

NEW ZEALAND
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

BULLETIN 144

**ANALYSIS OF HYDROLOGICAL
OBSERVATIONS IN THE
NEW ZEALAND REGION, 1874-1955**

by

D. M. GARNER

New Zealand Oceanographic Institute

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Memoir No. 9.

1962

ANALYSIS OF HYDROLOGICAL OBSERVATIONS IN THE NEW ZEALAND REGION, 1874–1955



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Frontispiece: HMS Challenger at anchor in Wellington Harbour, New Zealand, 1874 (ship on left with white band)

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FOREWORD

DURING the past century a number of oceanographic expeditions have worked in the South-West Pacific Ocean, Tasman Sea, and Southern Ocean in the vicinity of New Zealand. The hydrological results available have been analysed and have provided a general background against which the Institute's hydrological work in the off-shore region around New Zealand could be planned and evaluated.

The material has been edited for publication by Mr M. O'Connor,
Information Bureau, Department of Scientific and Industrial Research.

J. W. BRODIE, Director,
New Zealand Oceanographic Institute,
Wellington.

CONTENTS

									<i>Page No.</i>
INTRODUCTION	++	++	++	++	++	++	++	++	9
Distribution of Stations		++	++	++	++	++	++	++	9
Sources of Data	++	++	++	++	++	++	++	++	10
Station Data	++	++	++	++	++	++	++	++	10
DISCUSSION	++	++	++	++	++	++	++	++	13
Introduction	++	++	++	++	++	++	++	++	13
Characteristic Water Properties			++	++	++	++	++	++	13
Surface Water	++	++	++	++	++	++	++	++	15
Antarctic Surface Water	++	++	++	++	++	++	++	++	19
Subantarctic Surface Water	++	++	++	++	++	++	++	++	19
Subtropical Surface Water	++	++	++	++	++	++	++	++	22
Coastal Surface Water	++	++	++	++	++	++	++	++	24
Antarctic Intermediate Water	++	++	++	++	++	++	++	++	25
The Deep and Bottom Water	++	++	++	++	++	++	++	++	26
ACKNOWLEDGMENTS	++	++	++	++	++	++	++	++	30
REFERENCES ..	++	++	++	++	++	++	++	++	30
APPENDIX A—SOURCES OF DATA	++	++	++	++	++	++	++	++	31
APPENDIX B—STATION CIRCUMSTANCES	++	++	++	++	++	++	++	++	32
APPENDIX C—STATION DATA	++	++	++	++	++	++	++	++	34
INDEX	++	++	++	++	++	++	++	++	45

FIGURES

Figure	Page No.
1. Hydrological station worked in New Zealand waters up to 1955	11
2. Sketch bathymetry of the sea floor around New Zealand	12
3. Temperature-salinity correlation curves for Stations Da 3628 in the Subtropical zone, Di 2217 in the Subantarctic zone, and Di 920 in the Antarctic zone	13
4. Generalised pattern of surface salinity (‰) around New Zealand	14
5. Distribution of surface salinity off south-eastern New Zealand; Danish Deep Sea Expedition, January 1929	15
6. Generalised pattern of salinity at the level of minimum salinity in the Antarctic Intermediate Water	16
7. The distribution of salinity at the level of maximum salinity in the Deep Water	17
8. The distribution of salinity at the level of bottom salinity below about 4,000 m	18
9. Vertical meridional cross section of salinity off the east coast of New Zealand across the Chatham Rise, constructed from <i>Dana</i> Stations 3639-3642, January 1929	19
10. Vertical meridional cross section of salinity off the east coast of New Zealand across the Chatham Rise, constructed from <i>Discovery</i> Stations 1281-1278, January 1934	20
11. Vertical meridional cross section of salinity off the east coast of New Zealand constructed from N.Z.O.I. Stations A 81 to A 36, February 1955	21
12. Vertical meridional cross section of salinity off the east coast of New Zealand constructed from N.Z.O.I. Station A 181 to A 131, May 1955	21
13. Vertical cross section of salinity from Cook Strait south-eastwards across the Chatham Rise and Bounty Trough, constructed from <i>Discovery</i> Stations 942-947, August 1932	22
14. Vertical cross section of salinity from Bank Peninsula eastwards along the Chatham Rise, constructed from station data of the Chatham Island (1954) Expedition	22
15. Vertical meridional cross section of salinity off the west coast of New Zealand constructed from <i>Discovery</i> Stations 921-920, June-July 1933	23
16. Vertical cross-section of salinity from the north-east Tasman Sea through Cook Strait to the Bounty Trough constructed from <i>Dana</i> Stations 3654-3643, January 1929	23
17. Vertical meridional cross section of salinity west of North Island, constructed from N.Z.O.I. Stations A 64 to A 54, February 1955	24
18. Vertical meridional cross section of salinity west of North Island, constructed from N.Z.O.I. Stations A 162 to A 151, May 1955	24
19. Vertical cross section of salinity from the north-east Tasman Sea towards the west coast of North Island, constructed from <i>Discovery</i> Stations 2728-2731, October 1950	25
20. Vertical cross section of salinity from the south-east Tasman Sea towards Foveaux Strait, constructed from <i>Discovery</i> Stations 2819-2821, May 1951	26
21. Vertical cross section of salinity from the Bounty Trough across the southern edge of the Campbell Plateau near Campbell Island, constructed from <i>Discovery</i> Stations 2213-08, January 1938	27
22. Vertical cross section of salinity from the head of the Bounty Trough over the eastern edge of the Campbell Plateau near the Antipodes Islands, constructed from <i>Discovery</i> Stations 2213-2217, February 1938	27
23a. Map showing positions of USS <i>Brough</i> bathythermograph soundings 251-279, taken across the southern edge of the Campbell Plateau, January 1958	28
23b. Vertical cross section of temperature constructed from bathythermograph soundings shown in fig. 23a.	28
23c. Variation in surface salinity associated with the temperature cross section shown in fig. 23b	29
24. Composite vertical zonal cross section of salinity across the Campbell Plateau constructed from various <i>Discovery</i> stations	29

PLATES

	Facing page
Frontispiece: HMS <i>Challenger</i> at anchor in Wellington Harbour, 1874.	
I SY <i>Terra Nova</i>	20
II The corvette <i>L'Astrolabe</i>	20
III RRS <i>Discovery II</i>	26
IV The Royal Danish Research Ship <i>Dana</i>	26

ANALYSIS OF HYDROLOGICAL OBSERVATIONS IN THE NEW ZEALAND REGION, 1874-1955

INTRODUCTION

A NUMBER of oceanographic stations devoted to a study of the temperature and chemistry of ocean waters have been worked around New Zealand, firstly by visiting oceanographic and hydrographic survey expeditions and, more recently, by marine workers in this country.

This study provides a convenient source of reference to the data scattered through the literature, and the general discussion following gives an interpretation of hydrological knowledge of New Zealand waters at the beginning of work in this field by the New Zealand Oceanographic Institute in 1955.

DISTRIBUTION OF STATIONS

The geographical extent of this analysis has been arbitrarily but conveniently defined by the New Zealand Oceanographic Institute's base plotting sheet *Lord Howe - Antipodes 60* which is bounded by latitudes 28° S and 56° S and by longitudes 158° E and 174° W.

Fig. 1 shows the position of those hydrological stations for which data have been available to the writer, worked during this period in the chosen area of interest. The plot distinguishes those stations at which vertical profiles of temperature and salinity were measured, from those including dissolved oxygen determinations as well.

In time, stations commence with those of the historic cruise of HMS *Challenger*, which was in New Zealand waters during 1874. For the purposes of the following summary, the original temperature and density data published in the records of the Expedition have been converted to salinities by the writer using Knudsen's Tables. Earlier, some subsurface measurements of temperature only were made in New Zealand waters (using minimum thermometers) by Dumont D'Urville's *Astrolabe* explorations (1837-40). After the *Challenger* investigations, the next hydrological stations were worked by the British Antarctic (*Terra Nova*) Expedition while engaged on hydrographic survey in the vicinity of the Three Kings Islands in 1911. Between the *Challenger* and *Terra Nova* work some deep temperature measurements were made in the northern part of the area, chiefly by visiting hydrographic survey vessels (Vaughan, 1937, p. 24). In more recent years the Danish *Dana* (1928-29) and British *Discovery* (1932, 1934, 1938, 1950, and 1951) investigations have provided the bulk of hydrological information from New Zealand waters. The Chatham Islands (1954) Expedition stations are shown, and for 1955 are plotted positions of the most seaward stations of a series of hydrological sections worked over the shelf normal to the coast by the New Zealand Oceanographic Institute. As the emphasis here is on oceanic waters, the remainder of the data of

this N.Z.O.I. work is excluded, as are *Galathea* Stations 603, 605, and 615, worked in Milford Sound in 1952. However, *Dana* stations in the Hauraki Gulf and Cook Strait and *Discovery* stations between the Three Kings Islands and Kaipara Harbour, and in Cook Strait, have been included.

Geographically, the major blank areas without stations are the North Cape - Lord Howe Islands - Kermadec Islands triangle, the eastern and southern central Tasman Sea, off-shore waters east of North Island (from the Kermadec Islands to the Chatham Islands), and to the south-east of the Bounty Islands - Antipodes Islands area.

Fig. 2 shows a sketch of the shape of the sea floor in the area chosen for this study. This was prepared by N. M. Ridgway from collector plots of oceanic soundings in the files of the N.Z.O.I.

SOURCES OF DATA

The sources of data used in this work have been listed (Appendix A) in alphabetical order of the reference symbols used on the chart of station positions (fig. 1).

STATION DATA

The position, date, and water depth at each station plotted in fig. 1 are listed (Appendix B). The arrangement is in alphabetical order of the plotting reference defined in Appendix A. Serial station numbers are those allotted by the original investigations, except for the *Terra Nova* stations which are numbered here consecutively from 1 in chronological order.

The numerical station data are given in Appendix C in the same order as shown in Appendix B.

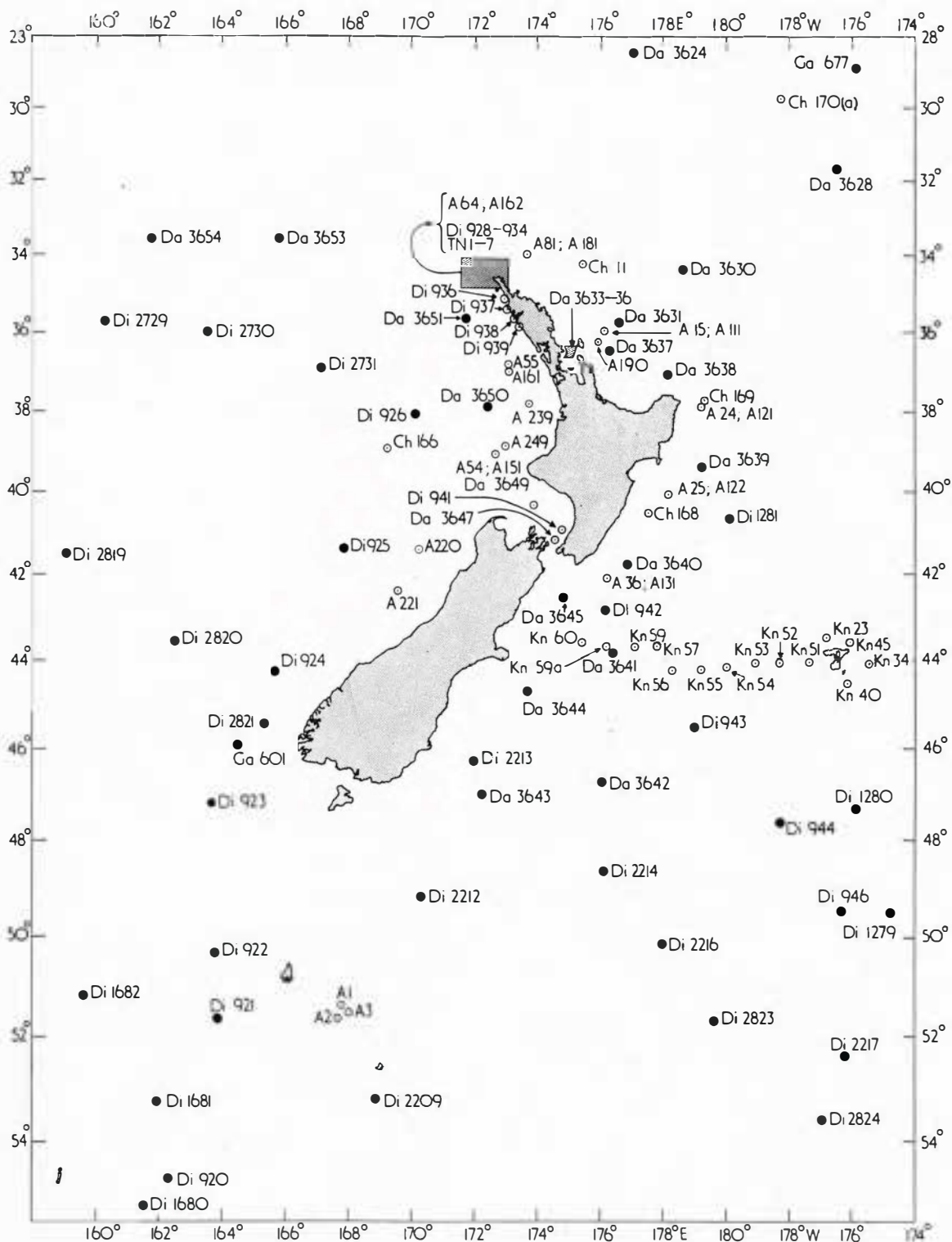


Fig. 1: Hydrological stations worked in New Zealand waters up to 1955. Stations giving vertical profiles of temperature and salinity are marked with open circles; where dissolved oxygen was also measured, stations are marked with filled circles. For key to station numbers, see Appendix A.

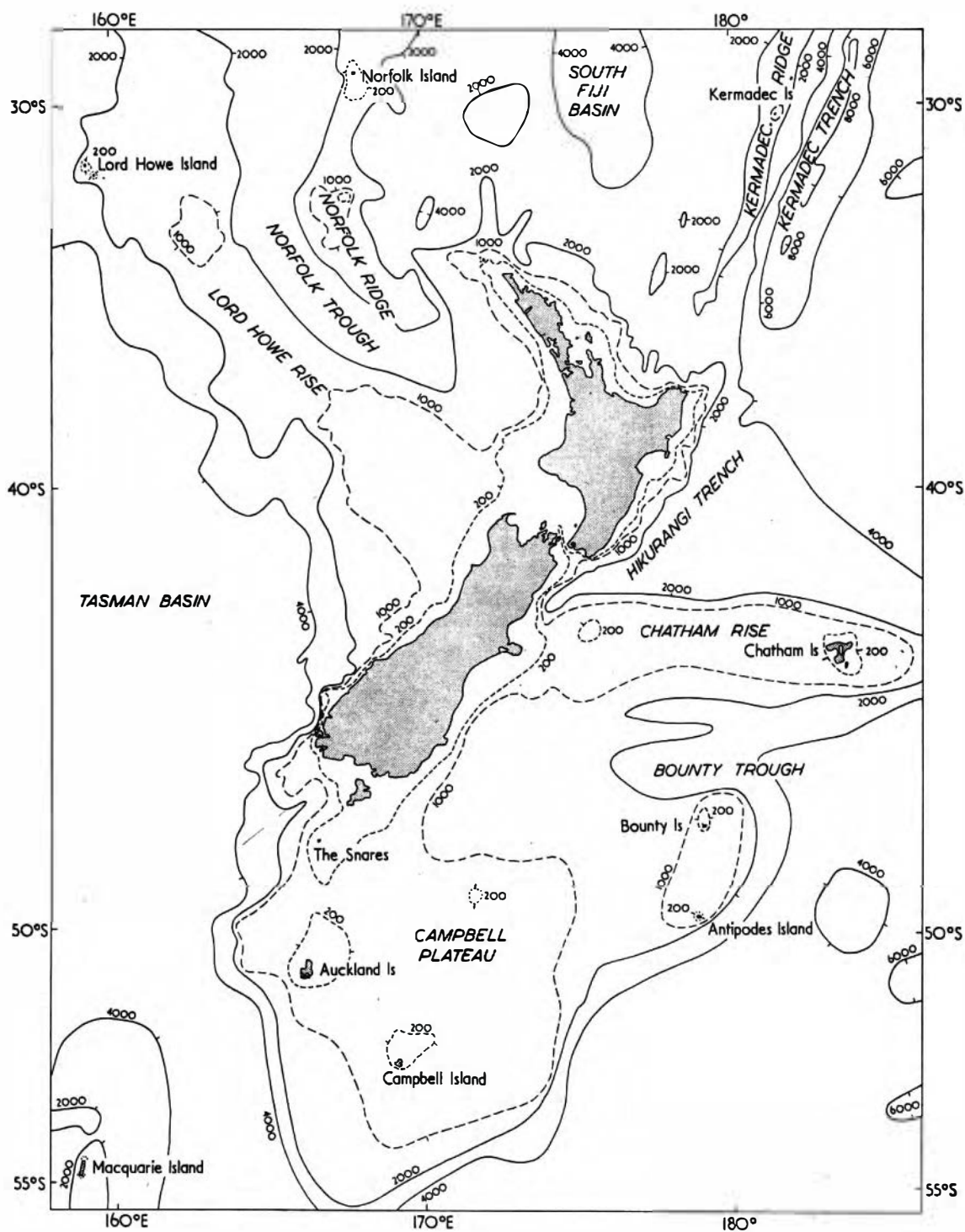


Fig. 2: Sketch bathymetry of the sea floor around New Zealand, prepared by N. M. Ridgway from material in N.Z.O.I. files. Contours are shown for depths of 200 m (shelf), 1,000 m, 2,000 m (N.Z. Plateau), 4,000 m, 6,000 m and 8,000 m.

DISCUSSION

INTRODUCTION

Deacon's (1937) analysis of the earlier *Discovery* data provides the foundation for any study of the hydrology of waters in the New Zealand area. Cochrane (1958) has given more recently a general summary of water characteristics of the Pacific Ocean, estimating the total amount of water present in the major oceanic water masses.

To illustrate the discussion, plots of some of the material contained in the Station List (Appendix c) have been made as follows: Temperature-salinity correlation plots for some representative stations are used to define the main water mass characteristics in the area (fig. 3); this definition is followed by a series of regional plots of salinity at various levels in the ocean between the surface and the bottom (fig. 4-8); the salt content provides a convenient indicator of water movements and mixing, the details of which are further illustrated using a series of diagrams showing the distribution of salinity in vertical cross section (fig. 9-24) over some of the major topographic features of the sea floor around New Zealand.

CHARACTERISTIC WATER PROPERTIES

From the form of the temperature-salinity characteristic curve for each station, three distinct hydrological regions may be defined around New Zealand. These are described by the characteristic curves for three widely separated stations as reproduced in fig. 3. Curve A at *Dana* Station 3628 (December 1928), represents water properties over the Kermadec Trench about 160 miles south-east from Raoul Island. Curve B represents *Discovery* Station 2217 (February 1938) which was worked about 250 miles south-east of the Antipodes Islands and Curve C, *Discovery* Station 920 (June 1932), about 120 miles east from Macquarie Island. Below a temperature of about 2°C the deeper water properties are very similar at each of these localities due to the widespread *Deep* (forming the salinity maximum) and *Bottom* waters of the Pacific Ocean.

Water characteristics above a temperature of 2°C are widely divergent. In the *antarctic zone*, typified by curve C, the T-S curve swings sharply

to the left due to mixing between the cold, Deep Water of relatively high salinity, and the equally cold, but much less saline, Antarctic Upper Water.

