JB02:

RRS John Biscoe
South Georgia and South Orkneys
Marine Biology (OBP2)
February 1980 - April 1980

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BRITISH ANTARCTIC
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SURVEY ARCHIVES

'John Biscoe' Cruise II

February - April 1980

1. Introduction

This was the second cruise in the BAS Offshore Biological Programme Series (see .An Off shore Biological Programme for MS. Document OBP 7) . R.R.S. John Biscoa had a major refit during 1979. The main engines were replaced and bowthruster, modern bridge controls, satellite navigator, hydrographic and trawl winches. A-frame derrick and a completely new laboratory suite were added. Much of the scientific equipment was also new and untested under Antarctic conditions Consequently this was as much a trial cruise as John Biscoe Cruise I.

2, Objectives

The original planning was for a cruise of 90 days in length, consisting of 3 x 20 day Drift Survey legs and 2 x 10 day South Georgia Circumnavigation survey legs . During the Drift Survey legs the ecology and biology of krill, Euphausia superba, would be studied primarily in relation to the environment, phytoplankton and other members of the sooplankton as the ship drifted across the Scotia sea. Krill behaviour and other aspects of swarming would be studied when krill patches were encountered. During periods when the ship zig-zagged over shelf and deeper water round South Georgia, the ecology and biology of krill would be studied in relation to upwelling and major predators especially birds and seals (in conjunction with land-based observations on Bird Island) and fish.

Completion of the refit was delayed considerably by factors outside MS control and eventually only 60 days were available for the cruise. Consequently the programme was modified to include 2 x 20 day Drift Survey lags and 1 x 10 day South Georgia Circumnavigation Survey leg. The programme was further modified in the field for scientific and logistic reasons, as will be described in the Cruise narrative.

3. Scientific complement

Bone, D.	Technician, nets
Clarke A.	Biochemist (Legs 1 and 3)
Everson, I.	Senior krill biologist
Heywood R.B.	Chief Scientist, Oceanographer
Johnson, C.	Doctor, Assistant biologist (Leg 1 only)
Morris, D.	Krill physiologist (Legs 1 and 3)
North, A..	Fish biologist
Pilcher, M.	Assistant biologist
Ward, P.	Krill biologist
Warren, J.	Technician, electronics
Whitaker, T.H.	blgologist
White, MG.	Senior fish biologist
Whitehouse, M. J.	Technician, chemist.

4. Cruise narrative

December 31. North, Pilcher and Whitehouse sailed with Biscoe from Southampton to clean laboratory suite after the last minute refit work.

January 25. Everson and Warren joined ship at Montevideo to test the the SIMRAD EKS 120 echosounder and to carry out a preliminary krill distribution survey between South Georgia and South Orkneys, and in the vicinity of the Antarctic Peninsula down to 64° 15' S, 58° 30' W. (Samples JBII 1 to 17). Ship occupied with base relief at South Georgia, Signy Island, Palmer Station.

February 8. White flew to Port Stanley,. Falkland Islands, to collect fish samples for a stock assessment zurvey. Other material was obtained by North from South Orkney Islands (60°35' S 45°30' w) and wzfsland (64°33' S 63°35 'W).

February 15. Bone, Heywood, Ward, Whitaker and White, together 'with Captain Phelps and C/O Baker, joined ship at Port Stanley Final fitting-out of laboratory suite completed during 5 day stay.,

February 20. Ship sailed for South Georgia at 2000 GMT, Preliminary testing of STD-DO which revealed laboratory terminal not connected to slip-ring and slip-ring not water-proofed;*

February 23. Rest and relaxation period for crew. Scientists prepared chemicals and carried out final preparations for the Drift Survey Leg. The slip-ring on the STD-DO winch was found to be of poor design and construction wiring broke very It was waterproofed, by ships engineers and electrician using a kit supplied by Lebus,

February 27. Clarke and Morris embarked to carry out biochemical and feeding studies on krill. Ship sailed for the Drift Survey at 1100 GMT. Six days had been allocated for finding a suitable concentration of krill and establishing the Drift Survey. Acoustic krill searches were carried out within 10 n mile radius of icebergs of sufficient size to act as surface current markers and the Drift Survey began on 5 March at 60°S 46°W. Considerable problems were experienced with the hydraulic power pack to STD-DO/hydrographic and trawl winches, primarily due to bad workmanship during installation, but all were solved through the ingenuity and endurance of the ships engineers. Captain and deck officers quickly mastered the use of the bow thruster and variable pitch propeller and hydrographic stations were worked in 30-40 knot winds,

It gradually became apparent that the chances of a krill patch developing in the vicinity of the ship were slight. Consequently the decision was taken to extend the current drift survey by 6 days and to substitute a krill patch search and investigation leg for the second drift survey. The Drift Survey was otherwise extremely successful. A total of 174 stations were worked in a total drift time of 17 days, in which 100.4 n miles were 'covered (Fig. 1) at an average speed of 0.27 knots. Fifty three hours were lost through bad weather. The daily work schedule is given in Appendix I.

