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RRS DISCOVERY CRUISE 45

February - April 1972

Plankton Investigations at 11°N 20°W, 18°N 25°W and 30°N 23°W.

NIO Cruise Report No. 50

(Issued July 1972)

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Abbreviations

RMT 1 B 8+9	Rectangular midwater trawl with a sampling area of 1 sq m (mesh size 0.32mm).
RMT 1+8 B8-12	Standard combination of nets RMT 1 (mesh size 0.32mm) and RMT 8/5 (Rectangular midwater trawl with sampling area of 8 sq m; (mesh size 4.5mm).
RMT 25 B11	Rectangular midwater trawl with a sampling area of 25 sq m.
BN 2.4	Bottom net with mouth area 2.4m.
NN	Neuston net
BLL	Bottom longline
TSD	Temperature, salinity, depth probe.
WB	Water bottle (Standard NIO)
Trap B	Bottom trap
LHS B8	Longhurst Hardy Sampler. (LHS 1 NIO version LHS2 IMER Benthos Version see Section on Longhurst p. 14)

Introduction

Cruise 45 was planned to complete the latitudinal series of vertical plankton observations made over the past few years. This entailed working a complete day and night series of observations to 2000m at a position 30°N 23°W. In addition hauls from 1000-2000m both by day and by night were fished at 18°N 25°W to complete the series made there in 1969. The series worked at 11°N 20°W in 1968 was also incomplete, lacking the shallow hauls which subdivide the uppermost 100m and these were done during the present cruise.

The series at 11°N was originally made with the N113 instead of the RMT 1 used at other positions and it was hoped that time would be available to repeat this part of the series. In the event the gear worked well and a complete series to 2000m was worked with the new pattern nets. This series was subdivided into 25m or 50m horizons between 650m and the surface by day so as to obtain a more detailed picture of distribution within this critical depth range.

Comparisons between the IMER Benthos Hardy Longhurst and the NIO version were made. Bottom nets, traps and longlines were fished at a number of positions along the African shelf from South of Dakar to a position just South of Cape Bojador particular attention was paid to depths between 300 and 1500m.

Various other collections and observations were made including a 30 hour series of repeated TSD lowerings at a position on the edge of the N.W. African Coast upwelling region.

Itinerary

RRS Discovery sailed from Barry in the morning of the 4th February. Passage was made towards a position near the Canary Islands. It had been planned to work for a few days near the island of Fuerteventura where observations had been made on a number of occasions during the last six years, however diplomatic clearance had not at the time been obtained from the Spanish authorities and the observations had to be made some miles to the East of the island well outside territorial waters. This position was reached in the afternoon of 10th February. Tests of the net monitors and the RMT 1+8 combination net were successfully carried out. On the 11th the first of a series of hauls to compare the Benthos Hardy Longhurst net with the NIO version were made. Further tests of monitors and RMT nets were performed and further Hardy-Longhurst comparisons were carried out on the 12th. The ship then proceeded southward across the N.W. African shelf to a position 25°N 16°14'W just off the edge of the shelf where hourly TSD casts were made for a thirty four hour period. A buoy carrying two current meters on the mooring was laid at this position. Both meters appeared to have recorded throughout the period. The temperature section drawn from the TSD records showed very disturbed conditions but the semi diurnal cycle seen in other similar observations done by Mr. P.G.W. Jones from HMS Hydra and by RRS Discovery in 1968 was not very obvious. At the end of this station a short run of TSD casts was made towards the shore before turning to the South to make towards 18°N 25°W. On the 16th February a series

of TSD casts were started which continued at 60 mile intervals until early on the 19th. At the last five stations a combination net was fished obliquely from 0-1000m in addition to the TSD observations.

On 19th February work began at 18°N 25°W and a number of horizontal opening/closing hauls were made with the RMT 1+8. The hauls between 1000 and 2000m which were not done in 1968 were successfully accomplished. Hauls were made with the RMT 25 and with the neuston net, a water bottle cast was made to collect samples for iodine analysis. Work was completed at this position at 0800 on the 25th February and the ship sailed for the African coast. A series of neuston nets were fished on passage. On 27th February the bottom net was fished at several depths on the continental slope in the latitude of 18°N while on the following day bottom longlines and traps were fished nearby. The ship then sailed for Dakar arriving in the morning of the 29th February. At Dakar Mr. M.J. Harris and Mr. R. Williams left for UK and Mr. E. Darlington joined the ship from NIO.

Discovery left Dakar in the afternoon of the 2nd March and proceeded southwards to a position 10° 46'N 17° 27'W where bottom fish traps, lines, grabs and bottom nets were fished for comparison with similar observations North of Dakar. On the 5th March similar observations were made on a seamount in position 8° 45'N 20° 16'W, course was then set for the position 11°N 20°W where the main observations of the second leg of the cruise were to take place. A TSD cast was made early on 6th March South of the position which was reached at 2300 hrs on the same day.

Intensive operations with the RMT 1+8 followed during the next eight days. As on our previous visit in 1968 the fauna proved to be very rich and varied. The net monitor worked very well and a complete day and night series resulted. The day series should be of particular interest in that the depth horizons shallower than 650m were subdivided into either 25m or 50m horizons. In addition to the RMT 1+8, neuston net hauls, a number of TSD casts a water bottle station and a Longhurst haul were made. On the 14th March the ship began a series of TSD and 1000-0m oblique combination net hauls spaced at 60 mile intervals. The course ran from 11°N 20°W 240 miles to the West then 270 miles NW and finally 160 miles North until the latitude of 18°N was reached on 19th March. From this position Discovery started directly to the African slope off Cape Blanc where long lines, bottom nets and traps were worked in various depths on the 21st and 22nd. On the 23rd and 24th similar observations were made in about latitude 23°40'N and the same operations were carried out on 25th and 26th at 25°54'N. At 1336 on the 26th the ship sailed for Tenerife arriving about 0800 hours on the 27th. Mr. J. Moorey left for U.K. and Mr. R. Morris, Mr. G. Phillips and Mr. P. Parkes joined from U.K.

Discovery sailed from Tenerife at 1830 on 29th March towards 30°N 23°W for the final leg of the cruise. The position was reached at 0700 hours on the 31st March when a TSD cast was made, horizontal hauls with the RMT 1+8 followed and a complete day and night vertical series to 2000m was completed by the 7th April. This was followed by a twenty-four hour series of one hour tows at a depth of 250m and finally on the 8th a six hour tow between 3000 and 2000m was made with the RMT 1+8. The ship then proceeded

to Josephine Bank where, on the 11th and 12th April traps and bottom nets were fished between 270 and 1350m.

The ship then proceeded direct to Barry arriving at 0800 hrs on the 16th April.

Siphonophores

The most interesting siphonophore specimens which have been taken this cruise have mainly been of the physonect variety. One of the initial trial hauls (St 7782 #2, 800-700m) produced a complete specimen of the rare physonect, Nectalia loligo. Several later hauls, usually obliques or ones between 600 and 1000m, from the Cape Verdes (St 7803) and St 7824 (11°N, 20°W) produced further specimens in various degrees of completeness. At the same time pieces of specimens of the very large physonect Halistemma sp. nov. (? synonomy with Stephanomia amphytridis) began to appear, mainly in the deep hauls. Eventually a young specimen of this latter species was taken at St 7824 #39 (1000-895m) which had bracts of both the adult type and those typical of N. loligo. A close examination of the nectophores confirmed that N. loligo is probably a developmental stage of Halistemma sp. nov. This 'Nectalia' stage has also been noted in the development of Halistemma rubrum.

The other important physonect to be found was the very rare species, Stephalia corona of which only one, almost complete specimen was known to be in existence. Two complete specimens were caught in a bottom net at about 1500m (St 7846) and a further three damaged ones appeared at the same depth in another bottom net (St 7853). The first two specimens were observed to have actively contracting nectophores but unfortunately extended observations could not be made as pieces began to be detached and so the specimens were preserved. The other known specimen came from just south of the Wyville Thomson ridge at a depth which indicates that the net was also fished close to the bottom, and the rarity of the species may be due to the lack of sampling in this region.

Several other unidentified physonect nectophores were found in the catches from various depths, and they may represent some new species. For instance a physonect with large flimsy nectophores, with pale yellow nectosacs in one sample, and with highly looped radial canals was noted. Many specimens of Melophysa melo were caught, one being in moderately good condition with the nectophore and few bracts still attached. One specimen of the athorybiid, Athorybia rosacea was also found; both species being fairly rare. The presence of another new species of physonect, first seen in the SOND cruise, and of some nectophores of ?Erenna sp. with black pigmented straight radial canals was noted.

The line for the bottom traps and long line proved to be a useful means of collecting rhizophysid siphonophores - St 7822 #5 and #6 produced five good specimens of three of the rhizophysid species, and at St 7842 #2 (Trap B) a specimen of Rhizophysa filiformis was removed from the line and was estimated to be at least 30-40 feet long as it stretched from the line hauler, through the block and down to the sea surface. Luckily it had become attached at its

lower end so that the pneumatophore and budding regions remained intact.

Of the calycophoran siphonophores, the main interest lay in the numbers of Praya dubia and P. reticulata caught at the more southerly stations, although none of the nectophores was of great size. The rare prayid Maresearsia praeclara was noted at several stations and various depths, and several specimens at both the eu[illegible] and polygastric stages of Nectopyramis thetis, N. natans and N. diomedeae were noted although these species are little documented. A polygastric specimen of N. diomedeae from St 7803 #7 (2000-1500m), triangular in shape and measuring 6.5 x 5.0cm proved to be by far the largest specimen so far discovered. Other deep hauls, including the very deep net (St 7856 #80, 3000est-2010m), contained specimens of the little known Chuniphyes moserae.

Some minor projects which were undertaken during the cruise included the analysis of float length and gas gland size in Physalia physalis. Preparations of discharged nematocysts from several siphonophore species were made using chloral hydrate solutions, as suggested by Mr. A.K. Totton, and these were deep frozen to prevent deterioration before being photographed back at N.I.O. Finally an attempt was made at collecting live siphonophore material by hand netting from a dinghy, but the potentialities of such a technique were considered rather low in these circumstances.

Euphausiids

Horizontal Distribution

The 0-1000m RMT 1 + 8 hauls between 20°N 21°W and 12°N 24°W showed a change in the euphausiid community between 18-16°N. This was particularly clear in the closely related midwater species Nematoscelis microps and N. atlantica, the adult males which occur in two easily separable forms and both were taken in large numbers in different latitudes. Only male N. atlantica with keels on the 1st and 2nd abdominal tergites and enlarged 2nd and 3rd abdominal photophores, and male N. microps with keels on the 1st abdominal tergite and enlarged second abdominal photophore were taken south of 16°N. North of 18°N these forms were succeeded by males without the keel - photophore complex. Further analysis will probably support these observations in other groups of closely related species.

Vertical Distribution

Nineteen species were taken at 30°N and 22 at 11°N, of which 12 were common to both positions. By day the vertical distribution at 30°N of most migrant midwater species was between 400-600m these included: Thysanopoda subaequalis, Euphausia hemigibba, Stylocheiron maximum, Nematobrachion flexipes and the northern forms of Nematoscelis microps and N. atlantica. At 11°N the day distribution of the midwater migratory species: Euphausia gibboides, E. mutica, E. pseudogibba, Thysanopoda microphthalma, T. monocantha and the southern forms of Nematoscelis microps and N. atlantica, was shallower at 300-500m. The vertical range of migration towards the surface at night was greater at 30°N.

Between 500-700m by day at 11°N only small numbers of Stylocheiron maximum, Nematobrachion boopis, and Thysanopoda

micropthalma were caught. Greater numbers of these species were found at daytime depths of 600-900m at 30°N. All three migrated a short distance by night but were not found above 300m. Nematobrachion sexspinosus reported to be an uncommon species, was taken consistently in small numbers at night at 30°N between 200 and 700m. None were apparent in day time hauls although some may be found in a complete sort of the samples.

The smaller, near-surface species, principally belonging to the genus Stylocheiron: S. longicorne, S. suhmii, S. abbreviatum, and S. elongatum occupied the 200-300m layer at both positions. At 11°N all four species appeared to undergo a short diurnal migration to the surface layers at night. Whereas at 30°N S. longicorne and S. elongatum did not. At this latitude Euphausia gibboides and E. brevis were also abundant in the epipelagic fauna, whereas at 11°N E. gibboides and E. mutica, the close relative of E. brevis, were found in midwater.

