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Macroplanktonic biomass in the North Atlantic Ocean

P M Hargreaves & P J Allen

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ABSTRACT

The vertical and horizontal distribution of macroplanktonic biomass, measured by wet displacement volume is described. The data drawn from samples taken with rectangular midwater trawls 1 includes data on macroplanktonic vertical distribution based on horizontal tows taken at various stations in open ocean water located between the equator and 60° north to average depths of 1500m. Further data are derived from repeated samples taken within the top 600m at 44°N and from two transects of 0-1000m oblique hauls. Integrated data (0-1000m) shows that within the sampling area macroplanktonic biomass tends to be greatest to the north of 42°N and is lower in subtropical areas. Generally a decrease in biomass occurs with increasing depth. The present data are compared to previously published data on micronekton derived from the same stations and the ratio of macroplankton to micronekton discussed.

KEYWORDS

ATLNE
BIOLOGICAL DATA
BIOMASS
NORTHEAST ATLANTIC
PLANKTON
RECTANGULAR MIDWATER TRAWL (RMT 1), (RMT 8)

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INTRODUCTION

Although information is available on the distribution of total macroplanktonic or micronektonic biomass in the North Atlantic Ocean much of this relates to a relatively small number of stations, or to limited areas of the water column, or to the continental shelf, (see VINOGRADOV, 1968; DEEVEY and BROOKES, 1971; LONGHURST and WILLIAMS,1979; BOYD *et al* 1986). ANGEL and BAKER, (1982), summarising preliminary data from Rectangular Midwater trawls (RMT 1+8) taken in the deep water column at three widely separated stations concluded that the macroplanktonic standing stock generally exceeds that of the micronekton and that there is an exponential decrease in macroplanktonic and micronektonic biomass at depths below 1000m. WISHNER (1980) concluded that benthopelagic planktonic biomass decreases exponentially with depth until just above the sea-floor where an increase may occur. ANGEL (1989) found that there were clear seasonal differences in the depth of the biomass maximum within the top 100m at a series of stations in the vicinity of the Azores front.

During the last two decades the Institute of Oceanographic Sciences Deacon Laboratory (IOSDL) biology department has deployed opening/closing Rectangular Midwater Trawls (RMT) 1+8, mesh size 0.32mm and 4.5mm respectively, to collect numerous macroplanktonic and micronektonic samples in the North Atlantic mainly over depth ranges between the surface and 1000/2000m, (exceptionally down to 4000/5000m).

The provisional data set presented here, based mainly on RMT1 samples obtained during 1969-1988, provides useful information not only on standing stock within the water column at various stations but also enables comparisons to be made with micronekton standing crops and also between biomass profiles in widely separated geographic areas. This report, the second of two, presents macroplanktonic biomass profiles based on RMT1 catches. A previous report provides information on micronekton biomass based on RMT8 catches, (HARGREAVES and GREEN, 1990).

MATERIALS AND METHODS-HORIZONTAL HAULS

Prior to the late 1970's the IOS midwater trawl (RMT1+8), (BAKER *et al*, 1973; ROE *et al*, 1980) has been deployed for the sampling of macroplankton and micronekton respectively. The nets are opened and closed acoustically via a net monitor which activates the release gear. Information on the depth of the net and its velocity is telemetered back to the ship. Since the late 1970's a multiple version of the RMT 1+8 has been used (ROE and SHALE 1979). Here three pairs of RMT1 + RMT8 nets are deployed within the same framework and can be operated in sequence at the required depth. The main logistic advantage is that there is considerable saving in ship time spent in retrieving the nets.

At each station samples were taken systematically so that the whole water column between the near-surface and maximum depth was sampled. During the earlier cruises (1969-1972) day and night samples were taken to certain maximum depths (see Table 1). During later cruises this sampling strategy was continued except that, more usually, depths below 900m were sampled irrespective of the time of day. Generally nets were fished at 10-100m depth intervals in the top 900-1000m but at 200m, 250m or 500m intervals below this depth.

Initially the samples were fixed in 5% formalin solution in seawater. Total displacement volume of most samples was measured several months later after initial shrinkage had occurred, except for those samples taken during the 1960's and early 1970's where wet displacement volumes were either measured several years later or estimated from fractions of samples before being transferred to Steedman's preserving fluid, (1976).

So as to simplify the presentation of data in this report, the cruises are categorised into eight groups depending on geographic position and/or sampling strategy. These are described in subsections (i-viii) below and summarised in Fig. 1 and Table 1. At each station complementary Conductivity/Temperature/Depth (CTD) or Temperature/ Salinity/Depth (TSD) profiles were obtained and these will be summarised in a companion IOSDL data report.

(i) During 1969-74, at various times of the year, a series of horizontal hauls were taken at seven positions, approximately at 10° intervals of latitude between 0°N and 60°N and close to the 20°-25°W meridians, (Positions A-G). At each position samples were taken from near surface to a maximum depth .of 2000-2500m, with the exception of the station at 18°N where the maximum depth was 1250m. For cruise reports see DAVID (1970), DAVID *et al*, (1971; 1972), FOXTON (1971) and THORPE *et al*, (1974).

(ii) To provide further information on vertical and horizontal distributions of taxa, during 1973-1979 samples were taken at several sites to maximum depths of 1400-1500m. These included one site in the Rockall Trough, two in the Porcupine Seabight,one site over the Azores/Biscay Rise, and one in oceanic water near Bermuda, (Positions H-L). For cruise reports see DAVID and SWALLOW (1973), ANGEL (1978) and HERRING *et al*, (1979).

(iii) During May/June 1981 (Cruises 120/121) five stations were worked near to the Azores front within the area 30°-35°N, 30°-34°W, (Fig.1. positions M-Q, maximum depth 1400-2300m). The front delineates the edge of what is believed to be the southern branch of the south-easterly flowing N. Atlantic Drift/Gulf Stream which meanders in the region studied possibly as a result of the influences of seamounts, (GOULD 1982, 1985; KASE and SEILDER 1982).Western Atlantic Water (WAW) can be distinguished from Eastern Atlantic Water (EAW) by the depth of the 15-16° C isotherm. To investigate changes in patterns of biomass distribution across the front one station was worked in the frontal zone (position O), one in WAW (M), one in EAW (Q), one in an eddy of EAW (P), which had pinched off from the meander a month earlier, and one in WAW inside one of the meanders (N). Details of sampling are given in cruise reports (FASHAM *et al*, 1981; ANGEL *et al*, 1981b).

During October/November 1980 prior to cruises 120/121 three stations were worked in the Azores front area to a maximum depth of 1100m (cruise 114, positions R-T). One station was worked in EAW (position T), and one in mixed EAW/WAW (S). In addition what was thought to be WAW was sampled but this was later found also to be mixed EAW/WAW (R). However, the data obtained from all these positions proved to be useful to provide a seasonal comparison with the more recently acquired data from the frontal area. For details of sampling see IOS Cruise Report No. 108 (ANGEL *et al* 1981a).

(iv) During March/April 1984 at 39°- 46°N, 14°-15°W samples were collected to maximum depths of 800-1800m in order to study changes in the structure of the oceanic community where hydrographic stratification in the epipelagic and upper mesopelagic zone periodically results in a series of weak fronts. Details of sampling are given in IOS Cruise Report No. 168 (ANGEL *et al*, 1984). A series of hauls was taken in the vicinity of 39°N, 15°W and were repeated at the same position two-three weeks later (positions V,W respectively). A third series of samples was obtained at 45-46N, 14W (U). The two series at U and V were affected by poor weather conditions which prevented sampling. However, the sampling at position W extended deep into the water column providing useful comparative data with other samples.

v) During June/July 1985 samples were collected at the Great Meteor East, in the vicinity of 31°N 25°W to a maximum depth of 5000m, (Position X) as part of a study, commissioned by the Department of the Environment, on the vertical distribution of macroplankton and micronekton between the surface and the sea floor and on general environmental conditions. For details of sampling see ROE *et al*, (1986; 1987).

(vi) During June/July 1988 samples were collected at approximately 47°N 20°W (BIOTRANS site) to a maximum depth of 4500m, (Position Y). This cruise was undertaken as a prelude to the BOFS (Biogeochemical Ocean Flux sampling) programme. For details of sampling see cruise report 175, PUGH *et al*, (1988).

(vii) During May 1990 samples were collected at the Porcupine Seabight, in the area of 48°N 17°W to a maximum of 1900m, (position PS).

(viii) During April 1974 four series of repeated samples each at 100m, 250m, 450m and 600m respectively were taken over a 48hr period at 44°N, 12°-14°W close to the northern boundary of the subtropical gyre (Position 48HS - see Roe *et al*, 1984). In addition a series of vertical hauls were taken between the surface and 1000m at the same position (station 8507).

In this report the vertical biomass profiles at each station are illustrated by histograms of data standardised to mls per $10^3 m^3$ of water filtered. The average maximum depth is 2000m but exceptionally profiles are given down to 5000m. Night data for horizontal hauls are shaded. During some of the earlier sampling precise flow measurements were not made and for these samples flow has been standardised based on the duration of the haul assuming that the speed of the net was a constant 2 knots. The scales for the histograms vary between series according to the total volumes caught, rare occurrences are indicated with a '+' sign, (NS = No sample at this depth).

BIOMASS DISTRIBUTION PATTERNS - HORIZONTAL HAULS

Total biomass profiles, expressed as wet displacement volume, (wdv), normalised to mls per 10^3m^3 water filtered are described below. Data values are given in Appendix 1.

(i) 20°-25°W (Positions A-G, Figs. 1 and 2)

Concentrations of macroplanktonic biomass tended to be relatively high at position A, lower at B, D, F and G and lowest at C and E. At position A, which is close to the N.W. African Upwelling area, daytime values in the top 600m were particularly variable, reaching maxima of >120mls per 10^3m^3 in some hauls but not in others taken at similar depths (Appendix 1, Fig. 2). At stations B-G above 1000m in daytime there was less variation in biomass between continuous hauls, although deep and shallow maxima were apparent in some cases. Position F, for example, shows a maximum at 200-300m, and position D shows a maximum at 400-500m. Night data for positions B-G also demonstrated deep maxima at some depths. For example, position B has a maximum at 700-800m, and position F at 800-900m. A sharp decrease in biomass concentration is apparent for both day and, where available, night data below 1000m for positions A, B, D, E, F, and G.

(ii) Off-Bermuda, Azores/Biscay Rise, Porcupine Seabight, Rockall Trough (Positions H-K, Figs. 1 and 3).

Concentrations of macroplanktonic biomass tended to be relatively high at positions I and J, values exceeding 120mls per 10^3m^3 by day at depths of 0-100m and 400-500m for position I, and at 0-100m for position J. Values were lower at position K, and particularly low at H, (Fig. 3), daytime values, not exceeding 30mls per 10^3m^3. Positions J and K are at similar latitudes, but the former station was sampled in May and the latter in September. Seasonal effects could thus account for the differences in biomass concentrations observed for these two stations. Several samples from tropical and subtropical stations contained large aggregations of *Pyrosoma* in addition to the expected catch. These are marked with an asterisk in Appendix 1 where the total biomass values given excludes values for *Pyrosoma*) Standardised values for 24 repeated RMT8 hauls sampled at approximately 1000m at position I are given in Appendix 1. Angel *et al* (1982) calculated the mean displacement volume of macroplanktonic concentrations as 38.91 +/- 10.72 mls per 10^3m^3.

(iii) Azores front (Positions M-Q, R-T, Rp1-Rp2, Figs.1, 4 and 5)

Data from three stations worked in summer (M-Q), three in winter (stations R-T) and two sets of repeated samples within the surface 100m (RP1-RP2) has been described in detail (Angel, 1989). A summary will be given here.

During May/June 1981 concentrations of macroplanktonic biomass tended to be highest in EAW (position Q), E EDDY (position P), and at the front station (position O) with values of up to 53mls per 10^3m^3. Generally, values were lower in WAW (position M) and W MEANDER (position N), (Fig 4). However, at all stations by day and by night, biomass was greatest in the top 50-100m, coinciding with the depth of the seasonal thermocline. Below this depth there was an erratic decrease in biomass with increasing depth.

Macroplanktonic biomass concentrations for winter stations at the Azores front (positions R-T) are given in Fig. 5. Values tended to be lower at the predominantly WAW station (position R) than at the intermediate station (position S) and the EAW station (position T). The daytime concentrations at 600-700m at position S and the night-time concentrations at the surface 150m at positions S and T were unusually high and are shown with an asterisk. On investigation, these were found to be due to the presence of *Pyrosoma* in the catches at these depths. Two series of repeated night samples at 50m at stations 10232 and 10241, (RP1 and RP2), gave average standing crops of 39.50 and 39.14mls per 10^3m^3 respectively, excluding *Pyrosoma*, (Angel 1989). Values for the macroplankton crop in EAW suggested that the standing crop had increased considerably between November 1980 and May/June 1981. In WAW there was relatively little change in biomass concentrations between Winter and Summer.

ANGEL, (1989), comparing ratios of macroplankton and micronekton biomass, found that by day macroplankton exceeded micronekton biomass by up to an order of magnitude in the surface layers but that the ratios declined with depth, approaching unity at 200m in Winter. However in Summer the ratios were 5.5:1 (WAW) and 4.5:1 (EAW).

(iv) Cruise 146 (Positions U-W, Figs. 1 and 6)

Concentrations of macroplanktonic biomass showed little variation between the three stations at positions U, V, and W, except within the surface 80-200m at position V, (day), where the biomass was twice that recorded of similar depths at U or W. HULL, (1985), further investigating the relationship between wet displacement volume, wet weight and dry weight in various size fractions of material from these stations found that there were differences in the displacement volume/wet weight slopes for biomass measurement for material sized 0.32-1.0mm between the northern and southern stations but this could not be confirmed for the 1.0-4.5mm sized material.

(v) Great Meteor East (Position X, Figs. 1 and 7)

Planktonic and micronektonic biomass distribution based partly on dry weight were described by Roe *et al*,.1987.

Generally biomass concentrations tended to be low. Below 1000m there was an exponential decrease in biomass concentration (Fig. 7b).

(vi) 47°N,20°W (Position Y, Figs. 1 and 8)

Macroplanktonic biomass profiles were described by PUGH (1988). Above 500m depth, daytime biomass concentrations show a maximum of 32mls per 10^3m^3 in the 100-400m range, while at night there is a minimum between 300 and 400m and a maximum in the top 100m, which presumably indicates diel vertical migration. Below 500m, a slight decline in biomass was observed. There are two low values which can be related to loss of part of the catch due to its having been caught up in the mouth of the net, indicated by an asterisk in the table in Appendix 1.

(vii) Station 12060 (Position PS, Figs. 1 and 9)

Data for micronektonic biomass is presented as well as that for macroplanktonic biomass in the table in Appendix 1. The micronekton data for this station had not been collected in time for its inclusion in the report by HARGREAVES and GREEN, (1990), and has therefore been presented in this report. Macroplankton biomass concentrations showed a day-time maximum in the top 50-100m, and at night, maxima were observed in the surface 50m and between 200 and 300m depth. Macronektonic biomass concentrations also showed a maximum in the top 50m at night, but daytime concentrations were often quite variable, reaching, for example, 42mls per 10^3m^3 in one haul taken at 400-500m depth, but not at other hauls taken at the same depth.