In the *subantarctic zone*, typified by curve B, a warmer and more saline upper water enters the mixing diagram to produce an upper branch of the T-S curve in which salinity varies little but the temperature falls rapidly. This *Subantarctic Water* represents the upper 200 or 300 metres of the water column; between this and the Deep Water salinity maximum lies a point of inflexion representing the *Antarctic Intermediate* layer derived from a mixture of Antarctic Upper Water and Subantarctic Surface Water which has sunk

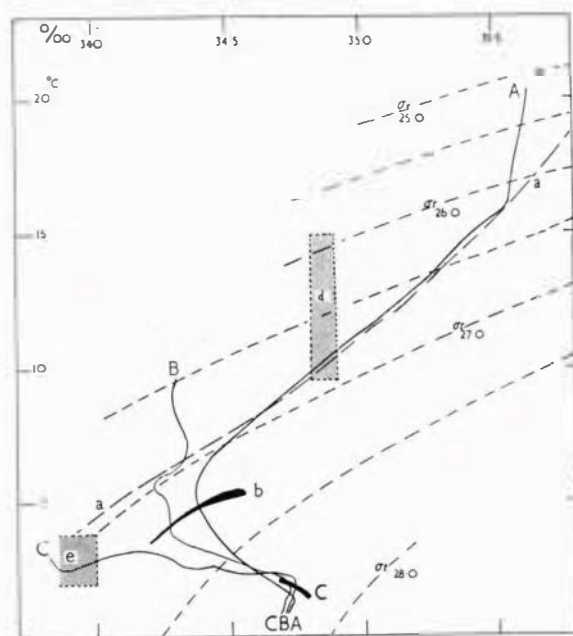


Fig. 3: Temperature-salinity correlation curves for three stations; Curve A, Da 3628—in the subtropical zone; Curve B, Di 2217—in the subantarctic zone; and Curve C, Di 920—in the antarctic zone. Isopleths of constant potential density (σ_t) are entered on this diagram as are (a) the loci of the cores of the shallow subtropical salinity maximum, (b) the intermediate antarctic salinity minimum, and (c) the Deep salinity maximum. (d) represents the range of properties in which is likely to be found the Subtropical Convergence, and (e) those for the Antarctic Convergence.

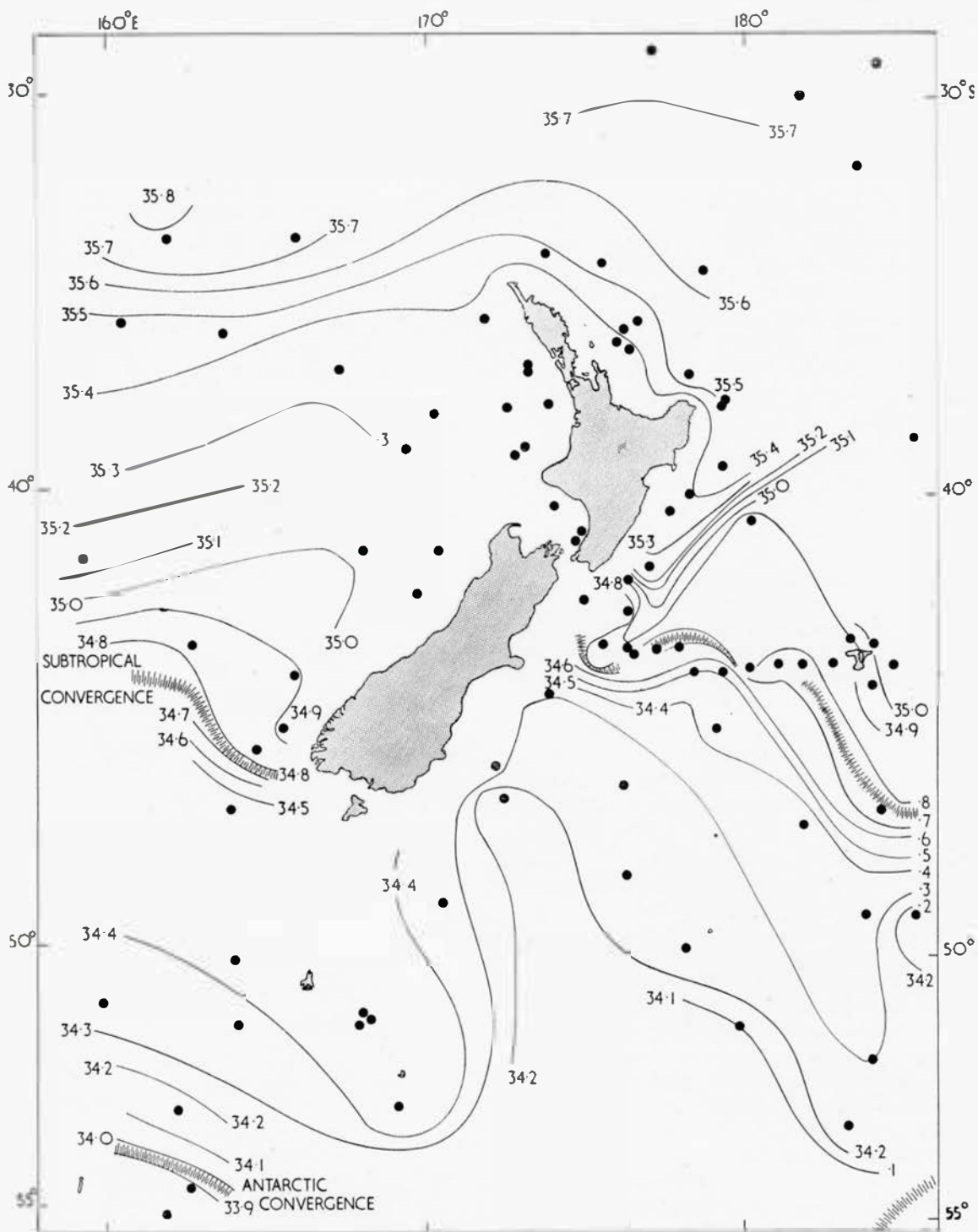


Fig. 4: Generalised pattern of surface salinity ($^{\circ}/_{\infty}$) around New Zealand derived from station data irrespective of time variations, seasonal or secular. The approximate positions of the Antarctic and Sub-tropical Convergences are shown.

at the *Antarctic Convergence*. The range of temperature and salinity in which this boundary between the Antarctic and Subantarctic zones may be found is represented by the area e and the T-S curve of fig. 3. In the *subtropical zone*, typified by curve A, the upper part of the T-S curve has swung well to the right as the warm and saline Subtropical Water forms the upper source of water properties on the mixing diagram, resulting in the formation of a well defined salinity minimum in the vertical water column at a temperature of about 5°C. This Antarctic Intermediate salinity minimum is widespread over the whole of the area north of the *Subtropical Convergence*. This boundary between the surface subtropical and subantarctic zones is found within the range of properties marked d in fig. 3. The nomenclature of water types and ideas on their formation follow Deacon (1937).

SURFACE WATER

The writer has recently (Garner, 1958, 1959a) discussed the geographical form of the Antarctic and Subtropical convergences in the vicinity of New Zealand and the general surface-water properties near these boundaries. The present discussion extends this description to include the intermediate and deep circulation in this area.

The properties of water at the surface and to a depth of 100 or 200 metres are dependent not only on water movements and mixing but also on external climatic factors. The seasonal temperature cycle makes the use of near-surface temperature data from sources as scattered in time as those used in the present study unsuitable as an indicator of circulation patterns. In the New Zealand region the salinity of near-surface water will be less sensitive to such influences, evaporation/precipitation differences being probably small and with little seasonal variation. A regional plot of surface salinity should therefore be helpful in classifying the origins of surface water around New Zealand. Such a plot based on the station data of Appendix C is given in fig. 4. It must be emphasised that this and similar regional salinity plots appearing in this work contain the effects of both seasonal and secular variations, as well as regional patterns. There are insufficient stations which are both closely related geographically and spread out over a period of years available here adequately to examine the question of secular variation. Observations in coastal waters around New Zealand (Garner, 1961) during 1955 showed,

in general, a pattern of surface salinity consistent with that given in fig. 4 except for a higher level around the northern part of North Island, reaching about 35.9‰. This would seem to indicate a stronger flow of Subtropical Water during 1955 which was not in evidence during the period covered by the observations discussed here; north-east of North Island, these include observations from *Challenger* (1874), *Dana* (1928), *Challenger II* (1951), and *Galathea* (1952) material. Values of salinity in the vicinity of the Subtropical and Antarctic convergences may be expected to cover a fairly wide range as the positions of these boundaries fluctuate in time. When the figures for surface salinity (fig. 4) are contoured a relatively simple picture appears, the gross features of which can be presumed to reflect the ocean circulation around New Zealand in greater degree than climatic or time variations.

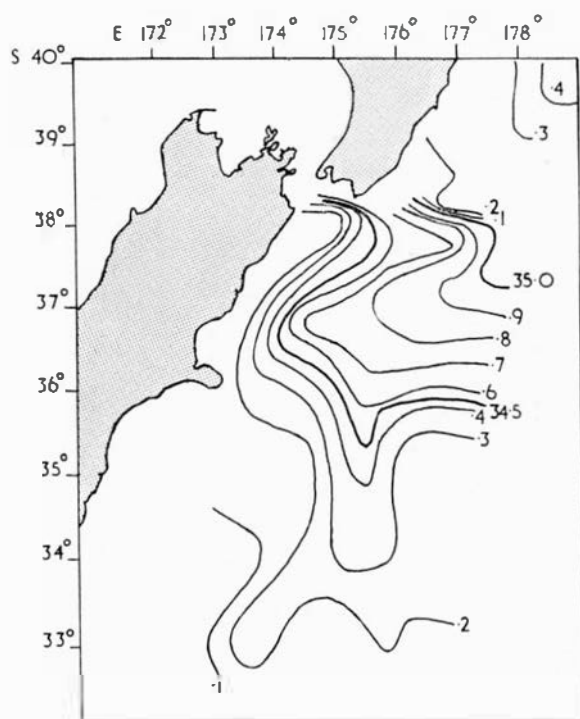


Fig. 5: Distribution of surface salinity off south-eastern New Zealand from measurements made in January 1929 by the Danish Deep Sea Expedition Round the World (Thomsen, 1937, p. 42).

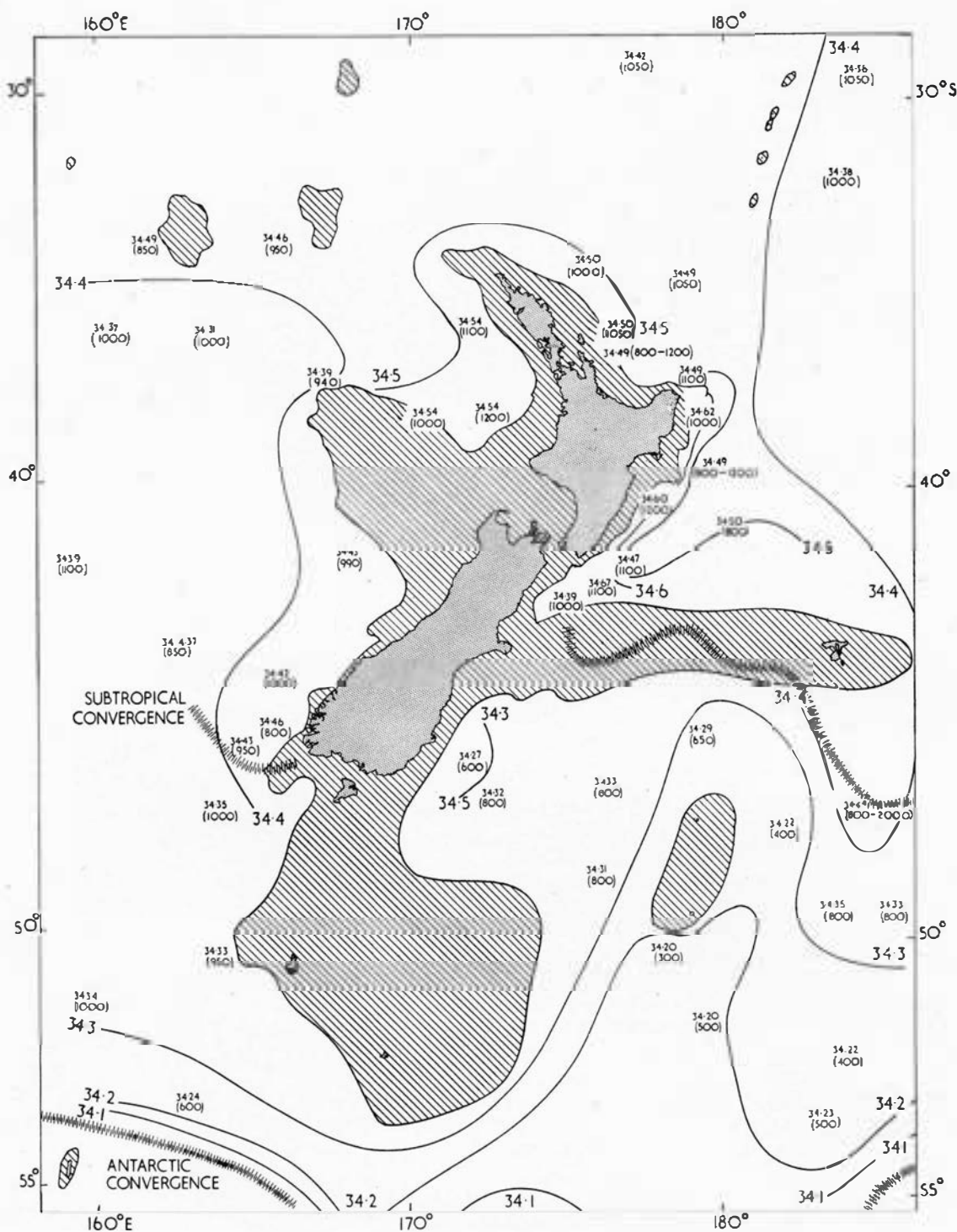


Fig. 6: Generalised pattern of salinity at the level of minimum salinity in the Antarctic Intermediate Water. The depth (m) of the salinity minimum deduced from temperature-salinity correlation curves drawn for each station, is shown in brackets with each plotted salinity figure. The surface positions of the Antarctic and Subtropical Convergences are shown, taken from fig. 4. Areas of water depth less than about 1,000 m north of the Subtropical Convergence, and less than about 800 m south of this convergence, are shown shaded.

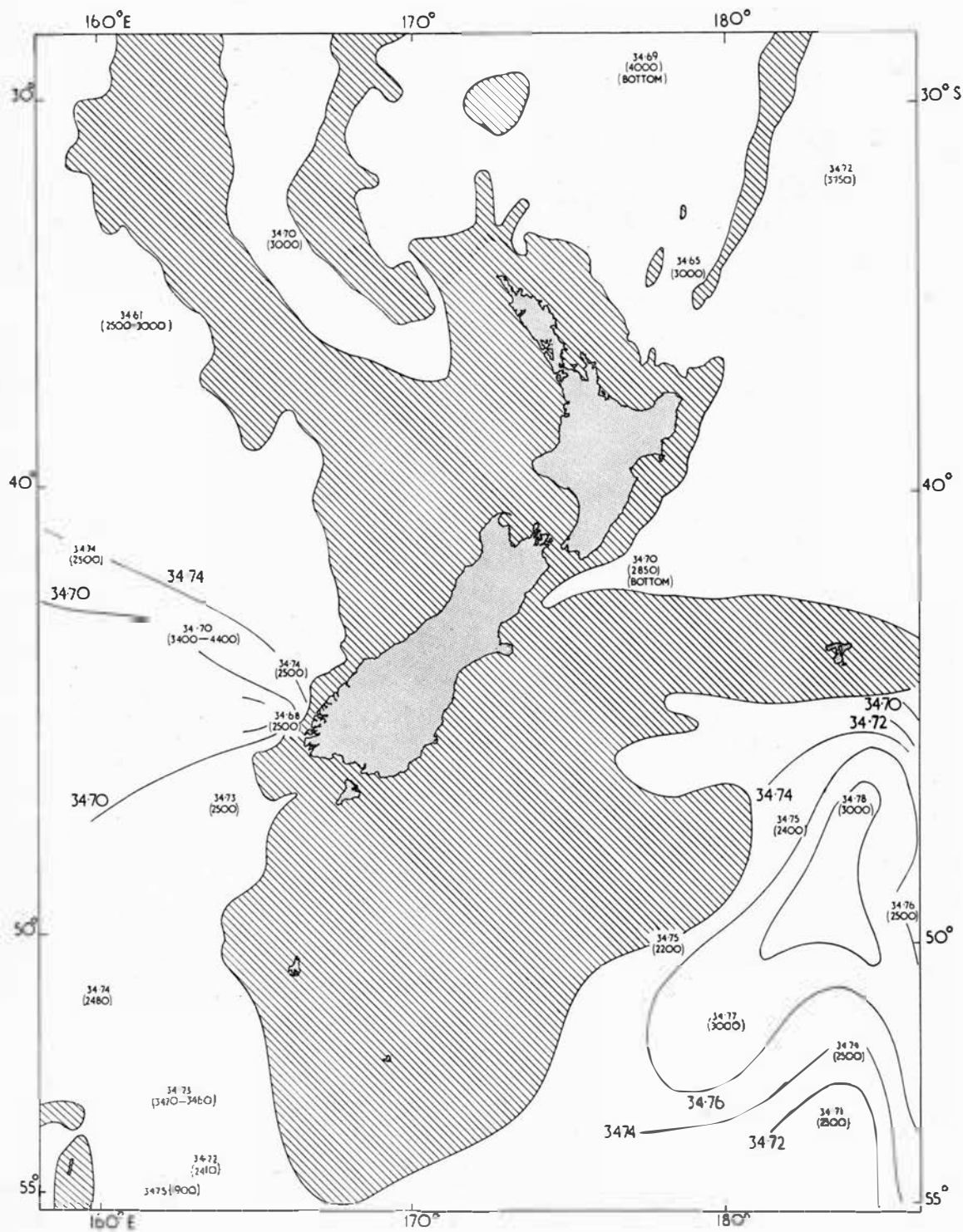


Fig. 7: The distribution of salinity at the level of maximum salinity in the Deep Water. The depth of the salinity maximum in metres is shown in brackets with each plotted salinity figure. Areas of water depth less than approximately 2,000 m are shown shaded.

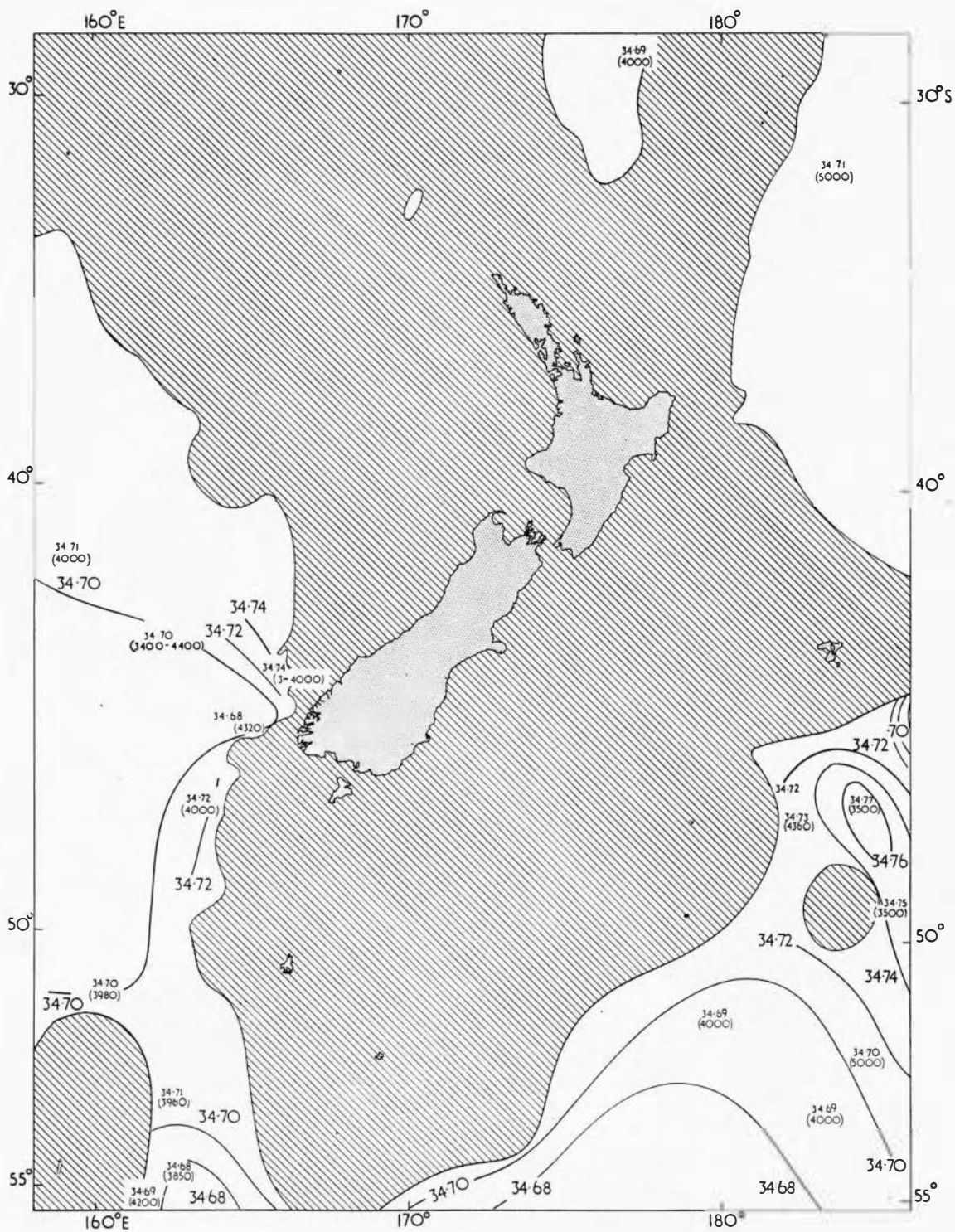


Fig. 8: The distribution of salinity at the level of bottom salinity below about 4,000 m. Areas of water depth less than, approximately, 4,000 m are shown shaded. The depth (m) of each plotted observation is shown in brackets.