Sampling

The samples which were collected from 50m horizons at 11°N showed a more sharply defined vertical distribution than those collected at 100m intervals in a previous year. A similar vertical distribution was noticed when trawls were made at selected isotherms.

Amphipods

The distribution and abundance of amphipods collected have varied considerably and reflect the wide geographical area covered during the cruise.

Species of the gammaridean genera Cyphocaris, Metacyphocaris, Crybelocephalus, Euandania, Paradania, etc. which form the bulk of the amphipod fauna from 700m to 2000m were less abundant at 11°N than at more northerly stations. The reverse tended to be true for the hyperiids Lanceola and Scypholanceola although members of these genera are known to occur in northern waters.

Between 700m and 200m the faunas at 11°N, 18°N and 30°N are essentially similar, with two species of Cyphocaris, and hyperiid genera such as Lanceola, Scina, Vibilia and Phronima forming a large part of the amphipod population. The abundance of Phronima spp., particularly P. sedentaria in the upper part of this range at 11°N and 30°N was particularly striking.

At all stations a pronounced change in the composition of the fauna occurred at or about 200m. Above this depth species of Hyperiidea Curvicornia formed a large proportion of amphipod catches. The families Lycaeidae, Pronoidae, Oxycephalidae and Platyscelidae were particularly well represented. The diversity of this epipelagic fauna was greatest at 11°N. The Curvicornia, Hyperia spp. and the gammaridean genus Synopia frequently formed an important part of night catches taken with surface nets.

Several additional specimens of an undescribed species of Crybelocephalus were obtained off Fuerteventura, while three specimens of Pegohyperia princeps were found in catches made at 18°N. Only two records of the latter both from the southern hemisphere, have been reported in the literature.

About 120 specimens of Cystisoma have been taken. These large, fragile animals are frequently badly damaged during capture, so it is particularly gratifying to report that many of the present specimens are in excellent condition. Preliminary examinations suggest that attempts to combine all of the described species under a single name are unjustified.

The use of baited fish traps along the continental slope of the African coast provided many specimens of the lysianassid genus Euonyx.

Some hundred of specimens have been isolated from bottom net catches. The families Oedicerotidae, Eusiridae and Lysianassidae were particularly well represented among the 170 or so species present. Little in the way of specific identification has been possible, but some of those species which have been run down are known to have ranges extending to the Azores and 53°N20°W.

Ostracods

Only superficial examination of planktonic ostracods is possible onboard ship, and there were few surprises in the specific composition of the catches. Specimens of Conchoecia valdiviae were preserved for study of the frontal organ by electron and light microscopy. The most noteable planktonic ostracods were caught in the last very deep haul at station 7856 which included several specimens of a Gigantocypris species which is a new species for the North Atlantic. The bottom nets caught some interesting species of Bathyconchoecia. In the hauls south of Dakar several specimens of Bathyconchoecia subrufa and B. septemspinosa were caught. The first species was previously only known from a single bottom net sample taken on the Discovery cruise 21. The second species, is spinous and only known previously by a single juvenile; together with B. deeveyae, it is a species that probably should be separated off as a new genus. Single specimens of two other Bathyconchoecia species were picked out of the later bottom net samples, both probably belonging to unknown species.

Decapod Crustacea

The decapod catches have not as yet been analysed in detail but the following preliminary comments can be made.

A series of oblique (0-1000m) RMT8 hauls with TSD observations to 1200m were made in the area 20°N to the Cape Verde Islands and southwards to 12°N, to provide additional data on the faunal changes that occur. The relative occurrence of the North Atlantic species pair Acanthephyra purpurea and A. pelagica and their tropical counterparts A. sexspinosa and A. acanthitelsonis is a useful indication of transition from one faunal area to the other. As on previous cruises there was no sudden faunal change but rather a broad area of transition

extending from about 20°N to the Cape Verde Islands. Temperate and tropical acanthephyrid species were present, A. purpurea and A. pelagica decreasing in abundance and frequency of occurrence to the south and A. sexspinosa and A. acanthitelsonis to the north. The TSD data provided no evidence of a physical discontinuity in the area but rather a gradual cooling of the mesopelagic zone from 20°N equatorwards.

The vertical series at 18°N 25°W (stn. 7803) provides data on the vertical distribution of decapods within this zone of faunal transition for comparison with that of cruise 30. A. purpurea, A. sexspinosa, A. pelagica and A. acanthitelsonis were present in small numbers. Day and night distributions were generally similar to those previously described.

Further collections were made at 11°N 20°W (stn 7824) to supplement those of cruise 21. As previously the hauls were exceptionally rich both in species and numbers. The daytime peak occurrence of A. sexspinosa at 600-500m and A. acanthitelsonis at 700-600m reflects the much shallower distribution of mesopelagic species at this position.

The sparse catches at 30°N 23°W (stn. 7856) contrasted with the rich hauls at 11°N. A. purpurea, Systellaspis debilis, Gennadas valens, G. elegans and Funchalia villosa were present at depths similar to those recorded at Fuerteventura.

Hauls below 1000m at the three positions yielded specimens of particular interest. Physetocaris microphthalma occurred at 18°N and 30°N one specimen being maintained alive for over 10 days. More than 50 specimens of the enigmatic Amphionides were taken (for Dr. D.I. Williamson) and two remained alive for 36 hours. Acanthephyra eximia and A. microphthalma were recorded at 30°N.

Cephalopoda

During this cruise 270 cephalopods were examined, 195 of those from two vertical series (155 from 11°N and 40 from 30°N). At 11°N the most abundant species was Mastigoteuthis flammea, 30 being identified. This was similar to the results obtained in this area in 1968. Also in relatively large numbers were Cranchia scabra and Japetella diaphana. Several individuals of Vampyroteuthis infernalis, Bathyteuthis abyssicola and Pyrgopsis pacifica were also found. Rare cephalopods included Galiteuthis, Alloposus and Octopoteuthis.

Very few squid were caught during the 30°N series the most numerous being Bathothauma, 10 of which were examined and one of these was a very large specimen with a mantle length of approximately 20 cms. Other species were only present in very small numbers.

Fish

Midwater fishes

The work carried out in 18°N 25°W, 11°N 20°W and 30°N

23°W, where partial or complete vertical series were fished, was of particular interest concerning the diversity and abundance of mesopelagic fishes. Preliminary analysis of the catches showed that at least 101 species of 72 genera were present at 30°N, 116 species of 87 genera at 18°N and 143 species of 113 genera at 11°N. Similarly the biomass of fishes was apparently least at 30°N and greatest at 11°N. As expected, myctophid and stomiatoid fishes dominated the catches in all 3 areas. Melamphaids, alepocephalids and ceratoid anglers were next in order of abundance, although considerably less numerous.

At 18°N the number of species of myctophids (ca 25) sampled were far fewer than those taken at the same position during cruise 30 (ca 45), though the latter was a more detailed survey. Of the stomiatoids, the genus Cyclothone was the most numerous, as found previously. The light coloured Cyclothone (C. alba, C. braueri and C. pseudopallida) dominated the shallower depths down to about 600m, with the darker species (C. pallida, C. acclinidens, C. livida and C. obscura) showing distribution maxima at various depths below this. The vertical distribution of Cyclothone, non-migrant species, was superficially similar at 11°N, but here C. braueri was completely replaced by the more southerly species, C. alba. Also, it appeared to compare favourably with the results obtained during a previous vertical series (cruise 21) in the same position. Correspondingly the vertical distribution of the migrant myctophids and stomiatoids suggest similar patterns to those found from the previous survey. At 30°N, however, there was somewhat less resemblance between the present catches and the results obtained by Isaacs-Kidd midwater trawl during the SOND cruise (No. 8). Although both vertical series were comparatively alike in the number of species present in the catches (ca 101 vs 112 from the SOND Cruise) there is an indication of a paucity of individuals in the current series. Another difference is the replacement of Cyclothone livida by C. microdon, a typically northern species, in the current series. No C. microdon occurred during the SOND cruise nor were observed in the catches at 28°N 14°W during the present cruise.

A series of 11 one-hour tows, all fished close to 250m depth at 30°N during a single 24 hr period provided some useful information on the temporal aspect of vertical migration. From a daytime total of 7 species the number increased to a maximum of 20 from the tow through sunset. One of the species from the latter haul, Ceratoscopelus warmingi, had previously been found to have a daytime depth distribution of 900-1500m. Although this and other species apparently migrated to shallower depths during the night, none of the night time tows yielded less than 14 species. Thus an overall total of 47 species was taken during this period which may be compared with the 24 species caught from the standard day and night tows at 300-200m during the vertical series.

Midwater species of special interest taken during the cruise were 2 Eurypharynx larvae (from 18°N & 30°N), a large specimen of Saccopharynx (11°N), an apparently unknown species of Stomias (18°N) which unfortunately was damaged, several Pachystomias (11°N & 18°N), several cetomimids (11°N & 18°N), 2 megalomycterids (18°N) 2 Eutaeniophorus (11°N) and a large specimen of Caulophryne (30°N).

Intensities of bioluminescent activity were measured from living fish and samples of light organs collected for chemical

analysis (by PJH), the brains of selected species were collected (NBM) whole specimens preserved for chemical analysis (by RJM) and eyes of Stylophorus and Gigantura were collected for Dr. N.A. Locket, of the Institute of Ophthalmology, for structural examination.

Bottom Fishes

Benthopelagic and benthic fishes were sampled by 15 bottom net operations (depth range 271-1503m) 16 traps (515-1445m) and 9 longline operations in 3 general areas on the African Continental slope between latitudes 9°N and 26°N. Three bottom nets (271-1341m) and 2 traps (33 & 313m) were also fished on the Josephine Bank (36°47'N 14°31'W). Wherever possible the three methods were used in conjunction for maximum coverage of sampling. The results indicated a close correlation between trap and line catches which differed considerably from the fish taken in the bottom net. Catches from the latter were much richer in the number of species and individuals, and also apparently in biomass.

Preliminary examination of the bottom net catches showed that at least 53 species of 45 genera of bottom fishes were present. Four elasmobranch genera were represented (Galeus, Apristurus, Chimaera and Harriotta) by a total of only 5 specimens, while by far the most numerous teleosts were macrurids (12 genera) and the trachichthyid, Hoplostethus. Catches within the shallower parts of the depth range fished were typified by Nezumia, Hymenocephalus and Hoplostethus, while from deeper water Bathygadus, Coelorhynchus and synaphobranchid eels were more commonly caught. In general the fish taken by the bottom net were small and only a single Coryphaenoides rupestris and one Mora were worthy of commercial interest. One noteworthy fish from the Josephine Bank was a specimen of Rondeletia, although it is doubtful whether this was caught on the bottom.

The 9 bottom longline operations yielded a mean hooking rate of 10%. About 50 hooks/operation were used, baited with squid or mackerel. The catches comprised mainly the squaloid sharks Centrophorus, Centroscymnus, Deania and Scymnodon. A single rajid was caught and 2 Coloconger, while Mora, a scopaenid and a single specimen of Coelorhynchus occa were the only species common to both bottom line and net catches. However Centrophorus Deania, Scymnodon and Coloconger were taken in the traps as well on the lines, together with Etmopterus and Myxine. Synaphobranchus and Simenchelys were the only species caught in traps which were also caught in the nets.

Neuston

The hauls taken on the first leg of the cruise (Stations 7803-7809) showed a paucity of both species and numbers. The daytime samples contained mainly small Velella and Scomberesox sp. together with a number of juvenile flying fish. Subsequent samples taken at six-hourly intervals showed no increase in volume, Velella and Scomberesox being the dominant forms although pontellid copepods were sometimes present.

A total of 26 hauls were taken at 10°N 19°W spanning the

24 hour period, but concentrating on the dawn and dusk periods. The fauna at 10°N was richer than either the 17°N or 30°N stations. The day hauls were mainly rather small but varied and included Porpita and Halobates which were only found at 10°N. Fuel oil was present in virtually every sample, but here was untilised by Lepas fascicularis as a settlement site, which latterly became one of the most abundant animals in the neuston, both in numbers and biomass. Velella was concpicuous by its absence from the samples at this station. The night hauls were much richer mainly being composed of copepods, amphipods, stomatopod and decapod larvae, the latter sometimes occurring in very large numbers. A dawn series which was taken on 9.III.72 was very interesting as surface temperature discontinuities were being crossed at the times of sampling. The Lepas fascicularis colonies were associated with the warmest water (as were the cyprid larvae) and the pontellid copepods with the coldest water.

