I.O.S.

RRS CHALLENGER

CRUISE 5/82

23 MARCH – 5 APRIL 1982

BENTHIC BIOLOGY OF THE PORCUPINE SEABIGHT

CRUISE REPORT NO 140
1983

NATURAL ENVIRONMENT RESEARCH COUNCIL
INSTITUTE OF OCEANOGRAPHIC SCIENCES

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When citing this document in a bibliography the reference should be given as

THURSTON, M.H. 1982 RRS *Challenger* Cruise 5/82 (IOS Cruise 514): 23 March - 5 April 1982. Benthic biology of the Porcupine Seabight.
Institute of Oceanographic Sciences, Cruise Report, No.140, [20pp].

INSTITUTE OF OCEANOGRAPHIC SCIENCES

WORMLEY

R.R.S. CHALLENGER

Cruise 5/82

(IOS Cruise 514)

23 March - 5 April 1982

Benthic biology of the Porcupine Seabight

Principal Scientist

M.H. Thurston

I.O.S Cruise Report No. 140

1982

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ITINERARY

Depart Barry 0730 GMT 23 March 1982

Arrive Barry 0230 GMT 5 April 1982

SCIENTIFIC PERSONNEL

R.G. Aldred	IOS Wormley
D.S.M. Billett	" "
D. Edge	" "
R.S. Lampitt	" "
N.R. Merrett	" "
G.R.J. Phillips	" "
Mrs R. Russell	" "
M.H. Thurston	" " (Principal Scientist)
P.I. Wallin	" "
W.A. Crowe	University College, Galway (Observer)

SHIPS OFFICERS

J. Moran	Master
K. Avery	Chief Officer
J. Price	Second Mate
T. Boult	Third Mate
R. Crook	Chief Engineer
I. McGill	Second Engineer
H. Peck	Third Engineer
A. Greenhorn	Fourth Engineer
F. Dunning	Fishing Skipper

OBJECTIVES

1. To take a series of multi-net epibenthic sledge samples at the shallower transponder station (see Challenger 14/81 report) to investigate the replicability of hauls in terms of number of organisms and biomass.

2. To obtain more otter trawl samples at depths of 300-4000m as part of the continuing sampling of fish populations in the Sea-Bight.

3. To obtain a series of qualitative samples with the coarse mesh epibenthic sledge from 500-4000m to investigate the relationship between biomass and depth.

4. To make several short term and one longer term deployments of Bathysnap.

5. To obtain photographic evidence of megabenthic abundance and diversity, and of net function during epibenthic sledge hauls using the IOS and "Benthos" cameras.

6. To obtain soundings for eventual incorporation into an improved bathymetric chart of the Sea-Bight and to identify suitable areas for future biological sampling.

NARRATIVE

Challenger cleared the lock at Barry Dock at 0730/23 and proceded to the westward, making 9 knots in near calm conditions. The PES fish was streamed at 1100/24 and the passage continued to the position of the first station on the east side of the Sea-Bight. A run was made over the projected fishing ground in an attempt to ascertain that the chosen position was south of the coral forests known to exist close to this area. No indication of coral was found and the OTSB 14 was launched at 1720/24. On the successful completion of station 51401, the vessel made toward the north west side of the Sea-Bight in a sounding of 1200m at 13°W. Monitors were wire-tested en route to this position in order that Bathysnap could be deployed with the minimum delay. The transponders were located and Bathysnap was launched a little to the SW at 0706/25.

The shallower transponder station was to be the location of one of the major elements of the sampling programme. The wind, which had been rising slowly since our departure from Barry, was now blowing Force 6 southerly. Conditions were not ideal, but were workable using the epibenthic sledge, providing there was no further deterioration. Accordingly, the sledge in its multinet mode (BN1.5/3M) was launched at 0915/25 (station 51403#1). The wind moderated a little during the day but remained above 20 knots. Further sledges were fished successfully on a southerly heading. The reciprocal northerly 'recovery' courses were utilized to test the sensitivity and selectivity of several transmitter/receiver 'dolphins' in relation to the transponders. The sixth haul was completed at 1105/26. Material from all fine centre nets was preserved in the normal way, and the catches of the coarse lateral nets frozen for biomass studies. A "Benthos" camera directed forward was used on all of these hauls, and a shuttered IOS camera directed into the net on the first two. Station 51403 was completed with an OTSB 14 haul, the ship getting under way for the next station at 1650/26.

