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CRUISE 8/81

18 MAY – 1 JUNE 1981

BENTHIC BIOLOGY OF THE PORCUPINE SEABIGHT

CRUISE REPORT NO 119

1981

NATURAL ENVIRONMENT RESEARCH COUNCIL

INSTITUTE OF OCEANOGRAPHIC SCIENCES

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RRS CHALLENGER
CRUISE 8/81
(IOS Cruise 511)

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Benthic Biology of the Porcupine Sea-Bight

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Institute of Oceanographic Sciences,
Wormley, Godalming,
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Arrive Barry 0800GMT 1/6 1981

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C. Harman	Second Engineer
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OBJECTIVES

1. To obtain a series of quantitative megabenthos samples using the IOS epibenthic sledge, fitted with a single coarse net, at 500m depth intervals from 500m to 4000m along the western flank of the Sea-Bight to investigate the relationship between megabenthic biomass and depth.

2. To obtain, at these same stations, a series of samples with the SMBA multiple corer to examine the distribution with depth of the meiofauna/ macrofauna and chloroplastic pigments within the upper 5cm of the sediments.

3. To obtain a series of Reineck box cores at one depth to compare the meiofauna and chloroplastic pigment results with those obtained from the multiple corer.

4. To deploy Bathysnap and the amphipod trap system several times each.

5. To obtain a number of epibenthic sledge samples using the multiple net system (see Challenger cruise 9/79 report) for qualitative studies of the macro- and megabenthos, particularly at depths below 2000m.

6. To obtain two metre gravity core samples at 1000, 2000, 3000 and 4000m to investigate the recent geological history of the Sea-Bight.

7. In addition to the photographs taken with the IOS camera during routine sampling with the epibenthic sledge, to obtain a series of overlapping frames using a "Benthos" mini-camera on the sledge to check the distance-run figures provided by the meter-wheel. Since the "Benthos" camera is rated only to 1000m this exercise was limited to the upper part of the depth transect.

8. To deploy two bottom transponders at one station to allow more accurate positioning of the ship for towed hauls and particularly for vertical wire work.

NARRATIVE

Challenger sailed from Barry at 0730/18 into force 6 southwesterly winds which increased steadily during the day and produced a considerable swell reducing our speed to only 3-4 knots during the night. By 0700/19 both the wind and the swell had decreased sufficiently to allow a resumption of full speed and the first position in the Sea-Bight, at 51°N: 13°W and over a depth of 2000m, was reached at 0600/20. By this time the weather was very good and remained so, with light and variable winds until pm/22. The acoustic release command systems for Bathysnap and the amphipod trap were both wire tested at this position to 1800m, but at the end of the first test we were fortunate not to lose the release when it was brought up into the sheave of the hydrographic winch and jamming it with the ferrule on the end of the wire.

The wire tests were completed by 0830 and after a short steam, Bathysnap was launched at 1005 and its position on the bottom fixed by 1245 (Stn 51101).

Challenger now made towards station 51102 in 500m, with the intention of carrying out a brief mid-water towing test on the new version of the epibenthic sledge. With some minor problems (see sledge report) this test was successfully completed and station 51102 was reached at 2200/20.

A sledge sample with the coarse net was finally completed at this station at 0400/21 after two abortive attempts, the first abandoned because of the inexperience of the winch driver and the second due to a problem in the sledge monitor. However, one of the weak links on the lower net bar parted during the haul, negating its value as a quantitative sample and film from the benthos camera, which had been used during this haul, was unexposed, possibly because of a lack of synchronization between the shutter and the flash. Since the benthos camera housing was rated to a maximum of 1000m the quantitative sledge haul was not repeated at this time in the hope that it could be picked up later in the cruise after the camera system had received some attention.

Station 51102 was completed with a successful cast of the SMBA multiple corer.

Station 51103, at a nominal depth of 1000m was reached at 0730/21. This station was completed at 2053/21 after successfully deploying and recovering the amphipod trap, and obtaining good samples with both the "coarse" and "fine" net sledge, and with the multiple corer. The gravity corer was also used moderately successfully but obtained only a 75cm core.

Station 51104 (nominal 1500m) was reached at 2100/21 and a coarse sledge haul and a multiple corer cast were successfully completed by 0445/22.