Glaucus atlanticus, Physalia physalis, Salpa cylindrica Gonichthys sp., Myctophum sp. and large numbers of pteropods Diacria and Cavolinia were taken in OXFAM samples, but not in any Neuston Net hauls.

Samples taken at 20°N 23°W contained large numbers of Velella (which were also seen on the surface) Iodotea metallica and Pelagia noctiluca. Ianthina sp. was occasionally found attached to Velella, but no free floating specimens were caught. The fish were represented by two species, namely Scomberesox sp. and Macrorhamphosus gracile both being present in day hauls in small numbers. Macrorhamphosus exhibited a reverse migration at night, undergoing the normal dawn and dusk rises but occupying a deep nightime depth, and being one of the few fish to occupy the surface layers during the day.

Ornithology

During the cruise nearly 600 observations were made and 24 species of birds identified. Only 7 of these species were seen on more than a few occasions, and numbers were generally low. The general picture of distribution and numbers established during this cruise confirm evidence of a similar pattern obtained during previous visits to the area. The species seen with some regularity in some part or other of the area covered by the cruise were Cory's Shearwater, Leach's Storm Petrel, Gannet, Great and Pomarine Skuas, Lesser Black-backed Gull and Kittiwake.

Several days were spent during the second week in February, at a position 20-25km South of Fuerteventura. Gannets and kittiwakes were regularly present in small numbers despite the 'vagrant' status that the latter has in the Canary Islands. The rarity of the Kittiwake on the islands themselves is probably due to the strictly pelagic habit of this species outside the breeding season.

The continental shelf and slope off the African coast between 21°N and 26°N were visited twice during the cruise and considerable differences in the avifauna were noted. In mid-February Lesser Black-backed Gulls (mostly Larvus fuscus graellsii but up to 5% L.f. fuscus) were present in large numbers, and Gannets were plentiful. Five to six weeks later towards the end of March, Gannets were less abundant, and Lesser Black-backed Gulls were very scarce. The pelagic habit of the Kittiwakes was well

demonstrated during the first visit to the shelf when the small retinue of these birds deserted as soon as the 100 fm line was crossed, and only reappeared when the ship returned to deeper water. In addition to these visits, sampling programmes were conducted at the edge of the continental shelf in areas further south. At 18°N, at the end of February, Lesser Black-backed Gulls were still abundant and Gannets commonly met with, but no Kittiwakes were seen. Black-headed Gulls were common, however, and both Arctic and Pomarine Skuas occurred. South of Dakar there was another abrupt change, Pomarine Skuas being present at nearly every observation. Gannets, which were seen in small numbers only, were the only other birds seen at all regularly.

Very few birds were seen at 18°N 25°W, north of the Cape Verde Islands. Leach's Storm Petrel was fairly regularly present in small numbers, and a few Soft Plumaged Petrels and Little Shearwaters were recognised but no Cory's Shearwaters were seen despite the position being only 60km from one of the breeding grounds of this species.

During passage from the African Shelf to 11°N 20°W, Pomarine Skuas and Leach's Storm Petrels were seen, but very little else; a situation which also prevailed during the second week in March while stations were worked at 11°N 20°W.

At 30°N 23°W during the first week in April very few birds were seen. Small numbers of Cory's Shearwaters and Leach's Storm Petrels were recorded, but little else apart from a few Great and Pomarine Skuas on passage.

During passage towards Barry, elements of the northern fauna such as Gannets and Kittiwakes, which had been met with south to 10°N and 25°N respectively, during February and early March, were now found only north of 45°N.

Pigment Investigations

Considerable numbers of the siphonophores Velella and Physalia have been collected and deep-frozen for extraction and analysis of their carotenoprotein and biliprotein blue pigments respectively, and samples of the blue pigmented Salpa cylindrica have been obtained for similar analysis. A number of species of deep water medusae have been collected in order to investigate the extent of porphyrin pigmentation in these animals. The characteristic orange-red pigmentation of whale fishes has been extracted from three species for subsequent identification. Several additional species of oceanic decapod crustaceans have been collected in order to supplement previous work on the relationship between pigment and lipid content and the species depth distribution. Work on the embryonic development and on the buoyancy of the eggs of these animals has also been continued.

Bioluminescence

Work in the programme of qualitative and quantitative observations on the bioluminescence of oceanic animals has concentrated largely upon the squids, decapod crustaceans,

echinoderms and fish.

Among the squids luminescence has been observed and examined in species of Ommastrephes, Ctenopteryx, Bathothauma, Pyrgopsis, Phasmatopsis, Vampyroteuthis, Octopoteuthis(?), Histioteuthis, Spirula and Heteroteuthis, in addition to a number of enoploteuthids and cranchiids. The distribution of photogenic tissue in the related species Ommastrephes caroli and O. pteropus has been investigated, and considerable quantities of material from the latter species deep frozen for investigation of the chemical basis of its luminescence. The emission of a luminescent secretion appears to be a feature common to all 20 species of the decapod crustacean family Oplophoridae that have been examined, and similar secretion has been observed from certain pasiphaeids, as well as from Heterocarpus. Material from these animals has been stored for investigation of the extent of luciferin-luciferase cross reactions.

Further examples of self luminous echinoderms have been observed at a number of stations, and very large catches of some species have enabled sufficient material to be stored for investigation of the chemistry of the systems. The brightness of the luminous responses of some of these animals has been particularly remarkable.

It has been possible to study the luminescence of a number of species of angler fishes in some detail, and this has provided some insight into the control of intensity in the esca. Particularly striking is the brilliance of the luminescent responses of Edriolynchus. Observations of the luminescence of the scopelarchid fish Benthalbella have been extended, and the luminescence of the shark Isistius observed in several specimens. Records of the brilliant displays of Astronesthes and Echiostoma have supplemented work on the simple photogenic bodies of stomiatoid fishes, and feebler luminescence of these bodies observed in other species. Further observations of the red emission from the subocular photophore of Pachystomias have assisted in a comparison of the system of this fish with those of Aristostomias and Malacosteus (with Prof. E.J. Denton).

Material from several groups of animals has been fixed for light or electron microscopy, in association with workers at London, Cambridge, Portsmouth and St. Andrews, and some success has been achieved in the culture of luminous bacteria from some fish and squid. Some specimens have been deep-frozen for analysis of the characteristic pigments associated with squid and fish photophores.

Response of mesopelagic animals to pressure

Individuals of 14 species representing ostracods, cephalopods, fish and decapod crustacea were held at constant temperature in a pressure vessel and subjected to stepped, pressure increases within the range 200 to 6000 lbs/sq in. Response was either observed visually or monitored electronically.

Acanthephyra purpurea, A. sexspinosa, S. debilis and O. spinosus all displayed the same general pattern of response.

Pressure increases up to 2000 lb/sq ins induced a temporary rise in the level of swimming activity. At pressures in excess of 2000 lb/sq ins there was a cessation of activity and, with two exceptions, eventual death after periods of 10-30 minutes.

Funchalia villosa and F. taaningi, in contrast, survived recycling to 2500 lb/sq ins, deepened in pigmentation and retained a high level of activity when removed from the pressure chamber.

Argyropelecus sp. became orientated vertically and swam vigorously at the relatively low pressure of 210 lbs/sq ins. Pressure changes of ± 20 lbs about this value caused the fish to either sink or rise in the chamber.

Any assessment of the significance of these preliminary results must await the complete analysis of the records and data.

Swimbladder Survey

A) Examination of the transparent, shallower-living species of Cyclothone caught during this cruise (C. braueri, C. alba and C. pseudopallida) shows that in contrast to the deeper-living black species (livida, acclinidens, microdon, obscura etc.) a gas-filled swimbladder is present in the adult phase. These transparent species, which are most numerous between 400 and 600m and non-migratory, must be prominent sound scatterers at appropriate frequencies (the probable dimensions of the ellipsoidal swimbladder are close to 2.5 x1.5mm).

B) Members of the berycoid family Melamphaidae (Poromitra, Scopeloberyx and Melamphaes) have a well-developed gas-filled swimbladder and must also be potential scatterers, particularly at depths between 500 and 1000m.

Survey of Mauthnerian System

Brains of mesopelagic, bathypelagic and benthopelagic fishes have been dissected and fixed for later examination of the relative development of the Mauthnerian System (a pair of giant neurones and crossed giant motor fibres that enable fishes to escape rapidly from disturbances). Comparative study should reveal the species with the most efficient (ie. the largest) neural means of escape.

Longhurst

During the first leg of the cruise intercalibration hauls were made off Fuerteventura using the NIO sampler mounted on a $1m^2$ frame net with 0.33mm mesh, and the IMER sampler mounted on a $\frac{1}{2}$m diameter ring net using 0.20mm mesh. Daytime hauls were made at 250m and 500m with both samples in an area already well known from previous Discovery cruises. A further night haul at 250m was taken with the IMER sampler. Each haul was a horizontal tow for about one hour with one minute wind-ons. The results will not only provide an indication of the effects of mouth size and mesh size on the results, but will also allow more meaningful linking of results from the IMER studies on seasonal changes and the NIO depth and microdistribution studies.

Two further hauls were carried out using the NIO sampler at station 7803, to investigate the timing of vertical migration using 3 minute wind-ons, and at station 7824 as a complimentary tow to the night-time repeated combination net tows at 250m.

RMT Nets

RMT 1+8

During the cruise the RMT 1+8 combination net completed 132 opening and closing hauls. This included 2 vertical series and other miscellaneous sampling. One hundred and twenty-six of the hauls were completely successful, of the 6 unsuccessful hauls 3 were complete failures due to malfunctions of the net monitor, however this was at the beginning of the cruise when the new G type monitor was undergoing its first sea trials. This monitor completed 66 successful hauls, including 9 with the RMT 25, down to depths of 2000m and at all depths fired the release gear very easily with the exception of 2 RMT 25 hauls which were difficult to open. This monitor complete with both nets was lost at station 7824 #63. The other 3 unsuccessful hauls were caused by the failure of a release gear jaw; after the damaged parts had been replaced no further trouble was experienced with this equipment. The damage to the release gear was probably due to the severe conditions that the net was fished in on cruise 39.

After the loss of the G type monitor the older F type were used and on 18 hauls the net showed a reluctance to close and one haul was difficult to open and close. This trouble was cured by fitting a later type of receiver (Mk III) to one of the F type monitors. After this modification the net monitor gave no further trouble, operating on one occasion at a depth of 2060m.

A new flow meter designed and made by Mr. R.A. Wild was used for the first time this cruise. This was a small independently mounted unit and therefore dispersed with the problem of gymbal mounting the entire monitor. The original flow meter was mounted on the monitor end cap. The new flow meter orientated itself well in the water and gave very encouraging results.

In an attempt to overcome the difficulty in closing the net the receiver scroll was independantly gymbal mounted, but the results were inconclusive.

RMT 25

9 successful hauls were made with a new RMT 25. This net differed from the one used previously in that the mesh size was increased from 1 to 2 cms. The net bars were increased in strength to overcome the bending experienced at 60°N. The railway line weight bar was replaced by 2 streamlined, adjustable weights with a maximum total weight of 880lbs, but were used at 720lbs. This was an increase of 220lbs over the railway line and although the net appears to fish at a better angle there was no means of measuring the apparent improvement. Of the nine hauls 6 of the catches were of moderate size, 1 was large and 2 were disappointingly small.

Bottom Nets

The BN 2.4 was fished on 18 occasions, of which 16 produced

samples of benthos. The two unsuccessful hauls did not reach the bottom and failure was attributable to flooding of the monitor. Thirteen successful hauls were made on the Africa continental shelf at 6 localities between 9°N and 26°N in depths of 273-1584m and the remaining 3 on the Josephine Bank (lat. 37°N), between 271 and 1356m.

