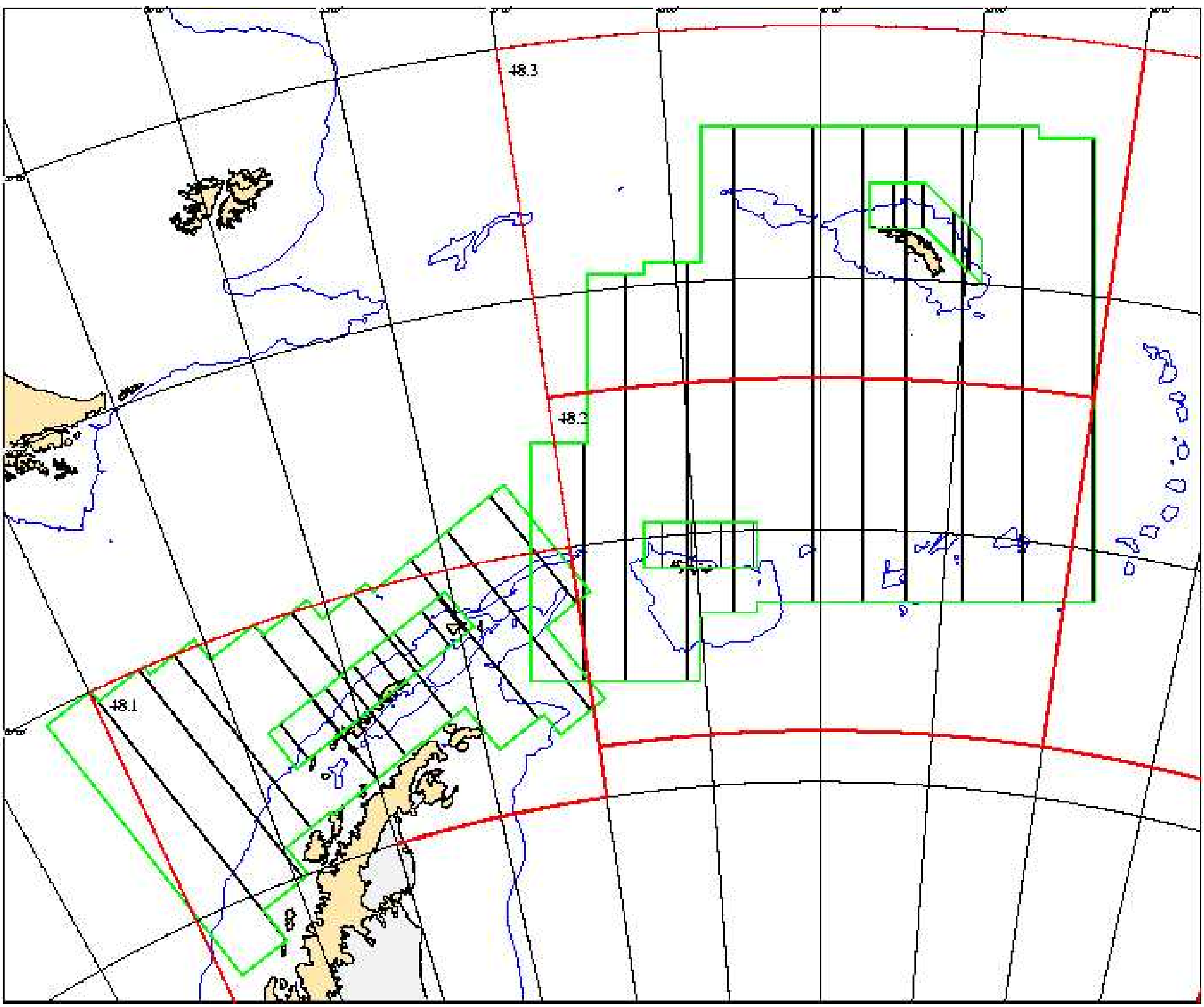
The CCAMLR krill synoptic survey

Transects in relation to FAO statistical areas

The three major subareas (48.1, 48.2 & 48.3) can be seen in relation to the large-scale and meso-scale transects of the synoptic survey. In addition, a small area of Area 41, to the north of Subarea 48.1, will be sampled.



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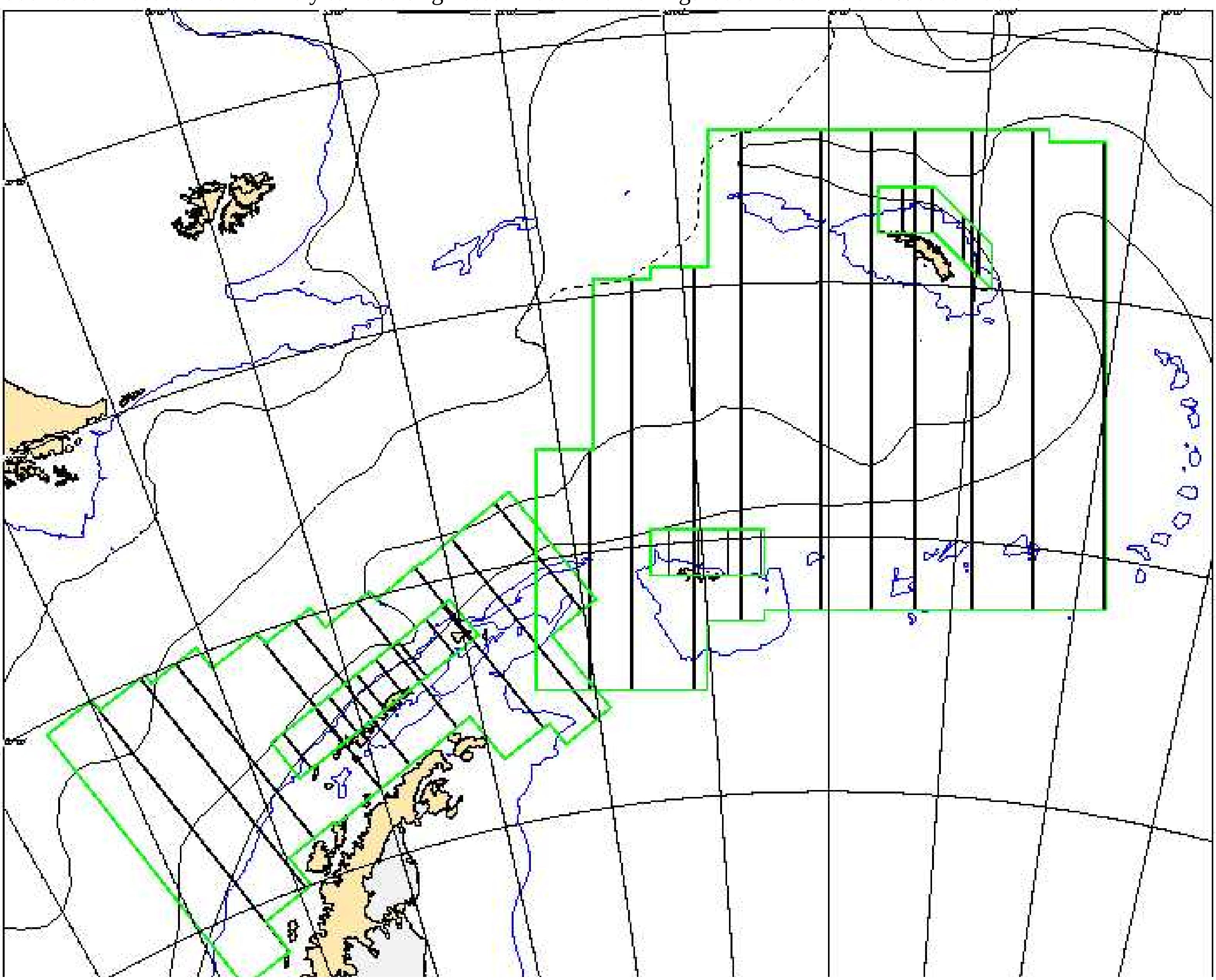
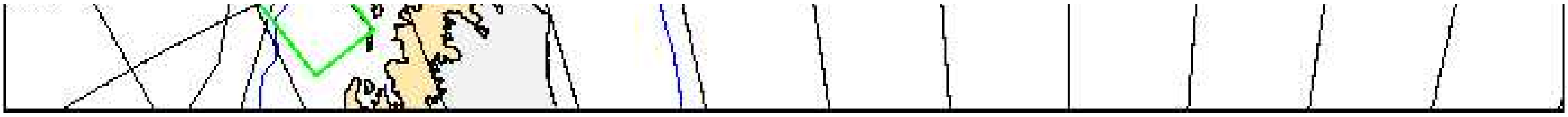
The CCAMLR krill synoptic survey

Transects in relation to oceanic frontal boundaries

The major fronts of the Antarctic Circumpolar Current (ACC) are identified, as black lines from north to south, as Subantarctic Front (SAF), Polar Front (PF), southern ACC Front (SACCF), southern ACC Boundary after Orsi et al. (1995). The dotted black line represents the course of the PF according to Trathan et al. (1997). The transects have been arranged to cover water masses that are likely to have originated in both the Bellingshausen Sea and the Weddell Sea.





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The CCAMLR krill synoptic survey

Planning meeting invitation

Letter sent out as SC-CIRC

Dear colleagues,

The CCAMLR krill synoptic survey will take place in January 2000. The primary objective of the synoptic survey is to improve estimates of Bo (pre-exploitation biomass) used in the krill yield model to estimate sustainable yield for Area 48 (SC-CAMLR-XII, paragraphs 2.39 and 2.41 to 2.47). At the 1998 meeting of WG-EMM plans for the synoptic krill survey in Area 48 were discussed (SC-CAMLR-XVII/3, paragraphs 9.49 to 9.90). At that meeting we received a firm committment from 3 countries (Japan, UK, USA) to participate in the survey and had expressions of interest from Brazil, Korea and Russia. It was agreed that a planning meeting should be held in March 1999 to finalize plans for the survey.

This planning meeting will take place in Cambridge (UK) from 8-12 March 1999. We invite all participating nations to send representatives (cruise leaders and/or key experts) to the meeting. Please inform the Survey Co-ordinator of your intention to attend the meeting as soon as possible and no later than 15 February 1999.

For nations that would like to participate in the survey it is vital that you indicate your intention to participate prior to the planning meeting. Such notification should set out the intended level of your particpation and the facilities that you will be able to offer. The planning meeting will offer the last chance to co-ordinate participation prior to detailed planning of the survey itself.

If there are individuals with appropriate skills who would like to take part in the survey even though their country is unable to participate then we would like to hear from you as soon as possible. There are likely to be a limited number of berths available for key experts.

For further information on the survey and the planning meeting please contact the Survey Co-ordinator.