Challenger now returned to the position of Bathysnap which was located and checked by 0745/22. Moving some two miles to the west, the amphipod trap was successfully deployed by 0942 (51105#1). An echo sounder run for the sledge hauls revealed rough topography to the west of the amphipod and Bathysnap positions and we therefore moved to the north and east where a multiple corer sample and a coarse epibenthic sledge sample were successfully obtained by 1700/22. (51105#2 and 3). However, during the sledge haul the south-westerly wind increased to 25-30kts and with a gale forecast it was considered imprudent to attempt the recovery of either the amphipod trap or Bathysnap until conditions improved. By 2000/22, when the treatment of the catch from the sledge had been completed, a heavy swell was running and the ship remained hove to awaiting an expected improvement. During the night, however, the wind further increased to 45kts and, although it had decreased to c. 30kts by the morning, the swell was much too heavy to deploy any gear and Challenger accordingly remained hove to.

By 2200/23 wind had decreased to c. 25kts with the likelihood of a further moderation before a subsequent forecast deterioration. The ship therefore steamed back to the amphipod trap position from which she had moved some 37 miles, to arrive at first light on 24.

At 0550/24 Challenger was close to the amphipod trap position and although there was still a heavy swell and the wind speed was still 20-25kts the trap was released successfully from the bottom at 0618 and successfully brought aboard at 0630/24.

Bathysnap was released at 0726 and brought inboard with little difficulty at 0825 though the wind tended to push the ship over the gear and some very minor damage was sustained when Bathysnap was struck by the underside of the starboard quarter before it drifted clear of the stern.

To complete the 2000m station the fine net epibenthic sledge was shot at 0942, but at 1115, as it reached the sea-bed, the Mufax traces were lost due to a monitor malfunction. After a further 15 minutes on the bottom, without the reappeareance of the traces, the haul was terminated and the sledge was inboard by 1300/24 with a small catch.

Challenger now steamed to the 2500m station (51106) at approximately 50°30'N: 13°00'W, arriving at 1730/24. The epibenthic sledge was shot by 1745 and inboard by 2104. This station was completed by a multiple corer which was inboard at 2330.

Bathysnap was deployed at station 51107 at a depth of 2700m and a good position fix obtained with it on the bottom by 0305/25 and the ship proceeded SW towards a proposed station at approximately 3000m. This depth was known to be a difficult one in which to find a suitable ground to shoot the epibenthic sledge and a series of echo sounding runs were therefore undertaken around the 3000m isobath between 49°55'N and 50°15'N, but with little success. During the forenoon the westerly winds increased to gale force, raising a considerable swell which made the deployment of gear impossible and by 2200 the swell was so heavy that the vessel was hove to for the night.

At 0730/26 echo sounding was resumed and Challenger made for a possible trawlable area at about 3500m at about 50°07'N: 13°45'W. By noon the swell had moderated somewhat and the multiple corer was launched (Stn 51108). However, no suitable trawling ground in this area had been located and in anticipation of an expected moderation the vessel moved to a station at about 4000m at the mouth of the seabight (51109) where two sledge hauls and one multiple corer cast were successfully completed by 0700/27.

Overnight the wind had fallen very considerably and had backed to the south, causing the swell virtually to disappear. Challenger therefore made for the bathysnap position and during the passage we came across, and were able to pick up, a 17" Benthos glass sphere. In very good conditions Bathysnap was successfully retrieved by 1708/27. However, because of the problem of Bathysnap drifting under the stern on the first retrieval, the rubber boat was launched on this occasion in order to make fast the line from the ship without bringing the vessel close to the gear. This was successful, though great difficulty was experienced in towing Bathysnap towards the ship and the exercise would have been impossible if the weather conditions had not been good.

The vessel now moved downslope once more to try to work a station as close to 3000m depth as possible and a multiple corer (51110#1) cast was completed by 2000/27. A short echo-sounding survey revealed an acceptable, but far from ideal, area for sledging and the amphipod trap was accordingly deployed (51110#2) to be retrieved later at the end of the station. By 1310/28 two epibenthic sledges had been completed and the amphipod trap had been retrieved. During this station the ship experienced full frontal conditions, with visibility at times reduced to 200 yards, but by the time the station had been completed the visibility had improved so that Challenger could travel at full speed to an additional station to the original programme (51111) at a depth of 2600-2700m in a region previously sampled during Discovery Cruise 105 (station 10112) and close to the second Bathysnap position (51107).