The immediate impression of the 16 samples obtained was that no two hauls were alike, although some species occurred in more than one catch. Several catches were dominated by siliceous sponges of various species. Particularly striking was the considerable density of a large vase-shaped form on the plateau of the Josephine Bank at 275m. Two catches from 1500m on the African slope contained considerable numbers of a large thick walled anemone. The sponge dominated sample from the Josephine Bank contained many gorgonians; an indication of fairly strong water movements. Decapod crustaceans, both Natantia and Reptantia were present in most samples, and formed an important element of the fauna at several stations. A rich fauna of smaller crustaceana was found at all stations worked on the African shelf, though not on the Josephine Bank. Amphipods were abundant and showed considerable specific diversity. Echinoderms formed a very obvious part of most catches, one being dominated by ophiuroids and several by various species of holothurians. Large echinoids also occurred at several stations. Fish formed an important part of most catches; macrurids and halosaurs being particularly abundant.

Preliminary observations suggest at least some faunal affinities with material collected at stations off the Azores and at 53°N.

Some animals have been kept alive and those surviving taken back to the NIO.

Bottom Traps

Bottom traps of simple design and construction were fished on 18 occasions. Two types were used, one of pyramidal shape, 65" base and 48" slant height with 3 entrances, the other rectangular, 24" x 16" x 16" with two entrances. The pyramidal traps were covered in 1" galvanised "chicken" wire, one having a fine mesh ($\frac{1}{4}$") netting bottom: the rectangular trap was covered in fine mesh ($\frac{1}{4}$") netting. Traps were baited with frozen mackerel and squid and laid on polypropylene line secured to a floating dhan buoy; they were recovered using the line hauler. Fishing depth varied from 300-1166m, while fishing time was generally of 6 hours duration.

Four localities were fished: the shelf north of Dakar (1 trap), the shelf south of Dakar (5 traps), C. Blanco to C. Bojador (13 traps) and Josephine Bank (3 traps). Catches were encouraging and included a variety of fishes, crabs and the large caridean shrimp Heterocarpus grimaldii. The latter was a feature of catches from the shelf between C. Blanco to C. Bojador, the maximum catch being 56 in the small trap at stn 7854, depth 1166m.

STN.	DATE 1972	POSITION LAT °N	LONG °W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7782	10/ 2	27 44.5	14 24.7	TSD	0-2000	1610-2259	CASTS 1610 AND 1655 TSD AT 2052 HRS
# 0		27 45.4	14 24.5	WB			
7782	11/ 2	27 44.0	14 22.8	RMT8+1 B8-12	130- 200	0024-0115	NET FAILED TO CLOSE
# 1		27 42.7	14 21.4				
7782	11/ 2	27 39.4	14 17.9	RMT8+1	700- 800	0309-0554	
# 2		27 34.5	14 13.6				
7783	11/ 2	27 42.9	14 21.7	RMT8+1	225- 280	1000-1200	
# 1		27 39.4	14 19.1				
7783	11/ 2	27 36.8	14 17.4	LHS2 B8	242- 253	1315-1434	
# 2		27 34.4	14 16.0				
7783	11/ 2	27 36.6	14 16.9	LHS1 B8	244- 260	1553-1753	89 SAMPLES OBTAINED
# 3		27 32.2	14 15.8				
7784	11/ 2	27 34.3	14 17.3	RMT8+1	1200-1500	2306-0450	
# 1		27 23.6	14 9.1				
7785	12/ 2	27 40.0	14 21.0	LHS2	489- 516	0843-1034	
# 1		27 36.3	14 18.7				
7785	12/ 2	27 32.0	14 15.1	LHS1	480- 515	1238-1404	
# 2		27 29.0	14 12.8				
7786	12/ 2	27 26.9	14 13.9	RMT8+1	690- 830	1805-2007	MONITOR ERROR - WRONG DEPTH FISHED
# 1		27 27.6	14 18.4				
7787	12/ 2	27 29.1	14 21.5	LHS2	240- 260	2125-2241	
# 1		27 30.1	14 24.3				
7788	13/ 2	25 4.4	16 33.7	RMT8+1	600- 700	2130-0030	
# 1		25 9.1	16 38.6				

STN.	DATE 1972	POSITION LAT °N	LONG °W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7789	14/ 2	24 58.2	16 14.7	TSD	0- 200	0445-0501	
# 1		24 58.1	16 14.9				
7789	14/ 2	24 57.8	16 15.3	TSD	0- 200	0550-0603	
# 2		24 57.7	16 15.4				
7789	14/ 2	24 57.3	16 15.7	TSD	0- 200	0643-0656	
# 3		24 57.2	16 15.7				
7789	14/ 2	24 57.2	16 15.9	TSD	0- 200	0743-0757	
# 4		24 57.2	16 15.9				
7789	14/ 2	24 56.9	16 16.5	TSD	0- 200	0846-0901	
# 5		24 57.0	16 17.0				
7789	14/ 2	24 57.3	16 14.2	TSD	0- 195	1046-1057	
# 6		24 57.3	16 14.2				
7789	14/ 2	24 57.0	16 14.3	TSD	0- 195	1145-1155	
# 7		24 57.0	16 14.3				
7789	14/ 2	24 56.5	16 14.3	TSD	0- 195	1245-1256	
# 8		24 56.4	16 14.3				
7789	14/ 2	24 56.5	16 14.1	TSD	0- 195	1345-1357	
# 9		24 56.5	16 14.1				
7789	14/ 2	24 56.6	16 14.2	TSD	0- 195	1445-1457	
# 10		24 56.6	16 14.2				
7789	14/ 2	24 56.7	16 14.3	TSD	0- 195	1545-1556	
# 11		24 56.7	16 14.4				
7789	14/ 2	24 56.7	16 14.2	TSD	0- 195	1645-1656	
# 12		24 56.7	16 14.3				

STN.	DATE 1972	POSITION LAT °N	LONG °W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7789 # 13	14/ 2	24 56.8 24 56.8	16 14.5 16 14.5	TSD	0- 195	1745-1755	
7789 # 14	14/ 2	24 56.5 24 56.5	16 14.5 16 14.4	TSD	0- 200	1845-1857	
7789 # 15	14/ 2	24 56.4 24 56.4	16 14.4 16 14.4	TSD	0- 200	1945-1959	
7789 # 16	14/ 2	24 56.5 24 56.6	16 14.0 16 14.0	TSD	0- 200	2046-2059	
7789 # 17	14/ 2	24 56.3 24 56.3	16 14.4 16 14.5	TSD	0- 200	2145-2157	
7789 # 18	14/ 2	24 56.4 24 56.3	16 14.7 16 14.7	TSD	0- 200	2244-2258	
7789 # 19	14/ 2	24 56.2 24 56.2	16 14.7 16 14.8	TSD	0- 200	2344-2357	
7789 # 20	15/ 2	24 56.2 24 56.1	16 14.8 16 14.8	TSD	0- 200	0043-0057	
7789 # 21	15/ 2	24 56.0 24 55.9	16 14.7 16 14.7	TSD	0- 200	0143-0156	
7789 # 22	15/ 2	24 55.7 24 55.8	16 14.7 16 14.7	TSD	0- 200	0243-0255	
7789 # 23	15/ 2	24 56.0 24 56.1	16 14.6 16 14.7	TSD	0- 200	0345-0357	
7789 # 24	15/ 2	24 56.0 24 55.9	16 14.5 16 14.5	TSD	0- 200	0445-0501	

STN.	DATE 1972	POSITION LAT ° N	LONG ° W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7789 # 25	15/ 2	24 56.0 24 55.9	16 14.2 16 14.3	TSD	0- 200	0543-0556	
7789 # 26	15/ 2	24 56.0 24 56.0	16 14.2 16 14.3	TSD	0- 200	0643-0655	
7789 # 27	15/ 2	24 56.0 24 56.0	16 14.3 16 14.3	TSD	0- 200	0745-0758	
7789 # 28	15/ 2	24 56.1 24 56.0	16 14.1 16 14.1	TSD	0- 195	0845-0855	
7789 # 29	15/ 2	24 55.4 24 55.4	16 14.1 16 14.2	TSD	0- 195	0945-0955	
7789 # 30	15/ 2	24 55.5 24 55.4	16 14.3 16 14.6	WB	0- 175	1004-1024	
7789 # 31	15/ 2	24 55.5 24 55.5	16 15.0 16 15.0	TSD	0- 195	1045-1055	
7789 # 32	15/ 2	24 55.5	16 15.0	*TSD	0- 185	1056-1232	* TSD HELD AT 150M. FOR 82 MIN.
7789 # 33	15/ 2	24 55.8 24 55.8	16 14.4 16 14.4	TSD	0- 200	1345-1356	
7790 # 1	15/ 2	24 55.5 24 55.5	16 4.8 16 4.9	TSD	0- 65	1545-1551	
7791 # 1	15/ 2	24 54.5 24 54.5	15 53.8 15 53.9	TSD *WB	0- 58	1705-1715	* NUTRIENT SAMPLES
7792 # 1	15/ 2	24 54.1 24 54.0	15 43.4 15 43.5	TSD *WB	0- 47	1821-1829	* NUTRIENT SAMPLES

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STN.	DATE 1972	POSITION LAT °N	LONG °W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7793	15/ 2	24 53.4	15 33.1	TSD	0- 35	1937-1944	* NUTRIENT SAMPLES
# 1		24 53.4	15 33.1	*WB			
7794	16/ 2	23 27.1	17 35.0	TSD	0-1200	0843-0935	*WB AT 1200M.
# 1		23 28.3	17 34.7	*WB			
7795	16/ 2	22 50.5	18 26.3	TSD	0-1200	1457-1548	
# 1		22 50.5	18 26.3				
7796	16/ 2	22 14.0	19 18.4	TSD	0-1200	2106-2209	
# 1		22 13.7	19 17.8				
7797	17/ 2	21 37.4	20 7.9	TSD	0-1200	0332-0438	
# 1		21 37.3	20 7.7				
7798	17/ 2	21 1.6	20 57.9	TSD	0-1200	0948-1038	
# 1		21 1.6	20 57.6				
7799	17/ 2	20 26.1	21 46.3	TSD	0-1200	1555-1648	
# 1		20 26.2	21 46.3				
7799	17/ 2	20 25.2	21 45.7	RMT8+1	0-1000	1730-1850	OBLIQUE HAUL
# 2		20 23.0	21 44.2				
7800	18/ 2	19 47.8	22 33.1	TSD	0-1200	0107-0216	
# 1		19 47.9	22 33.1				
7800	18/ 2	19 46.7	22 32.7	RMT8+1	0-1000	0304-0424	OBLIQUE HAUL
# 2		19 44.0	22 31.7				
7801	18/ 2	19 11.2	23 22.0	TSD	0-1200	1029-1130	*WB AT 1198 AND 1200M.
# 1		19 10.7	23 21.8	*WB			
7801	18/ 2	19 11.0	23 22.1	RMT8+1	0-1000	1152-1319	OBLIQUE HAUL
# 2		19 13.5	23 24.4				

STN.	DATE 1972	POSITION LAT °N	POSITION LONG °W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7802 # 1	18/ 2	18 37.6 18 37.5	24 14.4 24 14.5	TSD	0-1200	1929-2026	
7802 # 2	18/ 2	18 37.9 18 39.5	24 15.3 24 18.5	RMT8+1	0-1000	2055-2218	OBLIQUE HAUL
7803 # 0	19/ 2	18 0.8 18 1.2	25 1.1 25 1.4	TSD	0-1200	0431-0534	
7803 # 1	19/ 2	18 1.8 18 3.3	25 2.2 25 4.8	RMT8+1	0-1000	0606-0718	OBLIQUE HAUL FLOW DIST. 3.12 KM.
7803 # 2	19/ 2	18 6.4 18 11.7	25 8.1 25 15.1	RMT8+1	1015-1250	0922-1322	FLOW DIST. 14.70 KM.
7803 # 3	19/ 2	18 10.1 18 5.8	25 15.8 25 14.4	RMT8+1	910-1000	1518-1727	
7803 # 4	19/ 2	18 3.0 18 1.2	25 13.4 25 13.1	RMT8+1	220- 300	1843-1935	NET MAY HAVE CLOSED PREMATURELY AT 1922 FLOW DIST. 2.64 KM.
7803 # 5	19/ 2	17 57.0 17 56.4	25 12.0 25 12.0	RMT8+1	1075-1250	2131-2150	NET PREMATURELY CLOSED FLOW DIST. 3.60 KM.
7803 # 6	20/ 2	17 49.5 17 41.2	25 11.1 25 11.4	RMT8+1	1000-1250	0100-0500	FLOW DIST. 17.52 KM.
7803 # 7	20/ 2	17 46.7 17 50.9	25 10.8 25 16.1	RMT8+1	1500-2000	0916-1321	FLOW DIST. 16.32 KM.
7803 # 8	20/ 2	17 54.1 17 56.8	25 19.6 25 23.0	RMT8+1	800- 900	1517-1717	FLOW DIST. 7.80 KM.
7803 # 9	20/ 2	17 56.6 17 49.0	25 6.4 25 2.6	RMT8+1	1500-2000	2128-0128	FLOW DIST. 15.24 KM.