(viii) 48 hour series (Position 48HS1, 48HS2, Figs. 1 and 10)

Concentrations of micronektonic biomass for the series of samples taken at four depths of 100m, 250m, 450m and 600m are given in Fig. 10, (note change of scale for different depth hauls). Diel variation in biomass was most apparent at 100m depth, with an average daytime biomass concentration of 36.5mls per 10^3m^3, whereas the average night time biomass concentration was 66.1mls per 10^3m^3. At 250m, macroplanktonic biomass concentrations were generally relatively high, often exceeding 250mls per 10^3m^3. For a full discussion see Roe *et al*,(1984) who reported significant differences between populations from day and night hauls at 100m. Average day and night values for biomass concentration at 450m and 600m were lower than those at 250m, effects of diel vertical migration being least apparent at 600m depth.

MATERIALS AND METHODS - OBLIQUE HAULS

A series of oblique RMT 1 hauls were taken between the surface and 1000m across two different lines of stations in the North Atlantic (Figs.1, 11a and b). These were as follows :-

(i) During February/ March 1973 twelve oblique hauls were taken across an east-west transect between the surface and 1000m at 32°N 16°-60°W (Stations 8262-8279, Madeira - Bermuda).

(ii) During April/May 1978 a north-south line of hauls was taken to investigate the effects of a series of weak intermittent hydrographic fronts on species distribution. Eight (0-1000m) oblique hauls were taken between 42°N and 50°N, (stations 8792-9801).

Full details of the RMT1 net and sampling procedures are as described for the RMT1 horizontal hauls.

DISTRIBUTION PATTERNS - OBLIQUE HAULS

Oblique 1. Station 8262-8279 (Fig.11a)

Macroplanktonic biomass concentrations in the 0-1000m hauls ranged from a minimum of 9.31mls per 10^3m^3 to a maximum of 22.35mls per 10^3m^3, tending to be slightly higher at 16°-20° W, although no clear change in biomass profiles from east to west was apparent.

Oblique 2. Stations 9792-9801 (Fig.11b)

Macroplanktonic biomass concentrations in the 0-1000m hauls were generally higher than in the Madeira-Bermuda transect, reaching average values of 29mls per 10^3m^3. There was no apparent change in biomass concentrations from north to south.

DISCUSSION

These data, although based on single samples, are considered to be representative of macroplankton distribution within the North-East Atlantic Ocean. ANGEL *et al* (1982), summarizing data from 24 repeated hauls at a depth of 1000m, gave means for the values of macroplankton as 38.91 +/- 10.72 per 10^3m^3 which suggests that a single sample has a 90% probability of being within a factor of two of the mean, though at this depth the variability was lower than that observed by McGOWEN (1976) for zooplankton in the area of the California Current. Throughout the sampling area macroplankton biomass declined with increasing depth thus confirming observations by various authors, including VINOGRADOV (1968) and LONGHURST and HARRISON (1989) that there is a vertical decrease of macroplanktonic biomass of about one order of magnitude for each kilometre of depth.

There was some disparity between day and night totals throughout the water column but this was attributable to two major factors; net avoidance by day, and accumulation of diel migrants by night particularly near the surface.

A summary of totals by day of macroplankton, expressed as wet displacement volume (mls) beneath $1m^2$ of sea surface at 0-1000m is given in Fig. 12, together with a summary of the daytime profiles at most deep-water stations sampled in summer (Figs. 13a, 13b, and 14a), and two deep-water stations sampled in winter (Figs. 13c and 14b). The data agree well with those of BE, FORNS and ROELS (1971) who, studying geographic variation in biomass distribution of zooplankton in the upper 300m in the Atlantic, recorded values of wet displacement volume in the upper 300m as 50-100mls per 10^3m^3 to the north of 45°N. The present data also confirm the comparatively low values recorded in open oceanic subtropical waters. ALLISON and WISHNER (1986) similarly recorded higher values of zooplankton biomass at the northern boundary of the Gulf stream than in the Sargasso Sea. With regard to the Azores Front stations, there is clearly a reduction in macroplankton biomass in WAW in comparison with EAW, values for the latter stations, however, agreeing broadly with those recorded at 30°N 23°W, (position D). The high values for macroplanktonic biomass to the North of 40-42°N can be correlated with the occurrence of deep winter mixing and high productivity which has been well documented for high latitudes, while lower values to the South of 40°N can be correlated with more stable oligotrophic water, (see ROBINSON *et al*, 1979; RAYMONT, 1983). The high and rather erratic profiles off the N.W. African coast are as expected in this unstable region.

As expected, seasonal variations occurred between values for macroplanktonic biomass, not only at higher latitudes but also in the subtropics (Figs. 12, 13b, and 13c). This was exemplified in the Azores Front summer and winter data (see ANGEL 1989, and Figs. 14a and 14b). DEEVEY, (1971) also reported seasonal changes in the annual cycle of zooplankton off Bermuda.

Values for micronekton at specific stations as described by HARGREAVES and GREEN (1990) have been compared to those of macroplankton. A summary of daytime ratios of macroplankton/micronekton (Figs. 15-19) show that in general at northerly latitudes during April to October the wet displacement volume of macroplankton exceeds that of micronekton by a factor of 2 to 3 whilst in subtropical regions the ratios are in the region of 3 to 5, a situation which, to some extent, was reflected down to the depths of 600-700m. However, in deeper water, ratios of macroplankton/micronekton tended to be lower and more variable. With regard to the slope of the profiles, a reduction of ratio with increasing depth was clearly seen for depths between 200m and 800m at 30°N, whereas at 53°N the ratios between 200m and 1000m remained at the same level and increased at 1000-2000m. The variation in day/night ratios pointed to a reduction in ratio by night, which is almost certainly due to diel migration.

Throughout the sampling area dominant taxa included ostracods, copepods, other larval and juvenile crustaceans, chaetognaths and molluscs. Some have been identified to species, the data of which may have proved to be important in confirming the existence of faunal zones, ocean circulation and other hydrographic features, (FASHAM and ANGEL, 1975; McGOWAN, 1974,1986; McGOWAN and WILLIAMS, 1973; McGOWAN and WALKER, 1985). ANGEL, (1989), discussing vertical profiles in the vicinity of the Azores Front, found that biological communities on either side of the front were almost indistinguishable in terms of their species composition, despite differences in the size of the standing crops.

In conclusion it is hoped that these estimates of standing crop will prove to be useful in furthering our understanding of the processes involved in modifying the flux of organic material through the water column in the open ocean (see ROBINSON and BAILEY, 1981; FOWLER and KNAUER, 1985). Recently, LONGHURST and HARRISON (1989) have emphasised the importance of biomass profiles not only as an indirect method to assess the availability of regenerated dissolved nitrogen, but also as a pointer to sources of particulate organic matter.

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Table 1. Horizontal hauls: Summary of the main sampling positions in the Northeastern Atlantic.

	STATION	POSITION		MONTH	YEAR	MAX. DEPTH (m)	TIME
	8553-8568	00^{0}N 22^{0}W	(A)	JUL/AUG.	1974	2000	D &/or N
	7824	11 N 20 W	(B)	MARCH	1972	2000	D &/or N
	7089	18 N 25 W	(C)	NOV.	1969	1250	D & N
(i)	7856	30 N 23 W	(D)	MAR/APR.	1972	2500	D & N
	7406	40 N 20 W	(E)	OCT/NOV.	1970	2000	D &/N
	7711	53 N 20 W	(F)	MAY/JUN.	1971	2000	D &/N
	7709	60 N 20 W	(G)	APR/MAY	1971	2000	D &/N
	8281	32 N 64 W	(H)	MARCH	1973	3500	D &/or N
	9801	42 N 17 W	(I)	MAY	1978	4000	D &/or N
(ii)	9791	50 N 14 W	(J)	MAY	1978	1505	D &/or N
	10115	50 N 14 W	(K)	SEP.	1979	1300	D &/or N
	10105	54 N 13 W	(L)	AUG/SEP.	1979	1900	D &/or N
	10380	30 N 34 W	(M)	JUNE	1981	2300	D &/or N
	10378	32 N 30 W	(N)	JUNE	1981	1415	D & N
	10376	33 N 33 W	(O)	MAY	1981	1700	D &/or N
(iii)	10382	33 N 32 W	(P)	JUNE	1981	1400	D &/or N
	10379	35 N 33 W	(Q)	JUNE	1981	1900	D & N
	10233	32 N 32 W	(R)	NOV.	1980	1100	D & N
	10222	30 N 30 W	(S)	OCT.	1980	1100	D &/or N
	10228	33 N 32 W	(T)	NOV.	1980	1100	D & N
	10232	33 N 32 W	(RP1)	NOV.	1980	65	N
	10241	33 N 32 W	(RP2)	NOV.	1980	110	N
	11050-11058	46 N 14 W	(U)	APRIL	1984	800	D &/or N
(iv)	11036-11047	39 N 15 W	(V)	MAR/APR.	1984	1095	D &/or N
	11078-11095	39 N 15 W	(W)	APRIL	1984	1405	D &/or N
(v)	11261	31 N 25 W	(X)	JUN/JUL.	1985	1500	D &/or N
(vi)	11794	47 N 20 W	(Y)	JUN/JUL	1988	4450	D &/or N
(vii)	12060	48 N 17 W	(PS)	MAY	1990	1900	D &/or N
(viii)	8507-8508	44 N 13 W	(48HS)	APRIL	1974	100, 250,450,600	D & N

TABLE 2. Day-time ratios of RMT8:RMT1 total standardised biomass for stations sampled at various positions.

MONTH	STATION		POSITION	DAY-TIME RATIO BIOMASS RMT8/RMT1
MARCH	7824	(B)	11^{0} N 20^{0} W	1.5
MARCH	8281	(H)	32 N 64 W	3.2
MAR/APR.	7856	(D)	30 N 23 W	5.8
APR/MAY	7709	(G)	60 N 20 W	1.8
MAY	9801	(I)	42 N 17 W	2.7
MAY	9791	(J)	50 N 14 W	3.4
MAY	10376	(O)	33 N 33 W	3.4
MAY/JUNE	7711	(F)	53 N 20 W	2.3
JUNE	10380	(M)	30 N 34 W	5.3
JUNE	10378	(N)	32 N 30 W	3.2
JUNE	10382	(P)	33 N 32 W	4.3
JUNE	10379	(Q)	35 N 33 W	4.5
JUL/AUG.	8553-8568	(A)	00 N 22 W	2.5
SEPT.	10115	(K)	50 N 14 W	3.3
OCT.	10222	(S)	30 N 30 W	3.4
OCT/NOV	7406	(E)	40 N 20 W	1.3
NOV.	7089	(C)	18 N 25 W	1.4
NOV.	10233	(R)	32 N 32 W	1.8
NOV.	10228	(T)	33 N 32 W	2.9

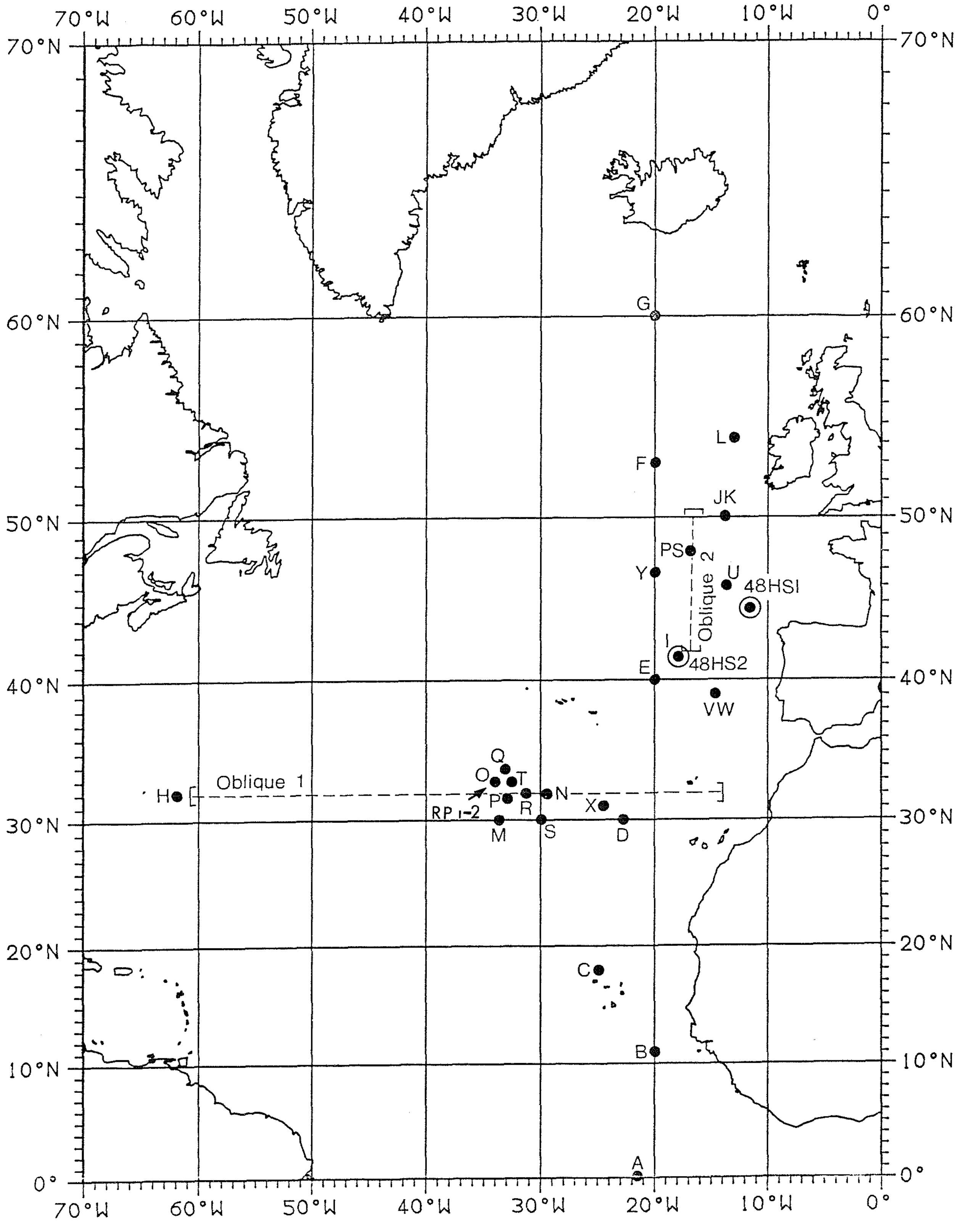


Fig. 1. Station positions in the North Atlantic for which macroplanktonic biomass data are available. A-Y, 48HS1-2, RP1-2, and PS represent the position of RMT1 horizontal hauls.