ANTARCTIC SURFACE WATER

Antarctic Surface Water as defined in curve C, fig. 3, in general is found south of the area discussed here. Data with a T/S relation typical of the antarctic zone of surface water as defined in the previous section came from *Discovery* Stations 920 and 1680 east of Macquarie Island. Water properties at *Discovery* Station 2825, just outside the boundaries adopted in fig. 1, suggest the presence of the Antarctic Convergence near the south-eastern corner of the area plotted. Mackintosh (1946) finds that the mean position of the Antarctic Convergence passes to the south of Macquarie Island and has a marked southwards deflection to the east of this, reaching a maximum in about longitude 180° . The appearance of the convergence in lat. 54° S at long. 160° E (the south-eastern area of fig. 4) may thus be unusual.

The Antarctic Convergence seems to follow the trend of the 34.0‰ isohaline (fig. 4).

SUBANTARCTIC SURFACE WATER

North of the Antarctic Convergence is found Subantarctic Surface Water whose properties were defined by curve B of fig. 3. This water extends northwards to the Subtropical Convergence, which, both on the basis of its tendency to follow the 34.8‰ isohaline (Garner, 1959) and the difference between characteristic curves for the Subtropical and Subantarctic zones (fig. 3), may be plotted geographically as shown in fig. 4. West of New Zealand the convergence approaches the coast in the vicinity of the south-west corner of South Island. East of the country the Subtropical convergence crosses the Chatham Rise from the vicinity of southern Cook Strait, taking a sharp southward trend just west of the Chatham Islands.

Between the Antarctic and Subtropical convergences, two distinct regions are evident in the subantarctic zone. Relatively high salinity is found over the Campbell Plateau, south of New Zealand, with much lower salinity prevailing over the

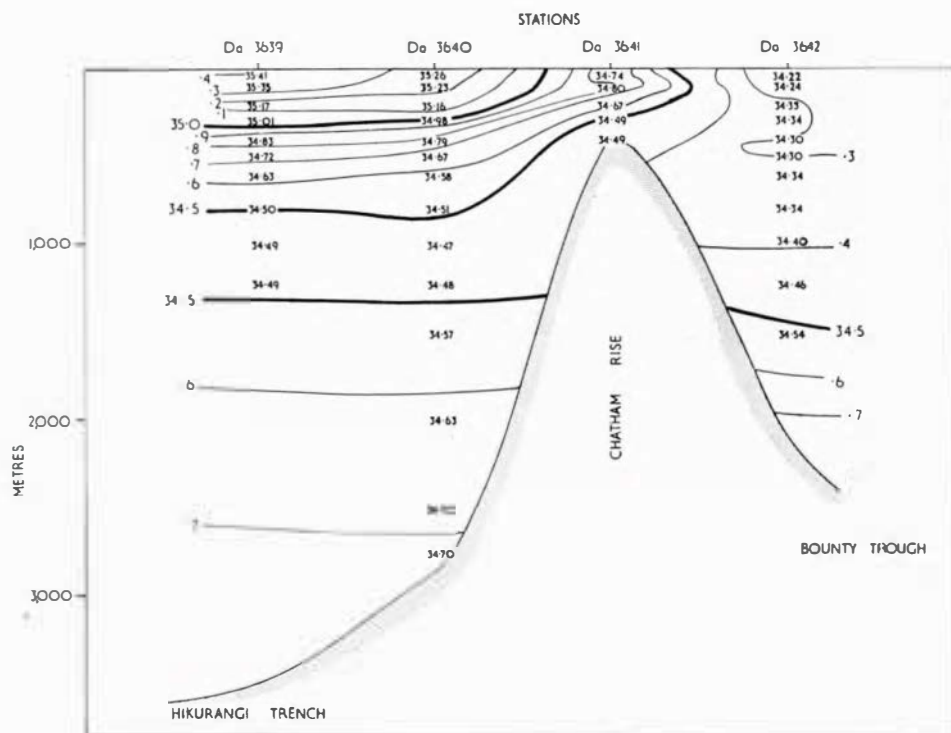


Fig. 9: Vertical meridional cross section of salinity off the east coast of New Zealand across the Chatham Rise, constructed from *Dana* Stations 3639-3642, January 1929, showing the Subtropical Convergence

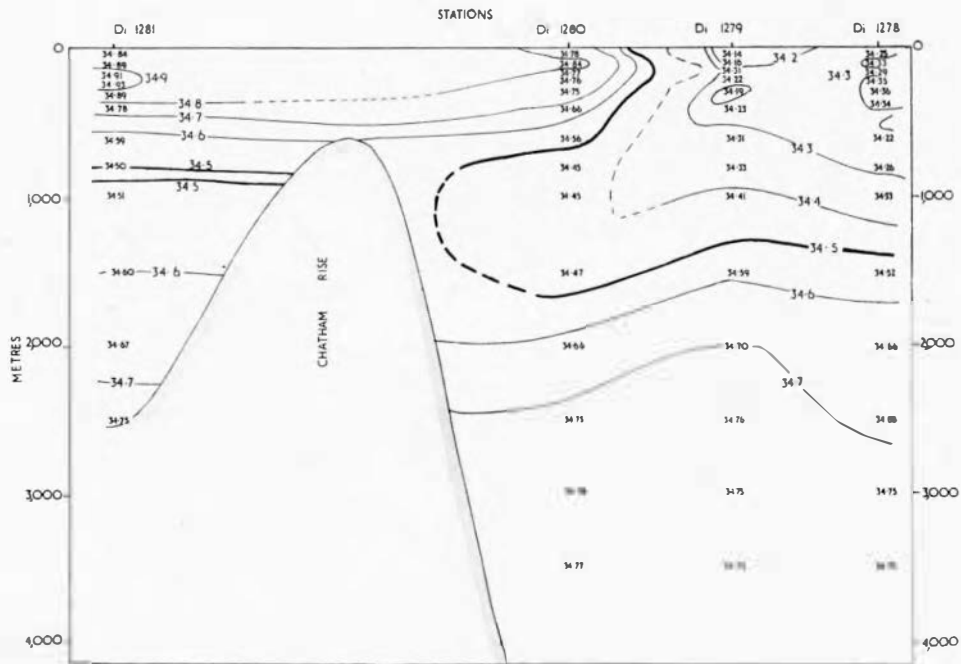
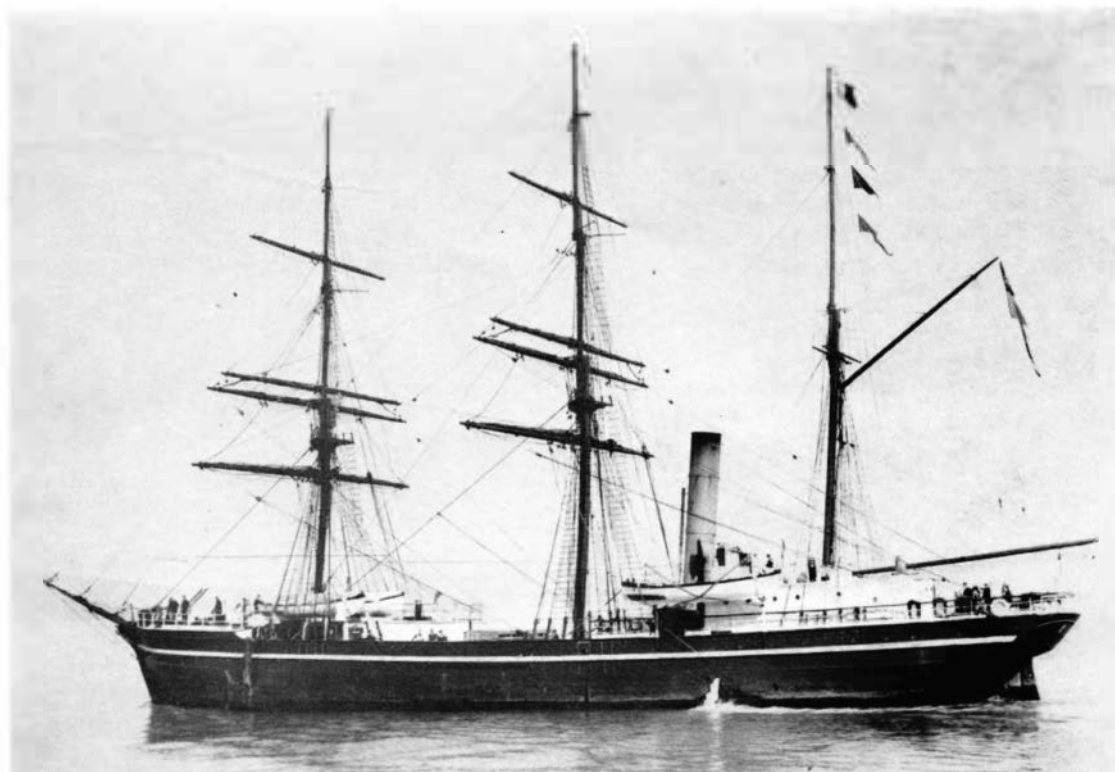


Fig. 10: Vertical meridional cross section of salinity off the east coast of New Zealand across the Chatham Rise, constructed from *Discovery* Stations 1281–1278, January 1934, showing the Subtropical Convergence.

deeper water to the east, south, and west of this region. Sverdrup (1946, p. 699) shows how this Subantarctic Water, characterised by the lower salinities, say between $34^{\circ}/_{00}$ and $34.2^{\circ}/_{00}$, has nearly the same properties around the whole circumpolar belt between the Antarctic and Subtropical convergences. Extending south-eastwards into this subantarctic water past the south of South Island is a tongue of relatively high salinity. Since surface temperature in this tongue seems also to be higher than normal for Subantarctic Water (Garner, 1959, fig. 4 and 5) this relatively highly saline *Campbell Plateau Water** will be partly formed through horizontal mixing southwards of Subtropical Water across the Subtropical Convergence in the south-east Tasman Sea. The convergence retains its surface identity as a pronounced temperature-salinity boundary of this area, and much of this southwards transfer of high-salinity water will take place in the high-salinity subsurface current which Deacon (1937,

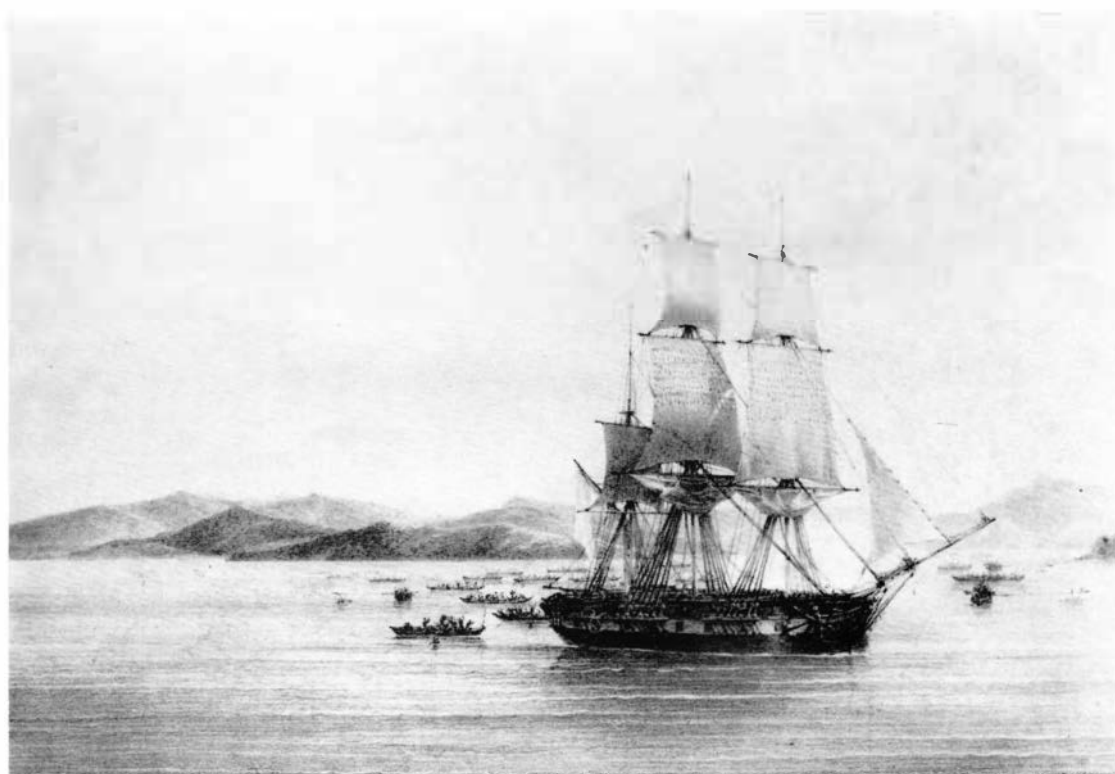
pp. 57, 63, and 72) traced in *Discovery* data from subtropical into subantarctic regions, almost reaching the Antarctic Convergence in places. This layer will probably have a resultant movement towards the south-east with a balance between the driving forces of wind and thermohaline differences. South-west of New Zealand, as Deacon has observed (1937, p. 65), this saline layer can be followed as far south as 52° S (Stations Di 921, 922, fig. 15) lying at a depth of about 500 m. South-east of New Zealand any movement in this layer appeared to be small, salinity maxima being barely discernible in Stations Di 944 and 948, for example. Vertical mixing between this layer and surface water thus probably accounts for much of the relatively high surface salinity observed over the Campbell Plateau. Quite a pronounced temperature-salinity boundary is observed between Campbell Plateau Water and Subantarctic Water, especially at the eastern and southern limits of the former where strongly convergent components of motion between the two bodies of water may be expected. A steep gradient in surface temperature marks the southern limit of Campbell Plateau Water. Deacon (1937) shows this boundary almost coincident with the Antarctic Convergence

*This water has been found to be more extensive than the present data show (Burling, 1961) and the name Australasian Subantarctic Water has been proposed.



By courtesy of the Alexander Turnbull Library

Plate I: SY Terra Nova. British Antarctic (Terra Nova) Expedition, 1910-13



By courtesy of the Alexander Turnbull Library

Plate II: The Corvette L'Astrolabe. D'Urville's "Voyage au Pole Sud et dans L'Océanie"

east of Macquarie Island (fig. 15). A section of bathythermograph soundings obtained in January 1958 through the courtesy of the United States Navy shows a pronounced boundary in latitude $55\frac{1}{2}^{\circ}$ S south of Campbell Island (fig. 24). This temperature section was obtained just before the working of a detailed hydrological section across the Antarctic Convergence south of New Zealand (Garner, 1958b, fig. 3) and combination of the two provides a near-synoptic section through

Campbell Plateau, subantarctic, and antarctic surface layers in this region. Of particular interest in the section (fig. 24) is the core of cold, low-salinity water upwelling just to the south of the surface boundary between Campbell Plateau and subantarctic water, possibly at the centre of a strong cyclonic eddy—a phenomenon that has been frequently observed at water-mass boundaries around New Zealand. The eastern boundary of Campbell Plateau water in the Auckland Island

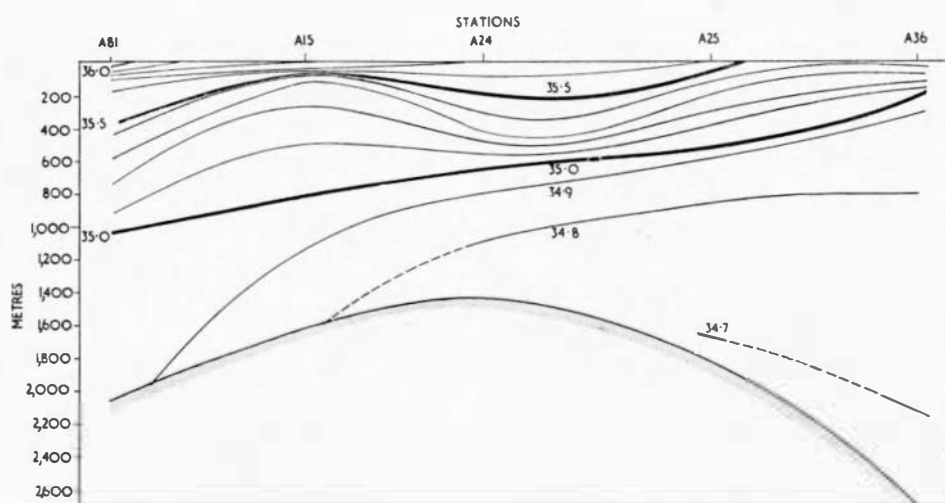


Fig. 11: Vertical meridional cross section of salinity off the east coast of New Zealand constructed from N.Z.O.I. Stations A 81 to A 36, February 1955.

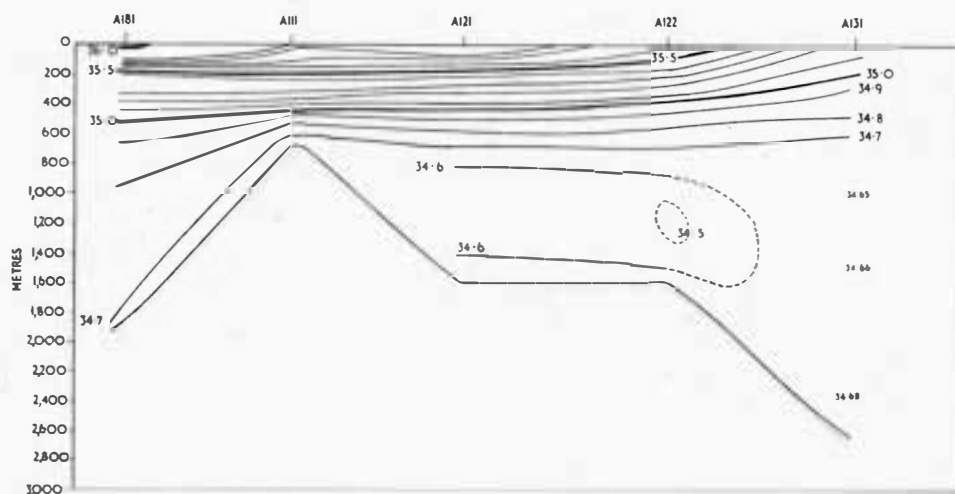


Fig. 12: Vertical meridional cross section of salinity off the east coast of New Zealand constructed from N.Z.O.I. Stations A 181 to A 131, May 1955.

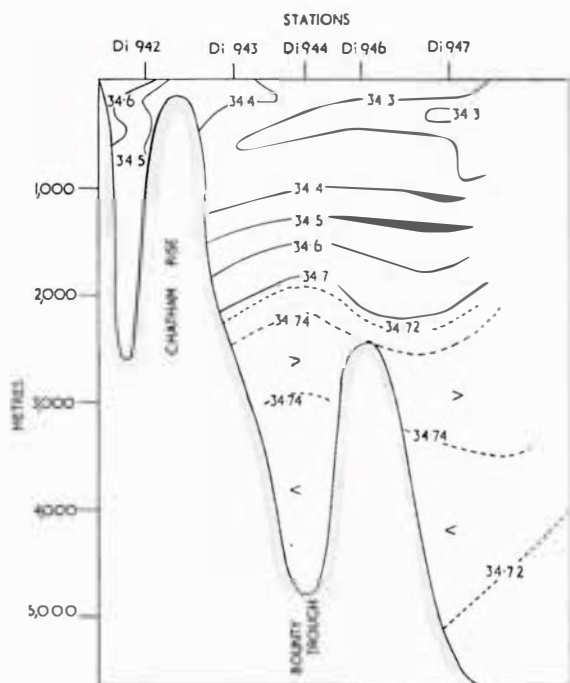


Fig. 13: Vertical cross section of salinity from Cook Strait south-eastwards across the Chatham Rise and Bounty Trough (see Deacon, 1937, pl. 32), constructed from *Discovery* Stations 942–947, August, 1932.

vicinity is well marked in a section between Macquarie Island and Stewart Island published by Moroshkin (1958, p. 59) based on *Ob* stations (24 March – 7 April 1956). In this section a steep surface gradient of salinity between 34.1 and 34.5‰ was observed at the surface between latitudes 53° 25' S and 53° 36' S (Stations 70 and 71). A pronounced subsurface salinity maximum, with salinity at the core of over 34.6‰, was present over the eastern slopes of the Campbell Plateau, with the Subtropical Convergence located just south of Stewart Island, salinity reaching 34.8‰ at latitude 48° (Station 77). The mixing out of the subsurface salinity maximum over the topographic “high” of the Campbell Plateau is illustrated in vertical salinity cross sections (fig. 21, 22, and 24).

