INFORMATION ON OCEANOGRAPHIC CRUISES IN THE MOZAMBIQUE CHANNEL

BY

ANTÓNIO JORGE DA SILVA AND ANTÓNIO MUBANGO
INSTITUTO DE DESENVOLVIMENTO PESQUEIRO
MAPUTO - MOZAMBIQUE

AND

ROALD SÆTRE
INSTITUTE OF MARINE RESEARCH
BERGEN - NORWAY

CONTENTS

INTRODUCTION

The primary objectives of this data summary are to display some features of the distribution of hydrographic and chemical parameters in the Mozambique Channel in a form which, hopefully, will be useful for oceanographers. Additionally, it will serve as a basis for the processing of the more recent data obtained after 1977 from the Mozambican waters.

Table 1 summarizes the oceanographic cruises carried out in the Mozambique Channel. The information on cruises up to 1970 is from the comprehensive work of LUTJEHARMS (1972) and covers all oceanographic work carried out in the area. After 1970 some of the VAUBAN cruises have been deleted from the table as they were carried out in very near shore and shallow areas along the Madagascan coast.

Cruises from which data are included in the present report are marked with an asterisk in Table 1. The criterions for the selection of the data to be included have been:

- The data should not previously been published in a compressed form.
- The data should contribute in elucidating the general oceanographic circulation or conspicuous oceanographic features in the area.

The National Oceanographic Data Center (NODC) in Washington, D.C. supplied the data for the following cruises: COMMANDANT ROBERT GIRAUD - 1960 and 1962, ATLANTIS II - 1965, ARIEL - 1968, and the VAUBAN cruises of 1973 and 1975. The data for the ALIDADE - 1952 cruise were obtained from Centre National pour l'Exploitation des Oceans (CNEXO) in Brest. The ERNST HAECKEL 1979-1980 data were supplied by the originator and the rest from one of the publications listed under references for each cruise. The results from the three last cruises in Table 1 will be reported separately. The list of references for the cruises up to 1970 is not complete. Additional references can be found in LUTJEHARMS (1972).

The data are presented in the form of vertical sections and horizontal maps. For the sections deeper than 1200 m there is a change in the vertical scale at 500 m. Table 1 contains all the hydrographic stations within the Mozambique Channel, while the sections contain only those positioned within the frame of the bathymetric map in Fig. 1.

The horizontal maps consist of the following types:

A. Station grid
B. Surface distribution ($T^{o}C$ and S^{o}/oo)
C. Core layers.

Fig. 2 shows a typical and simplified T-S and $T-O_2$ diagram from the central Mozambique Channel where the different core layers are indicated:

1. The shallow salinity minimum
2. Subsurface oxygen minimum
3. Subsurface salinity maximum
4. Intermediate oxygen maximum
5. Intermediate salinity minimum
6. Intermediate salinity maximum
7. Deep oxygen minimum.

Core layer maps are included for those cruises which covered more or less the whole Mozambique Channel, of which only the ALMIRANTE LACERDA cruises of 1964 took oxygen measurements.

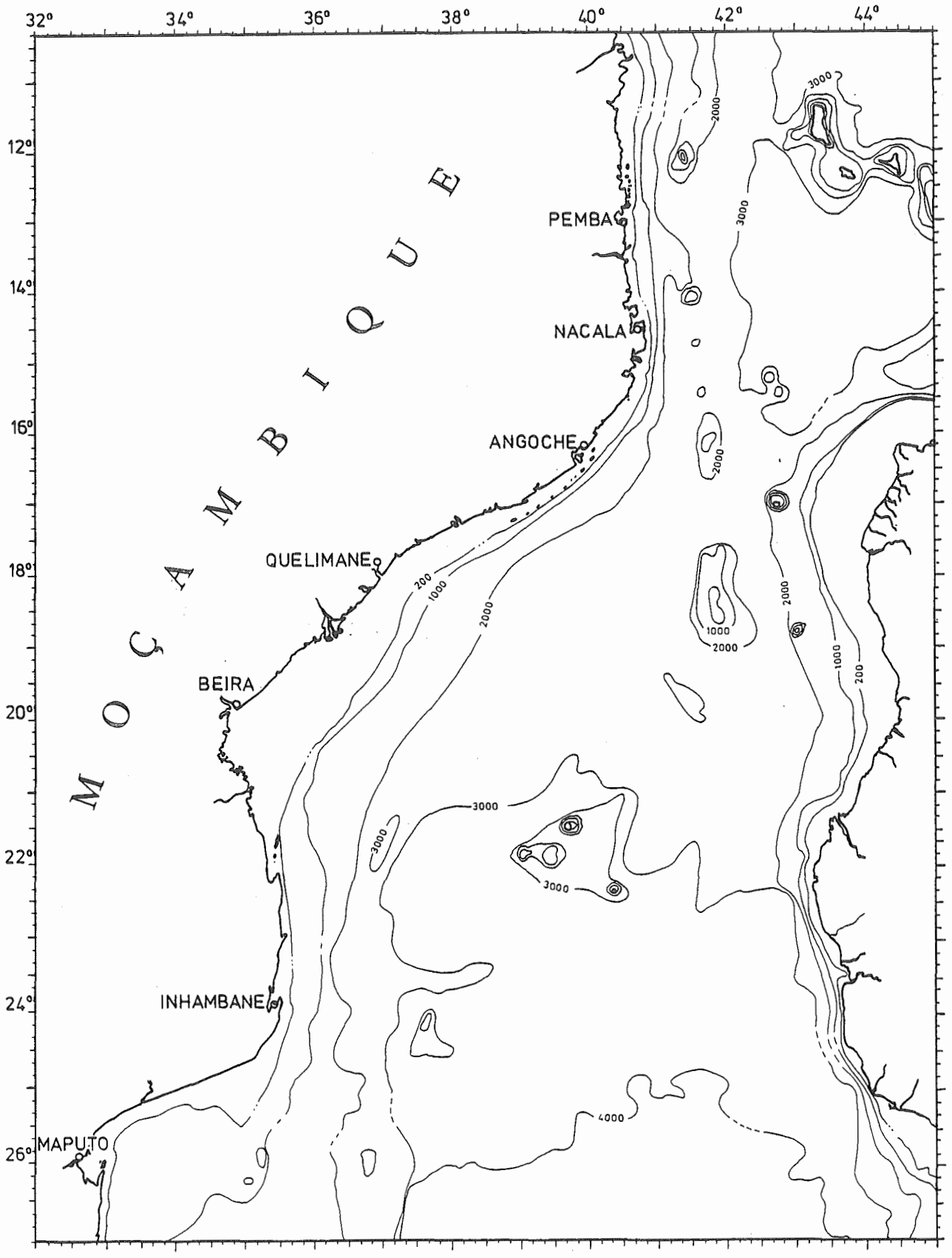

Fig. 1. Bathymetric map of the Mozambique Channel. Depth in meters.

Table 1. INVENTORY OF OCEANOGRAPHIC CRUISES IN MOZAMBIQUE CHANNEL.

Present report includes data from cruises signaled with *

YEAR	SHIP	COUNTRY	MONTH	NO. OF STATIONS	REFERENCES
1913	MOWE	GER	Jan-Feb	20	LUTJEHARMS (1972)
1930	DANA II	DAN	Jan-Jun	6	LUTJEHARMS (1972)
1935	DISCOVERY II	GBR	Apr	7	CLOWES and DEACON (1935) CLOWES (1950) LUTJEHARMS (1972)
1952	WILLIAM SCORESBY	GBR	Aug	7	LUTJEHARMS (1972)
1950-52	GALATHEA	DAN		5	LUTJEHARMS (1972)
1952	ALIDADE *	FRA	Nov-Dec	33	LUTJEHARMS (1972)
1957	COMMANDANT ROBERT GIRAUD *	FRA	Oct-Nov	65	MÉNACHÉ (1961) MÉNACHÉ (1963) LUTJEHARMS (1972)
1960	COMMANDANT ROBERT GIRAUD *	FRA	Sep	51	ANON (1960) LUTJEHARMS (1972)
1961	AFRICANA II	RSA	Jun	13	ORREN (1963) VISSER and VAN NIEKERK (1965) MOSTERT (1966) LUTJEHARMS (1972)
1962	COMMANDANT ROBERT GIRAUD *	FRA	Sep-Oct	51	ANON (1963) CREPON (1964) LUTJEHARMS (1972)
1963	ATLANTIS II *	USA	Oct-Nov	19	LUTJEHARMS (1972)
1964	ALMIRANTE LACERDA *	POR	Apr-May	44	ANON (1965) LUTJEHARMS (1968) LUTJEHARMS (1972)
1964	ALMIRANTE LACERDA *	POR	Sep	44	ANON (1967) LUTJEHARMS (1972)
1964	ANTON BRUNN	USA	Sep-Nov	34	LUTJEHARMS (1972)
1964	VLADIMIR VOROBIEV	USR	Oct-Nov	18	EROFEEVA and RJONSNITSKY (1970)
1965	ALMIRANTE LACERDA *	POR	Apr-May	27	ANON (1973)
1965	ATLANTIS II *	USA	May-Jun	22	LUTJEHARMS (1972)
1965	VLADIMIR VOROBIEV	URS	May-Jul	33	KHIMITSA (1968) EROFEEVA (1970) EROFEEVA and RJONSNITSKY (1970) LUTJEHARMS (1972)
1965-66	VLADIMIR VOROBIEV	URS	Dec-Jan		EROFEEVA (1970)
1966	ALMIRANTE LACERDA *	POR	Jul	28	ANON (1973)
1966	VAUBAN	MAD	Oct	14	DONGUY and PITON (1969)
1966	VAUBAN	MAD	Nov-Dec	11	DONGUY and PITON (1969)
1967	VAUBAN	MAD	Jan-Feb	14	DONGUY and PITON (1969)
1967	VAUBAN	MAD	Jun-Jul	10	DONGUY and PITON (1969)
1967	VAUBAN	MAD	Jul-Aug	16	DONGUY and PITON (1969)
1967	VAUBAN	MAD	Sep	7	DONGUY and PITON (1969) PITON and MAGNIER (1975)
1968	VAUBAN	MAD	Mar	14	MAGNIER and PITON (1974) PITON and MAGNIER (1975)

Table 1. (contd)

YEAR	SHIP	COUNTRY	MONTH	NO. OF STATIONS	REFERENCES
1968	VAUBAN	MAD	May	17	LUTJEHARMS (1972) MAGNIER, PITON and CITEAU (1973)
1968	ARIEL	URS	Jul-Aug	29	LUTJEHARMS (1972)
1970	VAUBAN	MAD	Nov	39	MAGNIER, PITON and CITEAU (1972) MAGNIER and PITON (1973)
1970	VAUBAN	MAD	Dec	24	MAGNIER, PITON and CITEAU (1972) MAGNIER and PITON (1973) MAGNIER, PITON and CITEAU (1973)
1971	VAUBAN	MAD	Mar	34	MAGNIER, PITON and CITEAU (1972, 1973) MAGNIER and PITON (1974) PITON and MAGNIER (1975)
1971	VAUBAN	MAD	May	23	CITEAU, PITON and MAGNIER (1973) MAGNIER, PITON and CITEAU (1973) PITON and MAGNIER (1975)
1971	VAUBAN	MAD	Nov-Dec	18	CITEAU, PITON and MAGNIER (1973) MAGNIER, PITON and CITEAU (1973) MAGNIER and PITON (1974) PITON and MAGNIER (1975)
1972	VAUBAN	MAD	Jan-Feb	21	MAGNIER, PITON and CITEAU (1973) MAGNIER and PITON (1974) PITON and MAGNIER (1975)
1973	VAUBAN	MAD	May	23	PITON and MAGNIER (1975)
1973	VAUBAN *	MAD	Mar	34	
1974	VAUBAN	MAD	Jun-Jul	34	
1975	VAUBAN *	MAD	Mar	25	
1976-77	AELITA	URS	May-Aug	110	BUDNICHENKO et al. (1977)
1977	DR.FRIDTJOF NANSEN	NOR	Sep	41	SÆTRE and PAULA E SILVA (1979)
1977	DR.FRIDTJOF NANSEN	NOR	Nov	59	SÆTRE and PAULA E SILVA (1979)
1978	DR.FRIDTJOF NANSEN	NOR	Jan-Mar	65	SÆTRE and PAULA E SILVA (1979)
1978	DR.FRIDTJOF NANSEN	NOR	Apr-May	66	SÆTRE and PAULA E SILVA (1979)
1978	MYSLITEL	URS	Sep-Oct	66	ANON (1978) ISAENKO et al. (1980)
1978-79	NIKOLAY RESHETNYAK	URS	Dec-Jan	56	ANON (1979) ISAENKO et al. (1980)
1979	ERNST HAECKEL *	GDR	Mar	39	
1979	NIKOLAY RESHETNYAK	URS	May-Jul	64	ANON (1981) ISAENKO et al. 1980)
1979	MULEVE	MOZ	Jul-Aug	70(BT)	ANON (1981)
1980	ALEXANDER VON HUMBOLDT	GDR	Feb-Mar	203	
1980	ERNST HAECKEL *	GDR	Jul-Aug	234	
1980	DR.FRIDTJOF NANSEN	NOR	Oct-Nov	66	

COUNTRY CODES:

DAN - Denmark
FRA - France
GBR - United Kingdom
GDR - German Democratic Republic
GER - Federal Republic of Germany
MAD - Madagascar
MOZ - Mozambique
NOR - Norway
POR - Portugal
RSA - Rep. of South Africa
URS - Soviet Union
USA - United States of America

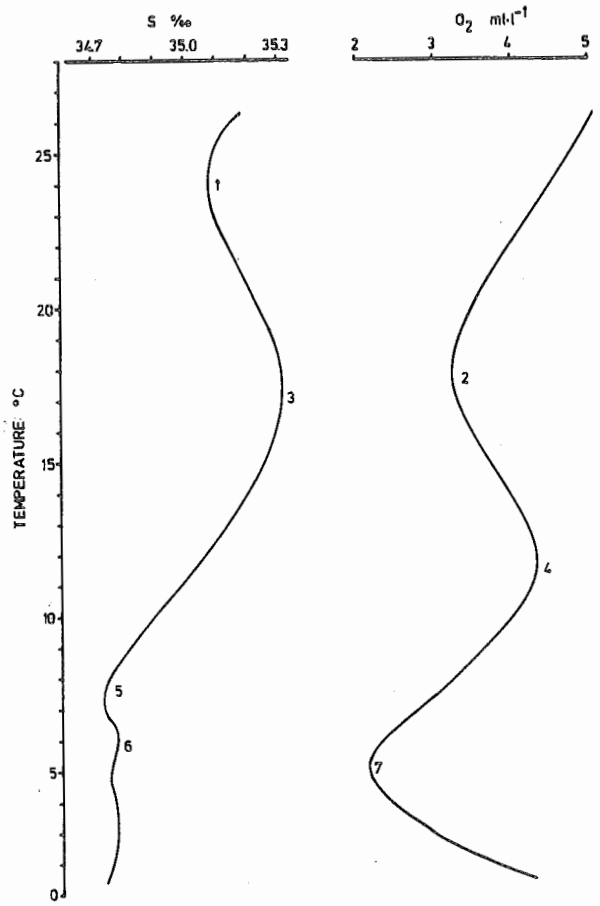

Fig. 2. Simplified T-S and T-O_2 diagram for the Central Mozambique Channel.

1. The shallow salinity minimum.
2. Subsurface oxygen minimum.
3. Subsurface salinity maximum.
4. Intermediate oxygen maximum.
5. Intermediate salinity minimum.
6. Intermediate salinity maximum.
7. Deep oxygen minimum.