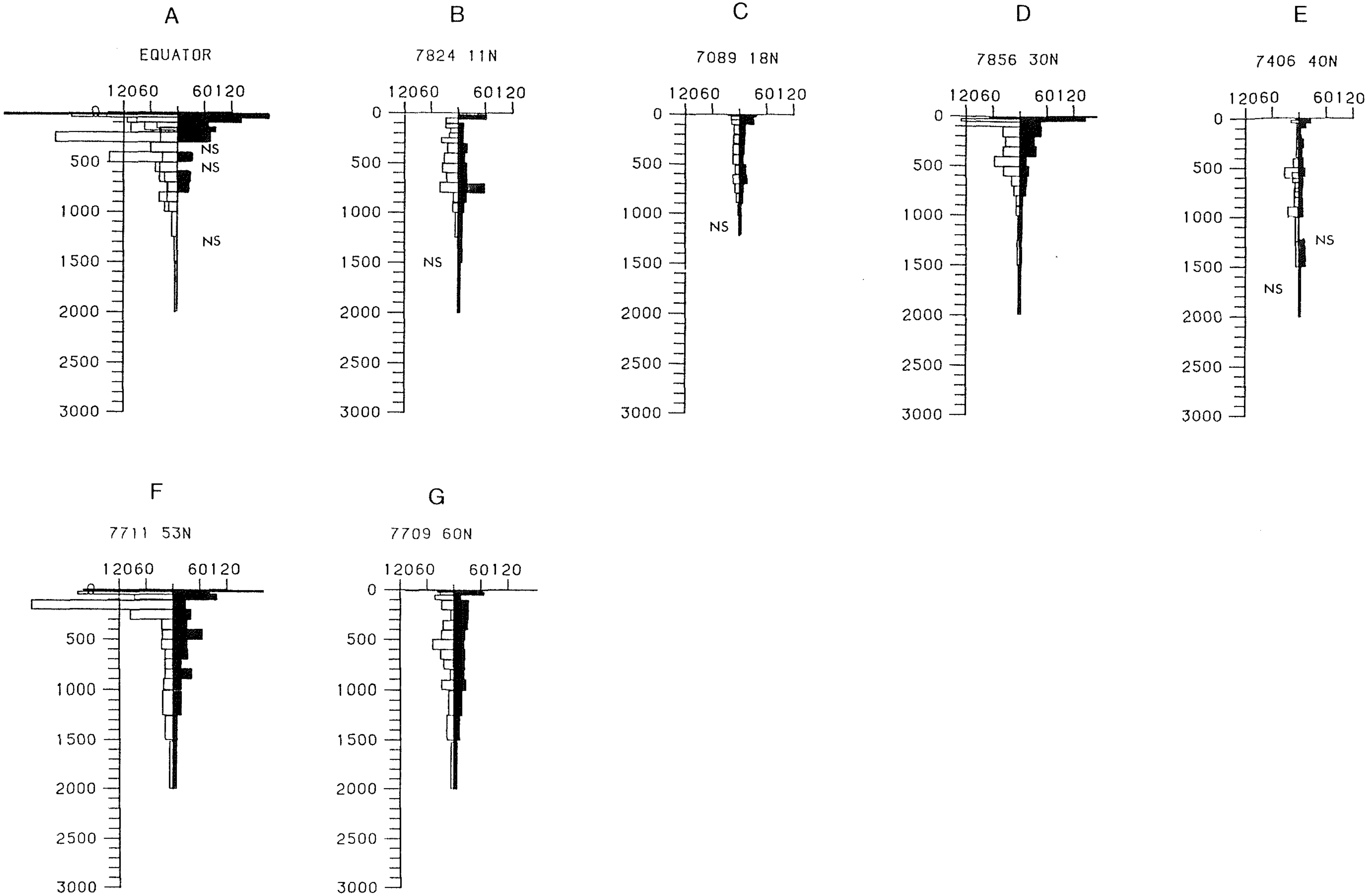


Fig. 2. Day and night profiles of total biomass, measured by wet displacement volume, from RMT1 samples taken at positions A-G. Values are standardised to mls. per $10^3 m^3$ water filtered. NS = No sample

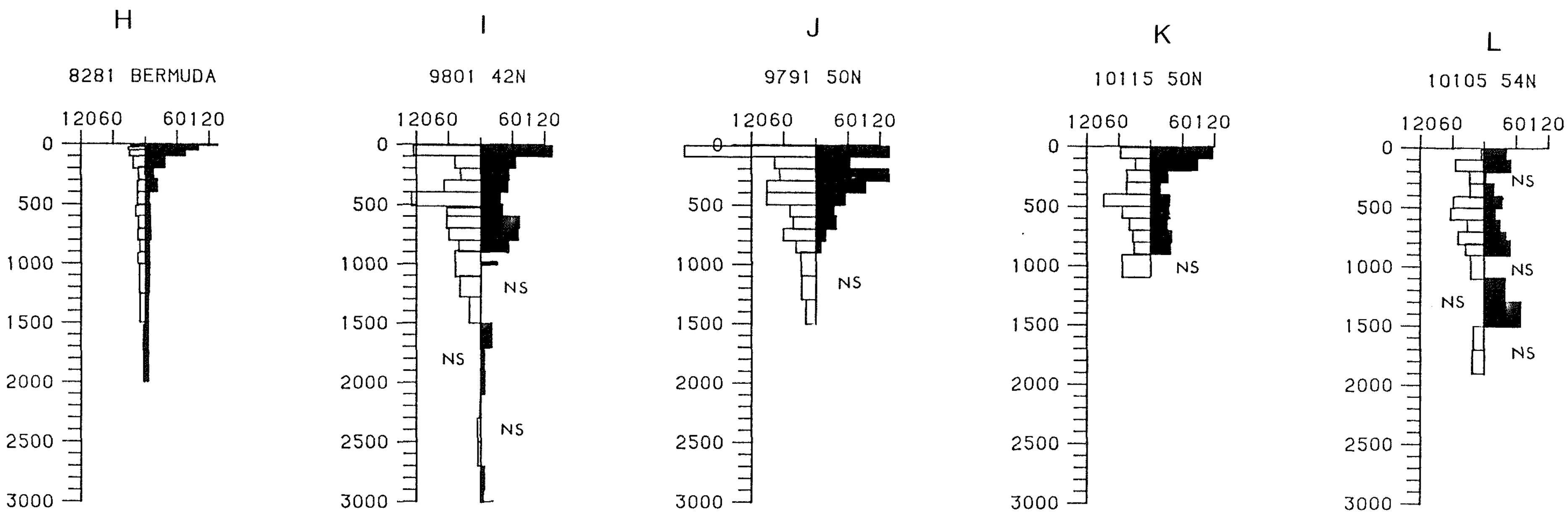


Fig. 3. Day and night profiles of total biomass, measured by wet displacement volume, from RMT1 samples taken at positions H-L. Values are standardised to mls. per $10^3 m^3$ water filtered. NS = No sample

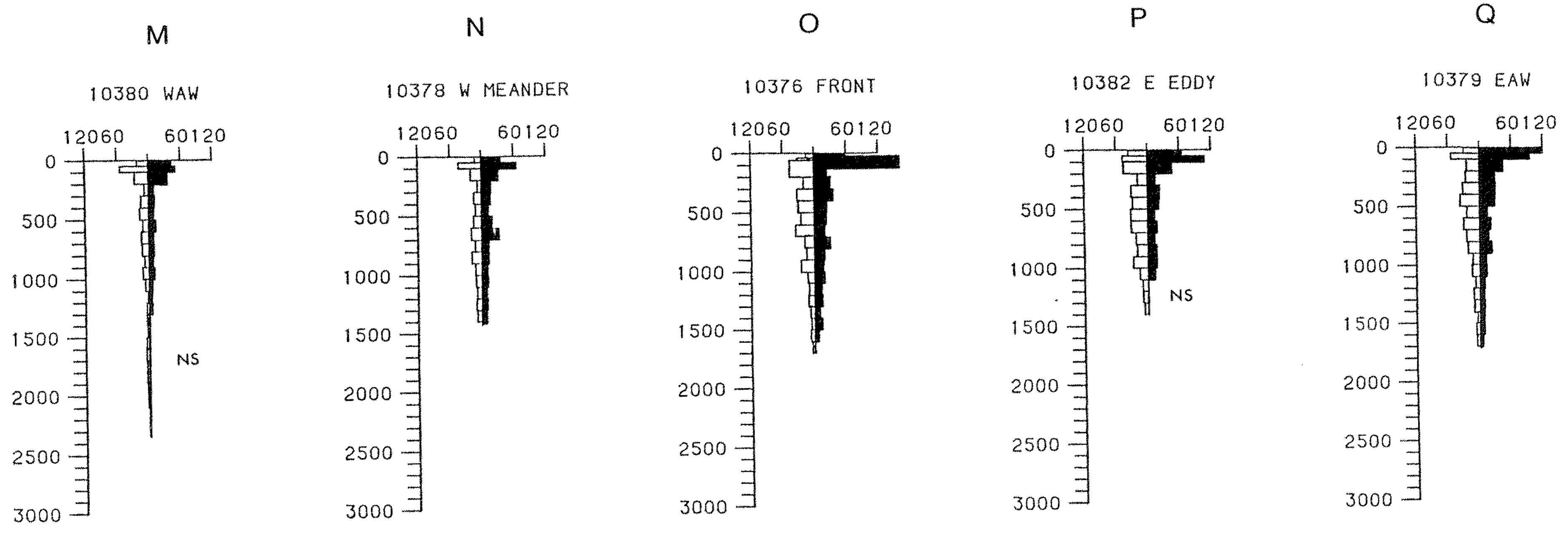


Fig. 4. Day and night profiles of total biomass, measured by wet displacement volume, from RMT1 samples taken at positions M-Q. Values are standardised to mls. per $10^3 m^3$ water filtered. NS = No sample

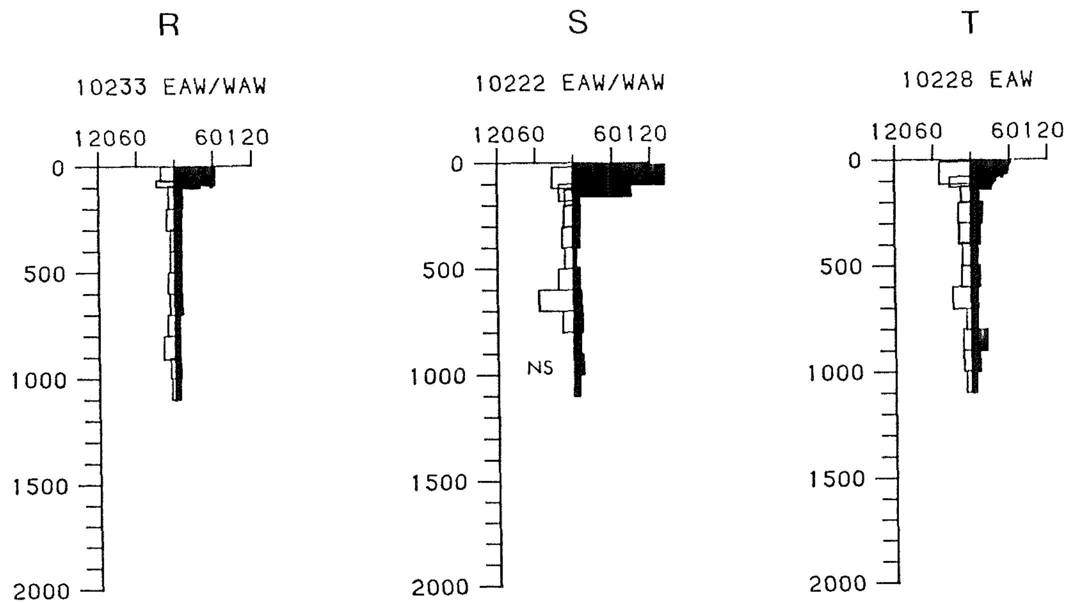


Fig. 5. Day and night profiles of total biomass, measured by wet displacement volume, from RMT1 samples taken at positions R-T. Values are standardised to mls. per $10^3 m^3$ water filtered. NS = No sample

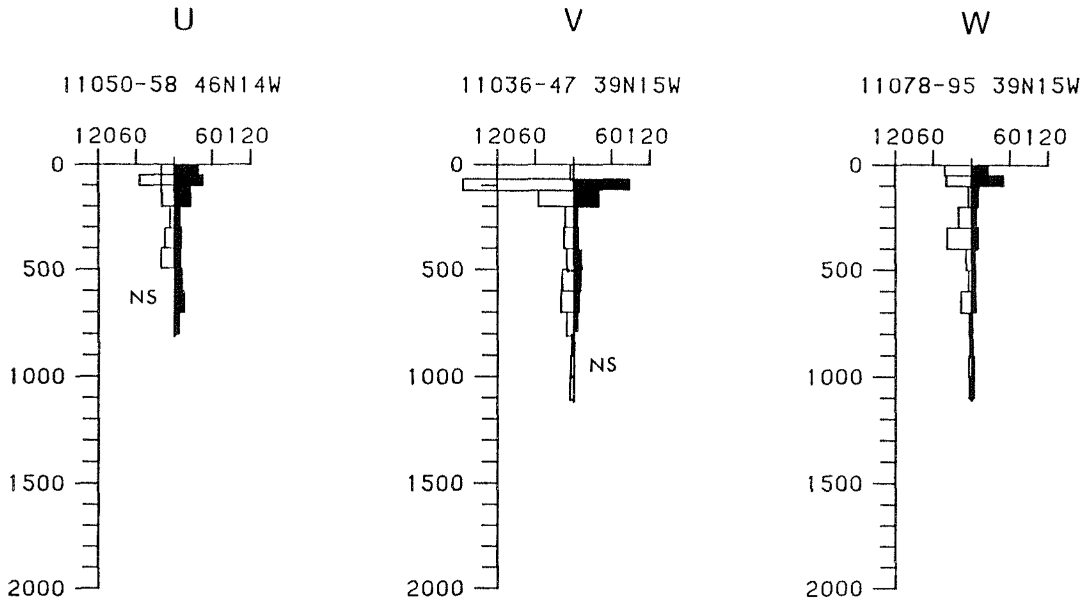


Fig. 6. Day and night profiles of total biomass, measured by wet displacement volume, from RMT1 samples taken at positions U-W. Values are standardised to mls. per $10^3 m^3$ water filtered. NS = No sample

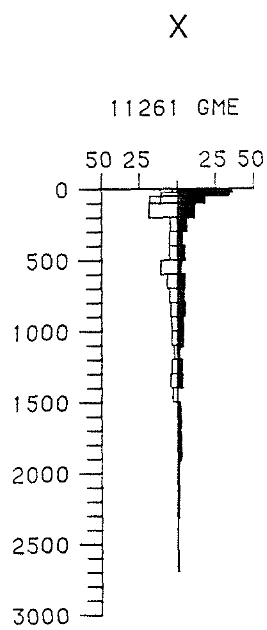


Fig. 7a. Day and night profiles of total biomass, measured by wet displacement volume, from RMT1 samples taken at position X. Values are standardised to mls. per 10^3 m^3 water filtered. NS = No sample

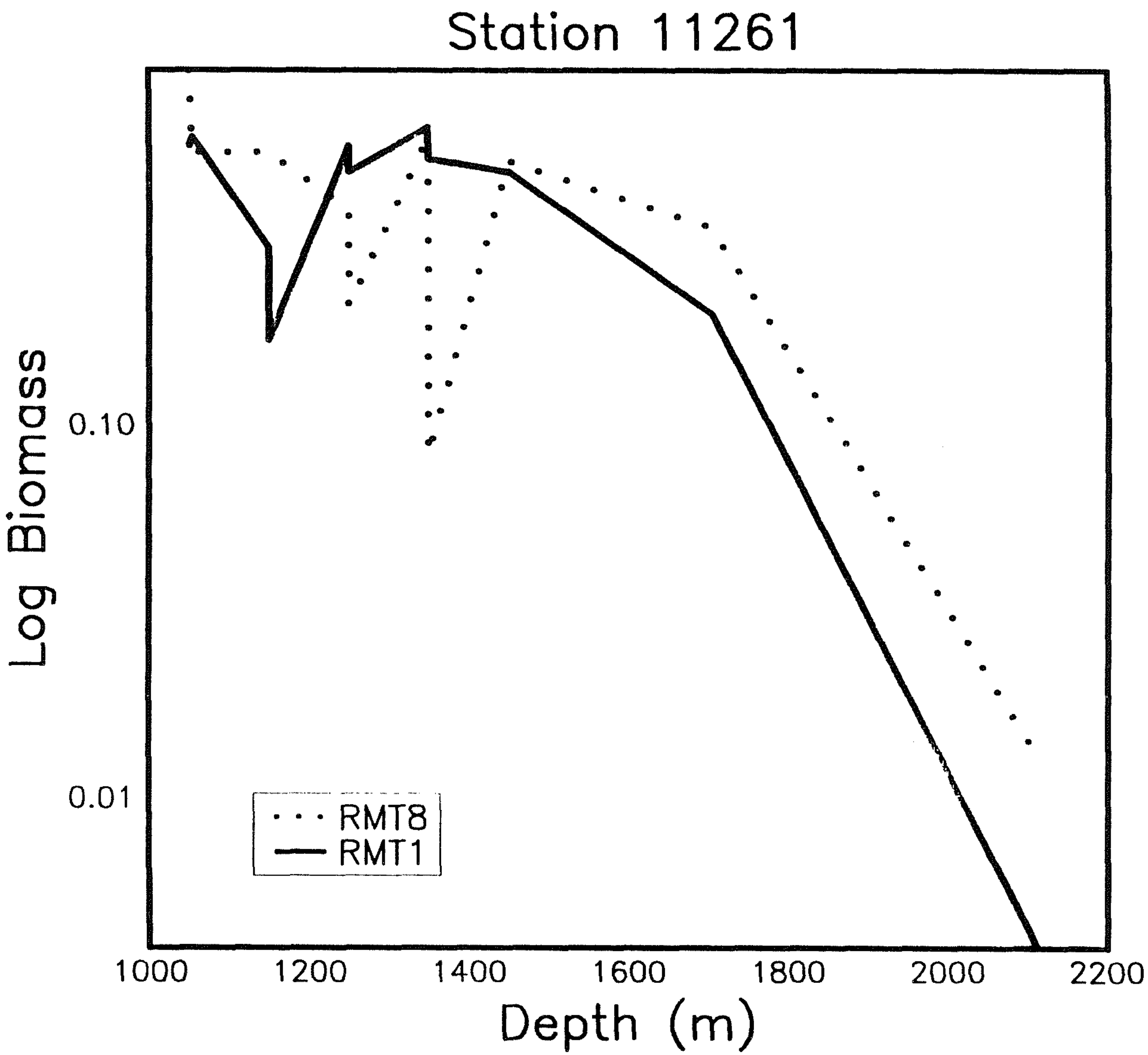


Fig. 7b. Log. biomass for RMT8 and RMT1 samples at position X.