East of the Campbell Plateau, Subantarctic Water is present, according to the salinity distribution (fig. 4), as a narrow tongue of low-salinity water extending towards the south Otago coast over the Bounty Trough. Quite a strong north-going movement in this water is felt along the east coast of South Island to the Subtropical Convergence.

SUBTROPICAL SURFACE WATER

North of the Subtropical Convergence is found high salinity water of subtropical origin. Highest surface salinity found among the stations represented in fig. 4 was around 35.8‰, in the

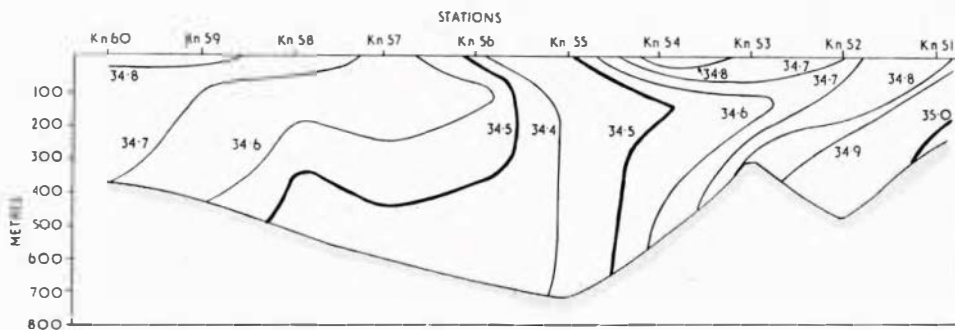
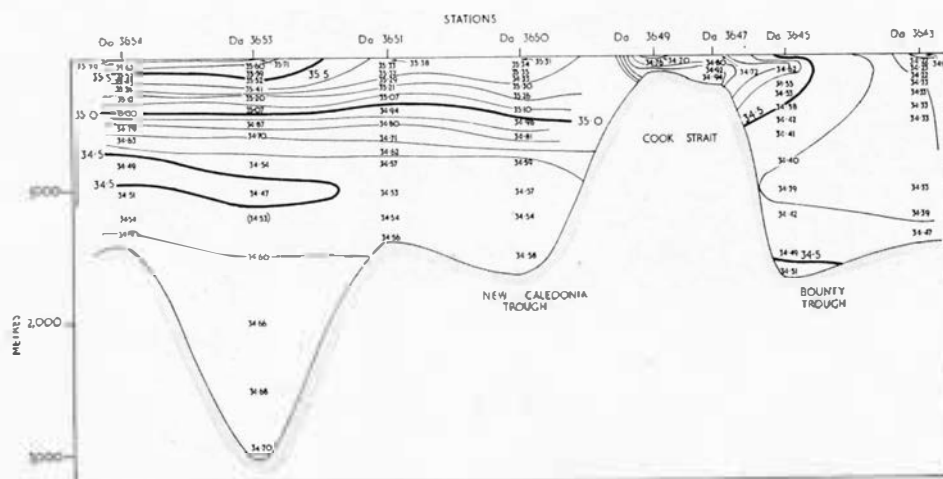
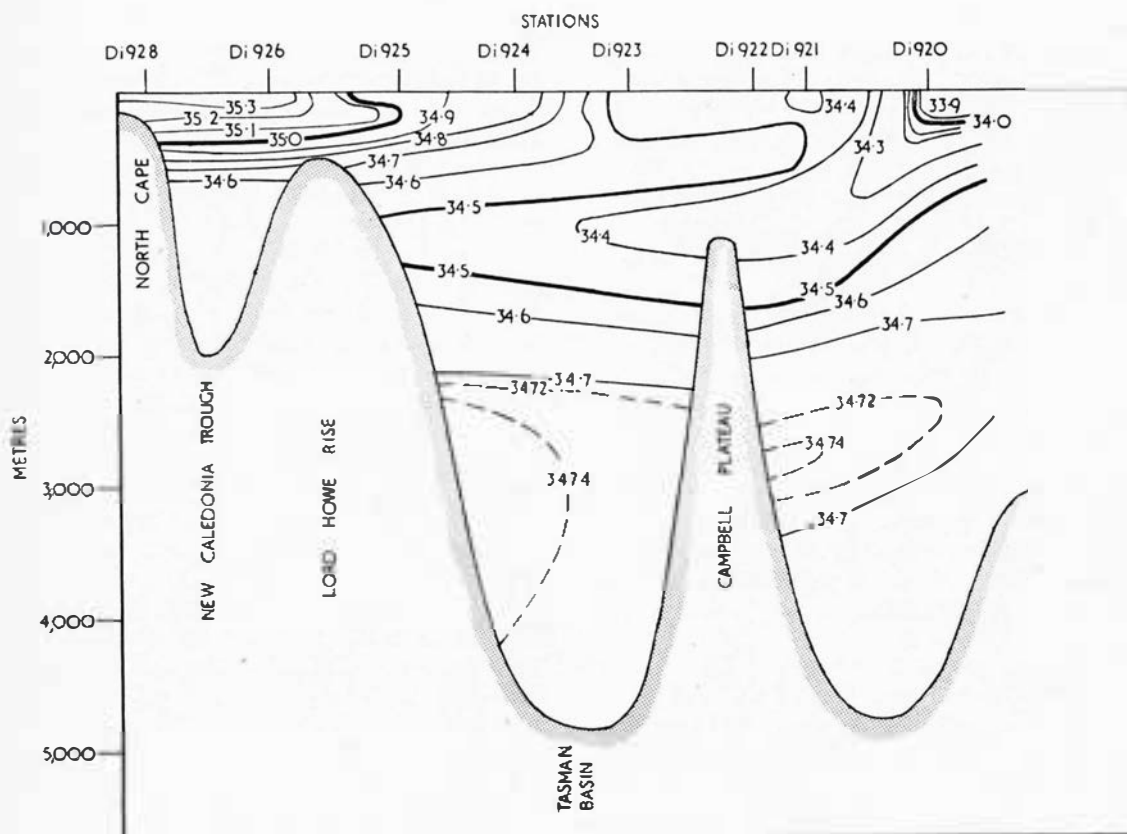


Fig. 14: Vertical cross section of salinity from Banks Peninsula eastwards along the Chatham Rise, constructed from station data of the Chatham Islands (1954) Expedition (Appendix A).



north-east Tasman Sea, and the recent (1955) higher values around $35.9^{\circ}/_{00}$ found in northern coastal waters before mentioned. The number of stations available in the subtropical area is inadequate to define any detail in the surface salinity pattern, especially in the Tasman Sea. East of New Zealand, the narrow tongue of high salinity in the East Cape Current off the east coast of North Island may be recognised and a marked southward deflection of isohalines is recorded near the deep water east of the Chatham Islands. The detailed structure of the surface salinity in the vicinity of the southern part of the East Cape Current high salinity tongue as revealed by *Dana* measurements (Thomson, 1937, p. 42) is shown in fig. 5. It is interesting to note that, while a steep surface salinity gradient is found east of Cape Palliser centred on $34.8^{\circ}/_{00}$, the value generally associated with the Subtropical Convergence, a pronounced tongue of relatively high salinity may be recognised extending towards Pegasus Bay from the north-east, and bounded by a steep surface salinity gradient from $34.3^{\circ}/_{00}$ to $34.6^{\circ}/_{00}$. A fairly broad zone of mixed water with complex surface gradients will probably be evident at the Subtropical Convergence where major south-

flowing currents have their maximum southward extension due to fluctuations in surface velocity. The complex gradients of surface salinity noted in fig. 4 east of the central New Zealand area probably arise through time differences in the various data used and fluctuations in the position of the major water-mass boundary found in this area.

COASTAL SURFACE WATER

Coastal water properties around New Zealand have recently been described by the writer elsewhere (Garner, 1961). Few of the stations discussed in the present work lie within the range of coastal influences. The *Terra Nova* observations around the Three Kings Island were used in an earlier discussion of the coastal upwelling often encountered in this region (Garner, 1959, fig. 7). *Dana* Stations 3633-36 in the Hauraki Gulf and 3647-9 in northern Cook Strait, and *Discovery* Station 941 in this area and Stations 936-939 off the west coast of the Northland Peninsula, all show the effect of landwater run-off in lower salinities and, in some cases, the relatively high temperatures of coastal waters in summer.

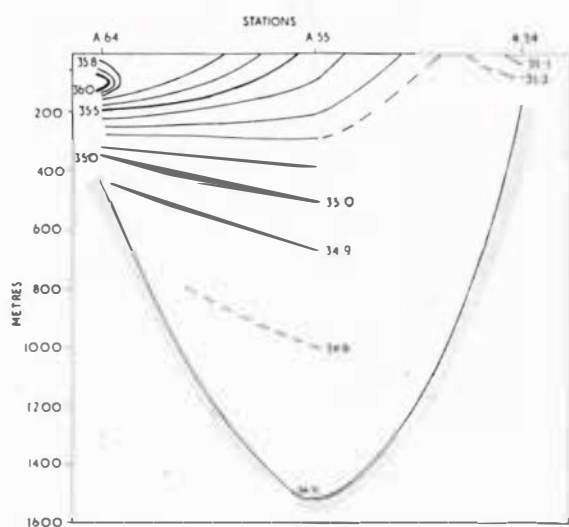


Fig. 17. Vertical meridional cross section of salinity west of North Island, constructed from N.Z.O.I. Station A 64-A 54, February 1955.

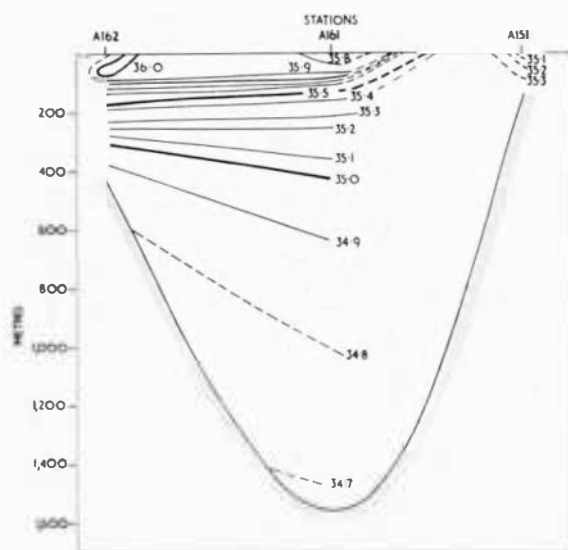


Fig. 18. Vertical meridional cross section of salinity west of North Island, constructed from N.Z.O.I. Stations A 162-A 151, May 1955.

ANTARCTIC INTERMEDIATE WATER

In fig. 6 is plotted the distribution of salinity at the intermediate salinity minimum representing the core of the Antarctic Intermediate Water. The depth of this minimum, shown in parentheses on the plot of fig. 6, varies from 800 m to 1,000 m north of the Subtropical Convergence, and approaches the surface near the Antarctic Convergence. The effect of bottom topography predominates in controlling the minimum salinity of the Antarctic Intermediate Water around New Zealand. The shaded area in fig. 6 is shallower than the local depth of occurrence of the salinity minimum. The most pronounced northwards extension of Intermediate Water of low salinity occurred eastwards of the Campbell Plateau, where the $34.2^{\circ}/_{\text{oo}}$ isohaline, which was found close to the Antarctic Convergence in the south-eastern and south-western sectors of the area, extended northwards into the Bounty Trough. No similar lowering of salinity in the deep water of the south-eastern Tasman Basin off the west coast

of the South Island was evident. (Deacon, 1937, p. 69). It may be that the lower Intermediate salinity found in the Bounty Trough is due, in part, to vertical mixing with the Subantarctic Surface Water in this region, which has a lower salinity than the water of subtropical origin in the south-east Tasman Sea. It will be noticed in fig. 6 that isohalines tend to parallel the contours of the topographic barrier, salinity increasing rapidly towards the shallower water, especially against steep slopes such as are found off the east coast of North Island. During a study of shelf hydrology in this region during 1955 (Garner, 1961), no trace of the Antarctic Intermediate Water was found up to 50 miles off shore from the east coast of North Island in February. A weak salinity minimum appears in the following May between East Cape and Cape Palliser; evidently hydrological properties at the Antarctic Intermediate level can be quite variable due to changing patterns of mixing and flow off the steep continental slope.

Muromtsev (1958) has suggested that a closed

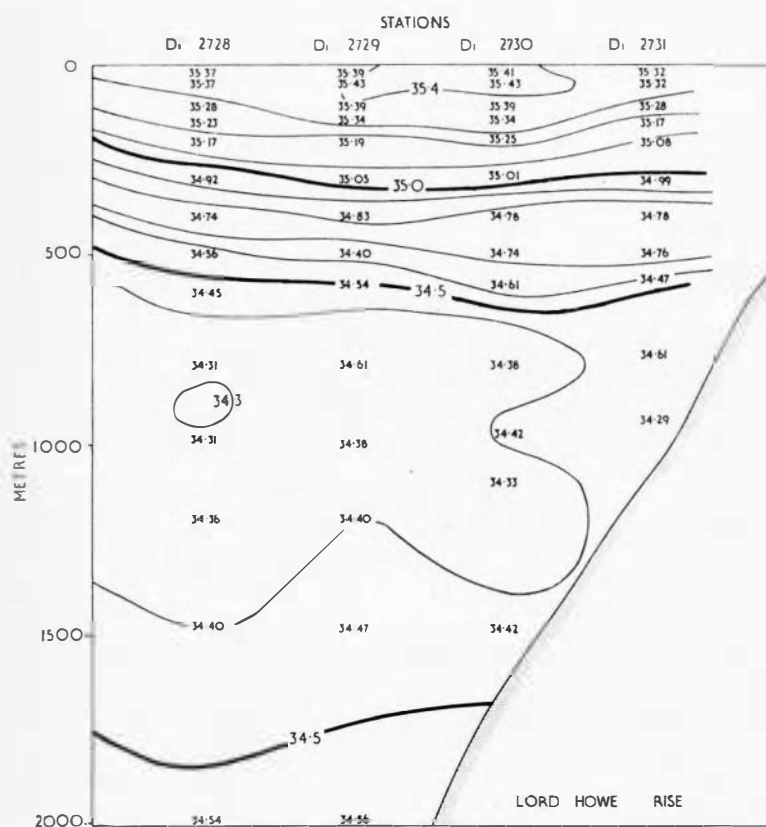


Fig. 19: Vertical cross section of salinity from the north-east Tasman Sea towards the west coast of North Island, constructed from Discovery Stations 2728-2731, October 1950.

circulation of Antarctic Intermediate Water may be present in the Tasman Sea. As may be seen in fig. 6, there is apparently no topographic barrier sufficiently high to prevent Antarctic Intermediate Water from moving either eastwards or westwards north of New Zealand, although those stations westward of the Kermadec Ridge show an intermediate salinity maximum of higher value than those to the east (compare *Dana* Stations 3638, 3624, and 3630, for example), and those in the eastern Tasman Sea. There is some doubt as to where the *Discovery* Stations 2729–2731 and 2819–2820 fit into the pattern of fig. 6, as it is noted in the station list (*Discovery Reports*, 28; 1957 p. 300) that there is some doubt about the analyses for salinity. After comparing the T-S curve for

these stations with others plotted in the vicinity it would appear that the doubt is to be attached to the absolute values rather than to the salinity-depth relation determined for each station. In particular, there is some evidence to suggest that Stations 2729–2731 in the north-east Tasman show salinities that are about $0.1^{\circ}/_{\text{‰}}$ low throughout the water column.

Sverdrup (1946, p. 728) notes that an Intermediate maximum in the dissolved oxygen content of waters along the one hundred and eightieth meridian, just east of New Zealand, is found between 600 and 800 m, above the low-salinity core of the Antarctic Intermediate Water.

THE DEEP AND BOTTOM WATER

Sverdrup (1946, p. 701) states that no salinity maximum is found below the Antarctic Intermediate Water in the south Pacific, salinity increasing towards the bottom or showing a constant value below a depth of 2,500–3,000 m. This seems to be true in most of the area examined here except in the southern regions, distinct maxima being evident between Macquarie Island Ridge and the Campbell Plateau (Stations Di. 1682, 920, 1680, 34.72 – $34.75^{\circ}/_{\text{‰}}$) and in the deep water east of the Campbell Plateau (Stations Di 2823, 2217, 34.74 – $34.77^{\circ}/_{\text{‰}}$) between depths of 2,500 and 3,500 m. In fig. 7 all areas around New Zealand less than 2,000 m in depth are shaded, and the highest value of salinity measured at each station below the Antarctic Intermediate layer is plotted where depths exceed this figure.

The Pacific Deep Water has usually been regarded as originating at the surface in the North Atlantic Ocean, being carried into the Pacific via the Antarctic Circumpolar Current after some modification in the south Indian Ocean.

Because of the higher salinity in the Deep Water to the east of South Island (esp. *Discovery* Station 1280) than was found around the same period south of the Tasman Sea, it has been suggested (Deacon, 1937, p. 101; Herdman, 1952, p. 435; Deacon, 1958) that a minor source of high-salinity Deep Water may exist north of New Zealand.

With the high surface temperatures prevailing in this area it seems difficult to imagine any process which would lead to the formation of water sufficiently dense to form Deep Water and the existence of such a source anywhere in the Pacific Ocean seems unlikely. Deacon, 1937, (fig. 19, p. 82) sketches the circumpolar distribution of

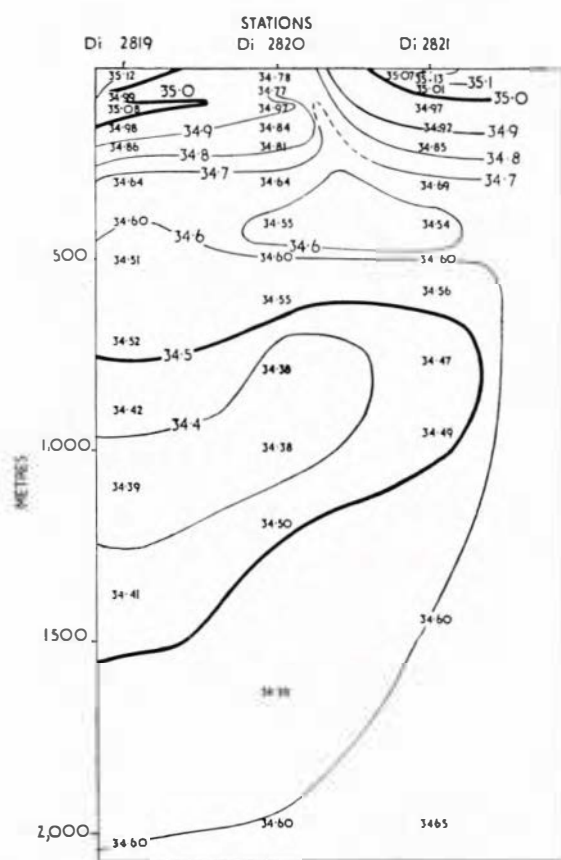
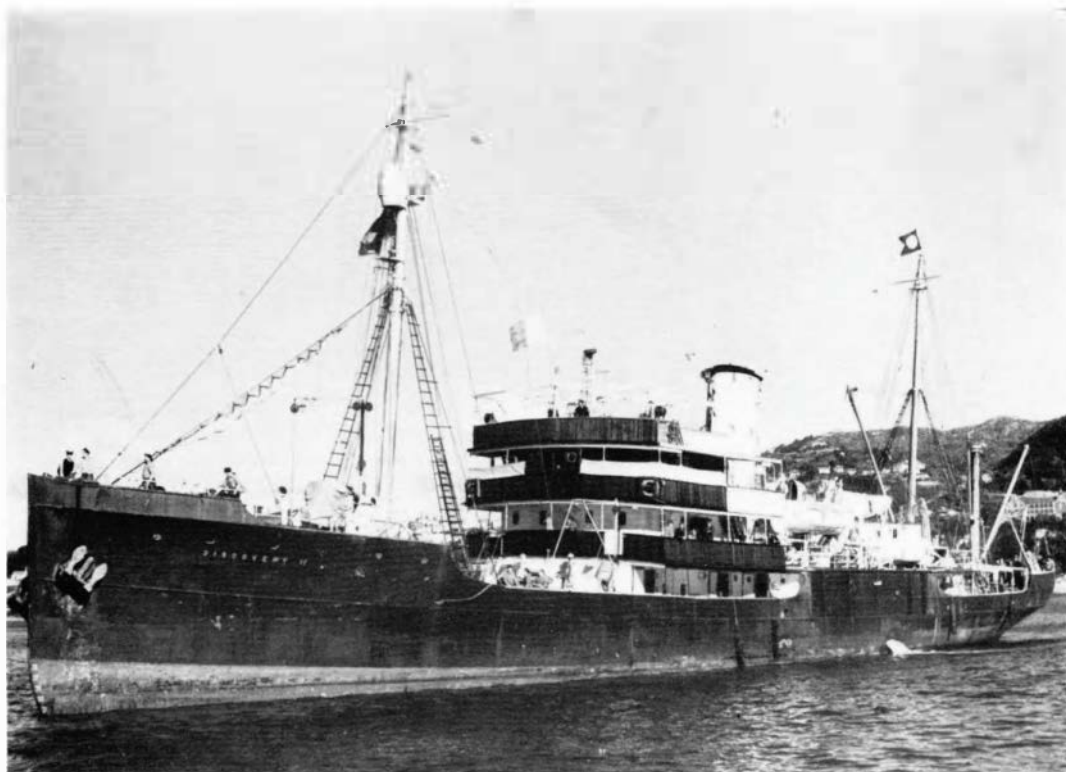


Fig. 20: Vertical cross section of salinity from the south-east Tasman Sea towards Foveaux Strait, constructed from *Discovery* Stations 2819–2821, May 1951.



