Scottish Marine Biological Association

Dunstaffnage Marine Research Laboratory

CRUISE REPORT

R.R.S. CHALLENGER

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CRUISE 9/84 (GORDON)

29 October - 13 November

1984

S.M.B.A., P.O. Box No. 3, Oban, Argyll, Scotland.

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Duration of Cruise:	29 October 1984 to 13 November 1984 - Ardrossan to Ardrossan.	
Locality:	Rockall Trough and the northern part of the Porcupine Sea Bight.	
Scientific Staff:	J.D.M. Gordon	SMBA Principal Scientist
	J.A.R. Duncan	SMBA (29-31 October)
	S.E. Philips	SMBA
	N.R. Merrett	IOS
	R.A. Russell	IOS
	D. Edge	IOS
	R.K. Young	MBA
	P. Pascoe	MBA
	N.A. Lockett	University of Adelaide
	K. Sulak	NATO Fellow at IOS
	A.C. Petersen	Irish Observer
Ship's Officers:	Captain	29-31 Oct., Moran.
		31 Oct.-13 Nov., P.H. Warne
	Chief Officer	S. Jackson
	2nd Officer	B. Richardson
	3rd Officer	T. Harrison
	Fishing Skipper	F. Dunning
	Chief Engineer	I. McGill
	2nd Engineer	I. Shufflebotham
	3rd Engineer	C. Philips
	4th Engineer	P. March

Aims of the Cruise:

(1) To sample the fish populations of the Rockall Trough using the Granton trawl and the semi-balloon otter trawl.

(2) To sample the fish populations of the Porcupine Sea Bight using the Granton trawl and the semi-balloon otter trawl.

(3) To carry out near-bottom sampling with an RMT8.

(4) To experiment with lights attached to bottom trawls.

(5) To experiment with midwater trawls.

(6) To collect material for Institutes and Universities.

Narrative (All Times GMT)

The scientific equipment was loaded on Saturday 23rd October and the scientific party joined ship on the morning of 29th October. Sailing originally scheduled for 14.00 was delayed by strong winds across the entrance to Ardrossan harbour until 16.00 and eventually postponed until next morning. Challenger sailed from Ardrossan at 07.00 (30/10) and headed for the slope to the west of Barra (Hebridean Terrace). At 18.00 hrs in steadily deteriorating weather conditions and poor forecasts it was decided to alter course to the contingency working areas in the Minch and carry out some of the equipment trials which were not dependent on deep-water. The area chosen afforded a lee from the southwesterly gales but during the night the wind veered to the south and at 06.00 (31/10) we altered course for shelter to the north of the Island of Rhum. Later in the morning Challenger was instructed to head for Oban to effect a change of master. At 19.40 Captain Warne embarked via Oban lifeboat off Craignure in the Sound of Mull. Challenger then steamed towards Oban and Captain Moran and Mrs Duncan were disembarked at 21.25 by Oban lifeboat. Challenger then steamed back up the Sound of Mull to anchor off Salen at 23.30 to await improved weather conditions. By the morning the winds had moderated and Challenger weighed anchor at 11.10 (1/11) and headed for the Hebridean Terrace.

Challenger reached the first station at 00.45 (2/11) and the PES fish was launched. The semi-balloon otter trawl was then fished between 01.21 and 04.10 at a sounding of 750 m. This net was fished again at a sounding of 1000 m (Station 2) between 04.48 and 08.15. Both stations yielded large catches of fish and while these were being sorted Challenger

steamed to occupy a 250 m station (Station 3). The semi-balloon trawl was fished between 10.34 and 12.30. On recovery the codend was found to be torn and only a few of the larger fish were retained. While this trawl was being dismantled and another prepared trials were carried out with a new MBA fast net between 15.08 and 20.40 (Station 4). The net was deployed three times, firstly to test the depressor, secondly to test the net and thirdly to test the net with lights attached. Challenger then steamed to Station 5 and the semi-balloon trawl was fished between 22.00 and 01.45 (3/11) over a sounding of 1250 m. Station 6 was at 1500 m and once again the semi-balloon trawl was fished successfully between 04.10 and 08.11.