Two sledge hauls were completed at this station by 0012/29 and the vessel moved north to repeat the 500m station, the benthic camera having by this time been fixed. However, instead of returning to the original shallow station some 90 miles away, a rather nearer point on the 500m contour was selected at about 51°27'N: 13°56'W (Stn. 51112). This position was reached at 0900/29.

During the cruise the sledge catches had seemed fairly consistently somewhat poorer than those we had previously taken in similar localities, prompting some concern that the sledge was not operating efficiently. Accordingly, the second haul at 51111 had been undertaken without the floatation spheres (see gear report) but had produced a very similar catch to that from the first haul at this station. At the 500m station, therefore, the first haul (51112#1), with the three nets fitted, was undertaken with the Benthos camera directed backwards towards the nets to monitor the behaviour of the gear on the bottom, while during the second sledge haul (51112#4), with the coarse net fitted, the Benthos camerawas directed forwards and was photographing at 3 second intervals.

Both Bathysnap and the amphipod trap had been deployed after the first sledge haul at this station, and after the second haul both of them were successfully retrieved, Bathysnap after some 5 hours on the bottom and the amphipod trap after only 4 hours on the bottom (51112#2 and 3). The station was completed by a multiple corer cast which had to be repeated because, for the first time on this cruise, this excellent piece of equipment failed to sample on the first deployment.

By the time this station was completed at 1800/29 the Master insisted that only a further 5 hours could be devoted to station time before our departure for Barry. Accordingly, the ship made an easterly course to a 1500m station at about 51°16'N: 13°17'W where we arrived at 2220h. After a multiple corer cast and an epibenthic sledge haul (51113#1 and 2) it was already too late (0020/30) to undertake an intended second sledge haul at this depth and the ship therefore made direct for Barry where she arrived at 0800/1.

Apart from periods of low visibility, the weather during the last 4 days of the cruise was excellent and throughout the cruise we lost less than 48 hours station time to bad weather. But for this loss we would certainly have completed the intended programme. As it was, we failed only in our intention to deploy the bottom transponders and to obtain the Reineck and gravity core samples. The cruise was therefore a considerable success scientifically, with the ship-side equipment all working very efficiently. The only problems encountered resulted from inexperience of some of the ship's watchkeepers in driving the winches and the crane, and occasionally a serious language barrier. In the weather conditions in which we were working these problems were not serious, but they might have been had we tried to work under more adverse conditions.

Finally, it is a pleasure to thank the Master and crew for their co-operation in achieving so many of the scientific objectives of the cruise, and to point out that, in clear contrast to the previous IOS benthos cruise, this one, as a consequence of collecting the floatation sphere, actually returned with more gear than that with which we began!

SHIP'S INSTRUMENTS

PES Mk III

The Mufax recorder basically performed well but as on Cruise 6B there were annoying white patches appearing regularly on the paper; I changed the Helix blade for a new one but this failed to improve the situation; the only other explanation I can suggest for the fault is the Helix electrical contacts which require a major dismantling of the recorder to access. The new towed fish performed very well but the cable appears to stretch in the water, straining and in some cases breaking the fairing end terminations at the brass clamps; the cable relaxed within 24 hours of recovery.

Trawl and winch monitors

Basically no problems but if felt tip pens were obtained for the servoscribe recorder we would use it as a useful monitor and record of cable tension.

Hydrographic winch

The poor siting and visibility of the wire out monitors combined with inexperienced operators once again almost resulted in lost gear; as it was the conducting cable termination was jammed in its sheave and several strands were sprung.

IOS INSTRUMENTS

Benthic sledge monitor

J18 was used for all but one haul. Initial problems with the switch position depleted flash and camera batteries and exposed a limitation of the flash indicator circuit; when the camera logic supply dropped below a critical level with respect to the monitor logic supply the monitor would not respond to the camera signals; the circuit has now been modified to tolerate external logic supplies of as little as one volt. Two hauls were carried out with low battery levels which probably resulted in pressure and temperature traces moving out of calibration; in future this should be avoided by use of a properly calibrated voltage trace. Rough calibrations were also only available for tilt angle and distance run; these should also be fully calibrated by the next deployment. J19 was used for only one haul and failed during the course of it; the fault was due to an FET power transistor failure in the power amplifier; these are very susceptible to damage by reverse voltage spikes and have therefore been replaced by a more conventional circuit until more robust versions become available. One meter wheel and one angle meter were used without problems for all hauls. Some trial hauls with a high speed camera were carried out which involved a specific battery pack and trigger circuit; after initial laboratory problems with the crystal oscillator were overcome, the unit performed as required, nine second and three second repetition intervals were used. The standard PES Mk III system was used on its own to monitor all the hauls without problem.