STN.	DATE 1972	POSITION LAT °N	POSITION LONG °W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7803 # 10	21/ 2	17 42.8 17 38.2	24 59.3 24 57.2	RMT8+1	405- 500	0357-0558	FLOW DIST. 8.64 KM.
7803 # 11	21/ 2	17 43.4 17 46.6	24 58.4 25 6.2	RMT8+1	1250-1500	0835-1235	FLOW DIST. 13.20 KM.
7803 # 12	21/ 2	17 48.5 17 50.1	25 9.9 25 13.8	RMT8+1	710- 800	1413-1613	FLOW DIST. 6.96 KM.
7803 # 13	21/ 2	17 56.2 17 49.5	24 58.9 24 53.1	RMT8+1	1250-1500	2044-0044	
7803 # 14	22/ 2	17 46.2 17 43.4	24 49.6 24 46.9	RMT8+1	305- 400	0235-0435	FLOW DIST. 5.28 KM.
7803 # 15	22/ 2	17 41.9 17 39.6	24 45.2 24 43.1	RMT8+1	205- 300	0536-0706	FLOW DIST. 6.24 KM.
7803 # 16	22/ 2	17 42.8 17 43.4	24 46.4 24 51.5	RMT8+1	610- 700	0845-1047	FLOW DIST. 6.72 KM.
7803 # 17	22/ 2	17 44.0 17 44.4	24 54.2 24 58.1	RMT8+1	500- 600	1147-1345	UPPER LIMIT DOUBTFUL, DEPTH TRACE FAULTY FLOW DIST. 7.08 KM.
7803 # 18	22/ 2	17 45.4 17 46.2	24 59.2 24 59.2	NN B5	0- 0	1514-1526	
7803 # 19	22/ 2	17 46.4 17 47.1	24 59.2 24 59.3	NN	0- 0	1526-1538	
7803 # 20	22/ 2	17 47.6 17 48.5	24 59.4 24 59.5	NN	0- 0	1543-1555	
7803 # 21	22/ 2	17 49.0 17 49.8	24 59.5 24 59.6	NN	0- 0	1558-1610	

STN.	DATE 1972	POSITION LAT °N	LONG °W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7803	22/ 2	17 50.4	25 0.0	RMT25 B II	0-1000	1626-1746	OBLIQUE HAUL
# 22		17 50.4	25 2.2				FLOW DIST. 3.36 KM.
7803	22/ 2	17 50.4	25 3.9	TSD	0-1200	1853-1954	*WB 2 CASTS TO 2000M.
# 23		17 50.0	25 3.8	*WB			
7803	23/ 2	17 49.1	25 6.3	RMT25	805-1000	0048-0601	
# 24		17 50.8	25 17.5				FLOW DIST. 17.52 KM.
7803	23/ 2	17 56.9	25 7.9	RMT25	605- 800	0957-1357	
# 25		17 51.9	25 0.2				FLOW DIST. 17.52 KM.
7803	23/ 2	17 53.4	24 58.4	RMT25	295- 400	1523-1645	NET CLOSED PREMATURELY - MONITOR FAULT
# 26		17 51.8	24 56.0				FLOW DIST. 5.40 KM.
7803	23/ 2	17 52.3	24 54.1	LHS1	490- 525	1917-2147	
# 27		17 47.6	24 50.6				
7803	24/ 2	17 48.5	24 52.4	RMT25	1500-2000	0056-0556	
# 28		17 54.6	24 58.9				FLOW DIST. 16.56 KM.
7803	24/ 2	18 0.9	25 0.9	RMT25	810-1000	0858-1258	
# 29		18 7.3	25 7.1				FLOW DIST. 12.96 KM.
7803	24/ 2	18 10.0	25 9.0	RMT25	410- 600	1422-1822	
# 30		18 16.1	25 14.6				FLOW DIST. 15.84 KM.
7803	24/ 2	18 16.0	25 13.7	RMT25	610- 800	2106-0106	
# 31		18 8.5	25 10.7				FLOW DIST. 15.12 KM.
7803	25/ 2	18 4.7	25 8.6	RMT25	405- 600	0307-0707	
# 32		17 57.5	25 5.4				FLOW DIST. 14.52 KM.
7804	25/ 2	17 54.2	24 11.7	NN	0- 0	1412-1424	
# 1		17 54.2	24 10.9				

STN.	DATE 1972	POSITION LAT °N	POSITION LONG °W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7805	25/ 2	17 51.5	23 10.7	NN	0- 0	2056-2108	
# 1		17 50.8	23 10.1				
7806	26/ 2	17 52.5	22 9.3	NN	0- 0	0311-0323	
# 1		17 52.5	22 8.4				
7807	26/ 2	17 52.9	21 7.5	NN	0- 0	0930-0942	
# 1		17 52.3	21 6.9				
7808	26/ 2	17 59.2	20 8.5	NN	0- 0	1630-1642	
# 1		17 58.8	20 7.8				
7809	26/ 2	18 3.4	19 8.6	NN	0- 0	2312-2324	
# 1		18 2.9	19 8.0				
7810	27/ 2	18 5.2	16 32.0	BN2.4 B15	307- 307	1641-1706	
# 1		18 5.7	16 32.0				
7811	27/ 2	18 7.6	16 37.2	BN2.4	681- 699	1858-1931	
# 1		18 8.3	16 37.4				
7812	27/ 2	18 10.6	16 44.3	BN2.4	0- 0	2219-2248	MONITOR FLOODED-NET NOT FISHED ON BOTTOM
# 1		18 11.4	16 44.6				
7812	28/ 2	18 14.5	16 45.6	BN2.4	0- 0	0023-0054	ABORTED - ELECTRONIC FAILURE
# 2		18 15.0	16 45.8				
7813	28/ 2	18 9.5	16 38.0	BLL B13	601- 601	0600-0900	
# 1		18 7.9	16 39.5				
7814	28/ 2	18 8.9	16 38.2	TRAP B B15	578- 578	0630-1110	
# 1		18 8.0	16 39.6				
7815	3/ 3	10 50.6	17 25.5	TRAP B	612- 694	1720-2215	TRAP MAY HAVE DRAGGED
# 1		10 50.9	17 26.6				

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7815	3/ 3	10 50.1	17 25.4	TRAP B	515- 515	1730-2130	FINE MESH BOTTOM
# 2		10 50.0	17 26.2				
7816	4/ 3	10 43.7	17 22.9	NN	0- 0	0010-0025	
# 1		10 42.6	17 22.9				
7816	4/ 3	10 42.4	17 22.9	BN2.4	273- 309	0109-0143	
# 2		10 43.3	17 22.8				
7816	4/ 3	10 44.0	17 22.6	GRAB B G)	267- 267	0220-0230	
# 3		10 43.9	17 22.6				
7816	4/ 3	10 43.9	17 22.6	GRAB B	267- 267	0234-0243	
# 4		10 43.9	17 22.6				
7816	4/ 3	10 44.2	17 23.3	BN2.4	271- 320	0318-0405	
# 5		10 44.3	17 23.7				
7817	4/ 3	10 43.4	17 32.2	BLL	649- 649	0610-0840	
# 1		10 43.1	17 31.5				
7818	4/ 3	10 27.4	17 57.1	NN	0- 0	1200-1212	
# 1		10 26.9	17 57.8				
7819	4/ 3	10 4.9	18 35.5	NN	0- 0	1603-1615	
# 1		10 4.4	18 36.4				
7820	4/ 3	9 47.0	19 10.0	NN	0- 0	2004-2016	
# 1		9 46.5	19 10.7				
7821	5/ 3	9 24.9	19 47.1	NN	0- 0	0000-0012	
# 1		9 24.4	19 47.7				
7822	5/ 3	8 59.0	20 19.8	TRAP B	1153-1153	0630-1200	FINE MESH BOTTOM
# 1		8 59.3	20 18.1				

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7822	5/ 3	8 58.7	20 20.3	BLL	1151-1151	0737-1000	
# 2		8 59.0	20 19.4				
7822	5/ 3	8 59.4	20 18.0	GRAB B	1155-1155	1310-1334	FAILED TO OPERATE
# 3		8 59.2	20 18.1				
7822	5/ 3	8 59.2	20 18.1	GRAB B	1166-1166	1335-1407	
# 4		8 59.2	20 18.0				
7822	5/ 3	8 59.0	20 17.6	TRAP B	1162-1162	1439-1939	FINE MESH BOTTOM
# 5		9 0.5	20 17.9				
7822	5/ 3	8 59.0	20 16.9	TRAP B	1164-1164	1509-2044	
# 6		9 0.0	20 17.1				
7822	5/ 3	8 59.1	20 16.3	BN2.4	1203-1203	1737-1813	
# 7		8 59.9	20 16.2				
7823	6/ 3	9 21.4	21 1.6	TSD	0-1200	1019-1131	* WB AT 1200M.
# 1		9 20.6	21 3.3	WB			
7824	7/ 3	10 57.0	20 3.1	RMT8+1	710- 800	0004-0204	
# 1		10 55.0	20 7.8				FLOW DIST. 8.40 KM.
7824	7/ 3	10 53.4	20 11.9	RMT8+1	900-1000	0341-0541	
# 2		10 51.4	20 16.9				FLOW DIST. 10.08 KM.
7824	7/ 3	10 50.6	20 19.2	NN	0- 0	0643-0655	
# 3		10 50.7	20 18.4				
7824	7/ 3	10 50.7	20 18.0	NN	0- 0	0657-0709	
# 4		10 50.8	20 17.2				
7824	7/ 3	10 50.8	20 17.1	NN	0- 0	0710-0722	
# 5		10 50.8	20 16.3				

STN.	DATE 1972	POSITION LAT N	POSITION LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7824	7/ 3	10 50.1	20 13.6	RMT8+1	605- 700	0833-1033	
# 6		10 49.0	20 10.3				FLOW DIST. 5.76 KM.
7824	7/ 3	10 48.9	20 8.9	NN	0- 0	1114-1126	
# 7		10 49.0	20 8.1				
7824	7/ 3	10 48.6	20 6.9	RMT8+1	500- 630	1208-1408	NET TOO DEEP DUE TO 5 MIN. MUFAX FAULT
# 8		10 46.6	20 4.8				FLOW DIST. 5.76 KM.
7824	7/ 3	10 45.9	20 3.6	NN	0- 0	1443-1455	
# 9		10 45.6	20 2.9				
7824	7/ 3	10 45.6	20 4.0	RMT8+1	505- 600	1548-1748	
# 10		10 45.1	20 9.3				FLOW DIST. 9.60 KM.
7824	7/ 3	10 45.0	20 11.7	NN	0- 0	1844-1856	
# 11		10 45.2	20 10.9				
7824	7/ 3	10 45.4	20 10.5	TSD	0-1200	1908-2011	* WB AT 500M.
# 12		10 45.4	20 11.1	WB			
7824	7/ 3	10 45.3	20 9.8	RMT8+1	1000-1250	2103-0103	
# 13		10 45.8	20 0.2				FLOW DIST. 15.36 KM.
7824	8/ 3	10 45.9	19 57.3	RMT8+1	805- 900	0231-0431	
# 14		10 46.1	19 53.4				FLOW DIST. 6.96 KM.
7824	8/ 3	10 46.3	19 51.6	NN	0- 0	0518-0530	
# 15		10 46.6	19 50.9				
7824	8/ 3	10 46.6	19 50.6	NN	0- 0	0532-0544	
# 16		10 46.8	19 49.8				
7824	8/ 3	10 58.2	20 5.4	RMT8+1	700- 800	0905-1105	
# 17		10 56.3	20 0.6				FLOW DIST. 7.44 KM.