Yours faithfully

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The CCAMLR krill synoptic survey

Planning meeting agenda

1. Introduction
    1. welcome by Director (BAS)
    2. meeting arrangements
2. Adoption of agenda
3. Survey design
    1. timing (time available, start times)
    2. assessment of survey coverage in relation to physical and biological variables
    3. randomization of surveys (explanation of techniques)
    4. boundaries and sampling intensity of second stratum
    5. intercalibration
    6. integration of national regional surveys
    7. contingency plans (bad weather etc)
    8. additional survey tracks for new participants
4. Primary protocols
    1. acoustics including calibration
    2. net sampling for population structure and target strength
    3. CTD's and station ADCP
5. Opportunities for secondary sampling
    1. predator observations (IWC collaboration)
    2. larval krill/zooplankton/macrozooplankton
    3. krill feeding, growth
    4. physical environment - towed undulator
    5. others
6. Secondary protocols
    1. predator observations
    2. sea surface samples

   3. underway ADCP
   4. chlorophyll, nutrient, dissolved oxygen measurements
   5. others
7. Data entry, maintenance and archive requirements for cruise
8. Data analysis
   1. time table
   2. workshop
   3. methods
   4. publication strategy
9. International experts
   1. allocation of additional experts
   2. intership exchanges
   3. collaboration with other programmes
10. Preparation of report
    1. report of meeting to WG-EMM
    2. preparation of protocols
    3. dissemination on web-site
11. Additional discussion groups
    1. beyond the EK500 (Acousticians)
    2. RMT8 and associated equipment

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The CCAMLR krill synoptic survey

Report of Planning Meeting

British Antarctic Survey, 8-12 March 1999

1 A planning meeting for the CCAMLR-sponsored multi-national, multi-ship near-synoptic acoustic survey for krill biomass in Area 48 to be conducted in January 2000 (hereafter referred to as CCAMLR-2000) was convened by J. Watkins and held at the British Antarctic Survey during the week of 8 through 12 March 1999. Also in attendance were A. Brierley, I. Everson, C. Goss, A Murray, J. Priddle, K. Reid, P. Trathan, and P. Ward from the UK; T. Pauly from Australia; S. Kim from Korea, M. Naganobu and S. Kawaguchi from Japan; and D. Demer and R. Hewitt from the U.S.A.

2 S. Hedley, representing the International Whaling Commission (IWC) was also present and expressed her gratitude for the opportunity to explain the IWC's broad objectives with regard to the study of cetaceans and their habitat and to present the IWC request to participate on CCAMLR-2000. She also expressed the hope for fruitful collaboration between IWC and CCAMLR scientists as well as a closer relationship between the two organizations.

Survey Design

3 The group reaffirmed that the principal participants conducting of the survey will be Japan, the U.K. and the U.S.A. The time period of the survey would be early January to mid-February with specific start and stop dates dictated by the necessities of national programs. Each country would contribute 30 days of ship time for the conduct of CCAMLR-2000. Specific ship schedules are listed under Itinerary.

4 S. Kim noted that the CCAMLR Sub-Group on International Coordination intends to encourage several countries who plan to have field programs in the vicinity of the South Shetland Islands during

the austral summer of 1999/2000 to repeat the CCAMLR-2000 transects in this area. The close-spaced CCAMLR-2000 transects on the north side of the South Shetland Islands are likely to be surveyed four times (one by Korea in late-December, one by Japan in late-December, one by the CCAMLR-2000 survey vessel in late January/early February, and one by the U.S.A. in late February/early March).

5 It was understood that Brazil, Russia and the Ukraine are also interested in participating but that each of these countries is not in a position to make firm commitments at this time to CCAMLR-2000. It was further reported that the Ukraine will be conducting field work in the vicinity of the South Orkneys during the 1999/2000 austral summer and that their ship will be equipped with an echo sounder other than a Simrad EK500; that Russia may have a research vessel available during the survey period and that it will be equipped with a Simrad EK500 echo sounder; and that Brazil has a research vessel equipped with an EK500 but that the availability of this ship during the survey period is less certain. Accordingly, it was decided that the Ukrainians would be encouraged to conduct an acoustic survey with a calibrated system in the vicinity of the South Orkneys and that this information could be used to complement the planned survey coverage and as an aid in the interpretation of survey results. It was also decided that if Russia were able to participate that they would be encouraged to conduct a replicate of one of the three planned survey tracklines with a calibrated EK500 system.

6 It was recognized that the extent of sea ice may affect the degree to which the southward extent of planned transect lines may be conducted. It was agreed, therefore, to examine recent trends in the annual extent of sea ice and if a reasonable probability existed that the planned transect lines could not be completed, then the survey design would be adjusted so as to achieve a more efficient use of time.

7 During a discussion of the survey design it was noted that the proposed transects run along meridians were not parallel, converging as they approach the pole. Considerable discussion ensued weighing the advantages of design simplicity against the disadvantages of over-sampling the higher latitudes relative to the lower ones (transect spacing at the highest latitudes would be approximately 65% of the transect spacing at the lowest latitudes). Ultimately, it was decided to use transects that were parallel on the earth's surface. In order to orient these transects as closely as possible along the prevailing topographic gradient the area was divided into two grids. The first grid includes subareas 48.2 and 48.3 and was aligned N-S along the 40° W meridian. The second was aligned along a bearing of 330° at 50° W in order to take account of the topography in subarea 48.1. These grids were used to describe the nominal survey design, which would yield the maximum survey coverage using the available ship time. A randomization scheme will now be applied to all possible parallel transects on this grid to achieve the final survey design. Every third transect will then be assigned to each ship and cruise tracks will be laid out. Each transect will have a unique number. In addition the nominal noon and midnight stations will be laid out for each transect and be assigned a unique number. A. Murray agreed to undertake these tasks with the understanding that his work is critical to the success of CCAMLR-2000 and should be thoroughly checked.

8 Weather contingencies were discussed and it was agreed that the following guidelines would be adopted by each cruise leader in the event that weather and/or equipment failure caused introduced delays such that the survey could not be completed within the allotted time. Noon and midnight stations

will be placed along each transect (the actual time of the station will vary according to the net sampling rules laid out in paragraph 10 below and adjustment for local apparent time). The cruise leader on each survey vessel will check progress against the expected time at the station and make adjustments if necessary according to the following hierarchical scheme:

1. Lengthen daytime acoustic survey operations by beginning and ending acoustic transects at the local apparent time of civil twilight; else
2. Increase vessel speed without sacrificing quality of acoustic data (see Acoustic Sampling Protocol for guidance); else
3. Delete daytime net sampling and CTD cast.

In addition, the cruise leader will check progress against the expected time at the approximate mid-point of each major transect (7 for each ship) and make adjustments if necessary according to the following hierarchical scheme:

1. Break survey work on current line and redirect the survey vessel toward the beginning of the next transect; else
2. Break survey work on current line and redirect the survey vessel toward the most adjacent point on the next transect; else
3. Delete an entire transect according to a randomly determined transect ranking order (to be provided).

Primary Protocols

9 During a discussion of acoustic sampling protocols it was reaffirmed that acoustic data should be collected at all times. The costs of data storage were considered to be relatively cheap when compared to the cost of missing data collection that may prove useful for future analysis. This principle pertains to time periods while calibrating, to noisy conditions during rough seas, to station times, and to transits between sampling transects. The directive, in essence, is to turn on the echo sounder and record data from the time the ship leaves the pier to the time it returns again. It was also noted that additional specifications regarding the characterization of noise and operational guidelines as to its acceptable level should be developed; that guidelines should be developed for simultaneous use of echo sounders and ADCPs; that lists of instrument settings for calibration and underway data collection should be developed and distributed among survey participants; and that during calibration only TS gain and Sv gain be adjusted while keeping axis offset angles (in the case of split beam transducers) set to zero and the beam angles set to the manufacturer’s description, adjusted for sound speed, for the specific transducer. In light of the fact that the acoustic data are critical to the success of CCAMLR-2000, it was also emphasized that data should be recorded redundantly and equipment spares should be aboard each ship. These and other issues are to be addressed in a updated Acoustic Sampling Protocol.

10 During a discussion of net sampling protocols it was noted that some directed net sampling effort would be necessary to reduce the uncertainty associated with the delineation of krill in the acoustic data

record. This sampling would be directed at a variety of "acoustic morphs", some presumed to be krill and some presumed not to be krill, and, as such, would not be appropriate for the primary purpose of the net sampling as stated at the WG-EMM meeting in Cochin; that is, the description of krill population demography. Nonetheless, it was noted by the group that the primary purpose of CCAMLR-2000 is to provide an estimate of B_0 from an acoustic survey and some directed sampling is necessary to achieve this end. Discussion further ensued as to whether the net sampling effort should be increased by reducing the number and/or length of acoustic transects or whether the currently planned net sampling effort (one tow at midnight and another at midday) should be reallocated with some tows used for directed sampling and others as standard oblique tows at pre-determined locations. Again, the primary purpose of CCAMLR-2000 was invoked as a rationale for reallocating net sampling effort rather than reducing acoustic sampling effort. The following fishing strategy was adopted:

1. At local apparent midnight conduct a standard oblique tow in conjunction with a CTD cast.
2. From the time of local apparent sunrise to local apparent noon conduct a directed tow if an acoustic morph of interest was detected and a reasonable chance of sampling it existed.
3. If a directed tow was conducted between local apparent sunrise and three hours before local apparent noon, delay the CTD cast until local apparent noon.
4. If a directed tow was conducted after three hours before local apparent noon, conduct the CTD cast at the same locale.
5. If no suitable acoustic morphs were detected by local apparent noon, conduct a standard oblique tow in conjunction with a CTD cast.

Additional issues were raised during discussion of the net sampling protocol including the desire to standardize nets among all participants, the treatment of "other zooplankton", and the use of additional nets for sampling smaller zooplankton. These issues were addressed in the revised Net Sampling Protocols. It was noted that Japan does not currently have access to an RMT-8 net and that this may be addressed by inviting the participation of an outside expert, together with an RMT-8 net, on the Japanese survey vessel.

11 During a discussion of the CTD protocols, it was noted that both the general flow pattern across the Scotia Sea as well as the position of fronts were important determinates of the dispersion of krill and that describing these should be the objectives of the oceanographic sampling protocol. It was further noted that CTD sampling to the depth of a particular oceanographic feature (eg. a vertical boundary of the circumpolar deep water) may be more rational than sampling to an arbitrary depth of 1000m. This could be considered a plane of no motion for geostrophic calculations as it relates to the structuring of krill habitat. Discussion ensued as to whether this would add to the time required to conduct the CTD casts, but without a detailed analysis of climatic atlases this question could not be readily answered. It was also noted that the U.K. intends to collect ADCP measurements to approximately 400m depth with hull-mounted transducers and that Japan intends to collect LADCP measurements over the full extent of the CTD cast; only the U.S. does not expect to make ADCP measurements. These measurements of absoulute currents may be used to interpret CTD data. It was therefore decided that the current protocol (CTD casts to 1000m depth (or to the bottom if shallower) should stand pending investigation of the

climatological depth of UCDW. It was further noted that the position of fronts along the transects could be more accurately described with the use of towed and/or expendable sensors. Issues relating to CTD measurements are addressed in the revised CTD Protocols.

Secondary Sampling

12 S. Hedley presented an overview of the IWC's objectives, sampling methods, and personnel requirements for their participation on CCAMLR-2000. Discussion ensued as the value of relative versus absolute estimates of cetacean abundance. The IWC's short-term objective with regard to CCAMLR 2000 is to relate the spatial distribution of baleen whales to krill and other environmental covariates; in this regard relative abundance may be adequate. There is some debate, however, within the IWC scientific community on this point. On the other hand, the IWC's long range objective is to evaluate the impact of baleen whale consumption on the krill resource (presumably this is of direct interest to CCAMLR as well); in this regard absolute estimates of whale abundance are more appropriate. For CCAMLR-2000 the IWC would like to achieve 100% coverage of all transects using the double platform method which will generate absolute estimates of whale abundance. This would require two 4-observer teams (8 berths) on each survey vessel. Tradeoffs between transect coverage and the proportion of the survey that could be conducted using the double platform method were described if fewer berths were available. It was noted that firm commitments needed to be passed by the CCAMLR-2000 coordinator to Greg Donovan at IWC in time for the annual meeting in May. The final protocols for pelagic krill predator observations may differ between ships and will be determined in consultation with the IWC and published on the web site.