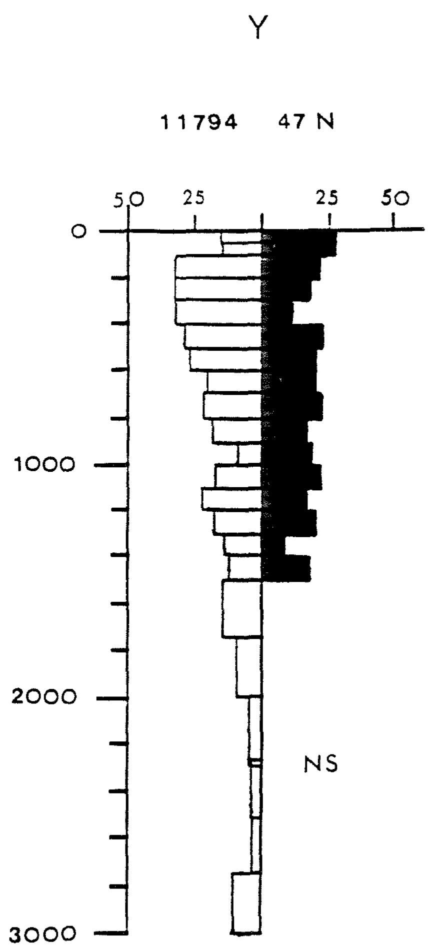


Fig. 8. Day and night profiles of total biomass, measured by wet displacement volume, from RMT1 samples taken at position Y. Values are standardised to mls. per $10^3 m^3$ water filtered. NS = No sample.

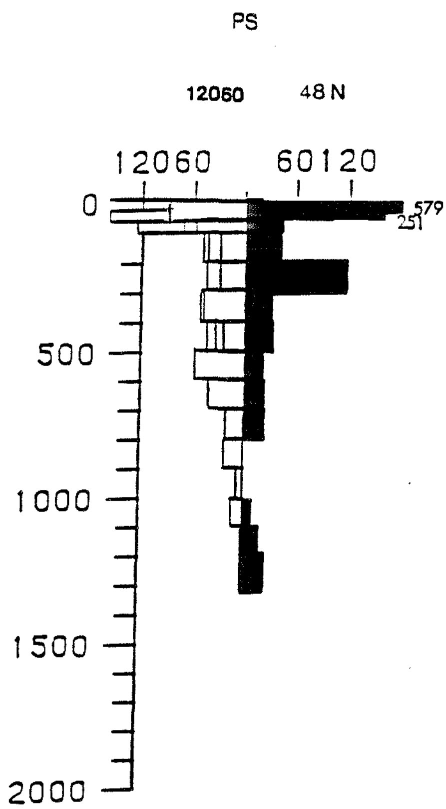


Fig. 9. Day and night profiles of total biomass, measured by wet displacement volume, from RMT1 samples taken at position PS. Values are standardised to mls. per $10^3 m^3$ water filtered. NS = No sample, + = low value.

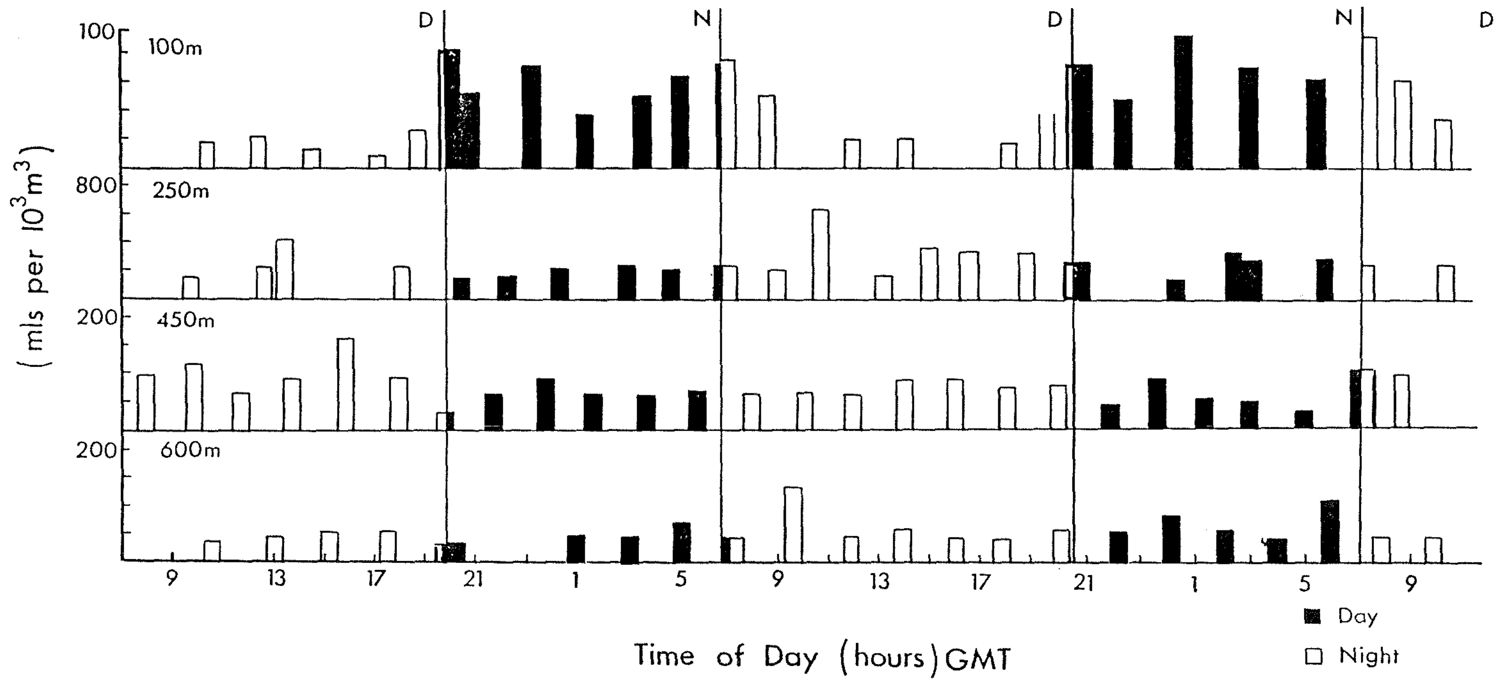


Fig. 10. RMT1 biomass profiles recorded during a 48 hr. period at each of four discrete depth ranges of 100m, 250m, 450m, and 600m at 44°N 13°W, (position 48HS).

Fig. 11a. Total biomass (mls. per $10^3 m^3$ water filtered) for Oblique1 hauls

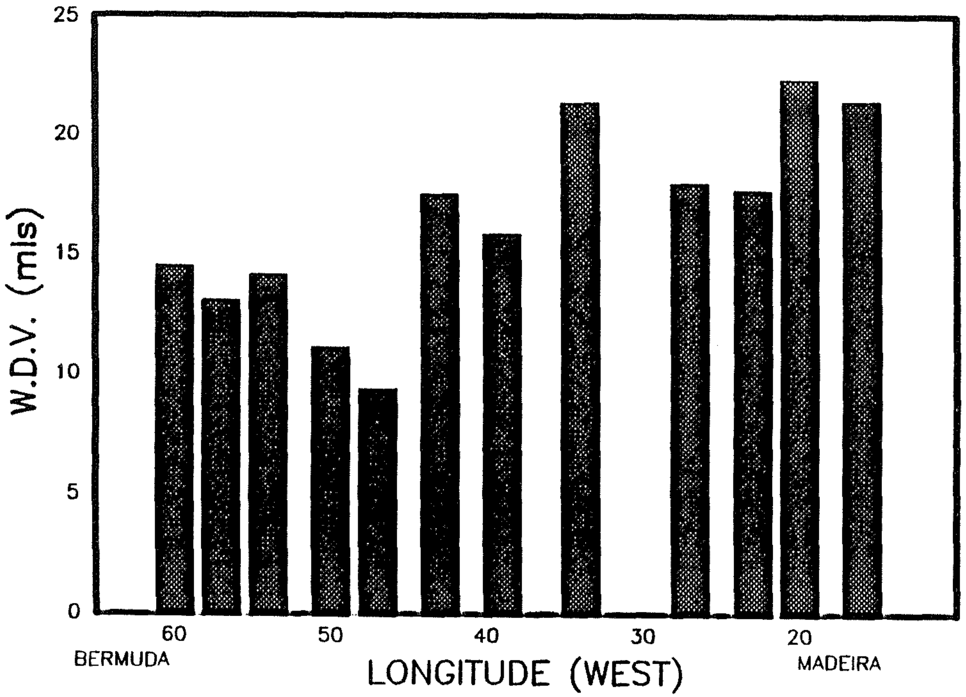
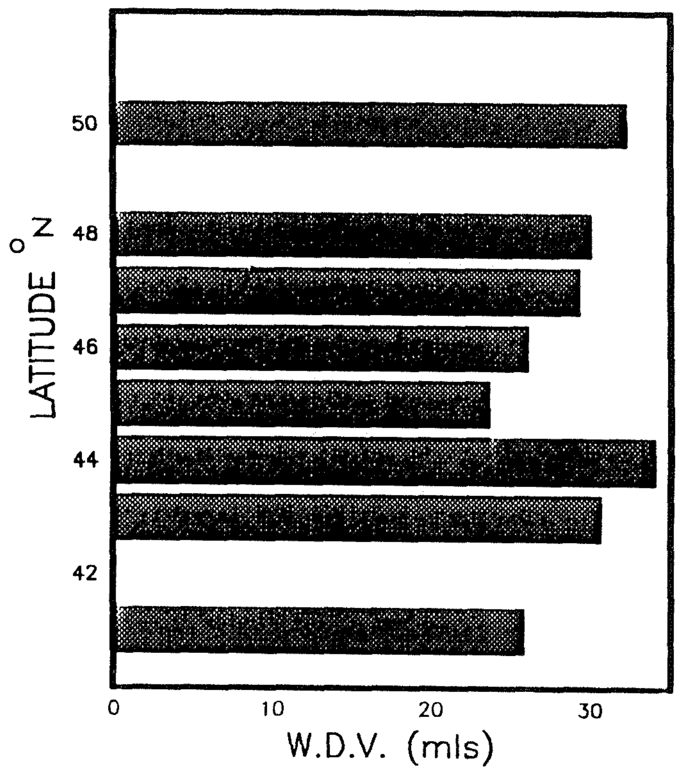


Fig. 11b. Total biomass (mls. per $10^3 m^3$ water filtered) for Oblique2 hauls.



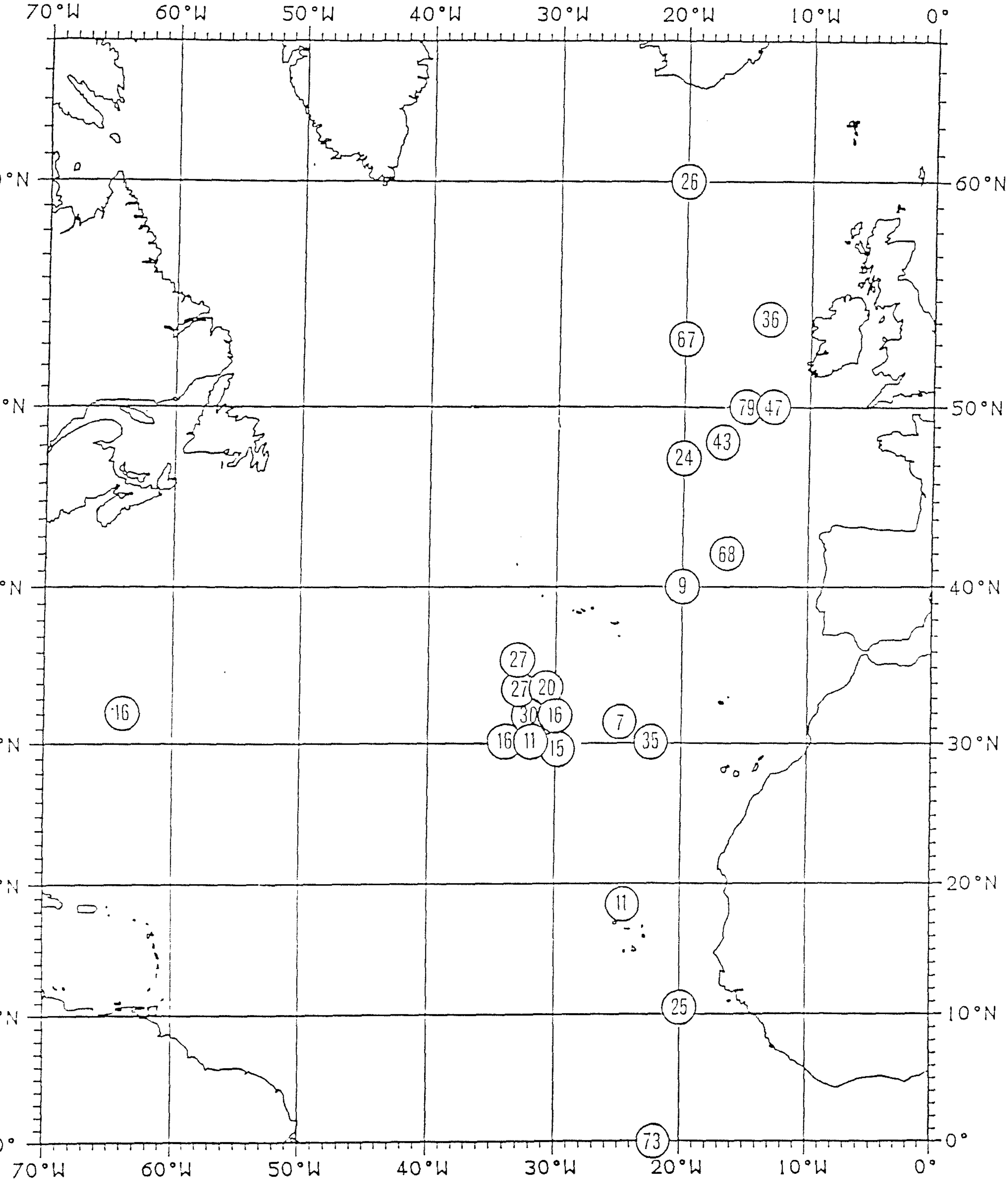


Fig. 12. Estimated total macroplanktonic biomass (mls) beneath $1m^2$ of sea surface in the top 1000m of the water column at the positions sampled.