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7824	8/ 3	10 54.7	19 58.2	NN	0- 0	1201-1213	
# 18		10 54.5	19 57.3				
7824	8/ 3	10 53.3	19 55.7	RMT8+1	1000-1250	1313-1713	
# 19		10 48.8	19 46.9				FLOW DIST. 16.32 KM.
7824	8/ 3	10 47.9	19 44.8	NN	0- 0	1810-1822	
# 20		10 47.7	19 44.0				
7824	8/ 3	10 56.0	19 46.7	RMT8+1	1500-2000	2057-0057	
# 21		10 54.8	19 38.2				FLOW DIST. 15.60 KM.
7824	9/ 3	10 54.2	19 38.2	RMT8+1	610- 700	0240-0440	
# 22		10 52.5	19 42.8				FLOW DIST. 8.40 KM.
7824	9/ 3	10 54.7	19 55.1	NN	0- 0	0615-0627	
# 23		10 54.9	19 56.2				
7824	9/ 3	10 55.0	19 56.6	NN	0- 0	0629-0641	
# 24		10 55.2	19 57.5				
7824	9/ 3	10 55.3	19 57.9	NN	0- 0	0643-0655	
# 25		10 55.4	19 58.9				
7824	9/ 3	10 55.5	19 59.1	NN	0- 0	0656-0708	
# 26		10 55.4	20 0.1				
7824	9/ 3	10 55.4	20 0.5	NN	0- 0	0710-0722	
# 27		10 55.4	20 1.4				
7824	9/ 3	10 55.4	20 1.7	NN	0- 0	0724-0736	
# 28		10 55.4	20 2.6				
7824	9/ 3	10 55.4	20 3.0	NN	0- 0	0737-0749	
# 29		10 55.4	20 3.9				

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7824	9/ 3	10 54.7	20 3.0	RMT8+1	405- 510	0830-1030	
# 30		10 51.7	19 58.9				FLOW DIST. 7.68 KM.
7824	9/ 3	10 50.9	19 57.8	NN	0- 0	1058-1110	
# 31		10 50.7	19 57.0				
7824	9/ 3	10 49.9	19 55.3	RMT8+1	305- 400	1145-1345	
# 32		10 47.0	19 51.3				FLOW DIST. 7.44 KM.
7824	9/ 3	10 46.3	19 50.1	NN	0- 0	1413-1425	
# 33		10 46.2	19 49.2				
7824	9/ 3	10 45.8	19 47.3	RMT8+1	800- 910	1514-1714	
# 34		10 48.6	19 43.1				FLOW DIST. 6.72 KM.
7824	9/ 3	10 49.7	19 41.2	NN	0- 0	1754-1806	
# 35		10 50.0	19 40.5				
7824	9/ 3	11 3.3	19 48.3	RMT8+1	1250-1500	2044-0044	
# 36		11 4.9	19 38.3				FLOW DIST. 16.32 KM.
7824	10/ 3	11 4.9	19 37.2	RMT8+1	500- 600	0216-0416	
# 37		11 2.9	19 41.2				FLOW DIST. 7.08 KM.
7824	10/ 3	11 1.9	19 52.4	WB	0-2000	0540-0738	
# 38		11 1.5	19 53.3				
7824	10/ 3	11 1.1	19 55.8	RMT8+1	895-1000	0903-1103	
# 39		11 0.3	20 0.2				FLOW DIST. 7.68 KM.
7824	10/ 3	11 0.1	20 2.1	NN	0- 0	1146-1158	
# 40		11 0.1	20 3.0				
7824	10/ 3	11 0.2	20 5.1	RMT8+1	575- 600	1245-1445	
# 41		10 59.7	20 9.6				FLOW DIST. 8.16 KM.

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7824	10/ 3	10 59.4	20 12.9	RMT8+1	550- 575	1607-1807	
# 42		10 58.8	20 17.1				FLOW DIST. 8.16 KM.
7824	10/ 3	10 58.8	20 18.2	TSD	0-1200	1853-1959	* WB AT 1200M.
# 43		10 58.8	20 18.5	WB			
7824	10/ 3	10 57.8	20 18.5	RMT8+1	240- 265	2100-2300	
# 44		10 56.0	20 14.9				FLOW DIST. 7.32 KM.
7824	10/ 3	10 55.5	20 13.8	RMT8+1	236- 261	2333-0133	
# 45		10 53.9	20 10.0				FLOW DIST. 7.44 KM.
7824	11/ 3	10 53.4	20 8.9	RMT8+1	220- 260	0204-0404	
# 46		10 51.8	20 5.5				FLOW DIST. 7.44 KM.
7824	11/ 3	10 51.4	20 4.2	RMT8+1	240- 260	0438-0638	
# 47		10 49.9	20 0.3				FLOW DIST. 7.44 KM.
7824	11/ 3	10 48.2	20 3.4	RMT8+1	525- 550	0858-0958	
# 48		10 47.4	20 5.9				FLOW DIST. 5.04 KM.
7824	11/ 3	10 46.3	20 9.9	RMT8+1	500- 525	1119-1219	
# 49		10 45.4	20 12.5				FLOW DIST. 4.56 KM.
7824	11/ 3	10 44.1	20 17.6	RMT8+1	400- 510	1353-1453	
# 50		10 43.1	20 20.0				FLOW DIST. 5.04 KM.
7824	11/ 3	10 42.1	20 22.6	RMT8+1	400- 450	1553-1653	
# 51		10 41.1	20 24.9				FLOW DIST. 4.56 KM.
7824	11/ 3	10 40.3	20 27.3	RMT8+1	350- 400	1743-1843	
# 52		10 39.3	20 29.6				FLOW DIST. 4.56 KM.
7824	11/ 3	10 47.6	20 20.6	RMT8+1	50- 100	2045-2245	
# 53		10 44.5	20 18.4				FLOW DIST. 7.20 KM.

STN.	DATE 1972	POSITION LAT N	POSITION LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7824	11/ 3	10 44.2	20 18.9	RMT8+1	10- 29	2315-0115	
# 54		10 43.7	20 25.3				FLOW DIST. 10.08 KM.
7824	11/ 3	10 44.1	20 19.6	RMT1 B899	0- 10	2328-0027	
# 55		10 43.9	20 22.7				
7824	12/ 3	10 43.5	20 25.9	RMT8+1	20- 60	0136-0336	
# 56		10 40.8	20 24.0				FLOW DIST. 6.00 KM.
7824	12/ 3	10 39.5	20 23.0	LHS1	238- 268	0430-0534	64 SUBSAMPLES
# 57		10 37.9	20 21.2				
7824	12/ 3	10 52.8	20 12.0	RMT8+1	300- 350	0855-0955	FLOW TRACE LOST
# 58		10 52.1	20 14.8				
7824	12/ 3	10 51.0	20 18.9	RMT8+1	250- 300	1118-1218	
# 59		10 50.3	20 21.5				FLOW DIST. 4.80 KM.
7824	12/ 3	10 49.7	20 23.9	RMT8+1	200- 250	1307-1407	
# 60		10 49.0	20 26.2				FLOW DIST. 4.32 KM.
7824	12/ 3	10 48.4	20 28.7	RMT8+1	150- 200	1454-1554	
# 61		10 47.7	20 31.2				FLOW DIST. 4.32 KM.
7824	12/ 3	10 47.3	20 33.0	RMT8+1	100- 150	1628-1728	
# 62		10 46.7	20 35.3				FLOW DIST. 4.56 KM.
7824	12/ 3	10 46.4	20 36.6	RMT8+1	48- 101	1755-1855	NETS AND MONITOR LOST
# 63		10 45.7	20 39.0				FLOW DIST. 4.32 KM.
7824	12/ 3	10 59.1	19 59.3	TSD	0-1200	2329-0027	* WB AT 1200M.
# 64		10 59.1	19 59.9	WB			
7824	13/ 3	10 58.9	20 0.3	RMT8+1	205- 300	0233-0433	
# 65		10 57.7	19 57.3				

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7824 # 66	13/ 3	10 53.6 10 50.0	19 58.6 20 11.2	RMT8+1	0- 100	0834-1328	INTENDED 50-100M. NET DID NOT CLOSE
7824 # 67	13/ 3	10 48.2 10 45.0	20 10.7 20 7.2	RMT8+1	50- 110	1451-1705	DIFFICULTY IN CLOSING NET
7824 # 68	13/ 3	10 43.7 10 41.8	20 5.7 20 3.8	RMT8+1	600- 655	1758-1911	DIFFICULTY IN CLOSING NET
7824 # 69	13/ 3	10 37.9 10 34.4	20 0.9 19 57.7	RMT8+1	100- 200	2124-2324	
7824 # 70	13/ 3	10 33.4 10 30.1	19 56.7 19 53.6	RMT8+1	305- 400	2358-0201	
7824 # 71	14/ 3	10 28.9 10 25.3	19 52.3 19 49.2	RMT8+1	405- 500	0249-0501	DIFFICULTY IN CLOSING NET
7824 # 72	14/ 3	10 45.1 10 44.0	20 4.1 20 11.0	RMT8+1	23- 50	0836-1036	
7824 # 73	14/ 3	10 44.0 10 43.5	20 12.7 20 19.4	RMT8+1	10- 25	1102-1302	
7824 # 74	14/ 3	10 43.9 10 43.6	20 14.3 20 17.7	RMT1	0- 8	1130-1232	
7825 # 1	14/ 3	10 46.8 10 46.5	21 9.9 21 10.4	TSD	0-1200	1810-1916	
7826 # 1	15/ 3	10 53.4 10 53.3	22 12.1 22 11.9	TSD *WB	0-1200	0038-0138	* WB AT 300M.
7827 # 1	15/ 3	10 59.7 10 59.6	23 13.2 23 13.6	TSD *WB	0-1200	0712-0819	* WB AT 600M.

STN.	DATE 1972	POSITION LAT N	POSITION LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7828	15/ 3	11 5.5	24 5.4	TSD	0-1200	1310-1422	* WB AT 1200M.
# 1		11 5.7	24 6.1	*WB			
7829	15/ 3	11 57.6	24 37.8	TSD	0-1200	2025-2123	* WB AT 1200M.
# 1		11 57.7	24 38.4	*WB			
7829	15/ 3	11 39.1	24 38.5	RMT8+1	0-1000	2142-0938	DIFFICULTY IN CLOSING NET-CLOSED AT 200M
# 2		11 58.4	24 47.8				
7830	16/ 3	12 51.9	25 19.4	TSD	0-1200	0708-0820	WB AT 1000M. FAULTS ON DEPTH TRACE.
# 1		12 52.4	25 19.8	WB			
7830	16/ 3	12 51.5	25 19.4	RMT8+1	20-1000	0858-0947	
# 2		12 50.2	25 18.7				
7831	16/ 3	13 18.4	25 33.2	RMT8+1	10-1000	1335-1517	
# 1		13 21.0	25 35.9				
7832	16/ 3	13 49.7	25 52.1	RMT8+1	30-1000	1900-2047	
# 1		13 50.5	25 56.2				
7832	16/ 3	13 51.0	25 57.5	TSD	0-1200	2136-2233	*WB AT 1200M.
# 2		13 51.4	25 57.6	*WB			
7833	17/ 3	14 46.9	26 24.8	TSD	0-1200	0427-0529	*WB AT 700M.
# 1		14 47.6	26 24.8	*WB			
7833	17/ 3	14 47.9	26 25.3	RMT8+1	10-1000	0548-0741	
# 2		14 48.7	26 29.2				
7834	17/ 3	15 39.9	26 28.6	TSD	0-1200	1413-1522	*WB AT 1200M.
# 1		15 40.2	26 29.7	*WB			
7834	17/ 3	15 40.3	26 30.7	RMT8+1	20-1000	1544-1733	
# 2		15 40.2	26 36.6				

