

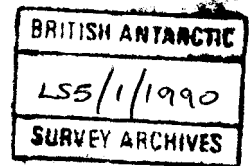
JB10:

**RRS John Biscoe
South Georgia
Marine Biology (OBP10)
December 1989 - February 1990**

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BAS MARINE LIFE SCIENCES CRUISE JB10



4-5 December 1989

Advance group from BAS and PML flew to Stanley to meet vessel.

6-8 December

Advance party and ship's personnel transferred large cargo items from 'tween-decks and the container laboratory was loaded. Scientific cargo was broken out of the cage.

9 December

Ship sailed from Stanley 0800 local and paused to bunker before departing for Montevideo. Safety talk by First Officer. Remaining gear stowed and a start on fitting out ship's labs, including container.

10-13 December

Labs have been fitted out. Flow cytometer and mass spectrometer have been run up in the container lab. Freezers are installed and associated glassware sorted. Autoanalyser run up and HPLC installed. Loggers tested. COSHH Assessment draft started and planning for cruise. Arrived Montevideo midday 13th.

14-18 December

Alongside at Montevideo. Main body of science group arrived on 15th. Airfreight arrived 18th and ship sailed soon after it was on board.

19-22 December

Ship on passage to South Georgia. Wet lab equipment set up and deck tanks for krill installed. RMT and LHPR rigged. Trawl winch set up and wire for UOR winch prepared and spooled. Work on wiring for new acoustics fish.

23 December

Arrived Stromness mid-afternoon, tied up to whaling station jetty.

24 December

Some further gear preparation, but most personnel ashore.

25 December

Christmas Day.

26 December

Preparatory work for acoustics calibration, including rigging boom for new fish.

27 December

Transferred to mooring buoy in Stromness Harbour for acoustics calibration. Due to problem with bow-thruster, the ship did not moor until 1400. Stations and transects plotted on bridge.

28 December

Continuing calibration of hull-mounted transducers. Deployment of new acoustics fish from crane aft to calibrate transducers. Slight problem with 38 kHz transducer in hull was traced to wiring and only partially solved. CTD cast to obtain salinity encountered problems with winch and with logging software.

29 December

Following a minor problem with the stepper motors controlling the target position for the acoustic fish, there was an additional period of calibration for this in the morning. The fish was transferred to its towing boom for'ard. Ship moved to the mouth of Cumberland Bay for a vertical net trial. First net was towed vertically whilst second was deployed with the ship drifting side on to the wind, in order to sample a larger volume of water. The latter a mixed success - more animals but not sufficient. A test deployment of the *in situ* rig with the sediment trap suspended beneath it was successful. The foredeck derrick was used to haul the rig wire. The ship then moved offshore to a water depth of approximately 1000 m to test the CTD and rosette. During a preliminary drop with a UOR sensor package, the CTD failed to transmit data and the fault was suspected to lie with the connector with the main cable, which was replaced.

30 December

An acoustic transect was run overnight to attempt to locate krill concentrations. The few swarms which were resolved appeared to associated with the edge of the shelf in many cases. The fault on the CTD was finally located in the slip ring on the winch, and repaired in Cumberland Bay in the afternoon. Test tows with the UOR proved the new winch and cable system to be successful, but electronics problems prevented access to the data. The ship sailed into Grytviken in the afternoon - the early arrival was an attempt to remedy a fault with the ship's windlass.

31 December

Alongside at Stromness, problems with several pieces of gear were solved by ship and science group personnel. The splice on the CTD cable was remade after it was found to be faulty. A damaged UOR logger housing was repaired, and software problems in these solved. A major setback was the discovery that the sediment trap motor and logger housing had leaked on the first deployment - this has wrecked the electronics and left us with a very expensive one-shot trap.

1 January 1990

The ship left Grytviken mid-morning and moved to Station 1 in East Cumberland Bay. A number of vertical profiles for chemical and biological analysis were undertaken. An acoustic run undertaken along the fixed transect in the bay revealed no traces of krill, and no fishing was undertaken. The station was close to the surface front between water contaminated with meltwater and glacial flour, and clear open water. Phytoplankton biomass appeared to be low, and net plankton dominated by the long pennate diatom *Thalassiothrix*. A few dinoflagellates and tintinnids were present in the samples. The physical profile showed clear influence of melt water in a shallow, warm and slightly dilute layer extending to approximately 30 m depth. Below this temperature declined and salinity increased. Glacial flour made the surface water very turbid in the water at the head of the fjord. This water was clearly divided from the more transparent coastal water by a front.