13 The extraordinary opportunity offered by CCAMLR-2000 to sample zooplankton across the Scotia Sea was discussed. Sampling may be accomplished without jeopardizing the primary sampling operations by adding a set of 1 m^2 333 micron mesh nets to the RMT-8 sampler which will be used to sample krill and other micro-nekton. Specific protocols were not developed except to note the value to all participants of a common zooplankton database, which could be accessed via the CCAMLR-2000 web site. Phytoplankton sampling was also discussed and it was determined that all three survey vessels will have fluorometers mounted on their flow-through systems as well as CTD instrument packages and will also make chlorophyll extractions from water samples. Additional measurements will vary among vessels and it was agreed that observation protocols would be posted on the web site as they are developed. It was further noted that water samples could be preserved in a Lugol's solution for subsequent analysis, but that the shelf life of such samples was only two years.

14 Underway observation systems will be maintained by all three survey vessels. Measurements will include wind speed and direction, air pressure, humidity, photosynthetically available radiation, sea surface temperature, salinity, turbidity and fluoresence. In addition, Japan will collect continuous measurements of particle volumes (as a proxy for zooplankton) and dissolved oxygen. The U.K. will also tow an undulating oceanographic recorder which will contain an optical plankton recorder and make additional measurements of photosynthetically available radiance, fluoresence, turbidity, salinity and temperature. It was noted that it would be advisable to standardize averaging intervals among the

three vessels. Japan has an ADCP that could be operated continuously, however, current plans call for it to be secured during underway operations and an LADCP used instead in conjunction with CTD casts. The U.K. will operate an underway ADCP but the U.S.A. has no current plans to do so.

15 The potential value of satellite imagery was discussed and was agreed that J. Watkins would investigate the various products that would be appropriate complements to CCAMLR-2000. In this regard it may be necessary to request SeaWiFS ground stations at Palmer and/or Rothera to archive specific imagery.

Data Collection and Archiving

16 With regard to the conduct of acoustic transects it was agreed that after the completion of station observations each survey vessel would relocate to the closest point along the intended transect before proceeding to the next station.

17 The utility of maintaining an underway log was emphasized. Such a log would contain notes regarding the start and stop times of acoustic transects, comments on weather conditions and sea state as they affect the acoustic records, unusual features noted in the acoustic data, and any other details that may be of use when interpreting the acoustic data after the survey is finished. Similar notes obtained in conjunction with net sampling and CTD operations would clearly be useful as well. Discussion ensued regarding routine logs and the various numbering systems for activities and stations employed by different national programs. It was agreed that, as a minimum, the start and end times and positions of all operations should be recorded in an electronic format such that a list could be made up and queried for all activities conducted at a given set of stations or, alternatively, all locations where a given set of activities was conducted.

18 With regard to computer problems associated with the year 2000 (Y2K), all vessel coordinators were encouraged to check the GPS receivers on their ships that will be in use during CCAMLR-2000. These receivers will be the primary source for time stamping the acoustic date set and must be compatible with the millenium change. It is highly desirable that all data collections on a survey vessel are referenced to the same time standard and thus redundant Y2K compliant GPS receivers are critical. Vessel coordinators were also encouraged to check with Simrad and SonarData for assurances that their equipment and software has been tested for Y2K compliance.

Data Analysis

19 The group reaffirmed and strongly endorsed the decisions made at the last planning session for CCAMLR-2000 held during the WG-EMM meeting in 1998 at Cochin, India, that a) the collection of acoustic data, micro-nekton samples from RMT-8 nets, and CTD profiles would form the core data sets, and that b) the analyses and interpretation of these core data sets, and the reporting of results, would be conducted in a collaborative fashion. The core data sets refer to those collected according to the survey

design described in Paragraph 7.

20 It was agreed that because an estimate of B0 derived from the acoustic data is expected to be tabled at the meeting of WG-EMM in July 2000, a data workshop should be held sometime during May-June 2000. It was tentatively agreed that the workshop would be held over a one to two week period in La Jolla where computational facilities and other logistic support are readily available. It was emphasized that results from the directed net sampling for identification of acoustic morphs, the oblique net sampling for the determination of krill demographic structure and the oceanographic sampling would be of value in interpreting the acoustic records. As such, it will be highly desirable to include these elements in the workshop. It was also recognized that summary statistics from the regional surveys conducted at South Georgia and the South Shetland Islands would be valuable in the interpretation of the results.

21 With regard to analysis of the acoustic data it was noted the two of the most important tasks will be target strength estimation and the apportionment of backscattered energy to krill and other scatterers of lesser interest. It is anticipated that several methods of accomplishing these tasks will be applied to the data set and results compared as part of the final report to WG-EMM. Accordingly, it was suggested that working papers on various techniques to estimate TS and to delineate taxa in the acoustic data set be invited for the upcoming meeting of WG-EMM in July 1999, that time be requested at that meeting for survey participants to discuss these methods and to select the most promising methods, and that individual scientists be commissioned to develop the computer code required to implement the selected methods on a production basis. This code could then be brought to the workshop and applied to the data sets at hand with the potential of saving a substantial amount of time that would otherwise be spent at the workshop accomplishing these preliminary tasks. The group agreed to this idea in principle.

22 It was also emphasized that the May/June 2000 workshop would be only the first of many workshops and collaborative analyses that may be expected in the aftermath of CCAMLR-2000.

Other Issues

23 J. Watkins reported to the group that D. Miller from South Africa and V. Siegel from Germany had expressed interest in participating in CCAMLR-2000. It was agreed that their participation was very desirable and that recommendations as to how to best deploy additional experts should be made after all expressions of interest are received and a better idea of how they could contribute is in hand. Exchange of personnel between ships was also discussed and it was decided that such agreements would be first explored between national programs and ultimately coordinated by the CCAMLR-2000 coordinator (J. Watkins). M. Naganobu noted that Japan would not be able to send any personnel to other ships but would welcome experts in the field of acoustics and net sampling, particularly if the latter were able to bring an RMT-8 net.

24 The importance of maintaining liaison with other institutions and groups conducting field programs in this sector of the Southern Ocean was recognized. In particular, it was recognized that substantial

benefits could accrue by making these groups aware of the developing plans for CCAMLR-2000 and inviting their comments and suggestions. It was recognized that there could be several collaborative opportunities of which we are currently unaware and that individual scientists should actively engage colleagues outside of the CCAMLR community regarding planned operations and the existence of the web site. In particular, the group agreed that the coordinators for SO-GLOBEC (S. Kim and E. Hoffman) should be contacted.

25 M. Naganobu presented a plan to conduct a series of deep CTD casts across the Drake Passage (following the standard WOCE transect) with the intention of describing the flow field. The group recognized the potential value of such a set of observations and enthusiastically endorsed the plan.

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The CCAMLR krill synoptic survey

Planning Meeting

Appendix II - List of actions resulting from planning meeting

Action	Reference	Responsible
Update ships schedules	Paragraph 3	Watkins
Examine recent trends in sea ice extent	Paragraph 6	Hewitt
Finalize survey design • determine exact transect alignment • randomize transects • produce final survey plot • check calculations • produce station plots • produce grid of day length for different dates and lat/lon	Paragraph 7	Murray, Trathan & Watkins

Further development of acoustic protocols • noise measurement protocols • guidelines for concurrent operation of EK500 and ADCP	Paragraph 9	Demer, Brierley & Pauly
Further development of net sampling protocols	Paragraph 10	Watkins, Kawaguchi & Siegel
Further development of CTD protocols • explore climatological depth of Upper Circumpolar Deep Water	Paragraph 11	Amos, Naganobu & Trathan
Inform IWC of berths available on each ship	Paragraph 12	Watkins
Produce guidelines for zooplankton sampling	Paragraph 13	Watkins, Siegel and Kawaguchi
Produce guidelines for surface monitoring	Paragraph 14	Priddle, Watkins & others
Investigate availability of satellite imagery	Paragraph 15	Watkins & Trathan
Contact Southern Ocean -GLOBEC co-ordinators	Paragraph 24	Watkins

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The CCAMLR krill synoptic survey

Planning Meeting Participants

Some of the participants at the CCAMLR Synoptic Survey Planning Meeting held at British Antarctic Survey, Cambridge from 8 to 12 March 1999. From the left Dr So Kawaguchi (Japan), Dr Roger Hewitt (USA), Mr Keith Reid (UK), Dr Phil Trathan (UK), Dr Andrew Brierley (USA), Dr Suam Kim (Korea), Ms Cathy Goss (UK), Mr Alistair Murray (UK), Dr David Demer (USA), Dr Jon Watkins (UK), Dr Mikio Naganobu (Japan). Photo courtesy of Dr Naganobu.

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The CCAMLR krill synoptic survey

Acoustic sampling protocols

Appendix A - Survey settings

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/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/ANGLE SENS.ATHW.=15.7
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/3 DB BEAMW.ALONG=9.4 DG
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/3 DB BEAMW.ATHW.=9.3 DG
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/TRANSDUCER TYPE=200-28 /TRANSCEIVER MENU/TRANSCEIVER-3 MENU/TRANSDUCER DEPTH=0.00 M
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/2-WAY BEAM ANGLE=-20.9 DB
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/SV TRANSD. GAIN=23.26 DB
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/TS TRANSD. GAIN=23.18 DB
/ETHERNET COM. MENU/LOCAL ETH ADDR.=08:00:14:51:57:90
/ETHERNET COM. MENU/LOCAL IP ADDR.=193.061.088.151
/ETHERNET COM. MENU/REMOTE ETH ADDR.=08:00:20:78:28:1F

/ETHERNET COM. MENU/REMOTE IP ADDR.=193.061.088.255
/NAVIGATION MENU/NAVIG. INPUT=SERIAL
/NAVIGATION MENU/START SEQUENCE=$GPGGA
/NAVIGATION MENU/SEPARATION CHAR.=002C
/NAVIGATION MENU/STOP CHARACTER=000D
/NAVIGATION MENU/FIRST FIELD NO.=2
/NAVIGATION MENU/NO. OF FIELDS=6
/NAVIGATION MENU/SPEED INPUT=MANUAL
/NAVIGATION MENU/MANUAL SPEED=10.0 KNT
/NAVIGATION MENU/NMEA TRANSFER=ON
/NAVIGATION MENU/BAUDRATE=4800
/NAVIGATION MENU/BITS PER CHAR.=8
/NAVIGATION MENU/STOP BITS=2
/NAVIGATION MENU/PARITY=NONE

This protocol has been developed by D.A. Demer (U.S.A.), Andrew Brierley (U.K.) and Tim Pauly (Australia)
Page last updated on 17 March 1999

The CCAMLR krill synoptic survey

Acoustic sampling protocols

Appendix B-- Calibration Settings:

/OPERATION MENU/PING MODE=NORMAL
/OPERATION MENU/PING AUTO START=OFF
/OPERATION MENU/PING INTERVAL=2.0 SEC
/OPERATION MENU/TRANSMIT POWER=NORMAL
/OPERATION MENU/NOISE MARGIN=0 DB
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/MODE=ACTIVE
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/TRANSDUCER DEPTH=0.00 M
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/TRANSD. SEQUENCE=OFF
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/ABSORPTION COEF.=10 DBKM
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/PULSE LENGTH=MEDIUM
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/BANDWIDTH=WIDE
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/MAX. POWER=2000 W
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/ALONGSHIP OFFSET=0.00 DG
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/ATHW.SHIP OFFSET=0.00 DG
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/MODE=ACTIVE
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/TRANSDUCER DEPTH=0.00 M
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/TRANSD. SEQUENCE=OFF
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/ABSORPTION COEF.=28 DBKM
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/PULSE LENGTH=LONG
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/BANDWIDTH=NARROW
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/MAX. POWER=1000 W
TRANSCEIVER MENU/TRANSCEIVER-2 MENU/ALONGSHIP OFFSET=0.00 DG
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/ATHW.SHIP OFFSET=0.00 DG
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/MODE=ACTIVE
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/TRANSDUCER DEPTH=0.00 M