Challenger proceded to shallower soundings, completing a trawl in 750m of water at 2200/26. After a further period of steaming the ship reached the 500m contour where the coarse net epibenthic sledge was fished. This formed the first sample of the planned biomass transect. A further three coarse net hauls at nominal 500m intervals were completed during the 27th, the last one, at 2000m coming aboard at 2320. The first attempt at sampling at 1500m was aborted when the net turned over in midwater. No cause for this behaviour could be established. As a precautionary measure, two 10" glass buoyancy spheres were attached to the frame for the second successful attempt. The spheres were left on for subsequent hauls.

During the return to the Bathysnap position a trawl was worked at 1750m (station 51409). The initial attempt had to be aborted soon after the gear had been transferred to the single warp as the engine room had problems with water in the fuel. The second attempt was also not successful, there being no signal from the pinger. After a brief investigation, the 'through the door' pinger was replaced by an old pattern one mounted on the sweeps. This gave very adequate signals. Bathysnap was released at 1058/28 and was inboard at 1154/28. Recovery, from surfacing to all in board, took 29 minutes and followed previously formulated instructions. The technique, involving a light

line for passing aft the lazy line and instrument package, worked well, but was not tested as sea and wind conditions were excellent.

The vessel proceded south and Bathysnap was re-deployed in 2665m of water (station 51410) at the site of a drop made on Cruise 512 (Challenger 14/81). Bathysnap was cast off at 2036/28. Almost immediately, a good satellite fix was obtained and a course set for the next station. This involved a short northerly run to make sounding in 2500m where a trawl and a sledge were completed at 1242/29. The wind got up overnight but at 20-25 knots did not affect the scientific programme. The nominal 3000m sledge was deliberately fished somewhat shallower than this depth in the hope that it would be possible to establish whether the population of the holothurian Kolga hyalina sampled from Discovery in 1979 was still present. No such evidence was found. This haul was preceded by a short echo sounder survey. The IOS sampling programme in the Porcupine Sea-Bight was initiated in 1976, and in many areas smooth fishing grounds have been located. However, the bathymetry between 2700m and 3400m is complex and suitable areas of sea bed for sledge and trawl operations are limited in number and extent. Lateral displacements of smaller magnitude than the possible error of satellite fixes can take gear off suitable bottoms onto dangerously rough ground. Under these circumstances pre-fishing echo sounder runs are a necessity. Successful hauls with the sledge (station 51412) and trawl (station 51413) were completed by 0758/30.

Challenger then proceded to the IOS deep transponder station at 4000m where the trawl and sledge were fished (station 51414). Hauls made at these depths are expensive in time due to the length of wire necessary to reach the bottom, and the fishing time needed to obtain reasonable catches. For these reasons it was not until 0626/31 that the sledge was launched over a depth of 3500m to obtain the last of the projected eight hauls for biomass studies (station 51415). Following the recovery of Bathysnap, the sledge was converted back to the multinet mode and two hauls were made over the tracks of nets fished during previous cruises which obtained large numbers of Kolga. Station 51416 was an attempt to repeat Discovery station 10113#1, and 51417 to repeat haul 50605#1. The first of these hauls was delayed briefly by camera problems and the second by difficulties in finding fishable bottom. The bathymetry at these depths is much more complex than is shown on

availabe charts and it proved impossible to find the bottom fished during 50605#1. Station 51417 was, therefore, worked at a slightly shallower depth.

The prime object of working stations 51416 and 51417 had been to locate populations of Kolga, so that a photographic record of activity could be obtained with Bathysnap. No Kolga were found in either sample, so the location of the final Bathysnap drop was changed to the site of station 51408 at 2000m where substantial populations of other species of holothurians had been found. Accordingly Challenger headed north and Bathysnap was launched at 1305/1.

On the way to the shallow transponder station a trawl was worked in 1500m (station 51419). Sampling at the shallow transponder station was started again (51420) with the first net reaching the bottom at 0035/2. Recovery of the second haul proved difficult as the centre net contained about $0.8m^3$ of sediment. Some of the sediment was lost when the net developed a small split along one seam and more was lost when the cod-end was opened. The sample could no longer be considered quantitative, nor could it justify the time and effort which would be required to sort it. Accordingly it was discarded. The third and fourth hauls were completed without mishap, although the fourth was delayed by further camera problems. The recovery of the latter haul coincided with a forecast warning of south easterly gales in sea area Fastnet. The Master decreed an end to the sampling programme, and the ship was steered due east to take shelter in Dingle Bay. The wind rose sharply during the night but by mid-morning of April 3, had moderated sufficiently for the vessel to proceed towards Barry. The passage was made at a leisurely pace, the vessel docking at 0230/5.