The weather conditions remained excellent and it was decided to dismantle the semi-balloon trawl and fish the RMT8 with the near bottom echosounder. Station 7 was at a sounding of about 1000 m and the RMT was deployed between 12.01 and 15.36. The net was opened for two hours at depths between 11 and 48 m off the bottom. Challenger then steamed to a sounding of about 850 m and once again the RMT8 was fished close to the bottom between 16.27 and 19.35 (Station 8). The RMT system was then removed and the semi-balloon trawl re-assembled. Station 9 (1750 m) was reached at 22.14 and the bottom trawl was deployed between 22.27 and 03.05 (4/11). This was followed by another semi-balloon trawl (Station 10) at 500 m between 08.34 and 11.02. This completed the standard SMBA transect of stations on the Hebridean Terrace within the depth ranges possible in the absence of the deep-wire.

The RMT8 system was then re-assembled and Station 11 was occupied between 12.00 and 15.35 over soundings between 575 and 725 m. Challenger then steamed to a sounding of about 1300 m and the RMT8 was

again deployed between 18.05 and 22.10 (Station 12). Although the net opened close to the bottom it may have remained open on hauling until a depth of about 600 m.

It was then decided to begin a series of trials for MBA on the effect of attaching lights to bottom trawls. The semi-balloon trawl was assembled and lights were attached to the headline. The depth chosen for the trials was 1000 m and the same towing course was maintained throughout the series. Station 13 was fished with the trawl with lights illuminated between 00.17 and 02.42 (5/11). At Station 14 the lights and batteries were left attached but were not switched on. The net was shot at 03.15 and recovered at 06.00 but it was found that the foot rope had parted at the wing end. From the Mufax trace this probably occurred after about 20 minutes on the bottom. The broken foot rope resulted in tears on the codend and the loss of all but the largest fish from the catch. While the trawl was being repaired Challenger steamed to Station 15 where the net was deployed between 08.42 and 11.18 with lights attached but not illuminated. On recovery the repaired foot rope had again parted at the joint but because there was no damage to the trawl and the Mufax trace had indicated a steady bottom contact it was assumed that this had occurred during hauling.. The foot rope was repaired once more and Station 16 was fished between 13.00 and 15.30, this time with the lights switched on. Challenger then steamed to the start position for Station 17 and the semi-balloon trawl was fished between 18.03 and 20.57 with lights attached but switched off. This completed four valid hauls with and without lights, one pair in darkness and the other pair during the daytime. Before leaving the Hebridean Terrace it was the intention to obtain samples with a gravity corer for University College, London. However,

since the remainder of the cruise depended on the use of both trawl warps of equal length it was decided not to risk accidental damage at an early stage in the cruise. Challenger then steamed to occupy stations in the Porcupine Sea Bight.

The first station in the northern part of the Sea Bight was reached at 09.00 (7/11) and the semi-balloon trawl was deployed between 09.17 and 13.40 (Station 18) over a sounding of about 1250 m. This station was specifically to collect sponges for Dr Rice of IOS. Challenger then steamed to occupy a 1500 m station and the semi-balloon trawl was deployed between 15.53 and 20.32 (Station 19). By this time the weather had begun to deteriorate and Challenger remained hove to until 22.00 to allow the catch to be sorted and weighed. She then steamed to occupy an RMT station but on arrival at 00.45 (8/11) the weather conditions precluded the operation of an RMT. The semi-balloon trawl was assembled and fished between 07.00 and 09.52 over a sounding of 1000 m (Station 20). On recovery it was found the other leg of the foot rope had parted and the net was extensively torn.

Challenger then steamed northwards to occupy a shallow RMT station but on passage the wind and swell increased and by 12.00 speed was reduced to 3 knots. Challenger was on station at 19.08 but remained hove to awaiting an improvement in the weather. By 01.00 (9/11) the weather had improved sufficiently to work midwater nets. The MBA fast net, which had been modified since the previous trials, was assembled and fished between 02.50 and 05.22 and again between 05.39 and 07.26. The RMT8 was then assembled and fished close to the bottom at soundings between 350 and 400 m between 09.48 and 12.38 (Station 22). Trials were then carried out with the SMBA midwater trawl (Station 23) between

15.22 and 17.39. Unfortunately the trawl warps had become twisted round one another and no catch was obtained.