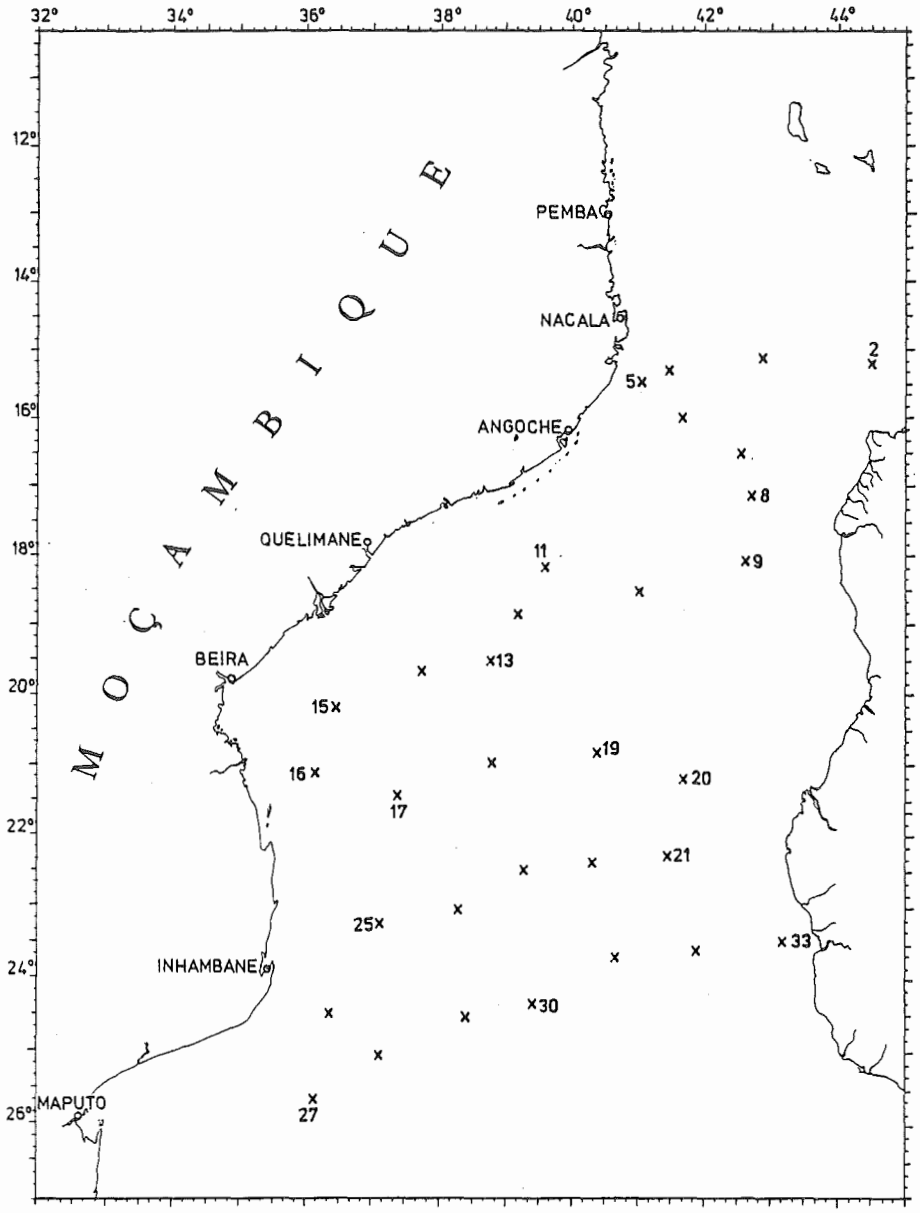

Fig. 3. ALIDADE, 29 Nov.-18 Dec. 1952. Grid of stations.

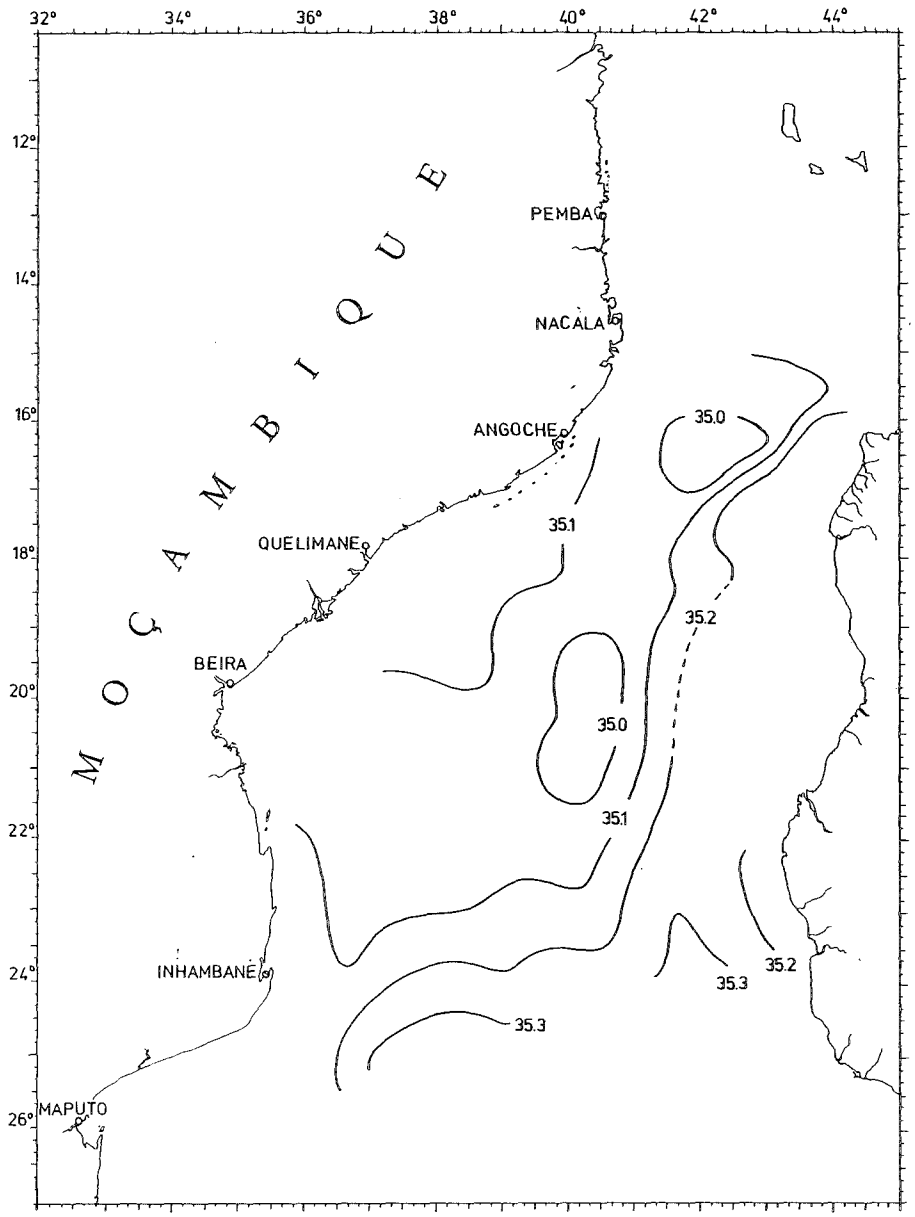

Fig. 4. ALIDADE 1952. Surface temperature.

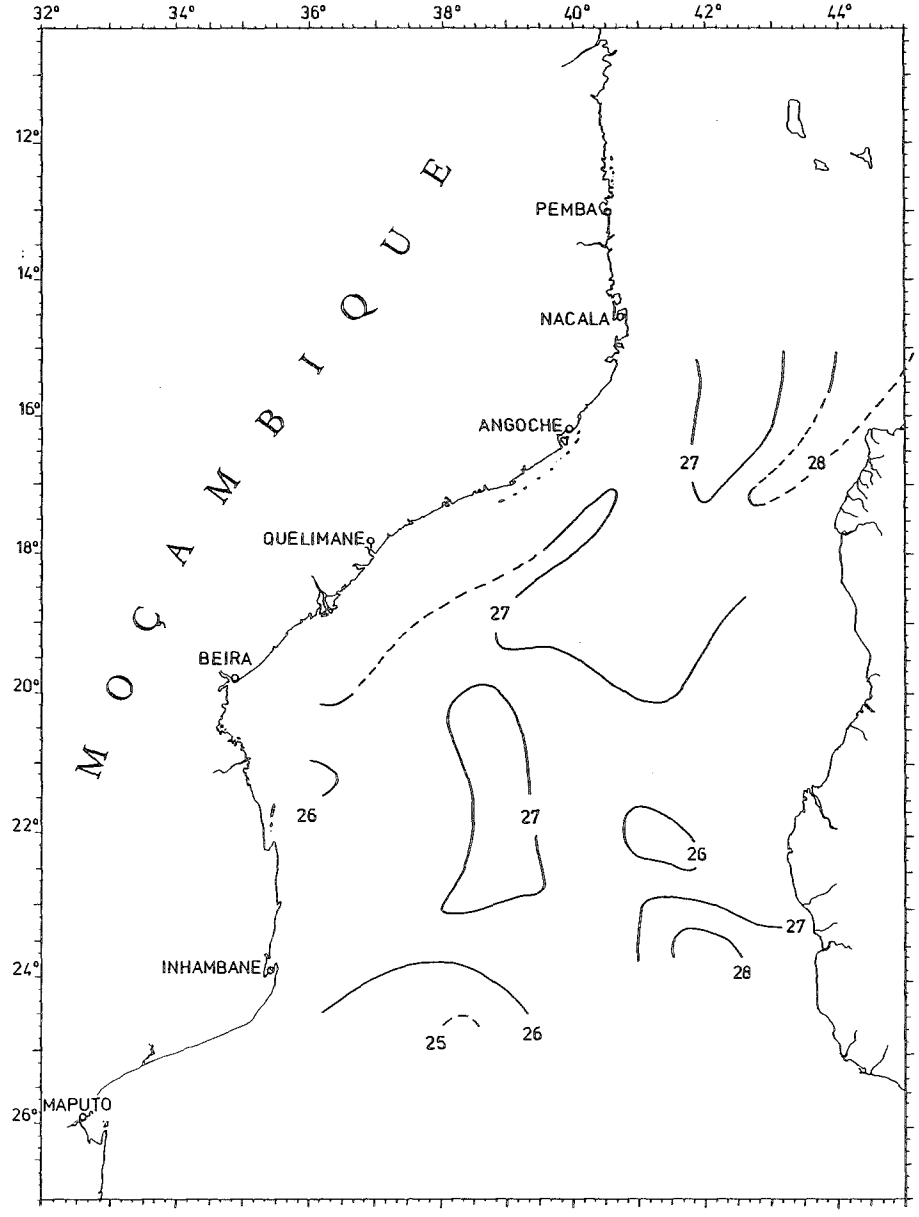

Fig. 5. ALIDADE 1952. Surface salinity.

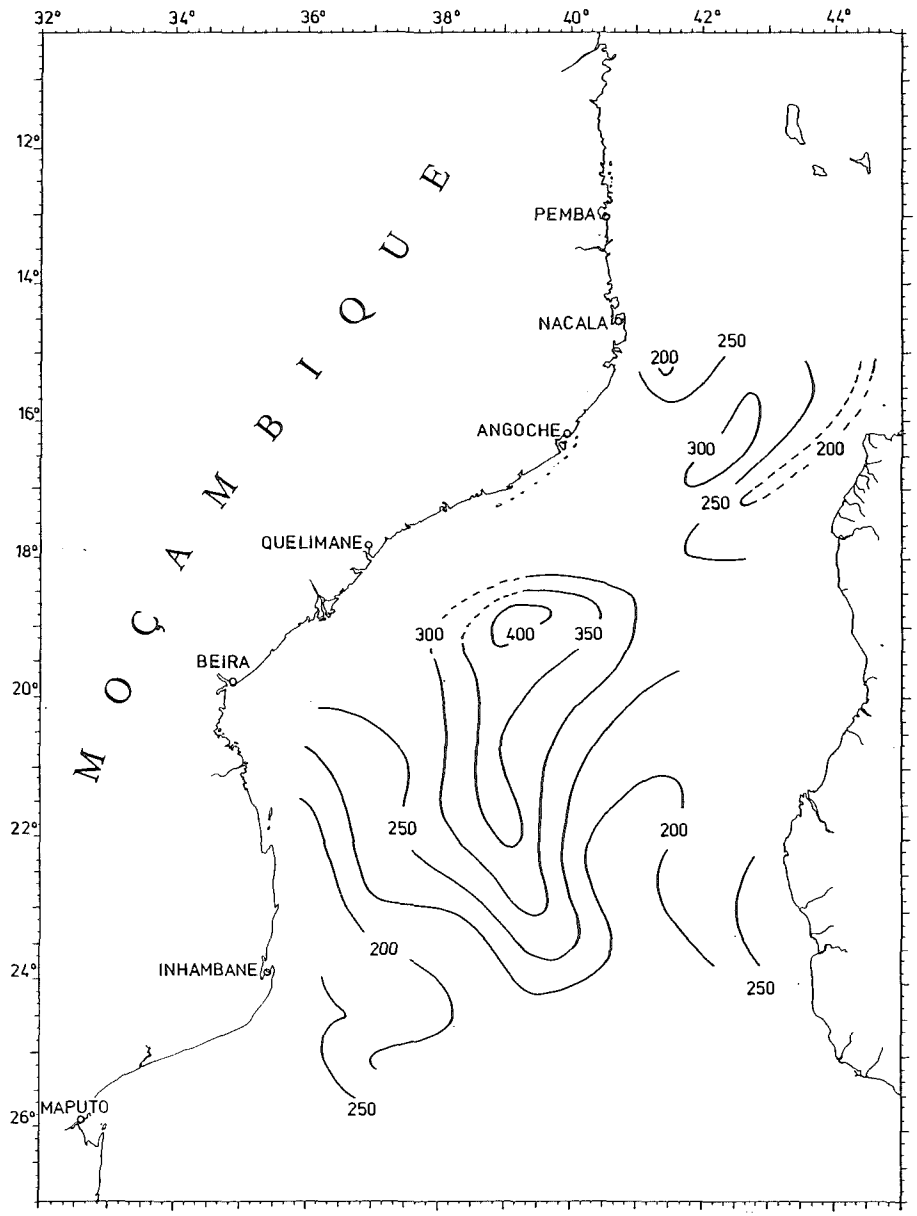

Fig. 6. ALIDADE 1952. Depth of subsurface salinity maximum.