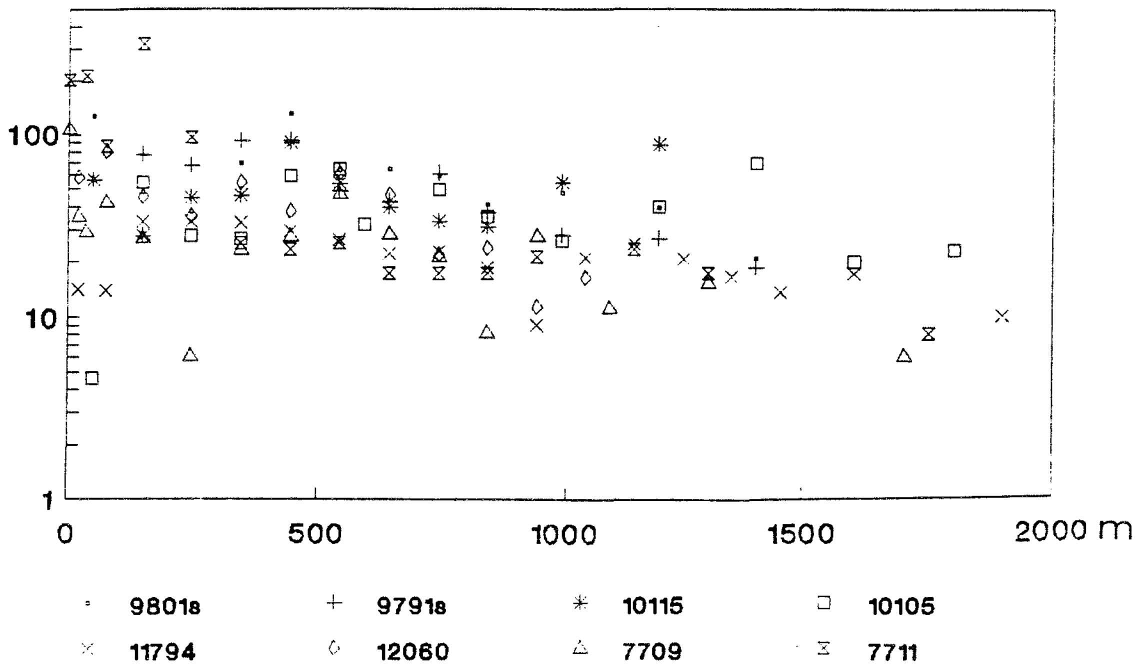


Fig. 13a. Daytime profiles of biomass for summer stations north of 42°N.

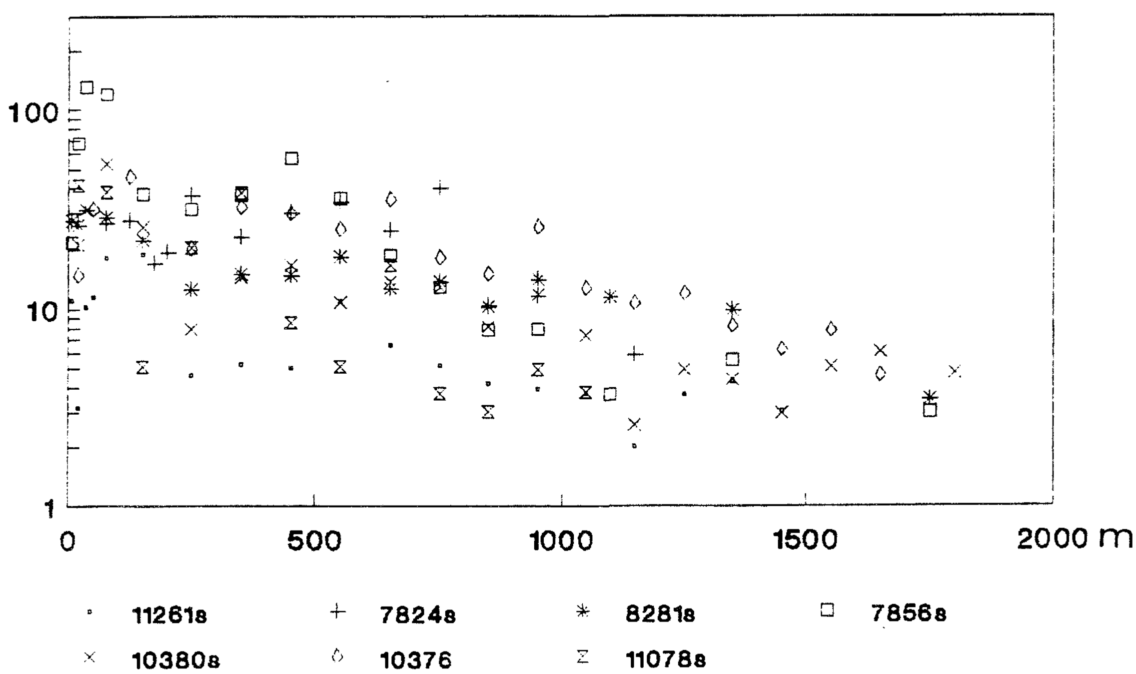


Fig. 13b. Daytime profiles of biomass for summer stations south of 42°N (RMT1)

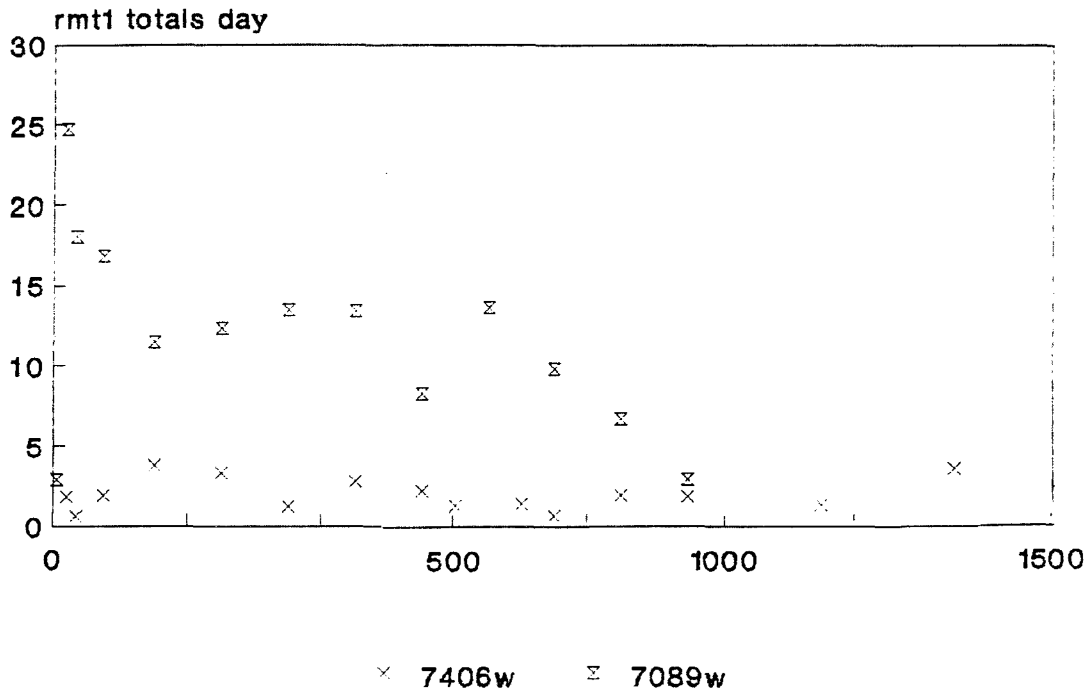


Fig. 13c. Daytime profiles of biomass for winter stations south of 40°N (RMT1)

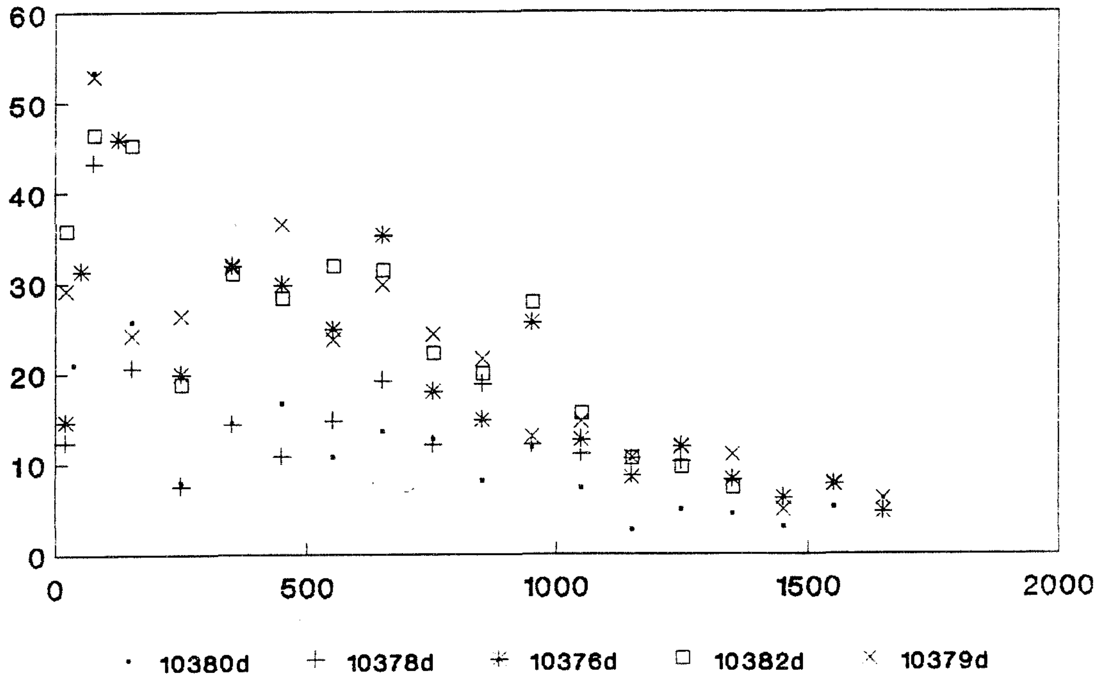


Fig. 14a. Daytime RMT1 biomass values at Azores front stations sampied in summer.

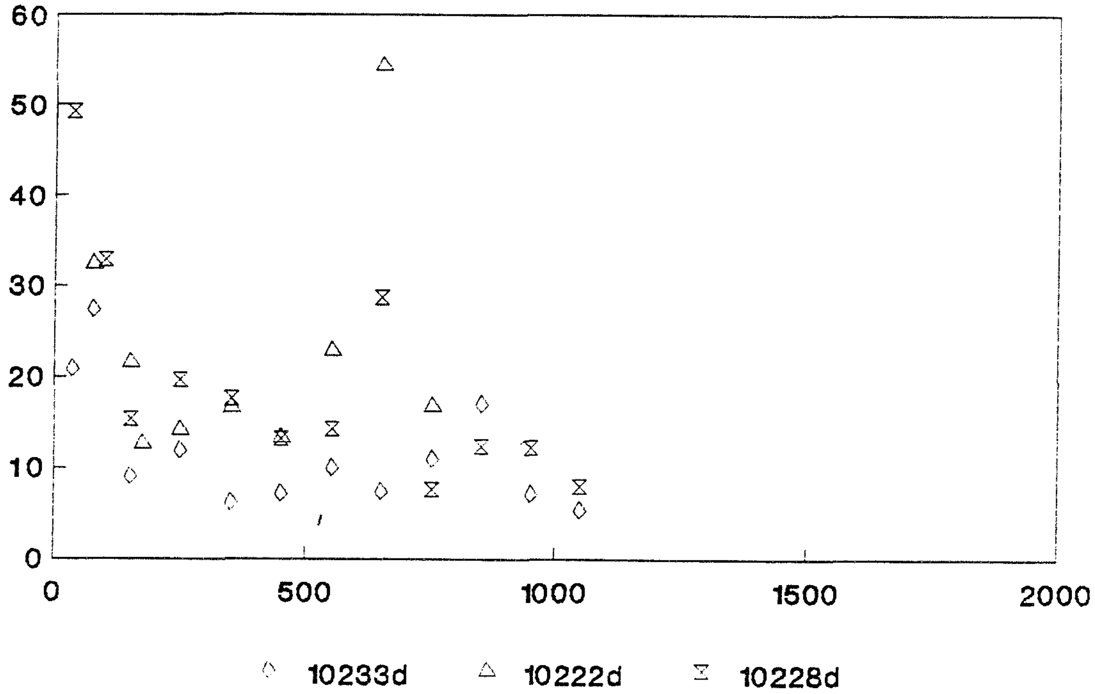


Fig. 14b. Daytime RMT1 biomass values at Azores front stations sampled in winter

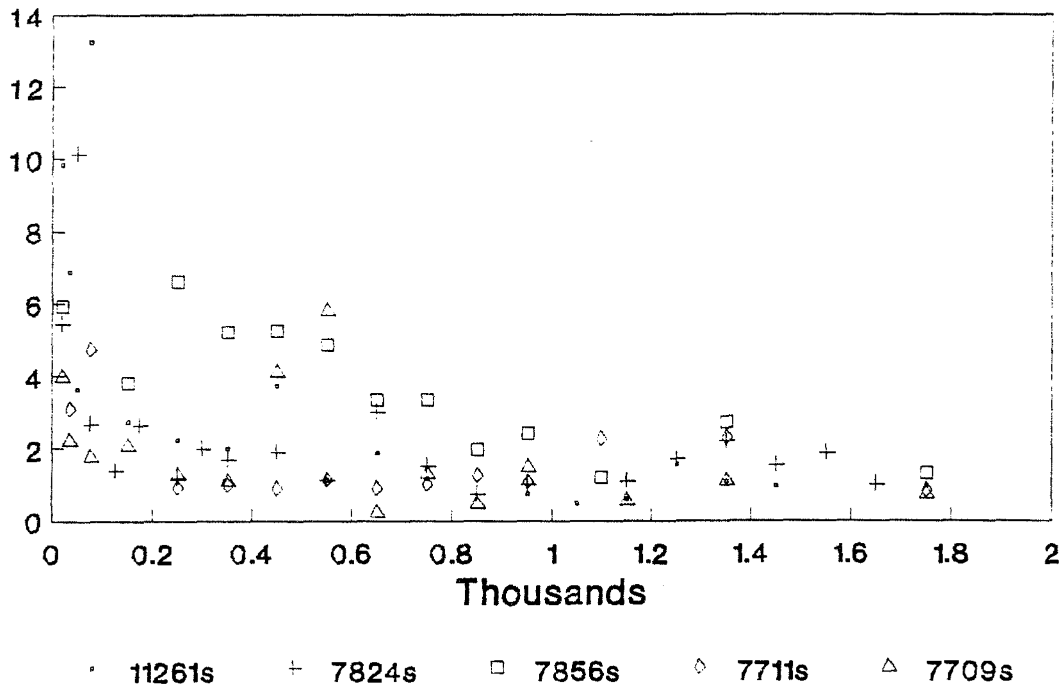


Fig. 15. Daytime ratios of macroplankton/micronekton of some of the main stations throughout the sampling area.