2 January

Water samples were collected for *in situ* incubation and the rig was deployed at dawn. The sediment trap was rigged as a single sample collector and attached to the bottom of the rig wire at 50 m depth. Problems continued with the three self-contained sensor packages. Vertical profiles and an LHPR run were undertaken around midday. UOR tows were then carried out, but a fault with the depth sensor rendered the data useless. The rig was tracked successfully using the ship's radar throughout the day,

and was recovered smoothly at dusk. Vertical profiles and a night time LHPR tow were completed before midnight. A vertical zooplankton net contained a species assemblage different from that encountered earlier, with Subantarctic copepods dominating.

3 January

Weather very calm and mild. A trial of the upward-looking echosounder was undertaken in the slack time before the diurnal LHPR series. This series started at 0700, with each of ten hauls over a twenty-four hour period sampling a depth range of 150 m in a double oblique haul lasting approximately 30 minutes. Interspersed with these were vertical nets and CTD casts. Problems were encountered with the CTD, both in the logger software and with a kink in the sea-cable which necessitated the third resplicing of the cruise. The bench-top through-flow fluorometer was inexplicably unable to communicate with the oceanographic logger.

4 January

The weather continued to be calm. UOR sensor package faulty lead rectified. The LHPR series was continued, finishing early morning. A UOR run was carried out into the open sea from the head of Cumberland East Bay. The ship returned to station where a number of profiles and net hauls were carried out. Whilst on station, the lithium cells from the sediment trap housing were disposed of. The ship then set off on a series of horizontal profiling transects, using underway instrumentation, acoustics on all legs and the UOR and continuous chemical profiling on selected runs. Some problems continue. It has proved impossible to get the Turner bench-top fluorometer to talk to the oceanographic logger and we have had to rely on a jury-rig with the LHPR sensor package.

5 January

Transect studies continued. The UOR continued to give problems. It was recovered at night with some difficulty after the hydraulics failed - only to find that it had failed to record any data. The weather was already deteriorating.

6 January

Weather became progressively worse in the early morning with the wind a steady 40 kts gusting to 50. The final legs of the transect study were abandoned as the UOR was unserviceable and the acoustics suffering from the ship's motion. Although we arrived on Station 2 early, work was impossible because of the weather. Towards late afternoon, the wind dropped and a CTD cast was carried out successfully. The 24 hour series of diurnal LHPR profiles was started in the evening. The scientific echo sounder indicated high krill biomass. This was fished with the RMT. Although the net opening system failed to function, a useful quantity of krill was caught and placed in the holding tank.

7 January

The diurnal LHPR series continued through most of the day, with a sampling interval of two hours at night and three hours during the day. In the early morning, a frame-net tow from the foredeck was undertaken in the anticipation of catching krill close to the surface. The net contained a large volume of *Themisto*, which were retained for chemical analyses, but no krill.

8 January

The weather deteriorated to the point where it was clear that it would be inadvisable to deploy the *in situ* rig. A token ¹⁵N and ¹⁴C experiment was

set up in one of the environmental chambers. A series of short acoustics transects was run in the early morning. Vertical profiles and the midday LHPR were undertaken successfully. The relatively high phytoplankton biomass of 3-5 mg chl a m⁻³ was shown to be dominated by a wide variety of diatoms. Several colonial taxa were present, such as *Chaetoceros* and *Rhizosolenia* spp. *Phaeocystis* colonies were present in the vertical net haul, although not common. As the weather had moderated, the sediment trap was deployed in the early afternoon, but had to be recovered at dusk as conditions deteriorated again. A small amount of faecal material was collected during the six hour deployment. During the night, the weather worsened, preventing the midnight activities which would have completed the station.

9 January

The ship was hove to overnight, with wind gusting to 50 kts. Conditions improved gradually through the day, but it was impossible to deploy equipment until nighttime. The work at Station 2 was concluded with an LHPR profile and associated vertical sampling.

10 January

The ship moved off along the transect through Station 4. After a thirty mile run which crossed the shelf-slope break, the ship turned and re-ran the transect towing the UOR and undertaking continuous chemical profiling in addition to acoustics and oceanographic logging. On return to Station 2, vertical net hauls and water samples for experiments were undertaken before moving off along a three-legged transect to Station 3. Icebergs were encountered at the western end of the first leg of the run and the UOR was brought inboard. A sixteen-mile long tab was sighted on the radar.