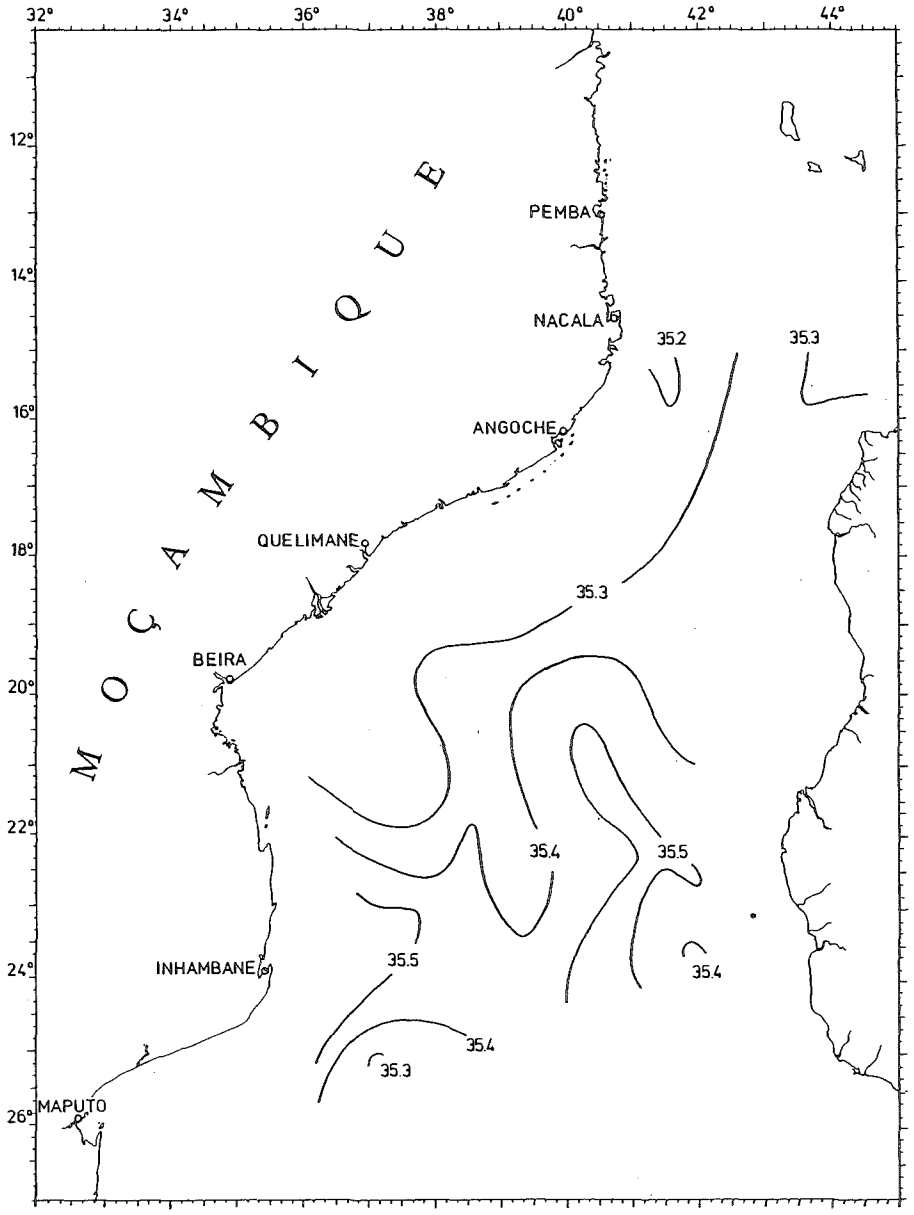

Fig. 7. ALIDADE 1952. Salinity at subsurface salinity maximum.

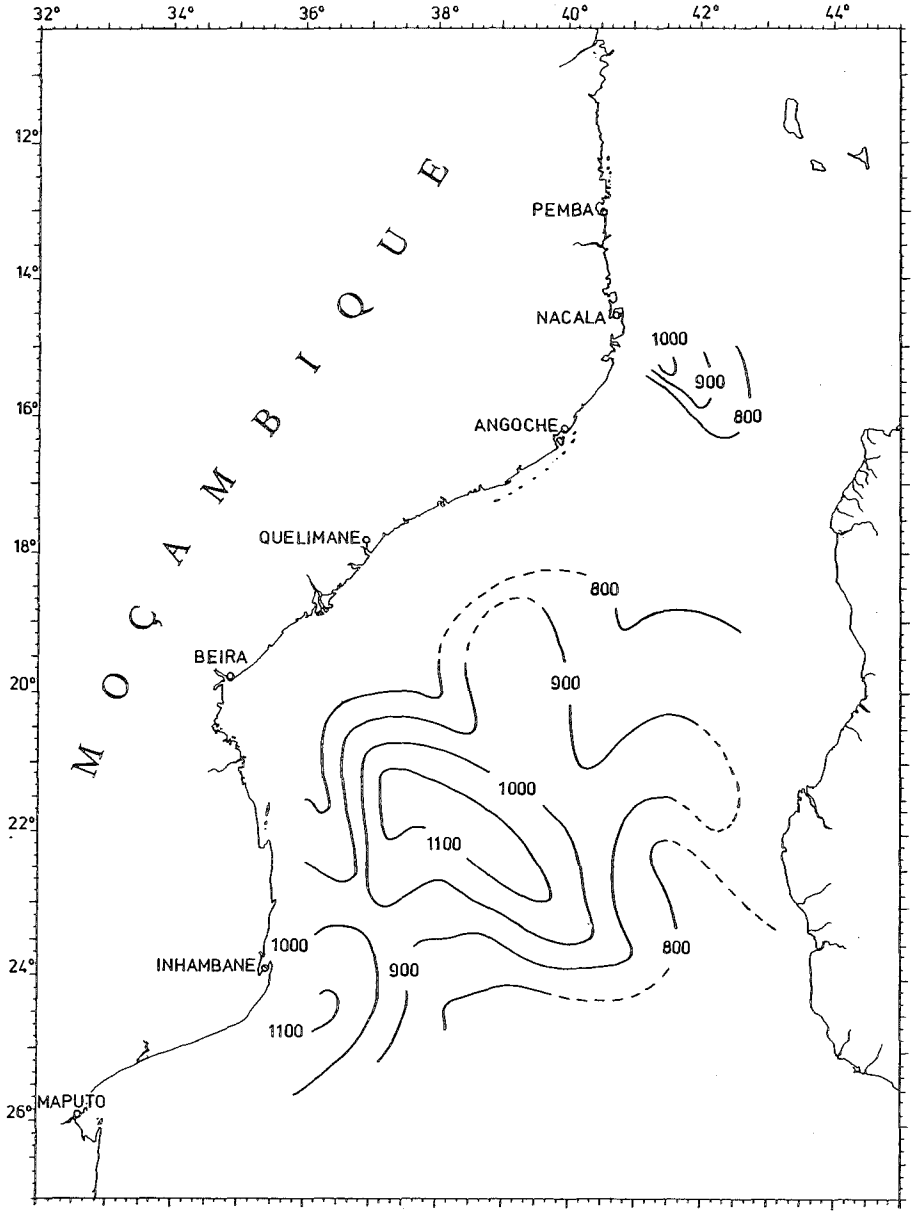

Fig. 8. ALIDADE 1952. Depth of intermediate salinity minimum.

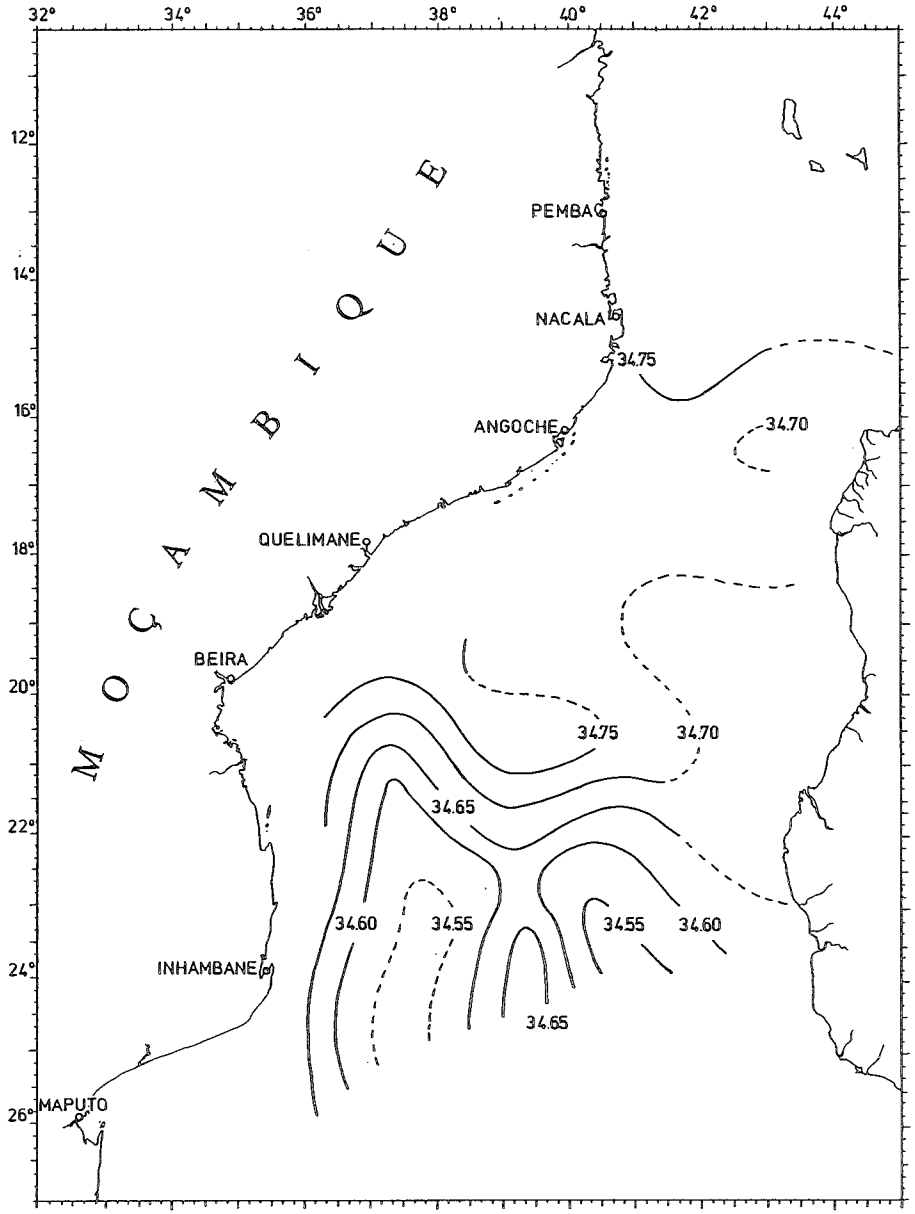

Fig. 9. ALIDADE 1952. Salinity at intermediate salinity minimum.

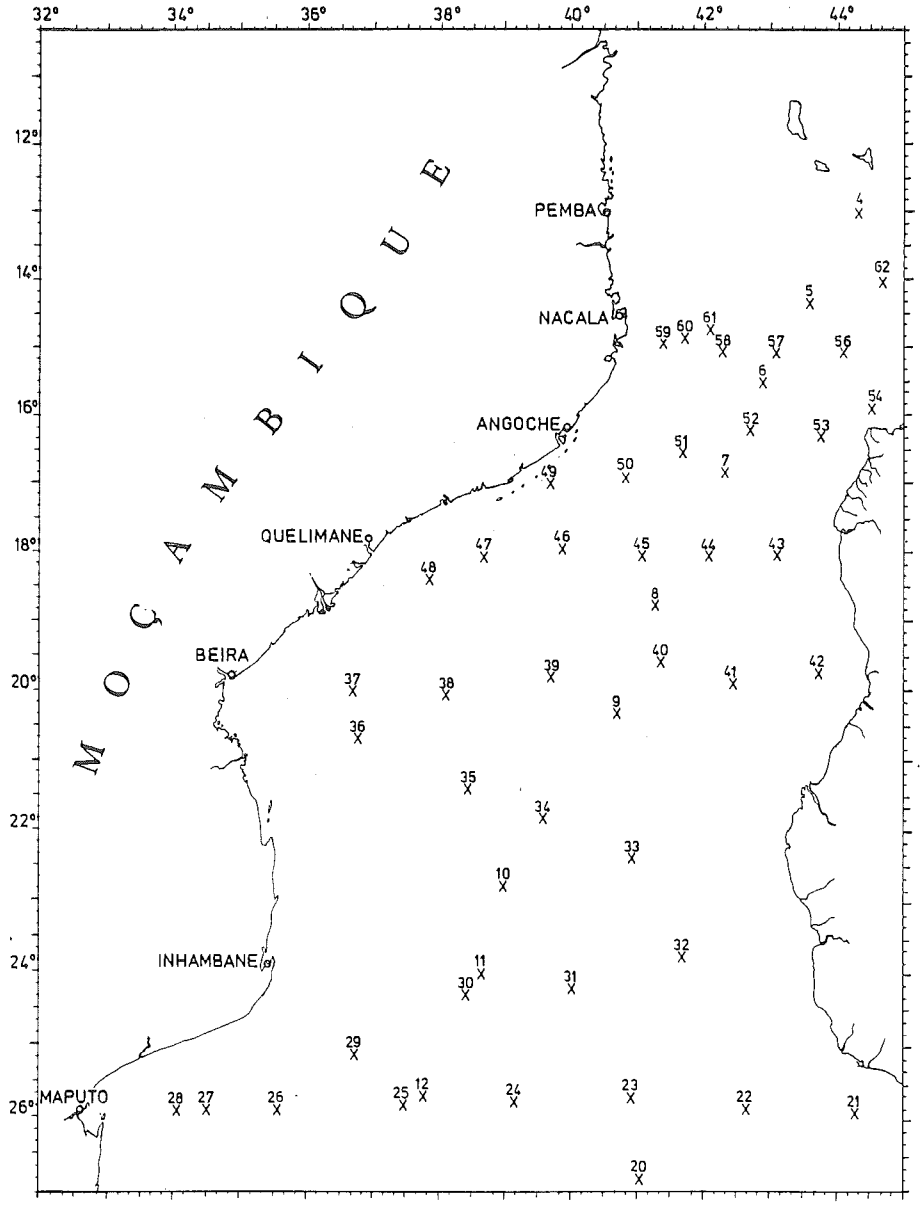

Fig. 10. COMMANDANT ROBERT GIRAUD, 12 Oct.-27 Nov. 1957. Grid of stations.

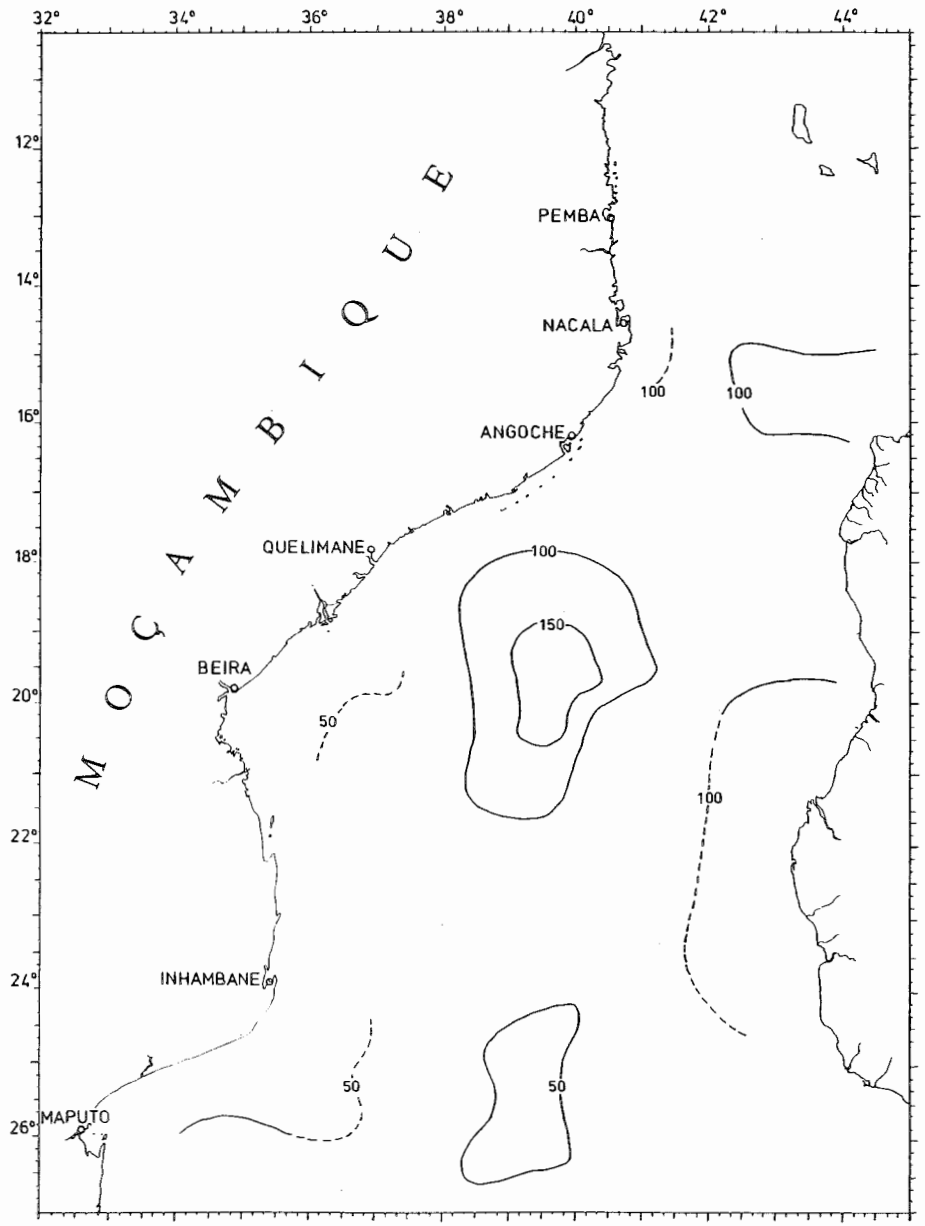

Fig. 11. COMMANDANT ROBERT GIRAUD 1957.
Depth of shallow salinity minimum.