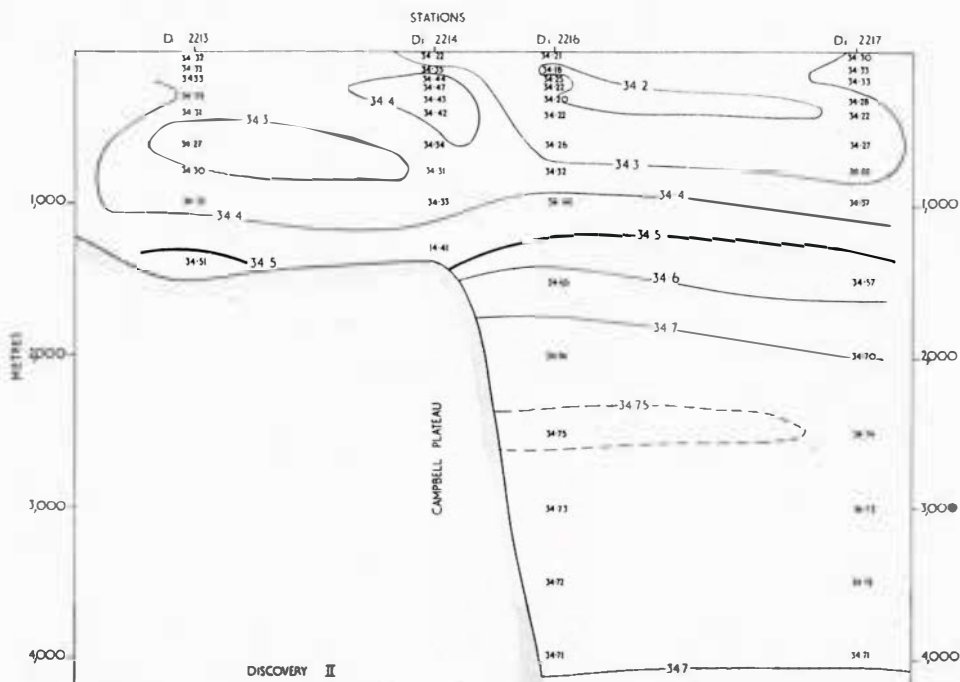
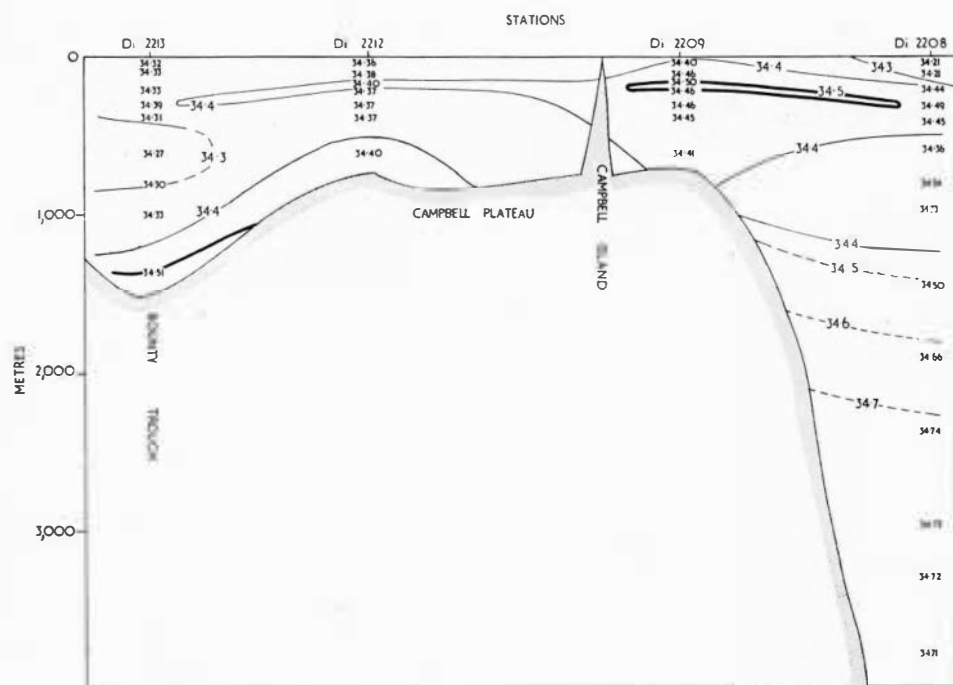
By courtesy of the Dominion

Plate III: RRS Discovery II (National Institute of Oceanography), in Wellington Harbour



By courtesy of the Alexander Turnbull Library

Plate IV: RDRS Dana. The Carlsberg Foundation's Oceanographical Expedition Round the World, 1928-30



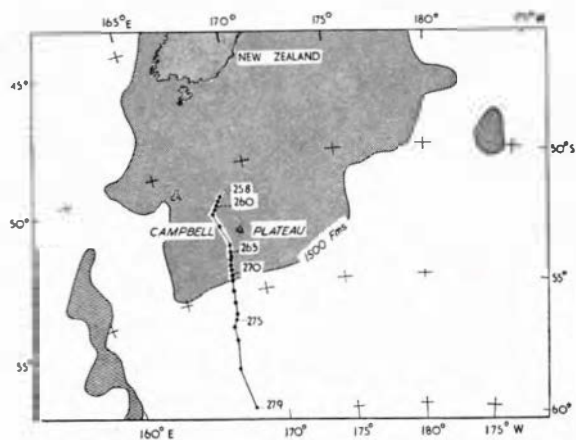


Fig. 23a: Map showing positions of USS *Brough* bathythermograph soundings 258-279 taken across the southern edge of the Campbell Plateau, January 1958. (By courtesy of the United States Hydrographic Office.)

maximum salinity in the Deep Water and, while the level of salinity decreases in general from the south-east Atlantic Ocean eastwards in the direction of the Atlantic Circumpolar Current, a number of closed high-salinity regions are evident, giving the impression of the intermittent formation of "pulses" of water, whose salinity is higher than usual, in the surface region of origin. Perhaps the high values measured east of South Island represent one of such pulses. The variation with

time of the position and salinity of these pulses could provide valuable evidence of rates of movement and mixing in the Deep Water. Deacon (1937) has shown that, in general, the Deep Water of the Pacific has a south-moving component, rising towards the surface south of the Antarctic Convergence. Considerable modification of this meridional circulation pattern must occur south of New Zealand because of the relatively narrow deep-water passage available for the entry of the Circumpolar Current into the Pacific Ocean.

The Deep Water of the South Fiji Basin has a lower salinity than that in the Kermadec Trench. From about 2,500 m depth to the bottom, at just over 4,000 m, the salinity at *Dana* Station 3624 was just over $34.69^{\circ}/_{00}$ in the Fiji Basin west of the Kermadec Islands. On the Pacific Basin side of the Kermadec Ridge a weak, perhaps doubtful, salinity maximum of just over $34.72^{\circ}/_{00}$ was measured at *Dana* Station 3628, with bottom salinities around $34.71^{\circ}/_{00}$ from 4,500 m to bottom at 5,000 m.

In those of the southern stations mentioned above where salinity decreases with depth below a Deep maximum, the presence of the Circumpolar Antarctic Bottom Water, with origin in the Weddell Sea, is indicated. Bottom salinities of $34.68-34.69^{\circ}/_{00}$ are indicated at depths of some 4,000 m. In fig. 8 the (relatively small) portion of the chosen area where depth is greater than

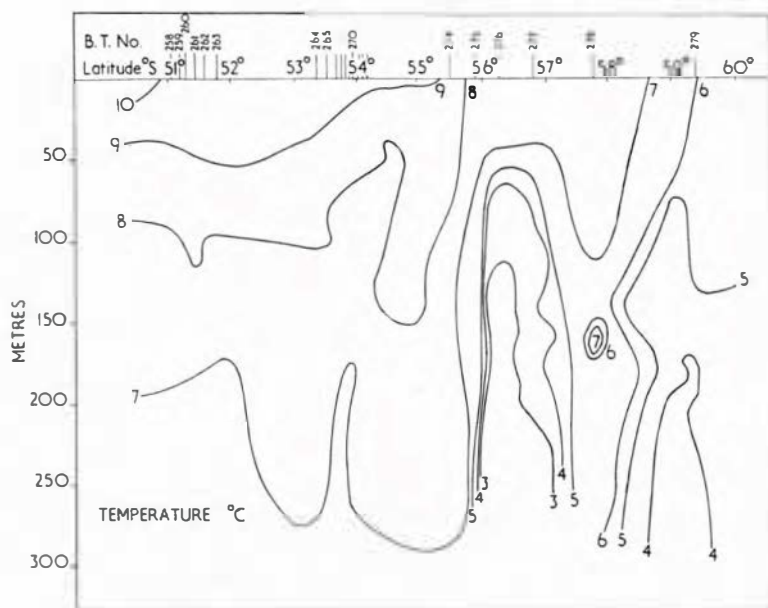


Fig. 23b: Vertical cross section of temperature constructed from bathythermograph soundings shown in fig 23a.

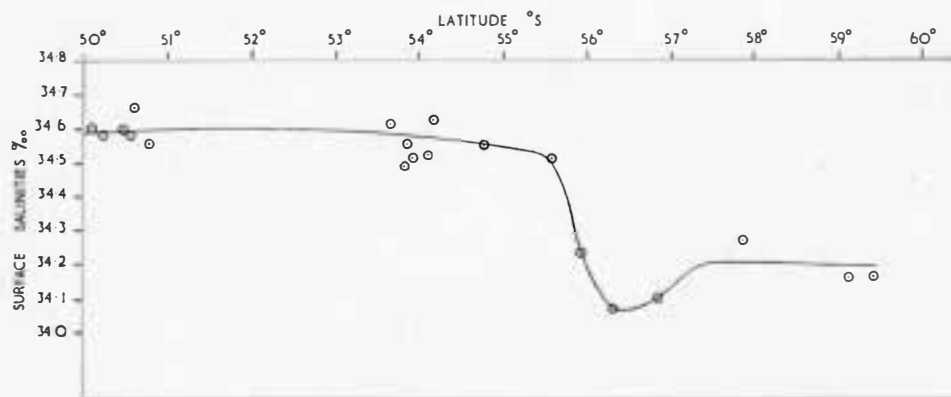


Fig. 23c: Variation in surface salinity associated with the temperature cross section shown in fig. 23b.

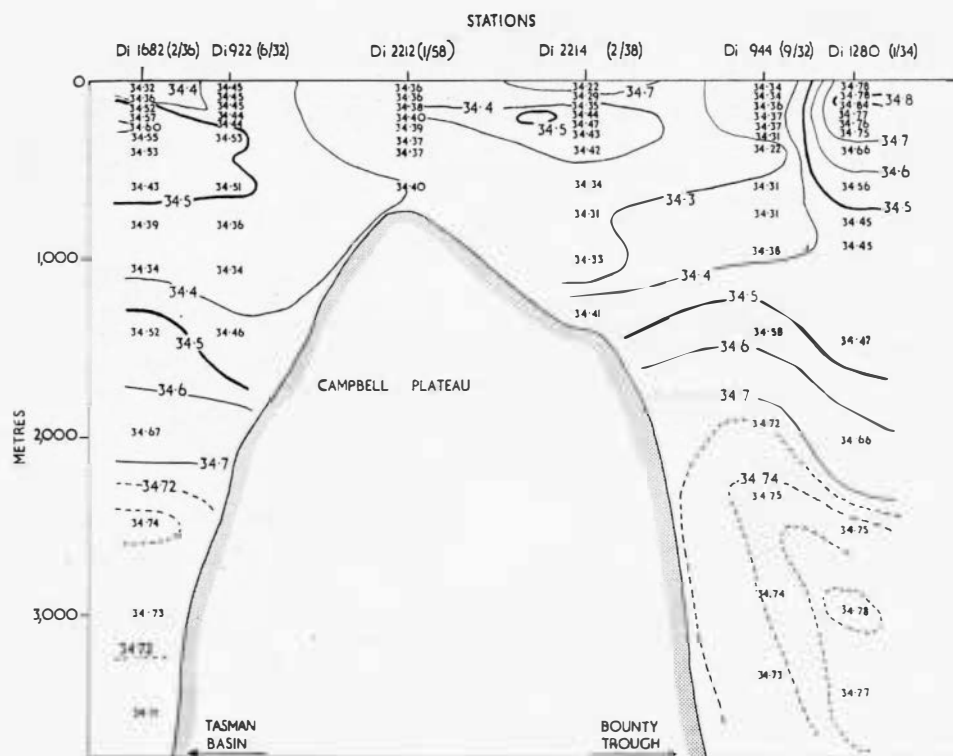


Fig. 24: Composite vertical zonal cross section of salinity across the Campbell Plateau constructed from various *Discovery* stations. Month and year when observations were made are shown in brackets after each station.

4,000 m is sketched, with the available measurements of bottom salinity. Regional variations of bottom salinity shown are probably due mainly to variations of depth to bottom resulting in different relative positions on the T-S correlation for each observation.

Attention may be called to a small but significant increase of salinity measured between about 4,000 m and 5,000 m at three deep stations in the region, Di 2181 in the central Tasman Sea and Di 2823, 2824 south-east of the Antipodes Islands.

There is evidence to suggest that the salinity of the Deep Water is presently rather greater than

values found during the *Discovery* investigations represented here. Maximum salinity in the Deep Water between Macquarie Island and the Campbell Plateau was estimated at something greater than 34.8‰ by Soviet work in 1955 (Moroshkin, 1958, p. 59). This increase of about 0.1‰ over the earlier values measured seems to have taken place since 1952 when the Danish Deep Sea Expedition found a maximum salinity of 34.74‰ at a depth of just over 3,000 m about 100 miles west of Puyegur Point in the south-east Tasman Sea.

ACKNOWLEDGMENTS

The author's thanks are due to Mr A. Killerich and Dr Anton Fr. Bruun for access to unpublished *Galathea* records; Commander A. L. Lawford, National Institute of Oceanography, for help in securing *Terra Nova* data; U.S. Navy Hydrographic Office for bathythermograph records; Mr

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APPENDIX A—SOURCES OF DATA

A New Zealand Oceanographic Institute

- (a) Stations A 1–A 3 N.Z.O.I. records hitherto unpublished.
- (b) Stations A 15–A 249 N.Z.O.I. "The Hydrology of New Zealand Coastal Waters, 1955", by D. M. Garner, *N.Z. Dep. sci. industr. Res. Bull.* 138, 1961 (*N.Z. Oceanogr. Inst. Mem.* 8).

Ch *Challenger*—"Report on the Scientific Results of the Exploring Voyage of HMS *Challenger*, 1873–76": *Physics and Chemistry*, Vol. 1, 1884. "Report on the Specific Gravity of Samples of Ocean Water" by J. Y. Buchanan, pp. 27–31.

Ch *Challenger II*—"Temperature and Salinity observations in the Pacific and Indian Oceans and the Mediterranean, HMS *Challenger*, 1950–52". Hydrographic Department (The Admiralty). H.D. 496:1953, p. 9.

Da *Dana*—*Dana Rep.* 12, 1937: pp. 13–17.

Di *Discovery II*

- (a) Stations 920–947 *Discovery Rep.* 21, 1941–42: pp. 111–121.
- (b) Stations 1278–1281. *Discovery Rep.* 22, 1942–43: pp. 52–53.
- (c) Stations 1680–2217. *Discovery Rep.* 24, 1944–47: pp. 244–251.
- (d) Stations 2728–2821. *Discovery Rep.* 28, 1957; pp. 328–331; 362–365.

Ga *Galathea*

- (a) Station 677. "Characteristics of the Water Masses of the Philippine, Kermadec, and Tonga Trenches", A. F. Bruun and A. Killerich. *Papers in Marine Biology and Oceanography, Suppl. to Deep-Sea Research*, 3:418–425.
- (b) Station 601. Unpublished records of the Danish Deep Sea Expedition Round the World, 1950–52. (Data provided through the courtesy of A. Killerich.)

Kn Chatham Islands 1954 Expedition. "General Account of the Chatham Islands 1954 Expedition" by G. A. Knox, *N.Z. Dep. sci. industr. Res. Bulletin* 122, (*N.Z. Oceanogr. Inst. Mem.* 2) and unpublished records of the New Zealand Oceanographic Institute.

TN *Terra Nova*—Data provided through the courtesy of the National Institute of Oceanography, Great Britain (see "The Subtropical Convergence in New Zealand Surface Waters", by D. M. Garner, *N.Z. J. Geol. Geophys.* 2 (2):315–37).

