TR-141

TECHNICAL REPORT

OCEANOGRAPHIC STATIONS TAKEN IN THE INDIAN OCEAN BY USCGC EASTWIND (WAGB-279) IN 1961

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ABSTRACT

During late March and April 1961, the USCGC EASTWIND (WAGB-279) occupied 30 oceanographic stations in the Indian Ocean. Three sections were made, one running from off Cape Leeuwin, Australia west as far as 78° E. longitude, a second continuing north from this point to 4° N. latitude, and the third which continued west to just south of Socotra Island.

Measurements were made of temperature, salinity, and dissolved oxygen; and from these data density, sound velocity, and percentage of saturation of dissolved oxygen were derived. Transparency was determined by Secchi disc, and the Deep Scattering Layer was observed. Continuous recording of bottom depths by echo sounder was carried out through a region where few soundings had hitherto been reported.

Northward reaching tongues of Antarctic Intermediate water are shown on the southern profile and on the south-north profile along the 78° E. meridian. In mid-Indian Ocean, these masses push up toward the surface causing a divergence which is apparent in the salinity and dissolved oxygen profiles. Also delineated are high salinity waters with very low oxygen [illegible] Red Seas. The [illegible] n Ocean and re- [illegible] pattern to that

FOREWORD

This technical report presents data collected in an area that offers a real challenge to the oceanographer - The Indian Ocean.

The observations from aboard USCGC EASTWIND were made in water where few oceanographic measurements previously had been taken.

These data corroborate the findings of some earlier voyages and add to the marine scientists' knowledge of the environmental conditions of this vast ocean.

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Commander

USCGC EASTWIND, SYDNEY, AUSTRALIA

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I. INTRODUCTION

A. Historical

On her return trip from the Antarctic in late March and early April 1961, the U. S. Coast Guard icebreaker EASTWIND, Captain J. W. Naab, USCG, Commanding, took 30 oceanographic stations in the southeastern, central, and northwestern sections of the Indian Ocean (Fig. 1). This was part of the International Indian Ocean Expedition, the EASTWIND being among the first ships to participate in this great undertaking. Three sections were made: The first, east to west from off Cape Leeuwin, Australia along the 32° S. parallel of latitude from 110° to 78° east longitude; the second, north from 32° S. latitude along the 78° E. meridian as far north as 4° N. latitude; and the third, north and west from 8° N. 70° E. to 12° N. 54° E. The east-west section comprised 5 stations, the south-north section 23 stations, and the north-west section 4 stations.

Although the Indian Ocean is, perhaps, the least known oceanographically of all the major bodies of water, a fairly large number of vessels, nevertheless, have taken oceanographic stations there. Most of these observations, however, until recently, had been taken in the western and northern portions, and comparatively little had been reported on the great central water mass. Commencing with voyages of the GAZELLE and CHALLENGER in the 1870's and winding up with those of the DIAMANTINA from 1959 to 1962, the list of ships which have occupied oceanographic stations in the Indian Ocean is impressive. It includes such well known names as DANA, DISCOVERY II, METEOR, PLANET, WILLEBRORD SNELLIUS, NORSEL, VALDIVIA, ORMONDE, GAUSS, VITYAZ, MÖWE, CDT. CHARCOT, MABAHISS, ALBATROSS, and others.

In 1935, DISCOVERY II, returning from the Antarctic, ran a section through the Mozambique Channel, and this series of stations has been the basis for much of the present knowledge of the oceanography of the western portion of the Indian Ocean. Another important section was taken by DANA from Sumatra west across the northern portion of the Indian Ocean as far as Cape Delgado, Africa. North and south sections were made along the

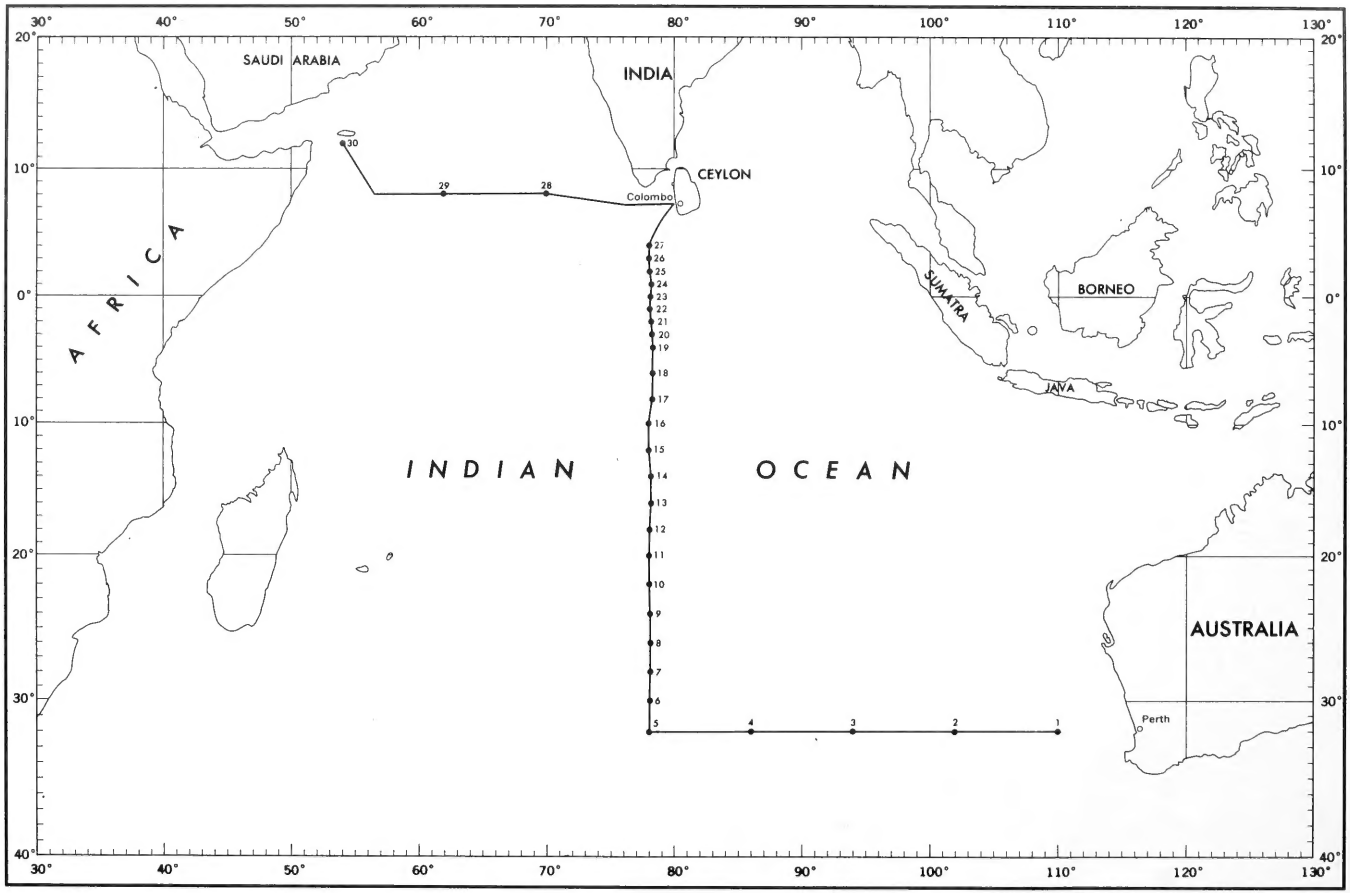


FIGURE 1. TRACK CHART OF EASTWIND, MARCH AND APRIL 1961

75° E. meridian by NORSEL in 1956, on the 90° E. meridian by DISCOVERY II in 1951, near the 86° E. meridian by ALBATROSS in 1945, and at 56° E. longitude on a line running from west of Madagascar to Cape Guardafui by NORSEL in 1955. In 1933, MABAHISS ran a section from the equator at about 63° E. longitude to the Gulf of Oman. Between the years 1959 and 1962, H.M.A.S. DIAMANTINA, operated by the Australian Commonwealth Scientific and Industrial Organization, Division of Fisheries and Oceanography (C.S.I.R.O., 1962, and 1962a), participated in a series of cruises that covered most of the waters to the south, west, and northwest of Australia. Three of her tracks ran along the 32° S. parallel, one of which continued to 95° E. longitude. In 1960, the Lamont Geological Observatory research vessel VEMA ran a track which zig-zagged across the 32° S. parallel and which extended as far west as Mauritius Island. In 1959 and 1960, the U.S.S.R. research vessel VITYAZ covered a large portion of the Indian Ocean with her cruises, of which one leg was slightly north of the 32° S. parallel. Other VITYAZ cruises paralleled the south-north profile of EASTWIND on both eastern and western sides along the 72°, 83°, and 90° meridians. A preliminary account of the results of these cruises is reported upon in Okeanologiya (Bezrukov, 1961). The Scripps Institution of Oceanography's research vessel ARGO, in 1960, ran cruise tracks south and north of the 32° S. parallel as far west as Mauritius. By far the most comprehensive of the recent works on the Indian Ocean is that of Muromtsev on "The Basic Pattern of the Hydrology of the Indian Ocean" (Muromtsev, 1959). An extensive data compilation from all available sources, as well as vertical sections, and areal distribution charts of temperature, salinity, density, and dissolved oxygen, accompanys Muromtsev's report. The International Indian Ocean Expedition plans call for an extensive and practically complete coverage of all parts of the Indian Ocean between the years 1963 and 1965 or 1966.

B. General Discussion of Oceanography of Indian Ocean

The Indian Ocean has long been believed to be similar to the Atlantic, and indeed there are several striking resemblances. Both bodies of water have midridges which join south of the Cape of Good Hope. Both ridges have a rift valley and are centers of seismic activity. The continuity of the two ridges and their rift valleys was recently confirmed from crossings made by VEMA in 1959 and 1960 (Ewing and Heezen, 1960). The Mediterranean feeds water of high salinity into the Atlantic, and the Arabian and Red Seas feed high salinity water into the Indian Ocean. The more important source of high salinity intermediate water for the Indian Ocean is the Arabian Sea; the Persian Gulf is too shallow to furnish much water southward. However, in the Red Sea, a salinity as high as 40‰ is caused by intensive evaporation and almost complete lack of run off from the land. This water at intermediate depths may be traced in the western portion of the Indian Ocean as far south

as the 40° parallel. The Red Sea, nevertheless, is much less important in supplying the Indian Ocean with water than is the Mediterranean the Atlantic because the Red Sea supply is variable with the season and from year to year.

However, unlike the Atlantic, in the Indian Ocean there is apparently no deep, northward-flowing return current, or if such exists, it is of much less importance and is sluggish. Also, the intermediate water is characterized by its low oxygen content which is lowest in the north and which increases toward the south, apparently gaining oxygen by mixture with other water (Sverdrup, Johnson, and Fleming, 1942).

Much of the earlier data collected in the Indian Ocean were either inaccurate or insufficiently refined for use in determining water mass movements. Thus, Möller's sections based on work prior to 1929 (Möller, 1929) are not generally recognized today. The work of Clowes and Deacon (1935) and Deacon (1937) were perhaps the earliest attempts at an accurate picture of circulation in the Indian Ocean. Later, the published reports of Tchernia, Lacombe, and LeFloch (1951) and of Tchernia, Lacombe, and Guibout (1958) have made use of more recent data. Circulation of the deep water in the western Indian Ocean was reported upon in a recent paper by Le Pichon (1960) in which the "core method" together with geostrophic computations were used. Le Pichon reported a deep current setting to the north which was deflected and weakened by the complex system of ridges. Deacon's (1937) idea of the mixing of Atlantic deep water with Indian Ocean water south of Africa was also confirmed in Le Pichon's paper.

Surface and near-surface currents form a rather complex pattern which varies with the season and from year to year. In general, an easterly current sets between Africa and Australia, and during the summer this bends and joins a current coming from the Pacific south of Australia. In winter this current continues on along the southern Australian Coast. The southern part of the Indian Ocean has a large anticyclonic system of currents which, again, is similar to that found in the Atlantic, but the currents in the Indian Ocean are much more variable. North of 20° S., a westerly setting, equatorial current flows. This current is strongest in winter because it is reinforced with water from the Pacific coming along north of Australia; however, in summer, the water north of Australia flows into the Pacific. The Agulhas Current, which sets south along the African coast, is reinforced by part of the South Equatorial Current which turns south. Most of this strong current returns to the Indian Ocean south of Africa, but some, apparently, turns westward and flows into the Atlantic. Probably some Antarctic Intermediate water flows northward in the southern portion of the Indian Ocean. Deep water from the Atlantic comes into the Indian Ocean around Africa. There is, evidently, some intermixing of intermediate water with deep water and bottom water. Red Sea water can be traced as far south as the Antarctic (Thomsen, 1933, 1935).

The generalized pattern of circulation and hydrology given above in its broader aspects is definitely lacking in detail, but many existing questions may be answered when results are published from recent cruises and from scheduled International Indian Ocean Expedition cruises.

II. DATA COLLECTION

Standard oceanographic station procedure as practiced by the U. S. Naval Oceanographic Office Oceanographers (H. O. Pub. No. 607, 1955), was carried out at each of the 30 stations occupied. A volunteer team of four Coast Guard enlisted men directed by Chief Quartermaster Davis, USN, collected the samples and assisted in some of the laboratory work. Paired reversing thermometers were attached to Nansen bottles, and bottles were placed at all intermediate standard depths. Dissolved oxygen was determined by the unmodified Winkler method on board ship. Salinity samples were sealed in citrate bottles and returned to the Oceanographic Laboratory of the U. S. Naval Oceanographic Office. Determination of salinity was made with a University of Washington type salinometer. Depths at which observations were actually made were determined by thermometric calculation from readings of protected and unprotected thermometers. Accuracy of observations is considered to be ±0.02° C. for temperature, ±0.05 parts per thousand (‰) for salinity, and ±0.05 milliliters per liter for dissolved oxygen. Percentage of saturation of dissolved oxygen was interpolated from Fox's Tables (Fox, 1907). When light permitted, transparency was determined with a 30 cm. white Secchi disc. Meteorological information was obtained every 3 hours by aerographers assigned to the icebreaker. Continuous underway soundings were made by a UQN-1B echo sounder.

III. DATA COMPUTATION AND PRESENTATION

A. Oceanographic Station Data

These data were processed, coded, and forwarded to the National Oceanographic Data Center for machine interpolation of values at standard depths and computation of density (Sigma-t), anomaly of dynamic depth from the surface to each level, and sound velocity[1].

These oceanographic station data are presented in Appendix A.

B. Vertical Distribution Profiles

Temperature, Salinity, Density (Sigma-t), Dissolved Oxygen, percentage Saturation of Dissolved Oxygen, and Sound Velocity were plotted as vertical distribution profiles for each of the three sections of the cruise. These are presented as figures 2 through 19.

Contours represent the author's interpretation and have been constructed as closely as possible to the observed values. Limitations caused by positioning of stations and determinations of sample depths make the profiles portray a general picture of conditions rather than a precise delineation of oceanographic parameters throughout the section.

C. Vertical Distribution Station Graphs

Vertical distribution graphs were prepared for selected stations along the cruise track. These are presented as figures 20, 21, and 22.

D. Temperature-Salinity Curves

Temperature-Salinity (T-S) curves were contructed for selected stations along the cruise track. These are presented as figures 23, 24, and 25.

[1] KUWAHARA, Susumu, Velocity of sound in sea water and calculation of the velocity for use in sonic sounding, Hydr. Rev., v. 16, no. 2, pp. 123-140, 1939.

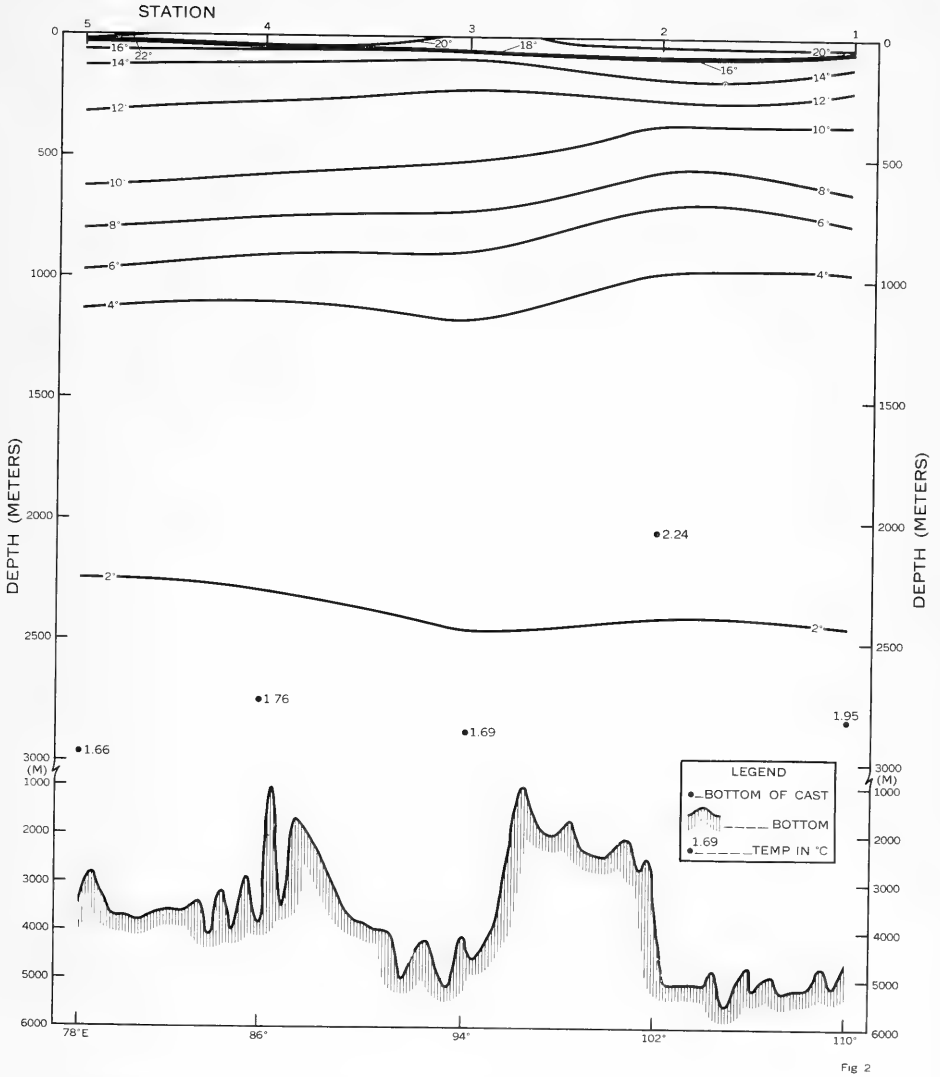


FIGURE 2. VERTICAL DISTRIBUTION OF TEMPERATURE BETWEEN STATIONS 1 and 5.

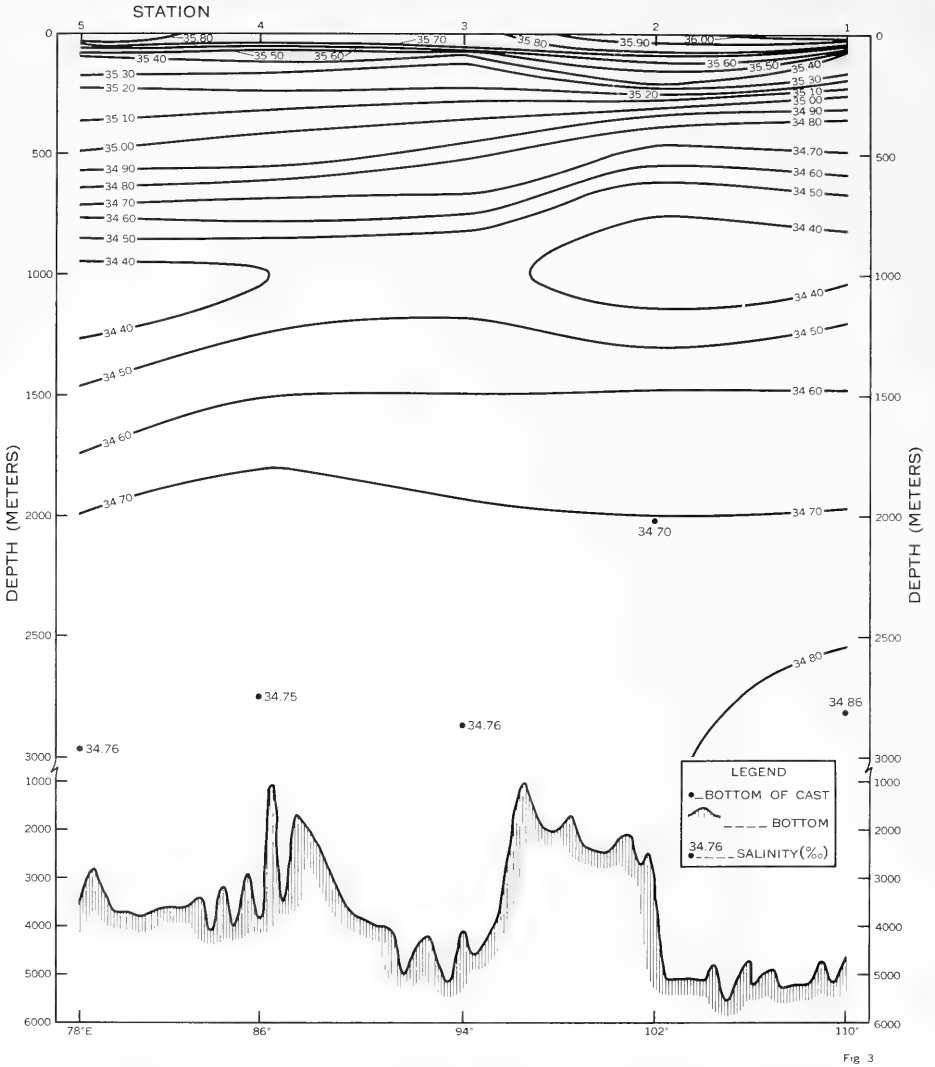


Fig 3

FIGURE 3. VERTICAL DISTRIBUTION OF SALINITY BETWEEN STATIONS 1 and 5.

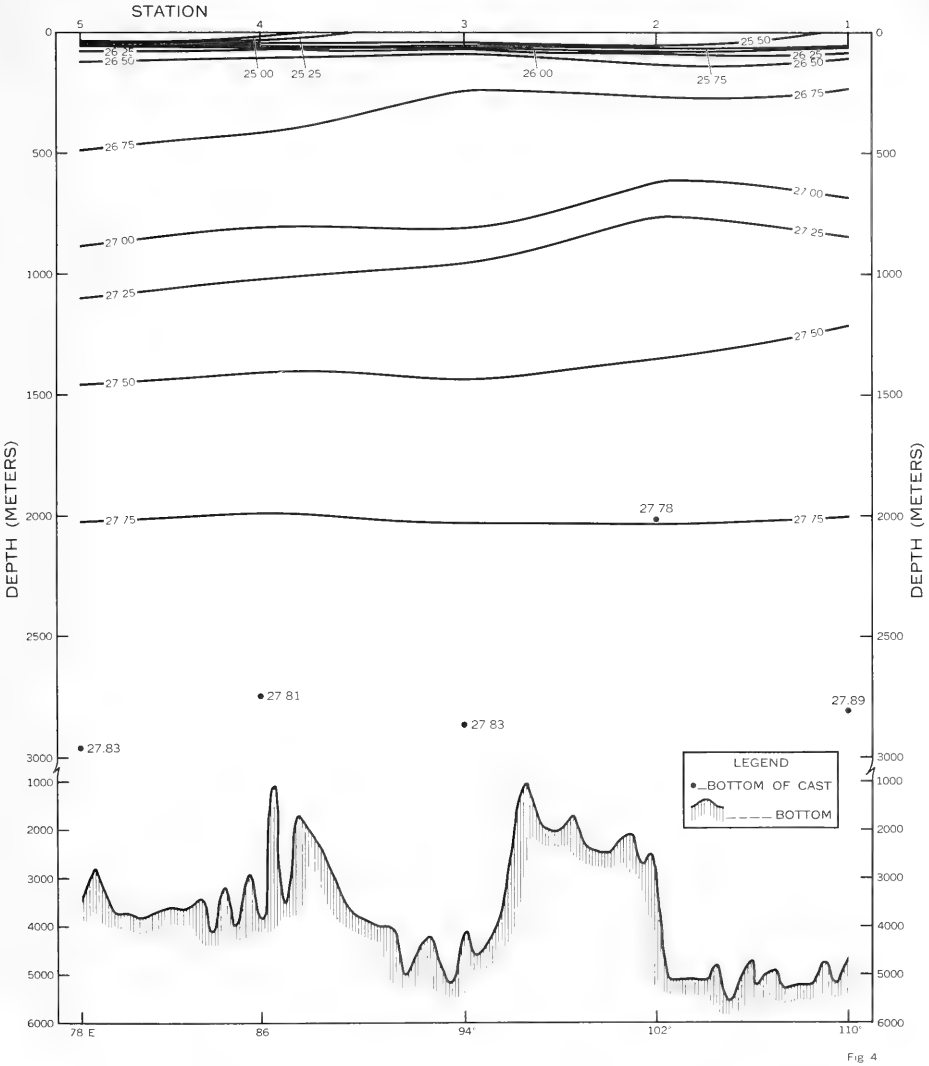


FIGURE 4. VERTICAL DISTRIBUTION OF DENSITY (SIGMA-T) BETWEEN STATIONS 1 and 5.

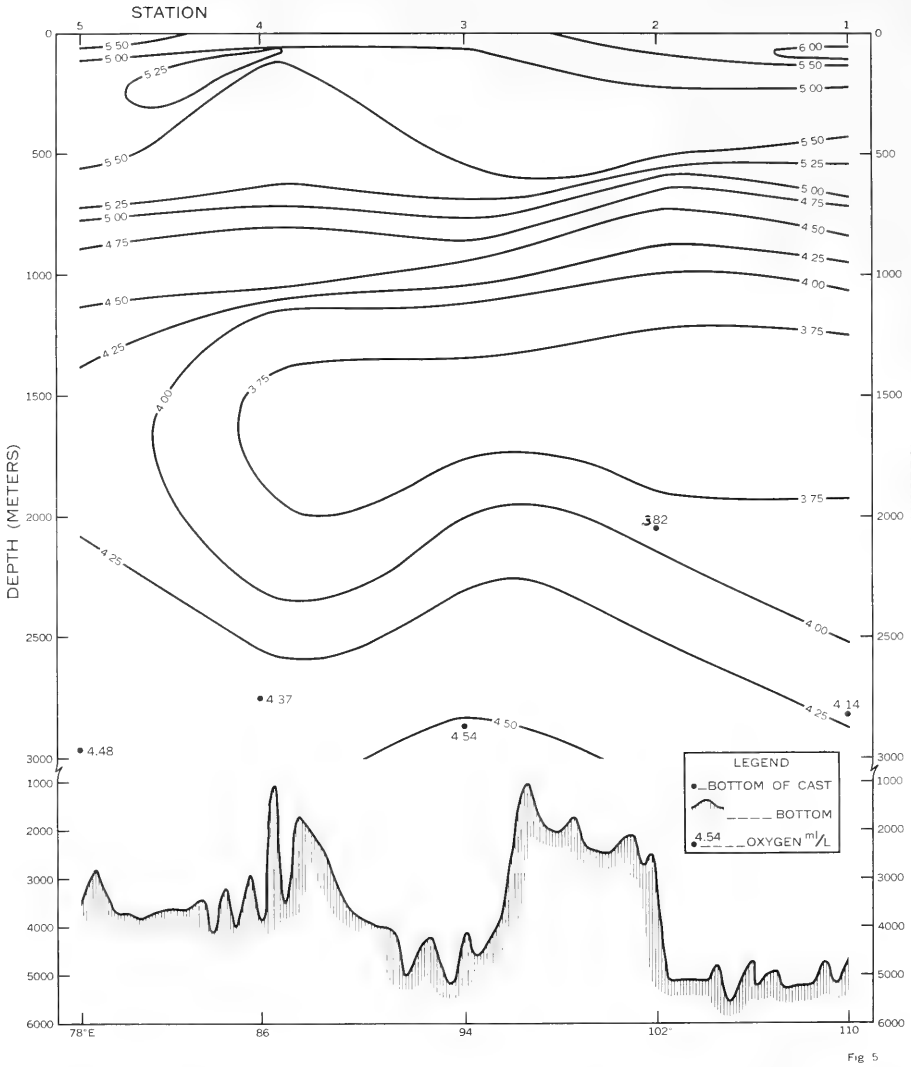


FIGURE 5. VERTICAL DISTRIBUTION OF DISSOLVED OXYGEN BETWEEN STATIONS 1 and 5.