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7835	18/ 3	16 40.5	26 35.4	TSD	0-1200	0018-0115	*WB AT 1200M.
# 1		16 40.8	26 35.6	*WB			
7835	18/ 3	16 41.0	26 36.1	RMT8+1	10-1000	0129-0304	
# 2		16 42.4	26 39.6				
7836	18/ 3	17 37.4	26 35.3	RMT8+1	500-1500	1349-1859	FISHED 1250-1500M. CLOSED AT 500M.
# 1		17 42.5	26 46.2				
7836	18/ 3	17 47.9	26 54.8	RMT8+1	900-1000	2224-0040	SLIGHT DIFFICULTY IN CLOSING.
# 2		17 50.8	27 0.2				
7836	19/ 3	17 52.1	27 2.7	RMT8+1	195- 300	0141-0342	
# 3		17 54.4	27 7.0				
7837	19/ 3	17 38.4	26 35.3	TSD	0-1200	0758-0914	*WB AT 600M.
# 1		17 38.8	26 35.4	*WB			
7838	21/ 3	21 29.6	17 39.1	BN2.4	533- 566	1954-2024	
# 1		21 30.4	17 39.5				
7839	21/ 3	21 33.0	17 52.4	BN2.4	919- 947	2346-0016	
# 1		21 33.7	17 52.8				
7840	22/ 3	21 37.3	18 4.5	BN2.4	1500-1548	0342-0412	
# 1		21 38.1	18 4.8				
7841	22/ 3	21 39.5	17 50.4	TRAP B	944- 944	0713-1300	
# 1		21 38.9	17 51.1				
7841	22/ 3	21 38.6	17 50.3	BLL	918- 918	0759-0956	
# 2		21 38.5	17 50.7				
7841	22/ 3	21 37.9	17 50.4	TRAP B	898- 898	0924-1550	FINE MESH BOTTOM
# 3		21 38.4	17 50.5				

STN.	DATE 1972	POSITION LAT N	POSITION LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7841	22/ 3	21 38.3	17 51.9	BLL	947- 947	1159-1427	
# 4		21 38.7	17 52.1				
7842	23/ 3	23 43.0	17 14.1	TRAP B	951- 951	0610-1046	
# 1		23 42.5	17 15.9				
7842	23/ 3	23 42.6	17 14.6	TRAP B	953- 953	0645-1127	FINE MESH BOTTOM
# 2		23 42.2	17 16.2				
7842	23/ 3	23 41.8	17 14.5	BLL	940- 940	0740-0940	
# 3		23 42.0	17 15.3				
7843	23/ 3	23 41.6	17 3.7	TRAP B	614- 614	1438-1923	FINE MESH BOTTOM
# 1		23 42.9	17 2.9				
7843	23/ 3	23 41.4	17 4.1	TRAP B	623- 623	1500-1848	COARSE TRAP + RECTANGULAR FINE TRAP
# 2		23 42.5	17 3.5				
7843	23/ 3	23 41.0	17 4.7	BLL	632- 632	1545-1800	
# 3		23 42.0	17 4.3				
7844	23/ 3	23 43.3	16 56.7	BN2.4	479- 485	2116-2146	
# 1		23 43.9	16 56.3				
7845	24/ 3	23 50.5	17 5.9	BN2.4	947- 958	0054-0126	
# 1		23 51.0	17 5.4				
7846	24/ 3	23 53.0	17 26.9	BN2.4	1500-1504	0525-0555	
# 1		23 53.7	17 26.5				
7847	24/ 3	23 56.3	17 30.7	RMT8+1	600- 800	1141-1342	
# 1		23 59.5	17 34.4				FLOW DIST. 8.98 KM.
7847	24/ 3	24 2.2	17 37.2	RMT8+1	0- 595	1523-1707	NET WOULD NOT CLOSE,CLOSING COD END USED
# 2		24 4.7	17 40.2				

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7848	25/ 3	25 46.4	15 57.1	TRAP B	929- 929	0727-1300	FINE MESH BOTTOM
# 1		25 46.8	15 57.2				
7848	25/ 3	25 47.1	15 57.4	TRAP B	976- 976	0805-1355	COARSE MESH + RECTANGULAR FINE MESH
# 2		25 47.0	15 57.1				
7848	25/ 3	25 47.5	15 58.2	BLL	985- 985	0850-1106	
# 3		25 47.4	15 57.9				
7849	25/ 3	25 45.0	15 54.2	BLL	798- 798	1554-1831	
# 1		25 45.0	15 54.1				
7850	25/ 3	25 45.5	15 55.5	RMT8+1	0- 360	1632-1713	TEST HAUL NET FAILED TO CLOSE
# 1		25 46.0	15 56.7				
7851	25/ 3	25 43.6	15 47.9	BN2.4	486- 559	2127-2157	
# 1		25 44.3	15 47.9				
7852	26/ 3	25 49.5	15 53.1	BN2.4	933-1045	0013-0042	
# 1		25 50.4	15 53.0				
7853	26/ 3	25 51.7	16 2.4	BN2.4	1503-1518	0419-0451	
# 1		25 52.4	16 2.4				
7854	26/ 3	25 54.6	15 51.8	TRAP B	1166-1166	0730-1240	COARSE MESH + RECTANGULAR FINE MESH
# 1		25 56.3	15 51.3				
7854	26/ 3	25 54.3	15 52.2	TRAP B	1102-1102	0805-1155	FINE MESH BOTTOM
# 2		25 55.9	15 51.8				
7855	26/ 3	25 55.4	15 54.3	RMT8+1	495- 605	0932-0942	MONITOR TEST (FANNY)
# 1		25 55.6	15 54.5				
7855	26/ 3	25 55.9	15 55.4	RMT8+1	110- 130	1100-1103	MONITOR TEST (FRED)
# 2		25 55.9	15 55.4				

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7856	31/ 3	29 59.6	23 1.0	TSD	0-1200	0728-0822	*WB AT 1200 M.
# 1		29 59.6	23 0.8	*WB			
7856	31/ 3	29 58.1	23 0.9	RMT8+1	405- 505	0910-1110	
# 2		29 53.6	23 1.8				FLOW DIST. 9.45 KM.
7856	31/ 3	29 50.9	23 2.6	RMT8+1	910-1000	1219-1419	
# 3		29 47.4	23 4.5				FLOW DIST. 8.43 KM.
7856	31/ 3	29 45.0	23 5.4	RMT8+1	795- 900	1534-1734	
# 4		29 40.5	23 7.7				FLOW DIST. 8.19 KM.
7856	31/ 3	29 39.3	23 8.6	NN	0- 0	1820-1832	
# 5		29 40.2	23 8.6				
7856	31/ 3	29 58.0	23 1.0	RMT8+1	900-1000	2055-2255	
# 6		29 54.7	23 1.7				FLOW DIST. 6.61 KM.
7856	1/ 4	29 51.1	23 2.8	RMT8+1	800- 895	0038-0238	
# 7		29 47.0	23 3.8				FLOW DIST. 8.66 KM.
7856	1/ 4	29 44.7	23 4.1	RMT8+1	405- 500	0342-0542	
# 8		29 40.2	23 5.0				FLOW DIST. 8.35 KM.
7856	1/ 4	29 56.1	23 2.4	RMT8+1	700- 800	0924-1133	SLIGHT DIFFICULTY IN CLOSING
# 9		29 51.9	23 4.9				FLOW DIST. 9.13 KM.
7856	1/ 4	29 49.1	23 6.3	RMT8+1	600- 700	1244-1448	SLIGHT DIFFICULTY IN CLOSING
# 10		29 45.2	23 8.4				FLOW DIST. 8.90 KM.
7856	1/ 4	29 43.4	23 9.3	RMT8+1	305- 400	1542-1743	
# 11		29 38.7	23 11.4				FLOW DIST. 9.06 KM.
7856	1/ 4	29 37.9	23 12.1	NN	0- 0	1808-1820	
# 12		29 38.8	23 12.0				

STN.	DATE 1972	POSITION LAT N	POSITION LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7856	1/ 4	29 56.7	23 0.5	RMT8+1	700- 800	2117-2323	DIFFICULTY IN OPENING AND CLOSING
# 13		29 52.7	23 0.9				FLOW DIST. 8.82 KM.
7856	2/ 4	29 50.2	23 1.2	RMT8+1	600- 700	0038-0244	DIFFICULTY IN OPENING AND CLOSING
# 14		29 45.8	23 2.5				FLOW DIST. 9.21 KM.
7856	2/ 4	29 43.1	23 3.7	RMT8+1	300- 400	0357-0612	DIFFICULTY IN CLOSING
# 15		29 37.7	23 4.4				FLOW DIST. 9.92 KM.
7856	2/ 4	29 58.5	23 1.6	RMT8+1	500- 600	0959-1204	SLIGHT DIFFICULTY IN CLOSING
# 16		29 54.1	23 4.4				FLOW DIST. 10.08 KM.
7856	2/ 4	29 52.4	23 4.8	RMT8+1	205- 300	1251-1500	SLIGHT DIFFICULTY IN CLOSING
# 17		29 48.3	23 6.3				FLOW DIST. 9.61 KM.
7856	2/ 4	29 47.2	23 6.5	RMT8+1	102- 203	1528-1729	
# 18		29 42.6	23 8.1				FLOW DIST. 10.40 KM.
7856	2/ 4	30 0.0	22 59.9	TSD	0-1200	1950-2049	*WB AT 1200 M.
# 19		30 0.1	23 0.3	*WB			
7856	2/ 4	29 58.5	22 59.7	RMT8+1	500- 600	2138-2348	MUFAX MALFUNCTION - FLOW ESTIMATED
# 20		29 53.2	22 58.4				FLOW DIST. 10.71 KM.
7856	3/ 4	29 50.8	22 57.8	RMT8+1	205- 300	0042-0245	
# 21		29 45.6	22 57.6				FLOW DIST. 10.40 KM.
7856	3/ 4	29 43.8	22 57.4	RMT8+1	100- 200	0324-0530	
# 22		29 38.4	22 57.3				FLOW DIST. 10.08 KM.
7856	3/ 4	29 36.9	22 57.0	NN	0- 0	0553-0605	
# 23		29 36.0	22 56.7				
7856	3/ 4	29 59.1	22 59.7	RMT8+1	55- 100	0842-1042	
# 24		29 54.5	22 59.7				FLOW DIST. 9.29 KM.

STN.	DATE 1972	POSITION LAT N	POSITION LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7856	3/ 4	29 53.6	22 59.6	RMT8+1	25- 50	1100-1300	
# 25		29 48.8	22 59.5				FLOW DIST. 9.69 KM.
7856	3/ 4	29 49.0	22 59.7	RMT8+1	10- 25	1330-1430	
# 26		29 50.8	23 1.1				FLOW DIST. 5.04 KM.
7856	3/ 4	29 52.0	23 1.7	RMT1	0- 10	1458-1558	DEPTH ESTIMATED
# 27		29 53.8	23 3.0				
7856	3/ 4	29 54.0	23 3.2	GRAB B	5171-5171	1610-1850	
# 28		29 53.6	23 4.3				
7856	3/ 4	29 54.5	23 3.8	NN	0- 0	1905-1917	
# 29		29 55.2	23 3.4				
7856	3/ 4	29 55.3	23 3.4	NN	0- 0	1918-1930	
# 30		29 56.0	23 2.9				
7856	3/ 4	29 56.3	23 2.8	NN	0- 0	1931-1943	
# 31		29 57.0	23 2.3				
7856	3/ 4	29 57.3	23 2.2	NN	0- 0	1945-1957	
# 32		29 58.0	23 1.7				
7856	3/ 4	29 58.1	23 1.7	NN	0- 0	1958-2010	
# 33		29 58.8	23 1.2				
7856	3/ 4	29 59.1	23 1.0	NN	0- 0	2012-2024	
# 34		29 59.9	23 0.6				
7856	3/ 4	30 0.1	23 0.4	NN	0- 0	2025-2037	
# 35		30 0.8	23 0.0				
7856	3/ 4	30 1.0	22 59.9	NN	0- 0	2038-2050	
# 36		30 1.7	22 59.4				