March 23, Ship arrived at Grytviken at 1230 GMT. Clarke, and Morris disembarked to continue shore-based studies. During this stay the SIMRAD fish-echosounder was calibrated after the test hydrophone had been positioned by divers. Chemicals were made up in the Research Station laboratories and various modification made to ship-board laboratories and equipment.

March 26, Ship sailed 1902 GMT., RMT net monitors were calibrated in outer cumberland Bay.

March 27. South Georgia, Circumnavigation Survey began 0100 GMT. The daily work schedule is given in Appendix 2 and the Survey track in Fig, 2. The legs were approximately 100 n miles long but varied because the programme waz built around a series of midnight stations alternating over shelf and deep water. The survey was successful and 163 stations were worked in 11 days. Thirty four hours were lost through bad weather.. The ship echosounder waz very unreliable even in shallow water and considerable time was spent finding the 300 fm, 600 fm and 900 fm contours, The expandable bathythermograph proved disappointing with a 'success rate of less than 1 in 5 (at the time the probes were thought to be affected by the cold but information recently received from Institute fur Seefischerei, Hamburg suggests that the probes were old and had deteriorated during storage).. Fortunately there. was sufficient time to carry out STD profiling. The STD probe had to be unplugged from the winch cable whenever it was returned to the laboratory. The repeated unplugging weakened the plug which eventually broke on the penultimate day of this leg and water entered the winch cable. The STD probe could not be used for vertical profiling for the remainder of the cruise. A large krill patch was encountered in 300 m depth waters to the north east of South Georgia.

7April . South Georgia Circumnavigation Survey completed 0140 GMT. Bird Island base closed down for winter and personnel taken on board for transport to Grytviken. Steamed along course north of island to relocate large krill patch. Its position was relatively unchanged and the decision was taken to carry out the Krill Patch Investigation here after a minimal turn round period at Grytviken.

8April . Turn round completed in 3 hrs 40 mins. Clarke and Morris embarked. Originally the Krill Patch study was to last 16 days but the RRS Bransfield accident made any possible reduction in time desirable for logistic reasons. The discovery of the patch during the previous leg was particularly fortuitous since time did not have to be spent in preliminary searches. The final programme of rectangular grid acoustic searches to map out the morphology and changing position of the krill patch, with net hauls for target identification, life history, feeding studies, etc. and water bottle casts for environmental/phytoplankton data took only 5½ days. Ten hours were lost through bad weather and 88 stations were worked. Salinity, temperature and oxygen profiles of the surface water (3 m depth) were obtained during acoustic runs from the STD probe immersed in a water bath continually fed from the laboratory non-toxic sea water supply.

April 14. Ship steamed into deep water where 2 day-time and 1 night-time deepwater RMT hauls were taken to provide specimens for Clarke's biochemical studies, and larval krill.

April 15. Ship tied alongside 1130 GMT. End of John Biscoe Cruise II. **Clarke** disembarked to complete shore-based research. OBP equipment sorted out and packed. As much as possible was stored at Grytviken.

April 18. Ship sailed for Port Stanley in heavy seas.

April 23. Most OBP scientists disembarked. Whitaker elected to stay on board to visit Signy Island, Pilcher and Whitehouse were asked to return to UK on ship so that the former could repair nets and the latter continue chemistry studies on passage.

April 28. Majority OBP scientists arrived UK.

5. Summary of data

1) Drift Survey Leg

Time out of Grytviken	25 days
Actual time of Drift Survey	17 days
Stations worked successfully	174
STD profiles	24
XBT profiles	1
Water bottle profiles	1
Vertical water profiles	4
PAR profiles	2
^{14}C uptake *in situ* experiments	11
RMT net hauls from aft	59
RMT net hauls from starboard beam	6
Neuston net hauls	45
Large LHPR net hauls	12
Standard LHPR net hauls	8

2) South Georgia Circumnavigation Survey Leg

Time out of Grytviken	12 days	
Actual time on Circumnavigation Survey	11 days	
Stations worked successfully	163	
STD profiles	31	
XBT profiles	17	(some at STD stations)
Water bottle profiles	3	
RMT net hauls from aft	24	
Neuston net hauls	17	
High speed tow net hauls	77	

3) Krill Patch Study Leg

Time out of Grytviken	6.5 days
Astual time on Patch Study	5 days
Stations worked successfully	88
XBT profiles	3
Water bottle profiles	9
RMT net hauls at 'standard depths'	25
RMT net hauls at acoustic targets	17
Neuston net hauls	8
Large LHPR	9
0.45 m round net hauls	5

6. Scientific findings

Only a limited analysis of data and specimens could be carried out during the cruise, However it is reasonable to conclude that valuable data have probably been obtained on:

1) The effect of upwelling on production both in the vicinity of sea mounts (Drift Leg) and shelf areas (Circumnavigation Leg).