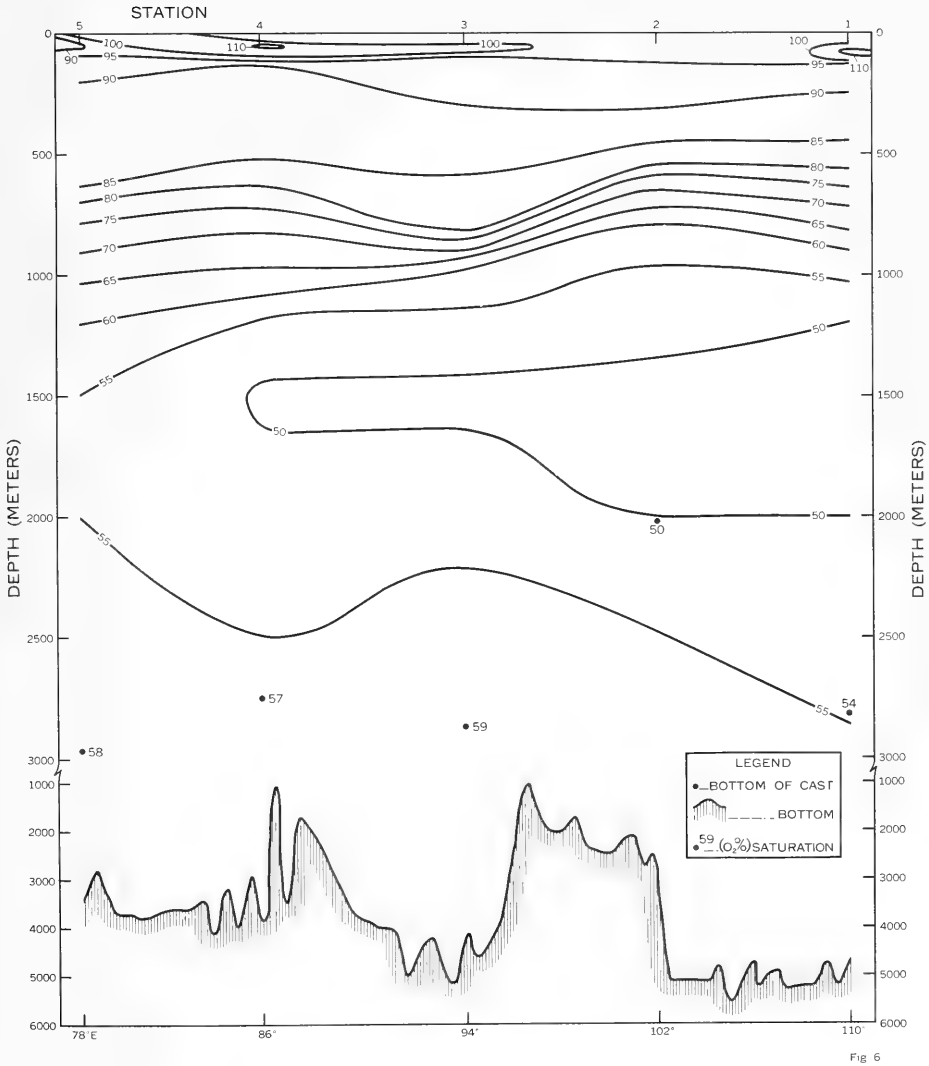


Fig 6

FIGURE 6. VERTICAL DISTRIBUTION OF PERCENTAGE OF SATURATION OF DISSOLVED OXYGEN BETWEEN STATIONS 1 and 5.

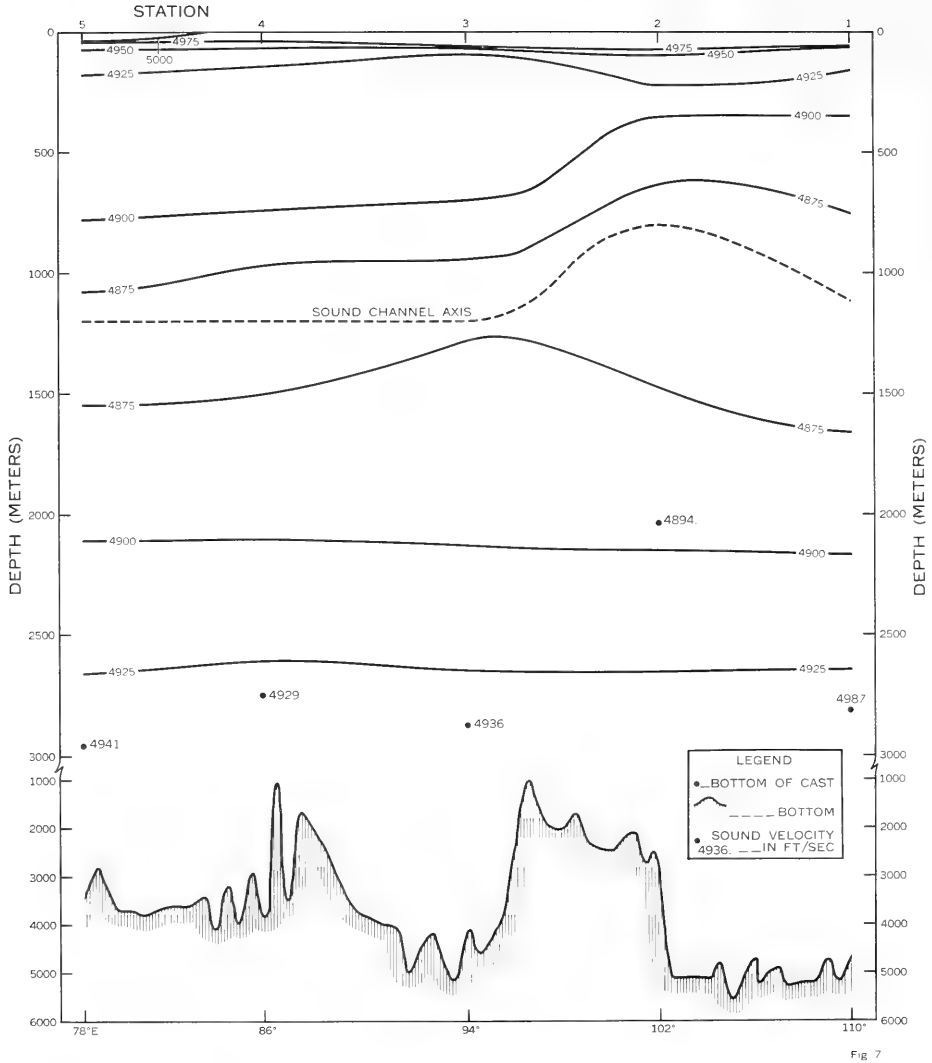


Fig. 7

FIGURE 7. VERTICAL DISTRIBUTION OF SOUND VELOCITY BETWEEN STATIONS 1 and 5.

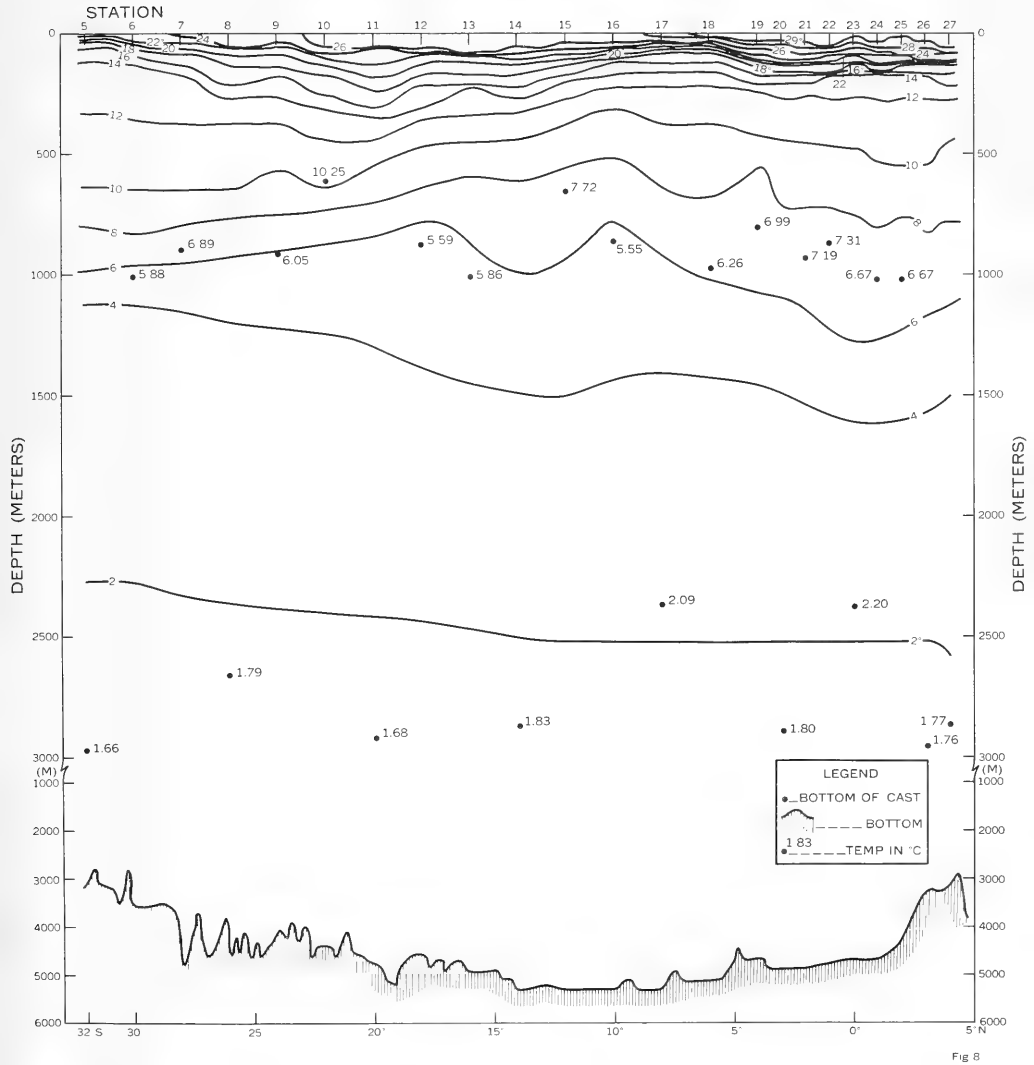


Fig 8

FIGURE 8. VERTICAL DISTRIBUTION OF TEMPERATURE BETWEEN STATIONS 5 and 27.

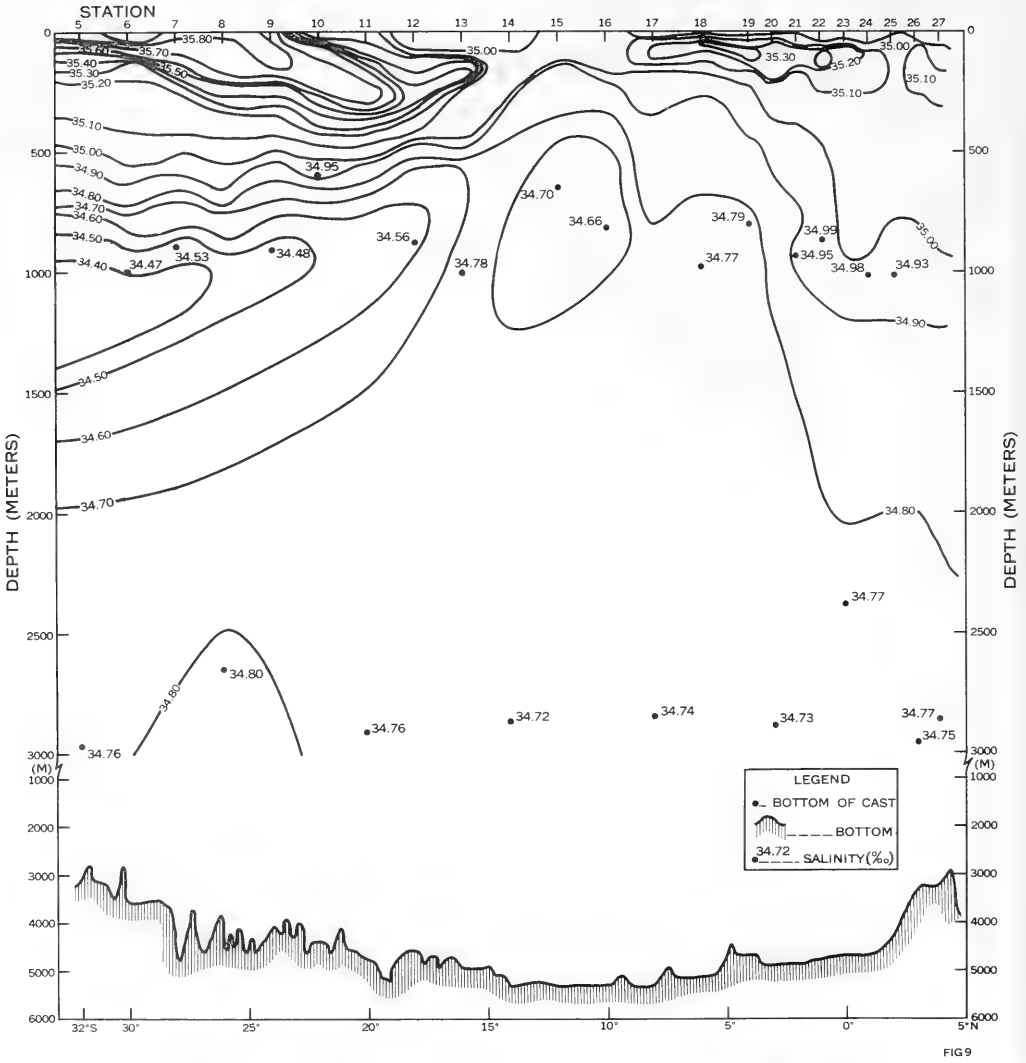


FIGURE 9. VERTICAL DISTRIBUTION OF SALINITY BETWEEN STATIONS 5 and 27.

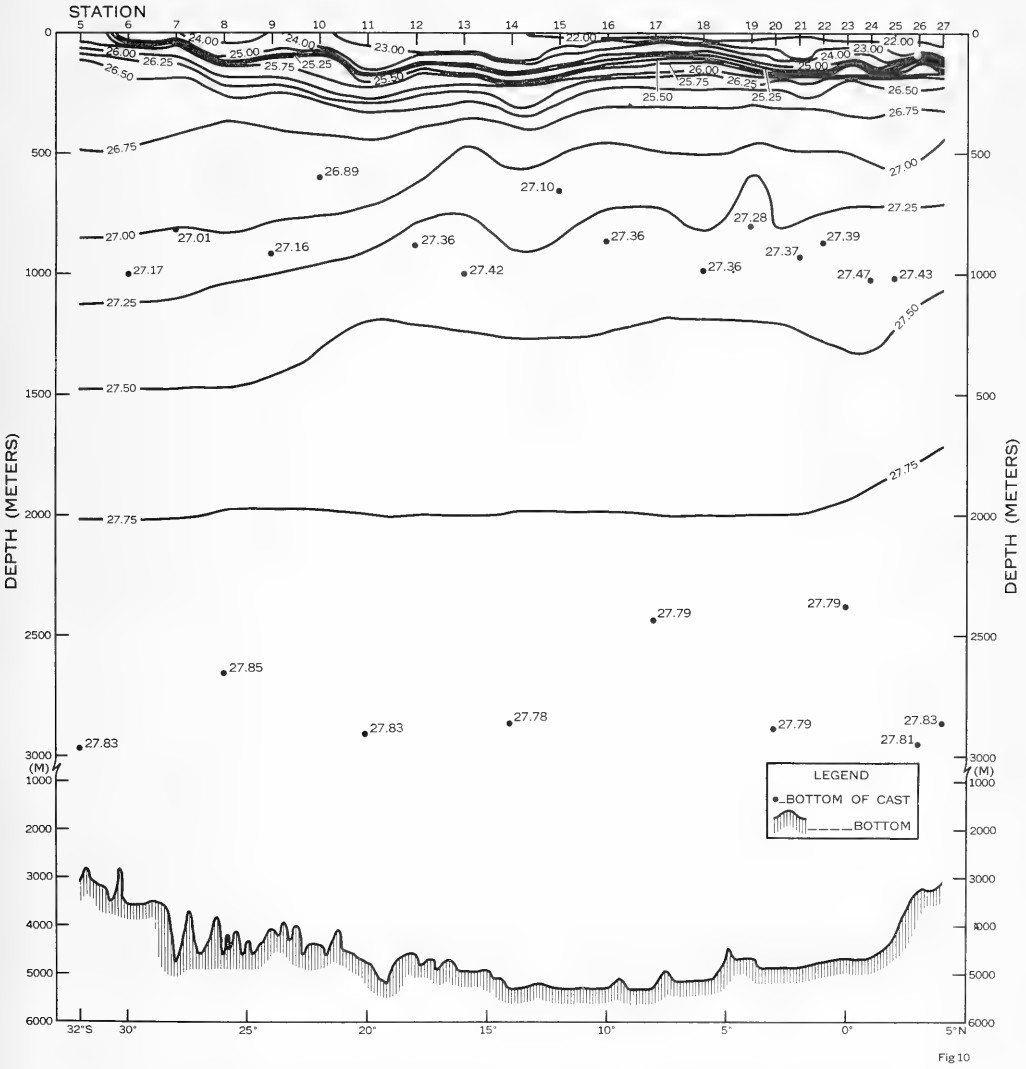


Fig 10

FIGURE 10. VERTICAL DISTRIBUTION OF DENSITY (SIGMA-T) BETWEEN STATIONS 5 and 27

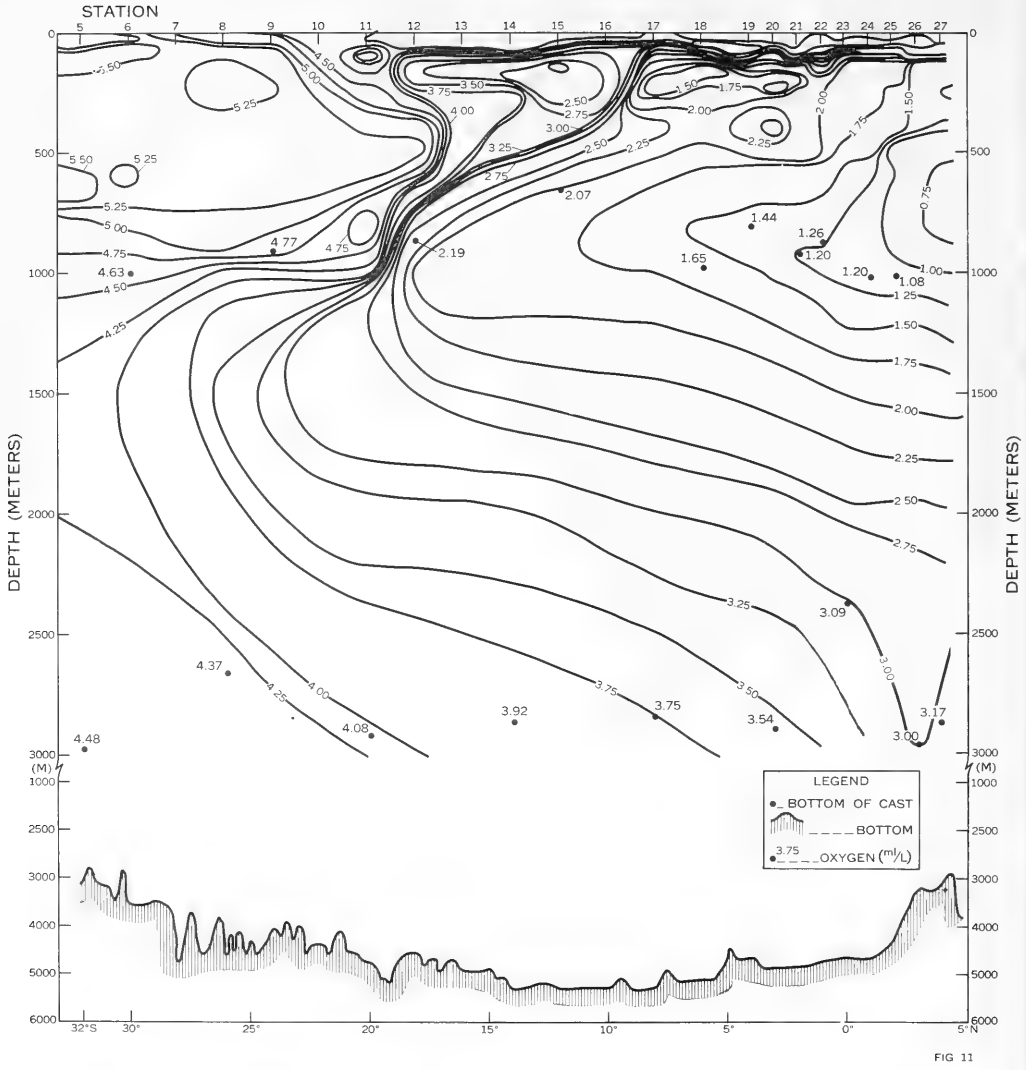


FIGURE 11. VERTICAL DISTRIBUTION OF DISSOLVED OXYGEN BETWEEN STATIONS 5 and 27.

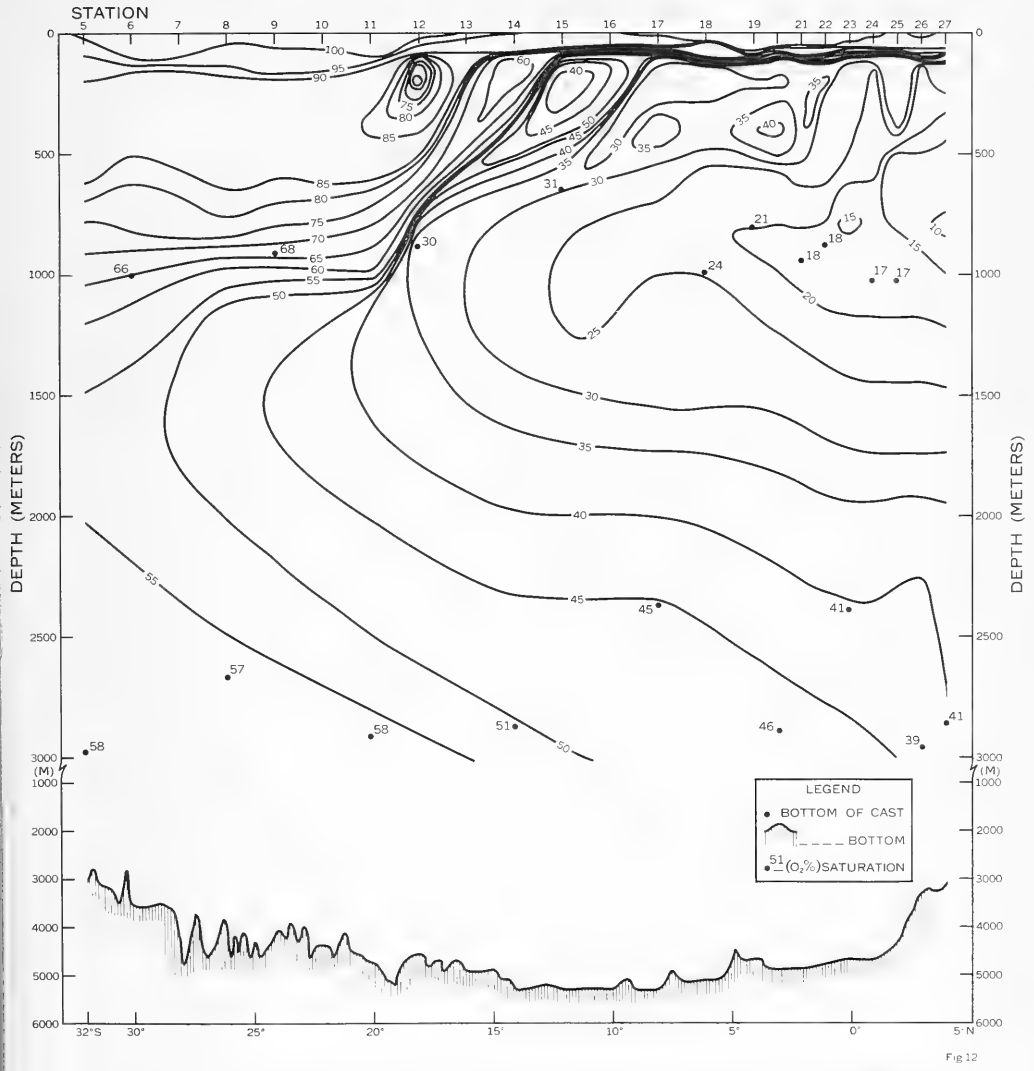


Fig 12

FIGURE 12. VERTICAL DISTRIBUTION OF PERCENTAGE OF SATURATION OF DISSOLVED OXYGEN BETWEEN STATIONS 5 and 27.

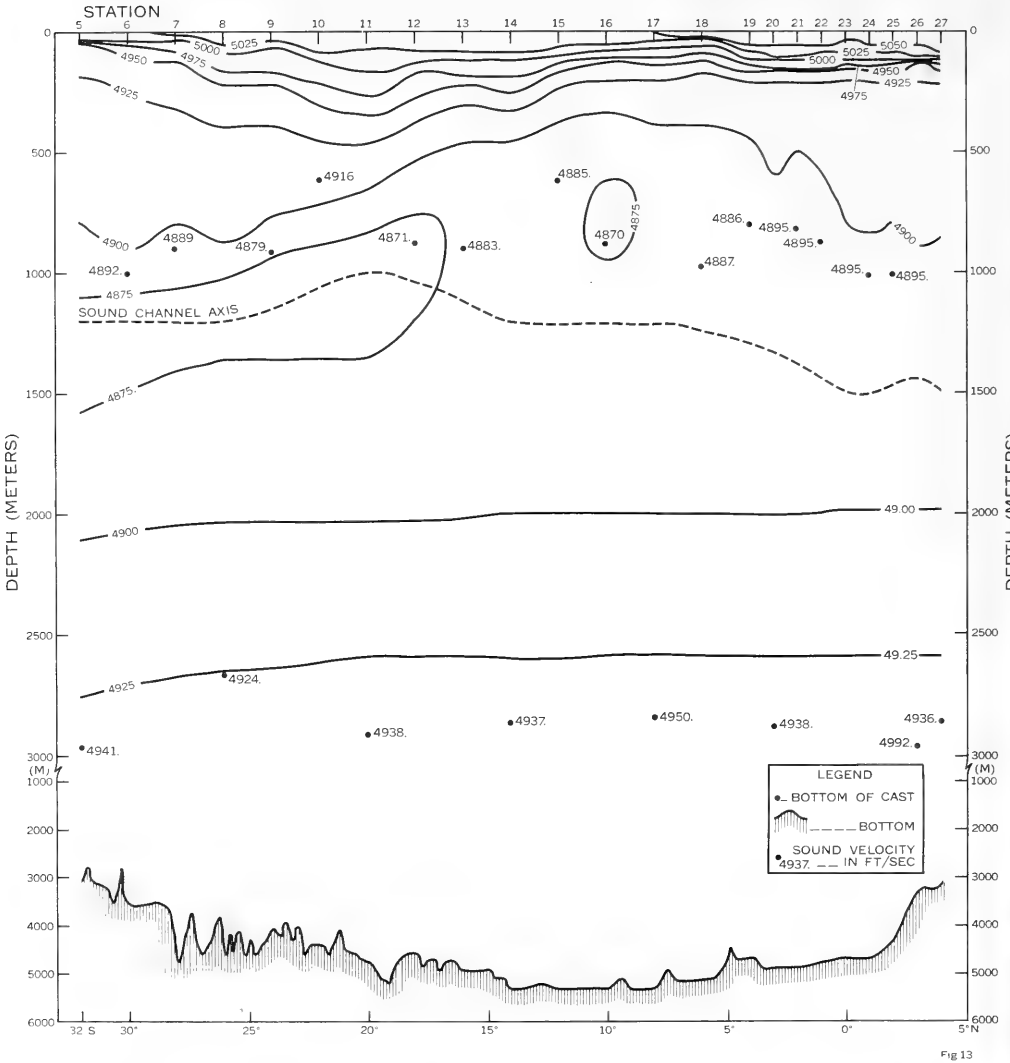


Fig 13

FIGURE 13. VERTICAL DISTRIBUTION OF SOUND VELOCITY BETWEEN STATIONS 5 and 27.