Challenger then steamed south for a deep RMT haul en route to the position of the IOS (Bidston) mooring which we had been asked to attempt to locate. The RMT was deployed at 01.13 (10/11) but there was a malfunction of the near bottom echosounder and the net probably touched the bottom. The net was hauled to 1160 m opened and fished to 100 m before closing and recovering at 04.27. Challenger then steamed for the position of the IOS (Bidston) mooring. Despite three satellite navigator fixes while in the area, which indicated a depth discrepancy of 20 m from that given, and repeated interrogation, we were unable to locate the mooring. Challenger then steamed northwards and on passage the position of the IOS Bathysnap was checked. At 15.12 the RMT was shot for a near surface haul and recovered at 17.33 (Station 25). The weather was by now beginning to deteriorate and a further RMT haul was abandoned. By 19.30 it was decided to shoot the SMBA midwater trawl. The doors were fitted directly to the trawl warps and the ship's speed was kept at 5 knots throughout. Despite this the warps were once again twisted on recovery at 22.42 and some difficulty was experienced in recovering the net in 30 knot winds and a heavy swell. All scientific work ceased and Challenger headed for Ardrossan at 23.25. With force 8-9 winds astern Challenger made good progress and docked at Ardrossan at 17.00 hrs (12/11). The scientific equipment was unloaded during the morning of the 13th November.

Results

Aims 1 and 2 - Bottom trawling

The Granton trawl was not used on this cruise because the wrong otter boards had been supplied. Those supplied could have been modified to fish successfully but the results with the semi-balloon trawls fished on two warps suggested that this was not necessary.

The lack of the deep winch rendered it necessary to fish the semi-balloon trawl on paired trawl warps. The trawl was shot using the auxiliary winches and the 50 m bridles were transferred to the port and starboard trawl warps. After a few trawls it was found that the wire out to depth ratio could be kept low and with 2900 m of wire out it was possible to fish at 1750 m. A transect of stations at 250 m increments was fished on the Hebridean Terrace between 500 and 1750 m. An attempt to trawl at 250 m led to considerable net damage. The catches were very similar to those obtained in earlier years using the Granton trawl and different to those taken by the same net fished on a single warp in 1983. The most noticeable differences were in the enhanced catches of large Alepocephalus bairdii, squalid sharks and the scabbard fish Aphanopus carbo. For example Alepocephalus bairdii accounted for 57.7% of the total catch of 747 kg at 1250 m compared with 11.9% of a total catch of 132 kg in 1983. The reason for these differences is almost certainly related to the herding action of the two warps and it was interesting that when the towing time was reduced from 60 to 30 minutes for the experiments with lights, the catches of these larger species decreased even when the lights were switched off. While it could be

argued that the battery packs attached to the headline of the trawl may have reduced headline height, it appears more likely that 30 minutes was too short a time for the fish being herded by the trawl warps to fatigue and drop back into the net.

Bottom trawling in the Porcupine Sea Bight was restricted to the northern transect and stations at 1250, 1500 and 1000 m were fished. The second trawl was damaged at the 1000 m station and no further bottom fishing was attempted.

J.D.M.G.

Aim 3 - Near bottom sampling with the RMT8

An IOS rectangular midwater trawl (RMT8) was modified with collapsible side wires for use with the stern 'A'-frame on 'Challenger'. This enabled the weight bar to be lifted outboard, from ropes temporarily attached to the stoppered side wires led through the ancillary blocks to the warping drums on the auxiliary winches. Simultaneously, the acoustic monitor frame was suspended from the centre block on a 50 m pennant connected to the backing warp on the starboard auxiliary winch. The inboard end of the pennant was then transferred to the starboard trawl warp, during the shooting procedure, for fishing.