2) Phytoplankton production during late summer/autumn. In situ ^{14}C experiments were carried out during the Drift Leg and biomass profiles were obtained daily throughout the cruise,

3) Krill biomass, Concentrations varied from O-15 litres oer ½ hr RMT 8 haul during the Drift Leg to a maximum of 173 litres (mean 33 litres) per 6 min RMT 8 haul during the Krill. Swarm Investigation, Horizontal patchiness was also investigated using a BAS constructed large scale verSion of the Longhurst-Hardy Plankton Recorder; Over 10,000 individual krill were measured and sexed.

4) Krill vertical distribution related to sex, age, feeding and time of day. Extensive acoustic records and 'aimed' as opposed to 'blind' RMT 8 hauls were obtained throughout the cruise,

5) Krill feeding behaviour and diet. Over 4000 visual gut analyses were performed on the ship to guide a more detailed examination that will follow in U.K.

6) Krill lipid biosynthesis This was investigated by measurements of tritium uptake by isolated hepatopancseas from 82 adult animals,

7) Zooplankton biomass, Crude volumetric measurement indicated a 10 fold increase in biomass on moving from deep 'oceanic' water onto the shelf during the Circumnavigation study,

8) Fish biomass and navigation Relatively few fish were caught compared to John Biscoe Cruise I, which could reflect geographic (Drift Leg) and seasonal (Circumnavigation and Krill Swarm Legs.) variation. Over 1000 individuals of several Nototheniform species were measured and sexed and otoliths and scales taken for ageing, These observations are being

supplemented by year-round collections of fish at Signy Island and South Georgia.

9) Fish feeding behaviour and diet. Gut contents showed that adult Nototheniform fish were feeding largely on adult *Euphausia superba* and *Thysanoessa* sp. Larval Nototheniforms and the small-bodied Myctophid fish were feeding on immature *E. superba* and copepods.

10) Fish stock separation. A large number of blood and muscle samples were taken for stock separation by gene-type analysis.

7. Equipment performance

1) Commodore PET.Desk-top computer. This proved an extremely useful, time-saving device and gave no trouble.

2) Plessey STD/General Oceanics Rosette system. The electronic problems that occurred were relatively minor and quickly corrected. Clearly a yearly service/calibration contract with Plessey (Nederlands) is desirable for the long-term. The main weakness of the system is the lack of a read facility on the digital recording unit - there is no means of checking on the ship the data being recorded. It is therefore desirable to provide either a tape-deck with a write/read facility or a microprocessor capable of translating the binary data into engineering units and printing selected data. The latter must be a near-term objective. The Rosette system became erratic towards the end of the cruise. Water had apparently gained access to the stepper-motor release gear. The system was drained and refilled with oil but before it could be tested the winch cable became unserviceable. One Niskin bottle was lost from the Rosette early in the cruise. It was probably dislodged by collision with the ship's side. A bridle was used afterwards as a safety chain to link all the bottles to the Rosette frame.

3) Autoanalyser. Minor electronic faults had to be corrected. Not all the problems with the orthophosphate analytical method were solved during the cruise.

4) SIMRAD EKS 120 echosounder. No problems were experienced with the equipment and it performed extremely well.

5) Plessey Precision Laboratory Salinometer. The sample chamber was found to be cracked but an adequate repair was effected with araldite. The ambient temperature in the laboratory suite varied considerably over a short time period and the apparatus could not compensate sufficiently. It was eventually used in the Chief Scientist's office. It is intended to transfer the Plessey apparatus to the Inshore Marine (Signy) section and to purchase for OBP a Guideline 'Autosal' model, which uses a thermostated water jacket.

6) Coulter Counter. The present apparatus, on loan from NERC Equipment Pool, cannot be used in rough weather because of surging of the mercury in the manometer. It is also a slow-acting machine which limits the number of analyses that can be performed under the time constraints of the programme. Application for funds to upgrade the apparatus will be made.

7) Water bottles. The rubber firing mechanism of the Niskin and GoFlo bottles perished rapidly in the cold waters. The plastic trigger arms of the N10 bottles were similarly affected and at least one was broken by the messenger weights on each cast. The spares list will be amended accordingly.