From the scientific viewpoint, the cruise was a resounding success with 28 sledge and trawl samples being obtained within the overall depth range 300-4300m. We were extremely fortunate with the weather. This, however, would have availed us little without the unstinting efforts and cooperation of the entire ships complement. The help of the fishing skipper, Mr. Frank Dunning, was particularly appreciated.

M.H. Thurston

IOS INSTRUMENTS

Net Monitors

The benthic net monitor, J18, was used for all 20 sledge hauls. Doubt was cast on the monitor's camera control and indicator circuit operation but when tested these appeared satisfactory.

On one hauls the upside down and inclinometer indicators proved their need and saved several hours of ship time.

The "Benthos" camera battery and trigger pack was used for 12 sledge trawls without problems.

The right-angled OTSB net montior was used successfully to fish 6 trawls, but it developed several faults. The cause was a crystal oscillator operating at too high a frequency which led to the failure of other components.

The wire mounted monitor was used in its place for 2 trawls, and the bottom echo provided adequate information to fish the two sites.

D. Edge

Underwater cameras

The reliability of IOS and Benthos cameras was less than might have been hoped, and as a result, 5 out of 23 films were completely blank. Most of the remaining films suffered to some degree or another from blank frames or double exposures.

Apart from 2 blank films the main problems with the standard IOS camera involved flash triggering. Double or multiple exposures caused by the flash triggering during film transport were not infrequent, and on several occasions sledge lauches were delayed by failure of the camera to trigger the flash. Changing camera circuit boards did not alleviate the problems, as faults occurred on all boards, and eventually it was necessary to modify the circuits. These problems were attributable to poor circuit design, and occurred despite modifications made after the previous cruise. A major design fault was the

operation of CMOS circuits by logic principles suitable only for TTL circuits.

Considerable problems were experienced with the shuttered IOS camera. After a minor accident in the dark room much time and energy were expended on the temperamental shutter and primitive flash triggering and synchronizing mechanisms. No degree of reliability could be achieved, and the camera was not used again.

Minor faults with the "Benthos" 374 camera were overcome by replacing components, sometimes of a higher power rating than the originals. The distressingly frequent single and sequences of blank frames was not cured. Four possible causes for these failures are (i) sledge tilting resulting in an above horizontal camera axis, (ii) camera failing to trigger flash, (iii) flash failing to fire and (iv) operating camera at a 3 second interval. A number of bench tests were carried out but failed to overcome the problems. Failure due to the last cause could be overcome by modifications to the camera electronics.

New developing tanks capable of holding the full standard base film capacity of the cameras were used for the first time. Kodak HC110 developer was used in preference to Patterson Acutol. A new film drying cabinet enabled films to be dried on the spirals and obviated dust, watermarks and finger prints on the negatives.

P.I. Wallin

ACOUSTIC NAVIGATION

Two sites in the Porcupine Sea-Bight have been marked by long term transponders (expected life greater than five years) to allow accurate long term repeat sampling.

The shallower site (1300m) was used to align the launch positions and courses of ten sledge hauls. Two hauls were started out of position due to confusion with an acoustic alternative path to one transponder (51403#1,#5). One haul was started out of position due to use of the wrong scaling factor to one transponder (51403#6). These confusions should be less frequent when

the bathymetric chart is updated. The other seven hauls were launched within an area covered by a circle of diameter 500 metres. Seven satellite fixes obtained while in acoustic contact with the transponders were used to obtain preliminary positions (± 200m) for them both. These will be combined with fixes from the previous cruise and a more powerful averaging technique to provide most accurate positions. A Bathysnap deployment was also positioned acoustically.

An otter trawl and sledge haul were carried out at the deep site (4000m) and phases of both were in acoustic contact with the transponders. This data will be used to position the sampling tracks. Five satellite fixes obtained while in this area will be combined with data from the previous cruise to position accurately this site.