Five near bottom samples were taken on the slope between 395-1415 m soundings, at approximately 200 m intervals. In each case the RMT8 was opened and closed close to the sea floor (10-49 m above the bottom) and fished for 2 hours. In addition an oblique 1160-100 m sample was taken in soundings of 1770 m, after the near bottom echo

sounder had failed to indicate its proximity to the sea bed and the weight bar of the net had grounded for some 3 minutes. The RMT8 remained closed at this stage and no damage was done. The resulting collection, made whilst retrieving the net, was free from sediment. Finally, a surface (30-300-20 m) tow was made to sample the upper layers over mid-slope soundings.

The aim of all these collections was to investigate the occurrence of young pelagic stages of the demersal ichthyofauna. Juvenile stages of macrourid and alepocephalid species were collected in all but the shallowest near bottom samples. No larvae were taken in either these hauls or the near surface tows. The catches overall also provided useful information on the pelagic macroplankton and microplankton impinging on the slope. An earlier 'Challenger' cruise (9/79) revealed larval macrourid fishes at similar levels in July and it is hoped that seasonal coverage can be obtained to shed light on the larval ecology of bottom-living fishes in the area. In this connection, ripe eggs stripped from 2 adult female Coryphaenoides rupestris caught in the first semi-balloon otter trawl (OTSB14) of the cruise were fertilized and their early development monitored during the time at sea.

N.R.M.

Aim 4 - The effect of artificial light on trawls

Recent work with rectangular midwater trawls and inshore shallow bottom trawls has shown that the use of lights on the net can lead to significant changes in both the composition and size of the catch. On

this cruise the study was extended by making four comparative hauls with and without lights, in daylight and darkness, with the semi-balloon trawl at 1000 m depth in the Hebridean Terrace. The lights used were standard deep sea diving lights and were powered by car batteries modified to overcome the effect of pressure at depth. Efforts were made to be consistent in as many factors as possible during the tows e.g. position, speed and direction of tow and time of day. Two lights and two battery packs were attached to the headline of the trawl and although this extra weight and drag may have affected the efficiency of the net, a good catch was produced by each of the 30 min hauls.

The small number of comparisons does not allow firm conclusions to be made, but the initial analysis of the catch data does, however, show some interesting differences. The most obvious difference in hauls with the lights on is the presence of cephalopods and decapod crustacea which were absent, with the exception of 1 decapod, from those with the lights off. Cephalopods were also absent and decapods very low in numbers in all other standard OTSB hauls (no lights) at different depths in the same area.

The total numbers of the 30 fish species caught by the comparative hauls show an increase of 14% with the lights on. Data for individual species is insufficient to be significant. However, when analysed as groups or families, the results (numbers) are of considerable interest, e.g. no elasmobranchs were taken with the lights off compared with 12 specimens from 6 species in the hauls with lights on. Of the other major families, the Chimaerids, Alepocephalids, Gadids and Eels, all show a considerable increase with the lights (44 - 233%), the Macrourids being the exception with a small decrease in numbers.

The preliminary results are therefore encouraging and it is hoped that future work of this nature can be linked with knowledge of the behaviour and vision of the animals concerned.

P.L.P. and R.K.Y.

Aim 5 - Midwater Trawls

(a) MBA Fastnet handling and fishing trials

This net was designed and developed at MBA Plymouth to sample in mid water mainly for squid which are known to exist in these waters, but have been able to avoid capture by both RMT10 and RMT50 nets. The purposes of the trials were (1) evaluate the stability of the net at various speeds, (2) determine tensions in the towing wire and examine angle of towing warp at various speeds and depths, (3) assess quality of fishing capabilities from catch results.

The gear consists of a net 5 m x 1 m mouth area carried on two heavy steel bars, the upper bar being fitted with a depressor plate. The length of these bars caused some problems during deployment and recovery but no other handling problems were experienced.

The net was apparently stable up to 6 knots and with the addition of extra weight on the lower bar would probably remain stable up to the designed speed of 8 knots, although the maximum speed attained on this ship was 6.8 knots.

The maximum pull experienced during the trials was 3.2 tons on commencing hauling at 6 knots whilst the net was apparently stable a warp angle of 45° was maintained at all speeds between 3 and 6 knots.