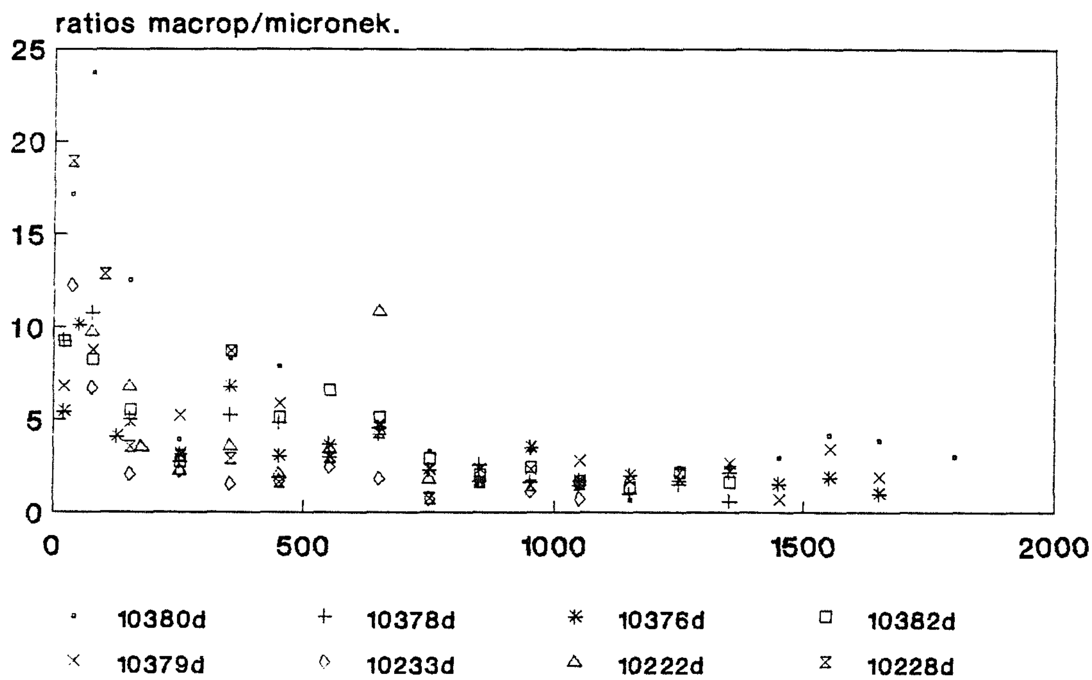


Fig. 16. Daytime ratios of macroplankton/micronekton at the Azores Front stations sampled in winter and summer.

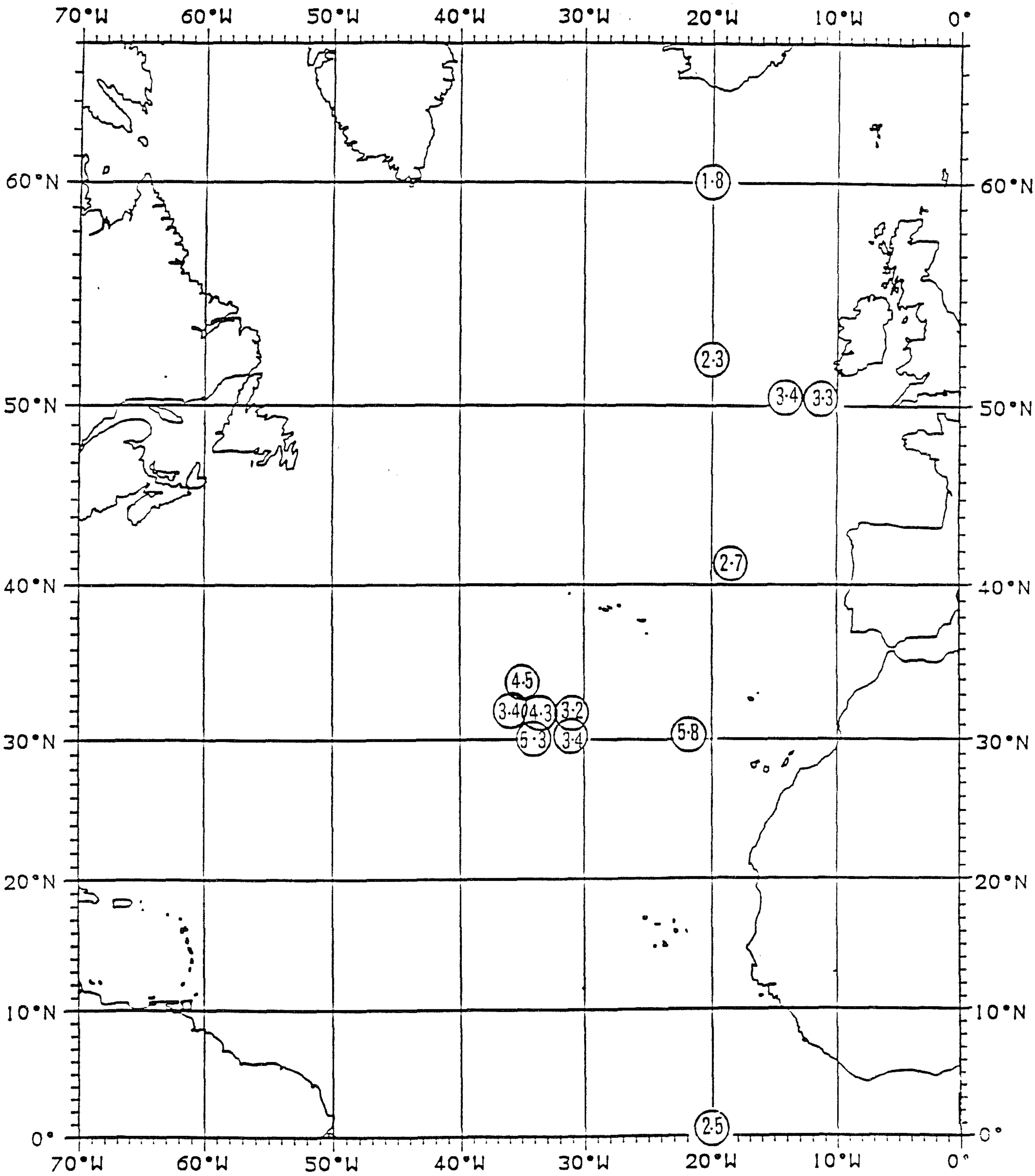


Fig. 17. Daytime ratios of RMT8:RMT1 biomass (mls beneath $1m^2$ sea surface) for stations at positions sampled from April to October inclusive.

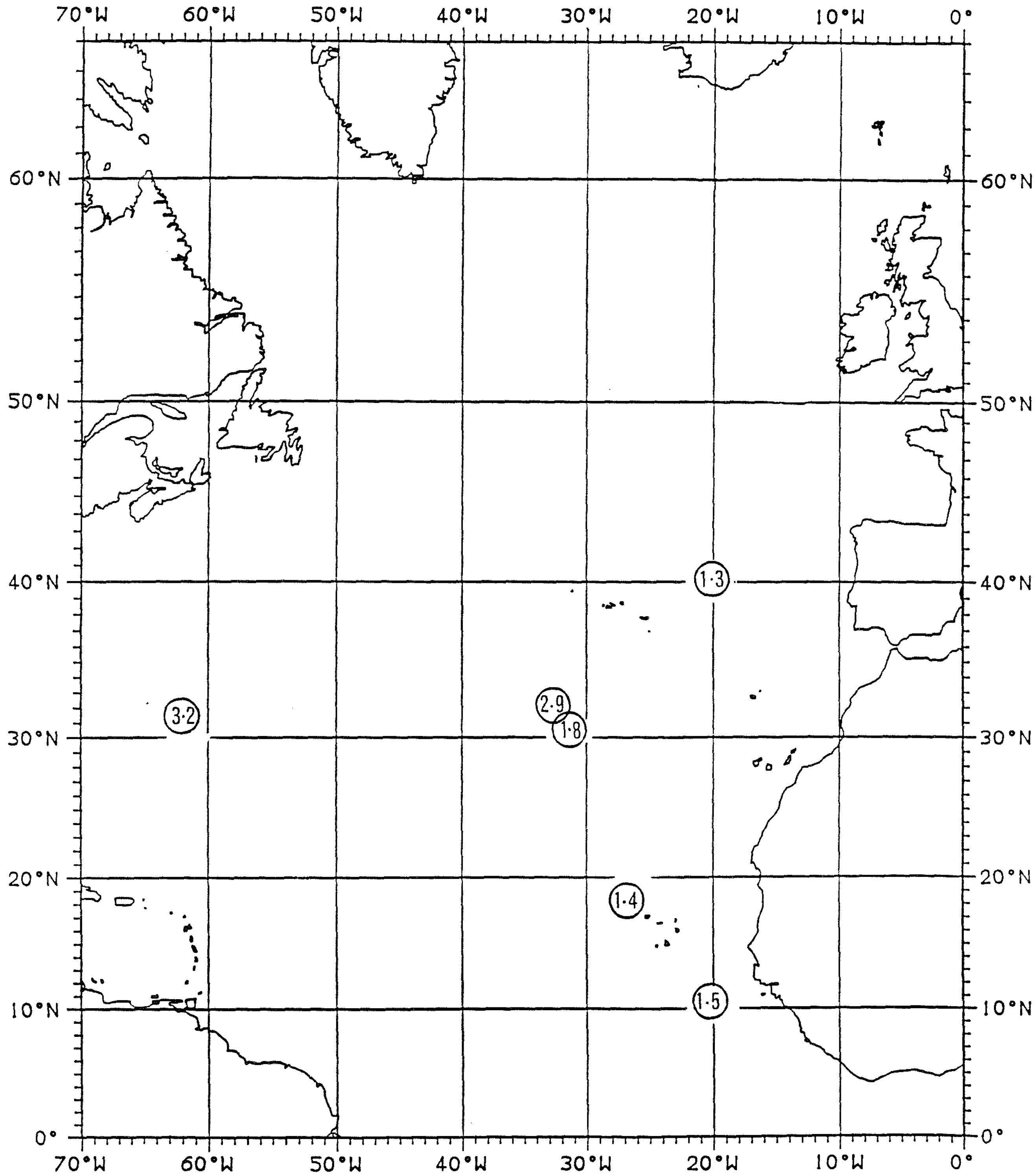
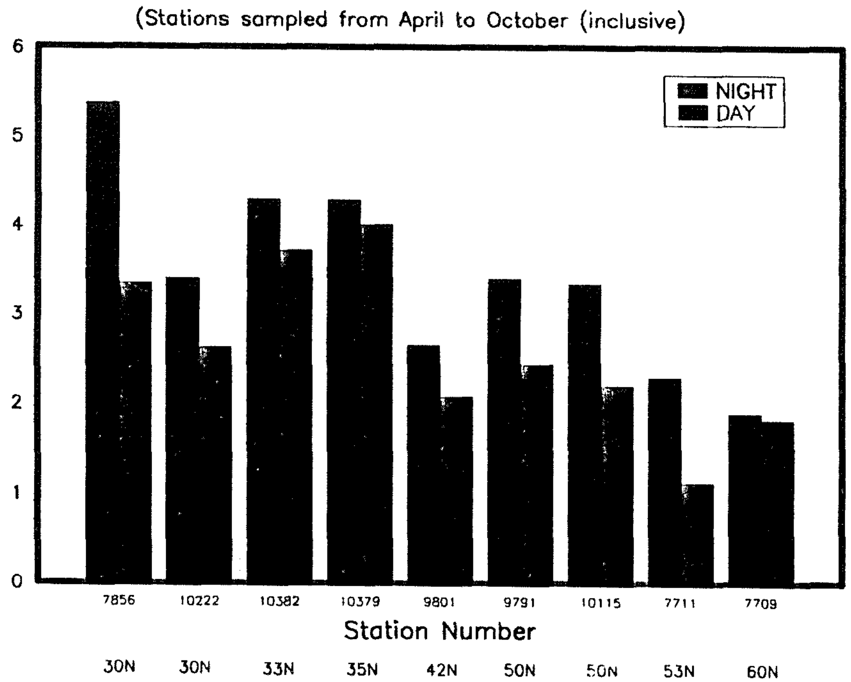
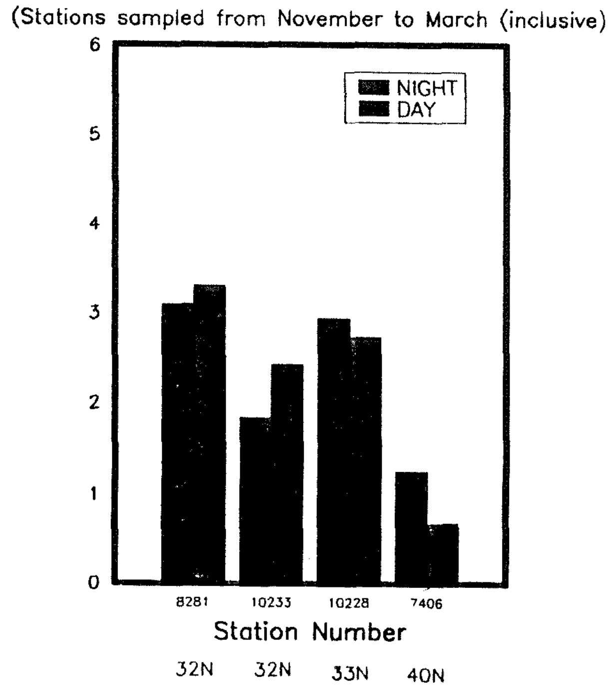


Fig. 18. Daytime ratios of RMT8:RMT1 biomass (mls beneath 1m sea surface) for stations at positions sampled from November to March inclusive.

Fig.19. Ratios of total std. RMT1 biomass in top 1000m (wrt RMT8 biomass)





APPENDIX 1. Biomass values per $10^3 m^3$ at station positions A-Y, PS, Oblique 1, Oblique 2. Most of the earlier data include the total catch in the 0.32 mm mesh RMT1 net i.e. animals of size fraction 0.32-4.5mm and a few >4.5mm the latter of which are likely to avoid the net. The more recent data excludes the >4.5mm fraction and this is indicated where appropriate. An asterisk indicates where data exclude values for intermittently occurring _Pyrosoma_.