G.R.J. Phillips

EPIBENTHIC SLEDGE

The epibenthic sledge was fished successfully on 20 occasions, 12 times using triple nets (BN1.5/3M) and 8 times with a single coarse mesh net (BN1.5/C). The mark I sledge was used throughout the cruise, the supra-benthic net extension being left off to facilitate the frequent camera and flash changes. On most occasions either the "Benthos" or IOS shutterless camera was arranged to take photographs ahead of the net but on two hauls the "Benthos" camera was fitted facing forward and the IOS shuttered camera facing back into the mouth of the lower nets.

The previously used fishing method was modified in an attempt to increase midwater stability and settle the net on the bottom without the need to pay out a lot of extra wire after initial contact had been made. The sledge was launched with the ship going ahead at three knots into the wind; the wire being paid away with the winch control on notch one (approx. 0.5m/sec). The wire to depth ratio was checked during the descent and maintained at about 1.8 or 1.9 to 1. Constant ship speed appeared to be the most important factor in maintaining this ratio. When the sledge was about 100m above the bottom ship speed was reduced to 1.5 knots and paying out continued until bottom contact was made. With the correct scope: depth ratio, an additional 50m of wire was usually sufficient to keep the net on the bottom. After the desired distance had been fished the sledge could be quickly lifted off the

bottom hauling on notch three. This hauling speed was reduced when the sledge was a few hundred metres from the surface.

The sledge turned upside down in midwater during paying out on one occasion so for subsequent hauls two ten inch glass buoyancy spheres were added near the top of the frame. It seems improbable that spheres have much effect on the stability but the sledge did not turn over for the remainder of the hauls. The high weight of monitor, cameras, battery packs and flash units must affect the stability of the sledge. Although the problem is a dynamic one, static balance in various configurations of the roll plane prior to a cruise might be advantageous.

R.G. Aldred

SLEDGE PHOTOGRAPHS

About half of the films were shot in order to find out more about the behaviour of the sledge. These used either an IOS camera looking back at the net or else a forward looking "Benthos" camera set at a short frame interval. The object of the backward looking camera was to see how often the bottom bar of the net lifted off the sea bed during the haul whilst the forward looking camera was intended to provide a series of overlapping frames which could be used to give a measure of towing speed independent of the odometer. The forward looking camera also provided qualitative and quantitative faunal data.

Films from the backward looking camera confirmed the importance of the tickler chains but the mud stirred up prevents measurement of the height of the bottom bar. The forward looking camera was very unreliable at the short frame interval of 3 sec but even when working satisfactorily, the number of overlapping pairs of frames was very small and insufficient for measuring sledge speed reliably.

The IOS camera was also used facing forward at 15 sec frame intervals as part of the faunal survey and as such it was successful.

R.S. Lampitt

BATHYSNAP

Three deployments of Bathysnap III were made during this cruise. The first two at 1208 and 2665m had a frame interval of 16 minutes and there were no problems with either the camera or the current meter. The third deployment at 2008m had a frame interval of 64 minutes giving records for the whole of April. Neither the current meter nor the LED on the camera worked but a dramatic photographic record of the arrival of benthic "fluff" was made. The gear was redeployed on 27 May 1982 during an applied physics cruise (Challenger 8/82) with a frame interval of 16 minutes. Unfortunately the current meter again failed and there was a serious intermittent flash failure.

R.S. Lampitt

BENTHIC INVERTEBRATES

Further information on the zonation of the invertebrate fauna within the Porcupine Sea-Bight was gathered principally from 8 otter trawl and 8 epibenthic sledge hauls. The latter were sampled at nominal 500m horizons for biomass determination. Data on the spatial variation of faunal compositon and density at 1300m was also obtained from 10 epibenthic sledge samples.

The shallowest sample, St. 51401 (300m), on the eastern flank of the Sea-Bight was dominated by the crustaceans Munida and Pandalus, the asteroid Astropecten irregularis, a small zoanthid and a tectibranch gastropod. A slightly deeper sample on the Porcupine Bank to the west of the Sea-Bight St. 51405 (530m), was again dominated by natant and brachyuran crustaceans, but in this case Geryon tridens was notable. The holothurian Stichopus tremulus was common to both stations and together with the bivalve Abra nitida was also found at St. 51404 (740m), where the hermit crab Parapagurus pilosimanus with its commensal zoanthid was particularly abundant. The asteroid Brisingella coronata, the pennatulids Kophobelemnon stelliferum and Umbellula, and a small unidentified actiniarian were also common.