APPENDIX B—STATION CIRCUMSTANCES

Station	Latitude	Longitude	Date	Depth (m)
A 1	51° 30' S	167° 51' E	8/11/54	640
A 2	51° 40' S	167° 46' E	8/11/54	683
A 3	51° 35' S	168° 00' E	8/11/54	631
A 15	35° 53' S	176° 16' E	29/1/55	—
A 24	37° 42' S	179° 25' E	8/2/55	780
A 25	40° 00' S	178° 21' E	8/2/55	1,000
A 36	42° 05' S	176° 16' E	10/2/55	1,480
A 54	38° 59' S	172° 44' S	15/2/55	1,100
A 55	36° 46' S	173° 06' E	15/2/55	826
A 64	34° 14' S	171° 40' E	17/2/55	230
A 81	33° 57' S	173° 46' E	17/2/55	1,115
A 111	35° 45' S	176° 24' E	9/5/55	370
A 121	37° 42' S	179° 31' E	10/5/55	1,870
A 122	39° 59' S	178° 17' E	11/5/55	870
A 131	42° 06' S	176° 14' E	12/5/55	1,455
A 151	38° 58' S	172° 40' E	14/5/55	86
A 161	36° 50' S	173° 01' E	15/5/55	850
A 162	34° 15' S	171° 42' S	15/5/55	230
A 181	33° 53' S	173° 50' E	16/5/55	1,050
A 190	35° 37' S	176° 52' E	22/9/55	>1,000
A 220	41° 25' S	170° 17' E	2/10/55	—
A 221	42° 21' S	169° 42' E	3/10/55	—
A 239	37° 47' S	173° 47' E	9/10/55	500
A 249	38° 47' S	173° 01' E	9/10/55	75
Ch (I) 166	38° 50' S	169° 20' S	23/6/74	503
Ch (I) 168	40° 28' S	177° 43' E	8/7/74	2,012
Ch (I) 169	37° 34' S	179° 22' E	10/7/74	1,280
Ch (I) 170 (a)	29° 45' S	178° 11' W	14/7/74	951
Ch (II) 11	34° 07' S	175° 28' E	5/7/51	1,843
Da 3624	28° 18' S	177° 01' E	10/12/28	4,110
Da 3628	31° 35' S	176° 25' W	15/12/28	5,475
Da 3630	34° 24' S	178° 43' E	17/12/28	3,160
Da 3631	35° 40' S	176° 40' E	18/12/28	2,200
Da 3633	36° 32' S	174° 57' E	2/1/29	58
Da 3635	36° 36' S	175° 06' E	3/1/29	46
Da 3636	36° 24' S	175° 20' E	3/1/29	46
Da 3637	36° 24' S	176° 26' E	4/1/29	1,225
Da 3638	37° 00' S	178° 16' E	4/1/29	2,300
Da 3639	39° 19' S	179° 18' E	5/1/29	3,490
Da 3640	41° 47' S	176° 55' E	7/1/29	2,850
Da 3641	43° 40' S	176° 36' E	8/1/29	410
Da 3642	46° 43' S	176° 09' E	9/1/29	2,060
Da 3643	46° 58' S	172° 14' E	10/1/29	1,400
Da 3644	44° 40' S	173° 39' E	11/1/29	940
Da 3645	42° 32' S	174° 50' E	12/1/29	1,660
Da 3647	41° 06' S	174° 30' E	19/1/29	220
Da 3649	40° 21' S	173° 55' E	20/1/29	97
Da 3650	37° 48' S	172° 30' E	21/1/29	1,640
Da 3651	35° 36' S	171° 52' E	22/1/29	1,390
Da 3653	33° 31' S	165° 53' E	26/1/29	3,030
Da 3654	33° 28' S	161° 45' E	27/1/29	1,620
Di 920	54° 41' S	162° 23' E	26/6/32	4,575
Di 921	51° 39' S	163° 52' E	27/6/32	4,292
Di 922	50° 20' S	163° 49' E	28/6/32	2,050
Di 923	47° 12' S	163° 41' E	29/6/32	4,574
Di 924	44° 18' S	165° 46' E	30/6/32	4,447
Di 925	41° 21' S	167° 56' E	1/7/32	1,170
Di 926	38° 02' S	170° 13' E	2/7/32	908
Di 928	34° 39' S	172° 26' E	3/7/32	152
Di 929	34° 21' S	172° 49' E	16/8/32	58
Di 931	34° 15' S	172° 29' E	17/8/32	95

Station		Latitude	Longitude	Date	Depth (m)
Di 932	..	.. 34° 13' S	172° 15' E	17/8/32	185
Di 933	..	.. 34° 13' S	172° 12' E	17/8/32	260
Di 934	..	.. 34° 12' S	172° 11' E	17/8/32	95
Di 936	..	.. 35° 05' S	172° 59' E	18/8/32	48
Di 937	..	.. 35° 19' S	173° 08' E	18/8/32	1,100
Di 938	..	.. 35° 31' S	173° 19' E	18/8/32	1,300
Di 939	..	.. 35° 51' S	173° 28' E	18/8/32	87
Di 941	..	.. 40° 54' S	174° 48' E	20/8/32	125
Di 942	..	.. 42° 46' S	176° 15' E	31/8/32	660
Di 943	..	.. 45° 28' S	179° 06' E	1/9/32	2,552
Di 944	..	.. 47° 42' S	178° 16' W	2/9/32	4,783
Di 946	..	.. 49° 25' S	176° 21' W	3/9/32	2,441
Di 1278	..	.. 51° 43' S	173° 18' W	24/1/34	5,389
Di 1279	..	.. 49° 27' S	174° 44' W	25/1/34	5,313
Di 1280	..	.. 47° 17' S	175° 51' W	26/1/34	5,130
Di 1281	..	.. 40° 43' S	179° 49' W	28/1/34	2,579
Di 1680	..	.. 55° 20' S	162° 49' E	8/2/36	4,877
Di 1681	..	.. 53° 16' S	161° 58' E	9/2/36	4,224
Di 1682	..	.. 51° 13' S	159° 32' E	10/2/36	4,484
Di 2201	..	.. 55° 53' S	167° 04' E	26/1/38	4,631
Di 2209	..	.. 53° 08' S	168° 56' E	27/1/38	678
Di 2212	..	.. 49° 09' S	170° 23' E	29/1/38	730
Di 2213	..	.. 46° 28' S	172° 05' E	8/2/38	1,498
Di 2214	..	.. 48° 38' S	176° 08' E	9/2/38	1,386
Di 2216	..	.. 50° 07' S	179° 43' E	10/2/38	4,554
Di 2217	..	.. 52° 22' S	176° 11' W	11/2/38	5,483
Di 2728	..	.. 35° 25' S	157° 50' E	20/10/50	4,821
Di 2729	..	.. 35° 37' S	160° 22' E	21/10/50	3,244
Di 2730	..	.. 35° 58' S	163° 39' E	22/10/50	2,000
Di 2731	..	.. 36° 54' S	167° 18' E	23/10/50	2,000
Di 2819	..	.. 41° 25' S	159° 04' E	24/5/51	5,090
Di 2820	..	.. 43° 32' S	162° 31' E	25/5/51	4,684
Di 2821	..	.. 45° 21' S	165° 23' E	26/5/51	1,000
Ga 601	..	.. 45° 51' S	164° 32' E	14/1/52	4,510
Ga 677	..	.. 28° 38' S	175° 53' W	5/3/52	9,160
Kn 23	..	.. 44° 33' S	176° 48' W	29/1/54	60
Kn 34	..	.. 44° 04' S	175° 24' W	1/2/54	238
Kn 40	..	.. 44° 32' S	176° 05' W	3/2/54	302
Kn 45	..	.. 43° 35' S	176° 03' W	7/2/54	255
Kn 51	..	.. 44° 02' S	177° 19' W	10/2/54	229
Kn 52	..	.. 44° 04' S	178° 04' W	10/2/54	476
Kn 53	..	.. 44° 07' S	179° 02' W	10/2/54	293
Kn 54	..	.. 44° 09' S	179° 59' W	10/2/54	> 550
Kn 55	..	.. 44° 11' S	179° 11' E	11/2/54	710
Kn 56	..	.. 44° 14' S	178° 23' E	11/2/54	658
Kn 57	..	.. 43° 40' S	177° 59' E	11/2/54	587
Kn 59	..	.. 43° 38' S	177° 19' E	11/2/54	531
Kn 59 (a)	..	.. 43° 37' S	176° 20' E	12/2/54	421
Kn 60	..	.. 43° 36' S	175° 31' E	12/2/54	375
TN 1	..	.. 34° 25' S	171° 40' E	23/7/11	140
TN 2	..	.. 34° 11' S	172° 11' E	28/7/11	130
TN 3	..	.. 34° 15' S	172° 00' E	5/8/11	-
TN 4	..	.. 34° 40' S	172° 15' E	19/8/11	180
TN 5	..	.. 34° 26' S	172° 17' E	27/8/11	-
TN 6	..	.. off North Cape		18/9/11	28
TN 7	..	.. 34° 39' S	172° 16' E	22/9/11	180

APPENDIX C—STATION DATA

In the three columns under each station number are listed, from left to right, depth in metres, temperature in degrees Centigrade, salinity in parts

per thousand, and (where measured) dissolved oxygen content in millilitres per litre. For information of position, date and depth see Appendix A.

A 1

Depth (m)	Temp. (°C)	Sal. (‰)
0	7.15	34.4
10	7.15	34.3
20	7.15	34.5
30	7.10	34.4
50	7.10	34.4
75	7.06	34.4
105	7.06	34.5
150	7.02	34.4
205	7.02	34.4
255	7.03	34.5
300	6.98	34.4
400	6.55	34.4
500	6.36	34.4
600	6.32	34.4

A 2

Depth (m)	Temp. (°C)	Sal. (‰)
0	7.15	34.4
10	7.15	34.5
20	7.15	34.5
30	7.15	34.5
50	7.15	34.4
75	7.06	34.3
105	7.06	34.4
150	7.07	34.5
205	7.07	34.5
255	7.03	34.4
300	6.98	34.4
400	6.60	34.5
500	6.41	34.5
600	6.37	34.4

A 3

Depth (m)	Temp. (°C)	Sal. (‰)
0	7.15	34.4
10	7.15	34.3
20	7.13	34.4
30	7.10	34.6
50	7.10	34.6
75	7.09	34.6
105	7.06	34.4
150	7.02	34.6
205	7.00	34.4
255	6.98	34.4
300	6.99	34.4
400	6.70	34.4
500	6.46	34.6
600	6.42	34.5

A 15

Depth (m)	Temp. (°C)	Sal. (‰)
0	20.12	35.81
10	20.12	35.76
20	20.07	35.70
30	18.22	35.58
50	16.90	35.49
75	15.60	35.42
100	14.89	35.33
150	14.28	35.26
200	13.52	35.22
300	11.50	35.19

A 24

Depth (m)	Temp. (°C)	Sal. (‰)
0	20.30	35.73
10	20.30	35.73
20	20.29	35.73
30	20.00	35.72
50	18.28	35.66
75	17.51	35.60
100	17.09	35.57
150	16.00	35.53
200	15.01	35.50
300	13.24	35.41
400	11.66	35.33
500	9.79	35.20
600	8.41	35.08
800	6.79	34.90
1000	5.31	34.82
1200	4.44	34.77

A 25

Depth (m)	Temp. (°C)	Sal. (‰)
0	19.28	35.61
10	19.28	35.61
20	19.28	35.61
30	19.28	35.59
50	19.21	35.53
75	16.80	35.50
100	16.22	35.41
150	14.39	35.32
200	13.30	35.30
300	11.27	35.20
400	10.44	35.11
500	9.61	35.03
600	8.82	34.93
800	7.20	34.81
1000	5.67	34.75
1200	4.00	34.73

A 36

Depth (m)	Temp. (°C)	Sal. (‰)
0	18.09	35.38
10	18.08	35.40
20	17.70	35.41
30	16.00	35.42
50	15.83	35.40
75	15.25	35.35
100	14.79	35.26
150	14.00	35.15
200	13.20	35.06
300	10.78	34.91
400	9.51	34.87
500	8.70	34.85
600	8.00	34.83
800	6.91	34.80
1000	5.70	34.78
1200	4.60	34.77
1500	3.22	34.75
2000	2.24	34.71
2500	1.79	34.68

A 54

Depth (m)	Temp. (°C)	Sal. (‰)
0	19.2	35.05
10	19.2	35.05
20	19.2	35.05
30	18.3	35.08
50	16.0	35.17
75	14.8	35.22
100	13.6	35.23
150	12.5	35.24

A 55

Depth (m)	Temp. (°C)	Sal. (‰)
0	20.68	35.44
10	20.68	35.44
20	20.68	35.44
30	20.04	35.44
50	14.84	35.43
75	14.03	35.42
100	13.61	35.41
150	12.95	35.37
200	12.31	35.31
300	11.04	35.19
400	9.88	35.09
500	9.01	35.00
600	8.21	34.92
800	6.94	34.84
1000	5.39	34.80
1200	3.97	34.77
1500	3.22	34.71

A 64

Depth (m)	Temp. (°C)	Sal. (‰)
0	22.7	35.79
10	22.7	35.81
20	22.7	35.84
30	22.7	35.86
50	22.0	35.91
75	20.4	35.00
100	19.1	36.02
150	17.2	35.73
200	16.11	35.50
300	12.00	35.14
400	10.54	34.86

A 81

Depth (m)	Temp. (°C)	Sal. (‰)
0	22.21	36.02
10	22.21	36.01
20	22.20	36.00
30	22.20	35.90
50	22.00	35.85
75	20.72	35.74
100	19.23	35.68
150	17.91	35.61
200	16.90	35.56
300	14.72	35.48
400	13.28	35.42
500	12.30	35.36
600	11.20	35.29
800	9.69	35.16
1000	8.33	35.04
1200	6.88	34.90
1500	5.49	34.90
2000	4.14	34.90

A 111

Depth (m)	Temp. (°C)	Sal. (‰)
0	18.20	35.93
10	18.20	35.92
20	18.20	35.89
30	18.17	35.86
50	17.90	35.84
75	17.25	35.78
100	16.00	35.70
150	14.40	35.59
200	13.55	35.49
300	12.20	35.34
400	11.04	35.09
500	9.38	34.83

A 121

Depth (m)	Temp. (°C)	Sal. (‰)
0	19.46	35.82
10	19.46	35.82
20	19.46	35.82
30	19.46	35.83
50	19.46	35.83
75	19.46	35.82
100	18.33	35.76
150	15.72	35.58
200	14.61	35.40
300	12.52	35.22
400	11.26	35.05
500	10.00	34.93
600	9.07	34.78
800	7.54	34.62
1000	6.08	34.52
1200	4.68	34.55
1500	2.50	34.63

A 122

Depth (m)	Temp. (°C)	Sal. (‰)
0	18.0	35.63
10	18.0	35.63
20	17.8	35.62
30	17.7	35.60
50	17.2	35.54
75	16.2	35.51
100	16.3	35.53
150	14.7	35.43
200	14.0	35.26
300	12.77	35.11
400	10.92	34.93
500	9.61	34.83
600	8.84	34.76
800	7.42	34.65
1000	6.03	34.51
1200	4.97	34.50
1500	3.15	34.60

A 131

Depth (m)	Temp. (°C)	Sal. (‰)
0	15.0	35.13
10	15.0	35.13
20	15.0	35.13
30	14.9	35.13
50	14.9	35.13
75	14.6	35.11
100	14.2	35.08
150	13.1	35.03
175	12.7	-
200	12.91	34.99
300	11.90	34.91
400	10.94	34.84
500	10.10	34.77
600	9.40	34.70
800	7.83	34.67
1000	6.48	34.65
1200	5.25	34.65
1500	3.74	34.66
2000	2.55	34.68
2500	1.81	34.71

A 151

Depth (m)	Temp. (°C)	Sal. (‰)
0	17.0	35.15
10	17.0	35.15
20	16.8	35.16
30	16.7	35.17
50	16.6	35.22
75	16.4	35.32
100	16.1	35.34
150	13.5	35.36

A 161

Depth (m)	Temp. (°C)	Sal. (‰)
0	18.67	35.69
10	18.67	35.70
20	18.67	35.75
30	18.67	35.84
50	18.67	35.92
75	18.67	35.80
100	16.49	35.64
150	13.81	35.39
200	12.98	35.31
300	11.61	35.16
400	9.98	35.05
500	9.06	34.99
600	8.08	34.92
800	6.60	34.84
1000	4.97	34.80
1200	4.02	34.75
1500	2.82	34.69

A 162

Depth (m)	Temp. (°C)	Sal. (‰)
0	20.2	35.88
10	20.2	35.90
20	20.2	35.96
30	20.2	36.00
50	20.1	36.01
75	19.7	35.97
100	18.5	35.87
150	15.9	35.59
200	14.42	35.36
300	12.14	35.05
400	9.62	34.84

A 181

Depth (m)	Temp. (°C)	Sal. (‰)
0	20.87	36.00
10	20.86	36.00
20	20.82	36.00
30	20.82	35.99
50	20.81	35.98
75	20.80	35.98
100	20.33	35.95
150	17.28	35.55
200	16.06	35.40
300	14.00	35.24
400	12.13	35.14
500	10.52	35.02
600	9.34	34.93
800	7.29	34.84
1000	5.71	34.79
1200	4.76	34.78
1500	3.59	34.75
1900	2.11	34.70

A 190

Depth (m)	Temp. (°C)	Sal. (‰)
0	13.88	35.73
10	13.88	35.73
20	13.71	35.73
30	13.63	35.72
50	13.51	35.71
75	13.34	35.69
100	13.12	35.68
150	12.90	-
200	12.72	-
300	12.52	-

A 220

Depth (m)	Temp. (°C)	Sal. (‰)
0	13.3	35.29
10	13.3	35.30
20	13.3	35.31
30	13.3	35.31
50	13.2	35.31
75	12.9	35.27
100	12.7	35.25
150	12.2	35.20
200	11.8	35.17
300	11.4	35.14

A 221

Depth (m)	Temp. (°C)	Sal. (‰)
0	13.2	35.28
10	13.2	35.28
20	13.0	35.29
30	12.9	35.35
50	12.7	35.41
75	12.5	35.18
100	12.3	35.16
150	11.9	35.14
200	10.9	35.13
300	10.4	35.12

A 239

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.3	35.65
10	14.3	35.65
20	14.3	35.65
30	14.3	35.65
50	14.3	35.65
75	14.0	35.58
100	13.8	35.54
150	13.2	35.49
200	12.2	35.43
300	11.2	35.35

A 249

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.1	35.36
10	14.0	35.35
20	13.8	35.34
30	13.7	35.33
50	13.5	35.32
75	13.4	35.32
100	13.2	35.31

Ch (I) 166

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.7	35.50
503	10.4	36.04

Ch (I) 169

Depth (m)	Temp. (°C)	Sal. (‰)
0	15.0	35.64
91	13.7	35.70
183	12.9	35.20
366	10.0	34.83
1280	4.4	35.10

Ch (I) 170a

Depth (m)	Temp. (°C)	Sal. (‰)
0	18.4	35.73
183	15.8	35.61
366	11.4	35.30
549	9.4	34.83
732	7.6	34.80

Ch (II) 11

Depth (m)	Temp. (°C)	Sal. (‰)
0	16.90	—
10	16.90	35.53
20	16.85	35.53
30	16.85	35.53
50	16.86	—
75	16.86	35.52
100	16.87	35.52
125	16.42	35.46
150	16.18	35.46
175	16.38	35.43
200	15.08	35.41
295	13.56	35.21
387	11.89	35.08
479	10.19	—
589	9.05	34.74
773	7.43	34.56
983	5.89	—
1122	4.68	34.56

Ch (I) 168

0	14.0	35.46
2012	2.9	34.86

Da 3624

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	22.58	35.70	—
10	21.11	35.70	5.10
25	20.54	35.71	—
50	19.36	35.72	5.33
75	18.71	35.68	—
100	17.65	35.63	5.11
150	16.83	35.58	4.88
200	16.08	35.51	4.60
250	15.08	35.39	4.34
300	14.34	35.32	4.48
400	12.44	35.12	4.45
500	9.66	34.76	4.58
600	8.52	34.66	4.56
800	6.53	34.46	4.79
1000	5.29	34.42	4.62
1200	4.02	34.43	3.99
1500	2.92	34.60	3.53
2000	2.30	34.62	3.42
2500	2.03	34.69	3.48
3000	1.88	34.69	3.53
3500	1.86	34.69	3.37
4000	1.90	34.69	3.45

Da 3628

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	20.27	35.62	—
10	19.92	35.66	5.20
25	19.28	35.59	—
50	17.96	35.57	5.41
75	16.44	35.55	—
100	15.93	35.54	5.14
150	15.20	35.44	4.98
200	14.12	35.34	4.68
300	12.35	35.14	4.59
400	10.73	34.91	4.52
500	9.32	34.74	4.63
600	7.92	34.56	4.88
700	7.08	34.47	5.02
800	6.45	34.41	5.00
1000	5.56	34.38	4.65
1200	4.20	34.42	4.22
1500	3.10	34.51	3.74
2000	2.42	34.60	3.32
2500	2.16	34.64	3.25
3000	1.89	34.68	3.72
3500	1.49	34.72	4.27
4000	1.22	34.72	4.52
4500	1.06	34.71	4.52
5000	1.02	34.71	4.55

Da 3630

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	18.24	35.61	—
10	18.25	35.56	5.41
25	18.07	35.59	—
50	17.03	35.53	5.60
75	15.63	35.42	—
100	15.14	35.43	5.24
150	14.04	35.34	4.97
200	13.63	35.29	4.85
300	11.76	35.15	4.51
400	9.99	34.92	4.42
500	9.33	34.76	4.47
600	8.40	34.68	4.53
800	6.92	34.54	4.57
1000	5.40	34.49	4.30
1200	4.41	34.50	3.99
1500	3.16	34.57	3.70
2000	2.67	34.60	3.62
2500	2.34	34.62	3.59
3000	2.23	34.64	3.48

Da 3631

0	18.90	35.47	—
10	18.71	35.47	5.45
25	17.84	35.44	—
50	16.75	35.40	5.74
75	15.03	35.37	—
100	14.33	35.32	5.00
150	13.79	35.26	4.77
200	12.92	35.19	4.63
300	11.52	35.06	4.44
400	10.42	34.90	4.37
500	9.38	34.78	4.43
600	8.32	34.68	4.44
800	6.68	34.58	4.33
1000	5.76	34.50	4.19
1200	4.42	34.52	3.86
1500	3.37	34.60	3.88
2000	2.06	34.67	3.53