STATIONS:8543-8591 POSITION:0-3°N 21-23°W (A)
GEAR:RMT1

STATION	DEPTH(m) UPPER	DEPTH(m) LOWER	STANDARDISED WDV(mls)/10^3M^3	
855903	10	28	964.88	
856803	10	25	105.46	
855902	25	52	236.71	
856705	23	55	158.35	
855804	51	102	91.04	
856802	50	103	112.44	
855901	105	200	104.09	
856205	100	160	45.87	
856704	100	180	73.29	
856703	150	200	36.43	
856204	150	205	38.94	
855803	203	300	271.59	
856801	198	306	37.50	
855601	300	405	59.61	
856702	305	400	58.62	DAY
855802	400	500	151.10	
856503	400	500	32.67	
855301	505	600	47.98	
856701	505	600	38.39	
855302	605	700	38.81	
856502	600	705	27.76	
855801	700	800	21.45	
856501	700	800	23.01	
855603	805	900	39.94	
856301	805	900	22.81	
855602	905	1000	28.02	
856302	905	1000	18.76	
856001	1005	1250	11.70	
855904	1250	1500	6.25	
856002	1510	2000	5.03	
856304	12	25	112.63	
856209	10	33	453.42	
856303	25	50	192.38	
856211	25	60	207.26	
856306	44	104	141.14	
856212	48	104	97.79	
856506	104	150	68.79	
856208	102	152	64.89	NIGHT
856505	150	200	40.90	
866207	152	200	84.95	
856213	200	300	73.75	
856806	206	300	27.71	
856503	400	500	32.67	
856502	600	700	27.76	
856501	700	800	23.01	

STATION:7824 POSITION:11^{0}N 20^{0}W (B)
GEAR:RMT1

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/$10^{3}M^{3}$	
782467	50	110	26.87	
782462	100	150	27.42	
782461	150	200	16.81	
782460	200	250	19.21	
782459	250	300	36.68	DAY
782432	305	400	22.78	
782430	400	500	30.04	
782410	505	600	34.09	
782406	605	700	24.71	
782417	700	800	40.23	
782434	800	910	10.42	
782439	895	1000	11.57	
782419	1000	1250	5.79	
782456	20	60	62.64	
782469	100	200	11.78	
782465	205	300	11.07	
782470	305	400	20.38	
782471	405	500	14.45	NIGHT
782437	500	600	19.06	
782422	610	700	19.25	
782401	710	800	57.94	
782414	805	900	17.87	
782402	900	1000	13.00	
782413	1000	1250	9.33	
782436	1250	1500	8.78	
782421	1500	2000	4.61	

STATION:7089 POSITION:18°N 25°W (C)
GEAR:RMT1

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
708935	0	10	2.86	
708931	10	20	24.67	
708930	20	50	18.03	
708920	55	100	16.78	
708919	112	194	11.43	
708925	210	290	12.32	
708918	210	300	9.46	
708929	305	400	13.46	DAY
708924	410	500	13.39	
708913	515	600	8.21	
708909	610	700	13.57	
708905	700	790	9.72	
708904	800	890	6.67	
708914	910	1020	2.86	
708928	10	25	36.70	
708927	25	60	29.11	
708926	49	100	31.78	
708923	110	200	13.33	
708903	210	300	12.50	
708911	300	400	10.71	
708922	410	500	8.85	NIGHT
708917	505	600	14.82	
708916	610	710	16.96	
708915	700	785	8.65	
708912	800	900	7.14	
708908	900	1010	3.51	
708932	1000	1250	4.52	

STATION:7856 POSITION:30°N 23°W (D)
GEAR:RMT1

STATION	DEPTH(m) UPPER	DEPTH(m) LOWER	STANDARDISED WDV(mls)/10^3M^3	
785627	0	10	21.43	
785626	10	25	67.26	
785625	25	50	131.49	PELAGIA SWARM
785624	55	100	120.00	
785618	102	203	37.38	
785617	205	300	31.43	
785611	305	400	36.68	
785602	405	505	56.50	
785616	500	600	35.43	
785610	600	700	18.35	DAY
785609	700	800	12.88	
785604	795	900	7.73	
785603	910	1000	7.87	
785650	1000	1250	3.65	
785651	1250	1500	5.47	
785654	1500	2000	3.00	
785680	2010	3000	1.19	
785640	0	10	171.43	
785639	10	25	132.08	
785638	25	50	146.42	
785637	50	100	45.42	
785622	100	200	47.27	
785621	205	300	31.89	
785615	300	400	36.05	
785608	405	500	14.68	
785620	500	600	20.38	NIGHT
785614	600	700	15.40	
785613	700	800	13.09	
785607	800	895	6.01	
785606	900	1000	5.28	
785648	1005	1250	5.30	
785652	1250	1500	3.92	
785657	1500	2020	2.17	

STATION:7406 POSITION: 40 N 20 W (E)
GEAR:RMT1

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3		
740639	0	10	5.89		
740617	10	25	7.50		
740615	25	50	18.03		
740616	50	100	4.46		
740601	110	205	4.46		
740602	210	300	5.00		
740609	310	400	5.18		DAY
740628	410	500	11.61		
740632	502	610	31.43		
740638	550	655	14.16		
740644	650	745	8.93		
740614	710	800	10.18		
740629	805	900	10.36		
740603	910	1000	39.46	numerous medusae	
740633	990	1250	7.47		
748000	1250	1510	8.57		
740642	0	10	21.07		
740619	10	27	26.07		
740613	30	50	26.15		
740612	52	100	15.71		
740605	110	195	3.39		
740620	210	300	10.00		NIGHT
740626	310	400	6.96		
740631	400	500	10.00		
740625	500	590	14.28		
740624	610	700	8.57		
740618	700	790	6.78		
740611	810	900	8.21		
740606	910	1000	9.13		
740641	1260	1500	10.35		
740646	1500	2000	3.48		
748201	2000	2500	3.15		

STATION:7711 POSITION: 53 N 20 W (F)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3		
771148	0	10	200.00		
771118	10	25	2.14		
771117	25	50	212.50		
771116	50	100	85.71		
771115	110	200	316.07	numerous salps	
771111	205	300	95.53		
771107	300	400	25.00		
771106	410	500	23.02		
771110	505	600	25.00		DAY
771109	605	700	16.96		
771108	700	805	16.96		
771104	800	900	17.85		
771101	900	1000	20.90		
771140	1005	1250	23.21		
771147	1260	1500	17.41		
771139	1520	2000	8.03		
771143	10	25	332.14		
771142	25	50	81.63		
771124	50	102	98.21		
771131	100	200	26.78		
771123	200	300	39.28		
771103	310	400	30.36		
771138	400	500	65.18		NIGHT
771137	495	590	31.25		
771132	605	700	33.03		
771130	710	800	17.86		
771113	800	900	41.28		
771102	900	1000	17.86		
771165	1020	1250	17.86		
771156	1250	1500	8.57		
771161	1520	2000	6.70		

STATION:7709 POSITION: 60°N 20°W (G)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
770960	0	10	107.14	
770959	10	25	35.71	
770958	25	50	29.46	
770933	55	100	41.96	
770901	110	200	26.78	
770902	205	300	6.25	
770974	310	400	23.31	
770907	410	500	26.78	
770927	500	600	46.43	DAY
770926	600	700	28.57	
770921	710	800	21.43	
770925	810	900	8.03	
770924	910	995	26.78	
770935	1010	1250	11.16	
770944	1260	1500	15.18	
770945	1525	2000	6.25	
770947	0	9	185.71	
770946	9	25	62.50	
770948	25	50	66.96	
770970	55	100	15.18	
770904	105	200	32.14	
770937	205	300	32.14	
770929	300	400	30.49	
770923	405	500	25.00	NIGHT
770903	495	590	22.32	
770936	600	700	25.00	
770928	705	800	23.75	
770922	800	900	22.11	
770917	900	1000	26.78	
770963	1000	1250	17.78	
770976	1250	1500	12.50	
770991	1520	2000	6.55	

STATION:8281 POSITION:32°N 64°W (H)
GEAR:RMT1

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
828124	0	10	27.41	
828123	12	25	26.36	
828125	26	50	31.32	
828126	52	100	28.80	
828142	102	200	21.93	
828141	190	300	12.57	
828105	305	400	14.91	
828131	405	500	14.69	DAY
828115	510	600	18.18	
828111	600	700	12.72	
828110	710	800	13.71	
828109	805	900	10.18	
828103	910	1000	13.96	
828114	1010	1250	11.50	
828130	1260	1500	9.81	
828135	1520	2000	3.47	
828117	0	10	136.43	
828120	10	25	43.74	
828118	25	50	100.53	
828119	55	100	75.75	
828116	102	200	37.33	
828132	205	300	15.49	
828102	295	400	22.16	
828128	405	505	6.74	
828113	505	600	8.87	
828108	605	700	9.51	NIGHT
828107	700	800	10.44	
828106	800	900	6.93	
828101	905	1000	7.79	
828112	1000	1250	6.73	
828129	1250	1500	5.16	
828133	1490	2000	5.46	
828145	2005	2500	1.32	

STATION:9801 POSITION:42°N 17°W (I)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
980109	10	95	125.00	
980110	95	200	47.17	
980111	200	300	36.93	
980121	300	400	68.39	
980122	400	515	129.08	
980123	515	600	62.55	
980103	600	700	62.96	
980104	695	800	58.73	
980105	800	900	40.19	DAY
980118	890	1100	47.15	
980119	1100	1280	38.54	
980120	1280	1500	20.76	
980182	2100	2300	1.89	
980183	2300	2500	5.88	
980184	2500	2700	5.46	
980190	3300	3500	1.87	
980189	3500	3710	2.90	
980188	3700	3900	1.90	
980115	10	100	134.29	
980116	100	200	66.12	
980117	200	300	52.99	
980112	300	400	50.25	
980113	395	500	36.09	
980114	500	600	40.89	
980127	600	700	72.85	
980128	700	800	70.61	
980129	800	900	52.53	NIGHT
980160	985	1010	30.13	
980179	1500	1710	21.04	
980180	1690	1900	5.83	
980181	1900	2100	7.33	
980185	2700	2900	6.85	
980186	2900	3100	4.43	
980187	3100	3300	2.78	
980191	4300	4520	4.28	

STATION:9801 (HAUL 57-58) POSITION:41-42°N 17°W (I)
GEAR:RMT1 1000m REPEATS

STATION	STANDARDISED WDV(mls)/10^3M^3
980158	53.40
980159	32.72
980160	30.07
980161	39.37
980162	36.49
980163	41.32
980164	43.82
980165	29.20
980166	44.94
980167	58.36
980168	36.23
980169	37.17
980170	44.61
980171	18.38
980172	50.98
980173	50.98
980174	25.45
980176	20.00
980177	41.98
980178	36.50

STATION:9791 POSITION:50°N 14°W (J)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	DEPTH(m) LOWER	STANDARDISED WDV(mls)/10^3M^3	
979105	10	100	244.93	
979106	100	200	76.24	
979107	200	300	67.15	
979114	300	400	91.53	
979115	400	500	92.00	
979116	500	600	48.08	DAY
979102	600	705	41.95	
979103	700	800	60.22	
979104	800	905	36.48	
979117	895	1100	27.43	
979118	1095	1300	26.37	
979119	1300	1505	18.49	
979111	10	100	137.60	
979112	100	200	64.00	
979113	200	300	136.52	
979108	300	400	92.99	
979109	400	500	54.45	NIGHT
979110	500	600	33.12	
979120	600	700	37.61	
979121	700	800	17.69	
979122	800	900	9.07	

STATION:10115 POSITION: 50°N 14°W (K)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
1011515	10	100	56.07	
1011516	100	200	27.46	
1011517	200	300	44.38	
1011505	300	400	45.37	
1011506	400	500	89.00	
1011507	500	600	53.21	DAY
1011502	600	700	39.40	
1011503	700	800	32.75	
1011504	800	900	30.57	
1011518	900	1100	53.71	
1011519	1100	1300	86.37	
1011521	10	100	117.26	
1011522	100	200	89.08	
1011523	195	300	31.71	
1011512	295	400	17.50	
1011513	400	500	34.16	NIGHT
1011514	500	600	53.50	
1011509	600	700	30.39	
1011510	700	800	39.60	
1011511	800	900	36.98	

STATION:10105 POSITION: 54°N 13°W (L)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
1010514	10	100	4.60	
1010515	100	195	53.61	
1010516	195	300	27.31	
1010508	300	410	26.37	
1010509	410	500	58.49	
1010510	500	600	63.52	
1010505	500	700	31.70	DAY
1010506	700	810	48.89	
1010507	800	900	34.82	
1010501	900	1100	25.60	
1010502	1090	1190	39.09	
1010503	1290	1500	68.63	
1010517	1500	1700	19.80	
1010518	1700	1900	22.87	
1010524	10	100	41.77	
1010523	100	200	50.41	
1010522	200	300	2.83	
1010521	300	400	18.19	
1010520	400	500	33.65	NIGHT
1010519	500	600	20.84	
1010511	600	700	29.92	
1010512	700	810	40.98	
1010513	770	900	49.21	

STATION:10380 POSITION:30°N 34°W (M)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	DEPTH(m) LOWER	STANDARDISED WDV(mls)/10^3M^3	
1038001	5	50	20.90	
1038002	50	100	53.27	
1038003	100	200	25.66	
1038021	200	300	7.82	
1038022	300	400	14.45	
1038023	400	500	16.59	
1039030	500	600	10.72	
1038031	600	700	13.60	
1038032	700	805	12.75	
1038008	800	900	8.02	DAY
1038009	900	1000	11.81	
1038010	995	1100	7.29	
1038005	1100	1200	2.57	
1038006	1200	1300	4.87	
1038007	1300	1400	4.35	
1038018	1400	1498	2.94	
1038019	1498	1600	5.08	
1038020	1600	1698	6.01	
1038033	1700	1900	4.67	
1038034	1900	2100	3.05	
1038035	2100	2300	1.35	
1038027	0	50	43.54	
1038028	50	100	50.09	
1038029	100	205	35.66	
1038015	200	300	8.99	
1038016	300	400	10.62	
1038017	400	505	9.19	
1038024	500	600	13.48	
1038025	600	710	8.56	NIGHT
1038026	705	800	9.07	
1038012	800	900	7.30	
1038013	900	1000	10.30	
1038014	1000	1100	5.44	
1038036	1102	1120	5.08	
1038037	1120	1200	4.14	
1038038	1200	1300	4.71	

STATION:10378 POSITION:32°N 30°W (N)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	DEPTH(m) LOWER	STANDARDISED WDV(mls)/10^3M^3	
1037801	5	50	12.31	
1037802	50	100	43.15	
1037803	100	200	20.61	
1037827	200	300	7.45	
1037828	300	400	14.33	
1037829	400	500	10.85	
1037814	500	600	14.69	
1037815	600	705	19.20	DAY
1037816	705	800	12.06	
1037811	800	900	18.83	
1037812	900	1000	12.08	
1037813	1000	1100	11.04	
1037824	1100	1202	8.68	
1037825	1200	1305	10.24	
1037826	1305	1400	8.59	
1037821	0	52	36.44 *	
1037822	52	105	65.35	
1037823	105	200	31.43	
1037818	200	310	17.43	
1037819	300	405	16.69	
1037820	400	498	12.71	
1037808	500	602	20.11	
1037809	602	700	32.78	NIGHT
1037810	700	800	13.07	
1037805	800	902	13.03	
1037806	902	1000	9.90	
1037807	1000	1100	11.52	
1037830	1097	1200	8.70	
1037831	1200	1295	10.49	
1037832	1290	1415	8.71	

STATION:10376 POSITION:33^oN 33^oW (O)
GEAR:RMT1

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
1037603	5	40	14.68	
1037604	40	60	31.24	
1037605	60	200	45.84	
1037616	200	300	19.87	
1037617	300	400	31.94	
1037618	400	500	29.78	
1037613	505	600	24.84	
1037614	605	700	35.23	
1037615	690	798	17.99	DAY
1037628	795	900	14.87	
1037629	900	1005	25.57	
1037630	1005	1100	12.59	
1037625	1095	1205	10.59	
1037626	1205	1305	11.84	
1037627	1295	1400	8.17	
1037637	1400	1500	6.21	
1037638	1500	1600	7.76	
1037639	1600	1700	4.60	
1037631	5	25	58.89	
1037632	25	130	161.35	
1037633	130	205	24.41	
1037621	200	300	30.90	
1037622	300	400	36.35	
1037623	400	500	24.00	
1037610	500	602	22.75	
1037611	602	705	19.69	NIGHT
1037612	705	807	30.58	
1037607	800	900	18.95	
1037608	900	1000	16.57	
1037609	1000	1100	18.97	
1037634	1100	1200	12.52	
1037635	1200	1300	14.56	
1037641	1300	1400	9.26	
1037642	1398	1502	13.91	
1037643	1498	1600	6.51	