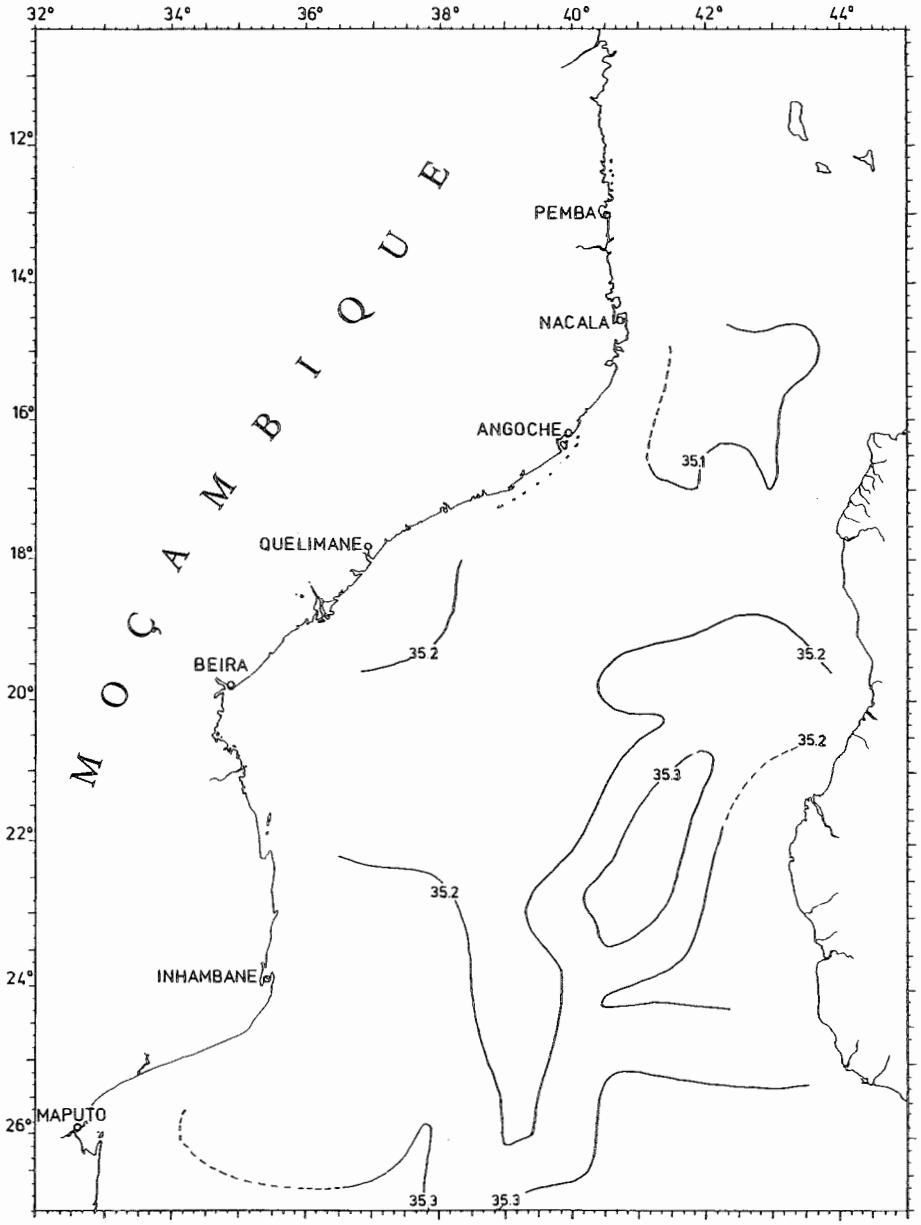

Fig. 12. COMMANDANT ROBERT GIRAUD 1957.
Salinity at shallow salinity minimum.

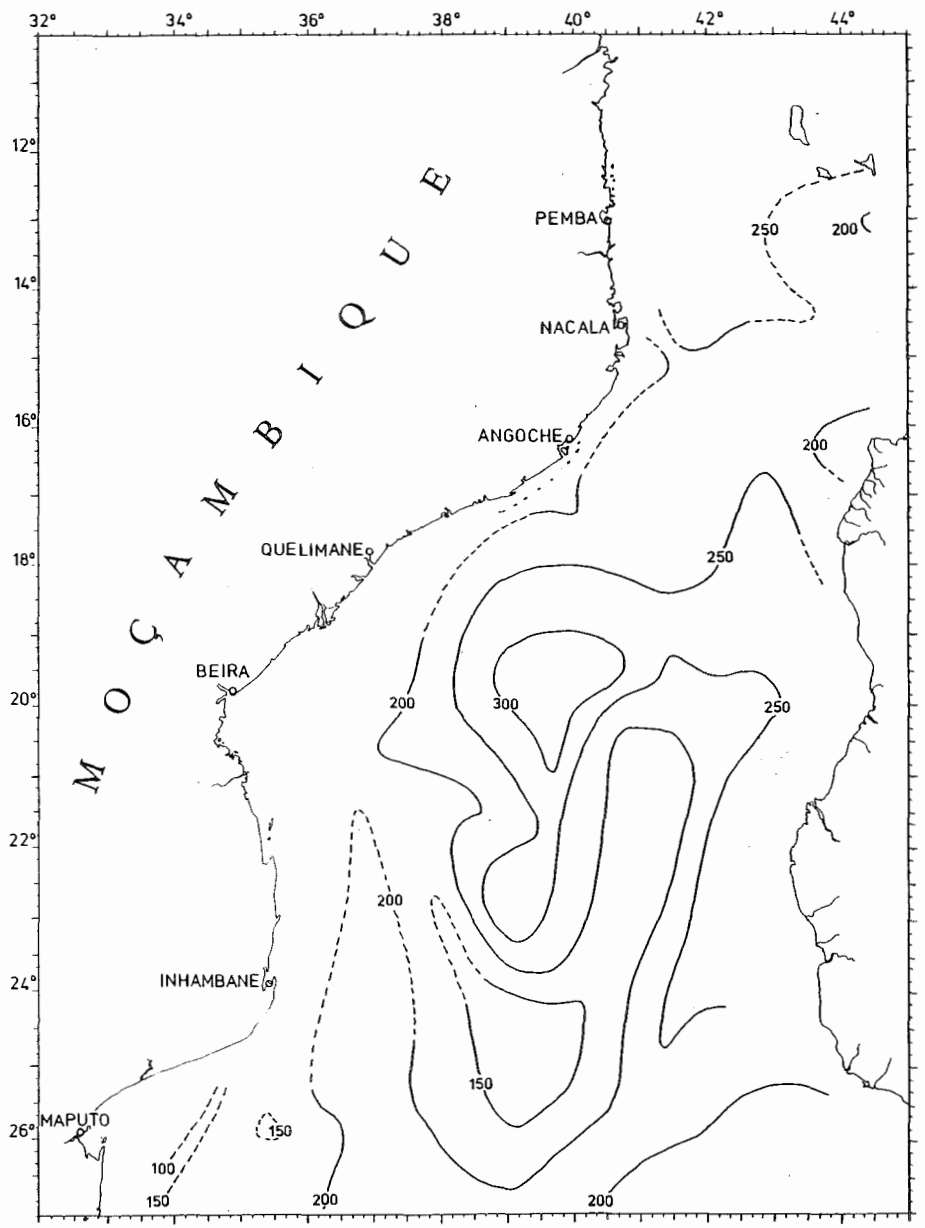

Fig. 13. COMMANDANT ROBERT GIRAUD 1957.
Depth of subsurface salinity maximum.

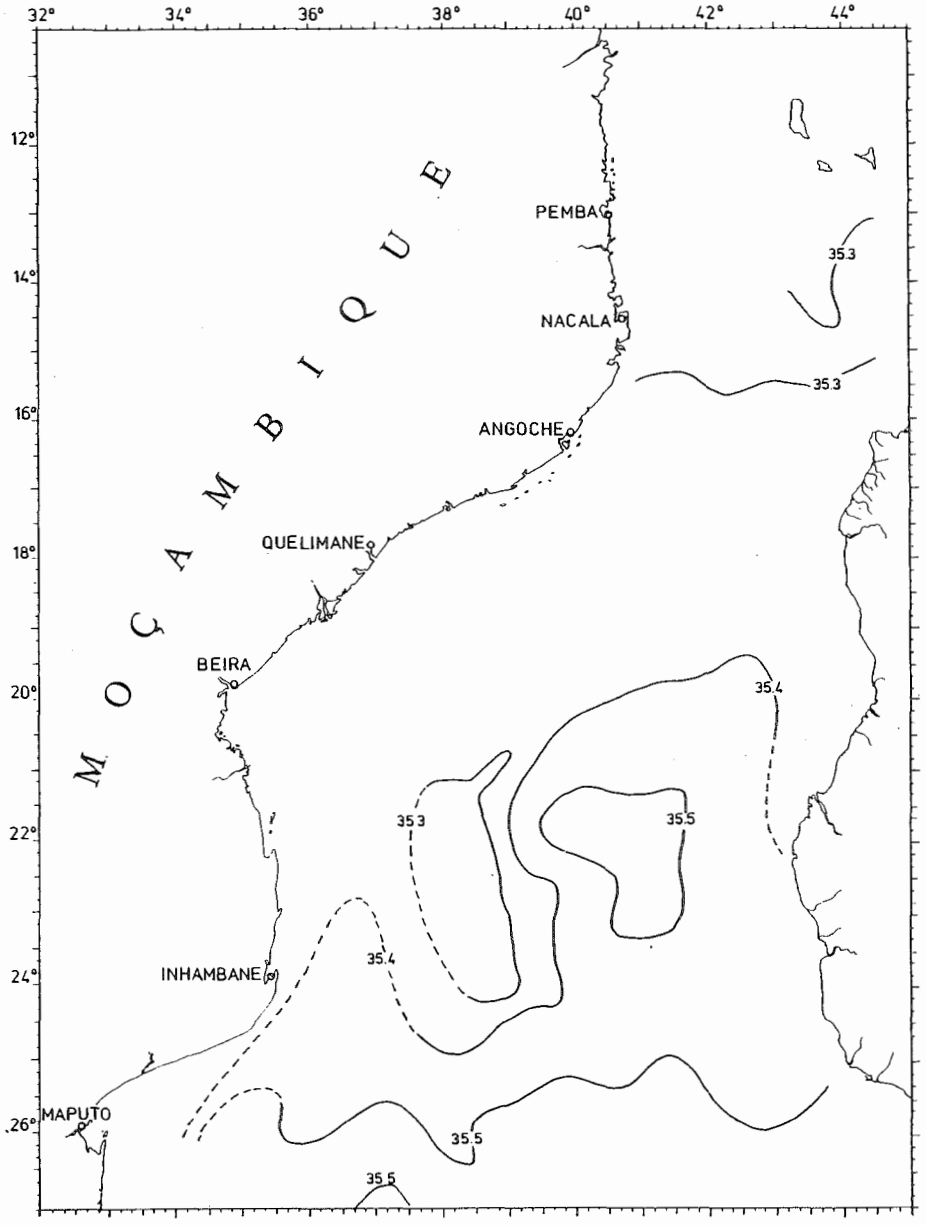

Fig. 14. COMMANDANT ROBERT GIRAUD 1957.
Salinity at subsurface salinity maximum.

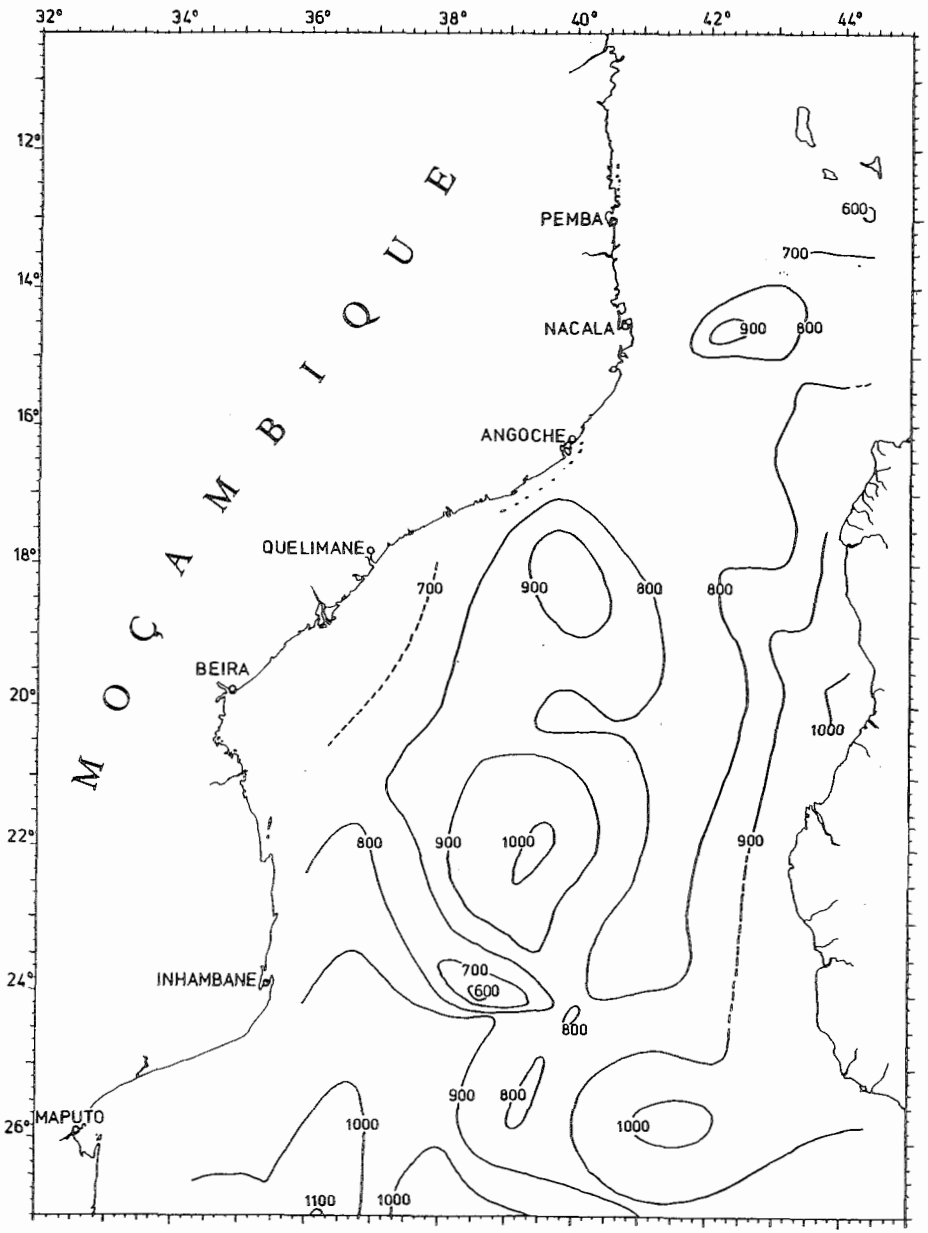

Fig. 15. COMMANDANT ROBERT GIRAUD 1957.
Depth of intermediate salinity minimum.