Da 3633

0	18.88	35.11	—
10	18.82	35.04	5.40
25	18.10	35.07	—
30	16.55	35.11	—
35	15.24	35.21	—
50	15.07	35.21	3.48

Da 3635

0	18.95	34.88	—
10	18.83	34.87	5.44
25	18.41	34.99	—
35	17.19	35.08	—
44	16.19	35.14	3.81

Da 3636

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	17.70	35.16	—
10	17.58	35.17	5.38
15	17.30	35.12	—
20	17.13	35.17	—
25	16.14	35.24	—
35	16.07	35.25	—
45	16.07	35.25	4.36

Da 3637

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	18.65	35.39	—
10	18.68	35.38	5.39
25	18.68	35.36	—
50	17.05	35.34	5.36
75	15.64	35.37	—
100	14.80	35.31	4.83
150	14.05	35.26	4.60
200	13.20	35.16	4.46
300	11.30	34.94	4.55
400	9.89	34.78	4.39
500	8.42	34.63	4.51
600	7.52	34.52	4.55
800	6.40	34.49	4.41
1000	5.20	34.49	4.12
1200	4.34	34.49	3.93

Da 3638

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	19.85	35.55	—
10	19.87	35.53	5.23
25	19.74	35.53	—
50	17.96	35.51	5.51
75	16.90	35.51	—
100	16.50	35.50	4.92
150	15.68	35.44	4.75
200	14.79	35.35	4.56
300	12.71	35.16	4.42
400	11.04	34.97	4.42
500	9.88	34.84	4.38
600	8.32	34.63	—
800	7.28	34.57	4.49
1000	5.98	34.51	4.33
1200	4.79	34.50	4.05
1500	3.68	34.56	3.75
2000	2.24	34.63	3.59

Da 3639

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	18.22	35.41	—
10	18.27	35.38	5.37
25	18.20	35.41	—
50	15.86	35.41	5.12
75	15.21	35.39	—
100	14.43	35.35	4.71
150	13.70	35.26	4.56
200	12.53	35.17	4.43
300	11.45	35.01	4.42
400	9.89	34.83	4.42
500	8.88	34.72	4.51
600	8.17	34.63	4.45
800	6.64	34.50	4.49
1000	5.54	34.49	4.23
1200	4.39	34.49	3.97

Da 3640

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	17.74	35.26	—
10	17.71	35.26	5.47
25	17.70	35.25	—
35	16.51	—	—
50	14.37	35.21	5.87
75	13.68	35.23	—
100	13.13	35.23	4.71
150	12.62	35.18	4.96
200	12.34	35.16	5.38
300	11.24	34.98	5.45
400	9.82	34.79	5.23
500	8.93	34.67	4.87
600	8.11	34.58	4.91
800	7.12	34.51	4.66
1000	5.70	34.47	4.38
1200	4.37	34.48	4.04
1500	3.18	34.57	3.67
2000	2.26	34.63	3.51
2500	1.79	34.70	3.83
2750	1.63	34.70	4.00

Da 3641

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	14.98	34.74	—
10	14.96	34.74	5.75
25	14.83	34.74	—
35	12.70	34.74	—
50	11.18	34.74	5.63
75	10.58	34.78	—
100	10.39	34.80	5.39
150	9.70	34.72	5.40
200	9.12	34.67	5.34
300	7.95	34.49	5.87
390	7.38	34.49	5.51

Da 3642

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	13.48	34.22	—
10	12.70	34.18	6.30
25	12.63	34.20	—
35	12.44	34.19	—
40	11.04	34.20	—
50	9.90	34.21	6.52
75	7.65	34.21	—
100	6.84	34.24	6.33
100	7.03	34.19	—
150	6.65	34.28	6.31
150	6.66	34.27	—
200	6.78	34.33	6.22
200	6.80	34.32	—
300	6.66	34.34	6.08
300	6.64	34.34	—
400	6.15	34.30	6.04
500	5.90	34.30	5.62
600	5.52	34.34	5.16
800	4.05	34.34	4.84
1000	3.23	34.40	4.58
1200	2.88	34.46	4.35
1500	2.60	34.54	4.10
2000	2.24	34.71	4.04

Da 3643

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	12.71	34.18	—
10	12.61	34.18	6.20
25	12.60	34.17	—
35	11.22	34.22	—
40	11.44	34.21	—
45	9.29	34.22	—
50	8.60	34.22	6.66
75	7.60	34.22	—
100	7.06	34.23	6.52
150	6.76	34.22	6.29
200	6.87	34.33	6.27
300	6.69	34.33	6.17
400	6.38	34.33	6.03
500	6.03	34.33	5.58
600	5.48	34.33	5.07
800	5.60	34.33	5.15
1000	4.14	34.33	4.79
1200	2.96	34.39	4.33
1350	2.71	34.47	4.12

Da 3644

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	13.00	34.30	—
10	12.91	34.31	6.32
25	12.73	34.28	—
30	11.20	34.31	—
35	10.62	34.32	—
50	8.88	34.33	6.72
75	8.39	34.34	—
100	8.15	34.33	6.53
150	7.81	34.44	6.20
200	7.92	34.49	6.10
300	7.08	34.38	6.32
400	7.26	34.43	6.05
500	7.00	34.45	5.99
600	6.70	34.40	5.62
800	5.64	34.40	4.96
900	4.91	34.35	4.91

Da 3645

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	15.34	—	—
10	14.83	34.49	5.96
25	14.57	34.51	—
35	13.92	34.52	—
40	11.02	34.60	—
50	10.92	34.60	5.63
75	10.49	34.70	—
100	9.76	34.62	5.50
150	9.32	34.60	5.45
200	8.85	34.55	5.54
300	8.44	34.53	5.59
400	7.97	34.48	5.47
500	7.56	34.42	5.27
600	7.24	34.41	4.98
800	6.10	34.40	4.45
1000	5.34	34.39	4.09
1200	4.14	34.42	3.89
1500	2.90	34.49	3.52
1600	2.64	34.51	3.48

Da 3647

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	16.50	34.72	—
10	15.87	34.72	—
25	15.61	34.72	—
30	14.83	34.72	—
35	13.85	34.78	—
50	13.57	34.80	—
75	12.94	34.86	—
100	12.78	34.92	—
150	12.73	34.94	—
200	12.75	34.95	—

Da 3649

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	17.95	34.70	—
10	17.76	34.67	—
25	16.63	34.69	—
35	15.39	34.70	—
50	14.58	34.76	—
75	12.71	34.96	—
95	12.63	34.97	—

Da 3650

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	19.80	35.34	—
10	19.87	35.34	—
25	17.70	35.29	—
50	14.67	35.34	5.75
75	14.15	35.35	—
100	13.84	35.35	5.28
150	13.58	35.33	5.32
200	13.27	35.30	5.35
300 ¹	12.83	35.26	5.26
400 ¹	11.64	35.10	4.54
500 ¹	10.40	34.96	4.34
600 ¹	9.16	34.81	4.31
800	7.18	34.59	4.12
1000	6.08	34.57	4.02
1200	4.70	34.54	3.80
1500	3.05	34.58	3.35

Da 3651

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	20.98	35.38	—
10	21.14	35.34	5.20
15	21.03	35.34	—15
20	19.04	35.26	—
25	18.54	35.26	—
35	18.14	35.32	—
50	15.25	35.33	5.1
75	14.23	35.32	—86
100	13.81	35.32	5.1
150	13.20	35.29	5.10
200	12.64	35.21	4.72
300	11.48	35.07	4.61
400	10.28	34.94	4.33
500	9.07	34.80	4.35
600	8.38	34.71	4.33
700	7.60	34.62	—
800	6.56	34.57	4.17
1000	5.00	34.53	3.92
1200	3.95	34.54	3.67
1350	2.96	34.56	3.55

Da 3653

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	21.95	35.71	—
10	22.00	35.71	4.78
25	21.99	35.70	—
35	21.73	35.66	—
50	18.64	35.60	5.21
75	18.17	35.60	—
100	17.36	35.59	4.51
150	16.30	35.52	—
200	14.84	35.41	4.27
300	12.90	35.20	4.34
400	11.67	35.07	4.35
500	9.99	34.87	4.31
600	8.62	34.70	4.31
800	6.92	34.54	4.08
1000	5.28	34.47	4.00
1200	4.30	(34.53)	—
1500	3.38	34.60	3.33
2000	2.36	34.66	3.18
2500	2.04	34.68	3.18
3000	1.95	34.70	3.28

Da 3654

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	22.96	35.79	—
10	23.05	35.74	4.69
25	22.81	35.73	—
50	19.62	35.62	5.03
75	17.01	35.55	—
100	16.33	35.52	4.74
150	14.87	35.43	4.57
200	13.78	35.34	4.51
300	12.14	35.17	4.68
400	10.72	35.00	4.47
500	9.30	34.79	4.36
600	8.20	34.63	4.23
800	6.56	34.49	4.05
1000	5.52	34.51	3.97
1200	4.36	34.54	3.65
1500	3.18	34.60	3.30

Di 920

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	2.91	33.83	6.97
10	2.95	33.83	—
20	2.95	33.83	6.93
30	2.95	33.83	—
40	2.94	33.83	6.94
50	2.94	33.83	—
60	2.92	33.83	6.95
80	2.92	33.83	—
100	2.93	33.83	6.90
150	2.93	33.83	6.90
190	2.52	33.89	6.72
290	2.82	34.05	6.00
380	2.01	34.24	4.90
580	2.60	34.32	4.43
770	2.59	34.43	3.88
960	2.31	34.52	3.66
1440	2.20	34.69	3.88
1920	1.99	34.71	4.14
2410	1.62	34.72	4.17
2890	1.29	34.70	4.00
3370	0.99	34.69	4.02
3850	0.86	34.68	3.99

Di 921

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	7.74	34.36	6.21
10	7.74	34.36	—
20	7.74	34.36	6.20
30	7.75	34.36	—
40	7.74	34.36	6.21
50	7.74	34.36	—
60	7.74	34.36	6.19
80	7.74	34.36	—
100	7.74	34.36	6.19
150	7.79	34.37	6.21
200	8.08	34.44	6.04
300	8.74	34.50	5.90
400	8.75	34.50	5.77
500	8.65	34.50	5.24
1000	4.28	34.32	4.33

Di 922

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	8.24	34.45	6.05
10	8.24	34.45	—
20	8.24	34.45	6.06
30	8.24	34.45	—
40	8.24	34.45	6.02
50	8.24	34.45	—
60	8.23	34.45	6.02
80	8.20	34.45	—
100	8.20	34.45	6.04
150	8.14	34.44	6.04
200	8.09	34.44	6.05
300	8.21	34.53	5.61
400	7.80	34.50	5.71
600	7.61	34.51	4.99
800	6.16	34.36	4.54
1000	4.53	34.34	4.38
1500	2.87	34.46	3.67

Di 923

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	8.88	34.44	6.06
10	8.88	34.44	—
20	8.88	34.44	6.08
30	8.89	34.44	—
40	8.89	34.44	6.07
50	8.89	34.44	—
60	8.89	34.44	6.07
80	8.88	34.44	—
100	8.88	34.44	6.08
150	8.88	34.44	6.06
200	7.99	34.45	5.86
300	7.80	34.46	5.87
390	7.91	34.53	5.57
490	7.84	34.54	5.08
590	7.60	34.52	5.38
790	6.07	34.43	4.64
980	4.75	34.35	4.05
1380	3.09	34.44	3.61
1470	2.93	34.47	3.95
1970	2.36	34.67	3.84
2460	1.93	34.72	3.74
2950	1.50	34.73	3.96
3440	1.32	34.72	3.88
3930	1.29	34.72	3.89

Di 924

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	11.38	34.85	5.71
10	11.38	34.85	—
20	11.38	34.85	5.72
30	11.38	34.85	—
40	11.33	34.85	5.65
50	11.33	34.85	—
60	11.32	34.85	5.67
80	11.32	34.85	—
100	11.30	34.86	5.66
150	10.38	34.86	5.31
200	9.98	34.82	5.19
300	9.04	34.74	5.01
390	8.10	34.65	5.03
590	7.83	34.58	4.86
790	6.58	34.51	4.18
980	5.20	34.46	4.11
1470	3.03	34.56	3.53
1970	2.39	34.68	3.48
2460	1.95	34.74	3.94
2950	1.55	34.74	3.88
3440	1.28	34.74	3.95
3930	1.16	34.74	3.91

Di 925

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	12.07	34.93	5.67
10	12.07	34.93	—
20	12.08	34.93	5.67
30	12.08	34.93	—
40	12.08	34.93	5.67
50	12.08	34.93	—
60	12.08	34.93	5.65
80	12.08	34.93	—
100	12.08	34.93	5.67
150	11.55	35.08	5.21
200	11.20	35.01	5.22
300	10.40	34.92	4.83
400	9.33	34.77	4.75
590	8.33	34.63	4.83
790	7.04	34.55	4.27
990	5.34	34.43	4.02

Di 926

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	14.18	35.35	5.35
10	14.18	35.35	—
20	14.18	35.35	5.35
30	14.16	35.35	—
40	14.16	35.35	5.31
50	14.16	35.35	—
60	14.16	35.35	5.31
80	14.16	35.35	—
100	14.17	35.35	5.31
150	12.53	35.24	4.79
200	12.01	35.17	4.64
300	11.00	35.02	4.28
400	10.13	34.91	4.21
600	8.00	34.61	4.46
800	6.78	34.56	3.93

Di 928

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	14.92	35.39	5.10
10	14.92	35.39	—
20	14.92	35.39	5.18
30	14.91	35.39	—
40	14.90	35.39	5.14
50	14.84	35.39	—
60	14.82	35.38	5.11
80	14.41	35.32	—
100	14.03	35.28	4.72
150	13.52	35.22	4.48

Di 929

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	14.81	35.41	—
50	14.73	35.41	—
0	14.91	35.42	—
50	14.76	35.41	—

Di 931

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	14.64	35.39	—
80	14.64	35.39	—

Di 932

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	14.64	35.37	—
180	13.91	35.29	—

Di 933

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	14.62	35.37	—
280	13.62	35.28	—

Di 934

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	14.37	35.35	—
90	14.36	35.35	—
0	14.12	35.37	—
98	14.20	35.39	—

Di 936

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	13.86	35.30	—
45	13.72	35.29	—
0	13.93	35.30	—
56	13.91	35.30	—

Di 937

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	13.72	35.20	—
48	13.62	35.29	—

Di 938

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	13.81	34.86	—
36	14.12	35.31	—

Di 939

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	14.61	35.33	—
87	13.91	35.32	—
0	14.24	35.34	—
85	13.85	35.29	—

Di 941

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	11.03	34.89	—
150	11.03	35.05	—

Di 942

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	9.12	34.61	5.95
10	9.17	34.61	—
20	9.17	34.61	5.94
30	9.17	34.61	—
40	9.17	34.61	5.93
50	9.17	34.61	—
60	9.17	34.61	5.95
80	9.06	34.60	—
100	9.01	34.59	5.90
150	8.86	34.56	5.73
200	8.39	34.49	5.70
300	8.50	34.55	5.25
400	8.29	34.57	5.09
500	8.11	34.52	4.86

Di 943

Depth (m)	Temp. (°C)	Sal. (‰/‰)	O ₂ (ml/l)
0	7.37	34.42	6.34
10	7.39	34.43	—
20	7.40	34.43	6.35
30	7.40	34.43	—
40	7.40	34.43	6.33
50	7.40	34.43	—
60	7.40	34.43	6.32
80	7.38	34.43	—
100	7.39	34.43	6.22
150	7.30	34.45	6.08
200	6.61	34.36	6.20
300	6.38	34.36	5.98
400	6.08	34.34	6.08
600	5.76	34.30	5.55
800	4.86	34.34	4.80
1000	3.80	34.34	4.44
1500	2.60	34.55	3.73
2000	2.30	34.67	3.65

Di 944

0	6.54	34.34	6.26
10	6.60	34.34	—
20	6.60	34.34	6.26
30	6.61	34.34	—
40	6.61	34.34	6.27
50	6.61	34.34	—
60	6.58	34.34	6.23
80	6.51	34.36	—
100	6.51	34.36	6.40
150	6.50	34.37	6.42
190	6.41	34.37	6.29
280	5.90	34.31	6.24
380	5.41	34.22	6.16
570	4.81	34.31	5.05
750	3.68	34.31	4.80
940	3.10	34.38	4.38
1400	2.64	34.58	3.49
1880	2.25	34.72	3.77
2350	1.94	34.75	3.80
2910	1.57	34.74	4.26
3390	1.23	34.73	4.03
3880	1.00	34.73	4.12
4360	0.89	34.73	4.06

Di 946

0	6.90	34.33	6.43
10	6.90	34.33	—
20	6.90	34.33	6.44
30	6.87	34.32	—
40	6.84	34.31	6.45
50	6.80	34.30	—
60	6.81	34.30	6.40
80	6.81	34.30	—
100	6.53	34.30	6.41
150	6.53	34.30	6.35
190	6.24	34.29	6.36
280	5.93	34.27	6.25
380	5.95	34.29	5.64
560	5.10	34.34	4.91
750	3.93	34.35	4.51
940	3.28	34.38	4.59
1400	2.58	34.56	3.66
1870	2.33	34.64	3.66

Di 1278

0	9.18	34.25	6.20
10	9.18	34.25	—
20	9.18	34.25	6.21
30	9.18	34.26	—
40	9.18	34.26	6.22
50	9.18	34.26	—
60	9.17	34.26	6.21
80	8.05	34.31	—
100	7.95	34.33	6.14
150	6.85	34.29	6.21
195	7.06	34.35	6.00
295	6.82	34.36	5.85
390	6.57	34.34	5.75
590	5.26	34.22	5.62
780	4.43	34.26	4.85
980	3.69	34.33	4.40
1460	2.68	34.52	3.82
1940	2.34	34.66	3.72
2430	2.08	34.68	3.89
2920	1.74	34.75	4.08
3400	1.38	34.75	4.22

Di 1279

0	10.56	34.14	6.06
10	10.56	34.14	—
20	10.56	34.14	6.07
30	10.56	34.14	—
40	10.56	34.14	6.06
50	10.53	34.14	—
60	9.76	34.14	6.18
80	6.87	34.15	—
100	6.63	34.16	6.37
150	6.85	34.31	6.08
200	6.16	34.22	6.17
300	5.53	34.19	6.14
395	5.40	34.23	5.63
590 ¹	4.56	34.31	4.78
790 ¹	3.49	34.33	4.52
990 ¹	3.22	34.41	3.99
1490 ¹	2.46	34.59	3.75
1970 ²	2.21	34.70	3.78
2460 ³	1.94	34.76	4.05
2960 ⁴	1.56	34.75	4.27
3450 ²	1.22	34.75	4.34

Di 1280

0	12.72	34.78	5.81
10	12.72	34.78	—
20	12.72	34.78	5.80
30	12.72	34.78	—
40	12.72	34.78	5.79
50	12.71	34.78	—
60	12.69	34.78	5.78
80	10.67	34.83	—
95	10.49	34.84	5.64
145	9.96	34.77	5.69
190	9.58	34.76	5.67
285	9.18	34.75	4.96
380	8.41	34.66	5.26
570	7.69	34.56	4.95
760	6.78	34.45	4.69
950	5.80	34.45	4.24
1430	3.19	34.47	3.98
1980	2.44	34.66	3.60
2470	2.21	34.75	3.79
2960	1.82	34.78	3.98
3460	1.45	34.77	4.24

Di 1281

0	15.73	34.84	5.55
10	15.78	34.84	—
20	15.73	34.84	5.56
30	15.23	34.84	—
40	14.73	34.84	5.72
50	13.98	34.84	—
60	13.78	34.84	5.52
80	13.48	34.84	—
100	12.38	34.89	5.37
150	11.25	34.91	5.53
200	11.36	34.93	5.54
300	10.92	34.89	5.25
400	9.69	34.78	4.59
600	7.54	34.59	4.41
790	4.90	34.50	3.98
990	4.03	34.51	3.63
1490	2.78	34.60	3.46
1990	2.14	34.67	3.29
2480	1.67	34.75	3.86

Di 1680

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	6.18	33.87	6.70
10	6.18	33.87	—
20	6.09	33.87	6.70
30	5.70	33.86	—
40	5.58	33.85	6.68
50	5.30	33.86	—
60	4.18	33.88	6.71
80	3.23	33.92	—
100	2.96	33.96	6.62
150	2.81	34.05	6.26
200	3.12	34.14	5.70
300	2.73	34.19	5.34
390	1.73	34.24	5.09
580	2.51	34.47	3.66
770	2.41	34.58	3.35
960	2.29	34.66	3.48
1440	2.03	34.71	3.76
1920	1.57	34.75	4.05
2270	1.31	34.73	4.06
2750	1.05	34.70	4.10
3230	0.87	34.70	4.06
3710	0.75	34.69	4.25
4200	0.70	34.70	4.19