Corer monitor

A standard 10kHz Acoustic Beacon Type H clamped to the wire 50 metres above the corer was used to monitor bottom approach at all coring stations. At the deepest station (4000m) the bottom reflected signal was quite poor; if cores were required from very soft sediments in depths much below 4000m the IOS near bottom echo sounder interfaced with a suitable IOS telemetry beacon and mounted in the corer frame would be a better and probably the only workable technique.

Amphipod trap and Bathysnap moorings

The two command releases used for these moorings were successfully wiretested at 1800 metres in 2000 metres water depth; the opportunity was also taken to test 5 retractor systems in conjunction with the releases. The command releases were successfully used on four amphipod trap moorings (average duration 12 hours) and three Bathysnap deployments (4 days, 3 days and 6 hours); each deployment used one retractor and one pyrorelease on the main release mechanism and Bathysnap used an additional retractor to operate a compass, all operated successfully. The deepest deployment was 2900 metres. The release on Bathysnap sits completely out of the water when the unit is on the surface; this results in a total loss of acoustic signal. It was therefore found advisable to continually home on the acoustic signal from Bathysnap as it was rising through the water in order to ensure easy visual contact when it surfaced. This was also useful with the amphipod trap although the release sits 20 metres below the surface and so acoustic contact is not totally lost.

Other instrumentation

Two long life transponders (greater than 5 years operational life) were prepared but not deployed due to lack of time to complete an adequate bathymetric survey. Two otter trawl monitors used on the previous cruise and to be used as foul weather back-up work on this cruise were overhauled; both had totally discharged batteries - the 'round the corner' unit (mounted in the trawl door) also had a wrongly mounted tilt switch (my mistake) - the 'straight unit' (mounted on the side wires) had been partially flooded (through a faulty pressure switch) and will require total replacement of the electronic cards; both units will be rebuilt, recalibrated, and fitted with easy replacement battery packs plus spares before their next deployment (maximum battery life is 30 hours for these units).

G.R. Phillips

EPIBENTHIC SLEDGE

The latest version of the epibenthic sledge was used successfully throughout the cruise. It was the general opinion, however, that the catches were consistently rather smaller than those taken with the previous sledge. The main differences between the new sledge and the old sledge were: 1) the mouth of the suprabenthic net was moved to the front of the frame, this dispensing with the need for a forward extension of the net; 2) the addition of two 18" glass spheres to the top of the frame, giving a buoyancy of 100Kg. This second modification was made after extensive tank tests on a model (see Internal Document No. 132) in an attempt to improve the sledge's poor midwater stability to a degree which would allow the sledge to be righted, by incresing the ship's speed, if it became inverted during the launch. Although the stability was noticeably improved and the sledge never became inverted during a haul, when it was veered purposely upside down an increase in the ship's speed to 4.5kts would still not right it. The extra buoyancy had the predicted disadvantage of requiring more wire for a given depth to reach the bottom. The previous sledge required a wire to depth scope of approximately 1.4 whereas the present one requires 1.7. The only other annoying fault was the frequent breaking of the bottom bar weak links. The only difference which could explain this is that the eyebolts, to which the bar is tied, have been galvanised and the rougher surface could possibly have abraided the string.

The electronics, odometer, inclinometer and camera worked well throughout the cruise.

Two configurations of lower net were used: 1) 3 small nets, a central net with 1mm mesh and two outer nets with 4.5mm mesh for material hauls; 2) A single 4.5mm mesh net for biomass hauls.

A Benthos camera, with 3 second recycling, was used on three occasions in 500m in two different ways. 1) Looking forward to take overlapping frames in an attempt to check the accuracy of the odometer. The first attempt at this was unsuccessful as the camera and flash were not syncronized. 2) Looking aft into the mouth of the net to give information about the sledge's performance.