11 January

A slightly modified version of the transect to Station 3 was followed. Weather deteriorated as the pressure increased following yesterday's steep fall. Despite this, work proceeded with a condensed version of the timetable. Vertical profiling and a daytime and nighttime profiles using the LHPR were undertaken. The RMT was fished for krill at night. Again there were problems with the release gear, although one net opened and this caught krill, mysids and *Themisto*. The station provided an interesting contrast with Station 2. Although both were on shelf, the shelf around South Georgia is very much more extensive to the south. Mysids were more common in LHPR hauls. The water column had a complex thermocline between 50 and 100 m. Diatoms were rare in the phytoplankton - a net haul showed that many were incorporated into copepod faecal pellets but few were free-living. *Phaeocystis* (or something very similar) was present as small colonies.

12 January

Weather again deteriorated as we steamed north towards Station 4. The UOR was deployed at daybreak but had to be recovered when windspeed reached 60 kts. Sea-state worsened and work was postponed.

13 January

Poor weather continued until early morning. Work recommenced at 0700, and the 24-hour series of diurnal LHPR profiles was started at 1000. Other samples were interspersed with these hauls. An RMT haul was undertaken at night. Although few krill were caught, most were mature in contrast to earlier hauls.

14 January

The LHPR series continued until 0700. The remainder of the day was given over to vertical profiling and transect work. During the afternoon, a UOR transect was run for twenty miles from the seaward side of Station 4 down to Station 2. A number of XBTs were deployed to extend coverage of the temperature field. Throughout the day, there were large flocks of albatross and petrels, and groups of fur seals, in the area. A deep CTD cast was undertaken at night, prior to the midnight intensive LHPR profile. This covered the top 1000 m of the water column, and finished at the shelf-slope break.

15 January

The in *situ* rig was deployed with the sediment trap and ¹⁵N and ¹⁴C incubations. An acoustic grid was run in the early morning prior to the timetabled daytime activities. The day's work centered on the daytime intensive LHPR profile. In both this and the preceding nighttime profile, krill were caught at depths of around 500 m. After the rig was recovered at dusk, the RMT was fished in an effort to catch krill at these depths. However continuing problems with the release gear left the problem unresolved.

16 January

An acoustic run to Station 2 was then continued through Stewart Strait prior to dropping mail at Bird Island. The ship then proceeded to Station 5. On the way the automatic steering failed and the stern tube started to overheat, necessitating reduction of speed. Although we arrived on station late, the full programme of activities was carried out. The ship was successfully held on station using the bowthrust and the helm. With the failure of the line-out meter on the hydrographic wire, depths had to be estimated by counting drum revolutions. Despite the deep-water site, there was relatively high phytoplankton biomass, including *Phaeocystis*, and this extended uniformly down the water column. A nighttime RMT again caught myctophids but few krill.

17 January

Following the second LHPR tow and CTD cast, the ship set off on a transect run towards Station 6. Weather worsened at first, but improved in the afternoon.

18 January

Transect study continued. Having slowed during the night, the ship was held on Station 2 until visibility improved enough to allow deployment of the UOR. A complete transect to Station 6 was run. Water temperature was higher than when in the area previously. The presence of several bergs in the area necessitated the shifting of the station by a few miles. Preliminary series of vertical profiles was undertaken during the afternoon. An acoustic survey for krill showed little, and an RMT failed to catch large numbers of krill. As with Station 5, krill were present at depths of 300-500 m.

19 January

The diurnal series of LHPR hauls started at midnight. A frame-net was fished for krill but failed to catch many in the surface layer. Weather deteriorated, with the wind gusting to 35 knots. The diurnal series of LHPR hauls was abandoned after difficulty in recovering the second. Work recommenced at midday, but after a change of site because of icebergs. The station's activities were rescheduled to undertake the intensive LHPR hauls and associated profiles first. Work proceeded uneventfully.

20 January

Following the midnight LHPR haul, water was collected for the rig deployment, which was placed in the water at dawn. Vertical profiles to characterize the station were undertaken around midday, then the diurnal series of LHPR hauls was started afresh. Later, this was interspersed with water sampling and fishing for animals. The rig was recovered in calm conditions at dusk.

21 January

The diurnal LHPR series was continued until early morning, when once again bad weather prevented its completion. Wind rose to 50 knots. The ship remained on station until midday, then moved off on transect down to Station 2, restricted to 5 knots due to the weather. The UOR could not be deployed, but regular XBT casts were made along transect.