Unfortunately the fishing results were poor but this was probably due to the effect of the depressor design which will be changed before further trials. The quality of the small quantity of catch was encouraging, as previous attempts at similar work has caused a lot of damage to the material caught.

In all, four tows were carried out with various adjustments in between and whilst the catches were poorer than anticipated, the experience gained from these trials will allow a new depressor to be designed to allow the net to fish correctly.

R.K.Y. and P.L.P.

(b) SMBA Gourock No. 1 midwater trawl

This trawl has been used extensively by RV Calanus for sampling inshore pelagic fish populations. Earlier trials on Challenger were sufficiently encouraging to carry out further experiments. The net was modified for deep water work by replacing the shallow water floats by deep-sea floats, and weights were attached to the wing ends to help the net to descend when towed at high speed. The trawl was fished twice but on both occasions the net had rotated several times resulting in twisted trawl warps and on the last trial damaged bridles. The otter boards were different to those used previously but had been successfully operated by Calanus. Before further trials are carried out expert advice will be required on the rigging of the trawl.

J.D.M.G.

Aim 6 - Collection of Material

(a) N.A. Locket

Dr N.A. Locket, of the Department of Anatomy and Histology, University of Adelaide, South Australia, has studied the eye structure of some fishes from bottom and midwater nets.

Retinal samples have been fixed for electron microscopy, and the tissues embedded in Araldite, in which they last indefinitely. About 40 samples have been processed.

Alepocephalid and searsid fishes are amongst those which have a well developed fovea, of a kind also present in certain reptiles and birds, in the retina. An optical function has been postulated for this fovea, and the opportunity has been taken to examine fresh and recently fixed foveas to test various ideas.

Bathylagid and paralepidid fishes have a specialised area of retina rather than a true fovea. This has also been studied and material prepared for electron microscopy.

Certain fishes have reflecting or scattering tapeta behind the retina. Examples studied and prepared for microscopy include Chimaera, Epigonus and Malacosteus.

The quality of fixation of deep-sea material in the past has been variable: experiments with different fixation techniques have therefore been carried out to see if a reliable fixation technique for teleost eyes can be developed.

Samples of fish and invertebrate material have been prepared for demonstrations to a class on sense organs taught to third year science students.

Some photography, for teaching, research and general interest, was undertaken.

Professor E.J. Denton and Sir John Gray of the MBA are studying lateral line systems in some deep water fishes. They asked for specimens carefully fixed, and for a description of the location and relationships of the neuromasts, particularly in Hoplostethus. It was possible to dissect and describe this system, and specimens of the two species of Hoplostethus, Anoplogaster and a melamphaeid were fixed for further study.

They are also interested in the mechanical properties of the abundance of sergestid shrimps. Samples of antennae were prepared as requested.

(b) Dr K. Sulak

Whole swimbladders were excised at sea from freshly caught bottom fishes obtained at Stations 5, 6, 9 and 10 (580-1770 m depth) with the semi-balloon trawl. Swimbladders were obtained from 21 specimens representing 11 species. Swimbladder wall tissue was quick frozen at sea in liquid nitrogen to prevent irreversible degradation. Samples will remain frozen until processed by Dr J.B. Wittenberg at Albert Einstein College, New York City. Drs Wittenberg and Sulak hypothesize that a temperature dependent phase shift in the lipid membrane swimbladder wall is important in determining the minimum depth to which abyssal fish species may rise. Using the samples obtained they will attempt to determine the temperature at which irreversible breakdown of the lipid membrane begins. This may provide insight into one mechanism limiting the temperature-dependent bathymetric and geographic limits of deep-sea bottom fishes.

Also obtained at sea and quick frozen were blood samples from four deep-sea fish species. These samples will be analysed to detect the presence of special hyperbaric hemoglobins. Such hemoglobins, which have previously been found in one abyssal macrourid fish, do not begin to function in oxygen uptake until pressures of 50-100 atmospheres (equivalent to water depths of 500-1000 m). These special hemoglobins, probably unique to deep-sea fishes with oxygen filled swimbladders, are of particular interest biochemically and medically. They are extremely efficient in oxygen uptake, and unlike other hemoglobins, have no affinity for carbon monoxide.