The presence of many gorgonians at St. 51406 (1120m) was responsible for a diverse catch due to commensal ophiuroids, pectinids, actiniarians and polychaetes. However, echinoderms dominated, particularly the echinoid

Phormosoma placenta, the asteroid Plutonaster bifrons and the holothurians Laetmogone violacea and Ypsilothuria talismani.

At 1300m, St. 51403 and St. 51420, a series of repeat hauls were undertaken using the epibenthic sledge. Variability in faunal composition was primarily caused by the patchy distribution of a large hexactinellid sponge Pheronema which housed a number of commensals, notably the ophiuroid Ophiactis abyssicola, the brachyuran crab Dorynchus, pectinids, polychaetes and sipunculids. There appeared to be a negative correlation between the two sponges Pheronema and Thenea. The density of some fauna was not particularly variable, notably the Crustacea, while other animals did vary in density but for no apparent reason, such as the holothurian Ypsilothuria talismani.

At St. 51407 (1490m) the echinoderms became the dominant phylum with Benthogone rosea, Mesothuria (Zygothuria) lactea, Ypsilothuria talismani, Zoroaster fulgens, Plutonaster bifrons, Bathybiaster vexillifer and Phormosoma placenta dominating a catch which also contained cirripedes, natant crustaceans, a few Parapagurus and one large specimen of the actiniarian Actinoscyphia saginata. A similar sample was taken at St. 51419 (1500m) although several Hygrosoma petersii (Echinoidea) and a large specimen of the asteroid Brisinga endecacnemos were also taken.

The same echinoderm assemblage was found at St. 51409 (1660m) with the exception of Ypsilothuria talismani and the inclusion of the holothurian Paelopatides gigantea and the ophiuroid Ophiomusium lymani. The holothurian Benthogone rosea was particularly abundant. Pennatulaceans, actiniarians, madreporarians, eryonid crustaceans and the natant crustacean Glyphocrangon were present.

Ophiomusium lymani, Paelopatides gigantea, Benthogone rosea and Plutonaster bifrons were still dominant at 2000m (St. 51408) although two other echinoderms Benthopecten simplex and Echinus affinis were also common. Two specimens of Munidopsis longirostris were taken as well as a number of sponges, madreporarians and sipunculids, the latter mainly found in scaphopod shells.

The fauna was very different at St. 51411 (2500m) with the asteroid, Hymenaster membranaceus, the dominant organism. Several necks of the fragile

echinoid Echinosigra paradoxa were taken but otherwise the fauna consisted mainly of gorgonians, madreporarians and the crustaceans Glyphocrangon, Munidopsis and Neolithodes grimaldii. These crustaceans were also present at 2800m (Stns 51412, 51416, 51417). The catches were small consisting mainly of clinker and empty pteropod tests. Small ophiuroids and asteroids occurred as well as a few bivalves, gastropods, polychaetes (generally found in the crevices of the clinker), and the ostracod Azygocypridina.

A particularly large catch of the "football" holothurian referred to the genus Benthothuria was taken at St. 51413 (2770-2940m). The 130 specimens sampled occupied a total volume of 180ℓ. More specimens were taken at St. 51415 (3510m) as well as two large Benthodytes ?lingua and several types of apodous holothurian. Ophiuroids were very abundant including a euryalid species inhabiting a gorgonian. Polychaetes were again found within the crevices of the clinker. The catch also included the amphipod Cyphocaris, the decapods Glyphocrangon and Munidopsis, pennatulids, actiniarians, pycnogonids and two large echinothurians.

St. 51414 (4100m) produced a large echinoderm catch, principally of the holothurians Pseudostichopus atlanticus, Oneirophanta mutabilis and Psychropotes longicauda and the asteroids Freyella spinosa and Dytaster sp. Actiniarians were common, including one species commensal with a pagurid. Several specimens of the crustacean Munidopsis and the asteroid Styrachaster were also taken.