22 January

Station 2 was reached at 0130. The ship then altered course to travel to the west of Willis Islands and then steamed down a transect south of Bird Island. The UOR was deployed for the full length of the transect and functioned efficiently. The acoustics towfish was tested on the east-west leg before the next main transect. The ship turned north to steam along transect. The UOR was deployed in near perfect weather. However, this broke suddenly in mid-afternoon and the ship was reduced to slow speed. At the end of the transect, the survey grid was abandoned and the ship headed for Stanley.

23-24 January

The labs were cleared up and gear not required for Leg 2 was stowed. UOR tows continued as the ship proceeded westward.

OBP10 LEG 2 CRUISE DIARY

31 January 1990 - Left FIPASS at 0900 to bunker in Berkley Sound. Sailed for Shag Rocks and South Georgia at 1800. Estimated steaming time to Shag Rocks is 56 hours. Weather sunny but reasonable swell on beam making ship roll during night.

1 February 1990 - Morning spent preparing Krill Swarm Sampler (KSS) for test deployment at 1330. TV camera installed to look at operation of cod-end nets. Net deployed successfully but cod-end bars failed to drop cleanly, thus 3 nets sampling at once. Upon recovery seen that frame of net in front of towing bridle bent downwards at 60-90%. Net also smashed against side of trawl gantry on recovery. Horizontal frame irreparable. UOR transect initiated after KSS, will run until 2000 and then data will be downloaded, water-bottle casts to 20 and 40 m and then another UOR tow through night. Likely that we cross convergence in early hours of tomorrow morning.

2 February 1990 - Switched on echo sounder to look for krill, continuing with UOR tows. No **sign** of krill. Around 2100 when UOR due to be recovered, winch failed to start. Cable eventually transferred to main trawl winch and UOR recovered. No idea whether UOR winch can be fixed at present time, no spares.

3 February 1990 - Ship altered course to pass well to north of desired track around Shag Rocks. So at 0800 altered course to pick up 200 m contour again. Very few echo marks on sounder. Day spent steaming towards WP2 on shelf to west of Bird Island. UOR winch now working again, dirt in the system. Passed through large concentration of bergs, few krill swarms in general area. Evening and starting a run down northeast coast of South Georgia, approx 8 miles offshore. Only a couple of swarms seen, diffuse and close to surface, plus large diffuse concentration close to bottom in between sea mounts (unfishable). Academic Knipovitch sighted at 2100, called on VHF but apparently Inigo not onboard!

4 February 1990 - No krill seen until early in morning large numbers of Macaroni penguins detected heading out from Hercules Bay? to northeast. Acoustic run continued down coast of South Georgia, about 10 m off shore in a water depth of 100-200 m. At WPT 5 (54½14.9'S 35½55.5'W) headed out at right angle to coast for 20 miles towards area where OBP3 swarm studies carried out. Good krill swarms detected before WPT 5 and along 20 mile leg. At WPT 6 (53½58.2'S 35½36.5'W) turned again through 90° to run back on parallel transect to inshore one. Krill swarms started to fade out soon after turn. ZNET at WPT 8 (53½44.0'S 36½37.0'W) and then transect with UOR, acoustics and bird obs, between inshore and offshore transects undertaken early evening from WPT 8 to WPT 9 (54½06.5'S 35½46.0'W). Ship then returned to position of large krill swarm (54½.07.7'S 35½42.0'W) to undertake RMT haul. Three nets fished at between 70 and 30 m, producing catches of krill of about 5 l in each net although only last net open in reasonable concentration according to echo sounder.

5 February 1990 - RMT fished through extensive layer and catches of 6 l from net open for 5 min. Simultaneous FNET caught 10 small krill. **Many juvenile krill. While** remaining over krill layer exploratory CTD **cast** into swarm made. RMT at 0700 (Z) produced virtually no krill but

lots of **Thermisto**. Watch from 0800-1200 dedicated to CTD casts to determine fine structure of water column, water bottle casts and vertical plankton nets. Overran until 1600 when returned to inshore station for start of 3 hour plus UOR tow out towards shelf break and beyond. After UOR returned to position where large krill swarm noted. Unable to get into position to launch cameras although krill close on sonar. Moved closer inshore and located second swarm. Launched cameras and also took water samples with CTD above, in and below swarm. Activities continued until 0200.