/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/TRANSD. SEQUENCE=OFF
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/ABSORPTION COEF.=42 DBKM
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/PULSE LENGTH=LONG
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/BANDWIDTH=NARROW
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/MAX. POWER=1000 W
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/ANGLE SENS.ALONG=0.0
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/ANGLE SENS.ATHW.=0.0
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/3 DB BEAMW.ALONG=7.1 DG
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/3 DB BEAMW.ATHW.=7.1 DG
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/ALONGSHIP OFFSET=0.00 DG
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/ATHW.SHIP OFFSET=0.00 DG
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/MINIMUM DEPTH=10.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/MAXIMUM DEPTH=500 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/MIN. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/MAX. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/BOTTOM LOST AL.=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/MINIMUM LEVEL=-50 DB
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/MINIMUM DEPTH=10.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/MAXIMUM DEPTH=500 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/MIN. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/MAX. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/BOTTOM LOST AL.=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/MINIMUM LEVEL=-50 DB
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/MINIMUM DEPTH=10.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/MAXIMUM DEPTH=500 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/MIN. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/MAX. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/BOTTOM LOST AL.=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/MINIMUM LEVEL=-50 DB
/LOG MENU/MODE=SPEED
/LOG MENU/PING INTERVAL=20
/LOG MENU/TIME INTERVAL=20 SEC
/LOG MENU/DIST. INTERVAL=1.0 NM
/LOG MENU/NM PULSE RATE=200 /NM
/LAYER MENU/SUPER LAYER=1
/LAYER MENU/LAYER-1 MENU/TYPE=PELAGIC
/LAYER MENU/LAYER-1 MENU/RANGE=4.0 M
/LAYER MENU/LAYER-1 MENU/RANGE START=29.0 M
/LAYER MENU/LAYER-1 MENU/MARGIN=1.0 M
/LAYER MENU/LAYER-1 MENU/SV THRESHOLD=-100 DB
/LAYER MENU/LAYER-1 MENU/NO. OF SUBLAYERS=1
/LAYER MENU/LAYER-2 MENU/TYPE=OFF
/LAYER MENU/LAYER-3 MENU/TYPE=OFF

/LAYER MENU/LAYER-4 MENU/TYPE=OFF
/LAYER MENU/LAYER-5 MENU/TYPE=OFF
/LAYER MENU/LAYER-6 MENU/TYPE=OFF
/LAYER MENU/LAYER-7 MENU/TYPE=OFF
/LAYER MENU/LAYER-8 MENU/TYPE=OFF
/LAYER MENU/LAYER-9 MENU/TYPE=OFF
/LAYER MENU/LAYER-10 MENU/TYPE=OFF
/TS DETECTION MENU/TS DETECTION-1 MENU/MIN. VALUE=-60 DB
/TS DETECTION MENU/TS DETECTION-1 MENU/MIN. ECHO LENGTH=0.8
/TS DETECTION MENU/TS DETECTION-1 MENU/MAX. ECHO LENGTH=2.5
/TS DETECTION MENU/TS DETECTION-1 MENU/MAX. GAIN COMP.=4.0 DB
/TS DETECTION MENU/TS DETECTION-1 MENU/MAX. PHASE DEV.=2.0
/TS DETECTION MENU/TS DETECTION-2 MENU/MIN. VALUE=-60 DB
/TS DETECTION MENU/TS DETECTION-2 MENU/MIN. ECHO LENGTH=0.8
/TS DETECTION MENU/TS DETECTION-2 MENU/MAX. ECHO LENGTH=2.5
/TS DETECTION MENU/TS DETECTION-2 MENU/MAX. GAIN COMP.=4.0 DB
/TS DETECTION MENU/TS DETECTION-2 MENU/MAX. PHASE DEV.=2.0
/TS DETECTION MENU/TS DETECTION-3 MENU/MIN. VALUE=-60 DB
/TS DETECTION MENU/TS DETECTION-3 MENU/MIN. ECHO LENGTH=0.8
/TS DETECTION MENU/TS DETECTION-3 MENU/MAX. ECHO LENGTH=2.5
/TS DETECTION MENU/TS DETECTION-3 MENU/MAX. GAIN COMP.=4.0 DB
/TS DETECTION MENU/TS DETECTION-3 MENU/MAX. PHASE DEV.=2.0
/ETHERNET COM. MENU/TELEGRAM MENU/REMOTE CONTROL=ON
/ETHERNET COM. MENU/TELEGRAM MENU/SAMPLE RANGE=0 M
/ETHERNET COM. MENU/TELEGRAM MENU/STATUS=ON
/ETHERNET COM. MENU/TELEGRAM MENU/PARAMETER=ON
/ETHERNET COM. MENU/TELEGRAM MENU/ANNOTATION=OFF
/ETHERNET COM. MENU/TELEGRAM MENU/SOUND VELOCITY=OFF
/ETHERNET COM. MENU/TELEGRAM MENU/NAVIGATION=ON
/ETHERNET COM. MENU/TELEGRAM MENU/MOTION SENSOR=OFF
/ETHERNET COM. MENU/TELEGRAM MENU/DEPTH=1
/ETHERNET COM. MENU/TELEGRAM MENU/DEPTH NMEA=OFF
/ETHERNET COM. MENU/TELEGRAM MENU/ECHOGRAM=1&2&3
/ETHERNET COM. MENU/TELEGRAM MENU/ECHO-TRACE=1&2&3
/ETHERNET COM. MENU/TELEGRAM MENU/SV=OFF
/ETHERNET COM. MENU/TELEGRAM MENU/SAMPLE ANGLE=OFF
/ETHERNET COM. MENU/TELEGRAM MENU/SAMPLE POWER=OFF
/ETHERNET COM. MENU/TELEGRAM MENU/SAMPLE SV=OFF
/ETHERNET COM. MENU/TELEGRAM MENU/SAMPLE TS=OFF
/ETHERNET COM. MENU/TELEGRAM MENU/VESSEL-LOG=ON
/ETHERNET COM. MENU/TELEGRAM MENU/LAYER=ON
/ETHERNET COM. MENU/TELEGRAM MENU/INTEGRATOR=OFF
/ETHERNET COM. MENU/TELEGRAM MENU/TS DISTRIBUTION=OFF

/ETHERNET COM. MENU/TELEGRAM MENU/TOWED FISH=OFF
/ETHERNET COM. MENU/UDP PORT MENU/STATUS=2200
/ETHERNET COM. MENU/UDP PORT MENU/PARAMETER=2200
/ETHERNET COM. MENU/UDP PORT MENU/ANNOTATION=2200
/ETHERNET COM. MENU/UDP PORT MENU/SOUND VELOCITY=2200
/ETHERNET COM. MENU/UDP PORT MENU/NAVIGATION=2200
/ETHERNET COM. MENU/UDP PORT MENU/MOTION SENSOR=2200
/ETHERNET COM. MENU/UDP PORT MENU/DEPTH=2200
/ETHERNET COM. MENU/UDP PORT MENU/ECHOGRAM=2200
/ETHERNET COM. MENU/UDP PORT MENU/ECHO-TRACE=2200
/ETHERNET COM. MENU/UDP PORT MENU/SV=2200
/ETHERNET COM. MENU/UDP PORT MENU/SAMPLE ANGLE=2200
/ETHERNET COM. MENU/UDP PORT MENU/SAMPLE POWER=2200
/ETHERNET COM. MENU/UDP PORT MENU/SAMPLE SV=2200
/ETHERNET COM. MENU/UDP PORT MENU/SAMPLE TS=2200
/ETHERNET COM. MENU/UDP PORT MENU/VESSEL-LOG=2200
/ETHERNET COM. MENU/UDP PORT MENU/LAYER=2200
/ETHERNET COM. MENU/UDP PORT MENU/INTEGRATOR=2200
/ETHERNET COM. MENU/UDP PORT MENU/TS DISTRIBUTION=2200
/ETHERNET COM. MENU/UDP PORT MENU/TOWED FISH=2200
/ETHERNET COM. MENU/ECHOGRAM-1 MENU/RANGE=500 M
/ETHERNET COM. MENU/ECHOGRAM-1 MENU/RANGE START=0 M
/ETHERNET COM. MENU/ECHOGRAM-1 MENU/AUTO RANGE=OFF
/ETHERNET COM. MENU/ECHOGRAM-1 MENU/BOTTOM RANGE=0 M
/ETHERNET COM. MENU/ECHOGRAM-1 MENU/BOT. RANGE START=10 M
/ETHERNET COM. MENU/ECHOGRAM-1 MENU/NO. OF MAIN VAL.=714
/ETHERNET COM. MENU/ECHOGRAM-1 MENU/NO. OF BOT. VAL.=0
/ETHERNET COM. MENU/ECHOGRAM-1 MENU/TVG=20 LOG R
/ETHERNET COM. MENU/ECHOGRAM-2 MENU/RANGE=500 M
/ETHERNET COM. MENU/ECHOGRAM-2 MENU/RANGE START=0 M
/ETHERNET COM. MENU/ECHOGRAM-2 MENU/AUTO RANGE=OFF
/ETHERNET COM. MENU/ECHOGRAM-2 MENU/BOTTOM RANGE=0 M
/ETHERNET COM. MENU/ECHOGRAM-2 MENU/BOT. RANGE START=10 M
/ETHERNET COM. MENU/ECHOGRAM-2 MENU/NO. OF MAIN VAL.=714
/ETHERNET COM. MENU/ECHOGRAM-2 MENU/NO. OF BOT. VAL.=0
/ETHERNET COM. MENU/ECHOGRAM-2 MENU/TVG=20 LOG R
/ETHERNET COM. MENU/ECHOGRAM-3 MENU/RANGE=500 M
/ETHERNET COM. MENU/ECHOGRAM-3 MENU/RANGE START=0 M
/ETHERNET COM. MENU/ECHOGRAM-3 MENU/AUTO RANGE=OFF
/ETHERNET COM. MENU/ECHOGRAM-3 MENU/BOTTOM RANGE=0 M
/ETHERNET COM. MENU/ECHOGRAM-3 MENU/BOT. RANGE START=10 M
/ETHERNET COM. MENU/ECHOGRAM-3 MENU/NO. OF MAIN VAL.=714
/ETHERNET COM. MENU/ECHOGRAM-3 MENU/NO. OF BOT. VAL.=0