Whole specimens of various macrourid species were preserved frozen in formalin. These will be used for dissection by Dr Sulak in conjunction with the hypothesis that head structure in macrourid fish reflects accommodation to directional sensory organs, rather than mechanical adaptation to prey capture.

(c) P.L. Pascoe - Parasites of Deep Sea Fishes

During the cruise the opportunity was taken to collect, observe and preserve material of parasitological interest from several of the fishes caught in the bottom trawls. This work can possibly be related to the ecology and behaviour of the host species

(1) Monogenean parasites on gills and skin. A total of 28 species of fish were examined, 6 of which were found to be infected with these often little known parasites. The specimens were collected and treated in various ways for a study of morphology and attachment mechanisms of adult and larval stages.

(2) Blood parasites. Samples of blood and spleen were taken from a number of bottom dwelling fishes to be examined subsequently for the presence of blood parasites and various blood cell types.

(d) Other Material

In addition to the shipboard studies described above a variety of other material was collected. These are listed in full in Appendix 1. This is the first time such a list has been compiled for a fishing cruise report and I think it shows how institute cruises can benefit other institutes and universities.

Acknowledgements

Despite the loss of time at the start of the cruise due to bad weather and illness, we were fortunate to achieve so much from a winter cruise to Rockall. We are grateful for the willing co-operation of Captain Warne, his officers and crew, for all their help and advice. Special thanks are due to the fishing skipper, Mr. Dunning, for his expert assistance and long hours on watch. We would also like to thank the operations staff of RVS for their help in planning the cruise and their efficiency in orgasnising the change of master at the start of the cruise.

Appendix 1

List of Material collected during the cruise

Material	For whom collected
Invertebrates from bottom trawls	
(a) Rockall Trough (b) Porcupine Sea Bight	J.D. Gage, SMBA A.L. Rice, M.H.Thurston and P.A. Domanski, IOS
Blood Samples from macrourid fish	Miss J. Hanson, Salford University
Tissue samples from Hoplostethus atlanticus	Dr P. Smith, New Zealand Ministry of Agriculture and Fisheries
Parasitic Copepods from morids and macrourids	Dr A.M. Bullock, SMBA
Swimbladder tissue for lipid analysis	Dr Wittenberg, Albert Enstein College, New York and Dr Sulak, Virginia Institute of Marine Science
Haemoglobin samples	Dr Sulak, Virginia Institute of Marine Science
Macrourids for anatomical studies	Dr Sulak, Virginia Institute of Marine Science
Cephalopods and decapods from bottom trawls	Dr M. Clarke, MBA
Museum specimens of bottom fish	MBA
Monogenean parasites	P. Pascoe, MBA
Blood and spleen samples for parasite and cell type studies	P. Pascoe, MBA
Muscle and liver from sharks for heavy metal analysis	Langston, MBA
Plankton samples for distribution studies	Harbour, MBA
Eyes from a variety of fish species	Dr N.A. Locket, University of Adelaide
Fish and invertebrates for research and teaching	University of Adelaide
Amphipods and Phronima	Dr E.N.K. Clarkson, University of Edinburgh
Hoplostethus atlanticus, H. mediteranneus and Sergestid antennae	Professor E.J. Denton, M.B.A.
Anoplogaster and melamphaeid specimens	Sir John Gray, MBA