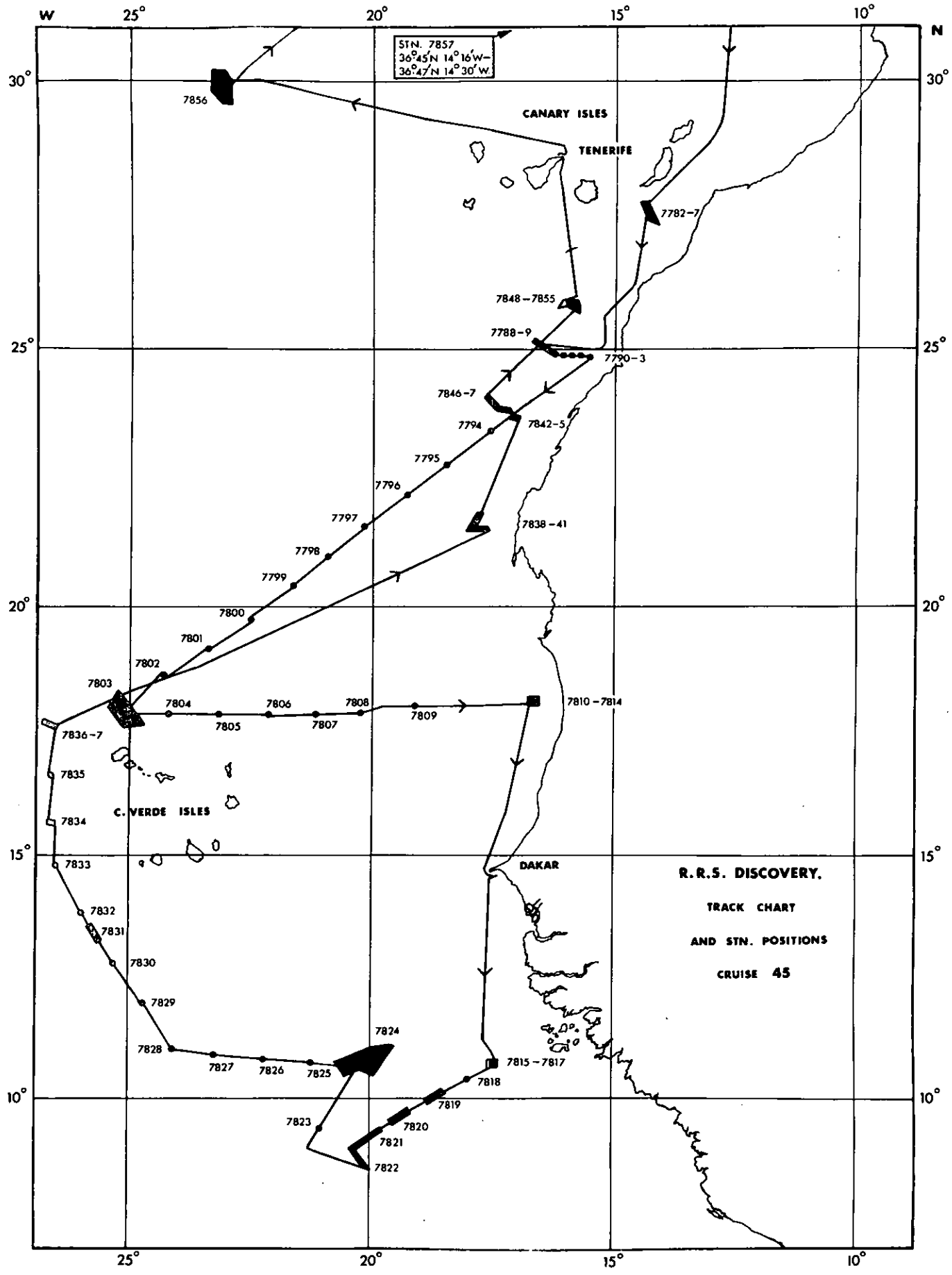
STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7856	3/ 4	30 1.3	22 58.8	RMT8+1	50- 100	2115-2315	
# 37		29 56.6	22 57.6				FLOW DIST. 10.24 KM.
7856	3/ 4	29 55.4	22 57.3	RMT8+1	25- 50	2342-0042	
# 38		29 53.0	22 56.6				FLOW DIST. 4.88 KM.
7856	4/ 4	29 52.3	22 56.3	RMT8+1	10- 25	0057-0157	
# 39		29 49.9	22 55.4				FLOW DIST. 4.72 KM.
7856	4/ 4	29 49.6	22 55.4	RMT1	0- 10	0217-0247	
# 40		29 50.4	22 56.1				
7856	4/ 4	29 49.4	22 56.6	RMT8+1	410- 500	0334-0534	14 DEG. C ISOTHERM FISHED
# 41		29 44.9	22 57.6				FLOW DIST. 9.29 KM.
7856	4/ 4	30 0.4	23 0.6	RMT8+1	0-1000	0834-1039	OBLIQUE. WOULD NOT CLOSE TILL HAUL 730M.
# 42		29 55.4	22 59.7				
7856	4/ 4	29 47.5	23 0.5	NN	0- 0	1606-1618	
# 43		29 48.3	23 0.2				
7856	4/ 4	29 48.6	23 0.0	NN	0- 0	1619-1631	
# 44		29 49.4	22 59.6				
7856	4/ 4	29 49.8	22 59.5	NN	0- 0	1633-1645	
# 45		29 50.6	22 59.1				
7856	4/ 4	29 50.7	22 59.0	NN	0- 0	1646-1658	
# 46		29 51.5	22 58.7				
7856	4/ 4	29 51.9	22 58.6	NN	0- 0	1659-1711	
# 47		29 52.7	22 58.3				
7856	4/ 4	29 48.7	23 0.5	RMT8+1	1005-1250	2114-0114	
# 48		29 54.0	23 8.8				FLOW DIST. 18.74 KM.

STN.	DATE 1972	POSITION LAT N	POSITION LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7856	5/ 4	29 55.4	23 11.0	RMT8+1	310- 345	0227-0427	15 DEG.C ISOTHERM FISHED
# 49		29 57.6	23 14.6				FLOW DIST. 8.35 KM.
7856	5/ 4	30 3.7	23 0.2	RMT8+1	1000-1250	0917-1317	
# 50		30 13.8	23 1.6				FLOW DIST. 22.21 KM.
7856	5/ 4	30 13.6	23 1.9	RMT8+1	1250-1500	1452-1853	
# 51		30 4.8	23 4.0				FLOW DIST. 17.32 KM.
7856	5/ 4	29 56.6	23 5.3	RMT8+1	1250-1500	2206-0206	
# 52		29 46.5	23 7.5				FLOW DIST. 20.16 KM.
7856	6/ 4	29 41.9	23 8.4	RMT8+1	425- 500	0349-0554	13 DEG. C ISOTHERM FISHED
# 53		29 37.2	23 10.2				FLOW DIST. 9.13 KM.
7856	6/ 4			RMT8+1	1500-2000	0831-1234	
# 54							FLOW DIST. 17.80 KM.
7856	6/ 4	29 59.3	22 59.9	TSD	0-2000	1513-1639	* WB AT 2000M.
# 55		29 59.5	23 0.0	*WB			
7856	6/ 4	29 59.5	23 0.0	WB	0-2500	1648-1928	2 CASTS OF 12 BOTTLES EACH
# 56		29 59.4	23 0.3				
7856	6/ 4	30 1.2	23 5.7	RMT8+1	1500-2020	2129-0136	MUFAX FAULT - NO FLOW
# 57		30 6.9	23 15.7				
7856	7/ 4	30 8.9	23 18.1	RMT8+1	15-1000	0245-0421	OBLIQUE HAUL
# 58		30 11.2	23 21.1				FLOW DIST. 5.98 KM.
7856	7/ 4	30 11.1	23 20.1	NN	0- 0	0606-0618	
# 59		30 10.6	23 19.3				
7856	7/ 4	30 10.3	23 19.0	NN	0- 0	0621-0633	
# 60		30 9.8	23 18.2				

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7856	7/ 4	30 9.6	23 17.9	NN	0- 0	0634-0646	
# 61		30 9.1	23 17.2				
7856	7/ 4	30 8.9	23 16.9	NN	0- 0	0648-0700	
# 62		30 8.4	23 16.2				
7856	7/ 4	30 8.2	23 15.9	NN	0- 0	0703-0715	
# 63		30 7.7	23 15.2				
7856	7/ 4	30 7.4	23 15.0	NN	0- 0	0716-0728	
# 64		30 6.8	23 14.3				
7856	7/ 4	30 6.6	23 14.0	NN	0- 0	0731-0743	
# 65		30 6.1	23 13.3				
7856	7/ 4	30 5.8	23 13.1	NN	0- 0	0745-0757	
# 66		30 5.3	23 12.4				
7856	7/ 4	30 4.6	23 12.0	RMT8+1	240- 260	0831-0931	250M. SERIES 1
# 67		30 5.2	23 14.7				FLOW DIST. 5.20 KM.
7856	7/ 4	30 5.6	23 16.3	RMT8+1	230- 261	1005-1105	250M. SERIES 2
# 68		30 6.3	23 18.9				FLOW DIST. 5.04 KM.
7856	7/ 4	30 5.1	23 11.8	RMT8+1	240- 260	1236-1336	250M. SERIES 3
# 69		30 6.5	23 13.9				FLOW DIST. 5.04 KM.
7856	7/ 4	30 6.8	23 14.4	NN	0- 0	1405-1417	
# 70		30 6.1	23 14.1				
7856	7/ 4	30 5.8	23 14.0	NN	0- 0	1418-1430	
# 71		30 5.1	23 13.7				
7856	7/ 4	30 4.8	23 15.1	RMT8+1	240- 260	1544-1644	250 M. SERIES 4
# 72		30 6.4	23 17.2				FLOW DIST. 5.28 KM.

STN.	DATE 1972	POSITION LAT N	LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7856	7/ 4	30 5.9	23 11.3	RMT8+1	240- 260	1753-1853	250 M. SERIES 5
# 73		30 7.5	23 12.9				FLOW DIST. 4.57 KM.
7856	7/ 4	30 8.7	23 14.0	RMT8+1	240- 260	1930-2030	250 M. SERIES 6
# 74		30 10.4	23 15.5				FLOW DIST. 4.96 KM.
7856	7/ 4	30 11.5	23 16.6	RMT8+1	240- 260	2106-2210	250 M. SERIES 7
# 75		30 13.2	23 18.4				FLOW DIST. 4.72 KM.
7856	7/ 4	30 8.5	23 14.3	RMT8+1	240- 260	2335-0036	250 M. SERIES 8
# 76		30 10.0	23 16.4				FLOW DIST. 4.72 KM.
7856	8/ 4	29 58.1	23 6.3	RMT8+1	240- 260	0339-0439	250 M. SERIES 9
# 77		29 58.9	23 8.9				FLOW DIST. 5.04 KM.
7856	8/ 4	29 59.8	23 10.5	RMT8+1	245- 255	0519-0625	250 M. SERIES 10
# 78		30 0.7	23 13.2				FLOW DIST. 5.36 KM.
7856	8/ 4	30 1.2	23 14.8	RMT8+1	240- 260	0705-0808	250 M. SERIES 11
# 79		30 1.9	23 17.1				FLOW DIST. 4.72 KM.
7856	8/ 4	29 58.8	23 17.3	RMT8+1	2010-3000	0950-1550	LOWER DEPTH ESTIMATED. BEYOND MON. RANGE
# 80		29 45.2	23 13.8				FLOW DIST. 27.88 KM.
7857	11/ 4	36 45.4	14 16.4	TRAP B	313- 313	1425-1831	COARSE MESH + RECTANGULAR FINE MESH
# 1		36 45.4	14 17.7				
7857	11/ 4	36 45.2	14 16.3	TRAP B	300- 300	1441-1905	FINE MESH BOTTOM
# 2		36 45.0	14 17.4				
7857	11/ 4	36 44.1	14 18.1	BN2.4	271- 277	1532-1602	
# 3		36 44.6	14 18.3				
7857	11/ 4	36 51.9	14 25.8	BN2.4	978-1040	2230-2255	
# 4		36 52.4	14 25.6				

STN.	DATE 1972	POSITION LAT N	POSITION LONG W	GEAR	DEPTH (M)	FISHING TIME GMT	REMARKS
7857	12/ 4	36 46.6	14 31.4	BN2.4	1341-1356	0230-0300	
# 5		36 47.3	14 31.0				


W
25°
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15°
10°
N
30°
25°
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15°
10°
STN. 7857
36°45'N 14°16'W–
36°47'N 14°30'W.
7856
CANARY ISLES
TENERIFE
7782–7
7848–7855
7788–9
7790–3
7846–7
7794
7842–5
7795
7796
7797
7798
7799
7800
7801
7802
7803
7838–41
7804
7805
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7809
7810–7814
7836–7
7835
7834
C. VERDE ISLES
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7815–7817
DAKAR
R.R.S. DISCOVERY.
TRACK CHART
AND STN. POSITIONS
CRUISE 45

FIG. 1.


FILE
END
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