8) *In situ* ^{14}C equipment. This proved an excellent system for ease of deployment and recovery. Unfortunately many bottles broke during incubation. The cause was presumed to be shattering of the neck by the glass stopper being drawn in by contraction of the contents through temperature change and solution of entrapped gases, Modification of bottle filling techniques reduced but did not stop the losses. Experiments are to be carried out using silicon rubber stoppers.

9) **RMT 8+1.** The main net burst on several occasions under the weight of the catch. One wide spreader bar was also bent.

Net monitor performance was not satisfactory. The response to the open/close command frequencies gradually became very unreliable. No fault could be traced and the system worked perfectly in the laboratory even when very erratic out on deck and in the water.. The monitors are being returned to IOS for assessment. The flowmeters were also erratic and eventually failed through a break in the connecting cable caused by water pressure. The signal to noise ratio was generally poor. It was difficult to discern the monitor trace below 300 m and almost impossible below 600 m. It was discovered that the system available for handling and towing the transducer fish was unsatisfactory. The fish was being towed nearer the ship and further aft than desirable and interference was from the variable pitch propeller. No changes were possible during the cruise but a winch and boom system which will correct the fauhhas been designed and will be submitted for action in the current refit.

10) Large Longhurst-Hardy Plankton Recorder. Some modification to the frame was necessary to facilitate launching from the Biscoe e.g, wooden skids fitted to ease passage over the stern lip. It was designed to use one of the IOS net monitors to open and close the recorder box mouth and switch on the electronics of the motor drive. Unfortunately the drive mechanism of the opening/closing device was not strong enough to withstand the stresses involved in deployment and recovery. Several unsuccessful. attempts were made to improve the system. Eventually the opening/closing device was bolted in the open position and the recorder deployed in the running mode. This limited fishing time to 50 mins. with the gauze-advance set to 60 second intervals. Otherwise the system worked well. A catch of nearly 1000 krill was handled without: the gauzes jamming, Improvements to the opening/closing device, the spool braking mechanism and the frame will be carried out this summer. The frame behaved well in the water and only yawed out of line when affected by the ship's wake. The drogue lines tended to twist reducing its effectiveness. The problem can be solved by the use of braided lines and swivels.

11) Standard Longhurst-Hardy Plankton Recorder. This worked very well. The new frame was easy to handle and gave ready access to the recorder box and control cylinder.

12) Neuston nets. These worked fine. Only routine maintenance required,

13) Large Lowestoft tow net. Two welds broke when the net was deployed for the second time. It will be repaired in U.K.

14) Small Lowestoft tow net. The net worked well but required a more effective depressor to drive the net deep without using excessive wire out.

15) 'Benthos' time/depth.recorder. This did not work satisfactorily, Although the circuitry was not faulty the power demand was excessive and eventually too much for the available batteries. Remedial action will be taken in U.K.

16) Underwater electrical connectors. The Brantner moulded rubber connectors were not strong enough to withstand the frequent connection/ disconnection necessary with the RMT and STD apparatus. Wires broke within the moulding and it was also difficult to keep the plugs free of salt water contamination when not in use.

The Electro Oceanics, Marsh-Marine and Rochester types were much more robust and easier to maintain.

17) Radio-location device. The system built at short-notice by Whitaker was adequate as a location device for the ^{14}C *in situ* experiment equipment,

However, it could not be used as the Drift Marker for the Drift Survey leg because it provided no direct or accurate read-out of the bearing in the wheelhouse, which is necessary far final approach navigation, and no indication of range. To steam accurately to a buoy its actual position and not just general direction must be known.. Otherwise considerable time must be spent steaming at right angles to the required direction in order to triangulate on the buoy. Icebergs are reliable integrators of the Antarctic Surface Water current but unfortunately they cannot be found to order (compare the Cruise I and II drift tracks). If the Drift Survey is to remain part of the Offshore Biological Programme then a marker buoy must be obtained. Such a buoy must be purpose built with a sturdy mast by means of which it can be handled, and with sufficient stability to support a large flag. The Captains and Officers prefer a RACON radio location device. Available equipment is being researched by Captain Phelps, R/O R. Wade and D. Bone.

18) Cold/Cool Rooms. These worked satisfactorily although it should be noted that the present cold room temperature is inadequate for satisfactory long-term storage of material for biochemical analyses (-40°C or lower is necessary), Both rooms should be fitted with alarm systems to indicate adverse temperature change. A small -300C or -400C cabinet on the refrigerator flat should eventually be provided 8s a back-up system, An AC power supply should be available in the cool room so that it can be used as an experimental laboratory.

19) Electrical/radio interference. The laboratory shielding was generally effective.