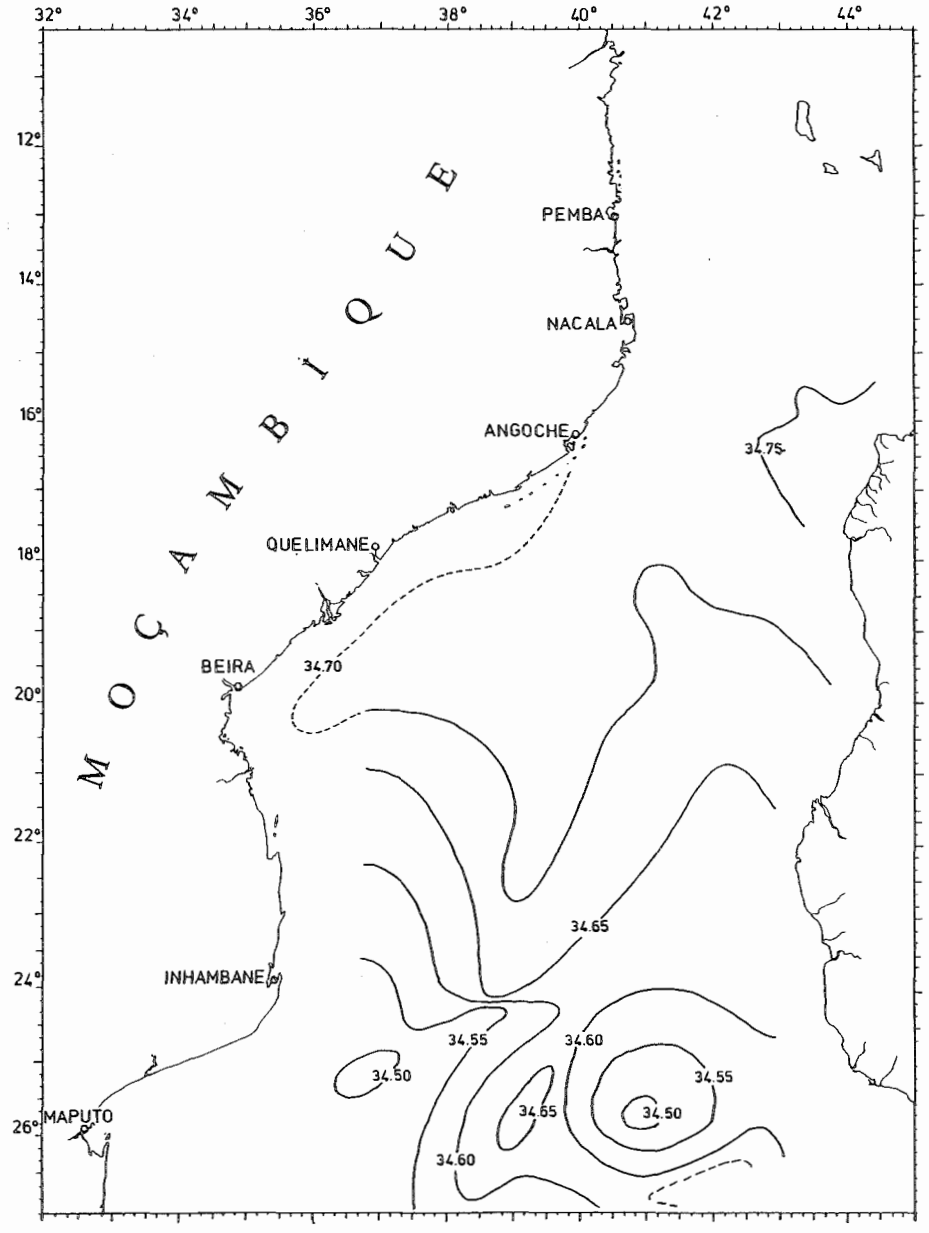

Fig. 16. COMMANDANT ROBERT GIRAUD 1957.
Salinity at intermediate salinity minimum.

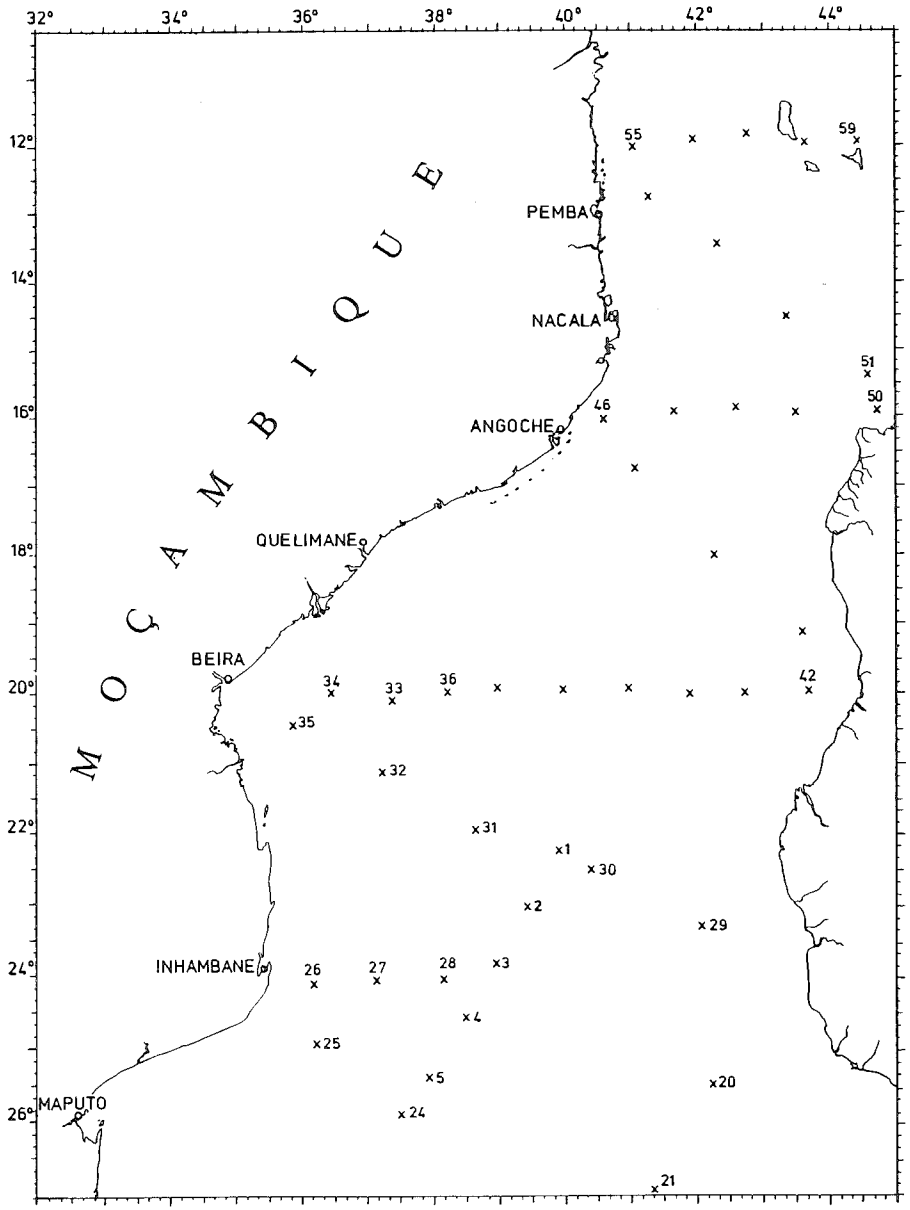

Fig. 17. COMMANDANT ROBERT GIRAUD, 4 Jul.-18 Aug. 1960. Grid of stations.

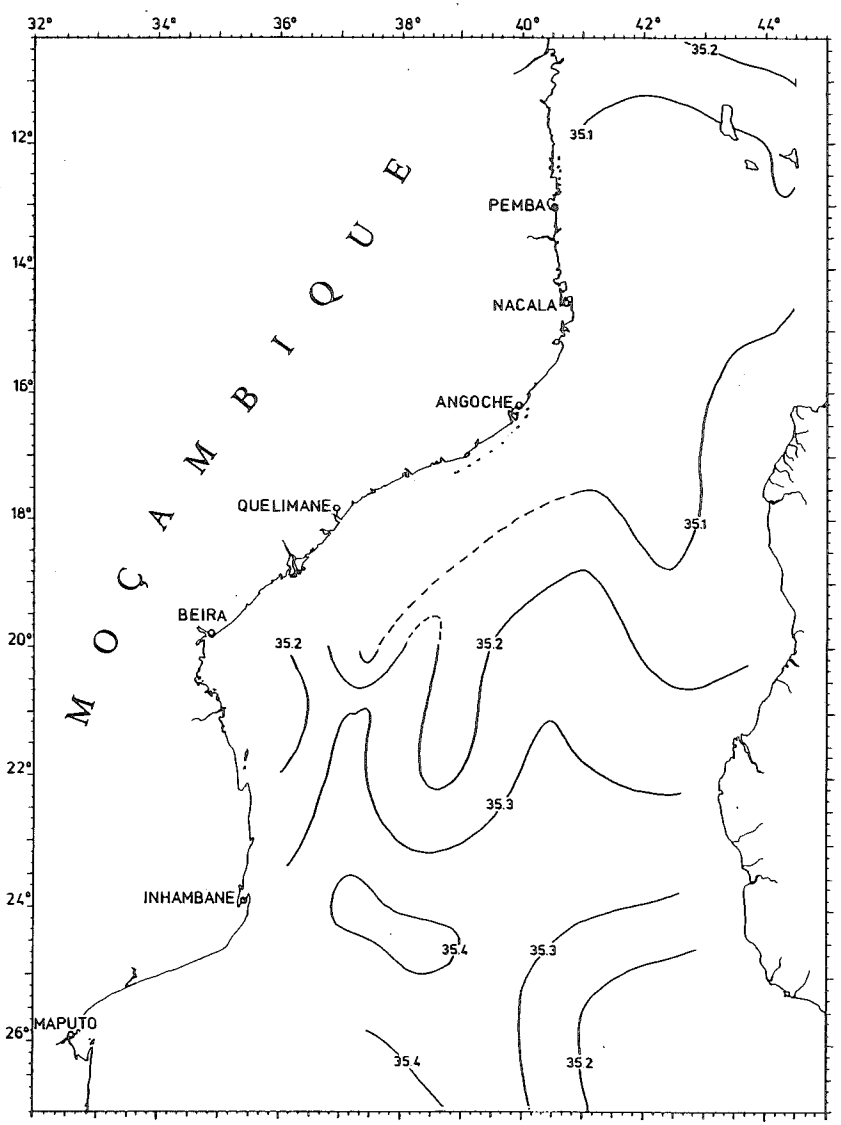

Fig. 18. COMMANDANT ROBERT GIRAUD 1960. Surface salinity.

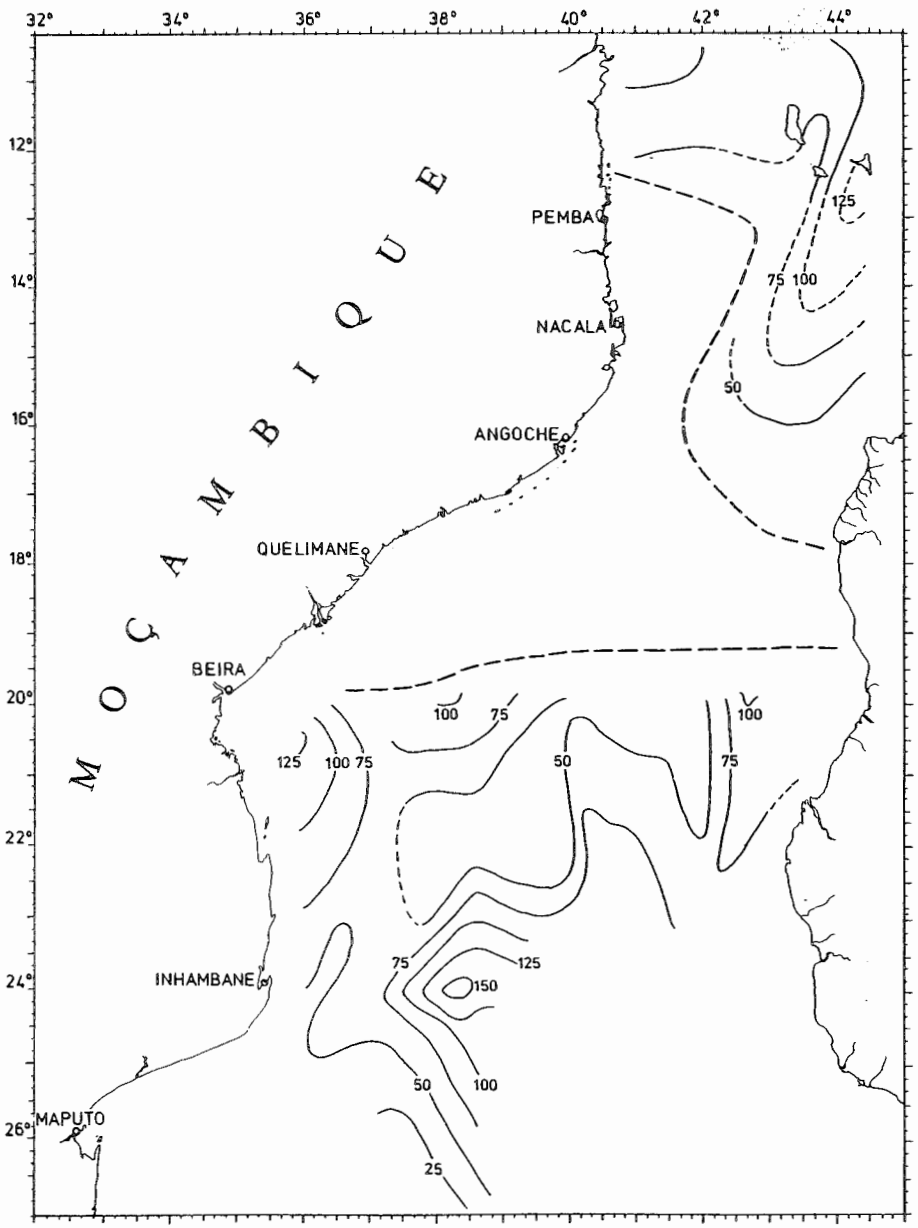

Fig. 19. COMMANDANT ROBERT GIRAUD 1960. Depth of shallow salinity minimum. No minimum observed between