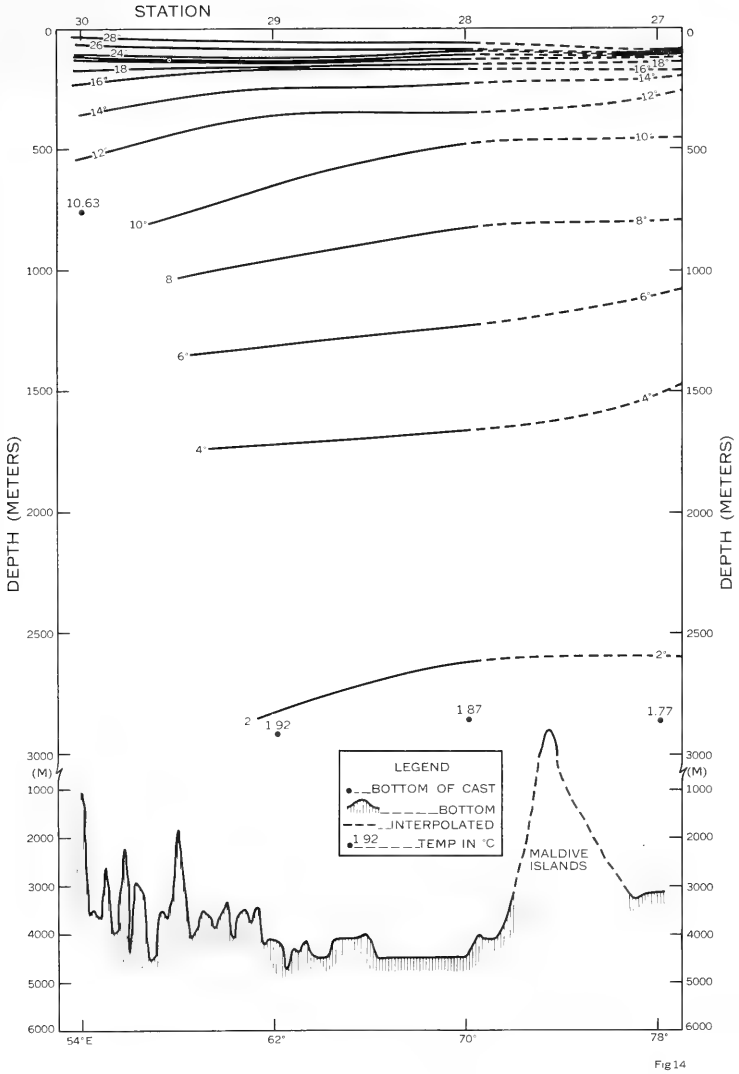


FIGURE 14. VERTICAL DISTRIBUTION OF TEMPERATURE BETWEEN STATIONS 27 and 30.

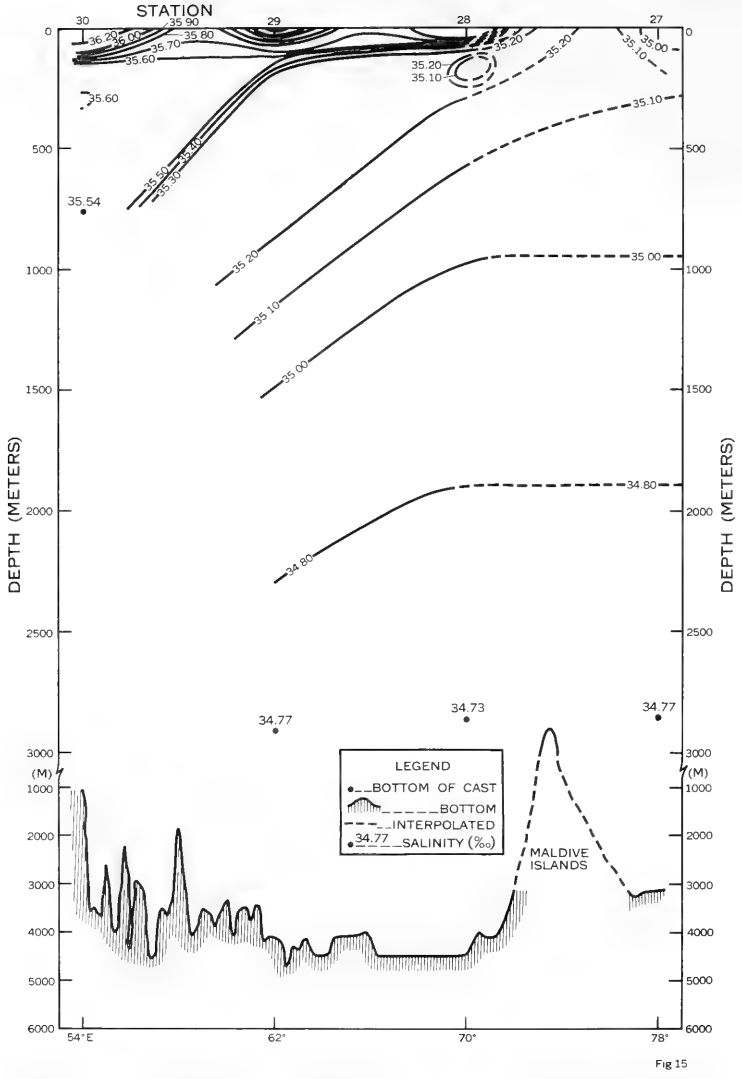


FIGURE 15. VERTICAL DISTRIBUTION OF SALINITY BETWEEN STATIONS 27 and 30.

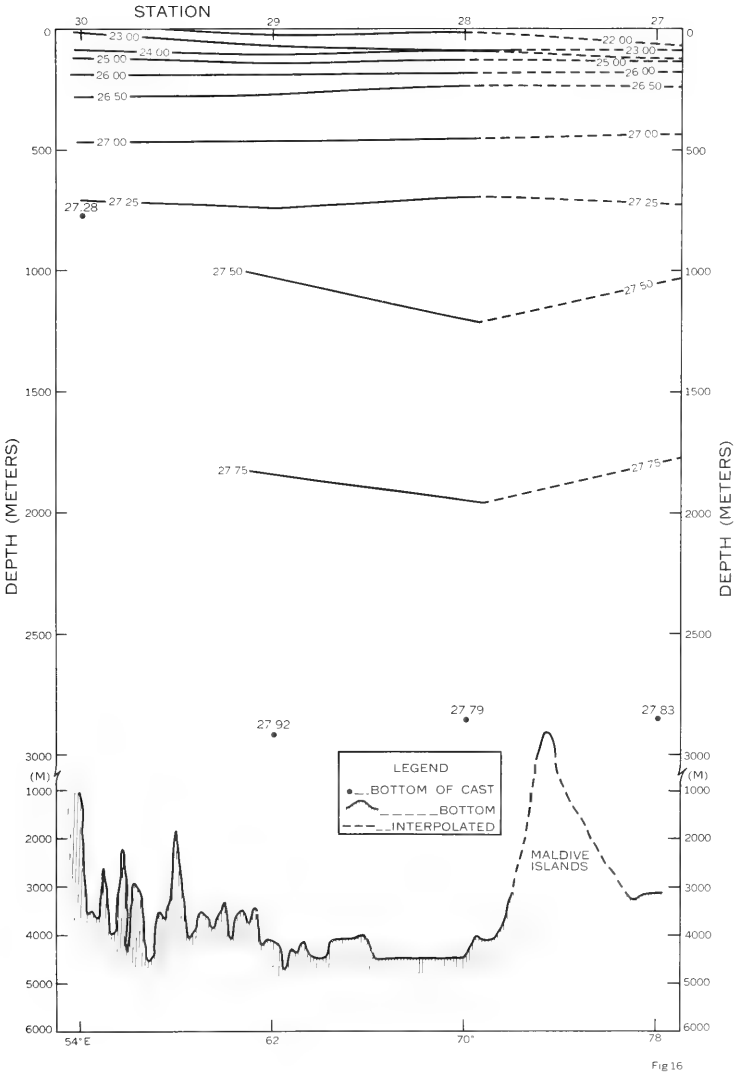


FIGURE 16. VERTICAL DISTRIBUTION OF DENSITY (SIGMA-T) BETWEEN STATIONS 27 and 30.

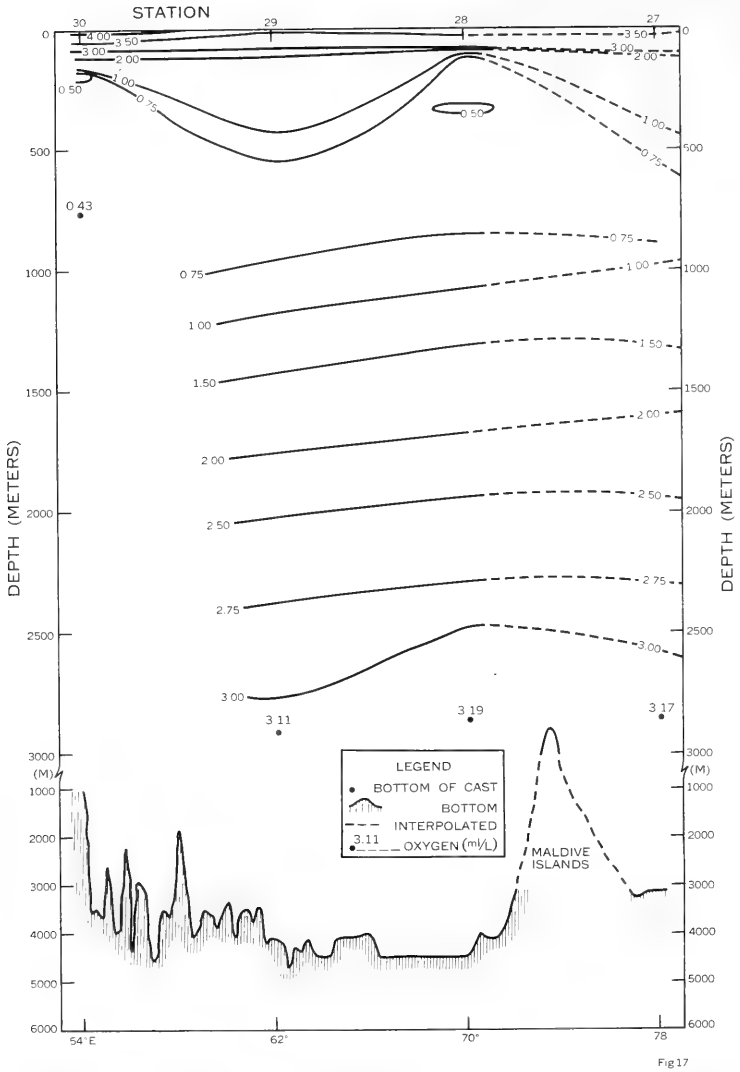


FIGURE 17. VERTICAL DISTRIBUTION OF DISSOLVED OXYGEN BETWEEN STATIONS 27 and 30.

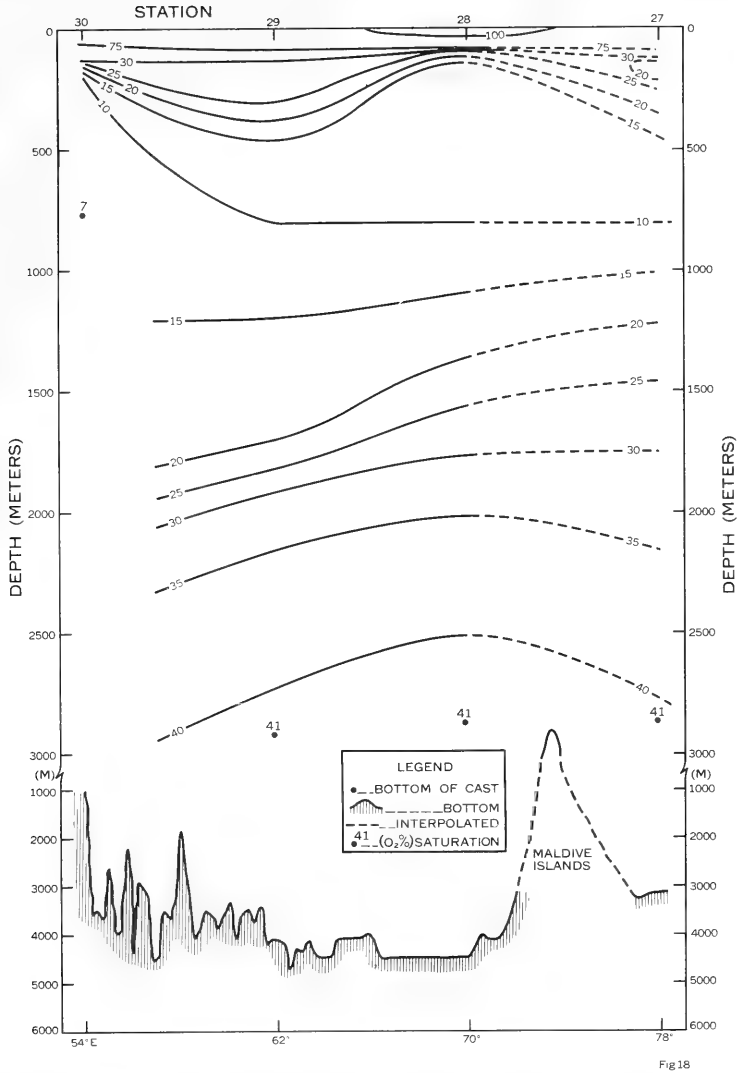


FIGURE 18. VERTICAL DISTRIBUTION OF PERCENTAGE OF DISSOLVED OXYGEN BETWEEN STATIONS 27 and 30.

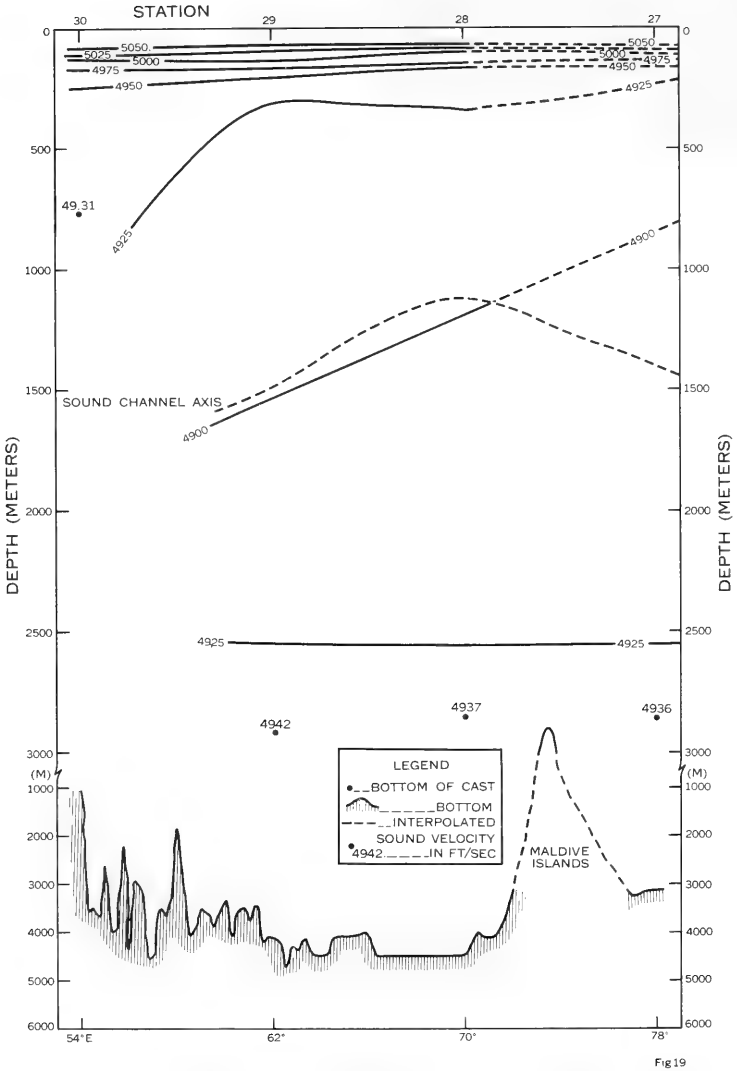
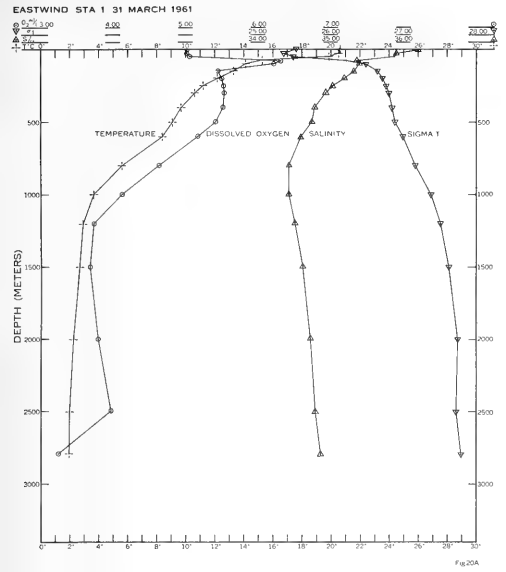
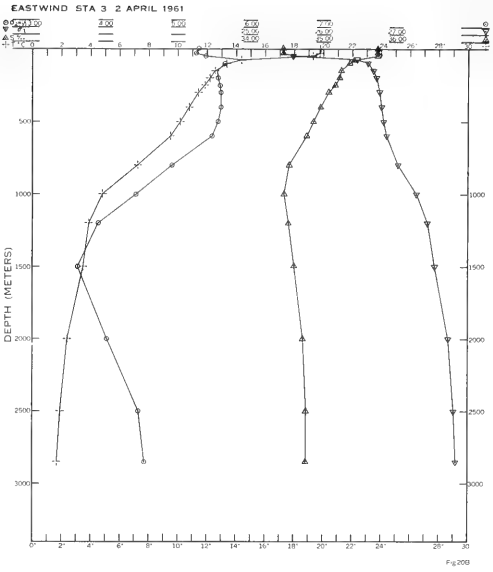
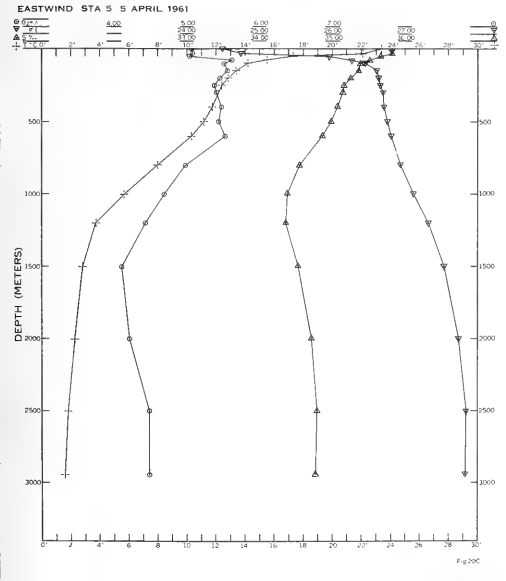


FIGURE 19. VERTICAL DISTRIBUTION OF SOUND VELOCITY BETWEEN STATIONS 27 and 30.







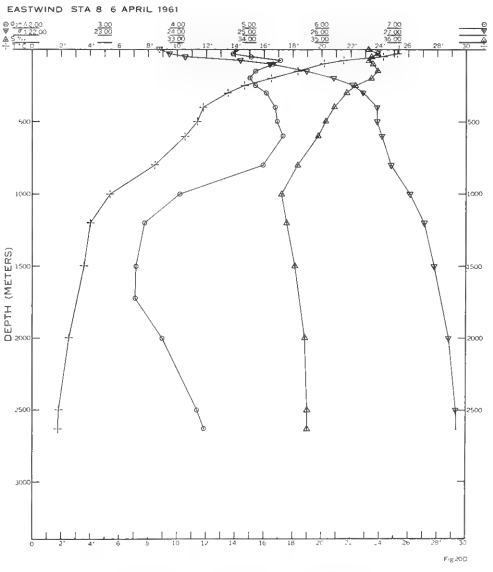
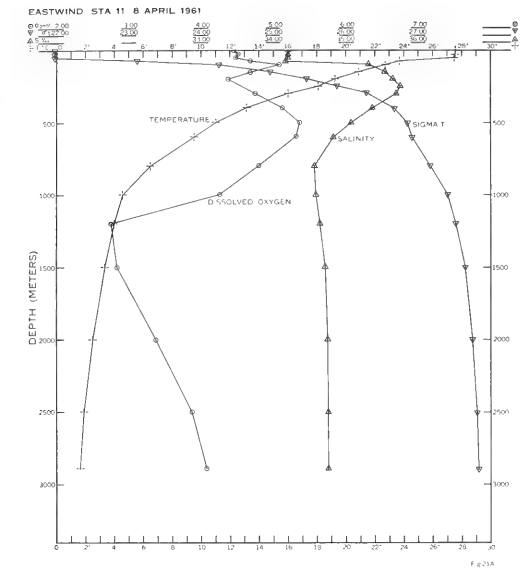
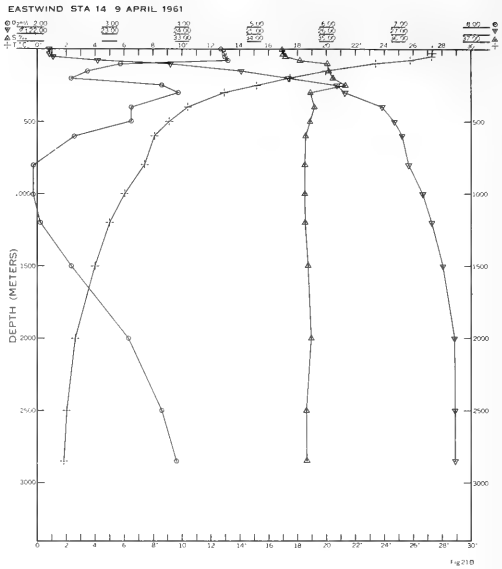
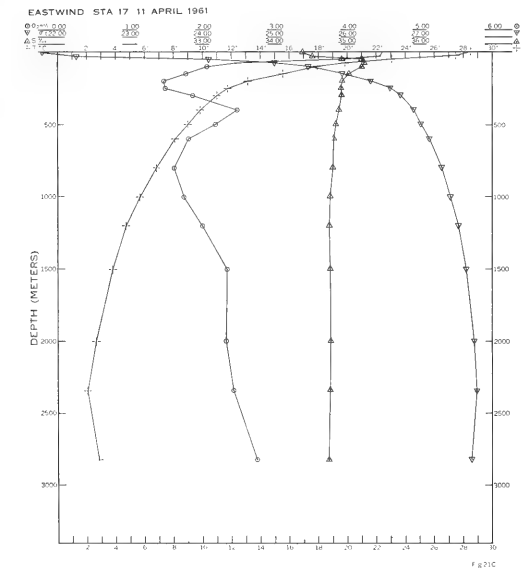


FIGURE 20. VERTICAL DISTRIBUTION OF TEMPERATURE, SALINITY, DENSITY (SIGMA-T), AND DISSOLVED OXYGEN AT STATIONS 1, 3, 5 and 8.







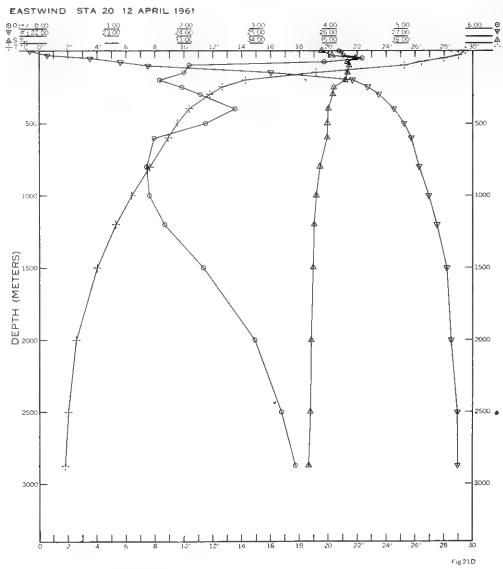
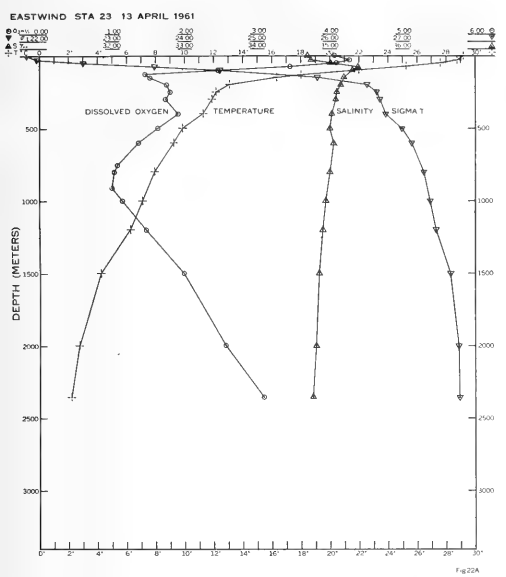
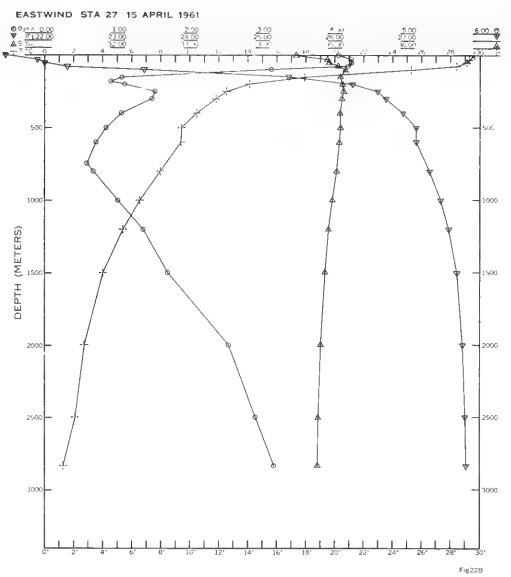
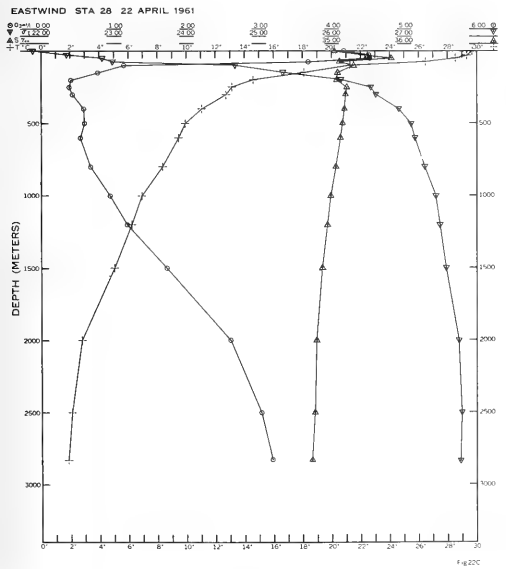


FIGURE 21. VERTICAL DISTRIBUTION OF TEMPERATURE, SALINITY, DENSITY (SIGMA-T), AND DISSOLVED OXYGEN AT STATIONS 11, 14, 17, and 20.