20) Bow Thruster. The bow thruster is too small for the ship and was not able to maintain the vessel on station in winds exceeding 15-20 knots. Static stations were worked in winds of 30-40 knots using a combination of bow thruster and main engines,

21) Winches. Hydrographic and trawl winches are unnecessarily noisy and make sleep difficult for scientists, officers and crew. Remedial action is urgently required, The control gear on both winches is not weather-proofed! The line out meters on both winches are unreliable and there should be a back up mechanical system. The trawl winch meter actually records in 1/3 metres! Neither winch could veer or haul at the specified maximum rate. The accumulator springs on the hydrographic winch only come into play near the breaking strain point of the cable. A secondary weaker spring system should be supplied to ease the strain on deployed apparatus. The throttle levers on both winches worked against a spring return which made this operation extremely tiresome on a long haul. 'There is divergence of opinion as to whether this is a good safety factor that should be retained or a nuisance that should be replaced. The engaging mechanism of the trawl winch clutch is very poor and requires redesigning.

22) A-Frame Gantry, This is a very rugged and useful piece of equipment which increases the safety of work on the after deck. Unfortunately the luffing speed is extremely slow. The strain gauge block requires rewiring. It was broken very early in the cruise and consequently was not fully tested. However, it did appear to give inaccurately high readings. On several occasions the end splice on the trawl wire became jammed in the block, partly because there is little clearance room when the RMT and large LHPR are being deployed, partly because the winch driver's field of view is restricted and partly because the winch driver's task is a complicated one. A metal ball weight on the wire above the thimble would be the simplest remedy.

23) Water bottle Annex, Use of this room and the monorail system could be greatly eased by the provision of secondary doors which would allow the storm doors to be left open during most working conditions.

24). Ship's Echo-Sounder. The deep echo-sounder is adequate for normal navigational purposes but not sensitive enough for the Offshore Biological. Programme below 600 m. Considerable time and fuel was wasted on the Circumnavigation Survey searching for a sounding trace. On the Drift Survey the STD was often not lowered to the required depth (3000 m) because the maximum available depth was not known,

25) Doppler log. A system is required to supply forward and transverse speeds into the navigator for precise DR's and for accurate measurement of net-towing speeds,

26) Foredeck. .During the current refit a laudophone and hydraulic power supply should be installed.

8. Operational Techniques for certain apparatus

1) RMT. The A-frame gantry is not high enough to lift the RMT 8 + 1 clear of the deck and the following method was devised to handle the weight bar. The RMT 8 side wires were run through rings at the ends of the spreader bar between RMT-1 and RMT 8 and brass stoppers attached immediately below the top eyes of the side wires. A further length of 8 mm wire terminating in a ring was shackled on above the top eye of each RMT 8 side wire. During fishing the ring was held up by a snap hook on a short rope pennant attached to the outer end of the upper spreader bar. The combined length of pennant and side wire extension was such that they hung slack when clipped together. For launching the rings were released from the pennants and clipped into snap hooks on the ends of runners going over the quarter blocks of the gantry. The side wires were pulled through the rings on the bar ends so that the sliding bars of the RMT 8 and the lower spreader bar rested on the weight bar. The runners lead to the stern bitts, As the net monitor was lifted by the main winch and the gantry luffed out the weight of the weight bar was taken on the runners by the rising of the quarter blocks, slack being paid out when necessary, When the quarter blocks were outboard of the ship the runners were lowered away until the side wires had passed back through the rings as far as the brass stoppers, The side wire extensions were then detached from the runners and clipped to the rope pennants and the net lowered away. During recovery of the net the weight was taken by the runners being wrapped round the warping drums of the winch, A drogue attached to the cod end of the RMT 1 prevented it moving forward and coming on deck underneath the RMT 8. Launching and recovering the RMT requires 1 winch/gantry driver (petty officer), 2 crew men on the runners and 2 scientists to handle the net. Maintaining this level of manning throughout 24 hrs was very demanding on the crew, especially because the deck force was reduced by one man at certain times to provide steward service for the scientists, The manning level. could perhaps be reduced by one man if two small winches under one control were installed to handle the weight bar runners.

On six occasions the RMT 8 was launched from the foredeck to sample krill in the O-5 m depth stratum. The net was lifted out using the starboard cargo derrick, The technique was successful but on one occasion the RMT 8 spreader bar was bent considerably, This was caused by compression forces between the bar ends and the point at which the towing bridles were shackled to the cargo runners.