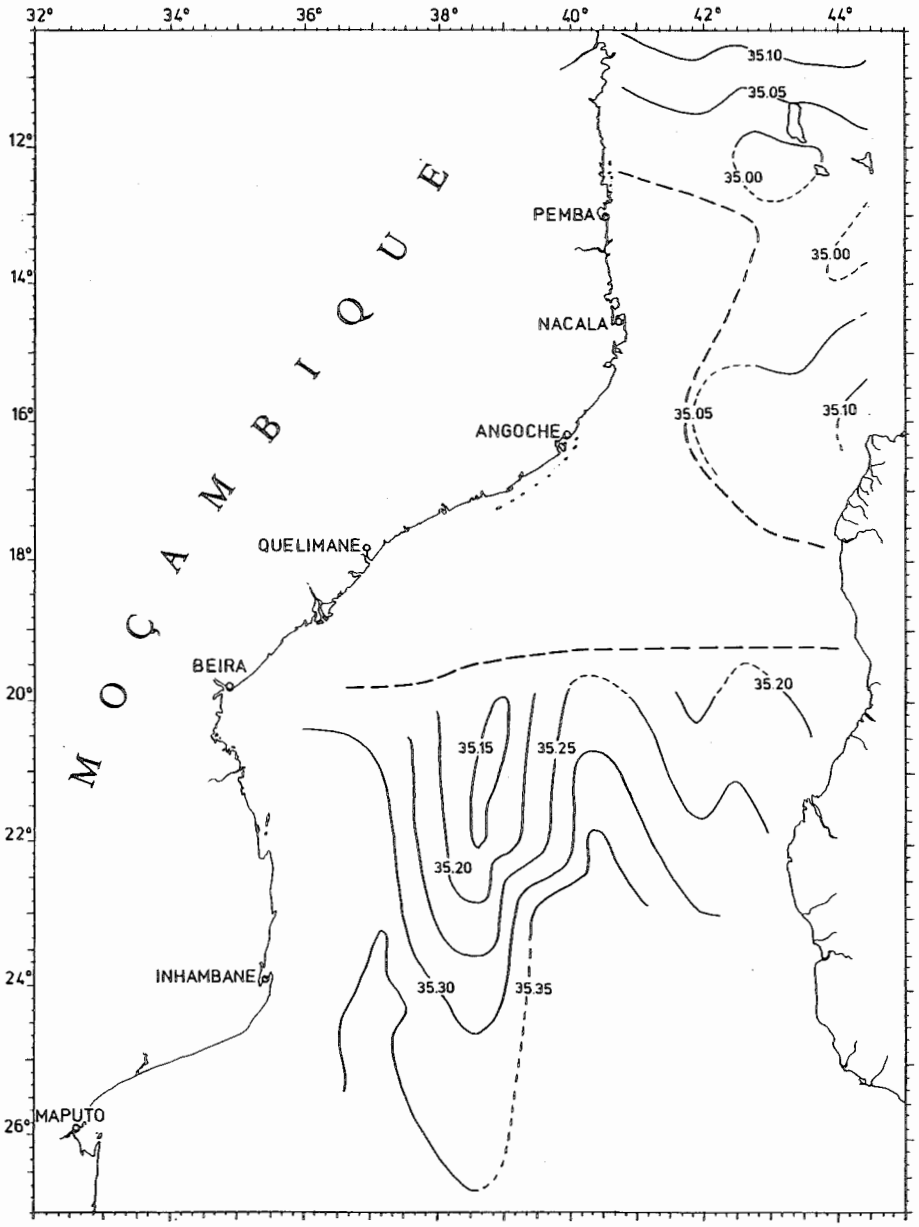

Fig. 20. COMMANDANT ROBERT GIRAUD 1960. Salinity at shallow salinity minimum. No minimum observed between

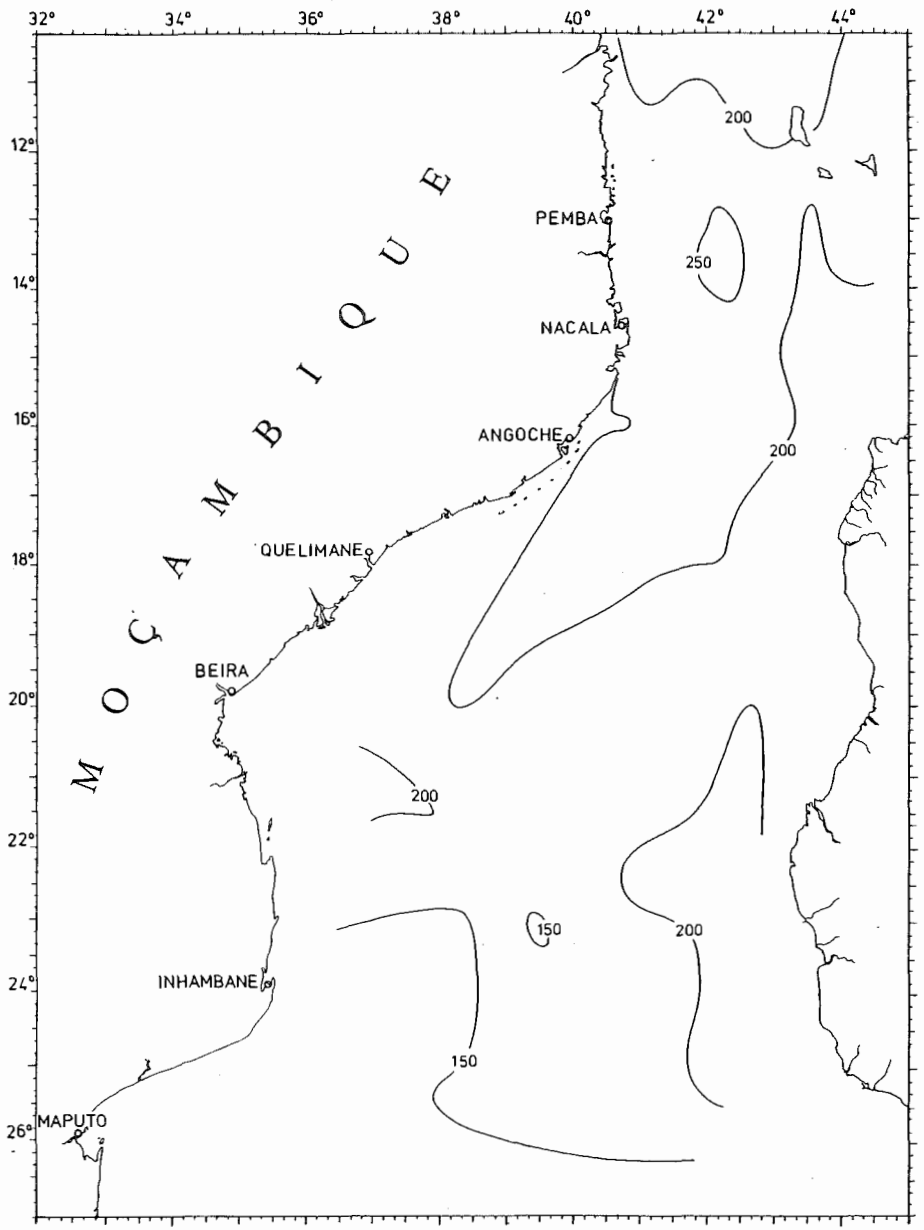

Fig. 21. COMMANDANT ROBERT GIRAUD 1960.
Depth of subsurface salinity maximum.

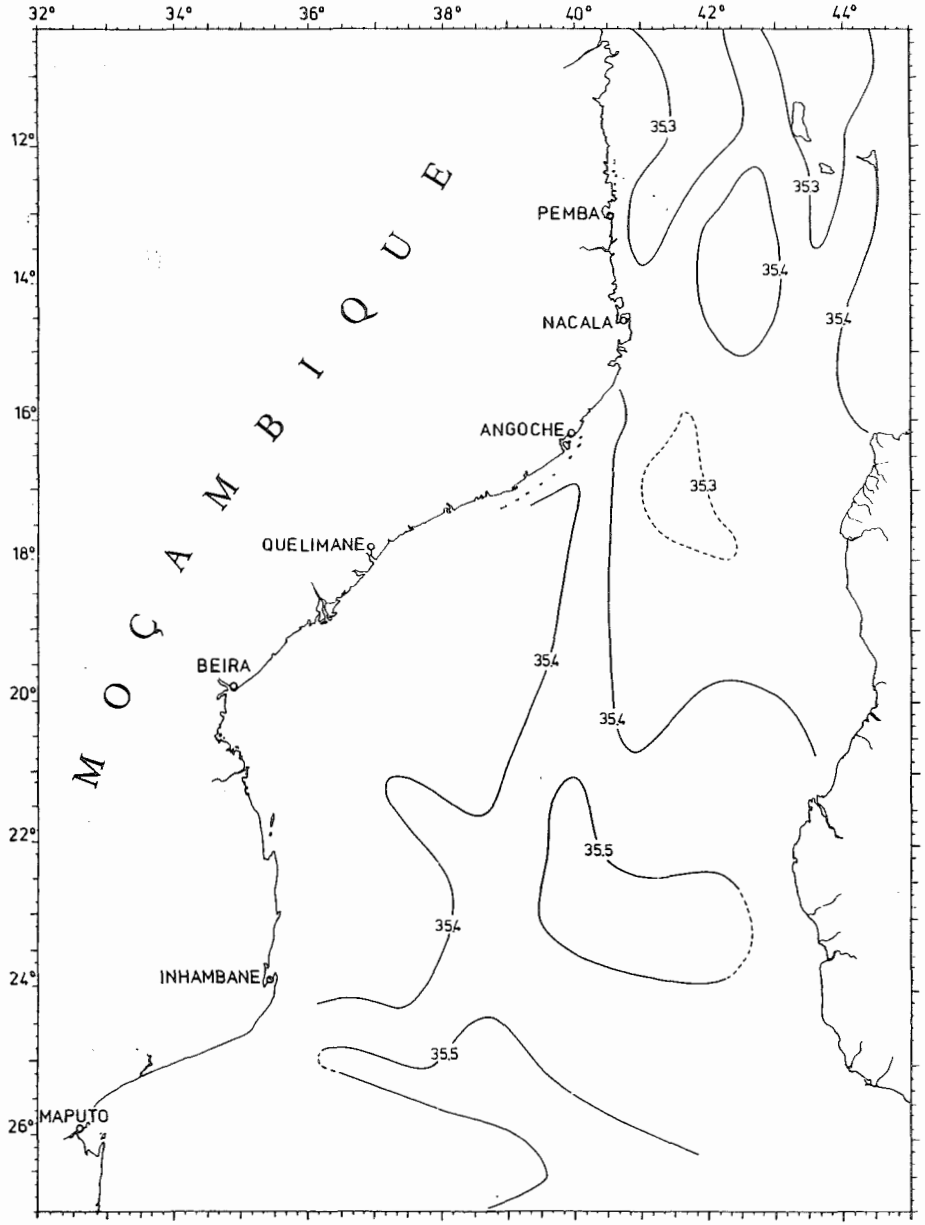

Fig. 22. COMMANDANT ROBERT GIRAUD 1960.
Salinity at subsurface salinity maximum.

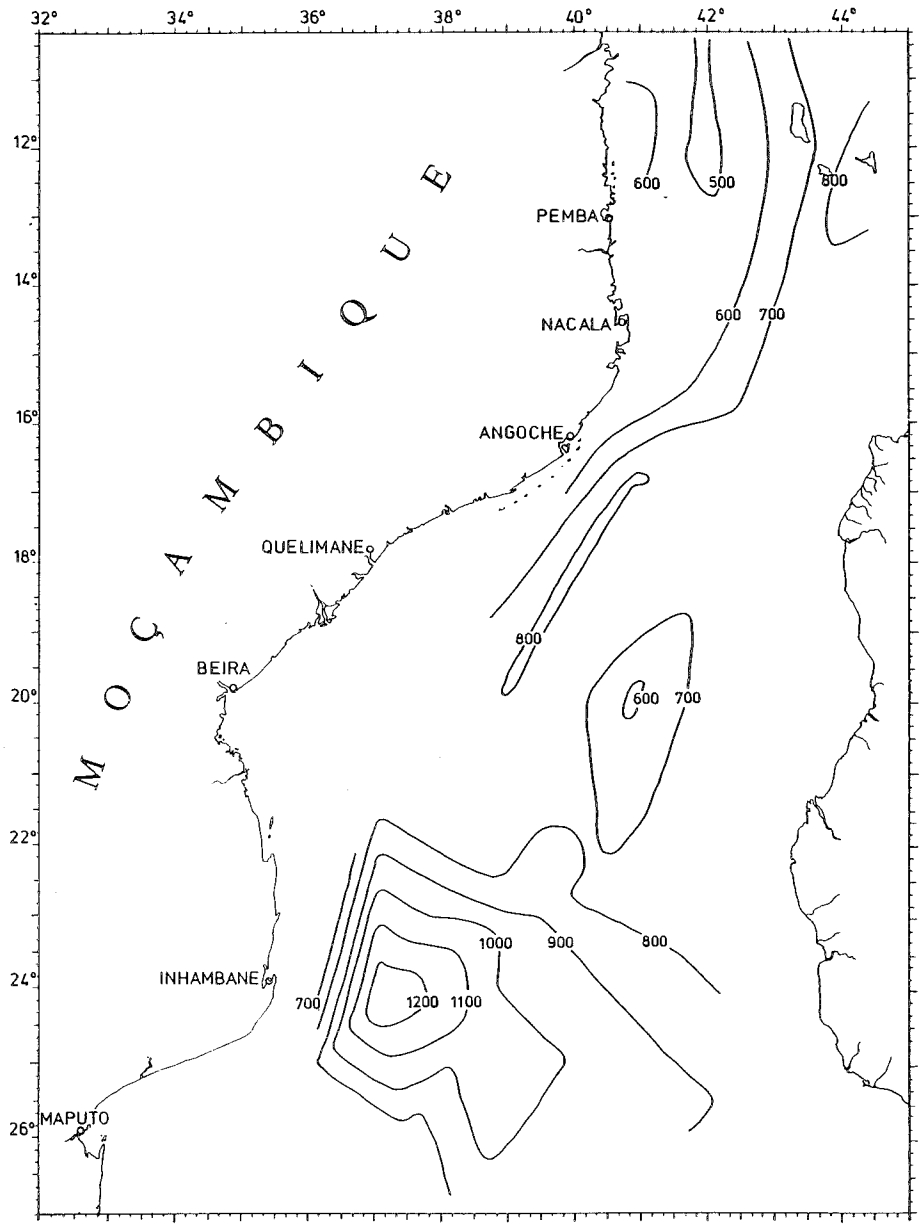

Fig. 23. COMMANDANT ROBERT GIRAUD 1960.
Depth of intermediate salinity minimum.

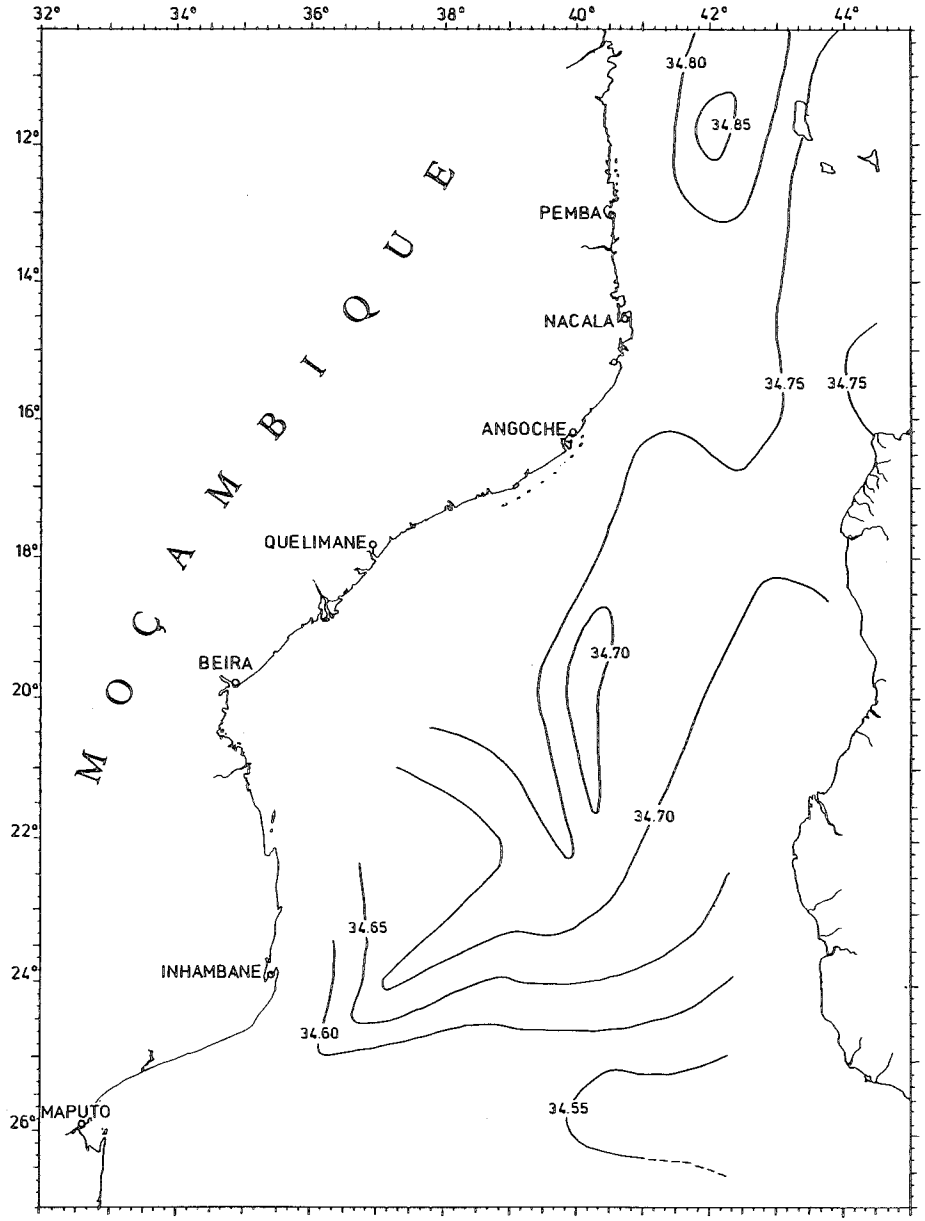

Fig. 24. COMMANDANT ROBERT GIRAUD 1960.
Salinity at intermediate salinity minimum.