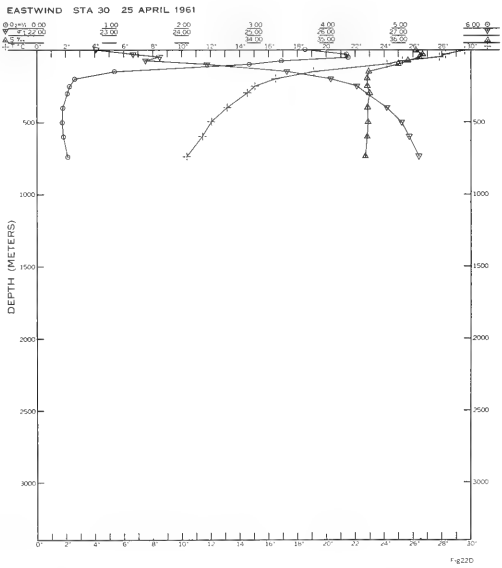
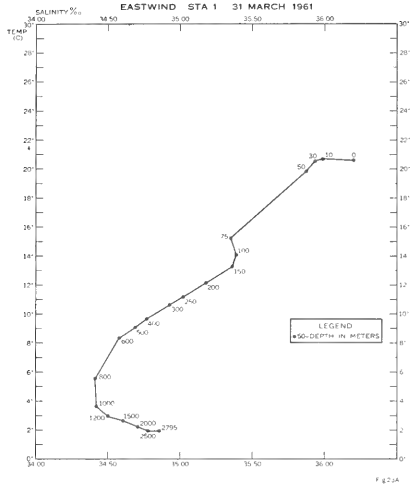
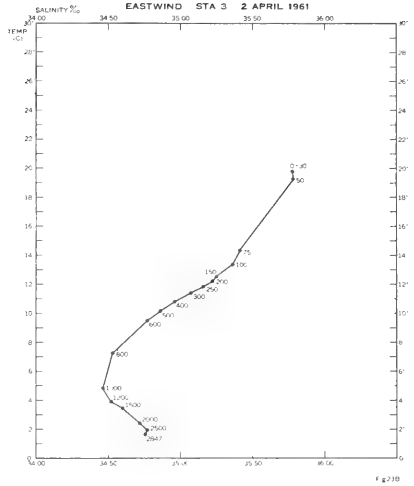
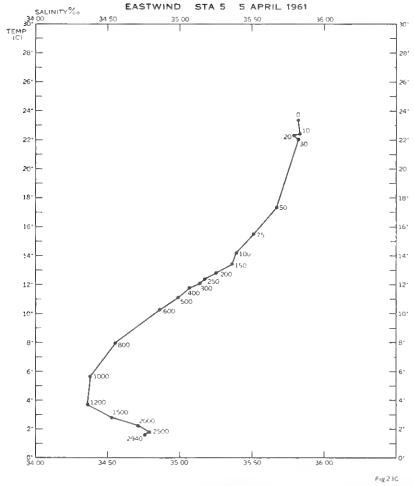


FIGURE 22. VERTICAL DISTRIBUTION OF TEMPERATURE, SALINITY, DENSITY (SIGMA-T), AND DISSOLVED OXYGEN AT STATIONS 23, 27, 28 and 30.







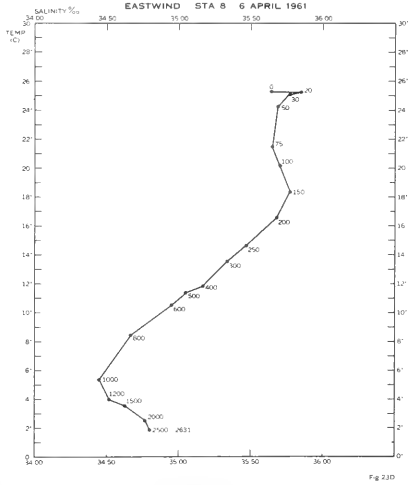
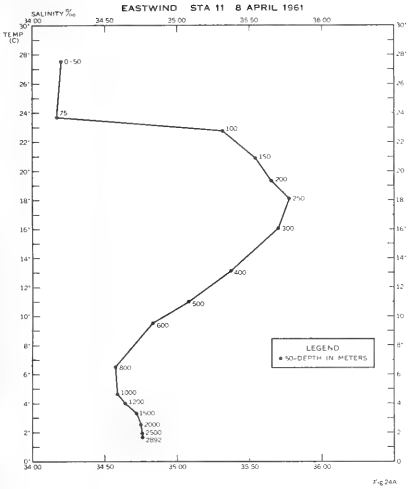
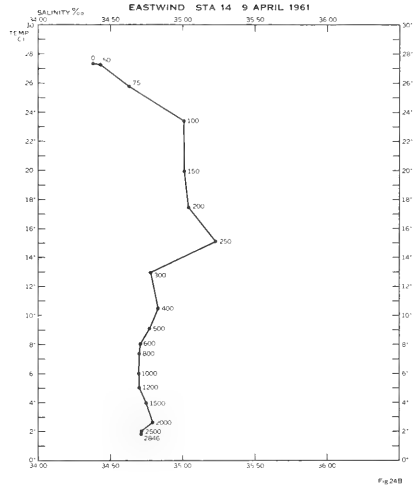
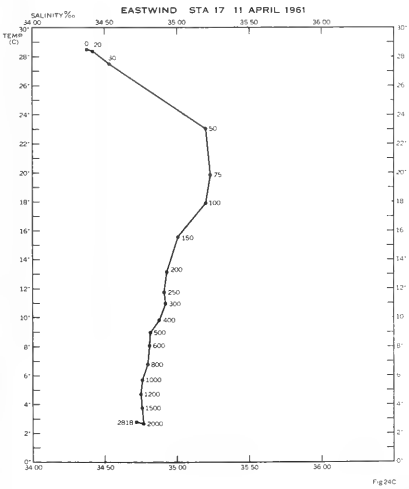


FIGURE 23. TEMPERATURE—SALINITY CURVE AT STATIONS 1, 3, 5, and 8.







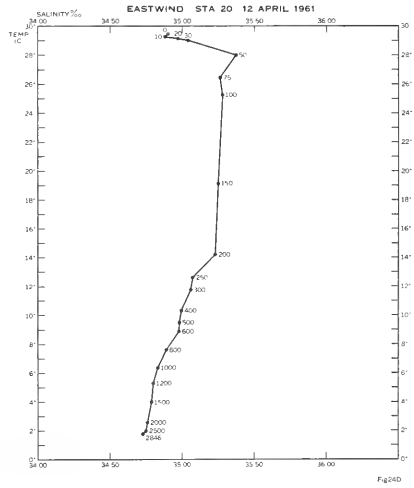
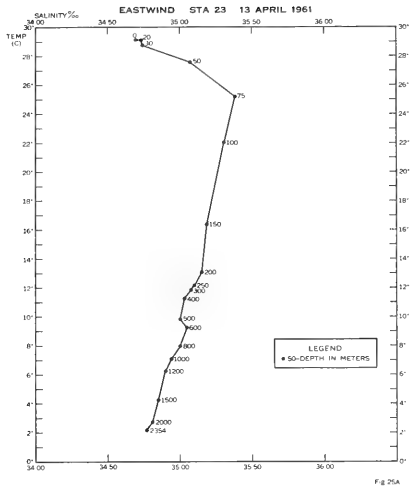
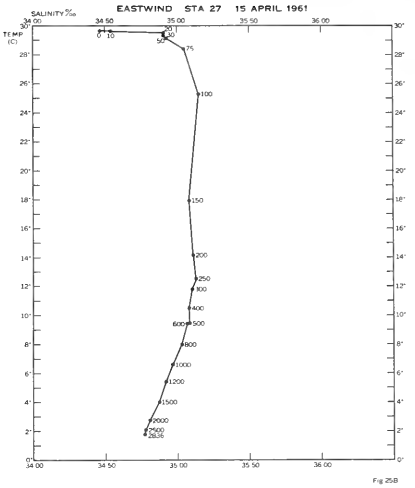
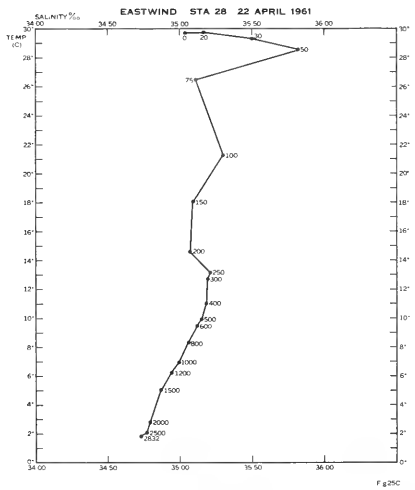


FIGURE 24. TEMPERATURE—SALINITY CURVE AT STATIONS 11, 14, 17 and 20.







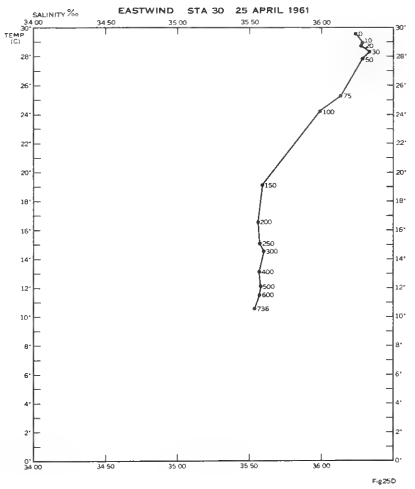


FIGURE 25. TEMPERATURE—SALINITY CURVE AT STATIONS 23, 27, 28 and 30.

IV. DISCUSSION OF RESULTS

The area of turbulence in the Indian Ocean, in the areas examined by EASTWIND, extended from the surface to a depth of about 50 meters, and in places somewhat deeper. As in other oceans, conditions in this region were fairly stable and uniform, but below this depth sudden and pronounced changes were encountered as the thermocline was reached. Below the thermocline at depths of from 200 to 600 meters, depending upon the geographic location, conditions tapered off slowly to the deepest observations. Despite the rough and variable bottom contour along the 32° S. parallel (Figs. 2 through 7), conditions did not show any striking trends. On the south-north profiles along the 78° E. meridian (Figs. 8 through 13), salinities and dissolved oxygen presented a complex pattern that indicated a divergence or upwelling between stations 11 and 16, at about 10° and 18° south latitude. The profiles constructed between stations 27 and 30 (Figs. 14 through 19), are somewhat artificial because of the wide spaces between stations and because of the existence of the Maldive Islands between stations 27 and 28. For this reason, these two stations were connected by broken line isopleths. Also, station 30, off Socotra Island, was taken at a considerably shallower depth than most of the other stations; and, as a consequence, without intervening data, isopleths at the lower depths were shown as terminating at an indefinite point.

A. Temperature

As depicted in Figures 2 and 20, temperatures along the 32° S. parallel from 110° to 78° E. in the zone of turbulence showed only a slight increase toward the west. The comparatively shallower water between 96° and 102° E. was reflected slightly in the curves of the isotherms at depth; all isotherms below the turbulence zone remained roughly parallel to the surface. The thermocline (and here the word is used in its strictest sense, namely a sustained drop of at least 1°C. per 30 meters change in depth) was located between 30 and 50 meters down to a depth of only 100 meters as far as station 5. The 2° isotherm was found throughout this section at depths between 2200 and 2500 meters. Substantially the same temperatures at depth were observed by DIAMANTINA in 1959 (C.S.I.R.O., 1962) although her temperatures were somewhat lower (17° to 19°) in the zone of turbulence because of the time of year (November) at which the temperatures were taken.

The most interesting profile is the one starting at 32° S. latitude and running north along the 78° E. meridian to 4° N. latitude. This profile comprised 23 stations. (Fig. 8, 20, 21, and 22). Stations were occupied at 2° intervals as far north at 4° S. latitude and at 1° intervals from there to 4° N. latitude. In the zone of turbulence, which showed a slight increase in depth (from 30 to 75 meters) until 13° S. was reached, temperatures increased from

23.35° C. at the surface at station 5, to a maximum of 29.68° C. at the surface at station 27. Isotherms followed an irregular pattern which reflected no indication of the divergence between 10° and 18° S. latitude. The 2°isotherm, which started at station 5 at around 2300 meters,dropped slowly to a depth of almost 2600 meters at station 27. The thermocline (again employing the term in its strict interpretation) varied from about 30 to 50 meters (at station 27, it commenced at 75 meters) to a depth of 250 to 300 meters. Below the lower limit of the thermocline proper, temperature decreased in a more or less even curve to about 1500 to 2000 meters, below which there was only a slight decrease to the bottom of the cast.

Stations 27, 28, 29, and 30 have been connected together in a section which extends from west of Ceylon to off Socotra Island at the mouth of the Gulf of Aden. A profile along this section is shown in Figure 14, while the vertical distribution of temperature at three of the stations is given in Figure 22. The bottom, which at first is fairly even, becomes highly irregular between stations 29 and 30 and shallows greatly as Socotra Island is approached. The zone of turbulence in this section decreased in extent from station 27, where it extended from the surface to a depth of 75 meters, to 30 meters depth off Socotra Island. Isotherms to a depth of about 200 meters were roughly parallel with the surface; below that depth they tended to slope downward commencing with the 16° isotherm. The 2° isotherm was found between depths of 2600 and 2850 meters, and it dropped fairly sharply between stations 28 and 29. The thermocline was found between depths of 50 and 250 meters. Below the thermocline, temperatures followed a gently arched curve to 1500-2000 meters depth, a pattern similar to that observed at the other stations occupied.

The maximum temperature observed at any station was noted at station 28 on 22 April 1961 at the surface (29.71° C). The minimum temperature was noted at a depth of 2940 meters at station 5 on 5 April 1961 (1.66° C).

B. Salinity

Figures 3, 9, and 15 show profiles of sections giving salinity values with depth along the 32° S. parallel, the south-north track along the 78° E. meridian, and from station 27 to station 30 in the northern part of the Indian Ocean. Vertical distribution of salinity at selected stations is shownin Figures 20, 21, and 22. In general, salinity values followed closely those reported by Muromtsev (1959), variations from the general pattern being caused by the time of year at which observations were made. In observations made by EASTWIND, although there was clear evidence of Antarctic Intermediate water at depth, there was no indication of Antarctic Bottom water at any of EASTWIND's stations because of the fact that casts were made only to 3000 meters.

In Figure 3, it will be noted that surface salinity values appreciably decreased from 110° to 78° E. longitude along the 32° S. parallel. Values were higher near the Australian coast and decreased as the mid-Indian Ocean area was approached. They were all well above 35.00‰ and at the easterly portion exceeded 36.00‰. In November 1959, DIAMANTINA reported almost completely uniform salinities at the surface of the order of magnitude of 35.86‰, along this parallel from 110° to 95° E. longitude (C.S.I.R.O., 1962). Isohalines were generally parallel with the surface, and salinity values decreased with depth to the 800 to 1000 meters level. At this stratum, a region of low salinity was encountered which extended some 300 meters downward. The position of this mass of low salinity water was at a somewhat higher level at the eastern end of the profile. This mass probably represented Antarctic Intermediate water from the south. Below the layer of low salinity, values increased towards the bottom. The region of low salinity also showed up in DIAMANTINA's data for the same area.

Vertical distribution of salinity is shown in Figure 20 for stations 1, 3, and 5. Here, in each case the salinity curve rather closely followed the temperature curve. The high salinity water to the east in the zone of turbulence and the intermediate layer of low salinity at 1000 meters are prominent.

Figure 9 represents a profile of salinity values from station 5 to station 27, or from 32° S. to 4° N. latitude along the 78° E. meridian. The most striking feature of this figure is the large mass of Antarctic Intermediate water of low salinity which pushed its way up from the south at depth and extends as far north as 10° S. latitude. It was probably this mass of water which caused the disturbance between 10° and 18° S. latitude. Water with a salinity of 35.00‰ or higher, which it is presumed, originated in the Arabian Sea area, can be seen to the right in the figure. This water extended in general from around 900 meters upwards to the zone of turbulence. A pocket of high salinity water was found just below the zone of turbulence between 11° S. and 2° N. Between 10° S. and 17° S. the low salinity, Antarctic Intermediate water, having a lower density, pushed the northern high salinity water closer to the surface and formed an upwelling or divergence. This upwelling is also evident in Figure 11, which shows the distribution of dissolved oxygen. There the Antarctic Intermediate water has a higher oxygen content than the Indian Ocean water. South of 19°S. somewhat higher salinities prevailed at the surface and throughout the zone of turbulence.

The vertical distribution of salinity at selected stations along the 78° E. meridian is shown in Figures 20, 21, and 22. As far north as station 8, (Fig. 20D), salinity follows the temperature curve fairly closely, but at station 11, (Fig. 21A), there is a sharp increase in salinity values below the zone of turbulence. Below 800 meters depth there was little change in salinity to the bottom of the cast. At

station 14 (Fig. 21B), the salinity curve sharply decreased between 100 and 300 meters, and from the latter depth showed only slight change to the bottom of the cast. At station 17, (Fig. 21C), the patch of high salinity water was encountered at 75 meters, and below the lower margin at 200 meters depth, conditions were relatively uniform to the bottom of the cast. At station 27 (Fig. 22B), the most northerly of this section, 35.00‰ water extended down as far as 900 meters. There was a slight increase from this point to the zone of turbulence where the salinity dropped to 34.47‰ at the surface.

In Figure 15 isohalines for stations 27, 28, 29, and 30 are shown. At the surface, there is a definite increase in salinity as the mid-Arabian Sea is approached, and this is accelerated near the Red Sea outlet at the Gulf of Aden. Furthermore, high salinity water, both from the Arabian Sea and from the Red Sea, penetrated deeper in the western end of the section. Water with salinity values of 35.00‰ or higher was found to a depth of 900 to 950 meters at station 27 (Fig. 22B), whereas at station 29 (Appendix A) it had descended below 1400 meters. Station 30 south of Socotra Island was considerably shallower than any of the other stations occupied but, nevertheless, showed the highest salinity values of any station observed because of its location in the center of the Red Sea outflow.

The vertical distribution of salinity at stations 27, 28, and 30 is shown in Figure 22 (B, C, and D). The curves for stations 27 and 28 are similar below the zone of turbulence. At station 30, however, the extremely high salinity water from the Red Sea reached a depth of 150 meters, and, from this depth to the bottom, a uniform condition of somewhat lower salinity (around 35.60‰) prevailed.

The meaning of the distribution of salinity values and their relation to the various other masses comprising the water of the Indian Ocean will be discussed in the next section under Temperature-Salinity relations. Identification of water masses can be made by salinity content. These results are further borne out by dissolved oxygen values which will be discussed in a later section.

C. Temperature-Salinity Relations

Figures 23, 24, and 25 depict the vertical distribution of temperature plotted against salinity. In Figure 23, (A, B, and C), T-S curves for stations 1, 3, and 5 along the 32° S. parallel are presented. The curves are very similar. At station 1, warm, highly saline, and less dense water was present in the zone of turbulence down to around 30 meters depth. This station was close enough to the Australian coast to be affected by the warm water current that sets south along the coast; however, only the upper waters appear to be affected by this current. Below 30 meters to about 150 meters, the waters gradually cooled and

salinity decreased. This layer is known as the Subtropical Surface Water Layer. From 150 meters down to 600 meters Indian Central Water was present. Below 600 meters the effect of the Antarctic Intermediate water was beginning to be felt, while between 600 and 1000 meters the station was in the Antarctic Intermediate water proper with low salinity. Below 1000 meters salinity increased toward the bottom of the cast while temperature dropped. The Antarctic Intermediate water is thus represented here by a tongue of low salinity water at mid-depth. It is formed at the Antarctic Convergence; there water of comparatively low salinity and temperature sinks, and the greater portion of it flows toward the north forming tongues of Antarctic Intermediate water at mid-depth which can be traced for long distances in all the oceans. Presence of Antarctic Intermediate water is also graphically portrayed in Figure 3, between depths of about 500 to 1300 meters.

The T-S curve at station 3 shows no influence of the warm coastal current along the western coast of Australia, since this station was 8 degrees farther west. Otherwise, water masses appear about as they did at station 1. The Antarctic Intermediate water extends from about 800 to 1200 meters. At station 5, Antarctic Intermediate water is found between 1000 and 1200 meters although a glance at Figure 23C will show that while the core of this mass is at 1200 meters the body extends down to around 1500 meters. Following the tongue of Antarctic Intermediate water further north on the south-north profile (Fig. 3), it will be seen that the core successively rises from 1200 meters at station 5, to 1000 meters at station 8, 800 meters at stations 11, 14, and 16.

The formation at the top of the T-S curve at station 8 (Fig. 23D) appears to be an anomaly. Possibly heavy local rainfall caused the fresher water layer to occur in the top 20 meters. EASTWIND had experienced rain neither at this station nor before arriving there. However, sudden, heavy rain squalls are frequent in these parts and are usually of very local extent. Between 20 meters and 150 meters there is Subtropical Surface water. Indian Central water is found between 150 and something under 1000 meters. Antarctic Intermediate water appears on the T-S curve between 1000 and 1200 meters.

In Figure 24A, at station 11, surface salinity had decreased sharply because of less evaporation that resulted from the increased humidity and because of the low salinity water that was brought in by the South Equatorial Current from the Malay Archipelago. An extremely sharp salinity gradient is noted between 75 and 100 meters. Below 100 meters is a fairly thin layer of Subtropical Surface water. The Indian Central water begins at about 250 meters and continues to 800 meters. Antarctic Intermediate water on the curve in Figure 24A for station 11 is between 800 and 1000 meters. Station 14 shows a T-S curve which is similar to that at station 11; the low salinity water in the upper 100 meters is from the South Equatorial Current. Below this down to 250 meters is subtropical

Surface water, and from 250 to about 600 meters is Indian Central water. The Antarctic Intermediate water had become mixed with other water and salinity had increased; however, there are some indications of this water on the T-S curve and also on Figure 9 below 600 meters.

By the time station 17 was reached, the last traces of Antarctic Intermediate Water had been left behind (Fig. 24C). The upper 50 meters contains low salinity water from the Malay Archipelago. Subtropical Surface water extends from 50 to 100 meters, and below this is the Indian Central water mass. Station 20 (Fig. 24D), shows a T-S curve similar to that at station 17. At station 23 on Figure 25A, there is an isothermal mixed surface layer. Below that, from 20 to 75 meters is Malay Archipelago water, and below that to about 500 meters Indian Central water.

Station 27, shown on Figure 25B, was taken on 15 April, with the season progressing toward maximum air temperatures in May. The top, almost isothermal, mixed, surface layer shows this. Below this, to 250 meters, is the thermocline circulation. Indian Central water is found below 250 meters. Station 28 (Fig. 25C), occupied on 22 April shows further evidence of approaching high air tempertures in the top 50 meters. From 50 meters to 200 meters the Indian Equatorial water mass is present. From 200 meters down to about 1000 meters the effect of Red Sea water is evident, with the cooler, less saline water below this level. At station 30, influence of Red Sea water is pronounced in the top 150 meters. Below 150 meters the water mass is Indian Equatorial water.

A series of 22 surface salinity samples taken from the southern entrance to the Red Sea at 12° 27' N., 44° 09' E. to the extreme end at 28° 45' N., 32° 57' E. (Table I), showed a steady and at most times regular salinity increase. Salinity (36.27‰) at the first sample location was almost exactly that found at survey station 30. This was apparently normal surface salinity for the greater part of the Gulf of Aden because of the broadening out of the water area after it passes the strait of Bab el Mendab. Half way up the Red Sea proper, salinity had reached 39.00‰, and 40.00‰ was attained before entering the narrow portion near the northern end. The highest salinity observed was at the most northern collection point. It was 41.57‰.

TABLE I. SALINITY VALUES AT THE SURFACE IN THE RED SEA, APRIL 1961

POSITION Latitude Longitude	SALINITY (‰)	WATER TEMPERATURE (F.)
12°27'N - 44°09'E	36.27	83.0
12°48'N - 43°17'E	36.40	83.3
13°43'N - 42°57'E	36.41	82.6
14°27'N - 42°27'E	36.82	82.0
15°15'N - 41°58'E	36.75	81.5
16°05'N - 41°27'E	37.50	81.9
16°55'N - 40°56'E	37.36	82.2
18°00'N - 40°17'E	37.43	82.9
18°34'N - 39°56'E	38.06	83.2
19°21'N - 39°26'E	38.38	82.9
20°08'N - 38°50'E	39.00	82.2
20°56'N - 38°16'E	39.11	81.0
21°44'N - 37°43'E	38.80	80.9
22°33'N - 37°15'E	39.66	78.7
23°21'N - 36°46'E	39.84	78.8
24°09'N - 36°16'E	39.55	78.3
25°00'N - 35°43'E	40.43	74.8
25°50'N - 35°13'E	40.26	75.0
26°37'N - 34°44'E	40.42	73.4
27°19'N - 34°16'E	40.48	73.0
27°19'N - 33°33'E	40.80	72.8
28°45'N - 32°57'E	41.57	69.0

D. Density

In Figure 4, the profile of density distribution with depth between stations 1 and 5 shows no startling features. In the zone of turbulence density decreased from east to west about one unit of sigma-t. At 50 meters depth, however, density remained nearly constant at around 26.00, and, as normally occurs, density increased with depth. The 27.00 isopleth was between 700 and 900 meters between these stations.

The profile of density distribution with depth, between stations 5 and 27 (Figure 10), shows a decided drop in density at the surface and in the zone of turbulence from south to north. Rising water temperatures are responsible for the lower densities. Commencing at about 50 meters depth, the 26.00 isopleth drops to 90 meters at station 8 and to 270 meters at station 11. North of this point, this isopleth is pushed upward by the tongue of water of lower salinity (Antarctic Intermediate water). By station 18, it has reached 150 meters depth, and from this point (5° S.) north, it remains at only a few meters below this level. The 27.00 isopleth shows considerably more of the effects of the tongue of Antarctic Intermediate water than the others. Starting at a depth of 850 meters at station 5, it is pushed up to a little under 500 meters at station 13 (16° S.) With minor up and down variations, it follows approximately this depth to the northern end of the section.

Between stations 28 and 30 (Fig. 16), there was a slight increase at the surface. This was caused by increasing salinity as the Red Sea was approached. The 26.00 isopleth almost constantly remains at a depth of about 175 meters, while the 27.00 isopleth only varies from 430 to 465 meters depth.

E. Dissolved Oxygen

The distribution of dissolved oxygen with depth between stations 1 and 5 is shown in Figure 5. Vertical distribution at selected stations along the 32° S. parallel is shown in Figure 20, A, B, and C. There was no apparent trend in the upper waters, but from around 1200 to 2000 meters a tongue of water with low oxygen extended from the east and became mixed as mid-Indian Ocean areas were reached at station 5. This is the characteristic low oxygen layer underlying Antarctic Intermediate water, which is comparatively high in oxygen. There was also water containing more oxygen below the low oxygen tongue that extended to the bottom of the casts.

In Figure 20, A. B. and C, vertical distribution curves for dissolved oxygen at stations 1, 3, and 5 are similar, and roughly follow the temperature curve below the zone of turbulence. The layer of low oxygen from the surface to 50 meters depth was apparently a result of the western coastal current of Australia.

Figure 11 shows the vertical distribution of dissolved oxygen with depth between stations 5 and 27 (32° W. and 4° N. along the 78° E. meridian). The most striking feature of this profile is the large mass of low oxygen water in the north which came in from the Arabian Sea and, to a lesser extent, from the Red Sea. To the south of the profile, this water pushed the high oxygen water upwards. Mixture of the two is clearly shown. The disturbed condition between 10° and 18° S. is also shown as in the salinity profile for the same stations.

In Figures 20,21, and 22, the vertical distribution of dissolved oxygen at selected stations along this south-north section is shown. The effect of the large body of low oxygen water is evident from the highly irregular form of the curve.

Figure 17 shows the vertical distribution of dissolved oxygen between stations 27 and 30. In the zone of turbulence, oxygen values were average, but below this depth values decreased rapidly. At station 28, the lowest values were observed. The lowest, 0.39 ml/l, occurred at 250 meters depth. Below a depth of from between 1000 and 1200 meters, where the 1.00 ml/l isopleth is shown in this profile, oxygen values increased steadily toward the bottom of the casts.