2) Large Longhurst-Hardy Plankton Recorder, The frame of this net is so large that it must be stowed on the boat deck when not in use. It was lifted down to the after deck by the crane - a difficult operation in high winds or heavy swell. When positioned as far forward as possible. between the trawl winch and the stern lip the stern. gates can be opened and closed. The frame moves quite-well on the weight bar, which acts as a roller, and heavy duty castors attached to the rear end. Wooden runners along the bottom of the

frame eased passage over the stern lip. The net was normally used with a drogue which steadied the frame vhen it was suspended clear of the deck and water. The height of the gantry does not allow the frame to be lifted clear of the deck and the following launch sequence was developed. After the gates were opened the drogue was thrown over. The frame was pushed back over the stern lip until the trawl wire was taking the weight. The gantry was then luffed out vhile the front of the frame was kept as high as possible. The frame vas quickly lowered to the water. On recovery the frame was lifted as high as possible and as quickly as possible. The gantry was then luffed in. As this happened the lover part of the frame came to rest on the stern lip. When the gantry was fully luffed in the frame was still about 1 metre aft of the required position. It was drawn into position by the crane; a rope being passed under the bar supporting the mooring line guide blocks to the frame. The drogue was then hauled in and the stern gates closed.

3) Safety. Life lines were worn by all personnel working on the hydrographic platform, and between the gantry arms on the after deck when the stern gates were open.

9. Messing and other facilities for Scientists

Each member of the scientific team worked at least 12 hours each day in shifts. No time was available for cleaning duties in the mess, alleyways or toilets. Scientific duties did not permit the change of dress required for an Officers/Scientists saloon. Consequently the Scientists had a separate Mess and a cabin boy acted as steward and cleaner. To provide this assistance a junior hand had to be taken off the deck force at certain pre-meal periods. The Chief Officer accepted this as an unfortunate necessity.

Hot meals are essential for the scientists on night duty. The catering officer kindly cooked meals between midnight and 0130 hrs. This clearly should not be considered a permanent arrangement. Provision of a bain-marie and hot-press within the FIDS (scientists) Mess would enable the normal catering staff to provide hot food for the night watches.

10. Conclusion

John Biscoe Cruise 11 has clearly demonstrated that the vessel is now a suitable platform for serious oceanographic research and that BAS is capable of playing an important role in BIOMASS and making a major contribution to the knowledge of the Southern Ocean Ecosystem. The cruise has also shown that neither men nor equipment are able to carry out more than 60 days of continuous intensive field work. The solution is probably the inclusion of fixed rest and relaxation periods at Grytviken and an initial work-up period for equipment preparation and trials, and the training of the new OBP staff and ship's crew.

A suitable cruise programme could be:

ITEM	Days
Work-up period	5
Drift Survey (Investigation of the general ecology of krill related to the Scotia Sea ecosystem, primary production and water movement)	30
Rest and Relaxation	5
South Georgia Circumnavigation Survey (13 days) and Long-line fishing (7 days)	20

(Investigation of-krill related to. bottom topography, upwelling and bird, seal and fish)

Rest and Relaxation	5
Acoustic Krill search and krill swarm study	20
(Investigation of krill biology and swarming behaviour)	
Close down period	5
	90

Such a programme must be subject to constant revision as research topics become more clearly defined and/or questions are answered.

Visiting scientists from within and outside NERC should be such as to complement studies and easily fit within the OBP programme if the latter is to be carried out within a reasonable time scale and not be seriously disrupted.

OBP makes considerable demands on married personnel and BAS should reaffirm its commitment to ensuring OBP staff spend the minimum time possible in the field. It should also be understood that the OBP field period cannot.be broken for base or field party relief except in real emergencies.. It is recommended that the Chief' Scientist or other senior member of OBP be.appointed to the Field Operations Working Group.

I wish to record, on behalf of the scientific team, appreciation and grateful thanks for tbe enthusiasm, efficiency and cooperation of the Officers and Crew of RRS John Biscoe. The success of the cruise was due to the splendid' team effort that developed.

Dr. R. B. Heywood
Chief Scientist, OPB.

Circulation:

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C. Elliott	D. Morris
I. Everson	M. 'Whitehouse
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Appendix 1

REGULAR DRIFT STATION PROGRAMME

TIME	ITEM		WATCH
2300_{30}			8 to 12,
0000_{30}	NEUSTON		
0100_{30}			
0200_{30}	and		12 to 4
0300_{30}	RMT/LHPR		
0400_{30}	or		
0500_{30}	RMT/LHPR		
0600_{30}		BOW	4 to 8
0700_{30}	STD		
0800_{30}		THRUSTER	
0900_{30}	^{14}C START		
1000_{30}	RMT/LHPR		8 to 12
1100_{30}			
1200_{30}	LIGHT PROFILE &	BOW	
1300_{30}	GREEN PYTHON	T.	
1400_{30}	RMT/LHPR	BOW	12 to 4
1500_{30}	^{14}C END	T.	
1600_{30}			
1700_{30}	and		
1800_{30}	RMT/LHPR		4 to 8
1900_{30}	or		
2000_{30}			
2100_{30}	and		
2200_{30}	RMT/LHPR		8 to 12
2300_{30}	or		