D.S.M. Billett

FISH

Fish sampling was primarily based on the catches of the OTSB 14, although useful comparisons were gained from the results of the BN1.5 net. A total of 64 species of bottom-living fishes was collected, of which 34 were common to both gears. Twenty two extra species were represented in the OTSB 14 catches, while 8 were peculiar to the BN1.5. All these species have previously occurred in IOS collections from the area, but noteworthy among them is the high proportion (10 species) in breeding condition. This includes the live-bearing bythitid, Cataetyx laticeps, two females which were found to bear ovaries

with copious numbers of embryos. In addition, 11 large egg cases of an unidentified ray were trawled from 1488-1529m. Two of these contained recognisable embryos, in different stages of development.

Sampling by the OTSB 14 was carried out on 8 occasions within the sounding rage 287-4212m. This totalled 11 hours of trawling on the bottom, covering a distance of 29 nautical miles. The overall catch of 3200 or so specimens, weighing 500kg, was largely worked up on board. Of these, the dominant species was the eel, Synaphobranchus kaupi, which contributed 53% of the catch by number. In terms of catch per unit effort, the greatest biomass was found between 740-2500m to confirm the findings of previous cruises.

The most important contribution of the BN1.5 catches to the study of fishes on the cruise was the comparison made possibly by the 24-hour series of hauls at around 1300m soundings with the single OTSB 14 tow made in that position. Useful information was obtained relating the catch per unit effort of the two nets. In addition, it was valuable to compare species richness sampled by both gears. While the OTSB 14 collected 17 species in its single tow, the cumulative total for the 6 hauls of the BN1.5 was 15, with 3 species unrepresented in the OTSB 14 sample. The most sampled in a single tow of the BN1.5 was 12 species, with a mean value for the series of 9.6. The six most numerous species represented were identical, although ranked in order of abundance minor differences were evident between the catches of the two nets.

Finally, a variety of samples were collected for Dr. R. Cherry, International Laboratory of Marine Radioactivity, Monaco and Dr. J.R. Sargeant, Institute for Marine Biochemistry, Aberdeen.

N.R. Merrett

ORNITHOLOGY

Ornithological observations were carried out as and when time permitted. Species diversity and numbers of birds seen were appreciably lower than has been the case on previous cruises to this area. Beyond the edge of the continental shelf only Kittiwakes (Rissa tridactyla) were seen with any frequency or in any numbers. Fulmars (Fulmarus glacialis), Gannets (Sula

bassana), Manx shearwaters (Puffinus puffinus), Great skuas (Catharacta skua) and a few Lesser black-backed gulls (Larus fuscus) were the only other species seen. Over the outer shelf Gannets and Lesser black-backed gulls were more abundant and more frequently seen. No storm petrels were seen. Few migrant non-sea birds were seen.