/ETHERNET COM. MENU/ECHOGRAM-3 MENU/TVG=20 LOG R
/SERIAL COM. MENU/TELEGRAM MENU/FORMAT=ASCII
/SERIAL COM. MENU/TELEGRAM MENU/MODEM CONTROL=OFF
/SERIAL COM. MENU/TELEGRAM MENU/REMOTE CONTROL=ON
/SERIAL COM. MENU/TELEGRAM MENU/STATUS=OFF
/SERIAL COM. MENU/TELEGRAM MENU/PARAMETER=OFF
/SERIAL COM. MENU/TELEGRAM MENU/ANNOTATION=OFF
/SERIAL COM. MENU/TELEGRAM MENU/NAVIGATION=OFF
/SERIAL COM. MENU/TELEGRAM MENU/SOUND VELOCITY=OFF
/SERIAL COM. MENU/TELEGRAM MENU/MOTION SENSOR=OFF
/SERIAL COM. MENU/TELEGRAM MENU/DEPTH=OFF
/SERIAL COM. MENU/TELEGRAM MENU/DEPTH NMEA=OFF
/SERIAL COM. MENU/TELEGRAM MENU/ECHOGRAM=OFF
/SERIAL COM. MENU/TELEGRAM MENU/ECHO-TRACE=OFF
/SERIAL COM. MENU/TELEGRAM MENU/SV=OFF
/SERIAL COM. MENU/TELEGRAM MENU/VESSEL-LOG=OFF
/SERIAL COM. MENU/TELEGRAM MENU/LAYER=OFF
/SERIAL COM. MENU/TELEGRAM MENU/INTEGRATOR=OFF
/SERIAL COM. MENU/TELEGRAM MENU/TS DISTRIBUTION=OFF
/SERIAL COM. MENU/TELEGRAM MENU/TOWED FISH=OFF
/SERIAL COM. MENU/USART MENU/BAUDRATE=9600
/SERIAL COM. MENU/USART MENU/BITS PER CHAR.=8
/SERIAL COM. MENU/USART MENU/STOP BITS=1
/SERIAL COM. MENU/USART MENU/PARITY=NONE
/MOTION SENSOR MENU/HEAVE=OFF
/MOTION SENSOR MENU/ROLL=OFF
/MOTION SENSOR MENU/PITCH=OFF
/UTILITY MENU/BEEPER=OFF
/UTILITY MENU/STATUS MESSAGES=ON
/UTILITY MENU/RD DISPLAY=OFF
/UTILITY MENU/FIFO OUTPUT=OFF
/UTILITY MENU/EXTERNAL CLOCK=OFF
/UTILITY MENU/DEFAULT SETTING=NO
/UTILITY MENU/LANGUAGE=ENGLISH

This protocol has been developed by D.A. Demer (U.S.A.), Andrew Brierley (U.K.) and Tim Pauly (Australia)
Page last updated on 17 March 1999

The CCAMLR krill synoptic survey

Acoustic sampling protocol

Appendix C -- Noise Settings:

/OPERATION MENU/PING MODE=NORMAL
/OPERATION MENU/PING AUTO START=OFF
/OPERATION MENU/PING INTERVAL=5.0 SEC
/OPERATION MENU/TRANSMIT POWER=NORMAL
/OPERATION MENU/NOISE MARGIN=0 DB
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/MODE=PASSIVE
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/TRANSD. SEQUENCE=OFF
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/ABSORPTION COEF.=10 DBKM
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/PULSE LENGTH=MEDIUM
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/BANDWIDTH=WIDE
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/MAX. POWER=2000 W
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/ALONGSHIP OFFSET=0.00 DG
/TRANSCEIVER MENU/TRANSCEIVER-1 MENU/ATHW.SHIP OFFSET=0.00 DG
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/MODE=PASSIVE
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/TRANSD. SEQUENCE=OFF
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/ABSORPTION COEF.=28 DBKM
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/PULSE LENGTH=LONG
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/BANDWIDTH=NARROW
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/MAX. POWER=1000 W
TRANSCEIVER MENU/TRANSCEIVER-2 MENU/ALONGSHIP OFFSET=0.00 DG
/TRANSCEIVER MENU/TRANSCEIVER-2 MENU/ATHW.SHIP OFFSET=0.00 DG
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/MODE=PASSIVE
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/TRANSD. SEQUENCE=OFF
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/ABSORPTION COEF.=42 DBKM
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/PULSE LENGTH=LONG

/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/BANDWIDTH=NARROW
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/MAX. POWER=1000 W
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/ANGLE SENS.ALONG=0.0
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/ANGLE SENS.ATHW.=0.0
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/3 DB BEAMW.ALONG=7.1 DG
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/3 DB BEAMW.ATHW.=7.1 DG
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/ALONGSHIP OFFSET=0.00 DG
/TRANSCEIVER MENU/TRANSCEIVER-3 MENU/ATHW.SHIP OFFSET=0.00 DG
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/MINIMUM DEPTH=10.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/MAXIMUM DEPTH=500 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/MIN. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/MAX. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/BOTTOM LOST AL.=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-1 MENU/MINIMUM LEVEL=-50 DB
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/MINIMUM DEPTH=10.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/MAXIMUM DEPTH=500 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/MIN. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/MAX. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/BOTTOM LOST AL.=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-2 MENU/MINIMUM LEVEL=-50 DB
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/MINIMUM DEPTH=10.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/MAXIMUM DEPTH=500 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/MIN. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/MAX. DEPTH ALARM=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/BOTTOM LOST AL.=0.0 M
/BOTTOM DETECTION MENU/BOTTOM DETECTION-3 MENU/MINIMUM LEVEL=-50 DB
/LOG MENU/MODE=SPEED
/LOG MENU/PING INTERVAL=20
/LOG MENU/TIME INTERVAL=20 SEC
/LOG MENU/DIST. INTERVAL=1.0 NM
/LOG MENU/NM PULSE RATE=200 /NM
/LAYER MENU/SUPER LAYER=1
/LAYER MENU/LAYER-1 MENU/TYPE=PELAGIC
/LAYER MENU/LAYER-1 MENU/RANGE=0.0 M
/LAYER MENU/LAYER-1 MENU/RANGE START=2500.0 M
/LAYER MENU/LAYER-1 MENU/MARGIN=1.0 M
/LAYER MENU/LAYER-1 MENU/SV THRESHOLD=-100 DB
/LAYER MENU/LAYER-1 MENU/NO. OF SUBLAYERS=1/LAYER MENU/LAYER-1 MENU/
TYPE=OFF
/LAYER MENU/LAYER-2 MENU/TYPE=OFF
/LAYER MENU/LAYER-3 MENU/TYPE=OFF
/LAYER MENU/LAYER-4 MENU/TYPE=OFF
/LAYER MENU/LAYER-5 MENU/TYPE=OFF

/LAYER MENU/LAYER-6 MENU/TYPE=OFF
/LAYER MENU/LAYER-7 MENU/TYPE=OFF
/LAYER MENU/LAYER-8 MENU/TYPE=OFF
/LAYER MENU/LAYER-9 MENU/TYPE=OFF
/LAYER MENU/LAYER-10 MENU/TYPE=OFF
/TS DETECTION MENU/TS DETECTION-1 MENU/MIN. VALUE=-90 DB
/TS DETECTION MENU/TS DETECTION-1 MENU/MIN. ECHO LENGTH=0.8
/TS DETECTION MENU/TS DETECTION-1 MENU/MAX. ECHO LENGTH=2.5
/TS DETECTION MENU/TS DETECTION-1 MENU/MAX. GAIN COMP.=4.0 DB
/TS DETECTION MENU/TS DETECTION-1 MENU/MAX. PHASE DEV.=2.0
/TS DETECTION MENU/TS DETECTION-2 MENU/MIN. VALUE=-90 DB
/TS DETECTION MENU/TS DETECTION-2 MENU/MIN. ECHO LENGTH=0.8
/TS DETECTION MENU/TS DETECTION-2 MENU/MAX. ECHO LENGTH=2.5
/TS DETECTION MENU/TS DETECTION-2 MENU/MAX. GAIN COMP.=4.0 DB
/TS DETECTION MENU/TS DETECTION-2 MENU/MAX. PHASE DEV.=2.0
/TS DETECTION MENU/TS DETECTION-3 MENU/MIN. VALUE=-90 DB
/TS DETECTION MENU/TS DETECTION-3 MENU/MIN. ECHO LENGTH=0.8
/TS DETECTION MENU/TS DETECTION-3 MENU/MAX. ECHO LENGTH=2.5
/TS DETECTION MENU/TS DETECTION-3 MENU/MAX. GAIN COMP.=4.0 DB
/TS DETECTION MENU/TS DETECTION-3 MENU/MAX. PHASE DEV.=2.0
/ETHERNET COM. MENU/TELEGRAM MENU/REMOTE CONTROL=ON
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/UTILITY MENU/FIFO OUTPUT=OFF
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/UTILITY MENU/DEFAULT SETTING=NO
/UTILITY MENU/LANGUAGE=ENGLISH

This protocol has been developed by D.A. Demer (U.S.A.), Andrew Brierley (U.K.) and Tim Pauly (Australia)
Page last updated on 17 March 1999

The CCAMLR krill synoptic survey

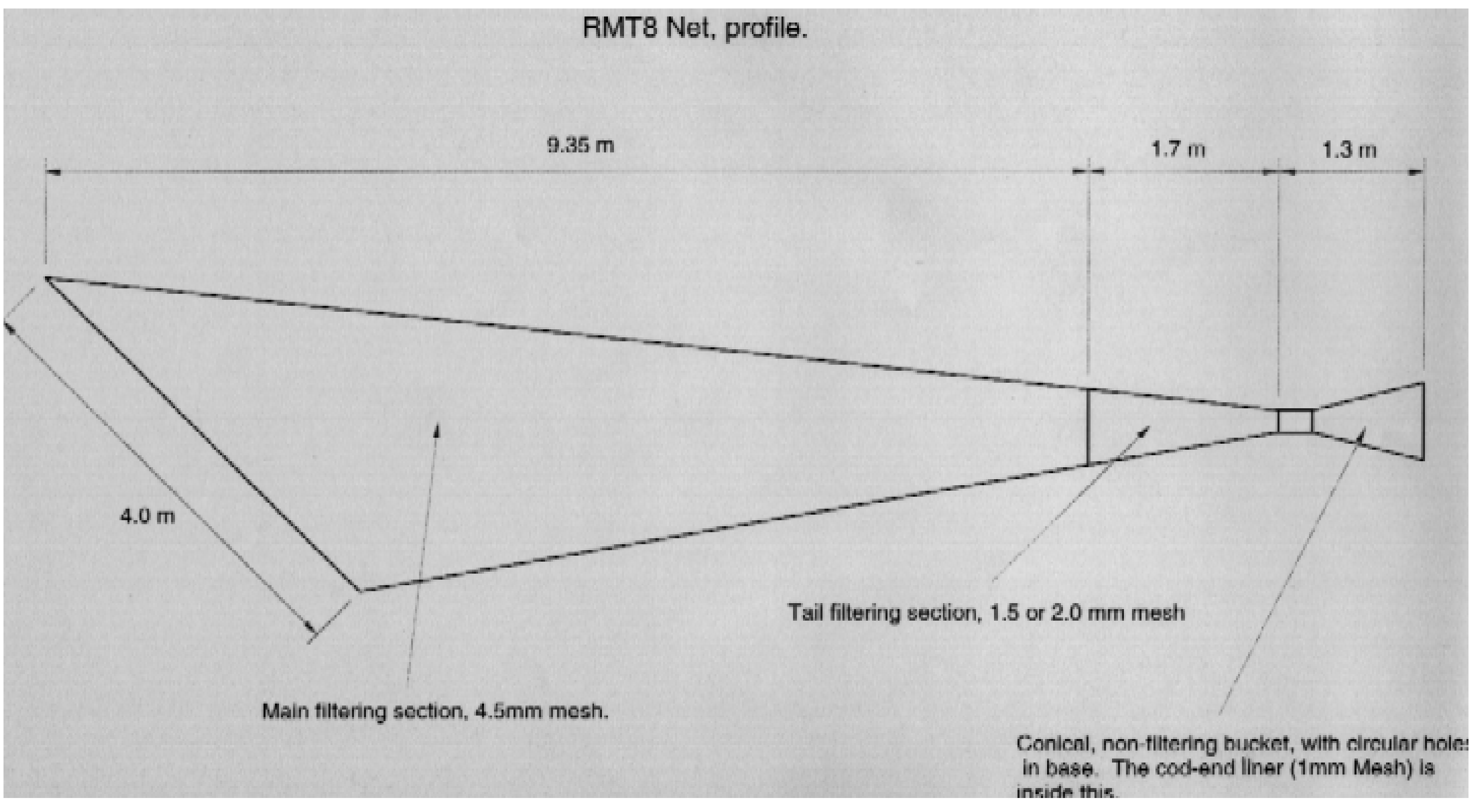
Brief description RMT net

Drawings (kindly supplied by Doug Bone) of the British Antarctic Survey RMT net system are provided for comparison with RMT net systems provided by other nations.
On this page you will find the following diagrams