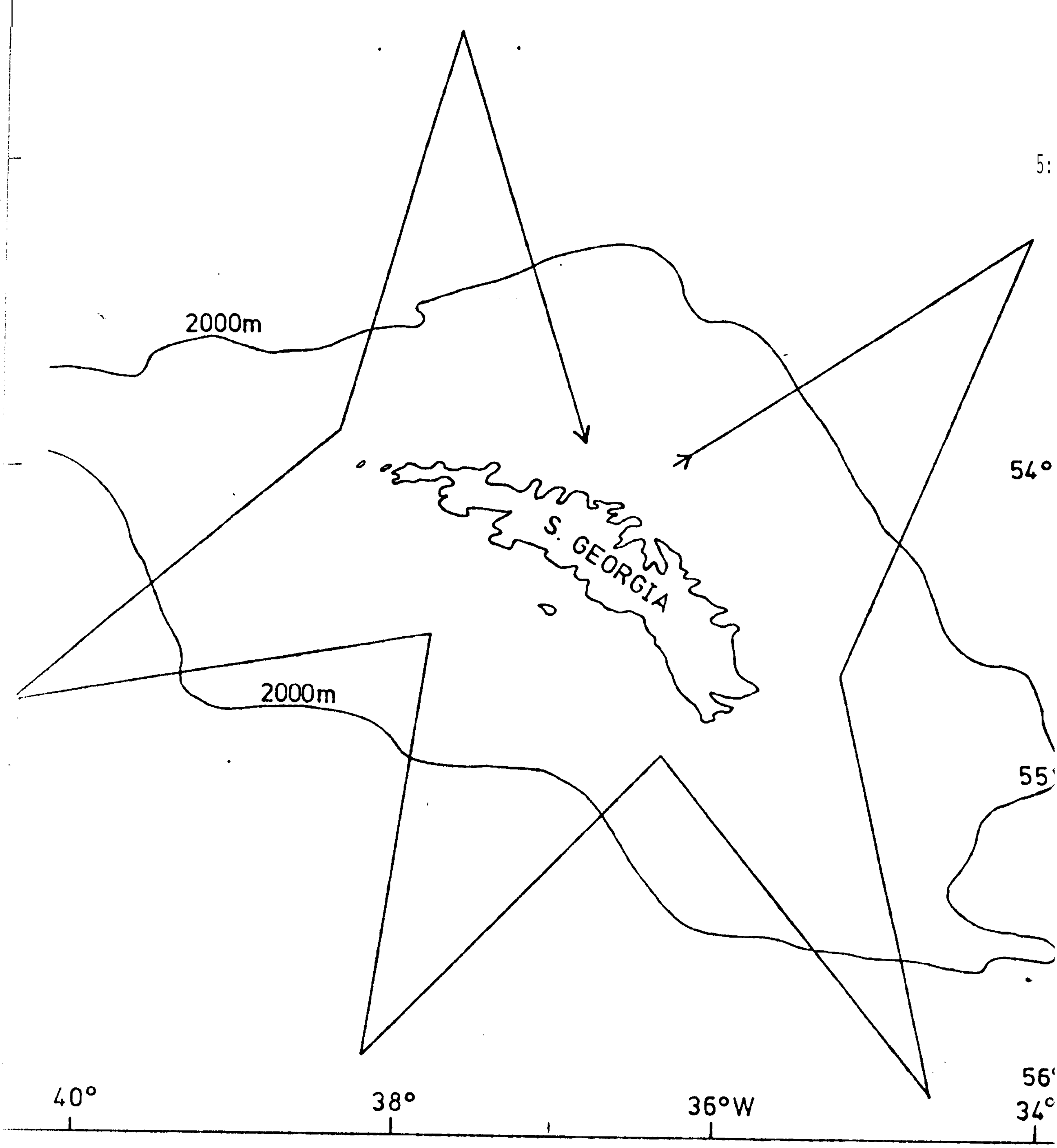
SLACK TIME TO BE USED FOR ACOUSTIC KRILL SURVEYS ON GIVEN COURSES AT 5 KNOTS. WATCH FOREMAN TO INFORM BRIDGE ASAP.