6 February 1990 - Repositioned ship for patch mapping survey using UOR and acoustics. Started at 0400 and will continue to 2200 (originally to 2000).

7 February 1990 -

8 February 1990 - Water samples for rig collected but due to weather only sediment trap deployed. Series of water samples taken at midday to characterize area where trap sited. Sediment trap recovered and then TV cameras deployed at night, once over side ship drifted for 1 hour and during that time passed over several dense swarms extending from surface to 30 m. TV also tried at 50 m where more diffuse layer observed.

9 February 1990 - Fished VKSS through good krill swarm from surface to 50 m. Technique of finding krill rich area and then steaming slowly with net in water seemed to work well. Unfortunately, net failed to work although many krill caught in net meshes. insufficient time for second haul so waited for daylight to steam 7*7 grid with UOR and acoustics. Three CTD's down centre of box interrupted by arrival of Academic Knipovitch wanting to occupy same space. Acoustic and UOR run without incident finishing at 1500. Slow speed (3 kts) acoustic run using upward looking sounder then carried out down centre east-west transect of grid. Znet for AA and PW then followed by repositioning ship for night-time krill fishing with VKSS and TV. Ship positioned over steep shelf break near to WPT X and Y of grid. Failure of power pack when net about to be launched resulted in 1 hour delay, when power restored krill had disappeared.

10 February 1990 - Ship steamed southwards to relocate krill at southern end of grid. Net finally fished in area where no swarms visible on sounder, catch salps and only couple of krill. Ship returned to half-way along transect M-N where horizontal waves in diffuse scattering layers mimicked bottom topography. A series of CTD yo-yo's to look at water structure were initiated until collection of water started at 0700, series of casts delayed by failure of hydraulics again and problems with logger system. ZNET's also deployed. By 1200 ship ready to steam UOR transects to add to eastern end of present box, however after 2 gloriously calm days, while deploying UOR wind gusting to 50 kts and operations cancelled. Ship hove to until...

13 February 1990 - Krill fishing in early hours found no swarms but an RMT caught 300 ml of krill and some salps. Started transects towards Bird Island at 0330. Covered transects through WPT's 9,8,7,6 and 5 with CTD's at WPT's 8,7 and 5. Started transect from WPT 5 to 4 but by evening wind gusting up to 50 knots and UOR not undulating. Decided to return to WPT 5 and wait in shelter afforded by island before proceeding at first light on 14th. CTD's indicate that water changed

along transects, on east phyto poor water while on west phyto rich water. Some krill found at northeastern end but generally very little around.

14 February 1990 - Diffuse layers on echo sounder fished from 100 m to 20 m near station 4. Catch turned out to be salps, *Thermisto* and large gravid female krill. Appeared to be no depth effect. Two Fnet's caught only large quantities of *Thermisto*. After fishing ship steamed towards Bird Island but weather was too rough for base relief. So rest of morning spent on acoustic survey to south and west of Bird Island. Very little seen apart from a patch detected between station 2 and station 4 when steaming towards BI at dawn. Ship returned to spot to fish. Relatively dense layers were found to comprise *Thermisto*, *Thysanoessa* and *E. frigida*. Mid-afternoon and 1 hour spent investigating surface noise with upward looking transducer for Lauro. Afterwards increasing swell and 35 knot wind meant that searching out towards station 4 was uncomfortable and conditions were not suitable for fishing. So ran off to south east to get into lee of SG and by 0200 on 15 th fishing extensive and dense 'krill' indications.

16 February 1990 - After RMT (caught *Thermisto*, *E. frigida*, *superba* and *Thysanoessa*) steamed back 4 hours to station 4. After UOR logger and first deep CTD, Captain announced to all that must break off and go into Bird Island (causing certain amount of bad-feeling). Arrived at BI by 1300 and put Andy Wood ashore, although transfer in heavy swell looked rather hazardous. All finished by 1700 and off to station 4 again. But on passing close to station 2 observed very large (1 run by 75 m) and dense target. Manoeuvred into fishing position and towed RMT through at dusk. Obvious that all moving closer to surface and dispersing. Catch was mixture of small euphausiids and parrots with about half volume of krill. No krill at surface, just parrots. Moved on to station 4 where now doing deep and shallow RMT's. Krill seem more mature at station 4 than at station 2. Finished station 4 (11) at and steamed back to position of large krill swarm between station 2 and 4. Shortly after passing over position noted by ship, krill detected. In contrast to previous time, just marked beginning and end of the swarm and then turned down wind to circle round and come up into wind between 2 marks. Ship stopped in swarm and TV camera launched to 45 m (55 m) on sounder. Light used several times to confirm presence of krill during drop.