In Figure 22 B, C, and D, the vertical distribution of dissolved oxygen is shown for stations 27, 28, and 30. The very low oxygen values observed at station 28 again stand out in the peculiarly shaped curve. Station 30 shows an entirely different type of oxygen curve as values decrease very rapidly below the zone of turbulence in the layer between 100 and 200 meters, and then remain almost without change from this depth to the bottom.

F. Percentage of Saturation of Dissolved Oxygen

Supplementing a knowledge of the actual values of dissolved oxygen in oceanic waters, it is of interest to know just how much oxygen is dissolved in comparison with the amount the water could hold under standard pressure at the temperature observed. Percentages of saturation less than maximum (100%) invite questions as to why the water is not saturated, and these questions are not always easy to answer. Temperature is involved because cold water will hold more dissolved gas than warm water. Currents which bring water of low or high oxygen from other regions often account for high or low saturation percentages. Abundance or scarcity of phytoplankton or a superabundance of oxygen consuming plankton are factors to be taken into consideration. When favorable conditions prevail such as calm, clear weather, bright sunshine, and abundant phytoplankton, supersaturation in the upper waters may result. With a transparent, snowless ice cover, percentages of supersaturation as high as 300% have been noted in inland lakes.

Figures 6, 12, and 18, show vertical distribution of percentage of saturation

of dissolved oxygen. It will be noted that in general the isopleths follow very closely those for actual dissolved oxygen values (Figs. 5, 12, and 17). In Figure 6, percentages along the 32° S. parallel are shown. Saturation or slight supersaturation can be observed at the surface and in the zone of turbulence where the water was well mixed by wind and waves, and where the water was in contact with the air. Below the zone of turbulence, percentages of saturation decreased; the lowest values occurred below the level of the Antarctic Intermediate water. Here, at between 1200 and 2000 meters depth there was only 50% saturation. Saturation percentages increased below these depths as far as the bottom of the cast.

As shown in Figure 12, dissolved oxygen saturation percentages at and near the surface, which commenced at 32° S. latitude at saturation point, declined somewhat as observations reached areas farther to the north. The 100% isopleth remains well within the zone of turbulence as far north as about 16°S. Here it terminates at the surface, and beyond this point complete saturation was never regained. The advancing season with higher air temperatures and water temperatures, plus low oxygen water from the Arabian Sea accounted for the decrease in saturation as one progresses northward. The large mass of low saturation water coming in from the Arabian Sea and pushing under the upper waters is clearly shown in Figure 12. Dissolved oxygen saturation reached a low at 800 meters depth at station 27 (10%). The 10% isopleth continues at a depth of 800 meters westward (as shown in Fig. 18) past station 29. At station 30, however, it rises sharply to the 200 meter level. Surface waters attained 100% saturation only at station 28, and there was a noticeable decrease westward. Red Sea water accounted for the low saturation percentages found at station 30 where, below 150 meters, saturation was less than 10%. The lowest saturation percentages (6%) were found at station 28 at 240 meters depth and at station 30 between 400 and 600 meters. Although dissolved oxygen saturation percentages increased toward the bottom of the cast east of station 30, a high saturation value was never attained. Mixing of the low oxygen water originating in the Red Sea accounted for this.

G. Sound Velocity

Figure 7 shows vertical distribution of sound velocity between station 1 and 5. At and near the surface, sound velocity is greatest at the western or mid-Indian Ocean end of the profile. The actual value reached slightly more than 5000 feet/second. A sound channel where the velocity has decreased to 4851 to 4866 feet/second, is located at a depth of 800 meters at station 2 but drops to 1200 meters at the next station and continues at this level to the end of the profile at 78° E. longitude.

Vertical distribution of sound velocity between station 5 and 27 is shown in Figure 13. Sound velocity at the surface increases toward the north because of

salinity increase. A sound channel, which starts out at 32° S. latitude in the tongue of Antarctic Intermediate water at a depth of 1200 meters, ascends to 1000 meters at station 11 (20° S. latitude) as it follows the tip of the tongue toward the surface. North of the divergence, the sound channel again drops to 1200 meters and continues at 1200 meters as far as 6° S. At the equator, the sound channel has descended to 1500 meters and with slight variation, maintains approximately this level to the end of the profile.

Sound velocity between stations 27 and 30 (Fig. 19) shows almost no change at or near the surface. Isopleths are nearly parallel with the surface until the 4925 line,which dips sharply downward west of station 29. This dip is reflected in the location of the sound channel which rises from 1500 to 1100 meters at station 28 and then drops to 1400 meters at station 27.

H. Transparency

Secchi disc transparency was determined whenever light conditions permitted; 18 out of the 30 stations include such observations. On the southern 32° S. section three transparency readings averaged 29.5 meters and ranged from 25 to 38.7 meters. On the south-north section 12 transparencys averaged 25 meters with a range between 22 and 30 meters. Three transparencys taken at stations 28, 29, and 30, averaged 30 meters with a range of between 27 and 38 meters. The highest or best transparency observed was at station 4 (38.7 meters) and second highest or best was at station 28 (38 meters). Thus, an average of all stations measured in the Indian Ocean comes to about 26 meters transparency.

I. Deep Scattering Layer

The deep scattering layer was followed by observing the fathometer trace three times per day, and it remained between depths of between 100 and 300 fathoms until the evening of 1 April at about 104° E. longitude. That evening it was weak at 250 fathoms and was not observed again until 11 April at latitude 8° S.,when it reappeared on the trace at between 200 and 400 fathoms. It was evident also at that time that at least part of the DSL had come to the surface because of the abundance of lumenescent ctenophores, fish, and squid that were dashing around under the powerful winch light, when stations were taken at night. The DSL continued on into the waters off Ceylon, and it was followed across the northern Indian Ocean but disappeared in the Red Sea.

The disappearance of the Deep Scattering Layer in mid-Indian Ocean and its reappearance near the Indian coast duplicate its performance in the Pacific Ocean where this phenomenon has been observed several times en route to New Zealand from Panama. It is the author's belief that no DSL exists in mid-ocean because of the scarcity of plankton, hence scarcity of plankton feeders, squid, and fish.

V. ACKNOWLEDGMENTS

It is a pleasure to acknowledge the cooperation of the U. S. Coast Guard, Captain J. W. Naab, in command of the EASTWIND, his officers and crewmen, who made possible the collection of the data discussed above. When it is considered that the taking of 30 ocean stations added several days to the length of the cruise and to the lateness of arrival in Boston, EASTWIND's home port, and that the ship and crew had already been away from home many months, it is especially gratifying to recall the willingness with which each man assisted in the program to the best of his ability. The author can recall no complaints whatsoever about the part the oceanographic program was playing in delaying final anchor time in Boston, and this is an unparalleled situation in his experience.

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APPENDIX A

OCEANOGRAPHIC STATION DATA

NODC REFERENCE NUMBER 00599

EXPLANATION OF OCEANOGRAPHIC STATION DATA

A. General

Each of the items appearing on the data pages is explained below. The vertical arrows shown in some of the column headings indicate the location of decimal points. The presence of asterisks to the right of data indicates those data are doubtful; hence, they were not used in the construction of the curve from which interpolated values (standard depth values) were derived. Observed values which were obviously invalid were omitted entirely.

B. Surface Observations

1. NODC Ref.No. This number is arbitrarily assigned. It identifies the cruise and provides a means of sorting from the IBM files all cards pertaining to that particular cruise. A cruise number for each ship is presented on the flysheet for the tabulated oceanographic data.

2. Station Number. Stations are numbered to designate a certain station location; however, stations are presented in the chronological order in which they were occupied.

3. Date. Month and day are given in Arabic numerals. The last three figures of the year are indicated. The hour is Greenwich Mean Time and is that hour nearest to the start of the first cast.

4. Latitude and Longitude. The position of the station is given in degrees and minutes.

5. Sonic Depth. Sonic Depth is the uncorrected sounding for the station, recorded in meters.

6. Maximum Sample Depth. The maximum depth from which a water sample was obtained at the station is given to the nearest 100 meters.

7. Wind. Wind speed is given in meters per second. Direction from which the wind blows is coded in degrees true to the nearest ten degrees. The last zero is omitted. North is 36 on this scale and calm is 0. See Table 1, Compass Direction Conversion Table for Wind, Sea, and Swell Directions.

8. Anemometer Height. The height of the anemometer above the waterline is given in meters.

9. Barometric Pressure. Barometric pressure is coded in millibars, neglecting the 900 or 1000. Thus, 996 millibars is coded as 96 and 1008 millibars is coded as 08.

10. Air Temperature. Dry bulb and wet bulb temperatures are entered to the nearest tenth of a degree Celsius (°C). A negative temperature is coded by dropping the minus sign and adding 50; thus -10° is coded as 60.

11. Humidity. The percent of humidity is coded directly, 100 percent being coded as 99.

12. Weather. Weather is coded as indicated in Table 2, Numerical Weather Codes - Present Weather.

13. Cloud. Cloud type and amount are coded as indicated in Tables 3, Cloud Type, and 4, Cloud Amount.

14. Sea. Sea direction and amount are coded as indicated in Tables 1 and 5, respectively.

15. Swell. Swell direction and amount are coded as indicated in Tables 1 and 6, respectively.

16. Visibility. Visibility is coded as indicated in Table 7, Visibility.

C. Subsurface Observations

1. Sample Depth. Observed (actual) depth of each sample is given in meters. Interpolated values at standard depths are also given. The standard depths, in meters, are: 0, 10, 20, 30, 50, 75, 100, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1200, 1500, 2000, 2500, 3000, and thence every 1000 meters.

2. Temperature. The Celsius (°C) temperature is given in degrees and hundredths.

3. Salinity. Salinity is given in parts per thousand (by weight) to two decimal places.

4. Sigma-t. To convert to density divide by 1000 and add 1. Thus, a sigma-t value of 22.35 converts to a density of 1.02235.

5. Delta-D. The values in the columns are the anomalies of dynamic depths from the surface to each level in dynamic meters. Each entry is the cumulative sum of the anomalies of dynamic depth of the layer above. These values have been computed for the standard depths only, and serve to identify computed points.

6. Dissolved Oxygen. These values when given are in milliliters per liter to two decimal places. Values of 10.00 or above rarely occur and are coded as 9.99.

7. Sound Velocity[1]. Sound velocity is given in feet per second to one decimal place, corrected for pressure at each depth. See footnote 1 on page 6.

TABLE 1. COMPASS DIRECTION CONVERSION TABLE FOR WIND, SEA, AND SWELL DIRECTIONS

Code	Direction	Code	Direction
00	Calm	19	185° to 194°
01	5° to 14°	20	195° to 204° SSW
02	15° to 24° NNE	21	205° to 214°
03	25° to 34°	22	215° to 224°
04	35° to 44°	23	225° to 234° SW
05	45° to 54° NE	24	235° to 244°
06	55° to 64°	25	245° to 254° WSW
07	65° to 74° ENE	26	255° to 264°
08	75° to 84°	27	265° to 274° W
09	85° to 94° E	28	275° to 284°
10	95° to 104°	29	285° to 294° WNW
11	105° to 114° ESE	30	295° to 304°
12	115° to 124°	31	305° to 314°
13	125° to 134°	32	315° to 324° NW
14	135° to 144° SE	33	325° to 334°
15	145° to 154°	34	335° to 344° NNW
16	155° to 164° SSE	35	345° to 354°
17	165° to 174°	36	355° to 4° N
18	175° to 184° S	99	Variable or unknown

TABLE 2. NUMERICAL WEATHER CODES—PRESENT WEATHER

00 Cloud development NOT observed or NOT observable during past hour	01 Clouds generally dissolving or becoming less developed during past hour.	02 State of sky on the whole unchanged during past hour.	03 Clouds generally forming or developing during past hour	04 Visibility reduced by smoke	05 Haze.	06 Widespread dust in suspension in the air, NOT raised by wind, at time of observation	07 Dust or sand raised by wind, at time of observation.	08 Well developed dust devil(s) within past hour.	09 Duststorm or sandstorm within sight of or at station during past hour.
10 Light fog	11 Patches of shallow fog at station, NOT deeper than 6 feet on land	12 More or less continuous shallow fog at station, NOT deeper than 6 feet on land	13 Lightning visible, no thunder heard.	14 Precipitation within sight, but NOT reaching the ground.	15 Precipitation within sight, reaching the ground, but distant from station.	16 Precipitation within sight, reaching the ground, near to but NOT at station.	17 Thunder heard, but no precipitation at the station.	18 Squall(s) within sight during past hour.	19 Funnel cloud(s) within sight during past hour.
20 Drizzle (NOT freezing and NOT falling as showers) during past hour, but NOT at time of ob	21 Rain (NOT freezing and NOT falling as showers) during past hour, but NOT at time of ob	22 Snow (NOT falling as showers) during past hour, but NOT at time of observation	23 Rain and snow (NOT falling as showers) during past hour, but NOT at time of observation	24 Freezing drizzle or freezing rain (NOT falling as showers) during past hour, but NOT at time of observation	25 Showers of rain during past hour, but NOT at time of observation	26 Showers of snow, or of rain and snow, during past hour, but NOT at time of observation.	27 Showers of hail, or of hail and rain, during past hour, but NOT at time of observation.	28 Fog during past hour, but NOT at time of observation.	29 Thunderstorm (with or without precipitation) during past hour, but NOT at time of observation.
30 Slight or moderate duststorm or sandstorm has decreased during past hour.	31 Slight or moderate duststorm or sandstorm no appreciable change during past hour.	32 Slight or moderate duststorm or sandstorm has increased during past hour	33 Severe duststorm or sandstorm, has decreased during past hour	34 Severe duststorm or sandstorm, no appreciable change during past hour	35 Severe duststorm or sandstorm, has increased during past hour	36 Slight or moderate drifting snow, generally low	37 Heavy drifting snow, generally low	38 Slight or moderate drifting snow, generally high	39 Heavy drifting snow, generally high.
40 Fog at distance at time of observation, but NOT at station during past hour	41 Fog in patches	42 Fog, sky discernible, has become thinner during past hour	43 Fog sky NOT discernible, has become thinner during past hour	44 Fog sky discernible, no appreciable change during past hour	45 Fog sky NOT discernible no appreciable change during past hour	46 Fog, sky discernible, has begun or become thicker during past hour.	47 Fog, sky NOT discernible, has begun or become thicker during past hour.	48 Fog, depositing rime, sky discernible.	49 Fog, depositing rime, sky not discernible.
50 Intermittent drizzle (NOT freezing) slight at time of observation.	51 Continuous drizzle (NOT freezing) slight at time of observation	52 Intermittent drizzle (NOT freezing) moderate at time of ob	53 Continuous drizzle (NOT freezing) moderate at time of ob	54 Intermittent drizzle (NOT freezing), thick at time of observation	55 Continuous drizzle (NOT freezing), thick at time of observation	56 Slight freezing drizzle	57 Moderate or thick freezing drizzle.	58 Drizzle and rain, slight.	59 Drizzle and rain, moderate or heavy.
60 Intermittent rain (NOT freezing), slight at time of observation.	61 Continuous rain (NOT freezing), slight at time of observation	62 Intermittent rain (NOT freezing) moderate at time of ob.	63 Continuous rain (NOT freezing), moderate at time of observation	64 Intermittent rain (NOT freezing), heavy at time of observation	65 Continuous rain (NOT freezing), heavy at time of observation.	66 Slight freezing rain	67 Moderate or heavy freezing rain.	68 Rain or drizzle and snow, slight.	69 Rain or drizzle and snow, moderate or heavy.
70 Intermittent fall of snowflakes, slight at time of observation	71 Continuous fall of snowflakes, slight at time of observation.	72 Intermittent fall of snowflakes, moderate at time of observation.	73 Continuous fall of snowflakes, moderate at time of observation.	74 Intermittent fall of snowflakes, heavy at time of observation.	75 Continuous fall of snowflakes, heavy at time of observation.	76 Ice needles (with or without fog).	77 Granular snow (with or without fog).	78 Isolated starlike snow crystals (with or without fog).	79 Ice pellets (sleet, U. S. definition).
80 Slight rain shower(s)	81 Moderate or heavy rain shower(s)	82 Violent rain shower(s).	83 Slight shower(s) of rain and snow mixed	84 Moderate or heavy shower(s) of rain and snow mixed.	85 Slight snow shower(s)	86 Moderate or heavy snow shower(s).	87 Slight shower(s) of soft or small hail with or without rain or rain and snow mixed.	88 Moderate or heavy shower(s) of soft or small hail with or without rain or rain and snow mixed.	89 Slight shower(s) of hail, with or without rain or rain and snow mixed, not associated with thunder.
90 Moderate or heavy shower(s) of hail, with or without rain or rain and snow mixed, not associated with thunder.	91 Slight rain at time of ob.; thunderstorm during past hour, but NOT at time of observation.	92 Moderate or heavy rain at time of ob.; thunderstorm during past hour, but NOT at time of observation.	93 Slight snow or rain and snow mixed or hail at time of observation.; thunderstorm during past hour, but not at time of observations.	94 Mod. or heavy snow, or rain and snow mixed or hail at time of ob.; thunderstorm during past hour, but NOT at time of observation.	95 Slight or mod. thunderstorm without hail, but with rain and/or snow at time of observation.	96 Slight or moderate thunderstorm, with hail at time of observation.	97 Heavy thunderstorm, without hail, but with rain and/or snow at time of observation.	98 Thunderstorm combined with duststorm or sandstorm at time of observation.	99 Heavy thunderstorm with hail at time of observation.

TABLE 3. CLOUD TYPE

Code	
0	Stratus or Fractostratus
1	Cirrus
2	Cirrostratus
3	Cirrocumulus
4	Altocumulus
5	Altostratus
6	Stratocumulus
7	Nimbostratus
8	Cumulus or Fractocumulus
9	Cumulonimbus

TABLE 4. CLOUD AMOUNT

Code	
0	No clouds
1	Less than 1/10 or 1/10
2	2/10 and 3/10
3	4/10
4	5/10
5	6/10
6	7/10 and 8/10
7	9/10 and 9/10 plus
8	10/10
9	Sky obscured

TABLE 5. SEA AMOUNT

Code	Mean Max. Height of Sea Waves in feet (Approx.)	Description
0	0	Calm (glassy)
1	0 - 1/3	Calm (rippled)
2	1/3 - 1 2/3	Smooth (wavelets)
3	1 2/3 - 4	Slight
4	4 - 8	Moderate
5	8 - 13	Rough
6	13 - 20	Very rough
7	20 - 30	High
8	30 - 45	Very high
9	over 45	Phenomenal+

+ As might be expected in center of hurricane

TABLE 6. SWELL AMOUNT

Code	Approximate Height (feet)	Description		Approximate Length (feet)
0	----	No swell		----
1	1 to 6	Low swell	Short or Average	0 to 600
2			Long	Above 600
3	6 to 12	Moderate	Short	0 to 300
4			Average	300 to 600
5			Long	Above 600
6	Greater than 12	High	Short	0 to 300
7			Average	300 to 600
8			Long	Above 600
9	----	Confused		----

TABLE 7. VISIBILITY

Code		
0	Dense fog	50 yards
1	Thick fog	200 yards
2	Fog	400 yards
3	Moderate fog	1000 yards
4	Thin fog or mist	1 mile
5	Visibility poor	2 miles
6	Visibility moderate	5 miles
7	Visibility good	10 miles
8	Visibility very good	30 miles
9	Visibility excellent	Over 30 miles

TABLE 8. WATER COLOR

Code (Percent yellow)	Description
00	Deep blue
10	Blue
20	Greenish-blue (or green blue)
30	Bluish-green (or blue green)
40	Green
50	Light Green
60	Yellowish-green
70	Yellow green
80	Green yellow
90	Greenish-yellow
99	Yellow

D. Additional information given on each station data sheet includes:

(1) The number of casts taken, the wire angle observed, the number of Nansen bottles used, and the type thermometers used.

(2) The number of protected thermometers considered to have functioned properly. (Indicated as accepted).

(3) The number of unprotected thermometers considered to have functioned properly. (Indicated as accepted when the computed thermometric depth was within $\pm$ 1% of the accepted depth between 0 and 1000 meters and $\pm$ 0.5% of the accepted depth below 1000 meters.)

Table 9 gives a summary of the paired protected thermometer readings for cruise 00599.

Table 9. SUMMARY OF PAIRED PROTECTED THERMOMETER READINGS, CRUISE 00599.

Total Number of Pairs Used During Cruise	DIFFERENCE °C. BETWEEN PAIRED THERMOMETERS Accepted and Averaged								One Thermometer of Pair Not Accepted
	.00	.01	.02	.03	.04	.05	.06	>.06	
391	39	78	68	41	41	26	11	12	75*
% of Total	10.	19.9	17.4	10.5	10.5	6.6	2.8	3.1	19.2

* Both readings of one pair were rejected.

Consec. Sta. No. 1 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0001	03	31	1961	04	32° 00′ S	110° 00′ E	5029	28

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
07	20		14	17 3	14 3		02	4	6	22	3			7	00	25

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	$\Sigma\Delta D$ ↓	O_2 ml/l ↓	V_t ↓
STD	0000	20 65				5 02	
OBS	0000	20 65	36 20*	25 52*		5 02	4993 0*
STD	0010	20 64				5 03	
OBS	0010	20 64	35 99*	25 36*		5 03	4992 8*
OBS	0019	20 62	35 93	25 32		5 02	4992 9
STD	0020	20 61	35 93	25 33		5 03	4992 9
OBS	0029	20 54	35 93	25 34		5 09	4992 8
STD	0030	20 53	35 93	25 35		5 09	4992 7
OBS	0048	20 41	35 94	25 39		5 14	4992 8
STD	0050	19 85	35 87	25 48		5 28	4987 5
OBS	0072	15 43	35 34	26 16		6 31	4943 8
STD	0075	15 24	35 35	26 21		6 31	4942 0
OBS	0097	14 15	35 39	26 47		6 29	4932 0
STD	0100	14 11	35 39	26 48		6 21	4931 7
OBS	0145	13 41	35 38	26 62		5 44	4926 8
STD	0150	13 30	35 36	26 63		5 44	4925 8
OBS	0193	12 36	35 21	26 70		5 48	4917 3
STD	0200	12 18	35 18	26 71		5 50	4915 6
OBS	0242	11 30	35 03	26 76		5 58	4907 5
STD	0250	11 21	35 02	26 77		5 60	4906 9
OBS	0291	10 76	34 95	26 80		5 65	4903 8
STD	0300	10 65	34 93	26 80		5 63	4903 0
OBS	0368	09 93	34 80	26 83		5 52	4898 0
STD	0400	09 70	34 77	26 84		5 54	4897 0
OBS	0460	09 30	34 72	26 87		5 58	4895 5
STD	0500	09 11	34 69	26 88		5 41	4895 4
OBS	0553	08 76	34 64	26 89		5 24	4894 1
STD	0600	08 39	34 58	26 91		5 17	4892 0
OBS	0645	07 91	34 53	26 94		5 06	4888 5
OBS	0737	06 51	34 45	27 07		4 68	4875 7
STD	0800	05 60	34 41	27 16		4 63	4867 3
OBS	0922	04 20	34 39	27 30		4 42	4855 5
STD	1000	03 66	34 42	27 38		4 11	4852 8
OBS	1107	03 03	34 46	27 47		3 80	4850 5
STD	1200	02 95	34 50	27 51		3 73	4855 0
OBS	1385	04 39*	34 57	27 42*		3 64	4886 4*
STD	1500	02 68	34 61	27 62		3 67	4869 5
OBS	1852	02 38	34 70	27 72		3 76	4886 4
STD	2000	02 22	34 71	27 74		3 79	4892 9
OBS	2321	01 99	34 74	27 79		3 89	4908 7
STD	2500	01 97	34 78	27 82		3 97	4919 2
OBS	2795	01 95	34 86	27 89		4 14	4936 7

Sta. No. 1

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	15°	11	20	17	2	0
II	25°	11	17	15	5	1

Consec. Sta. No. 2

SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0002	04	01	1961	14	32° 00′ S	102° 00′ E	3383	20

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR	AMT	DIR	AMT.		COL.	TRANS
07	27		20	19 8	17 8		50	8	5	26	2			7	00	

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	$\Sigma \Delta D$ ↓	O_2 ml/l ↓	V_f ↓
STD	0000	20 02	35 90	25 46	0 000	5 27	4986 2
OBS	0000	20 02	35 90	25 46		5 27	4986 2
STD	0010	20 03	35 91	25 47	0 025	5 33	4987 0
OBS	0010	20 03	35 91	25 47		5 33	4987 0
OBS	0019	20 02	35 91	25 47		5 19	4987 4
STD	0020	20 02	35 91	25 47	0 051	5 20	4987 5
OBS	0029	20 02	35 90	25 46		5 27	4988 0
STD	0030	20 02	35 90	25 46	0 076	5 26	4988 0
OBS	0048	20 00	35 92	25 48		5 20	4989 0
STD	0050	19 92	35 91	25 49	0 126	5 22	4988 3
OBS	0072	18 55	35 81	25 77		5 44	4976 5
STD	0075	18 17	35 79	25 85	0 185	5 47	4973 0
OBS	0097	15 93	35 67	26 30		5 63	4951 6
STD	0100	15 80	35 66	26 32	0 234	5 61	4950 5
OBS	0145	14 32	35 51	26 53		5 42	4937 1
STD	0150	14 26	35 51	26 54	0 316	5 42	4936 8
OBS	0193	13 58	35 44	26 63		5 43	4931 7
STD	0200	13 41	35 41	26 64	0 391	5 44	4930 2
OBS	0242	12 45	35 25	26 71		5 52	4921 4
STD	0250	12 32	35 22	26 72	0 463	5 57	4920 3
OBS	0290	11 52	35 07	26 75		5 69	4913 0
STD	0300	11 19	35 01	26 77	0 532	5 66	4909 6
OBS	0335	10 27	34 84	26 80		5 58	4900 2
STD	0400	09 56	34 75	26 85	0 664	5 58	4895 2
OBS	0400	09 56	34 75	26 85		5 58	4895 2
OBS	0465	09 02	34 66	26 87		5 66	4892 1
STD	0500	08 87	34 64	26 88	0 793	5 51	4892 3
OBS	0535	08 58	34 62	26 91		5 36	4890 7
STD	0600	07 38	34 54	27 02	0 914	4 99	4879 2
OBS	0670	06 21				4 67	
STD	0800	04 38	34 38	27 28	1 117	4 32	4850 7
OBS	0805	04 32	34 38	27 28		4 31	4850 2
STD	1000	03 97	34 37	27 31	1 291	3 99	4856 9
OBS	1010	05 74*	34 37	27 11*			4881 5*
STD	1200	03 61	34 45	27 41	1 454	3 76	4864 1
OBS	1350	03 33	34 52	27 49		3 65	4869 4
STD	1500	03 02	34 62	27 60	1 660	3 64	4874 3
OBS	1680	02 70	34 69	27 69		3 62	4880 8
STD	2000	02 26	34 70	27 73	1 928	3 81	4893 5
OBS	2015	02 24	34 70	27 73		3 82	4894 1

Sta. No.	Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
				Protected		Unprotected	
				Used	Accepted	Used	Accepted
2	I	10°	11	20	19	2	0
	II	28°	11	17	15	5	0

Consec. Sta. No. 3 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0003	04	02	1961	24	32° 09′ S	093° 49′ E	4114	28

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
07	02		28	18 1	15 6		80	9	9	16	2			7	00	25