R.G. Aldred

UNDERWATER CAMERAS

Underwater cameras were operated in conjunction with both the new epibenthic sledge and a completely redesigned Bathysnap system.

The Mk. 4 camera allocated to the latter trials had been modified to increase the normal operations duration from 36 to a possible 210 hours. Initially the system was deployed for 100 hours and here the photographic unit was loaded with mono film, the resultant record being processed and examined immediately following recovery to assess the potential value of the system in its present form and to verify the correct performance of the associated equipment under operational conditions. Satisfactory results were obtained here and during two further short duration stations where colour film was utilized as a recording medium.

Standard Mk. 4 cameras were mounted on the new epibenthic sledge to cover a total of thirteen hauls, these operating with colour film on five occasions. The original attachment points had been retained on the latest version of the sledge but logically the photographic unit had been angled in towards the centre line to cover an area of sea bed sampled by the net system which slightly modified the field of view. No major problems were encountered with the normal Mk. 4 system during the cruise.

The opportunity was taken to carry out trials with a new Type 324 Benthos photographic unit. This had a depth restriction of 1000 metres which restricted possible operating areas, but the system has a maximum cycling rate capability of three seconds as compared with our normal quarter minute interval. It was therefore decided to take advantage of this feature to study sledge performance by gaining a series of overlapping bottom shots to gauge stability etc.

Initially, shutter synchronisation problems were encountered when attempting to operate in conjunction with a Mk. 4 flash, but this was finally resolved by modifying the camera control wiring and two successful films were obtained with this combination towards the latter part of this cruise.

E.P. Collins

AMPHIPOD TRAPS

In the light of problems encountered during Cruise 509 in November 1980, the trap-rig employed was modified in several ways for the present cruise. As before, the traps consisted of perforated 2ℓ plastic bottles with funnels in place of lids. Six of these bottles were set radially in a fibre glass cylinder 70cm in diameter and 35cm high. The resultant rosette was free to rotate on a vertical spindle and was fitted with a fin to give a positive alignment to bottom currents. Two rosettes were used in a rig. The rosettes were separated by a 9m strop and matters arranged so that the lower was 1m above the sea-floor. Anchor chain was used as ballast, and c. 110kg was found to give a suitable rate of descent. Buoyancy consisting of four Benthos 17" spheres mounted in a frame was attached 10m above the upper rosette. A 10" sphere was used on the stray line. Separation of rig and ballast was achieved with the standard IOS release system using a retractor with pyro back-up.

The rig required three lifts at lauch and recovery, but gave no problems in moderate to poor conditions of weather and sea.

Traps were set on four occasions in depths of 500-2900m, and remained on the bottom for 5-44 hours. Results were disappointing in that very few amphipods, were taken. Bait was touched hardly at all in any of the upper rosette traps. The same was true of a proportion of the lower rosette traps, particularly those set for short periods. Bait in the bottom rosette of the set which remained on the bottom for 44 hours due to bad weather was totally consumed, however. Optimum bottom residence time would appear to be greater than 12 hours and less than 40 hours. This is a surprisingly long period in the light of published data. Also there appears to be a need for more efficient retention of organisms once they are in the traps.

M.H. Thurston

BATHYSNAP MK II

Since the loss of Bathysnap Mk I on cruise 17/80, major structural changes have been made such that the buoyancy and the camera were contained in a single structure. No current meter was incorporated but a polypropylene float in the field of view of the camera served as a current indicator. Three successful casts were made at depths of 2600, 2000 and 500m for up to 4 days duration. A variety of recovery techniques were tried but in spite of several difficulties, no damage was done to the gear.

The film from the first cast was developed on board and from only a cursory examination of the negatives it clearly shows some dramatic megafaunal activity and variations in current direction.

R.S. Lampitt

BENTHIC INVERTEBRATES

The catches from this cruise which were for the most part rather small, rather than adding to the list of fauna of the Porcupine Sea Bight were more notable for the scarcity of certain megafaunal animals that would have been expected to dominate.