APPENDIX 2

CHALLENGER CRUISE 9/84 - STATION DATA

Station No.		Date	Net	Position	Depth	Time on bottom or time fished	Duration	Speed (k)	Dist. run n.m.	Temp. °C	Discovery Coll. No.	Remarks
9/84/1		2/11/84	OTSB14	56°32.5' 09°12.9'	760- 815	02.23-03.26	63	2.5	2.6	9.5		
9/84/2		2/11/84	OTSB14	56°34.5' 09°16.1'	910- 960	06.17-07.15	58	2.6-2.7	2.3	7.5-8.0		
9/84/3		2/11/84	OTSB14	56°37.5' 08°59.4'	170- 240	11.04-12.05	61	2.9	2.9	10.4-10.7		
9/84/4	#1	2/11/84	Fast Net	56°32.5' 09°03.0'		15.08-16.12	-					Net torn - No catch.
	#2	2/11/84	Fast Net	56°39.1' 09°04.5'		16.31-18.15	-					
	#3	2/11/84	Fast Net	56°35.8' 09°18.1'		18.45-20.35	-					
9/84/5		2/11/84	OTSB14	56°29.2' 09°26.1'	1195-1210	23.42-00.39	57	2.5	2.4	5.7-6.1		
9/84/6		3/11/84	OTSB14	56°41.9' 09°33.5'	1520	05.52-06.51	59	2.5	2.3	4.5		
9/84/7		3/11/84	RMT8	56°44.6' 09°11.3'	1030-1105	13.04-15.05	121					
9/84/8		3/11/84	RMT8	56°34.8' 09°13.3'	800- 900	16.56-18.56	120				52101	Near bottom echo sounder fished 11-38 m off bottom
9/84/9		4/11/84	OTSB14	56°46.8' 09°36.5'	1770-1750	00.42-01.43	61	2.3	2.3	3.8	52102	Near bottom echo sounder fished 10-44 m off bottom
9/84/10		4/11/84	OTSB14	56°15.9' 09°12.6'	580- 630	09.26-10.26	60	1.9-2.5	2.2	10.0-10.2		
9/84/11		4/11/84	RMT8	56°23' 09°09.4'	560- 690	13.14-15.14	120					
9/84/12		4/11/84	RMT8	56°20.2' 09°31.5'	1340-1390	18.53- ?	?				52103	Near bottom echo sounder fished 10-49 m off bottom
9/84/13		5/11/84	OTSB14	56°24.9' 09°16.5'	940- 975	01.17-01.48	31	2.7	1.3	7.6-7.5	52104	Near bottom echo sounder fished 10-40 m off bottom
9/84/14		5/11/84	OTSB14	56°34.7' 09°15.9'	870- 930	04.21-04.53	32	2.5	1.2	7.4-8.3		Lights attached and on
9/84/15		5/11/84	OTSB14	56°26.2' 09°16.7'	950- 955	10.00-10.28	28	2.5	1.3	6.8-7.6		Lights attached and off - Net torn - part catch lost
9/84/16		5/11/84	OTSB14	56°24.8' 09°15.2'	940- 990	14.10-14.40	30	2.5	1.3	7.2-7.3		Lights attached and off
9/84/17		5/11/84	OTSB14	56°26.3' 09°16.7'	940- 965	19.30-20.02	32	2.6	1.4	7.6-7.9		Lights attached and on
9/84/18		7/11/84	OTSB14	51°41.5' 13°56.4'	1230-1250	10.45-11.42	57	3.2	3.1	6.8-7.3		Lights attached and off
9/84/19		7/11/84	OTSB14	51°36.4' 12°45'	1500-1520	17.53-19.22	61	2.7	2.4	4.6-4.8	52105	
9/84/20		8/11/84	OTSB14	51°55.0' 12°53.8'	950- 955	08.00-08.55	55	3.1	2.9	8.6-8.7	52106	Trawl off bottom during tow
9/84/21	#1	9/11/84	Fast Net	52°46.5' 13°10.4'		02.50-05.22					52107	Net torn - part catch lost
	#2	9/11/84	Fast Net	52°52.9' 13°13.6'		05.54-07.26						
9/84/22		9/11/84	RMT8	52°49.6' 13°6.2'	350- 400	10.16-12.19	123				52108	Near bottom echo sounder - 11-43 m off bottom
9/84/23		9/11/84	M/W Trawl	52°30.3' 12°56.8'		15.22-17.39						Trials - twisted warps - no catch
9/84/24		10/11/84	RMT8	51°23.0' 12°48.0'	1160- 100	02.53-04.27	94				52109	Near bottom echo sounder malfunction
9/84/25		10/11/84	RMT8	51°39.7' 12°55.8'	300- 20	15.22-17.23	121				52110	Oblique tow
9/84/26		10/11/84	M/W Trawl	52°03.4' 12°47.4'		19.50-22.42						Trials - twisted warps - no catch