M.H. Thurston

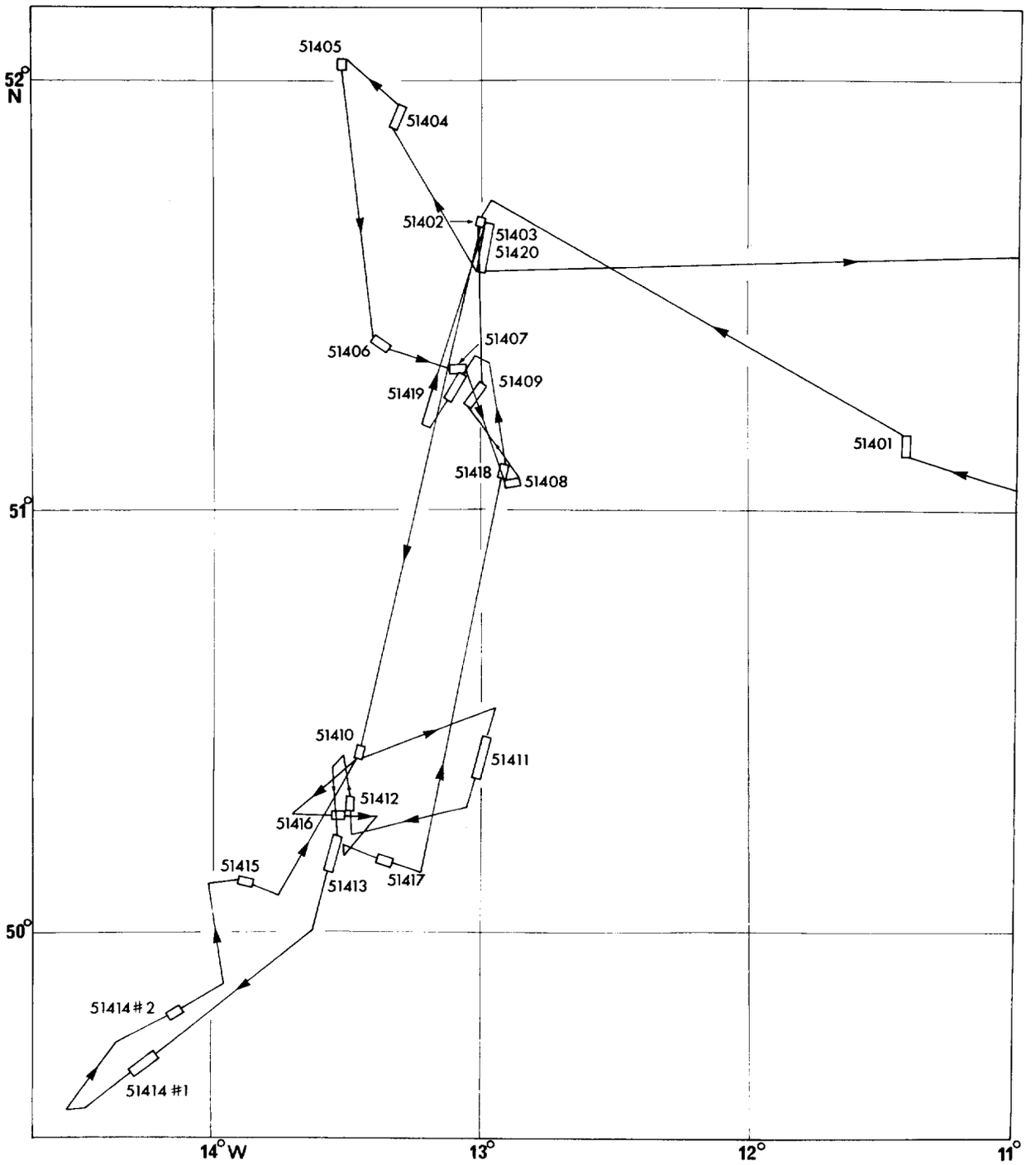
Explanation of Station List Symbols

+ For BN1.5 and OTSB 14 hauls, positions are for first and last bottom contact of gear, not ship positions. For Bathysnap, positions are ship positions at launch and recovery. For Sta. 51403 and 51420, positions are related to best-estimate positions of transponders, rather than individual satellite fixes.

* "Magnavox" Satellite Navigation system off-line. Positions probably very close to those of Sta. 51403#1 -#5.