Two stations were sampled at about 500m on the east flank of the Porcupine Bank, St. 51102 and St. 51112, both being dominated by the bivalve *Abra nitida* numerically and by the holothurian *Stichopus tremulus* and brachyuran *Geryon tridens* volumetrically. Differences were apparent between the stations, although this may have been due to the breakage of the weak links on the bottom net bar at St. 51102. At this station Hyalinoecia was common, while at the more southerly station (St. 51112) Crustacea, particularly Munida, Pandalus, crangonids and other natant decapods,were more abundant. Abra nitida again dominated numerically at St. 51103 (950m), although the larger megafauna consisted principally of the echinoid Phormosoma placenta, the asteroid Psilaster andromeda, and the commensal association of the decapod Parapagurus pilosimanus with zoantharians. The paucity of the holothurians Laetmogone violacea at this station was surprising. Likewise, holothurian were scarce at St. 51104 (1380m) apart from the small Ypsilothuria which dominated numerically along with small ophiuroids. The whole catch was rather smaller than expected, apart from the fish, but did contain several asteroids including Zoroaster fulgens, Bathybiaster vexillifer and Plutonaster bifrons. Another sample taken slightly deeper and further south (St. 51113,1530m) was dominated by the holothurians Benthogone rosea and Mesothuria lactea, some of which were in excellent condition. The amphipod Neohela monstrosa as well as small ophiuroids and asteroids were common in a catch that also contained two large skate eggs.

A classic Porcupine Seabight 2000m sample was taken at St. 51105 with the echinoderms Ophiomusium lymani, Echinus affinis, Benthopecten armatus, Benthogone rosea and Paelopatides gigantea predominating. Crustacea, notably Polycheles, Munidopsis curvirostra and Glyphocrangon longirostris were also common.

As expected,the asteroid Hymenaster membranaceus and the ophiuroid Ophiomusium lymani dominated at St. 51106 (2510m). Other small asteroids and solitary corals were also quite common. 19 "necks" of the fragile echinoid Echinosigra paradoxa were found but only 6 appeared to come from live specimens. Other fauna included the bivalves Malletia and Cuspidaria and the crustaceans Polycheles and Azygocypridina. The holothurian Psychropotes depressa was in this case notable by its absence.

Owing to the rather poor catches taken by the epibenthic sledge on this cruise it was decided to run a gear test at St. 51111 (2660m) to test the effect of the two 17" buoyancy spheres on the sampling of the net. The dominant animal in the catch, Hymenaster membranaceus was counted for a comparison and produced suprisingly similar numbers for the two hauls. As expected,the centre fine mesh net caught 1/2 to 1/3 the quantity of each of the outer two coarse mesh nets.

Slightly deeper, at depths where Kolga hyalina has been prevalent in past years, the catches were totally devoid of this holothurian. St. 51110#4 (2755m) contained a few H. membranaceus, Glyphocrangon, Azygocypridina, Munidopsis rostrata and polychaetes of the family Aphroditidae, but like St. 51110#3 (2800m) small ophiuroids and asteroids dominated numerically. Both catches contained large quantities of stones and clinker as well as tests of dead Diacria (Pteropoda).

Small catches were also taken at St. 51109 (3980m) dominated by small ophiuroids, probably Ophiocten hastatum, and asteroids including Freyella spinosa. Of the larger invertebrates the holothurians Psychropotes longicauda and Benthothuria were notable, and one haul produced the rare occurrence of a crinoid. Both hauls at this station contained large amounts of clinker.

D.S.M. Billett

ORNITHOLOGY

Observations were carried out as and when other duties permitted. About 90 ten minute counts were made together with additional casual records of presence and absence. Fifteen species of seabird were recorded. Fulmars (Fulmarus glacialis), kittiwake (Rissa tridactyla) and British storm petrels (Hydrobates pelagicus) were present during at least half of the ten minute counts. Fulmars were present during more observation periods than any other species but kittiwakes were numerically the most abundant. Two Cory's shearwater (Calonectris diomedea) seen on 24 May represent an early record for this species at such a northerly latitude. Easterly winds at the beginning of the cruise resulted in substantial falls of migrating land birds particularly swallows (Hirundo rustica).