STATION:10382 POSITION:33^oN 32^oW (P)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
1038226	5	50	35.72	
1038227	50	99	46.33	
1038228	97	200	45.11	
1038223	200	300	18.63	
1038224	300	400	30.89	
1038225	400	500	28.18	
1038214	500	600	31.74	
1038215	600	700	31.30	DAY
1038216	700	800	22.12	
1038211	800	900	19.91	
1038212	900	1000	27.70	
1038213	1000	1100	15.48	
1038202	1100	1200	10.44	
1038203	1200	1300	9.53	
1038204	1300	1400	7.21	
1038217	0	50	66.16	
1038218	50	100	108.74	
1038219	100	200	46.90	
1038220	200	300	15.02	
1038221	300	420	23.12	
1038222	405	500	21.06	
1038208	500	600	13.30	NIGHT
1038209	605	700	18.15	
1038210	700	800	13.07	
1038205	800	900	17.16	
1038206	900	1000	17.27	
1038207	1000	1100	13.01	
1038231	1080	1210	16.67	

STATION:10379 POSITION:35^{o}N 33^{o}W (Q)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
1037901	5	50	29.20	
1037902	50	100	52.88	
1037903	98	200	24.12	
1037904	200	300	26.03	
1037905	300	400	31.61	
1037906	400	500	36.41	
1037930	500	600	23.63	
1037931	600	700	29.74	
1037932	700	800	24.25	
1037918	800	900	21.56	
1037919	900	995	12.91	DAY
1037920	995	1100	14.64	
1037914	1100	1200	8.41	
1037915	1200	1300	11.77	
1037916	1300	1410	10.91	
1037927	1400	1500	4.91	
1037928	1498	1600	7.63	
1037929	1600	1700	6.09	
1037911	0	50	120.14 *	
1037912	50	100	95.92	
1037913	100	200	44.96	
1037924	200	300	29.24	
1037925	298	400	30.00	
1037926	400	500	29.32	
1037921	495	600	15.00	
1037922	600	700	21.58	
1037923	700	800	17.14	
1037908	800	900	20.49	NIGHT
1037909	900	995	11.85	
1037910	1000	1100	13.22	
1037933	1100	1200	8.86	
1037934	1200	1300	7.58	
1037935	1295	1410	8.56	
1037941	1400	1500	7.76	
1037942	1495	1600	7.76	
1037943	1600	1700	4.92	

STATION:10233 POSITION:32°N 32°W (R)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	DEPTH(m) LOWER	STANDARDISED WDV(mls)/10^3M^3	
1023316	0	70	20.84	
1023317	65	97	27.37	
1023318	90	200	9.06	
1023301	200	303	11.87	
1023302	295	400	6.14	
1023303	400	490	7.07	DAY
1023304	500	600	9.95	
1023305	600	700	7.39	
1023306	700	805	10.94	
1023326	800	910	17.03	
1023327	900	1010	7.12	
1023328	1000	1100	5.36	
1023322	10	90	64.03	
1023323	80	105	40.69	
1023324	95	200	12.48	
1023319	185	300	11.13	
1023320	300	400	11.50	
1023321	400	500	10.43	NIGHT
1023310	500	600	10.62	
1023311	600	700	12.42	
1023312	700	800	6.98	
1023307	800	900	7.86	
1023308	900	1002	8.57	
1023309	1000	1100	7.14	

STATION:10222 POSITION: 30 N 30 W (S)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
1022221	20	120	32.36	
1022222	100	180	21.58	
1022223	130	205	12.64	
1022210	200	305	14.20	
1022211	300	400	16.67	DAY
1022212	400	505	13.25	
1022207	500	600	22.88	
1022208	600	700	21.30 *	
1022209	700	800	16.95	
1022216	10	105	57.94 *	
1022217	105	160	90.57	
1022218	160	200	10.13	
1022213	200	300	11.46	
1022214	300	400	10.88	
1022215	400	500	4.33	NIGHT
1022204	495	600	10.73	
1022205	600	700	13.13	
1022206	700	800	14.03	
1022201	800	900	10.86	
1022202	900	1000	15.47	
1022203	1000	1100	8.54	

STATION:10228 POSITION: 32 N 33 W(T)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/$10^3 M^3$	
1022815	15	57	49.15	
1022816	80	130	32.78	
1022817	128	200	15.35	
1022831	205	300	19.57	
1022832	300	400	17.63	
1022833	390	505	13.15	DAY
1022803	500	605	14.31	
1022804	600	705	28.64	
1022805	705	805	7.58	
1022828	800	900	12.33	
1022829	900	1000	12.28	
1022830	995	1100	7.97	
1022824	10	120	54.82 *	
1022825	90	140	31.77 *	
1022826	120	200	12.33	
1022821	200	300	18.41	
1022822	300	400	15.16	
1022823	400	500	10.25	NIGHT
1022809	500	600	14.69	
1022810	600	700	10.54	
1022811	700	800	9.48	
1022806	800	900	24.69	
1022807	900	1000	13.10	
1022808	1000	1100	7.00	

STATION:11050 POSITION:46°N 14°W (U) (excludes >4.5 fraction)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/$10^3 M^3$	
1105602	50	100	53.96	
1105603	100	200	20.03	
1105501	200	305	7.28	DAY
1105502	305	400	14.91	
1105503	400	495	20.59	
1105801	0	50	38.20	
1105802	50	100	45.49	
1105803	95	200	25.40	
1105701	200	300	8.14	
1105702	300	400	10.84	NIGHT
1105703	395	500	9.59	
1105001	500	600	11.54	
1105002	600	700	15.35	
1105003	700	800	6.71	

STATION:11036 POSITION:39 N 15 W (V)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
1104702	50	105	172.79	
1104703	105	180	55.21	
1104201	180	280	13.33	
1104202	280	380	12.78	
1104203	380	480	10.53	
1104001	470	565	18.32	DAY
1104002	565	660	20.23	
1104003	660	800	10.76	
1103601	790	890	4.05	
1103602	890	995	5.10	
1103603	990	1095	6.18	
1104502	45	100	88.69	
1104503	100	180	38.77	
1103801	180	280	5.25	
1103802	280	385	7.21	NIGHT
1103803	385	470	12.07	
1103901	470	565	10.00	
1103902	565	660	7.34	
1103903	660	775	5.25	

STATION:11078 POSITION:39°N 15°W (W)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
1109401	0	50	41.36	
1109402	50	100	38.43	
1109403	100	200	5.09	
1108801	200	300	20.16	
1108802	300	400	37.93	
1108803	400	498	8.44	
1108301	500	600	5.05	
1108302	600	700	16.42	DAY
1108303	700	800	3.69	
1108101	800	905	3.00	
1108102	900	1000	4.85	
1108103	1000	1100	3.74	
1108601	0	50	26.13	
1108602	50	100	50.35	
1108603	100	200	9.49	
1107901	200	300	6.48	
1107902	300	400	10.37	
1107903	400	495	4.37	
1107801	500	600	5.18	NIGHT
1107802	605	695	6.45	
1107803	695	795	1.47	
1108501	800	900	1.49	
1108502	900	1000	3.18	
1108503	1000	1100	2.99	

STATION:11261 POSITION: 31°N 25°W (X)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3 (excludes >4.5 fraction)	
1126114	0	100	11.04	
1126129	2	25	3.15	
1126130	25	50	10.17	
1126131	50	100	17.99	
1126113	100	200	18.58	
1126112	200	300	4.56	
1126101	300	400	5.17	
1126102	400	500	4.98	
1126133	500	600	10.86	DAY
1126104	600	700	6.50	
1126105	700	800	5.14	
1126106	800	900	4.17	
1126115	900	1000	3.87	
1126116	1000	1100	3.68	
1126117	1100	1200	2.01	
1126126	1200	1300	3.66	
1126127	1300	1400	4.24	
1126128	1400	1500	3.04	
1126139	0	100	17.67	
1126173	0	25	35.88	
1126174	25	50	33.84	
1126175	50	100	18.20	
1126140	100	200	11.62	
1126141	200	300	6.05	
1126122	300	400	3.41	
1126123	400	500	5.02	
1126124	500	600	1.27	NIGHT
1126161	600	700	4.96	
1126162	700	800	4.25	
1126138	800	900	5.21	
1126119	910	1000	3.95	
1126120	1000	1110	3.86	
1126121	1100	1200	1.48	
1126166	1200	1300	3.01	
1126167	1300	1400	3.34	

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1126201	1500	1910	1.60	
1126202	1910	2315	1.01	
1126203	2310	2700	0.75	
1126204	2700	3110	0.18	
1126205	3110	3500	0.19	
1126206	3330	3910	0.31	
1126210	3900	4295	0.10	
1126211	4295	4720	0.12	
1126212	4720	5110	0.18	
1126225	5340	5375	0.15	
1126226	5375	5415	0.14	
1126227	5415	5430	0.24	DEEP
1126148	5132	5182	0.16	
1126147	5233	5279	0.08	
1126146	5325	5376	0.22	
1126154	5347	5388	0.12	
1126255	5388	5415	0.18	
1126156	5410	5425	0.04	
1126163	5345	5385	0.06	
1126164	5385	5410	0.11	
1126165	5410	5430	0.04	

STATION:11794 POSITION:Y
GEAR:RMT1

STATION	DEPTH(m) UPPER	DEPTH(m) LOWER	STANDARDISED WDV(mls)/10^3M^3 (excludes >4.5 fraction)	
1179404	0	50	14.03	
1179405	50	100	13.95	
1179406	100	195	32.66	
1179425	200	305	32.82	
1179426	300	400	32.17	
1179427	400	490	28.85	
1179417	500	600	26.16	
1179418	600	700	21.83	
1179419	700	800	22.38	
1179401	800	900	18.32	
1179402	900	1000	8.80 ⊗	
1179403	1000	1100	20.62	
1179435	1100	1200	24.60	DAY
1179436	1200	1300	20.34	
1179437	1300	1400	16.33	
1179456	1400	1500	13.54	
1179457	1500	1750	16.92	
1179458	1750	2000	10.10	
1179429	2000	2300	4.73	
1179430	2275	2505	3.08	
1179431	2500	2750	2.64	
1179465	2750	3010	12.76	
1179466	3010	3255	3.00	
1179467	3255	3500	0.94	
1179471	3490	3800	1.32	
1179449	20	110	26.22	
1179450	110	200	18.03	
1179451	200	300	14.17	
1179446	300	405	9.67	
1179447	405	505	22.07	
1179448	500	600	18.09	
1179438	600	700	18.76	
1179439	700	795	21.72	
1179440	795	900	15.56	NIGHT
1179409	890	1000	17.51	
1179410	1000	1115	24.08	
1179411	1115	1200	14.43	
1179421	1210	1315	22.53	
1179422	1305	1400	7.20 ⊗	
1179423	1400	1500	17.01	
1179472	3800	4085	2.21	
1179473	4085	4450	2.19	

⊗ Lower than expected; hang-up in net.

STATION:12060 POSITION 48°N 17°W (PS)
GEAR:RMT1M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3 (excludes >4.5 fraction)	
1208803	5	50	57.59	
1210503	5	50	86.64	
1206407	10	50	165.47	
1206406	50	100	122.20	
1208802	50	100	76.16	
1210502	50	105	60.61	
1206405	100	200	45.13	
1208801	100	200	57.99	
1210501	105	200	29.96	
1206203	200	300	40.97	
1208703	195	300	28.88	DAY
1210506	195	300	36.04	
1206202	300	400	57.31	
1210505	300	400	51.27	
1206201	400	500	53.95	
1208701	400	500	23.54	
1210504	400	500	37.26	
1206410	500	610	59.63	
1206409	610	710	45.93	
1206408	710	800	21.69	
1206903	800	900	23.41	
1206902	900	1020	11.17	
1206901	1020	1100	16.24	
1207703	5	25	578.87	
1207702	25	55	251.18	
1207701	50	100	37.15	
1207101	100	200	37.30	
1207706	200	300	120.57	
1207705	300	400	35.81	
1207704	400	500	31.35	
1207104	400	500	40.32	
1208206	500	600	19.79	NIGHT
1209306	500	610	21.77	
1208205	600	700	16.81	
1209305	610	700	18.93	
1208204	695	800	18.22	
1209304	700	800	22.10	
1209603	1000	1100	15.07	
1209602	1100	1200	20.47	
1209601	1190	1350	25.12	

STATION:12060 POSITION 48°N 17°W (PS)
GEAR:RMT8M

STATION	DEPTH(m) UPPER	LOWER	STANDARDISED WDV(mls)/10^3M^3	
1208803	5	50	30.89	
1206406	50	100	5.56	
1208802	50	100	25.69	
1210502	50	105	5.46	
1206405	100	200	10.75	
1208801	100	200	22.09	
1210501	105	200	4.08	DAY
1206203	200	300	4.22	
1208703	195	300	6.76	
1210506	195	300	13.82	
1206202	300	400	10.45	
1208702	300	400	9.48	
1210505	300	400	8.53	
1206201	400	500	13.33	
1208701	400	500	21.94	
1210504	400	500	42.23	
1206410	500	610	9.56	
1206409	610	710	10.03	
1206408	710	800	14.31	
1206903	800	900	8.75	
1206902	900	1020	14.77	
1206901	1020	1100	18.60	
1207702	25	55	66.95	
1207103	50	80	22.89	
1207701	50	100	13.74	
1207102	65	100	8.34	
1207101	100	200	6.01	
1207704	400	500	15.55	NIGHT
1207104	400	500	11.36	
1208206	500	600	10.08	
1209306	500	610	14.98	
1208205	600	700	6.83	
1209305	610	700	8.80	
1208204	695	800	7.30	
1209304	700	800	7.60	
1209603	1000	1100	13.22	
1209602	1100	1200	12.81	
1209601	1190	1350	18.64	

OBLIQUE HAUL:MADEIRA BERMUDA (OBLIQUE 1)
GEAR:RMT1 (FEB/MAR 1973)

STATION	DEPTH(m) UPPER	DEPTH(m) LOWER	POSITION	STANDARDISED WDV(mls)/10^3M^3
8262	0	1000	32 N 16 W	21.43
8263	0	1000	32 N 20 W	22.35
8264	0	1000	32 N 23 W	17.62
8265	0	1000	32 N 27 W	17.93
8270	0	1000	32 N 34 W	21.38
8271	0	1000	32 N 39 W	15.81
8272	0	1000	31 N 43 W	17.47
8274	0	1000	31 N 47 W	9.31
8275	0	1000	31 N 50 W	11.08
8276	0	1000	31 N 54 W	14.15
8277	0	1000	32 N 57 W	13.09
8279	0	1000	32 N 60 W	14.49

OBLIQUE HAUL:NORTH EAST ATLANTIC (OBLIQUE 2)
GEAR:RMT1 (APRIL/MAY 1978)

STATION	DEPTH(m) UPPER	DEPTH(m) LOWER	POSITION	STANDARDISED WDV(mls)/10^3M^3
9792	0	1000	50 N 16 W	32.33
9793	0	1000	48 N 17 W	30.02
9794	0	1000	47 N 17 W	29.28
9795	0	1000	46 N 17 W	26.05
9796	0	1000	45 N 16 W	23.61
9797	0	1000	44 N 16 W	33.27
9798	0	1000	44 N 16 W	34.06
9799	0	1000	43 N 16 W	30.66
9801	0	1000	43 N 17 W	25.81