STATION LIST

STATION	DATE 1982	POSITION (START)+ N	W	POSITION (END)+ N	W	GEAR	SAMPLER DEPTH (m)	DURATION (GMT)	DISTANCE RUN (m) ODOMETER OR SHIPS LOG	CALCULATED	REMARKS
51401#1	24:3	51°08.2'	11°24.9'	51°11.1'	11°24.8'	OSTB 14	307-287	1749-1847	-	5280	
51402#1	25:3	51°39.8'	13°00.4'	51°39.7'	13°00.1'	BSNAP	1210	0748/25-1058/28			
51403#1	25:3	51°37.7'	12°59.8'	51°36.6'	13°00.0'	BN1.5/3M	1292-1314	1006-1044	764	1958	"Benthos" camera facing forward, IOS shuttered camera facing into net
51403#2	25:3	51°37.4'	12°59.2'	51°36.9'	12°59.2'	BN1.5/3M	1317-1325	1454-1513	402	1029	IOS shuttered camera facing into net
51403#3	25:3	51°36.8'	12°59.1'	51°36.4'	12°59.3'	BN1.5/3M	1319-1325	2009-2027	458	682	"Benthos" camera facing forward
51403#4	26:3	51°36.7'	12°59.6'	51°36.0'	12°59.8'	BN1.5/3M	1319-1333	0037-0102	418	1451	"Benthos" camera facing forward
51403#5	26:3	51°37.8'	12°58.9'	51°37.3'	12°59.0'	BN1.5/3M	1289-1297	0510-0528	385	888	"Benthos" camera facing forward
51403#6	26:3	*		*		BN1.5/3M	1278-1295	0945-1006	412	-	"Benthos" camera facing forward
51403#7	26:3	51°36.4'	12°59.6'	51°39.2'	12°58.8'	OTSB 14	1330-1255	1442-1538	-	5350	
51404#1	26:3	51°53.3'	13°19.2'	51°55.8'	13°17.7'	OTSB 14	760-740	2018-2119	-	4960	
51405#1	27:3	52°01.8'	13°31.0'	52°01.1'	13°30.7'	BN1.5/C	492-503	0056-0124	554	1319	"Benthos" camera facing forward
51406#1	27:3	51°23.3'	13°22.4'	51°22.9'	13°21.7'	BN1.5/C	1072-1091	0705-0728	646	1095	"Benthos" camera facing forward
51407#1	27:3	51°19.5'	13°05.0'	51°19.7'	13°03.1'	BN1.5/C	1489-1511	1447-1516	628	2271	IOS shutterless camer facing forward
51408#1	27:3	51°03.6'	12°55.8'	51°03.8'	12°53.8'	BN1.5/C	1994-2001	2113-2145	797	2000	Net fished again after hauling commenced due to reduced ships speed. IOS shutterless camera facing forward
51409#1	28:3	51°16.5'	13°00.2'	51°19.0'	12°56.6'	OTSB 14	1651-1717	0552-0659	5190	6260	Monitor depths dubious; fishing depth calculated from Mufax record.
51410#1	28:3	50°25.6'	13°27.0'			BSNAP	2665	2222/28-1430/31			
51411#1	29:3	50°27.2'	12°59.1'	50°22.4'	13°01.3'	OTSB 14	2470-2500	0358-0544	-	9270	
51411#2	29:3	50°22.3'	13°01.2'	50°22.9'	13°00.8'	BN1.5/C	2500-2490	1019-1039	643	1158	IOS shutterless camera facing forward
51412#1	29:3	50°16.9'	13°29.3'	50°18.7'	13°29.0	BN1.5/C	2760-2790	1956-2044	1508	3271	IOS shutterless camera facing forward
51413#1	30:3	50°13.8'	13°32.3'	50°08.3'	13°34.2'	OTSB 14	2770-2940	0346-0536	9080	10290	
51414#1	30:3	49°43.7'	14°10.3'	49°39.0'	14°18.0'	OTSB 14	4097-4212	1418-1636	11300	12730	
51414#2	31:3	49°47.2'	14°10.2'	49°47.9'	14°08.5'	BN1.5/C	4090-4070	0102-0151	1267	2508	IOS shutterless camera facing forward
51415#1	31:3	50°06.9'	13°53.6'	50°06.9'	13°52.1'	BN1.5/C	3510-3470	0853-0931	1267	1780	IOS shutterless camera facing forward
51416#1	31:3	50°16.8'	13°31.4'	50°16.9'	13°30.7'	BN1.5/3M	2780-2770	2114-2132	611	877	Camera failed
51417#1	1:4	50°10.3'	13°22.3'	50°10.1'	13°21.2'	BN1.5/3M	2790-2770	0413-0439	651	1366	
51418#1	1:4	51°04.8'	12°54.4'			BSNAP	2009	1344/1:4-0542/27:5			Recovered on Challenger Cruise 8/82
51418#2	27:5	51°04.8'	12°54.4'	51°04.9'	12°53.4'	BSNAP	2009	2100/27:5-0754/17:7			Deployed on Challenger Cruise 8/82 and recovered on 10/82
51419#1	1:4	51°19.0'	13°05.4'	51°16.8'	13°07.4'	OTSB 14	1488-1529	1718-1819	5190	4672	
51420#1	2:4	51°37.3'	12°58.6'	51°36.9'	12°58.6'	BN1.5/3M	1326-1328	0033-0048	407	749	"Benthos" camera facing forward
51420#2	2:4	51°37.2'	12°59.1'	51°36.9'	12°59.1'	BN1.5/3M	1304-1309	0408-0423	388	710	"Benthos" camera facing forward
51420#3	2:4	51°38.3'	12°58.9'	51°38.0'	12°59.0'	BN1.5/3M	1293-1298	0803-0817	395	511	Camera failed.
51420#4	2:4	51°37.9'	12°59.5'	51°37.5'	12°59.6'	BN1.5/3M	1279-1287	1302-1319	397	710	IOS shutterless camera facing forward


52° N
51°
50°
14° W
13°
12°
11°
51405
51404
51402
51403
51420
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51415
51413
51417
51414 # 2
51414 #1