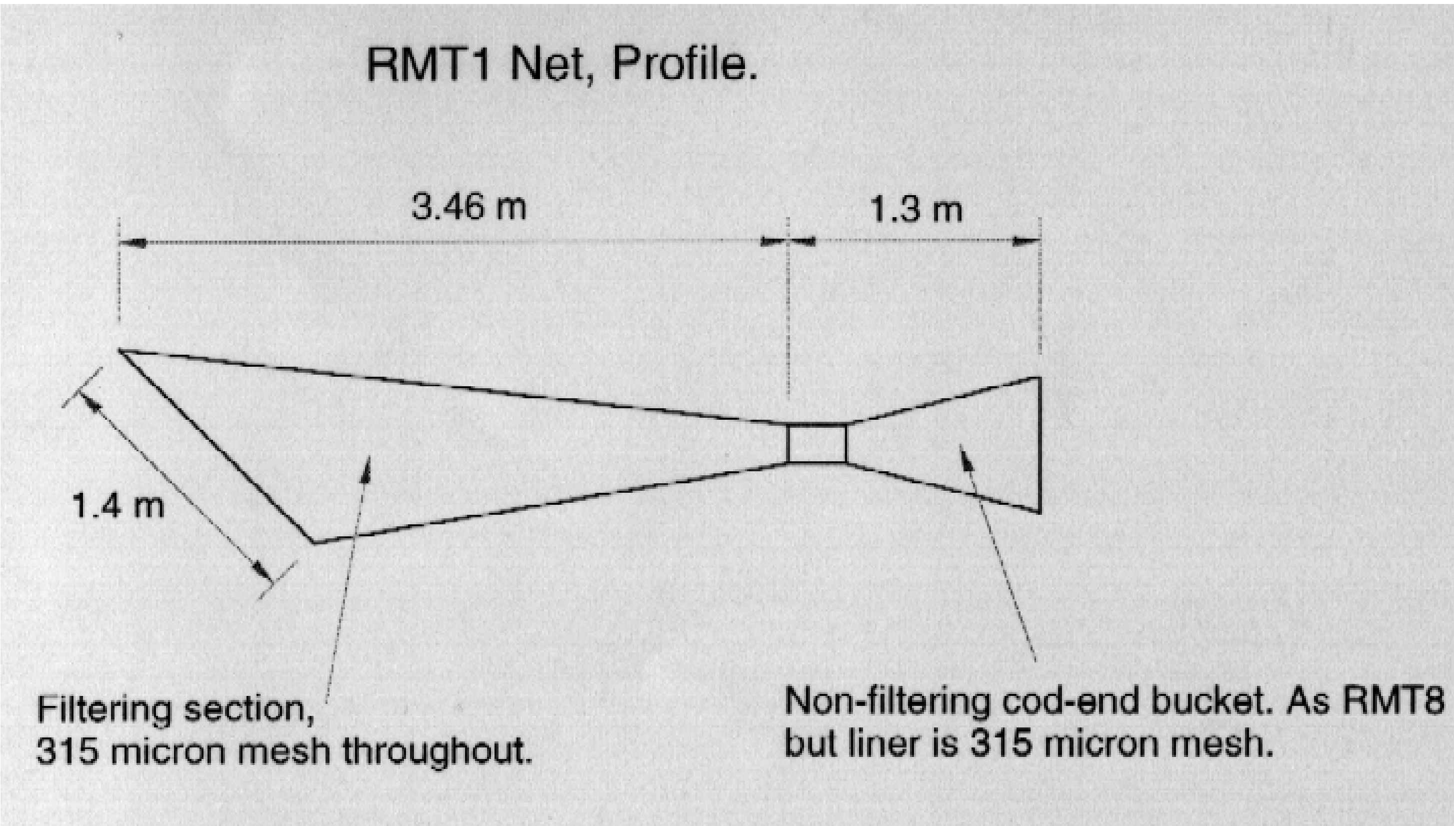
- Dimensions of RMT8 net shown in side view
- Dimensions of RMT 1 are shown in this side view
- Front view of RMT8+1 showing dimensions
- Front view of RMT8+1 net with main parts labelled

Eventually it is hoped that details of all the nets used will be available on this page.

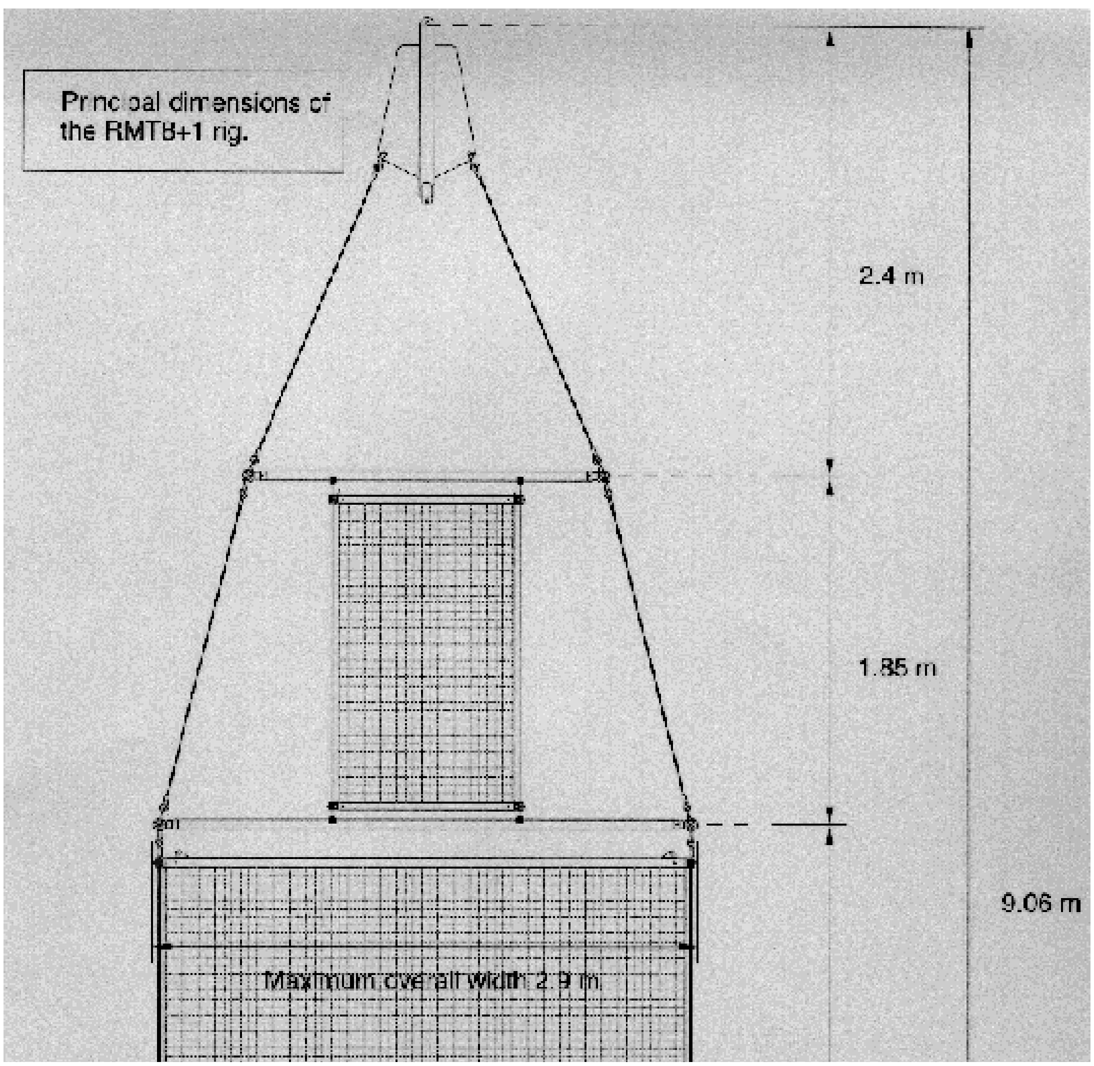
Dimensions of RMT8 net are shown in the side view below