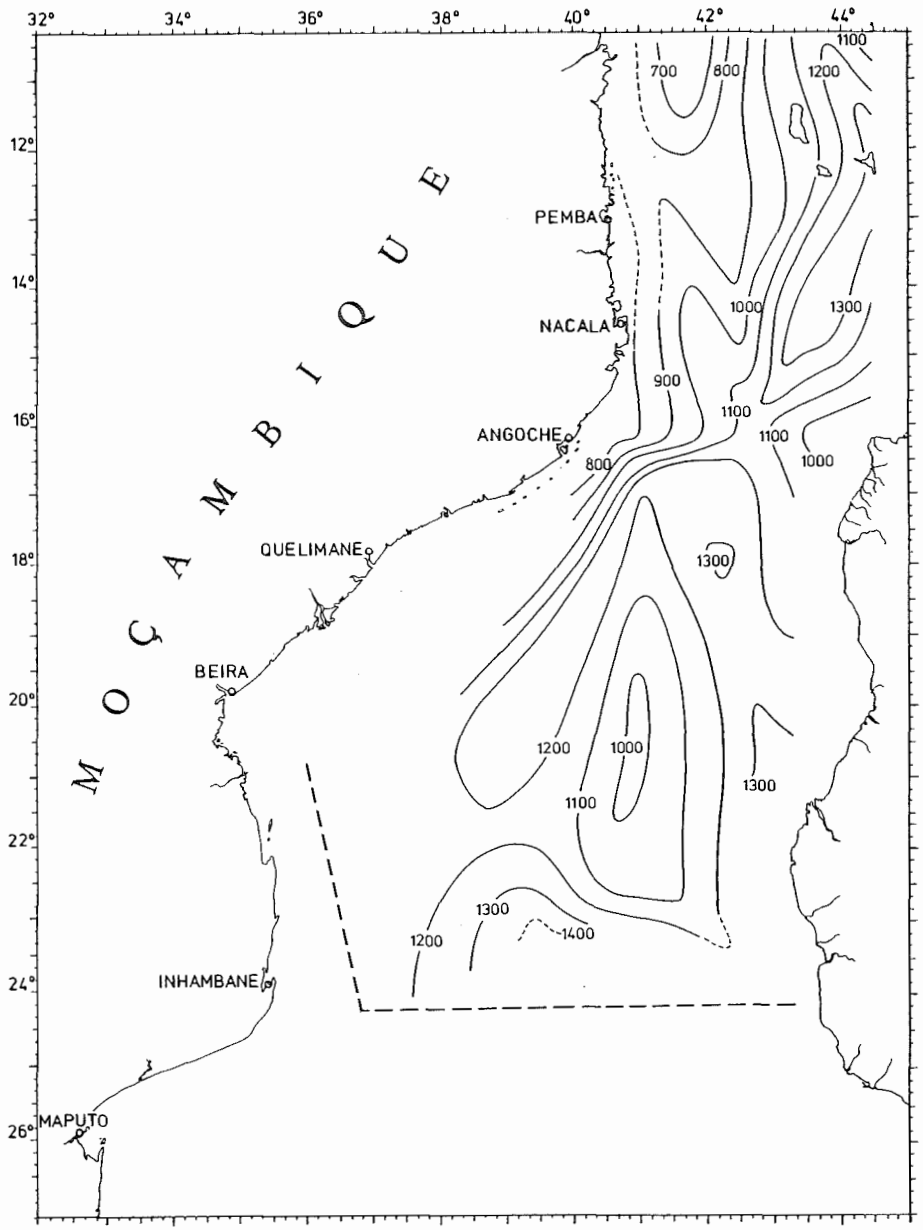

Fig. 25. COMMANDANT ROBERT GIRAUD 1960. Depth of intermediate salinity maximum. No maximum observed south of heavy dotted line.

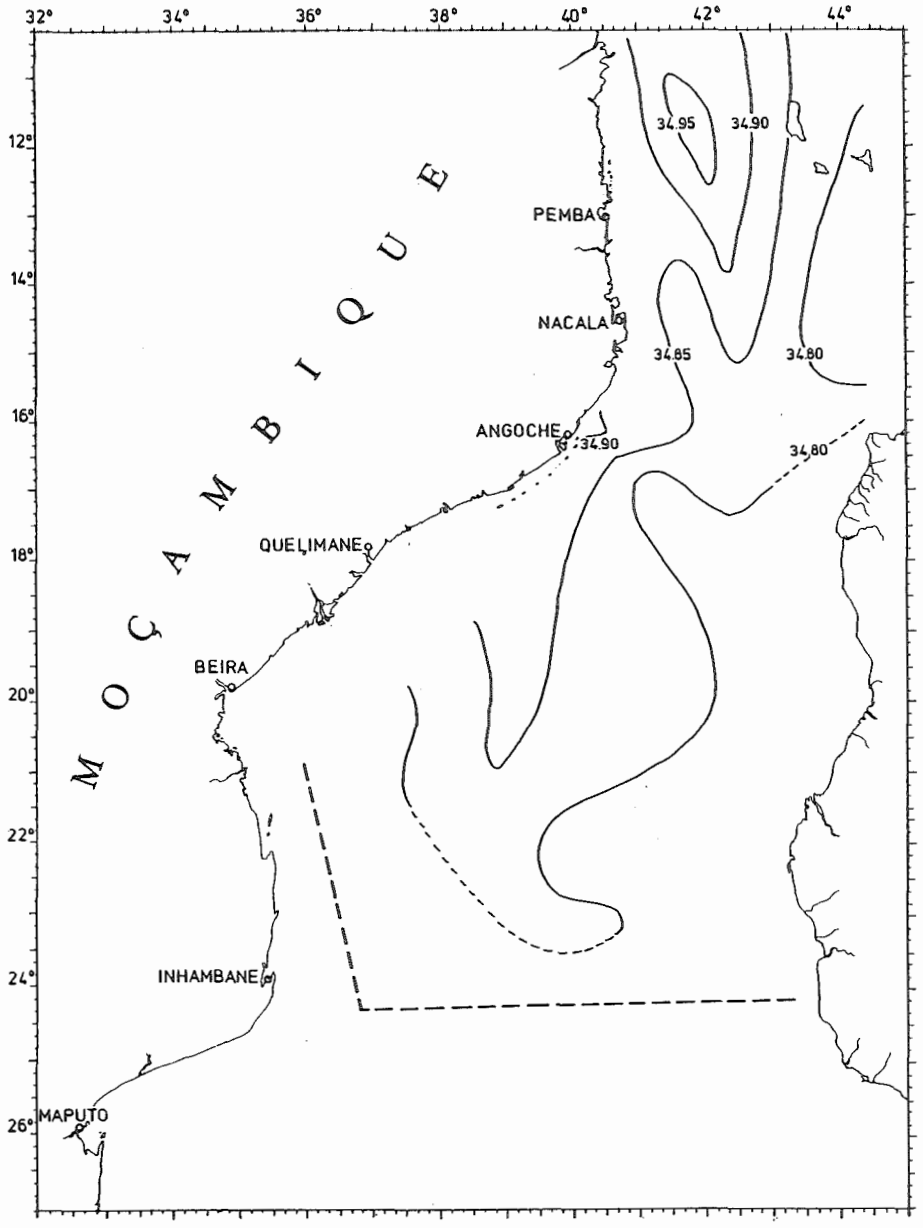

Fig. 26. COMMANDANT ROBERT GIRAUD 1960. Salinity at intermediate salinity maximum. No maximum observed south of heavy dotted line.

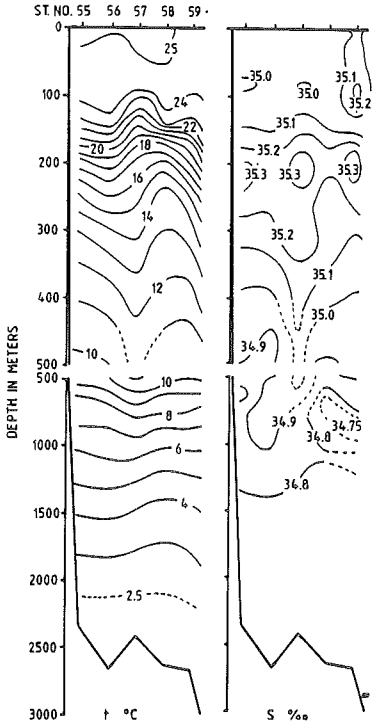

Fig. 27. COMMANDANT ROBERT GIRAUD 1960. t°C and S°/oo, 5-6 Aug.

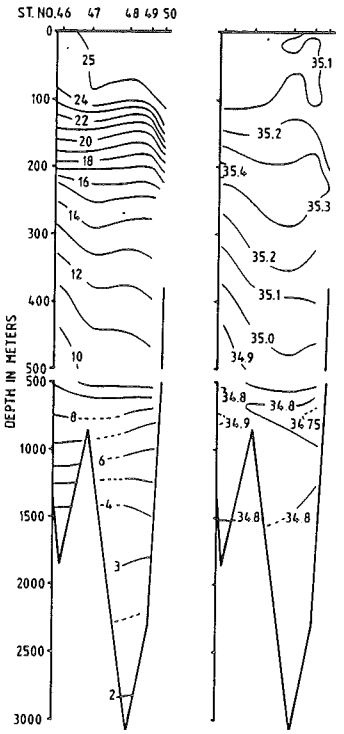

Fig. 28. COMMANDANT ROBERT GIRAUD 1960. t°C and S°/oo, 2-4 Aug.

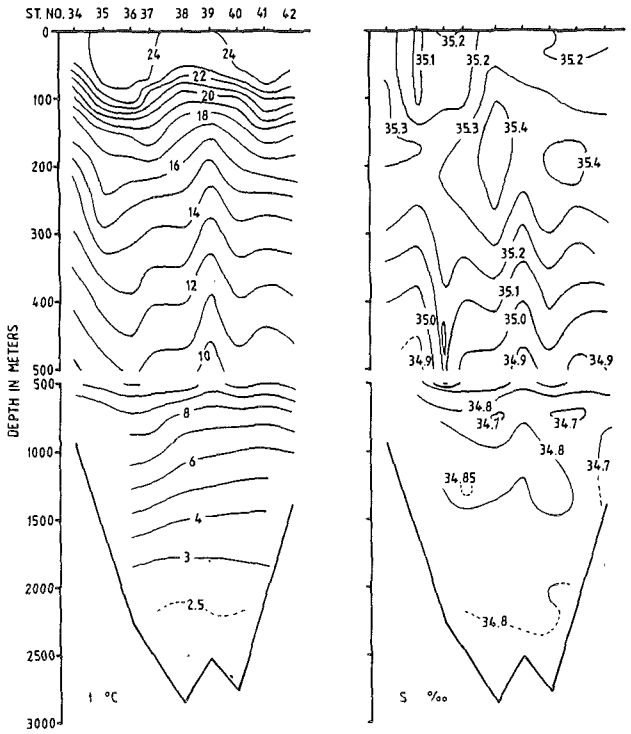

Fig. 29. COMMANDANT ROBERT GIRAUD 1960. t°C and S°/oo, 27 Jul.-1 Aug.

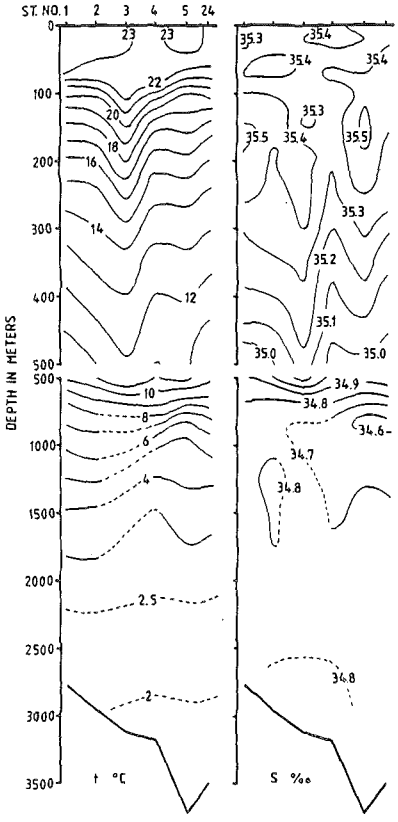

Fig. 30. COMMANDANT ROBERT GIRAUD 1960. t°C and S°/oo, 4-19 Jul.

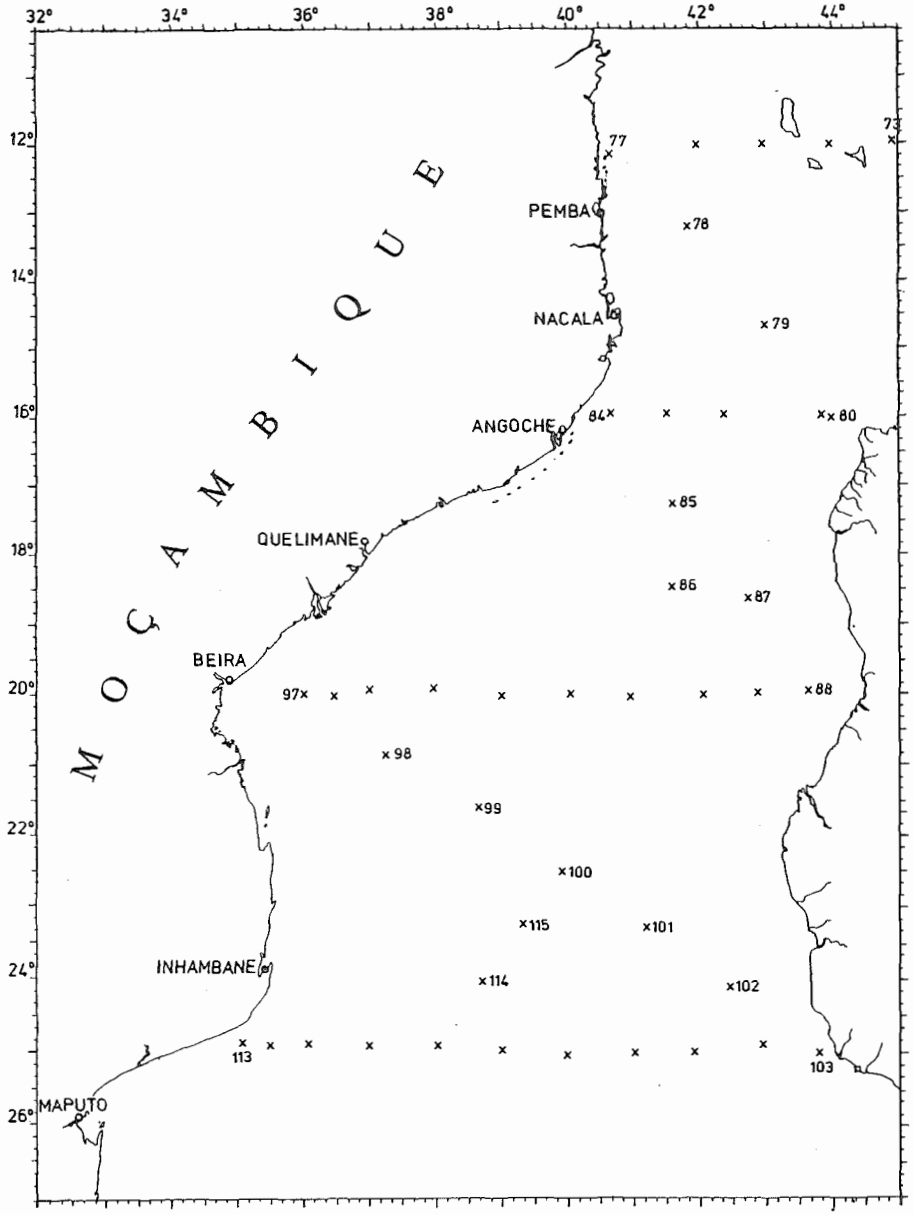

Fig. 31. COMMANDANT ROBERT GIRAUD, 6 Sep.-15 Oct. 1962.
Grid of stations.