Di 1681

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	9.11	34.17	6.26
10	9.12	34.17	—
20	9.16	34.18	6.28
30	9.18	34.18	—
40	9.18	34.18	6.28
50	9.20	34.18	—
60	9.11	34.16	6.21
80	8.52	34.16	—
100	8.27	34.23	6.17
150	7.62	34.37	5.99
200	7.82	34.46	5.86
300	7.49	34.43	5.87
400	6.84	34.40	5.53
590	5.07	34.24	5.04
790	4.17	34.31	4.62
990	3.42	34.33	4.32
1490	2.55	34.56	3.64
1980	2.23	34.69	3.71
2470	1.90	34.73	3.93
2970	1.58	34.73	4.02
3460	1.32	34.73	3.99
3960	1.15	34.71	4.03

Di 1682

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	10.33	34.32	6.18
10	10.31	34.32	—
20	10.31	34.32	6.19
30	10.31	34.32	—
40	10.30	34.32	6.19
50	9.71	34.36	—
60	9.51	34.43	6.03
80	9.10	34.50	—
100	8.71	34.52	5.83
150	8.42	34.57	5.81
200	8.41	34.60	5.86
300	8.29	34.55	5.79
400	8.23	34.53	5.66
580	7.06	34.43	4.91
780	5.70	34.39	4.45
970	4.23	34.34	4.46
1460	2.70	34.52	3.64
1980	2.39	34.67	3.63
2480	2.08	34.74	3.75
2980	1.65	34.73	3.99
3480	1.27	34.71	3.84
3980	1.12	34.70	3.79

Di 2208

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	8.24	34.21	6.33
10	8.24	34.21	—
20	8.24	34.21	6.22
30	8.24	34.21	—
40	8.24	34.21	6.22
50	8.24	34.21	—
60	8.24	34.21	6.20
80	8.24	34.21	—
100	8.24	34.21	6.20
150	7.56	34.37	6.06
200	7.77	34.44	5.97
300	7.83	34.49	5.85
400	7.49	34.45	5.61
570	6.39	34.36	5.04
760	5.17	34.34	4.58
950	3.92	34.33	4.33
1430	2.62	34.50	3.78
1900	2.36	34.66	3.78
2390	2.07	34.74	3.93
2860	1.73	34.73	3.97
3330	1.45	34.72	4.08
3800	1.22	34.71	4.17
4270	1.01	34.70	4.24

Di 2209

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	9.10	34.40	6.23
10	9.09	34.40	—
20	8.94	34.41	6.19
30	8.94	34.41	—
40	8.92	34.41	6.18
50	8.84	34.41	—
60	8.24	34.41	6.22
80	7.70	34.42	—
100	7.67	34.46	6.05
150	7.64	34.50	5.93
200	7.46	34.46	5.99
300	7.31	34.46	6.04
400	7.19	34.45	6.03
600	6.80	34.41	5.91

Di 2212

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	11.62	34.36	6.04
10	11.62	34.36	—
20	11.36	34.36	6.04
30	11.15	34.36	—
40	11.14	34.36	6.05
50	10.67	34.36	—
60	9.44	34.37	6.29
80	7.84	34.38	—
100	7.29	34.38	6.27
150	7.03	34.40	6.20
200	6.90	34.39	6.17
300	6.78	34.37	6.14
390	6.78	34.37	6.12
590	6.61	34.40	5.86

Di 2216

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	10.61	34.21	6.17
10	10.60	34.22	—
20	10.43	34.22	6.13
30	10.22	34.22	—
40	10.22	34.22	6.16
50	9.97	34.19	—
60	9.14	34.15	6.27
80	6.82	34.13	—
100	6.06	34.18	6.38
150	6.03	34.25	6.13
200	5.64	34.22	5.91
300	4.93	34.20	6.16
400	4.84	34.22	5.68
590	4.04	34.26	4.72
790	3.17	34.32	4.45
990	2.76	34.44	4.00
1480	2.35	34.65	3.74
1960	2.11	34.74	3.81
2450	1.75	34.75	4.05
2940	1.46	34.73	4.01
3430	1.14	34.72	4.20
3930	0.89	34.71	4.22

Di 2213

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	14.68	34.32	5.76
10	14.68	34.32	—
20	14.45	34.32	5.74
30	14.33	34.32	—
40	12.43	34.32	6.07
50	8.85	34.33	—
60	8.42	34.33	6.34
80	7.62	34.33	—
100	7.24	34.33	6.03
150	6.74	34.33	6.01
200	6.66	34.33	5.99
300	6.62	34.39	6.00
400	6.00	34.31	5.89
590	5.13	34.27	4.98
780	4.15	34.30	4.47
970	3.38	34.33	4.25
1360	2.65	34.51	3.58

Di 2214

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	10.97	34.22	6.19
10	10.94	34.22	—
20	10.54	34.22	6.21
30	10.15	34.23	—
40	9.34	34.25	6.34
50	8.94	34.29	—
60	8.72	34.29	6.33
80	7.76	34.32	—
100	7.52	34.35	6.16
150	7.44	34.44	5.99
200	7.38	34.47	5.90
300	7.08	34.43	6.02
400	6.99	34.42	6.07
580	5.98	34.34	5.09
780	4.90	34.31	4.61
970	3.64	34.33	4.42
1270	3.05	34.41	4.18

2217

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	9.58	34.30	6.26
10	9.58	34.30	—
20	9.55	34.30	6.20
30	9.44	34.30	—
40	8.92	34.30	6.21
50	8.82	34.29	—
60	8.74	34.28	6.14
80	8.77	34.33	—
100	7.71	34.33	5.96
150	6.64	34.33	6.04
200	6.53	34.33	6.01
300	6.09	34.28	6.22
400	5.64	34.22	6.00
600	4.96	34.27	5.26
800	3.84	34.28	4.61
1000	3.26	34.37	4.17
1500	2.49	34.57	3.63
1990	2.22	34.70	3.83
2490	1.96	34.74	4.05
2970	1.60	34.73	3.96
3450	1.26	34.72	4.15
3940	1.05	34.71	4.06
4440	0.92	34.70	4.25
4940	0.90	34.70	4.16

Di 2730

0	17.63	35.41	5.43
10	17.63	35.41	—
20	17.24	35.41	5.46
30	17.13	35.41	—
50	16.93	35.43	5.42
75	16.53	35.39	—
100	16.11	35.39	5.17
150	15.34	35.34	0.01
200	14.25	35.25	4.97
300	12.37	35.01	4.72
400	10.62	34.78	4.60
490	9.88	34.74	4.26
580	9.00	34.61	4.42
780	7.06	34.38	4.23
970	5.74	34.42	4.08
1170	4.51	34.33	3.68
1480	3.40	34.42	3.32

Di 2820

0	12.50	34.78	5.99
10	12.50	34.81	—
20	12.50	34.76	5.93
30	12.50	34.79	—
50	12.49	34.77	6.34
75	12.48	34.79	—
100	11.56	34.97	5.50
150	10.80	34.84	5.48
200	10.14	34.81	5.55
300	9.79	34.64	5.42
400	8.50	34.55	5.49
500	8.07	34.60	5.63
590	7.84	34.55	4.84
790	6.78	34.38	4.07
980	5.11	34.38	3.75
1180	3.93	34.50	3.49
1620	2.75	34.59	3.55
1960	2.37	34.60	3.33
2460	2.01	34.66	—
3430	1.32	34.70	3.81
4410	1.15	34.70	3.74

Di 2728

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	17.51	35.37	5.47
10	17.54	35.37	—
20	17.54	35.34	5.50
30	17.54	35.28	—
50	17.54	35.37	5.36
75	16.38	35.39	—
100	15.81	35.28	5.06
150	14.80	35.23	4.78
200	14.05	35.17	5.18
300	11.77	34.92	4.54
400	10.24	34.74	4.70
500	9.13	34.56	4.34
590	8.13	34.45	4.46
790	6.40	34.31	4.25
990	4.84	34.31	3.93
1190	4.32	34.36	3.76
1480	3.19	34.40	3.22
1980	2.36	34.54	3.27
2480	1.93	34.60	3.61
3460	1.24	34.61	3.73
4480	1.17	34.61	—

Di 2731

0	15.78	35.32	5.73
10	15.78	35.32	—
20	15.72	35.32	5.71
30	15.41	35.30	—
50	15.25	35.32	5.36
75	15.13	35.32	—
100	14.44	35.28	5.52
150	13.72	35.17	5.14
200	12.60	35.08	4.88
300	11.76	34.99	4.88
400	10.48	34.78	4.48
480	9.70	34.76	4.32
570	8.58	34.47	4.36
760	7.02	34.61	3.99
940	5.47	34.29	3.95

Di 2821

0	13.13	35.07	6.35
10	13.07	35.02	—
20	13.09	35.05	6.05
30	13.05	35.13	—
50	13.05	35.01	6.14
75	12.86	35.03	—
100	12.64	34.97	6.08
150	11.02	34.92	5.45
200	10.48	34.85	5.21
300	9.33	34.69	5.57
400	8.61	34.54	5.67
500	8.13	34.60	5.68
570	7.77	34.56	5.13
760	6.70	34.47	4.22
940	5.24	34.49	4.04
1430	3.12	34.60	3.51
1980	2.38	34.65	3.63
2960	1.46	34.73	3.67
3940	1.18	34.72	4.12

Di 2729

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	17.19	35.39	3.64
10	17.03	35.37	—
20	16.94	35.39	5.32
30	16.93	35.43	—
50	16.83	35.43	5.50
75	16.54	35.34	—
100	16.35	35.39	5.22
150	15.70	35.34	4.77
200	14.10	35.19	4.27
300	12.76	35.05	4.41
400	10.69	34.83	4.66
480	9.64	34.40	4.52
590	8.40	34.54	4.40
790	6.88	34.61	4.28
1000	5.38	34.38	3.68
1200	4.36	34.40	3.60
1480	3.31	34.47	3.22
1980	2.43	34.56	3.37
2490	1.94	34.61	3.62
2990	1.34	34.61	3.95

Di 2819

0	14.16	35.12	5.77
10	13.78	35.00	—
20	13.88	35.11	5.75
30	13.70	34.99	—
50	13.70	35.02	5.87
75	13.70	34.99	—
100	12.58	35.08	5.07
150	11.21	34.98	5.41
200	10.68	34.86	5.41
300	9.37	34.64	5.72
400	8.65	34.60	5.67
500	8.16	34.51	5.78
520	8.14	34.56	5.46
710	7.25	34.52	4.79
890	5.90	34.42	4.29
1090	4.74	34.39	3.92
1370	3.57	34.41	3.52
2030	2.49	34.60	3.40
2480	2.03	34.74	3.64
2930	1.66	34.74	3.81
3930	1.16	34.71	3.60
4920	1.12	34.74	3.80

Di 2823

0	7.95	34.09	6.57
10	7.94	34.14	—
20	7.94	34.16	6.61
30	7.93	34.13	—
50	7.93	34.13	6.61
75	7.93	34.13	—
100	7.92	34.13	6.61
150	7.23	34.20	6.43
200	6.38	34.31	6.35
300	5.77	34.33	6.41
400	5.50	34.34	6.28
500	4.81	34.20	6.00
560	4.67	34.23	5.22
760	3.83	34.28	4.59
950	3.05	34.35	4.08
1160	2.67	34.49	3.76
1980	2.22	34.65	3.82
2470	1.85	34.73	3.96
2960	1.57	34.77	4.03
3960	1.00	34.69	3.84
4950	1.90	34.72	3.87

DN 2824

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	8.80	34.25	6.46
10	8.80	34.23	—
20	8.80	34.23	6.47
30	8.80	34.23	—
50	8.80	34.23	6.45
75	8.80	34.25	—
100	8.69	34.33	6.36
150	6.84	34.33	6.22
200	6.53	34.25	6.33
300	6.29	34.24	6.31
400	5.88	34.32	6.32
500	5.44	34.23	6.16
600	4.86	34.23	5.66
800	4.28	34.31	4.81
1010	3.44	34.35	4.41
1190	3.06	34.40	4.13
1490	2.60	34.56	3.82
1990	2.32	34.65	3.61
2490	1.99	34.70	3.90
2990	1.63	34.70	3.74
3970	1.10	34.69	4.25
4980	0.95	34.72	3.96

Ga 601

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	12.71	34.81	—
24	12.20	34.76	6.21
47	12.03	34.78	6.10
95	11.45	34.84	5.89
189	9.82	34.78	5.44
284	9.02	34.67	5.48
379	8.34	34.58	5.40
474	7.76	34.54	5.12
568	7.94	34.54	5.26
663	7.35	34.52	4.88
758	6.80	34.50	4.60
853	6.02	—	4.64
947	4.20	34.43	4.35
1137	4.06	34.45	4.37
1421	3.08	34.54	3.73
1893	2.52	34.58	3.70
3054	1.52	34.74	4.25
3622	1.26	34.72	4.29
4000	1.16	34.72	4.35
4286	1.15	34.72	4.31

Ga 677

Depth (m)	Temp. (°C)	Sal. (‰)	O ₂ (ml/l)
0	24.02	35.64	—
47	22.00	35.58	5.15
94	17.92	35.55	5.02
182	16.08	35.46	4.55
376	11.77	34.97	4.35
564	8.25	34.58	4.61
766	6.42	34.39	4.97
956	5.13	34.37	4.50
1145	4.07	34.37	4.16
2822	1.89	34.68	3.37
3762	1.34	34.72	4.44
4232	1.19	34.72	4.52
4723	1.09	34.72	4.58
5194	1.07	34.72	4.48
5665	1.16	34.70	4.56
6496	1.27	34.72	4.62
7905	1.46	34.70	4.60
8845	1.68	34.72	4.56

Kn 23

Depth (m)	Temp. (°C)	Sal. (‰)
0	13.90	34.83
60	13.80	34.85

Kn 34

Depth (m)	Temp. (°C)	Sal. (‰)
0	13.95	34.76
31	13.90	34.68
61	13.80	34.66
122	12.55	34.92
183	11.55	35.01
235	11.00	35.00

Kn 40

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.40	34.95
30	14.15	34.88
62	13.40	34.90
120	12.60	34.96
184	11.85	34.96
243	10.95	34.96

Kn 45

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.20	35.06
30	13.60	34.90
61	12.95	34.86
122	12.05	34.97
183	11.55	35.02
259	11.00	35.02

Kn 51

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.06	34.78
140	10.89	34.94
231	10.12	35.00

Kn 52

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.00	34.70
137	9.55	34.74
247	8.34	34.92
335	7.67	34.96
436	6.56	34.98

Kn 53

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.00	34.77
132	8.78	34.58
213	8.05	34.69
229	7.89	34.72
287	7.66	34.81

Kn 54

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.06	34.81
137	8.34	34.52
213	7.57	34.56
303	7.32	34.57
451	6.90	34.61

Kn 55

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.06	34.47
118	7.67	34.39
247	6.89	34.39
341	6.78	34.39
442	6.73	34.39
545	6.22	34.39
700	5.88	34.38

Kn 56

Depth (m)	Temp. (°C)	Sal. (‰)
0	13.93	34.45
119	7.66	34.66
183	7.06	34.54
274	6.57	34.52
366	6.23	34.49
457	6.05	34.47

Kn 57

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.03	34.66
137	8.88	34.66
205	8.51	34.62
278	8.03	34.58
358	7.27	34.53
430	6.90	34.51

Kn 59

Depth (m)	Temp. (°C)	Sal. (‰)
0	14.29	34.77
120	9.95	34.67
266	8.78	34.58
369	7.63	34.49
460	7.36	34.47

Kn 59a

Depth (m)	Temp. (°C)	Sal. (‰)
0	15.65	34.81
113	10.82	34.69
177	9.58	34.68
316	8.46	34.63
399	7.68	34.58

Kn 60

Depth (m)	Temp. (°C)	Sal. (‰)
0	15.56	34.82
125	10.67	34.74
189	9.80	34.72
338	8.53	34.69

TN 1

Depth (m)	Temp. (°C)	Sal. (‰)
10	15.76	35.41
25	15.58	35.43
50	15.32	35.37
100	14.78	35.32
130	14.52	35.35

TN 2

Depth (m)	Temp. (°C)	Sal. (‰)
10	14.40	35.26
25	14.40	35.28
50	14.31	35.32
100	13.83	35.39

TN 3

Depth (m)	Temp. (°C)	Sal. (‰/ ‰)
10	14·21	35·57
25	13·60	35·25
50	13·43	35·21
100	13·00	35·23
200	11·60	35·14

TN 4

Depth (m)	Temp. (°C)	Sal. (‰/ ‰)
10	14·60	35·41
50	14·45	35·28
100	13·37	35·23

TN 5

Depth (m)	Temp. (°C)	Sal. (‰/ ‰)
10	14·90	35·28
50	14·60	35·34
100	13·98	35·30

TN 6

Depth (m)	Temp. (°C)	Sal. (‰/ ‰)
0	15·10	35·39
10	15·12	35·41
24	15·08	35·41

TN 7

10	14·70	35·19
50	14·67	35·34
100	14·20	35·32
160	13·48	35·34

INDEX

Antarctic Circumpolar Current 26, 28.
 Antarctic Convergence 15, 19, 20, 21, 25, 28.
 Antarctic Intermediate Water 13, 25, 26.
 Antarctic Surface Water 19.
 Antarctic Upper Water 13.
 Antipodes Islands 10, 13, 30.
Astrolabe 9.
 Atlantic Ocean 26, 28.
 Auckland Islands 21.
 Australasian Subantarctic Water 20.

Bottom Water, Circumpolar Antarctic 28.
 Bottom Water of the Pacific Ocean 13.
 Bounty Islands 10.
 Bounty Trough 22, 25.
 British Antarctic (*Terra Nova*) Expedition 9.
 Bruun, Dr Anton Fr. 30.

Campbell Island 21.
 Campbell Plateau 19, 20, 22, 25, 26, 30.
 Campbell Plateau Water 20, 21.
 Cape Palliser 24, 25.
Challenger HMS 9, 15.
Challenger II HMS 15.
 Chatham Islands 10, 19, 24.
 Chatham Islands (1954) Expedition 9.
 Chatham Rise 19.
 Cook Strait 10, 19, 24.
 Cullen, Mrs P. M. 30.

Dana HDMS 9, 10, 13, 15, 24, 26, 28.
 Danish Deep Sea Expedition 30.
 Deep Water 13, 26, 28, 30.
Discovery II RRS 9, 10, 13, 19, 20, 24, 26, 30.
 Dumont D'Urville 9.

East Cape 25.
 East Cape Current 24.

Galathea 10, 15, 30.

Hauraki Gulf 10, 24.

Indian Ocean 26.

Kaipara Harbour 10.
 Kermadec Islands 10, 28.
 Kermadec Ridge 25, 26.
 Kermadec Trench 13, 28.
 Killerich, A. 30.
 Krebs, Miss B. N. 30.

Lawford, Commander A. L. 30.
 Lord Howe Islands 10.

Macquarie Island 13, 19, 20, 21, 22, 28, 30.
 Macquarie Island Ridge 26, 30.
 Milford Sound 10.

National Institute of Oceanography 30.
 New Zealand 9, 13, 15, 19, 20, 21, 24, 25, 26, 28.
 New Zealand Oceanographic Institute 9, 10.
 North Cape 10.
 North Island 10, 15, 24, 25.
 Northland Peninsula 24.

Ob, MV 22.
 Otago, south coast 22.

Pacific Basin 28.
 Pacific Ocean 13, 26, 28.
 Pegasus Bay 24.
 Puysegur Point 30.

Raoul Island 13.
 Ridgway, N. M. 10, 30.

South Fiji Basin 28.
 South Island 19, 20, 22, 25, 26, 28.
 Stewart Island 22.
 Subantarctic Surface Water 13, 19, 20, 21, 22, 25.
 Subtropical Convergence 15, 19, 20, 22, 24, 25.
 Subtropical Water 15, 20.

Tasman Basin 25.
 Tasman Sea 10, 20, 24, 25, 26, 30.
Terra Nova, SY 9, 10, 24, 30.
 Three Kings Islands 9, 10, 24.

United States Navy 21.
 United States Navy Hydrographic Office 30.

Webb, C. T. 30.
 Weddell Sea 28.

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