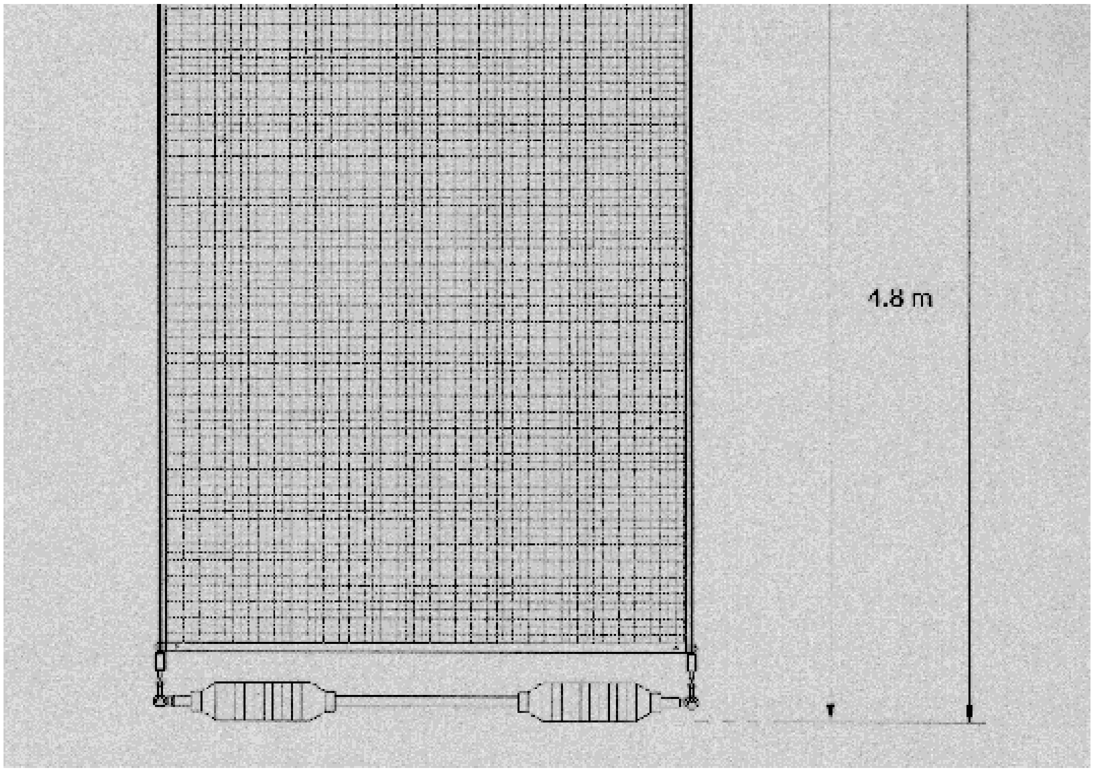


Dimensions of RMT1 are shown in the side view below

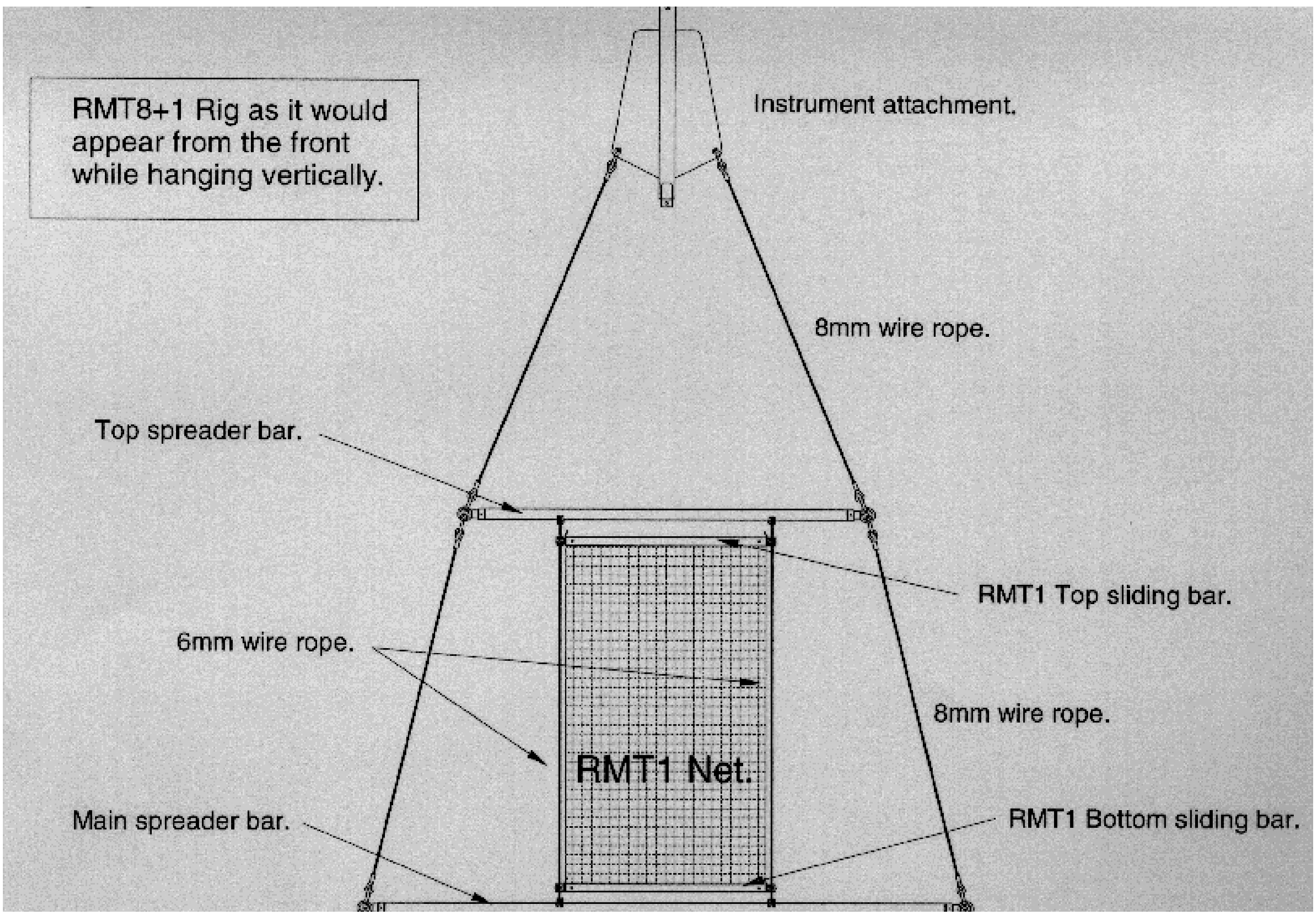


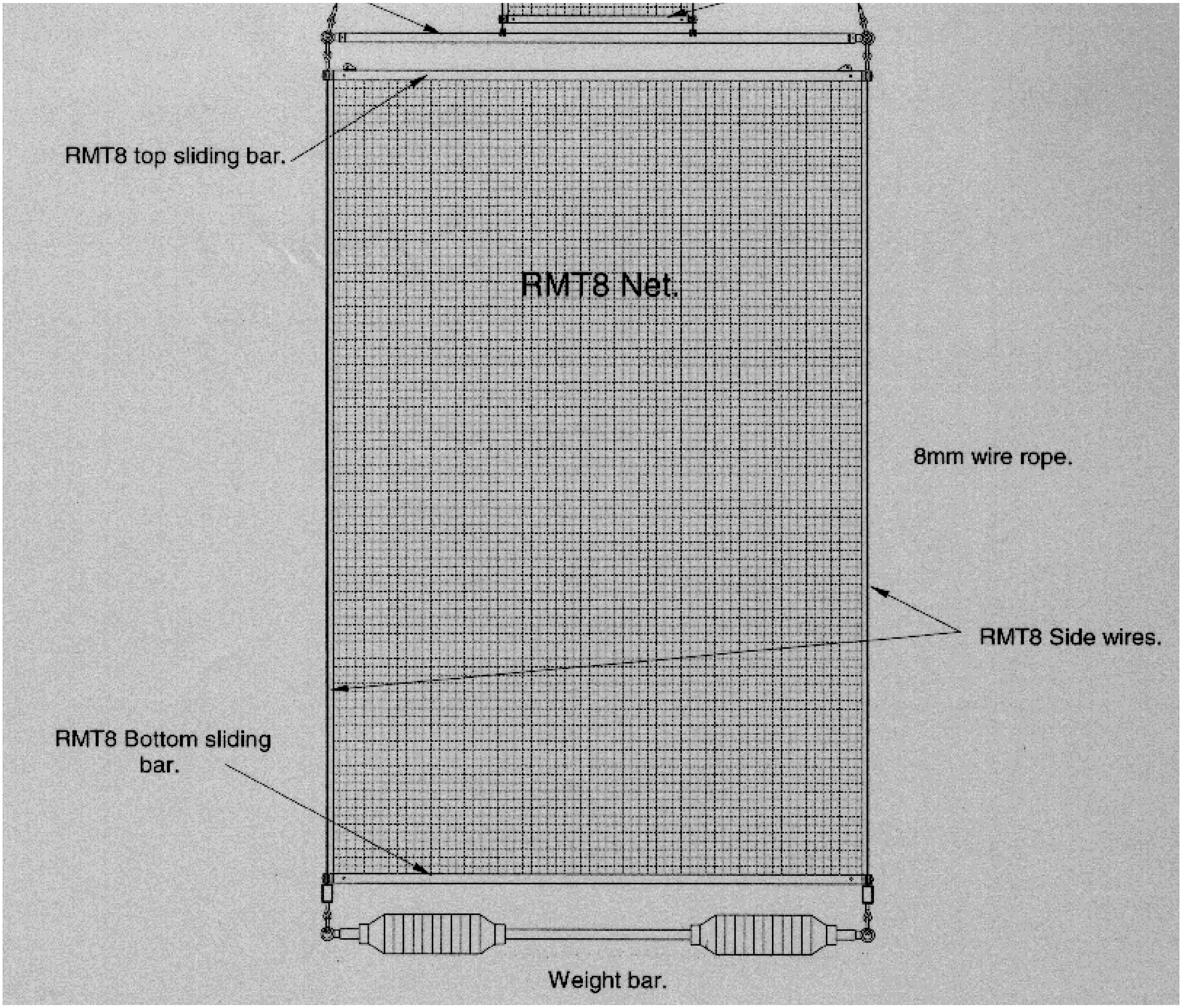
Front view of net showing main dimensions





Front view of net with main parts identified





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The CCAMLR krill synoptic survey

Net sampling protocols

Net haul data entry table

This table will be available in Excel and QuattroPro spreadsheet formats

Cruise :	CCAMLR Survey 2000
Ship name :	aaaaaaaaaaaaa
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
Filtered Water Volume (m^3):	mmmmm (in m3), no decimal point
Fishing Depth min (m):	mmm
Fishing Depth max (m):	mmm
Bottom Depth :	mmmm
Wind Speed (in knots):	kk
Wind direction (in degree):	ddd
Sample size (in ml) :	nnnnnn
Subsample size (in ml) :	nnnn
Comments :	

Net sample data entry form

Event No = nnn	No in total sample	No in subsample	No measured for length	Weight (g wet wt)
Euphausia superba				
Salpa thompsoni				
Ihlea racovitzai				
Thysanoessa macrura				
Thysanoessa vicina				
Euphausia frigida				
Euphausia triacantha				
Euphausia valentini				
Others				
Others				
Others				
Others				
Others				

Krill length frequency data entry form

Cruise:		Ship:		Station:		Event:		No. measured:		No in sample:		
Length	Juvenile	M2A1	M2A2	M2A3	M3A	M3B	F2B	F3A	F3B	F3C	F3D	F3E
17												
18												
19												
20												
21												
22												
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References

- Brierley AS, Watkins JL, Murray AWA (1997) Interannual variability in krill abundance at South Georgia. Mar. Ecol. Prog. Ser. 150: 87-98
- Jolly GM, Hampton I (1990) A stratified random transect design for acoustic surveys of fish stocks. Can. J. Fish. Aquat. Sci. 47: 1282-1291
- Murray AWA (1996) Comparison of geostatistical and random sample survey analyses of Antarctic krill acoustic data. ICES J. mar. Sci. 53: 415-421
- Petitgas P (1993) Geostatistics for fish stock assessments: a review and an acoustic application. ICES J. mar. Sci. 50: 285-298

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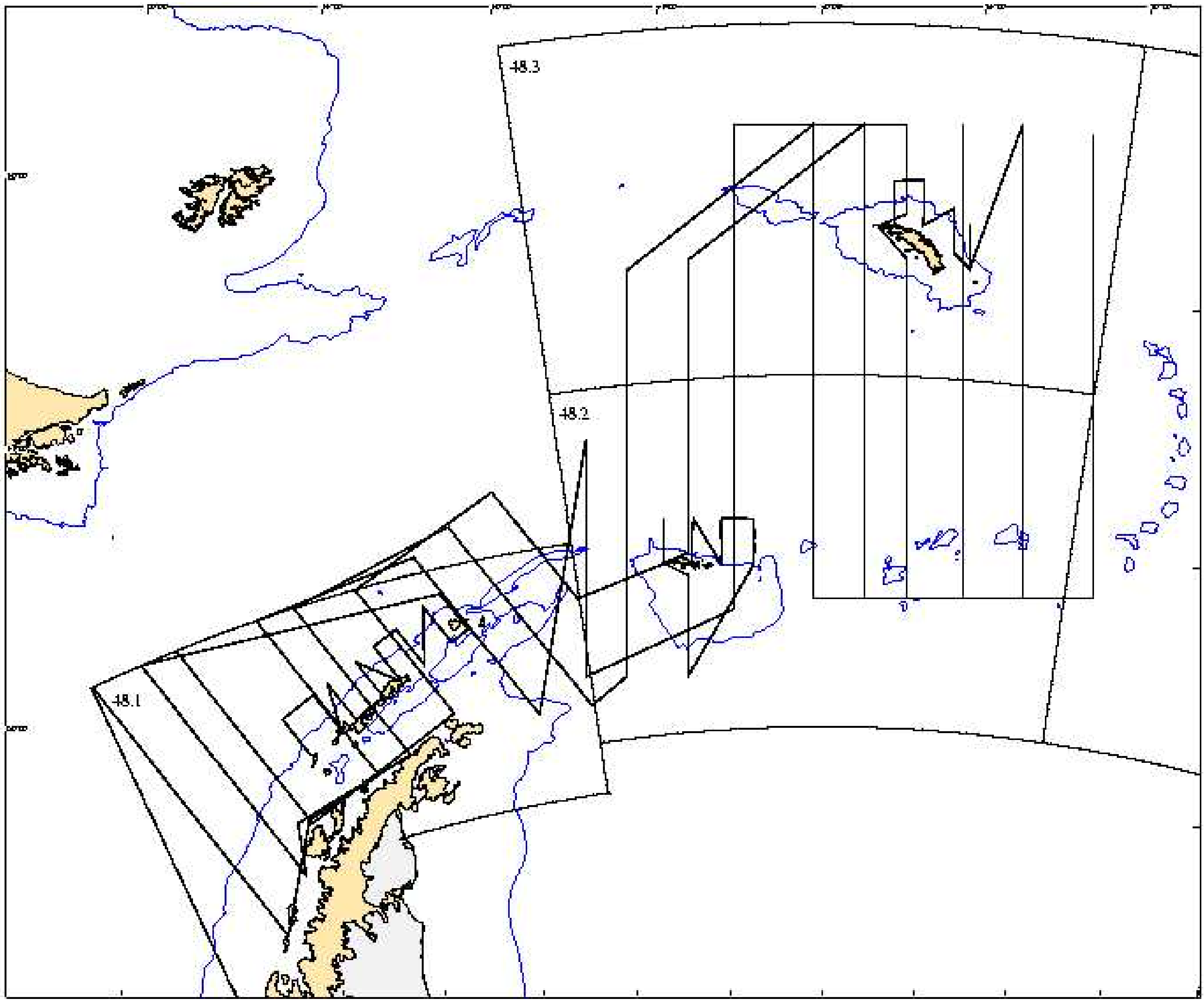
The CCAMLR krill synoptic survey