M.H. Thurston

STATION LIST

STATION	DATE 1981	POSITION (START) N	POSITION (START) W	POSITION (END) N	POSITION (END) W	GEAR	SAMPLER DEPTH (M)	DURATION GMT	ODOMETER DISTANCE RUN (M)
51101#1	20:5	51°02.3'	12°59.7'			Bsnap	2000	1110/20-0726/24	
51102#1	21:5	52°01.9'	13°27.0'	52°01.2'	13°26.8'	BN1.5C	520-530	0255-0321	607
51102#2	21:5	51°59.7'	13°24.9'			MC	585	0446-0447	
51103#1	21:5	51°45.2'	13°07.9'			Tamph	1000	0935-1527	
51103#2	21:5	51°47.0'	13°08.6'			MC	960	1036-1037	
51103#3	21:5	51°46.8'	13°08.3'			GC	985	1120-1120	
51103#4	21:5	51°47.9'	13°09.5'	51°48.3'	13°10.0'	BN1.5/C	960-950	1328-1352	635
51103#5	21:5	51°47.0'	13°13.1'	51°47.6'	13°13.8'	BN1.5/3M	950-930	1857-1939	1081
51104#1	22:5	51°24.9'	13°03.4'	51°24.3'	13°04.1'	BN1.5/C	1370-1390	0123-0149	619
51104#2	22:5	51°21.4'	13°03.3'			MC	1492	0412-0414	
51105#1	22:5	51°01.9'	13°04.6'			Tamph	2000	0942/22-0518/24	
51105#2	22:5	51°01.9'	13°01.5'			MC	2000	1213-1217	
51105#3	22:5	51°04.4'	12°53.7'	51°04.3'	12°54.9'	BN1.5/C	2030-2020	1451-1518	612
51105#4	24:5	51°05.2'	12°58.5'	51°05.1'	12°59.2'	BN1.5/3M	1993-1985	1118-1133	
51106#1	24:5	50°28.9'	13°05.8'	50°29.0'	13°06.6'	BN1.5/C	2510-2520	1919-1945	624
51106#2	24:5	50°29.1'	13°08.6'			MC	2510	2218-2223	
51107#1	25:5	50°25.4'	13°20.4'			Bsnap	2600	0305/25-1542/27	
51108#1	26:5	50°07.4'	13°57.1'			MC	3567	1331-1332	
51109#1	26:5	49°50.7'	14°02.1'	49°51.6'	14°02.7'	BN1.5/C	3960-3940	2039-2120	958
51109#2	27:5	49°48.1'	14°08.0'	49°48.4'	14°09.5'	BN1.5/3M	3980-3990	0338-0420	968
51109#3	27:5	49°49.1'	14°17.1'			MC	4167	0802-0803	
51110#1	27:5	50°16.8'	13°32.1'			MC	2785	1928-1929	
51110#2	27:5	50°09.6'	13°31.7'			Tamph	2910	2137/27-1310/28	
51110#3	28:5	50°16.4'	13°30.9'	50°15.4'	13°30.6'	BN1.5/3M	2785-2800	0214-0305	956

STATION	DATE 1981	POSITION (START) N	W	POSITION (END) N	W	GEAR	SAMPLER DEPTH (M)	DURATION GMT	ODOMETER DISTANCE RUN
51110#4	28:5	50°14.2'	13°27.0'	50°13.7'	13°25.4'	BN1.5/C	2755-2718	0639-0721	963
51111#1	28:5	50°21.2'	13°23.0'	50°20.7'	13°24.4'	BN1.5/3M	2660-2670	1721-1758	916
51111#2	28:5	50°23.4'	13°20.1'	50°23.0'	13°20.4'	BN1.5/3M	2620	2209-2246	900
51112#1	29:5	51°26.5'	13°58.6'	51°26.1'	13°59.4'	BN1.5/3M	530-515	0944-1023	872
51112#2	29:5	51°20.3'	14°00.5'			Bsnap	512	1215-1720	
51112#3	29:5	51°19.9'	14°00.4'			Tamph	512	1240-1649	
51112#4	29:5	51°25.5'	13°56.9'	51°24.4'	13°56.4'	BN1.5/C	550-560	1523-1545	619
51112#5	29:5	51°19.2'	14°00.0'			MC	510	1837-1838	
51113#1	29:5	51°16.5'	13°10.4'			MC	1500	2241-2242	
51113#2	30:5	51°15.2'	13°12.3'	51°14.6'	13°13.7'	BN1.5/C	1530-1540	0013-0052	976

BN1.5/3M Epibenthic sledge with two coarse nets (4.5-m) and one fine net (1.0mm)