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ Δ D ↓	O_2 ml/l ↓	V_t ↓
STD	0000	19 79	35 77	25 42	0 000	5 28	4983 6
OBS	0000	19 79	35 77	25 42		5 28	4983 6
STD	0010	19 78	35 79	25 44	0 026	5 26	4984 2
OBS	0010	19 78	35 79	25 44		5 26	4984 2
STD	0020	19 80	35 77	25 42	0 051	5 24	4984 9
OBS	0020	19 80	35 77	25 42		5 24	4984 9
OBS	0029	19 78	35 76	25 42		5 24	4985 2
STD	0030	19 77	35 77	25 43	0 077	5 25	4985 3
OBS	0049	19 55	35 81	25 52		5 35	4984 5
STD	0050	19 26	35 79	25 58	0 127	5 39	4981 8
OBS	0074	14 40	35 41	26 44		5 87	4933 4
STD	0075	14 35	35 41	26 45	0 178	5 86	4932 9
OBS	0098	13 43	35 37	26 61		5 66	4924 2
STD	0100	13 38	35 36	26 61	0 216	5 65	4923 7
OBS	0147	12 56	35 25	26 69		5 49	4917 0
STD	0150	12 55	35 25	26 69	0 288	5 54	4917 1
OBS	0197	12 28	35 22	26 72		5 70	4916 7
STD	0200	12 26	35 22	26 73	0 357	5 55	4916 7
OBS	0246	11 88	35 17	26 76		4 45	4914 9
STD	0250	11 84	35 16	26 76	0 425	4 58	4914 7
OBS	0295	11 44	35 08	26 78		5 61	4912 4
STD	0300	11 41	35 07	26 77	0 493	5 60	4912 3
OBS	0373	10 98	34 99	26 79		5 56	4911 4
STD	0400	10 79	34 96	26 80	0 628	5 59	4910 6
OBS	0467	10 35	34 89	26 82		5 60	4909 2
STD	0500	10 17	34 86	26 83	0 762	5 56	4908 9
OBS	0561	09 79	34 81	26 86		5 49	4907 7
STD	0600	09 51	34 77	26 87	0 894	5 47	4906 5
OBS	0654	09 06	34 71	26 90		5 38	4904 0
OBS	0748	08 09	34 60	26 97		5 03	4897 2
STD	0800	07 26	34 53	27 03	1 141	4 93	4889 5
OBS	0936	05 47	34 43	27 19		4 63	4873 7
STD	1000	04 82	34 46	27 29	1 347	4 43	4868 9
OBS	1124	03 93	34 50	27 42		4 09	4864 3
STD	1200	03 90	34 52	27 44	1 513	3 90	4868 4
OBS	1408	03 80	34 57	27 49		3 58	4879 6
STD	1500	03 50	34 60	27 54	1 728	3 62	4881 0
OBS	1882	02 56	34 69	27 70		3 87	4890 7
STD	2000	02 43	34 72	27 73	2 016	4 03	4896 0
OBS	2361	02 08	34 78	27 81		4 38	4912 6
STD	2500	01 96	34 77	27 81	2 238	4 46	4919 0
OBS	2847	01 69	34 76	27 83		4 54	4935 5

Sta. No. 3

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	10°	11	20	20	2	2
II	5°	11	17	17	5	3

Consec. Sta. No. 4

SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0004	04	04	1961	08	31° 59′ S	085 35′ E	3795	27

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ▼	WET ▼			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
04	09		27	23 3	18 1		02	4	3	10	2			7	00	39

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ▼		S‰ ▼		σ_t ▼		Σ Δ D ▼		O_2 ml/l ▼		V_f ▼	
STD	0000	21	31	35	69	24	95	0	000	4	48	4997	0
OBS	0000	21	31	35	69	24	95			4	48	4997	0
STD	0010	21	07	35	68	25	01	0	030	5	04	4995	5
OBS	0010	21	07	35	68	25	01			5	04	4995	5
STD	0020	21	07	35	70	25	03	0	059	5	08	4996	1
OBS	0020	21	07	35	70	25	03			5	08	4996	1
STD	0030	21	07	35	73	25	05	0	089	5	03	4996	8
OBS	0030	21	07	35	73	25	05			5	03	4996	8
STD	0050	18	27	35	53	25	63	0	142	6	05	4971	5
OBS	0050	18	27	35	53	25	63			6	05	4971	5
STD	0075	15	34	35	47	26	28	0	194	6	16	4943	5
OBS	0075	15	34	35	47	26	28			6	16	4943	5
STD	0100	14	23	35	44	26	50	0	236	5	61	4933	2
OBS	0100	14	23	35	44	26	50			5	61	4933	2
STD	0150	13	12	35	33	26	64	0	311	5	33	4923	7
OBS	0150	13	12	35	33	26	64			5	33	4923	7
STD	0200	12	49	35	26	26	71	0	382	5	40	4919	4
OBS	0200	12	49	35	55*	26	94*			5	40	4920	5*
STD	0250	12	13	35	19	26	73	0	452	5	39	4918	0
OBS	0250	12	13	35	19	26	73			5	39	4918	0
STD	0300	11	81	35	12	26	74	0	521	5	34	4917	1
OBS	0300	11	81	35	12	26	74			5	34	4917	1
OBS	0329	11	66	35	08	26	73			5	43	4917	0
STD	0400	11	32	35	03	26	76	0	660	5	40	4917	1
OBS	0414	11	23	35	02	26	77			5	40	4916	8
OBS	0498	10	60	34	93	26	81			5	45	4914	1
STD	0500	10	58	34	93	26	82	0	798	5	45	4914	0
OBS	0583	09	92	34	84	26	86			5	32	4910	7
STD	0600	09	80	34	82	26	87	0	931	5	30	4910	2
OBS	0670	09	22	34	74	26	90			5	17	4907	0
STD	0800	07	62	34	58	27	02	1	181	4	75	4894	2
OBS	0846	07	04	34	53	27	06			4	66	4889	4
STD	1000	04	94	34	41	27	24	1	395	4	59	4870	3
OBS	1025	04	69	34	40	27	26			4	55	4868	4
STD	1200	03	86	34	48	27	41	1	568	3	89	4867	7
OBS	1294	03	50	34	52	27	48			3	65	4868	4
STD	1500	03	10	34	60	27	58	1	779	3	68	4875	4
OBS	1761	02	67	34	68	27	68			3	71	4885	1
STD	2000	02	37	34	75	27	76	2	048	3	89	4895	3
OBS	2232	02	13	34	79	27	81			4	05	4905	7
STD	2500	01	90	34	79	27	83	2	257	4	23	4918	2
OBS	2719	01	76	34	75	27	81			4	37	4929	0

Sta. No. 4

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	0°	11	20	15	2	1
II	31°	11	17	17	5	4

Consec. Sta. No. 5 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0005	04	05	1961	15	32° 00′ S	078° 00′ E	3109	29

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
04	07		30	23 9	21 1		02		0		0			7	00	

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C	S‰	σ_t	$\Sigma \Delta D$	O_2 ml/l	V_f
STD	0000	22 35	35 82	24 76	0 000	5 06	5006 5
OBS	0000	22 35	35 82	24 76		5 06	5006 5
STD	0010	22 41	35 83	24 75	0 032	5 15	5007 7
OBS	0010	22 41	35 83	24 75		5 15	5007 7
STD	0020	22 29	35 79	24 76	0 064	5 08	5007 1
OBS	0020	22 29	35 79	24 76		5 08	5007 1
STD	0030	22 07	35 82	24 84	0 096	5 08	5005 9
OBS	0030	22 07	35 82	24 84		5 08	5005 9
STD	0050	17 34	35 67	25 96	0 148	5 04	4963 0
OBS	0050	17 34	35 67	25 96		5 04	4963 0
OBS	0074	15 57	35 52	26 26		5 63	4946 0
STD	0075	15 50	35 51	26 27	0 196	5 62	4945 3
OBS	0099	14 22	35 39	26 46		5 51	4932 8
STD	0100	14 20	35 39	26 46	0 238	5 51	4932 7
OBS	0149	13 41	35 36	26 61		5 56	4926 9
STD	0150	13 40	35 36	26 61	0 315	5 56	4926 9
OBS	0199	12 82	35 25	26 64		5 45	4923 0
STD	0200	12 81	35 25	26 64	0 389	5 45	4922 9
OBS	0248	12 44	35 17	26 65		5 38	4921 3
STD	0250	12 42	35 17	26 66	0 462	5 38	4921 2
OBS	0298	12 11	35 14	26 70		5 41	4920 5
STD	0300	12 10	35 14	26 70	0 534	5 41	4920 5
OBS	0385	11 81	35 08	26 71		5 47	4922 0
STD	0400	11 75	35 07	26 71	0 677	5 47	4922 2
OBS	0482	11 29	35 01	26 75		5 47	4921 5
STD	0500	11 16	34 99	26 76	0 820	5 44	4921 0
OBS	0579	10 50	34 88	26 79		5 42	4917 5
STD	0600	10 31	34 86	26 81	0 960	5 53	4916 4
OBS	0677	09 52	34 76	26 87		5 63	4911 2
OBS	0774	08 28	34 58	26 92		5 02	4901 0
STD	0800	08 00	34 55	26 94	1 224	4 98	4898 9
OBS	0970	06 12	34 40	27 08		4 73	4884 2
STD	1000	05 70	34 38	27 12	1 458	4 69	4880 4
OBS	1166	03 89	34 34	27 29		4 49	4865 5
STD	1200	03 75	34 36	27 32	1 651	4 43	4865 7
OBS	1461	02 92	34 51	27 52		4 09	4870 1
STD	1500	02 87	34 53	27 54	1 876	4 10	4871 8
OBS	1952	02 35	34 69	27 72		4 17	4891 9
STD	2000	02 28	34 71	27 74	2 156	4 21	4893 8
OBS	2445	01 83	34 79	27 84		4 46	4914 0
STD	2500	01 79	34 79	27 84	2 365	4 48	4916 6
OBS	2940	01 66	34 76	27 83		4 48	4940 6

Sta. No. 5

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	7°	11	20	17	2	1
II	2°	11	17	15	5	4

Consec. Sta. No. 6 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0006	04	06	1961	02	30° 00′ S	078° 00′ E	3566	10

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
07	08		28	23 3	19 4		02	8	5	07	2			7	00	30

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ Δ D ↓	O_2 ml/l ↓	V_f ↓
STD	0000	23 64	36 04	24 55	0 000	5 47	5018 1
OBS	0000	23 64	36 04	24 55		5 47	5018 1
STD	0010	23 63	36 08	24 59	0 034	4 88	5018 8
OBS	0010	23 63	36 08	24 59		4 88	5018 8
STD	0020	23 64	36 13	24 62	0 067	4 86	5019 6
OBS	0020	23 64	36 13	24 62		4 86	5019 6
STD	0030	23 62	36 06	24 58	0 101	4 90	5019 8
OBS	0030	23 62	36 06	24 58		4 90	5019 8
OBS	0049	19 50	35 79	25 51		5 75	4984 0
STD	0050	19 42	35 79	25 53	0 159	5 77	4983 3
OBS	0074	17 59	35 68	25 91		6 04	4966 9
STD	0075	17 52	35 68	25 93	0 217	6 03	4966 3
OBS	0099	16 03	35 57	26 20		5 72	4952 4
STD	0100	15 98	35 56	26 20	0 266	5 71	4951 9
OBS	0149	14 19	35 25	26 36		5 40	4934 9
STD	0150	14 16	35 25	26 36	0 356	5 40	4934 7
OBS	0198	13 23	35 23	26 54		5 41	4927 4
STD	0200	13 22	35 23	26 54	0 437	5 30	4927 4
OBS	0248	12 84	35 16	26 57		3 96	4925 8
STD	0250	12 82	35 16	26 57	0 515	4 04	4925 6
OBS	0298	12 35				5 41	
STD	0300	12 34	35 16	26 67	0 590	5 41	4923 3
OBS	0391	11 97	35 12	26 71		5 42	4924 3
STD	0400	11 91	35 11	26 71	0 735	5 42	4924 1
OBS	0489	11 32	35 04	26 77		5 35	4922 4
STD	0500	11 24	35 03	26 77	0 877	5 30	4922 1
OBS	0587	10 59	34 95	26 83		5 10	4919 3
STD	0600	10 50	34 93	26 83	1 015	5 17	4919 0
OBS	0685	09 81	34 82	26 86		5 37	4915 4
OBS	0782	08 78	34 69	26 93		5 12	4908 1
STD	0800	08 56	34 67	26 95	1 277	5 07	4906 4
OBS	0978	05 88	34 47	27 17		4 63	4881 8

Sta. No. 6

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	10°	11	20	19	2	1
II	7°	6	9	8	3	1

Consec. Sta. No. 7 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0007	04	06	1961	13	27° 58′ S	078° 03′ E	4755	09

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
11	09		25	23 9	21 0		01	8	3	04	4			7	00	

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ Δ D ↓	O_2 ml/l ↓	V_f ↓
STD	0000	24 88	35 82	24 02	0 000		5027 4
OBS	0000	24 88	35 82	24 02			5027 4
OBS	0008	24 94	35 82	24 00			5028 3
STD	0010	24 93	35 82	24 00	0 039		5028 4
OBS	0017	24 92	35 81	24 00			5028 7
STD	0020	24 92	35 81	24 00	0 078		5028 9
OBS	0026	24 92	35 80	23 99			5029 2
STD	0030	23 96	35 79	24 27	0 116		5021 7
OBS	0043	21 45	35 76	24 97			5001 1
STD	0050	20 71	35 75	25 16	0 181		4994 9
OBS	0064	19 42	35 73	25 49			4983 9
STD	0075	18 64	35 73	25 69	0 246		4977 2
OBS	0086	17 92	35 73	25 87			4971 0
STD	0100	17 09	35 69	26 04	0 300		4963 5
OBS	0129	15 73	35 60	26 29			4951 2
STD	0150	15 18	35 54	26 37	0 393		4946 6
OBS	0173	14 58	35 48	26 45			4941 4
STD	0200	13 85	35 40	26 55	0 475		4934 9
OBS	0217	13 46	35 35	26 59			4931 5
STD	0250	13 12	35 27	26 60	0 552		4929 4
OBS	0262	13 56*	35 25	26 49*			4934 8*
STD	0300	12 64	35 23	26 66	0 627		4926 9
OBS	0332	12 35	35 20	26 70			4925 4
STD	0400	11 77	35 12	26 74	0 770		4922 6
OBS	0416	11 65	35 10	26 75			4922 1
STD	0500	11 10	35 01	26 78	0 910		4920 4
OBS	0503	11 08	35 01	26 79			4920 3
OBS	0591	10 30	34 90	26 84			4915 9
STD	0600	10 22	34 89	26 85	1 047		4915 5
OBS	0682	09 43	34 78	26 90			4910 4
STD	0800	07 97	34 63	27 01	1 301		4898 9
OBS	0873	06 89	34 53	27 08			4889 0

Sta. No.	Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
				Protected		Unprotected	
				Used	Accepted	Used	Accepted
7	I	25°	11	20	17	2	1
	II	37°	6	8	8	4	1

Consec. Sta. No. 8 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0008	04	06	1961	24	25° 54′ S	078° 04′ E	4207	26

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
09	08		23	24 2	20 0		02	8	2	08	3			7	00	22

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓		S‰ ↓		σ_t ↓		$\Sigma\Delta D$ ↓	O_2 ml/l ↓		V_f ↓	
STD	0000	25	30	35	64	23	75	0 000	4	81	5030	1
OBS	0000	25	30	35	64	23	75		4	81	5030	1
OBS	0009	25	29	35	64	23	76		4	72	5030	5
STD	0010	25	29	35	68	23	79	0 041	4	71	5030	7
OBS	0019	25	29	35	86	23	92		4	68	5031	9
STD	0020	25	29	35	85	23	92	0 082	4	69	5031	9
OBS	0028	25	25	35	78	23	87		4	76	5031	9
STD	0030	25	19	35	77	23	89	0 122	4	77	5031	5
OBS	0047	24	69	35	71	23	99		4	92	5028	3
STD	0050	24	24	35	69	24	11	0 201	5	02	5024	8
OBS	0070	21	84	35	64	24	77		5	44	5005	6
STD	0075	21	50	35	65	24	87	0 288	5	42	5003	0
OBS	0093	20	41	35	68	25	19		5	36	4994	5
STD	0100	20	13	35	70	25	28	0 361	5	32	4992	4
OBS	0140	18	64	35	77	25	72		5	12	4981	2
STD	0150	18	36	35	77	25	79	0 486	5	08	4979	2
OBS	0188	17	11	35	75	26	08		4	99	4969	2
STD	0200	16	55	35	68	26	16	0 591	5	00	4964	1
OBS	0235	15	14	35	52	26	36		5	03	4951	1
STD	0250	14	66	35	47	26	43	0 681	5	08	4946	8
OBS	0282	13	81	35	37	26	53		5	18	4939	2
STD	0300	13	53	35	34	26	57	0 763	5	23	4937	1
OBS	0340	12	91	35	27	26	64		5	32	4932	4
STD	0400	11	85	35	17	26	77	0 910	5	35	4923	7
OBS	0423	11	59	35	14	26	79		5	36	4922	0
STD	0500	11	39	35	05	26	76	1 050	5	38	4923	9
OBS	0509	11	34	35	04	26	76		5	38	4923	8
OBS	0595	10	61	34	95	26	83		5	46	4920	0
STD	0600	10	57	34	95	26	83	1 189	5	46	4919	9
OBS	0681	09	79	34	86	26	90		5	44	4915	0
STD	0800	08	48	34	67	26	96	1 450	5	19	4905	4
OBS	0851	07	81	34	60	27	01		4	99	4899	7
STD	1000	05	39	34	45	27	22	1 673	4	04	4876	6
OBS	1022	05	12	34	44	27	24		3	94	4874	2
STD	1200	04	02	34	52	27	42	1 848	3	57	4870	1
OBS	1282	03	66	34	55	27	48		3	45	4870	1
STD	1500	03	58	34	63	27	56	2 063	3	44	4882	2
OBS	1718	03	32	34	70	27	64		3	42	4891	8
STD	2000	02	54	34	77	27	76	2 343	3	80	4897	8
OBS	2168	02	21	34	80	27	82		3	99	4903	1
STD	2500	01	83	34	80	27	85	2 550	4	28	4917	3
OBS	2631	01	79	34	80	27	85		4	37	4924	4

Sta. No. 8

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	16°	11	20	18	2	0
II	28°	11	17	13	5	2

Consec. Sta. No. 9 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0009	04	07	1961	11	24° 00′ S	078° 05′ E	4023	09

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
10	09		18	24 8	21 2		03	8	6	09	4			7	00	25

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ O ↓	σ_t ↓	Σ ΔD ↓	O_2 ml/l ↓	V_f ↓
STD	0000	25 05				4 43	
OBS	0000	25 05	36 00*	24 10*		4 43	5029 4*
OBS	0009	25 03	35 82	23 97		4 80	5029 1
STD	0010	25 03	35 82	23 97		4 80	5029 2
OBS	0018	25 03	35 82	23 97		4 80	5029 7
STD	0020	25 03	35 83	23 98		4 80	5029 8
OBS	0027	25 01	35 86	24 01		4 81	5030 2
STD	0030	24 72	35 86	24 10		4 82	5028 1
OBS	0045		35 84			4 85	
STD	0050	22 90	35 80	24 59		5 02	5014 1
OBS	0068	21 42	35 73	24 95		5 43	5002 2
STD	0075	20 83	35 75	25 13		5 43	4997 4
OBS	0092	19 68	35 78	25 46		5 44	4988 1
STD	0100	19 56	35 79	25 50		5 44	4987 5
OBS	0140	18 55	35 81	25 77		5 40	4980 5
STD	0150	18 10	35 80	25 88		5 37	4976 8
OBS	0188	16 47	35 74	26 22		5 27	4962 8
STD	0200	15 90	35 67	26 30		5 24	4957 4
OBS	0238	14 46	35 74*	26 68*		5 21	4945 0*
STD	0250	14 16	35 45	26 52		5 24	4941 4
OBS	0287	13 37	35 33	26 59		5 29	4934 6
STD	0300	13 17	35 31	26 62		5 29	4933 1
OBS	0340	12 60	35 24	26 68		5 31	4928 8
STD	0400	11 85	35 14	26 75		5 40	4923 6
OBS	0426	11 55	35 10	26 77		5 42	4921 5
STD	0500	10 75	35 00	26 84		5 45	4916 2
OBS	0513	10 61	34 98	26 85		5 45	4915 3
STD	0600	09 73	34 82	26 88		5 46	4909 4
OBS	0603	09 70	34 81	26 87		5 46	4909 1
OBS	0694	08 86	34 75	26 96		5 36	4904 1
STD	0800	07 47	34 62	27 07		5 09	4892 5
OBS	0884	06 06	34 48	27 16		4 77	4878 7

Sta. No. 9

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	25°	11	17	14	3	1
II	32°	6	8	8	4	2

Consec. Sta. No. 10

SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0010	04	07	1961	21	21° 58′ S	077° 58′ E	4389	08

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
10	09		18	25 3	21 1		25	5	8	08	3			7	00	

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	$\Sigma\Delta D$ ↓	O_2 ml/l ↓	V_f ↓
STD	0000	26 13	35 09	23 08	0 000		5034 6
OBS	0000	26 13	35 09	23 08			5034 6
STD	0010	26 14	35 08	23 07	0 048		5035 3
OBS	0010	26 14	35 08	23 07			5035 3
OBS	0019	26 13	35 09	23 08			5035 8
STD	0020	26 13	35 09	23 08	0 096		5035 8
OBS	0029	26 15	35 10	23 08			5036 5
STD	0030	26 15	35 10	23 08	0 144		5036 6
OBS	0048	26 11	35 15	23 13			5037 6
STD	0050	26 10	35 25	23 21	0 239		5037 9
OBS	0072	25 24	35 91	23 98			5034 9
STD	0075	24 89	35 86	24 04	0 347		5032 1
OBS	0096	22 76	35 61	24 48			5015 0
STD	0100	22 47	35 63	24 58	0 438		5012 8
OBS	0143	20 04	35 75	25 34			4994 4
STD	0150	19 88	35 76	25 39	0 589		4993 3
OBS	0192	18 71	35 79	25 72			4985 0
STD	0200	18 42	35 79	25 79	0 713		4982 8
OBS	0240	16 94	35 74	26 11			4970 5
STD	0250	16 47	35 70	26 19	0 817		4966 3
OBS	0289	15 01	35 58	26 43			4953 2
STD	0300	14 79	35 56	26 47	0 907		4951 4
OBS	0340	13 97	35 46	26 57			4944 7
STD	0400	12 63	35 30	26 72	1 062		4933 0
OBS	0420	12 27	35 25	26 75			4929 9
STD	0500	11 23	35 09	26 82	1 202		4922 2
OBS	0500	11 23	35 09	26 82			4922 2
OBS	0590	10 25	34 95	26 89			4915 5
OBS	0680	19 96*	35 69*	25 32*			5025 2*
OBS	0850	15 00*	35 80*	26 61*			4987 0*

Sta. No. 10

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	15°	11	20	20	2	1
II	32°	6	8	7	4	1

Consec. Sta. No. 11 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0011	04	08	1961	08	20° 00′ S	078° 02′ E	4755	29

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ▼	WET ▼			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
11	09		15	26 9	22 2		02	8	1	09	3			7		25

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ▼	S‰ ▼	σ_t ▼	$\Sigma \Delta D$ ▼	O_2 ml/l ▼	V_f ▼
STD	0000	27 56	34 20	21 96	0 000	4 45	5042 3
OBS	0000	27 56	34 20	21 96		4 45	5042 3
STD	0010	27 54	34 20	21 96	0 059	4 48	5042 8
OBS	0010	27 54	34 20	21 96		4 48	5042 8
STD	0020	27 53	34 21	21 98	0 117	4 44	5043 3
OBS	0020	27 53	34 21	21 98		4 44	5043 3
STD	0030	27 55	34 20	21 96	0 176	4 51	5044 1
OBS	0030	27 55	34 20	21 96		4 51	5044 1
STD	0050	27 52	34 20	21 97	0 294	4 48	5045 0
OBS	0050	27 52	34 20	21 97		4 48	5045 0
STD	0075	23 72	34 17	23 12	0 427	4 68	5016 6
OBS	0075	23 72	34 17	23 12		4 68	5016 6
OBS	0099	22 81	35 30	24 24		5 09	5014 5
STD	0100	22 77	35 31	24 25	0 533	5 08	5014 2
OBS	0149	20 92	35 54	24 95		4 69	5001 9
STD	0150	20 88	35 54	24 96	0 703	4 68	5001 6
OBS	0199	19 30	35 65	25 46		4 37	4990 5
STD	0200	19 29	35 65	25 46	0 844	4 38	4990 5
OBS	0249	18 14	35 77	25 84		4 60	4982 9
STD	0250	18 09	35 77	25 86	0 965	4 60	4982 5
OBS	0299	16 08	35 70	26 28		4 75	4965 2
STD	0300	16 05	35 70	26 29	1 067	4 75	4965 0
OBS	0380	13 65	35 43	26 61		5 03	4943 5
STD	0400	13 13	35 37	26 67	1 233	5 13	4938 8
OBS	0477	11 40	35 15	26 84		5 37	4923 0
STD	0500	11 01	35 08	26 85	1 373	5 37	4919 6
OBS	0572	09 89	34 88	26 90		5 34	4909 9
STD	0600	09 57	34 83	26 91	1 503	5 31	4907 5
OBS	0667	08 67	34 71	26 96		5 25	4900 0
OBS	0763	07 06	34 57	27 09		4 54	4884 9
STD	0800	06 51	34 57	27 17	1 733	4 81	4880 0
OBS	0955	04 83	35 28*	27 94*		4 92	4869 9*
STD	1000	04 65	34 59	27 41	1 914	4 26	4867 2
OBS	1150	04 11	34 62	27 49		2 76	4868 8
STD	1200	04 00	34 64	27 52	2 060	2 76	4870 3
OBS	1435	04 52*	34 71	27 52*		2 78	4891 7*
STD	1500	03 38	34 72	27 65	2 248	2 84	4879 8
OBS	1920	02 65	34 75	27 74		3 27	4894 5
STD	2000	02 53	34 75	27 75	2 508	3 38	4897 6
OBS	2404	02 02	34 76	27 80		3 81	4914 2
STD	2500	01 93	34 76	27 81	2 729	3 88	4918 5
OBS	2892	01 68	34 76	27 83		4 08	4938 1

Sta. No. 11

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	12°	11	20	19	2	1
II	22°	11	17	14	5	1

Consec. Sta. No. 12 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0012	04	08	1961	19	18° 00′ S	078° 02′ E	4572	09

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR	AMT.		COL.	TRANS.
10	06		14	26 4	22 8		02	8	2	07	3			7	00	

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ Δ D ↓	O_2 ml/l ↓	V_f ↓
STD	0000	27 25				5 01	
OBS	0000	27 25	34 76*	22 48*		5 01	5041 9*
OBS	0009	27 26	34 20	22 05		4 55	5040 6
STD	0010	27 26	34 20	22 05		4 54	5040 7
OBS	0019	27 27	34 19	22 04		4 53	5041 3
STD	0020	27 27	34 19	22 04		4 54	5041 3
OBS	0028	27 28	34 20	22 05		4 58	5041 9
STD	0030	27 28	34 20	22 05		4 56	5042 0
OBS	0047	27 25	34 23	22 08		4 47	5043 0
STD	0050	27 25	34 23	22 08		4 53	5043 1
OBS	0070	27 25	34 22	22 07		4 57	5044 3
STD	0075	25 99	34 44	22 64		4 40	5035 8
OBS	0093	22 29	35 06	24 20		3 87	5008 8
STD	0100	21 65	35 10	24 41		3 73	5003 8
OBS	0140	18 75	35 26	25 30		3 25	4980 4
STD	0150	18 36	35 28	25 42		3 27	4977 3
OBS	0188	17 02	35 32	25 77		3 37	4966 7
STD	0200	16 61	35 32	25 87		3 38	4963 3
OBS	0235	15 62	35 32	26 10		3 60	4955 3
STD	0250	15 48	35 43	26 21		3 96	4955 2
OBS	0285	14 76	35 49	26 42		4 45	4950 0
STD	0300	14 18	35 40	26 48		4 44	4944 3
OBS	0322	13 42	35 28	26 54		4 42	4937 0
STD	0400	11 69	35 11	26 75		5 14	4921 6
OBS	0416	11 38	35 07	26 78		5 23	4918 9
STD	0500	09 95	34 86	26 87		5 34	4906 2
OBS	0502	09 92	34 85	26 87		5 34	4906 0
OBS	0590	08 65	34 69	26 95		5 05	4895 1
STD	0600	08 43	34 67	26 97		4 92	4892 9
OBS	0677	07 02	34 57	27 10		3 95	4879 3
STD	0800	05 76	34 59	27 28		2 65	4870 2
OBS	0852	05 59	34 66	27 36		2 19	4871 3