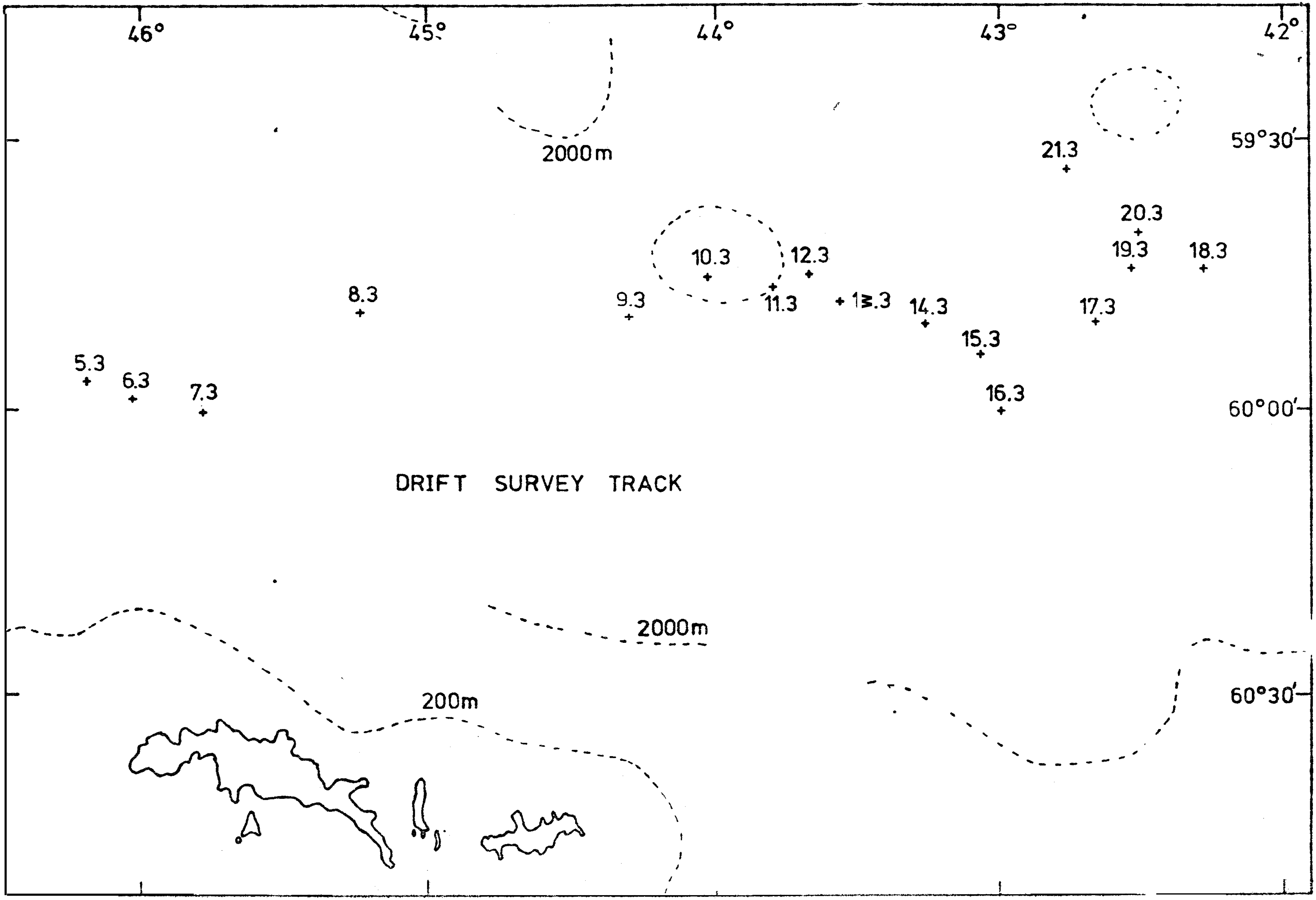
Appendix 2

SOUTH GEORGIA CIRCUMNAVIGATION

Midnight	
0100	**RMT (NEUSTRON)** Single oblique to 200 m ***or*** as topography permits
0200	
0200	
0300	
0400	
0500	HSTN, ACOUSTIC SURVEY, XPT's
0600	
0700	Service speed 7-8 kts
0800	
0900	
1000	
1000	
1100	STD's at 300 fm, 600 fm, 900 fm contours. Variable period because of poor depth echosounder
1200	
1200	
1300	**RMT** Single oblique to 200 m or as topography permits
1400	
1400	
1500	
1600	
1700	HSTN, ACOUSTIC SURVEY, XBT's
1800	
1900	Service speed 7-8 kts)
2000	
2100	
2100	
2200	STD's Variable time slot to allow for depth
2300	
2300	NEUSTON
Midnight	

SOUTH GEORGIA CIRCUMNAVIGATION TRACK




46°
45°
44°
43°
42°
59°30′
60°00′
60°30′
2000m
2000m
200m
DRIFT SURVEY TRACK
5.3
6.3
7.3
8.3
9.3
10.3
11.3
12.3
13.3
14.3
15.3
16.3
17.3
18.3
19.3
20.3
21.3