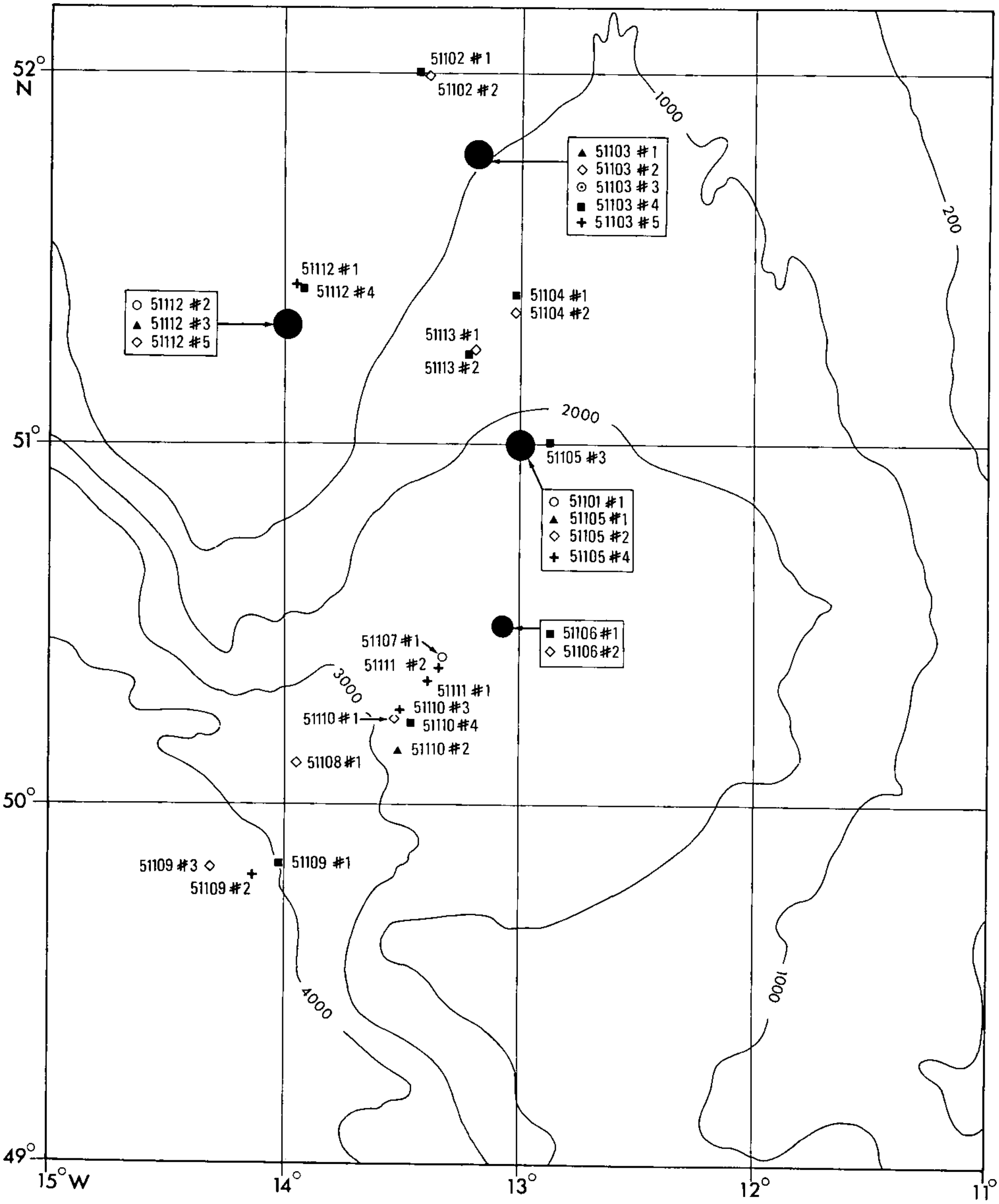
BN1.5/C Epibenthic sledge with single coarse net (4.5mm)

Bsnap Bathysnap

Tamph Amphipod traps

MC SMBA Multiple corer

GC Gravity corer



CHALLENGER CRUISE 8/81, (IOS CRUISE 511) : STATION POSITIONS.

Key: + BN 1·5/3M ■ BN 1·5/C
○ Bsnap ▲ Tamph
◇ MC ⊙ GC