17 February 1990 - After TV, repositioned ship for RMT through swarm - catch contained krill, *E frigida*, *Thermisto*, volumes around 5-10 litres. A clover-leaf survey over the swarm revealed a column of krill extending from below 100 m up to near surface with diffuse echoes on edges in top 50 m. This was completed by dawn when ZNET's were fished again. A second sector search after dawn recorded migration of swarm down to within 20 m of bottom (just out of reach of cameras). Therefore undertook a series of CTD casts to investigate small scale changes in water structure. Two UOR tows along 2 of the diagonal transects along the swarm were run but unfortunately the first leg was only 2 miles rather than the 3 requested. After this with the swarm sitting on the bottom out of reach of the camera and nets, the UOR logger was suspended at 60 m and then 30 m to investigate changes in the temperature structure of the thermocline over a period of several hours. As night approached wind increased and ship was practically hove to over swarm. Although it was not

possible to work we sat over swarm and observed the night time migration of swarm to surface, rate approx 50 m 30 min .

- 18 February 1990 - By early morning sea very rough with big swell from SW. After observing morning sinking of swarm ship headed to Rosita. Two anchors put out and afternoon spent calibrating echo sounders. Very valuable exercise. Confirmed that 38 kHz not operating properly but also that has affect on 120 kHz in sequence mode. Finished calibration with spheres by tea time and decided to sail out and steam some transects close to coast over night.
- 19 February 1990 - Still very windy with catabatic winds blowing out of bays. Steamed transects all day but found very few krill. Saw many fur seals heading out from Bay of Isles to north, but too rough offshore to follow them. First attempt at CTD postponed when wind gusting up to 55 kts. Managed CTD, ZNET and UOR logger later on in evening as people settling down for film. Decided to carry on down coast to area where working in first half of leg. If no krill there then to head back up coast towards Bird Island, keeping further offshore if possible.
- 20 February 1990 - Heading back to krill patch north west of Bird Island. Towing UOR and few krill. Arrived at patch co-ordinates and there it was, right on queue. Started sector search at 1830 but decided after 1 triangle that as krill moving up in water should fish with VKSS. By time net fishing all krill in top 50 m but despite this there was a good catch. Followed this with camera drop into swarm. This became very thick and TV light showed many krill swimming around in light. Integrated layer with DAT recorder and now have good record of this swarm over several days.
- 21 February 1990 - Fished VKSS through night, hauls tending to be oblique rather than vertical. Reasonable catches of krill from diffuse layers in top 50 m. At dawn attempted to sample swarm as it moved down towards bottom. Although depth, position etc all seemed right, haul produced very few krill. After this, a 3 mile clover leaf was run to relocate the krill. By breakfast time we were ready to start series of CTD casts for Roni and Ray, inside and outside swarm. Followed by a couple of ZNET's for Sally. After lunch a day-time VKSS for pictures and krill near bottom was very successful. More than 100 krill caught in one net. Finally started 58 mile UOR tow over 10 mile grid by 1420. Only 4 legs run before night fall and UOR taken out of water. However, krill found at centre of each leg! Unfortunately UOR didn't record so no results to go with acoustics and bathymetry. Finished off last leg at 6 knots in dark. After spent several hours trying to find krill again, non at eastern end of area but finally located good indications at centre of western transect. Decided to fish VKSS first and obtained reasonable catch. Then went for last camera drop, a deep ZNET and a shallow ZNET before final event, the VKSS at dawn. Unfortunately net did not reset after last haul and so most promising krill indication was not sampled. Both PS and DGB a little put out by this.
- 22 February 1990 - immediately VKSS onboard, set off for Stanley at 0415 in morning. Night watch eat Xmas cake supplied by PS and watched beautiful dawn over Bird Island. Rest of day spent packing and clearing up, seem to have made little impression so far.

PERSONNEL LIST FOR JB10

Version 3 - 11 August 1989

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Doug BONE
Geof CRIPPS
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2. Instrumentation and Systems Group

Paul WOODROFFE
ISG 2 (yet to be recruited)
ISG 3 (yet to be recruited)

3. Medical Officer

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Dave ROBINS (Plymouth Marine Laboratory)
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