Sta. No.	Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
				Protected		Unprotected	
				Used	Accepted	Used	Accepted
12	I	22°	11	20	18	2	2
	II	35°	6	8	6	4	4

Consec. Sta. No. 13 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0013	04	09	1961	06	16° 03′ S	078° 03′ E	4938	10

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
10	08		14	27 3	23 7		02	8	3	09	3			7	00	25

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	$\Sigma \Delta D$ ↓	O_2 ml/l ↓	V_f ↓
STD	0000	27 47	34 29	22 05	0 000		5042 0
OBS	0000	27 47	34 29	22 05			5042 0
STD	0010	27 46	34 25	22 03	0 058		5042 4
OBS	0010	27 46	34 25	22 03			5042 4
OBS	0019	27 47	34 23	22 01			5042 9
STD	0020	27 47	34 23	22 01	0 116		5043 0
OBS	0029	27 48	34 23	22 01			5043 6
STD	0030	27 48	34 23	22 01	0 174		5043 6
OBS	0048	27 41	34 23	22 03			5044 2
STD	0050	27 36	34 28	22 08	0 291		5044 1
OBS	0072	26 86					
STD	0075	26 18	34 77	22 83	0 426		5038 4
OBS	0097	22 18	35 08	24 25			5008 2
STD	0100	21 96	35 10	24 32	0 535		5006 5
OBS	0145	19 36	35 37	25 23			4986 8
STD	0150	19 36	35 45	25 29	0 695		4987 4
OBS	0193	18 08	35 70	25 81			4978 8
STD	0200	17 29	35 57	25 90	0 818		4971 0
OBS	0241	13 92	35 08	26 28			4936 8
STD	0250	13 65	35 07	26 33	0 916		4934 4
OBS	0290	12 65	35 03	26 50			4925 6
STD	0300	12 58	35 04	26 53	1 000		4925 5
OBS	0392	11 39	35 08	26 78			4917 6
STD	0400	11 14	35 07	26 82	1 147		4915 1
OBS	0490	09 04	34 92	27 07			4894 9
STD	0500	08 96	34 89	27 06	1 269		4894 4
OBS	0588	08 16	34 69	27 03			4888 9
STD	0600	08 01	34 68	27 04	1 381		4887 7
OBS	0686	07 14	34 67	27 16			4881 7
OBS	0785	06 51	34 72	27 29			4879 7
STD	0800	06 43	34 73	27 30	1 584		4879 6
OBS	0982	05 86	34 78	27 42			4883 1

Sta. No. 13

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	15°	11	20	17	2	0
II	12°	6	8	7	4	1

Consec. Sta. No. 14 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0014	04	09	1961	17	14° 00′ S	078° 03′ E	5303	28

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
08	11		13	27 2	24 4		80	8	1	10	2			6		

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ Δ D ↓	O_2 ml/l ↓	V_f ↓
STD	0000	27 35	34 38	22 16	0 000	4 54	5041 4
OBS	0000	27 35	34 38	22 16		4 54	5041 4
STD	0010	27 36	34 42	22 19	0 057	4 53	5042 2
OBS	0010	27 36	34 42	22 19		4 53	5042 2
STD	0020	27 36	34 40	22 17	0 113	4 52	5042 7
OBS	0020	27 36	34 40	22 17		4 52	5042 7
STD	0030	27 36	34 40	22 17	0 170	4 48	5043 3
OBS	0030	27 36	34 40	22 17		4 48	5043 3
OBS	0049	27 33	34 42	22 20		4 56	5044 3
STD	0050	27 29	34 43	22 22	0 283	4 60	5044 1
OBS	0074	25 92	34 61	22 79		4 71	5035 8
STD	0075	25 81	34 63	22 83	0 417	4 64	5035 0
OBS	0099	23 49	35 01	23 82		3 18	5019 1
STD	0100	23 41	35 01	23 84	0 532	3 15	5018 5
OBS	0148	20 05	35 03	24 79			4992 1
STD	0150	19 95	35 03	24 82	0 714	2 70	4991 3
OBS	0198	17 58	35 06	25 44		2 25	4971 8
STD	0200	17 48	35 09	25 49	0 858	2 33	4971 1
OBS	0247	15 32	35 31	26 16		3 67	4952 9
STD	0250	15 17	35 26	26 15	0 971	3 72	4951 3
OBS	0297		34 77			4 03	
STD	0300	12 94	34 78	26 25	1 066	3 95	4928 5
OBS	0370	10 78	34 85	26 72		2 89	4908 3
STD	0400	10 40	34 83	26 77	1 228	3 30	4905 5
OBS	0462	09 63	34 80	26 88		3 64	4899 9
STD	0500	09 11	34 77	26 94	1 357	3 29	4895 8
OBS	0555	08 50	34 74	27 01		2 84	4891 4
STD	0600	08 11	34 71	27 05	1 475	2 51	4889 1
OBS	0648	07 84	34 69	27 07		2 24	4888 5
OBS	0740	07 76	34 69	27 09		1 97	4892 9
STD	0800	07 42	34 70	27 14	1 694	1 97	4892 2
OBS	0927	06 63	34 71	27 26		1 96	4889 6
STD	1000	06 04	34 70	27 33	1 889	1 97	4886 2
OBS	1114	05 29	34 69	27 42		1 98	4883 0
STD	1200	05 01	34 70	27 46	2 054	2 04	4884 4
OBS	1395	04 37	34 71	27 54		2 25	4887 3
STD	1500	03 98	34 75	27 61	2 264	2 47	4888 3
OBS	1866	02 90	34 82	27 77		3 10	4895 2
STD	2000	02 66	34 79	27 77	2 535	3 26	4899 6
OBS	2350	02 18	34 73	27 76		3 60	4913 2
STD	2500	02 03	34 72	27 77	2 763	3 72	4919 8
OBS	2846	01 83	34 72	27 78		3 92	4937 3

Sta. No. 14

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	9°	11	20	16	2	0
II	25°	11	17	12	5	3

Consec. Sta. No. 15 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0015	04	10	1961	04	11° 58′ S	077° 48′ E	5304	06

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ▼	WET ▼			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
10	09		12	28 3	25 6		80	8	7	08	2			7	00	24

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ▼	S‰ ▼	σ_t ▼	$\Sigma \Delta D$ ▼	O_2 ml/l ▼	V_f ▼
STD	0000	27 71	34 21	21 92	0 000	4 52	5043 5
OBS	0000	27 71	34 21	21 92		4 52	5043 5
OBS	0008	27 70	34 21	21 92		4 50	5043 9
STD	0010	27 70	34 21	21 92	0 059	4 49	5044 0
OBS	0017	27 69	34 21	21 92		4 47	5044 3
STD	0020	27 69	34 21	21 92	0 118	4 48	5044 5
OBS	0025	27 70	34 21	21 92		4 51	5044 9
STD	0030	27 31	34 33	22 14	0 176	4 54	5042 7
OBS	0042	26 24	34 54	22 63		4 60	5036 1
STD	0050	25 27	34 60	22 98	0 283	4 13	5029 2
OBS	0063	23 94	34 68	23 44		3 63	5019 5
STD	0075	23 06	34 70	23 71	0 397	3 62	5013 0
OBS	0084	22 41	34 73	23 92		3 52	5008 1
STD	0100	21 31	34 90	24 35	0 495	2 76	5000 1
OBS	0126	19 44	35 02	24 94		2 05	4985 1
STD	0150	17 48	34 85	25 30	0 654	2 19	4967 2
OBS	0169	16 11	34 77	25 56		2 28	4954 3
STD	0200	14 07	34 79	26 03	0 773	2 37	4934 9
OBS	0215	13 43	34 80	26 17		2 42	4928 9
OBS	0236	12 90	34 88	26 34		2 32	4924 6
STD	0250	12 55	34 87	26 40	0 866	2 46	4921 5
OBS	0259	12 33	34 86	26 44		2 50	4919 6
STD	0300	11 40	34 86	26 61	0 947	2 12	4911 4
OBS	0300	11 40	34 86	26 61		2 12	4911 4
OBS	0365	10 08	34 80	26 80		2 89	4899 6
STD	0400	09 50	34 76	26 87	1 086	3 40	4894 5
OBS	0432	09 03	34 73	26 92		3 53	4890 6
STD	0500	08 21	34 67	27 00	1 207	2 69	4884 3
OBS	0506	08 16	34 67	27 01		2 63	4884 0
STD	0600	07 82	34 68	27 07	1 320	2 10	4885 3
OBS	0627	07 72	34 70	27 10		2 07	4885 7

Sta. No.	Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
				Protected		Unprotected	
				Used	Accepted	Used	Accepted
15	I	30°	11	20	19	2	1
	II	50°	6	8	7	4	2

Consec. Sta. No. 16 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0016	04	10	1961	15	10° 00′ S	077° 56′ E	5303	08

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
11	06		12	27 1	24 8		80	6	8	10	3				00	

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ Δ D ↓	O₂ ml/l ↓	V_t ↓
STD	0000	27 66	34 27	21 98	0 000		5043 3
OBS	0000	27 66	34 27	21 98			5043 3
OBS	0009	27 65	34 27	21 98			5043 8
STD	0010	27 65	34 27	21 98	0 059		5043 8
OBS	0018	27 65	34 28	21 99			5044 4
STD	0020	27 65	34 28	21 99	0 117		5044 5
OBS	0027	27 64	34 28	21 99			5044 8
STD	0030	27 34	34 40	22 18	0 175		5043 2
OBS	0046	25 49	34 84	23 09			5031 5
STD	0050	24 91	34 85	23 28	0 278		5027 2
OBS	0069	22 18	34 87	24 09			5005 8
STD	0075	21 26	34 86	24 34	0 381		4998 0
OBS	0092	19 00	34 84	24 92			4978 4
STD	0100	18 24	34 82	25 09	0 463		4971 5
OBS	0138	15 50	34 80	25 73			4946 4
STD	0150	15 18	34 89	25 87	0 590		4944 1
OBS	0184	14 06	35 01	26 20			4934 7
STD	0200	13 24	34 95	26 32	0 689		4926 5
OBS	0230	12 01	34 87	26 51			4914 3
STD	0250	11 40	34 85	26 60	0 770		4908 4
OBS	0276	10 90	34 84	26 69			4904 1
STD	0300	10 79	34 86	26 72	0 843		4904 3
OBS	0305	10 75	34 87	26 74			4904 2
OBS	0386	09 31	34 75	26 89			4891 4
STD	0400	09 14	34 74	26 91	0 974		4890 1
OBS	0470	08 34	34 71	27 01			4884 3
STD	0500	08 02	34 70	27 06	1 091		4882 0
OBS	0554	07 51	34 68	27 12			4878 7
STD	0600	07 14	34 66	27 15	1 197		4876 6
OBS	0646	06 79	34 65	27 19			4874 8
STD	0800	05 76	34 66	27 34	1 384		4870 5
OBS	0836	05 55	34 66	27 36			4869 8

Sta. No. 16

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	20°	11	20	19	2	1
II	40°	6	8	8	4	3

Consec. Sta. No. 17 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0017	04	11	1961	02	07° 53′ S	078° 12′ E	5303	28

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMID-ITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ▼	WET ▼			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
08	04		08	27 2	24 4		02	8	7	10	3			7	00	22

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓		S‰ ↓		σ_t ↓		$\Sigma\Delta D$ ↓		O_2 ml/l ↓		V_f ↓	
STD	0000	28	50	34	38	21	79	0	000	4	48	5049	8
OBS	0000	28	50	34	38	21	79			4	48	5049	8
OBS	0009	28	48	34	40	21	81			4	45	5050	3
STD	0010	28	47	34	40	21	81	0	060	4	46	5050	3
OBS	0018	28	41	34	40	21	83			4	51	5050	3
STD	0020	28	40	34	40	21	83	0	120	4	51	5050	4
OBS	0027	28	37	34	40	21	84			4	48	5050	6
STD	0030	27	50	34	57	22	26	0	178	4	45	5045	0
OBS	0046	23	67	35	18	23	90			4	28	5018	1
STD	0050	23	07	35	20	24	09	0	273	3	92	5013	4
OBS	0069	20	56	35	24	24	81			2	64	4992	8
STD	0075	19	87	35	23	24	99	0	359	2	46	4986	9
OBS	0092	18	23	35	20	25	39			2	06	4972	4
STD	0100	17	92	35	20	25	46	0	428	2	06	4969	8
OBS	0138	16	26	35	16	25	83			1	94	4955	5
STD	0150	15	57	35	09	25	93	0	545	1	77	4948	9
OBS	0184	13	87	34	96	26	20			1	47	4932	5
STD	0200	13	16	34	93	26	32	0	642	1	47	4925	6
OBS	0230	12	13	34	90	26	51			1	48	4915	7
STD	0250	11	74	34	91	26	59	0	724	1	49	4912	5
OBS	0276	11	29	34	92	26	68			1	51	4908	9
STD	0300	11	00	34	92	26	73	0	797	1	86	4907	0
OBS	0372	10	17	34	90	26	86			2	49	4901	4
STD	0400	09	84	34	88	26	91	0	929	2	48	4899	1
OBS	0465	09	20	34	85	26	99			2	35	4895	1
STD	0500	09	00	34	84	27	01	1	049	2	18	4894	7
OBS	0557	08	59	34	82	27	06			1	95	4893	0
STD	0600	08	11	34	81	27	13	1	159	1	81	4889	5
OBS	0650	07	66	34	80	27	19			1	69	4886	8
OBS	0744	07	15	34	81	27	27			1	60	4885	9
STD	0800	06	85	34	80	27	30	1	355	1	61	4885	3
OBS	0930	06	14	34	78	27	38			1	63	4883	7
STD	1000	05	69	34	76	27	42	1	524	1	75	4881	8
OBS	1117	05	04	34	74	27	49			1	93	4880	0
STD	1200	04	73	34	75	27	53	1	674	2	00	4880	8
OBS	1397	04	06	34	76	27	61			2	19	4883	3
STD	1500	03	80	34	76	27	64	1	867	2	34	4885	8
OBS	1967	02	76	34	77	27	75			2	98	4899	0
STD	2000	02	69	34	77	27	75	2	135	3	03	4899	9
OBS	2340	02	09	34	76	27	79			3	43	4911	4
STD	2500			34	75					3	57		
OBS	2818	02	83*	34	74	27	71*			3	75	4950	0*

Sta. No.	Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
				Protected		Unprotected	
				Used	Accepted	Used	Accepted
17	I	17°	11	20	20	2	1
	II	15°	11	17	17	5	2

Consec. Sta. No. 18

SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0018	04	11	1961	14	05° 58′ S	078° 09′ E	5121	10

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
02	14		08	28 9	25 0		02	8	4	00	1			7	00	

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ Δ D ↓	O_2 m l/l ↓	V_f ↓
STD	0000	29 38	34 80	21 81	0 000	4 08	5057 5
OBS	0000	29 38	34 80	21 81		4 08	5057 5
STD	0010	29 15	34 78	21 87	0 060	4 33	5056 4
OBS	0010	29 15	34 78	21 87		4 33	5056 4
STD	0020	29 05	34 79	21 91	0 119	4 05	5056 3
OBS	0020	29 05	34 79	21 91		4 05	5056 3
STD	0030	29 50	35 13	22 01	0 178	4 68	5061 3
OBS	0030	29 50	35 13	22 01		4 68	5061 3
STD	0050	22 12	35 32	24 45	0 271	3 70	5005 7
OBS	0050	22 12	35 32	24 45		3 70	5005 7
STD	0075	19 30	35 23	25 14	0 351	2 73	4981 6
OBS	0075	19 30	35 23	25 14		2 73	4981 6
STD	0100	17 83	35 19	25 48	0 419	1 88	4968 9
OBS	0100	17 83	35 19	25 48		1 88	4968 9
STD	0150	14 89	35 00	26 01	0 533	1 46	4941 5
OBS	0150	14 89	35 00	26 01		1 46	4941 5
STD	0200	12 66	34 96	26 45	0 626	1 66	4920 1
OBS	0200	12 66	34 96	26 45		1 66	4920 1
STD	0250	11 62	34 92	26 62	0 704	1 82	4911 2
OBS	0250	11 62	34 92	26 62		1 82	4911 2
STD	0300	10 96	34 89	26 72	0 776	1 93	4906 4
OBS	0300	10 96	34 89	26 72		1 93	4906 4
OBS	0378	10 04	34 85	26 85		1 95	4900 1
STD	0400	09 87	34 84	26 87	0 911	2 08	4899 3
OBS	0473	09 32	34 83	26 95		2 17	4897 0
STD	0500	09 13	34 84	26 99	1 033	1 89	4896 3
OBS	0568	08 64	34 86	27 09		1 45	4894 4
STD	0600	08 37	34 86	27 13	1 145	1 44	4892 9
OBS	0664	07 90	34 87	27 21		1 43	4890 9
OBS	0760	07 33	34 76	27 20		1 50	4888 9
STD	0800	07 10	34 76	27 24	1 347	1 53	4888 4
OBS	0956	06 26	34 77	27 36		1 65	4886 8

Sta. No.	Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
				Protected		Unprotected	
				Used	Accepted	Used	Accepted
18	I	4°	11	20	18	2	0
	II	5°	6	8	8	4	2

Consec. Sta. No. 19 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0019	04	12	1961	02	04° 03′ S	078° 15′ E	4663	08

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ▼	WET ▼			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	32		09	28 9	25 3		01	1	5	32	1			7		27

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ▼	S‰ ▼	σ_t ▼	$\Sigma\Delta D$ ▼	O_2 ml/l ▼	V_f ▼
STD	0000	29 18	35 15	22 14	0 000	4 15	5057 3
OBS	0000	29 18	35 15	22 14		4 15	5057 3
OBS	0008	29 18	35 00	22 02		4 20	5057 2
STD	0010	29 18	35 00	22 02	0 058	4 20	5057 4
OBS	0017	29 18	35 01	22 03		4 22	5057 8
STD	0020	29 18	34 98	22 01	0 116	4 27	5057 9
OBS	0026	29 17	34 94	21 98		4 34	5058 1
STD	0030	29 00	34 94	22 04	0 174	4 35	5057 1
OBS	0044	28 35	34 94	22 26		4 42	5053 3
STD	0050	28 23	35 13	22 44	0 286	4 51	5053 4
OBS	0065	27 26	35 43	22 98		4 63	5048 3
STD	0075	25 80	35 41	23 43	0 410	4 60	5037 7
OBS	0087	24 15	35 38	23 90		4 56	5025 2
STD	0100	22 35	35 38	24 43	0 511	3 87	5010 9
OBS	0131	18 94	35 32	25 30		2 58	4981 9
STD	0150	17 81	35 19	25 48	0 664	2 04	4971 7
OBS	0176	16 19	35 08	25 78		1 63	4956 7
STD	0200	14 43	35 07	26 17	0 775	1 72	4939 8
OBS	0220	13 25	35 05	26 40		1 79	4928 2
STD	0250	12 00	34 98	26 59	0 861	1 90	4915 8
OBS	0265	11 57	34 96	26 66		1 95	4911 7
OBS	0295	11 11	34 97	26 75		2 03	4908 2
STD	0300	11 05	34 96	26 75	0 933	2 10	4907 8
OBS	0370	10 32	34 88	26 82		2 61	4903 0
STD	0400	10 19	34 93	26 88	1 065	2 46	4903 5
OBS	0446	09 76	34 96	26 98		2 25	4901 2
STD	0500	08 76	34 88	27 08	1 183	2 06	4891 9
OBS	0526	08 31	34 85	27 13		1 96	4887 8
STD	0600	07 13	34 81	27 27	1 282	1 66	4877 1
OBS	0606	07 06	34 81	27 28		1 64	4876 6
OBS	0776	06 99	34 79	27 28		1 44	4885 7

Sta. No. 19

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	17°	11	20	19	2	1
II	36°	6	8	6	4	2

Consec. Sta. No. 20 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0020	04	12	1961	11	02° 57′ S	078° 12′ E	4864	29

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR	AMT.		COL.	TRANS.
04	32		76	30 0	26 1		02	1	6	01	2			7	00	26

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ Δ D ↓	O₂ml/l ↓	V_f ↓
STD	0000	29 45	34 90	21 86	0 000	4 14	5058 3
OBS	0000	29 45	34 90	21 86		4 14	5058 3
STD	0010	29 26	34 88	21 91	0 059	4 23	5057 5
OBS	0010	29 26	34 88	21 91		4 23	5057 5
OBS	0019	29 16	34 97	22 01		4 22	5057 7
STD	0020	29 16	34 97	22 01	0 118	4 21	5057 7
OBS	0029	29 05	35 01	22 08		4 18	5057 6
STD	0030	29 01	35 04	22 11	0 176	4 20	5057 5
OBS	0048	28 16	35 39	22 66		4 47	5053 7
STD	0050	27 98	35 37	22 70	0 285	4 46	5052 5
OBS	0072	26 43	35 26	23 12		4 30	5041 8
STD	0075	26 42	35 26	23 12	0 410	3 94	5041 9
OBS	0096	25 74	35 28	23 35		2 05	5038 0
STD	0100	25 23	35 28	23 50	0 525	2 07	5034 3
OBS	0145	19 82	35 25	25 02		2 08	4990 6
STD	0150	19 12	35 25	25 20	0 707	2 00	4984 4
OBS	0194	14 52	35 26	26 29		1 61	4941 2
STD	0200	14 26	35 23	26 33	0 821	1 66	4938 6
OBS	0243	12 77	35 07	26 51		1 94	4924 3
STD	0250	12 65	35 07	26 54	0 905	1 97	4923 4
OBS	0293	11 93	35 07	26 68		2 15	4917 9
STD	0300	11 80	35 06	26 69	0 980	2 22	4916 8
OBS	0391	10 43	34 99	26 89		2 71	4906 0
STD	0400	10 34	34 99	26 90	1 114	2 70	4905 5
OBS	0488	09 59	34 97	27 02		2 42	4901 7
STD	0500	09 52	34 98	27 04	1 233	2 29	4901 6
OBS	0584	09 01	34 99	27 13		1 65	4900 4
STD	0600	08 90	34 98	27 14	1 343	1 59	4900 0
OBS	0680	08 36	34 92	27 18		1 42	4897 8
OBS	0775	07 81				1 47	
STD	0800	07 64	34 88	27 25	1 544	1 48	4895 7
OBS	0965	06 59	34 84	27 37		1 51	4891 9
STD	1000	06 39	34 83	27 39	1 725	1 52	4891 3
OBS	1154	05 55	34 80	27 47		1 64	4889 3
STD	1200	05 32	34 80	27 50	1 883	1 73	4888 9
OBS	1439	05 97*	34 79	27 41*		2 16	4911 6*
STD	1500	04 00	34 79	27 64	2 084	2 27	4888 7
OBS	1915	02 74	34 76	27 74		2 90	4895 6
STD	2000	02 60	34 76	27 75	2 352	2 98	4898 6
OBS	2391	02 11	34 75	27 78		3 28	4914 7
STD	2500	02 01	34 75	27 79	2 577	3 35	4919 7
OBS	2868	01 80	34 73	27 79		3 54	4938 2

Sta. No.	Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
				Protected		Unprotected	
				Used	Accepted	Used	Accepted
20	I	15°	11	20	18	2	1
	II	15°	11	17	16	5	3

Consec. Sta. No. 21 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC, DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0021	04	12	1961	20	02° 00′ S	077° 53′ E	4846	09

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR	AMT.		COL.	TRANS.
05	27		09	30 6	26 7		02	8	2	30	2			7		

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ Δ D ↓	O_2 ml/l ↓	V_f ↓
STD	0000	29 33	34 95	21 94	0 000	4 22	5057 6
OBS	0000	29 33	34 95	21 94		4 22	5057 6
OBS	0009	29 35	34 96	21 94		4 37	5058 4
STD	0010	29 35	34 96	21 94	0 059	4 35	5058 4
OBS	0018	29 32	34 97	21 96		4 28	5058 7
STD	0020	29 31	34 99	21 97	0 118	4 30	5058 9
OBS	0027	29 24	35 03	22 03		4 34	5058 9
STD	0030	29 16	35 01	22 04	0 176	4 34	5058 5
OBS	0046	28 68	35 00	22 19		4 34	5056 0
STD	0050	28 67	35 06	22 24	0 290	4 36	5056 4
OBS	0069	27 82	35 26	22 67		4 45	5052 1
STD	0075	27 07	35 26	22 91	0 423	4 07	5046 9
OBS	0092	25 02	35 27	23 56		3 21	5032 1
STD	0100	24 10	35 27	23 84	0 537	3 12	5025 2
OBS	0138	19 98	35 26	24 98		2 56	4991 7
STD	0150	18 66	35 19	25 27	0 709	2 17	4979 9
OBS	0184	15 49	35 07	25 94		1 61	4950 0
STD	0200	14 26	35 07	26 20	0 825	1 88	4938 0
OBS	0230	12 56	35 06	26 55		2 15	4921 2
STD	0250	12 05	35 05	26 64	0 908	2 03	4916 6
OBS	0276	11 53	35 04	26 73		1 96	4912 2
STD	0300	11 40	35 02	26 74	0 980	2 12	4912 0
OBS	0350	11 00	35 00	26 79		2 31	4910 3
STD	0400	10 34	34 99	26 90	1 112	2 19	4905 5
OBS	0437	09 93	34 98	26 97		2 14	4902 8
STD	0500	09 43	34 92	27 01	1 232	2 17	4900 2
OBS	0525	09 26	34 91	27 03		2 18	4899 6
STD	0600	08 88	34 90	27 08	1 346	1 86	4899 4
OBS	0616	08 78	34 90	27 09		1 81	4899 1
OBS	0709	08 08	34 88	27 19		1 59	4895 9
STD	0800	07 57	34 89	27 27	1 551	1 40	4894 9
OBS	0907	07 19	34 95	27 37		1 20	4896 6

Sta. No. 21

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	23°	11	20	19	2	1
II	31°	6	8	8	4	3

Consec. Sta. No. 22 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0022	04	13	1961	03	01° 00′ S	077° 53′ E	4755	08

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR	AMT	DIR	AMT		COL.	TRANS
06	32		09	29 4	26 7		02	8	6	32	2			7	00	25

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ Δ D ↓	O_2 ml/l ↓	V_f ↓
STD	0000	29 32	34 65	21 72	0 000	4 25	5056 5
OBS	0000	29 32	34 65	21 72		4 25	5056 5
OBS	0009	29 31	34 60	21 68		4 35	5056 9
STD	0010	29 31	34 60	21 68	0 061	4 36	5056 9
OBS	0018	29 29	34 60	21 69		4 39	5057 3
STD	0020	29 29	34 60	21 69	0 123	4 37	5057 4
OBS	0027	29 29	34 61	21 70		4 33	5057 8
STD	0030	29 27	34 65	21 73	0 184	4 35	5058 0
OBS	0044	29 15	34 82	21 90		4 41	5058 6
STD	0050	29 04	34 91	22 00	0 303	4 41	5058 5
OBS	0066	27 81	35 11	22 56		4 42	5051 3
STD	0075	26 02	35 18	23 18	0 435	3 83	5038 6
OBS	0088	23 89	35 26	23 89		3 21	5022 7
STD	0100	23 17	35 32	24 15	0 542	3 17	5017 6
OBS	0131	20 75	35 38	24 87		3 07	4998 7
STD	0150	18 46	35 32	25 42	0 703	2 63	4978 4
OBS	0174	16 01	35 24	25 95		2 26	4955 4
STD	0200	13 79	35 15	26 37	0 812	2 17	4933 3
OBS	0219	12 72	35 11	26 55		2 11	4922 5
STD	0250	12 27	35 11	26 64	0 892	1 99	4919 3
OBS	0265	12 09	35 10	26 67		1 96	4918 1
STD	0300	11 89	35 07	26 68	0 964	2 01	4917 8
OBS	0326	11 67	35 05	26 71		2 03	4916 8
STD	0400	10 62	35 02	26 88	1 100	1 94	4908 9
OBS	0410	10 50	35 02	26 90		1 93	4908 1
OBS	0493	09 77	34 97	26 99		2 04	4904 1
STD	0500	09 70	34 97	27 00	1 223	2 01	4903 7
OBS	0579	09 02	34 94	27 09		1 78	4900 0
STD	0600	08 89	34 95	27 12	1 335	1 75	4899 7
OBS	0665	08 47	34 97	27 20		1 65	4898 5
STD	0800	07 61	34 99	27 34	1 530	1 38	4895 8
OBS	0848	07 31	34 99	27 39		1 26	4894 8