Survey track lines in relation to Statistical Areas



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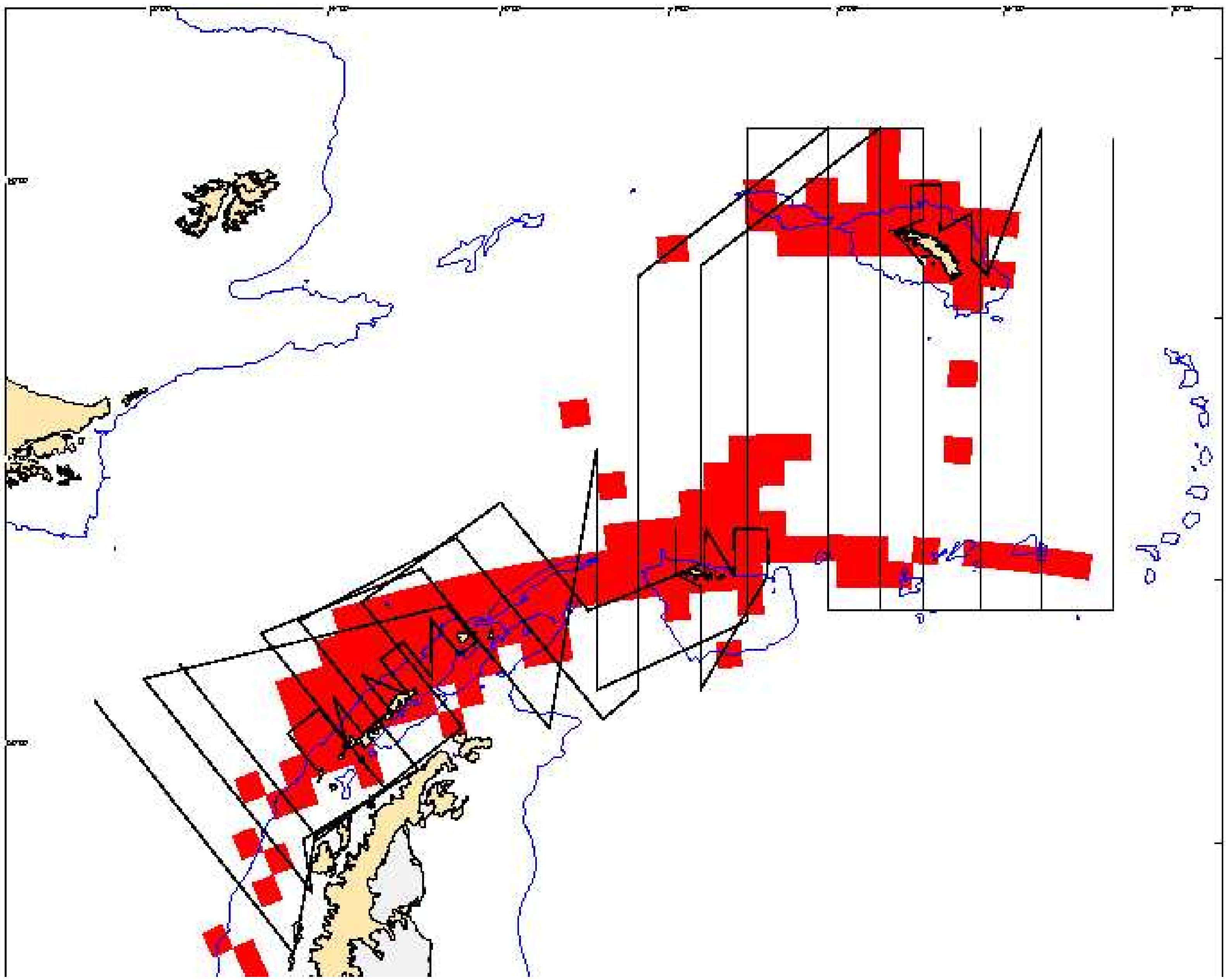
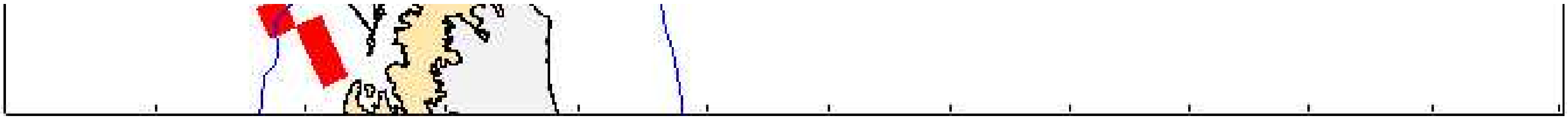
The CCAMLR krill synoptic survey

Synoptic survey cruise tracks with positions where krill catches have been reported during the period 1986 to 1992 (CCAMLR, 1997)





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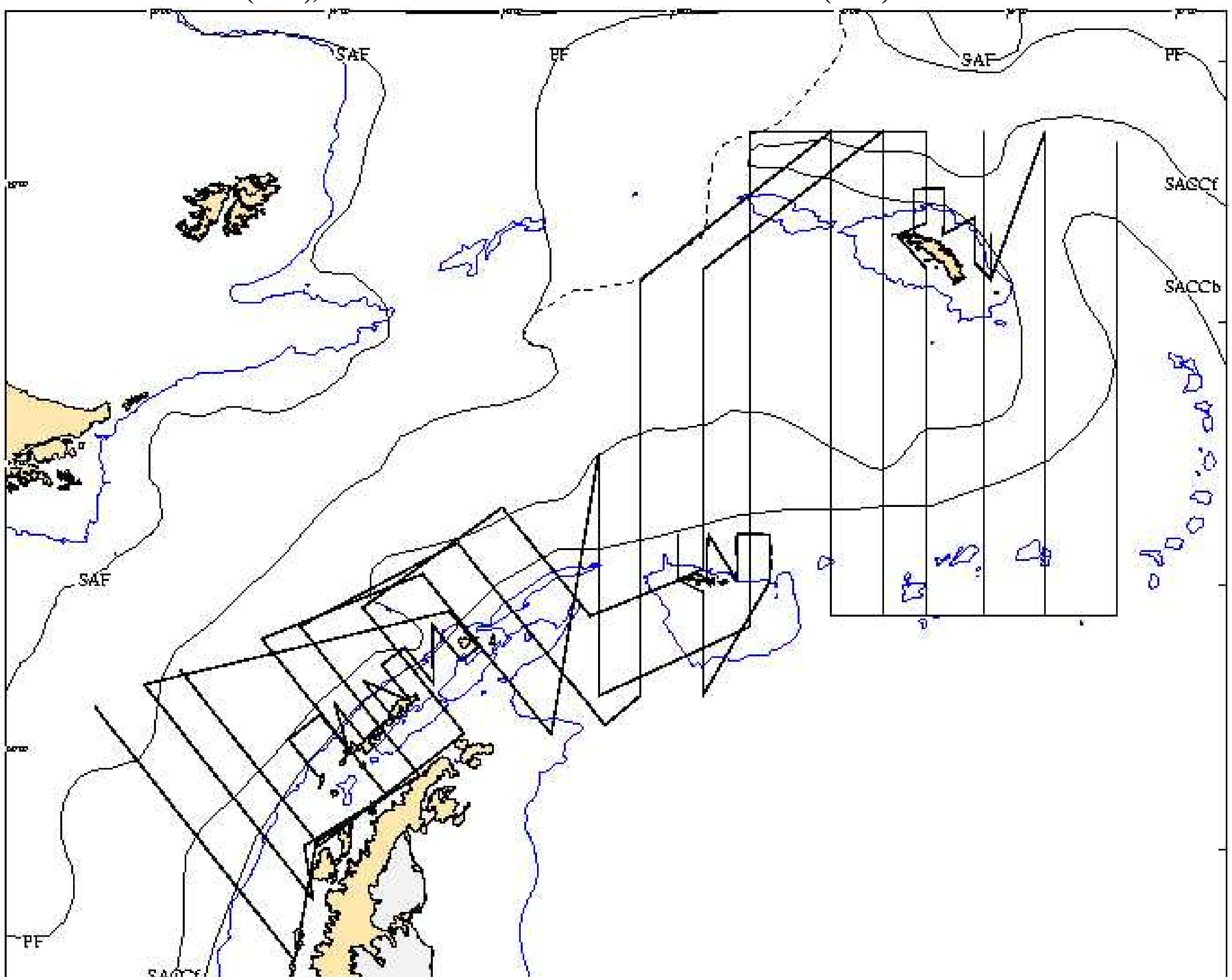
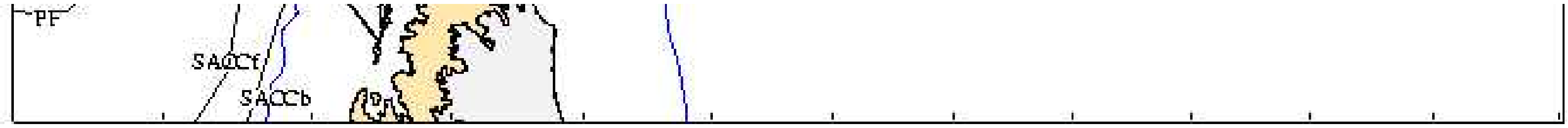
The CCAMLR krill synoptic survey

Synoptic survey cruise tracks with climatic positions of the major fronts in the Antarctic Circumpolar Current.

SAF - Subantarctic Front; PF - Polar Front; SACCf - Southern ACC Front; SACCb - Southern ACC boundary. Positions of fronts after Orsi et al. (1995), with the Polar Front modified after Trathan et al. (1997)





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The CCAMLR krill synoptic survey

Sampling Protocols

Net sampling

Introduction

This page is being developed by Jon Watkins and Volker Siegel

Field Sampling

Laboratory Sampling

Measurement of krill

- total volume of krill catch should be measured (dry/wet?)
- if sample is large then a random subsample of at least 100 krill should be taken
- measurements should be done by one person to remove observer variation (see Watkins et al. 1986)
- standard length measurement (AT) on fresh animals (ie measurements should be carried out on board)
- sex and maturity stage should be determined according to Makarov and Denys

Preservation of krill

- a sample of krill (~50) should be preserved in ethanol for genetic studies
- remainder of the sample (or a representative subsample if sample large) should be preserved in formalin

Data entry

All relevant data (*to be determined)* should be entered onto computer prior to the termination of the cruise. A suitable electronic data entry sheet format will be made available to all participants.

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