Sta. No. 22

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	25°	11	20	19	2	1
II	39°	6	8	7	4	2

Consec. Sta. No. 23 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0023	04	13	1961	18	00° 00′ N	078° 00′ E	4663	24

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR			DRY	WET			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	27		10	28 3	26 7		02	8	2	27	2			7	00	

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C	S‰	σ_t	$\Sigma \Delta D$	O_2 ml/l	V_f
STD	0000	29 13	34 69	21 81	0 000	4 06	5055 3
OBS	0000	29 13	34 69	21 81		4 06	5055 3
OBS	0009	29 14	34 67	21 79		4 22	5055 9
STD	0010	29 14	34 68	21 80	0 060	4 22	5056 0
OBS	0018	29 11	34 73	21 85		4 23	5056 4
STD	0020	29 10	34 73	21 85	0 120	4 25	5056 5
OBS	0027	28 96	34 72	21 89		4 28	5055 9
STD	0030	28 77	34 74	21 97	0 180	4 27	5054 8
OBS	0045	27 81	34 92	22 42		4 15	5049 4
STD	0050	27 61	35 07	22 60	0 291	4 09	5048 7
OBS	0068	26 24	35 40	23 28		3 72	5040 6
STD	0075	25 21	35 39	23 59	0 411	3 45	5033 0
OBS	0091	23 01	35 36	24 22		2 87	5015 9
STD	0100	21 99	35 31	24 48	0 509	2 46	5007 5
OBS	0137	18 00	35 19	25 44		1 45	4972 8
STD	0150	16 34	35 19	25 83	0 652	1 52	4957 1
OBS	0183	13 44	35 18	26 46		1 68	4928 6
STD	0200	13 09	35 15	26 51	0 748	1 75	4925 6
OBS	0230	12 54	35 11	26 59		1 82	4921 2
STD	0250	12 17	35 10	26 65	0 824	1 80	4918 2
OBS	0277	11 89	35 09	26 70		1 77	4916 5
STD	0300	11 88	35 08	26 69	0 896	1 74	4917 8
OBS	0304	11 88	35 08	26 69		1 73	4918 0
OBS	0380	11 71	35 06	26 71		1 84	4920 5
STD	0400	11 26	35 03	26 77	1 037	1 91	4916 4
OBS	0456	10 28	34 99	26 92		1 92	4908 1
STD	0500	09 84	35 00	27 00	1 165	1 63	4905 5
OBS	0530	09 60	35 01	27 05		1 49	4904 4
STD	0600	09 27	35 05	27 13	1 277	1 36	4904 7
OBS	0605	09 24	35 05	27 14		1 35	4904 7
OBS	0757	08 39	35 01	27 24		1 07	4903 1
STD	0800	07 95	35 00	27 30	1 475	1 03	4900 1
OBS	0909	07 14	34 97	27 40		1 00	4896 2
STD	1000	07 10	34 94	27 38	1 654	1 14	4900 9
OBS	1138	06 78	34 91	27 40		1 35	4904 9
STD	1200	06 26	34 90	27 46	1 821	1 47	4901 8
STD	1500	04 26	34 85	27 66	2 030	1 99	4892 6
OBS	1531	04 10	34 85	27 68		2 03	4892 2
OBS	1934	02 87	34 82	27 78		2 48	4898 8
STD	2000	02 72	34 81	27 78	2 290	2 57	4900 5
OBS	2354	02 20	34 77	27 79		3 09	4913 8

Sta. No.	Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
				Protected		Unprotected	
				Used	Accepted	Used	Accepted
23	I	15°	11	20	17	2	1
	II	40°	11	17	15	5	2

Consec. Sta. No. 24 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0024	04	14	1961	06	00° 56′ N	078° 01′ E	4663	10

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMID-ITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ▼	WET ▼			TYPE	AMT.	DIR	AMT	DIR	AMT		COL.	TRANS
08	32		10	28 9	26 1		03	8	8	32	2			7	00	24

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ▼	S‰ ▼	σ_t ▼	Σ Δ D ▼	O_2 ml/l ▼	V_f ▼
STD	0000	29 42	34 65	21 68	0 000	4 14	5057 2
OBS	0000	29 42	34 65	21 68		4 14	5057 2
STD	0010	29 41	34 64	21 68	0 061	4 21	5057 8
OBS	0010	29 41	34 64	21 68		4 21	5057 8
STD	0020	29 31	34 65	21 72	0 123	4 14	5057 7
OBS	0020	29 31	34 65	21 72		4 14	5057 7
STD	0030	29 23	34 64	21 74	0 184	4 28	5057 7
OBS	0030	29 23	34 64	21 74		4 28	5057 7
STD	0050	28 16	34 92	22 30	0 300	4 30	5052 2
OBS	0050	28 16	34 92	22 30		4 30	5052 2
STD	0075	25 99	35 04	23 09	0 430	3 58	5037 9
OBS	0075	25 99	35 04	23 09		3 58	5037 9
STD	0100	23 06	35 25	24 13	0 538	2 52	5016 5
OBS	0100	23 06	35 25	24 13		2 52	5016 5
STD	0150	18 63	35 15	25 25	0 704	1 38	4979 4
OBS	0150	18 63	35 15	25 25		1 38	4979 4
STD	0200	13 52	35 13	26 41	0 815	1 58	4930 3
OBS	0200	13 52	35 13	26 41		1 58	4930 3
STD	0250	12 35	35 10	26 62	0 895	1 64	4920 2
OBS	0250	12 35	35 10	26 62		1 64	4920 2
STD	0300	11 96	35 08	26 68	0 968	1 76	4918 7
OBS	0300	11 96	35 08	26 68		1 76	4918 7
OBS	0398	11 06	35 06	26 83		1 64	4914 1
STD	0400	11 04	35 06	26 83	1 107	1 64	4913 9
OBS	0497	11 25*	35 01	26 76*		1 59	4921 9*
STD	0500	10 23	35 01	26 94	1 234	1 58	4910 2
OBS	0597	09 53	35 02	27 07		1 34	4907 6
STD	0600	09 51	35 02	27 07	1 352	1 33	4907 5
OBS	0697	08 90	35 03	27 18		1 15	4905 9
OBS	0797	08 07	35 02	27 30		1 06	4901 5
STD	0800	08 05	35 02	27 30	1 557	1 06	4901 4
OBS	0996	06 67	34 98	27 47		1 20	4895 3

Sta. No. 24

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	5°	11	20	20	2	1
II	3°	6	8	7	4	3

Consec. Sta. No. 25

SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0025	04	14	1961	18	02° 00′ N	077° 57′ E	4297	10

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ▼	WET ▼			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
04	26		10	29 8	25 6		02	8	3	26	2			7	00	

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ▼	S‰ ▼	σ_t ▼	Σ Δ D ▼	O₂ ml/l ▼	V_f ▼
STD	0000	29 63				4 03	
OBS	0000	29 63	35 08*	21 93*		4 03	5060 2*
STD	0010	29 63	34 89	21 79		4 15	5060 1
OBS	0010	29 63	34 89	21 79		4 15	5060 1
STD	0020	29 52	34 92	21 85		4 20	5060 1
OBS	0020	29 52	34 92	21 85		4 20	5060 1
STD	0030	28 57	34 79	22 07		4 25	5053 5
OBS	0030	28 57	34 79	22 07		4 25	5053 5
STD	0050	28 22	34 88	22 25		4 25	5052 5
OBS	0050	28 22	34 88	22 25		4 25	5052 5
STD	0075	26 76	34 92	22 76		3 76	5043 3
OBS	0075	26 76	34 92	22 76		3 76	5043 3
STD	0100	23 21	34 96	23 86		2 38	5016 7
OBS	0100	23 21	34 96	23 86		2 38	5016 7
STD	0150	17 10	34 98	25 49		0 68	4963 9
OBS	0150	17 10	34 98	25 49		0 68	4963 9
STD	0200	13 41	35 08	26 39		1 19	4928 9
OBS	0200	13 41	35 08	26 39		1 19	4928 9
STD	0250	12 24	35 00	26 56		1 79	4918 5
OBS	0250	12 24	35 00	26 56		1 79	4918 5
STD	0300	11 36	35 04	26 76		1 92	4911 6
OBS	0300	11 36	35 04	26 76		1 92	4911 6
OBS	0398	11 11	35 02	26 79		1 93	4914 5
STD	0400	11 09	35 02	26 79		1 90	4914 4
OBS	0496	10 38	35 05	26 94		0 96	4911 9
STD	0500	10 37	35 05	26 95		0 97	4912 0
OBS	0596	09 79	35 02	27 02		1 05	4910 7
STD	0600	09 74	35 02	27 03		1 03	4910 3
OBS	0695	08 69	35 02	27 20		0 78	4903 2
OBS	0794	07 87	34 99	27 31		0 95	4898 7
STD	0800	07 83	34 99	27 31		0 96	4898 6
OBS	0993	06 67	34 93	27 43		1 08	4895 0

Sta. No. 25

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	0°	11	20	19	2	1
II	2°	6	8	8	4	2

Consec. Sta. No. 26 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE MO.	DAY	YEAR	HOUR	POSITION LATITUDE	LONGITUDE	SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
00599	0026	04	15	1961	02	03° 00′ N	077° 53′ E	3292	29

WIND SPEED	WIND DIR.	ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE DRY ▼	AIR TEMPERATURE WET ▼	HUMIDITY	WEATHER	CLOUD TYPE	CLOUD AMT.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	VIS.	WATER COL.	WATER TRANS.
04	32		09	30 0	26 1		01	9	8	32	2			7	00	23

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ▼	S‰ ▼	σ_t ▼	$\Sigma \Delta D$ ▼	O_2 ml/l ▼	V_f ▼
STD	0000	29 50	34 92	21 86	0 000	4 15	5058 7
OBS	0000	29 50	34 92	21 86		4 15	5058 7
STD	0010	29 48	34 91	21 86	0 060	4 26	5059 2
OBS	0010	29 48	34 91	21 86		4 26	5059 2
STD	0020	29 48	34 91	21 86	0 119	4 21	5059 8
OBS	0020	29 48	34 91	21 86		4 21	5059 8
STD	0030	29 41	34 93	21 89	0 179	4 30	5060 0
OBS	0030	29 41	34 93	21 89		4 30	5060 0
STD	0050	28 49	35 03	22 28	0 294	4 38	5055 0
OBS	0050	28 49	35 03	22 28		4 38	5055 0
STD	0075	26 50	35 22	23 06	0 425	4 16	5042 4
OBS	0075	26 50	35 22	23 06		4 16	5042 4
STD	0100	25 64	35 27	23 37	0 542	3 32	5037 5
OBS	0100	25 64	35 27	23 37		3 32	5037 5
STD	0150	15 21	35 02	25 96	0 709	0 83	4944 9
OBS	0150	15 21	35 02	25 96		0 83	4944 9
STD	0200	13 41	35 06	26 37	0 804	0 80	4928 8
OBS	0200	13 41	35 06	26 37		0 80	4928 8
STD	0250	12 76	35 10	26 54	0 886	1 44	4924 8
OBS	0250	12 76	35 10	26 54		1 44	4924 8
STD	0300	11 67	35 09	26 74	0 960	1 34	4915 4
OBS	0300	11 67	35 09	26 74		1 34	4915 4
OBS	0391	11 02	35 07	26 85		1 34	4913 2
STD	0400	10 97	35 07	26 85	1 095	1 29	4913 2
OBS	0488	10 43	35 09	26 97		0 96	4912 1
STD	0500	10 35	35 09	26 98	1 219	0 96	4911 9
OBS	0586	09 67	35 06	27 07		0 89	4908 8
STD	0600	09 50	35 06	27 10	1 334	0 84	4907 6
OBS	0684	08 67	35 03	27 21		0 67	4902 3
OBS	0782	08 19	35 00	27 27		0 75	4902 0
STD	0800	08 06	34 99	27 28	1 538	0 78	4901 5
OBS	0978	06 85	34 94	27 41		1 12	4896 4
STD	1000	06 71	34 94	27 43	1 714	1 17	4895 9
OBS	1173	05 69	34 91	27 54		1 49	4892 7
STD	1200	05 57	34 90	27 55	1 865	1 52	4892 7
OBS	1467	04 43	34 86	27 65		1 88	4893 0
STD	1500	04 29	34 85	27 66	2 059	1 93	4893 0
OBS	1956	02 82	34 80	27 76		2 63	4899 3
STD	2000	02 74	34 80	27 77	2 323	2 74	4900 8
OBS	2446	02 08	34 78	27 81		3 38	4917 6
STD	2500	02 02	34 78	27 82	2 541	3 34	4919 9
OBS	2936	01 76	34 75	27 81		3 00	4941 8

Sta. No.	Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS Protected Used	Protected Accepted	Unprotected Used	Unprotected Accepted
26	I	2°	11	20	18	2	1
	II	5°	11	17	14	5	3

Consec. Sta. No. 27 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0027	04	15	1961	14	03° 50′ N	078° 01′ E	3127	28

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMID-ITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ▼	WET ▼			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
05	29		08	30 6	26 1		02	8	2	30	2			7	00	

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ▼	S‰ ▼	σ_t ▼	Σ Δ D ▼	O_2 ml/l ▼	V_f ▼
STD	0000	29 68	34 47	21 46	0 000	4 06	5058 4
OBS	0000	29 68	34 47	21 46		4 06	5058 4
OBS	0009	29 66	34 47	21 47		4 15	5058 9
STD	0010	29 65	34 54	21 52	0 063	4 16	5059 1
OBS	0018	29 54	34 91	21 84		4 23	5060 1
STD	0020	29 48	34 91	21 86	0 125	4 23	5059 8
OBS	0027	29 32	34 91	21 91		4 23	5059 1
STD	0030	29 31	34 91	21 91	0 184	4 23	5059 2
OBS	0045	29 22	34 92	21 95		4 23	5059 5
STD	0050	29 14	34 93	21 99	0 302	4 24	5059 3
OBS	0068	28 86	34 97	22 11		4 26	5058 5
STD	0075	28 42	35 05	22 32	0 445	4 19	5056 1
OBS	0091	26 97	35 18	22 88		3 83	5046 8
STD	0100	25 30	35 15	23 38	0 571	3 13	5034 4
OBS	0136	19 67	35 08	24 93		1 25	4988 1
STD	0150	17 92	35 08	25 37	0 751	1 06	4972 4
OBS	0181	15 01	35 09	26 06		0 91	4944 9
STD	0200	14 15	35 11	26 26	0 864	1 10	4937 0
OBS	0226	13 18	35 13	26 48		1 33	4928 1
STD	0250	12 56	35 13	26 60	0 947	1 52	4922 6
OBS	0271	12 10	35 12	26 68		1 61	4918 7
STD	0300	11 87	35 10	26 71	1 020	1 48	4917 7
OBS	0372	11 06	35 08	26 85		1 18	4912 6
STD	0400	10 50	35 08	26 95	1 152	1 06	4907 7
OBS	0465	09 53	35 08	27 11		0 86	4900 0
STD	0500	09 46	35 08	27 13	1 265	0 85	4901 2
OBS	0558	09 74*	35 07	27 07*		0 80	4908 0*
STD	0600	09 41	35 07	27 13	1 371	0 71	4906 5
OBS	0651	09 17	35 06	27 16		0 63	4906 6
OBS	0745	08 43	35 04	27 26		0 58	4903 0
STD	0800	07 97	35 03	27 32	1 569	0 67	4900 5
OBS	0934	06 97	34 99	27 44		0 89	4895 6
STD	1000	06 57	34 97	27 47	1 736	1 01	4894 2
OBS	1122	05 86	34 94	27 54		1 22	4892 1
STD	1200	05 40	34 92	27 59	1 879	1 36	4890 5
OBS	1406	04 35	34 88	27 68		1 72	4888 4
STD	1500	04 01	34 87	27 70	2 059	1 90	4889 2
OBS	1880	02 94	34 82	27 77		2 45	4896 6
STD	2000	02 76	34 81	27 78	2 309	2 54	4901 1
OBS	2358	02 29	34 79	27 80		2 80	4915 5
STD	2500	02 12	34 78	27 81	2 529	2 91	4921 4
OBS	2836	01 77	34 77	27 83		3 17	4936 1

Sta. No. 27

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	20°	11	20	19	2	1
II	32°	11	17	16	5	2

Consec. Sta. No. 28 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0028	04	22	1961	02	08° 00′ N	069° 46′ E	4572	28

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ▼	WET ▼			TYPE	AMT.	DIR.	AMT.	DIR	AMT.		COL.	TRANS.
05	28		09	29 4	25 2		02	8	4	28	2			7	00	28

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ▼	S‰ ▼	σ_t ▼	$\Sigma\Delta D$ ▼	O_2 ml/l ▼	V_f ▼
STD	0000	29 71	35 04	21 88	0 000	4 17	5060 6
OBS	0000	29 71	35 04	21 88		4 17	5060 6
STD	0010	29 72	35 04	21 87	0 060	4 31	5061 3
OBS	0010	29 72	35 04	21 87		4 31	5061 3
OBS	0019	29 78	35 13	21 92		4 22	5062 5
STD	0020	29 74	35 17	21 96	0 119	4 26	5062 5
OBS	0029	29 36	35 46	22 31		4 50	5061 3
STD	0030	29 33	35 50	22 35	0 176	4 52	5061 3
OBS	0049	28 57	35 87	22 88		4 56	5058 4
STD	0050	28 57	35 82	22 84	0 281	4 53	5058 3
OBS	0074	26 78	35 10	22 88		3 82	5044 1
STD	0075	26 50	35 11	22 98	0 406	3 68	5042 0
OBS	0098	21 37	35 31	24 65		1 15	5002 0
STD	0100	21 26	35 30	24 67	0 509	1 14	5001 1
OBS	0148	18 28	35 09	25 29		0 80	4975 7
STD	0150	18 10	35 09	25 33	0 659	0 78	4974 1
OBS	0197	14 73	35 06	26 10		0 41	4942 8
STD	0200	14 61	35 07	26 13	0 775	0 41	4941 7
OBS	0246	13 20	35 21	26 53		0 38	4929 8
STD	0250	13 16	35 21	26 54	0 863	0 39	4929 6
OBS	0296	12 75	35 19	26 61		0 43	4927 7
STD	0300	12 74	35 19	26 61	0 940	0 43	4927 8
OBS	0363	12 19	35 21	26 73		0 45	4925 5
STD	0400	11 03	35 18	26 93	1 078	0 59	4914 3
OBS	0453	09 99	35 15	27 09		0 68	4905 1
STD	0500	09 93	35 15	27 10	1 193	0 60	4907 2
OBS	0544	09 88	35 14	27 10		0 55	4909 1
STD	0600	09 48	35 12	27 15	1 300	0 54	4907 6
OBS	0635	09 25	35 11	27 18		0 53	4906 8
OBS	0725	08 71	35 10	27 26		0 55	4905 5
STD	0800	08 36	35 06	27 29	1 499	0 68	4905 5
OBS	0912	07 71	35 01	27 35		0 85	4903 8
STD	1000	06 93	34 99	27 44	1 674	0 95	4899 0
OBS	1104	06 26	34 96	27 51		1 07	4896 3
STD	1200	06 23	34 94	27 50	1 831	1 19	4901 5
OBS	1388	05 87	34 91	27 52		1 46	4907 8
STD	1500	05 03	34 87	27 59	2 048	1 73	4903 1
OBS	1870	03 04	34 79	27 74		2 45	4897 3
STD	2000	02 80	34 79	27 76	2 338	2 61	4901 6
OBS	2350	02 29	34 78	27 79		2 94	4914 9
STD	2500	02 12	34 77	27 80	2 564	3 04	4921 3
OBS	2832	01 87	34 73	27 79		3 19	4937 1

Sta. No.	Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
				Protected		Unprotected	
				Used	Accepted	Used	Accepted
28	I	13°	11	20	20	2	0
	II	25°	11	17	17	5	2

Consec. Sta. No. 29

SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0029	04	23	1961	12	08° 00′ N	057° 08′ E	4023	29

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR.	AMT.		COL.	TRANS.
02	27		08	30 7	25 0		03	8	2	00	0			7	00	25

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	Σ ΔD ↓	O₂ml/l ↓	V_f ↓
STD	0000	29 57	35 00	21 89	0 000	4 12	5059 5
OBS	0000	29 57	35 00	21 89		4 12	5059 5
STD	0010	29 56	34 99	21 89	0 059	4 25	5060 0
OBS	0010	29 56	34 99	21 89		4 25	5060 0
OBS	0019	29 49	35 01	21 93		4 26	5060 1
STD	0020	29 49	35 02	21 94	0 119	4 26	5060 2
OBS	0028	29 45	35 14	22 04		4 29	5060 8
STD	0030	29 33	35 17	22 10	0 177	4 32	5060 2
OBS	0047	28 42	35 38	22 56		4 45	5055 5
STD	0050	28 39	35 42	22 60	0 287	4 44	5055 6
OBS	0072	27 42	35 66	23 10		4 35	5050 7
STD	0075	27 10	35 68	23 22	0 412	4 13	5048 5
OBS	0095	25 06	35 74	23 90		2 86	5034 2
STD	0100	24 67	35 72	24 01	0 520	2 62	5031 4
OBS	0143	20 90	35 55	24 96		1 28	5001 4
STD	0150	19 94	35 50	25 18	0 690	1 30	4992 9
OBS	0191	15 87	35 29	26 02		1 41	4955 2
STD	0200	15 62	35 28	26 07	0 812	1 45	4953 1
OBS	0238	14 45	35 25	26 30		1 55	4943 0
STD	0250	13 94	35 24	26 40	0 904	1 54	4938 2
OBS	0286	12 71	35 23	26 65		1 49	4926 8
STD	0300	12 51	35 23	26 69	0 983	1 46	4925 4
OBS	0385	11 52	35 23	26 88		1 23	4919 3
STD	0400	11 41	35 24	26 91	1 118	1 18	4918 9
OBS	0480	10 92	35 28	27 03		0 91	4918 2
STD	0500	10 84	35 28	27 04	1 238	0 82	4918 4
OBS	0575	10 50	35 27	27 09		0 62	4918 8
STD	0600	10 37	35 28	27 13	1 349	0 65	4918 8
OBS	0670	10 00	35 29	27 20		0 68	4918 6
OBS	0766	09 50	35 29	27 28		0 63	4918 3
STD	0800	09 22	35 27	27 31	1 551	0 65	4916 9
OBS	0957	07 98	35 19	27 45		0 75	4910 6
STD	1000	07 66	35 17	27 48	1 723	0 78	4909 0
OBS	1148	06 64	35 10	27 57		0 94	4904 5
STD	1200	06 32	35 07	27 59	1 870	1 03	4903 3
OBS	1436	06 77*	34 96	27 44*	*	1 46	4922 6
STD	1500	04 69	34 94	27 68	2 061	1 63	4898 8
OBS	1916	03 12	34 83	27 76		2 47	4901 3
STD	2000	02 94	34 83	27 78	2 323	2 53	4903 7
OBS	2402	02 29	34 82	27 83		2 81	4918 2
STD	2500	02 18	34 81	27 83	2 541	2 87	4922 4
OBS	2892	01 92	34 77	27 82		3 11	4941 6

Sta. No. 29

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	12°	11	20	17	2	0
II	19°	11	17	17	5	2

Consec. Sta. No. 30 — SURFACE OBSERVATIONS

NODC REF. NO.	STATION	DATE				POSITION		SONIC DEPTH UNCORRECTED	MAX. SAMPLE DEPTH
		MO.	DAY	YEAR	HOUR	LATITUDE	LONGITUDE		
00599	0030	04	25	1961	09	12° 00′ N	054° 00′ E	0750	07

WIND		ANEMO. HGT.	AIR PRESS	AIR TEMPERATURE		HUMIDITY	WEATHER	CLOUD		SEA		SWELL		VIS.	WATER	
SPEED	DIR.			DRY ↓	WET ↓			TYPE	AMT.	DIR.	AMT.	DIR	AMT.		COL.	TRANS.
00	00		12	30 0	24 4		01	1	2	00	0			7	00	27

SUBSURFACE OBSERVATIONS

	SAMPLE DEPTH (M)	T °C ↓	S‰ ↓	σ_t ↓	$\Sigma \Delta D$ ↓	O_2 ml/l ↓	V_t ↓
STD	0000	29 57	36 24	22 82	0 000	3 70	5063 7
OBS	0000	29 57	36 24	22 82		3 70	5063 7
STD	0010	28 96	36 29	23 07	0 049	4 16	5060 2
OBS	0010	28 96	36 29	23 07		4 16	5060 2
STD	0020	28 72	36 28	23 14	0 097	4 14	5059 1
OBS	0020	28 72	36 28	23 14		4 14	5059 1
STD	0030	28 26	36 33	23 33	0 144	4 28	5056 6
OBS	0030	28 26	36 33	23 33		4 28	5056 6
STD	0050	27 82	36 29	23 44	0 234	4 30	5054 4
OBS	0050	27 05*	36 29	23 69*		4 30	5048 8*
STD	0075	27 27	36 13	23 50	0 345	3 38	5051 4
OBS	0075	27 27	36 13	23 50		3 38	5051 4
STD	0100	24 20	35 99	24 35	0 446	2 93	5028 5
OBS	0100	24 20	35 99	24 35		2 93	5028 5
STD	0150	19 15	35 59	25 45	0 601	1 07	4986 0
OBS	0150	19 15	35 59	25 45		1 07	4986 0
STD	0200	16 57	35 56	26 06	0 717	0 52	4963 8
OBS	0200	16 57	35 56	26 06		0 52	4963 8
STD	0250	15 03	35 57	26 42	0 809	0 45	4951 0
OBS	0250	15 03	35 57	26 42		0 45	4951 0
STD	0300	14 53	35 60	26 55	0 891	0 42	4948 8
OBS	0300	14 53	35 60	26 55		0 42	4948 8
OBS	0399	13 13	35 57	26 83		0 36	4939 5
STD	0400	13 12	35 57	26 83	1 037	0 36	4939 4
OBS	0498	12 09	35 58	27 04		0 35	4933 8
STD	0500	12 08	35 58	27 04	1 162	0 35	4933 8
OBS	0598	11 47	35 57	27 15		0 36	4932 6
STD	0600	11 46	35 57	27 15	1 273	0 36	4932 6
OBS	0698	10 89	35 55	27 24		0 35	4931 8
OBS	0736	10 63	35 54	27 28		0 43	4931 0

Sta. No. 30

Cast No.	Wire Angle	Nansen Bottles	THERMOMETERS			
			Protected		Unprotected	
			Used	Accepted	Used	Accepted
I	2°	11	20	19	2	1
II	5°	5	7	6	3	0

U. S. Naval Oceanographic Office
OCEANOGRAPHIC STATIONS TAKEN IN THE INDIAN OCEAN BY USCGC EASTWIND (WAGB-279) IN 1961, October 1963.
84 p., including 25 figs., 1 table. (TR-141).

Contains results of 30 oceanographic stations taken in the Indian Ocean by USCGC EASTWIND during a return voyage from Antarctic in 1961. Starting West of Australia, stations were taken along the 32°S parallel, the 78°E meridian, and from 8°N 70°E to 12°N 54°E. Red Sea surface temperatures and salinities are included. Oceanography of Indian Ocean is discussed. Vertical distribution profiles of temperature, salinity, density (sigma-t), dissolved oxygen, percentage saturation of dissolved oxygen, and sound velocity; selected vertical distribution graphs; and temperature salinity curves are presented. Transparency and depth of deep scattering layer were measured. Appendix A contains a tabulation of oceanographic data for the 30 stations.

1. Indian Ocean - Oceanography
2. Oceanography - Indian Ocean
3. Ships - USCGC EASTWIND

i. Title: Oceanographic Stations Taken in the Indian Ocean by USCGC EASTWIND (WAGB-279) in 1961.

ii. Author: Willis L. Tressler

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