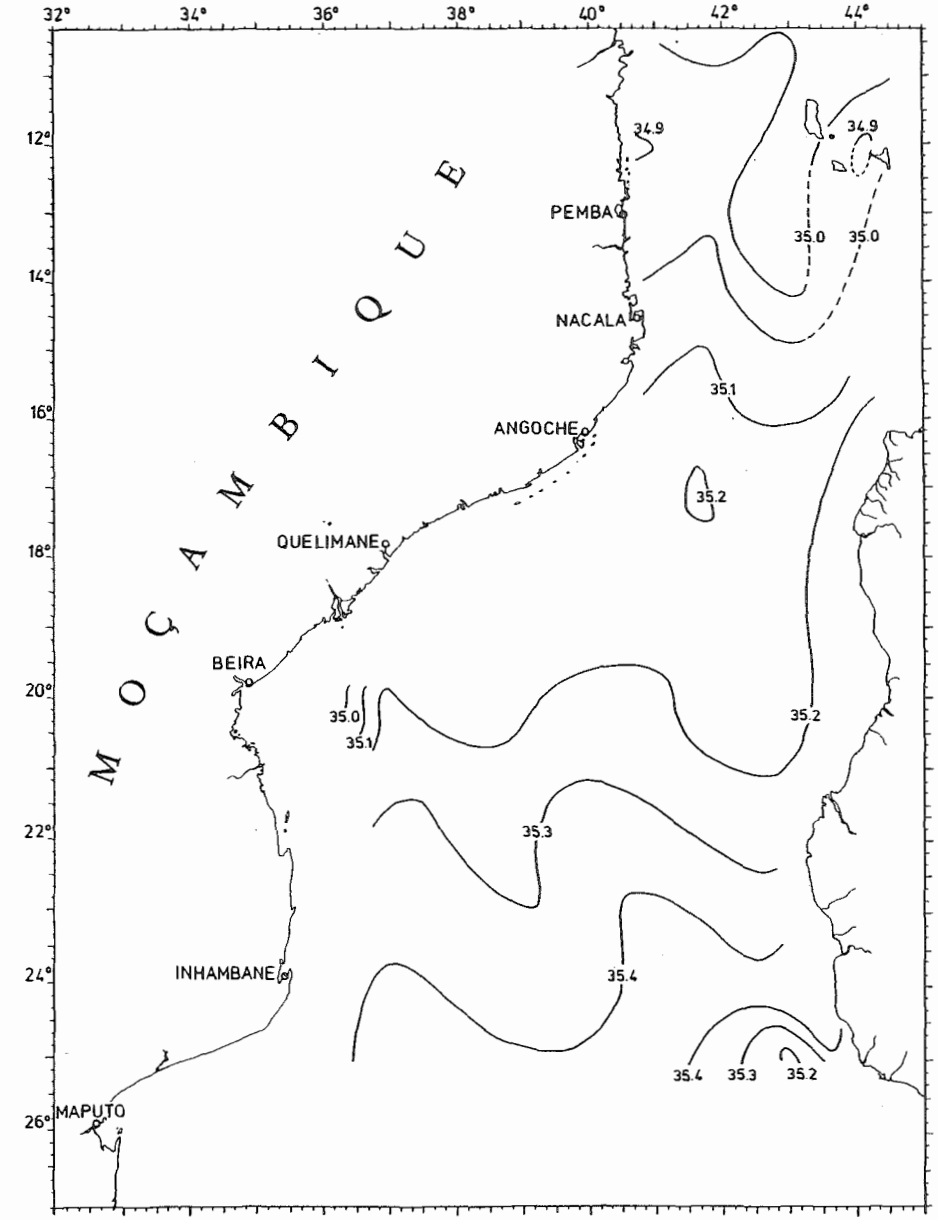

Fig. 32. COMMANDANT ROBERT GIRAUD 1962.
Surface salinity.

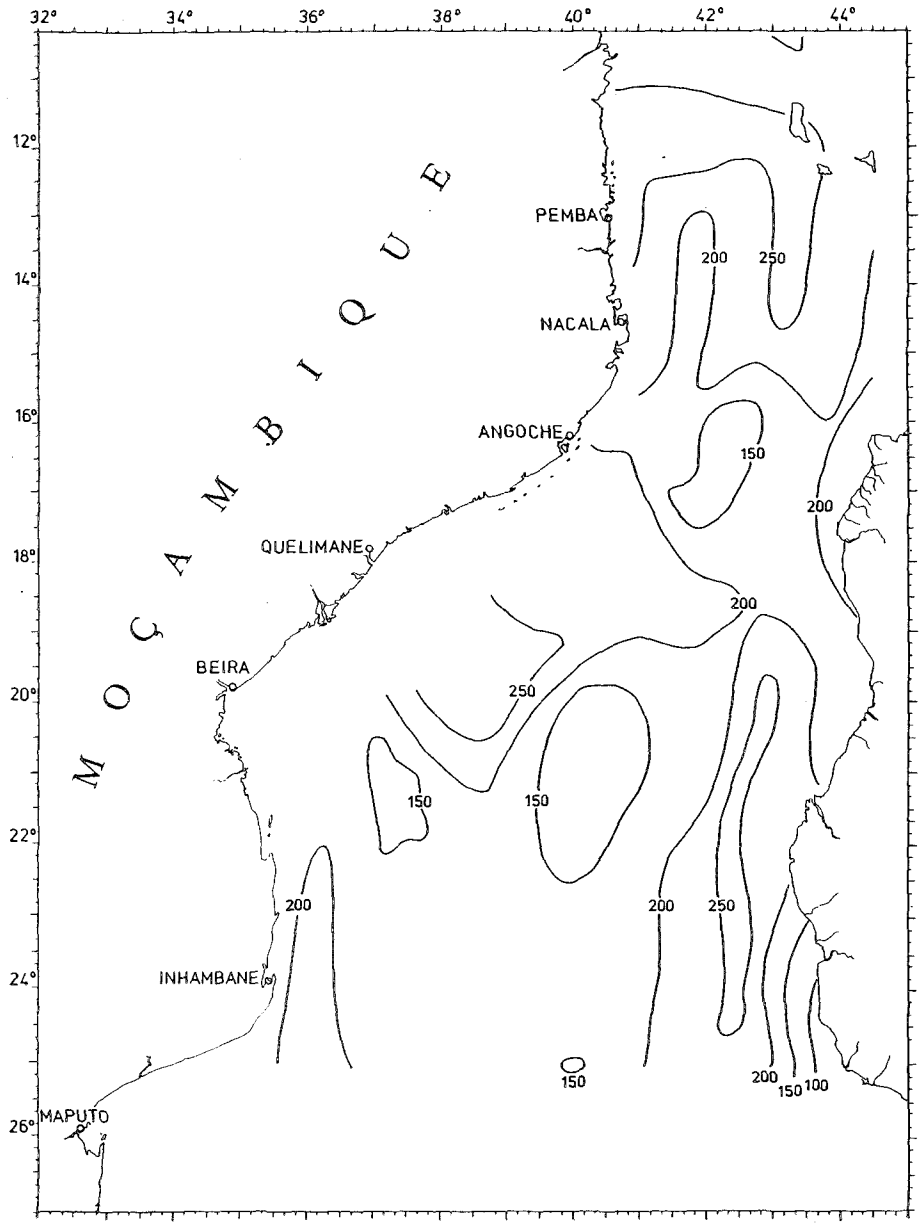

Fig. 33. COMMANDANT ROBERT GIRAUD 1962. Depth of subsurface salinity maximum.

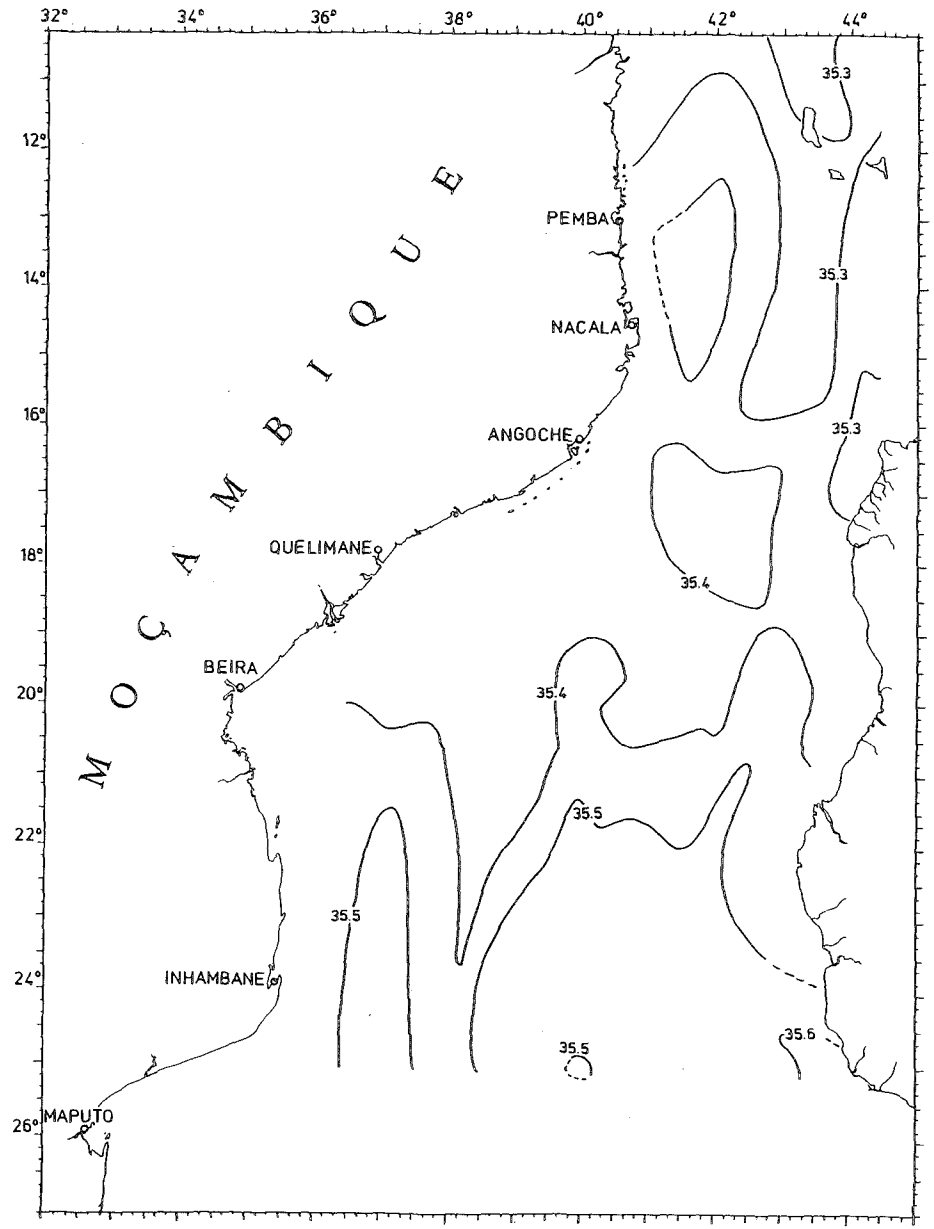

Fig. 34. COMMANDANT ROBERT GIRAUD. Salinity at subsurface salinity maximum.

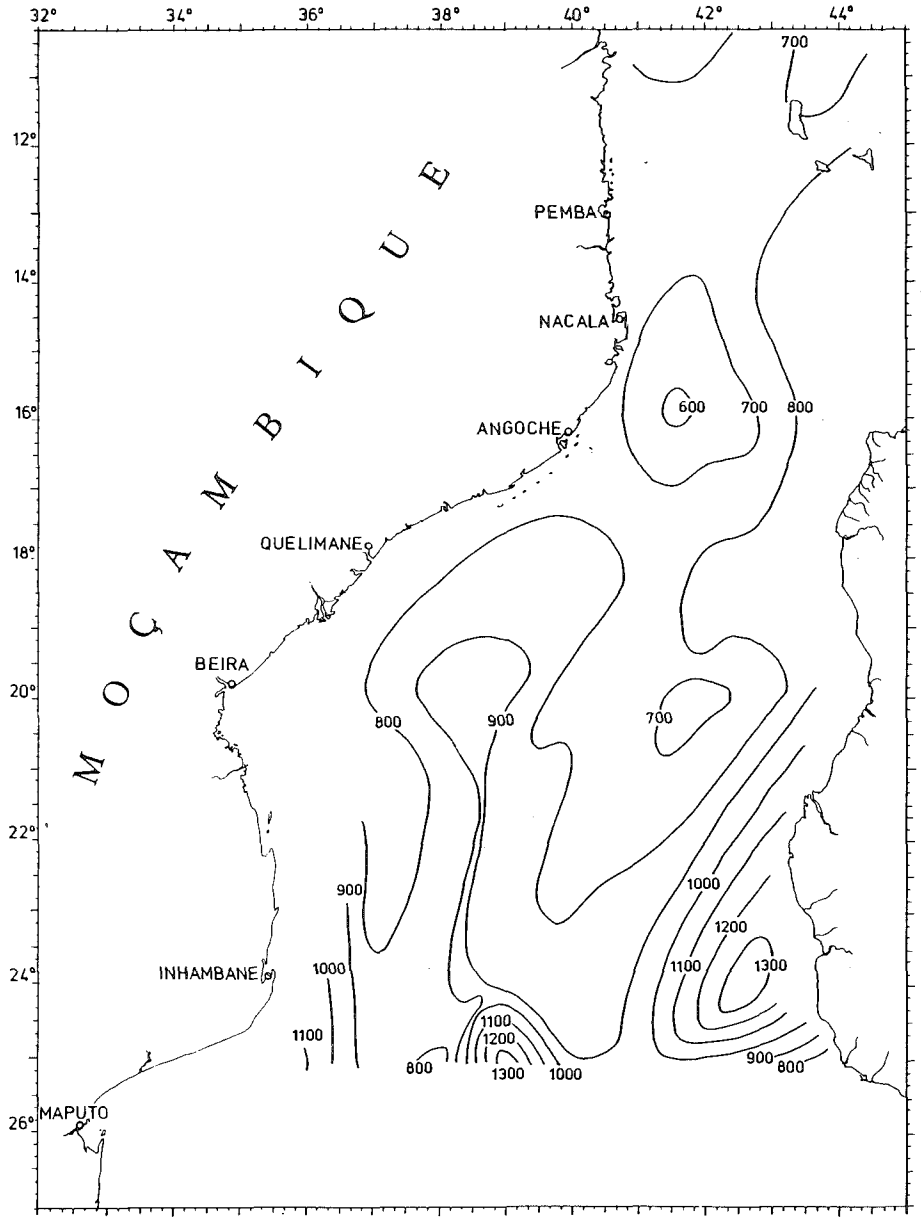

Fig. 35. COMMANDANT ROBERT GIRAUD 1962.
Depth of intermediate salinity minimum.

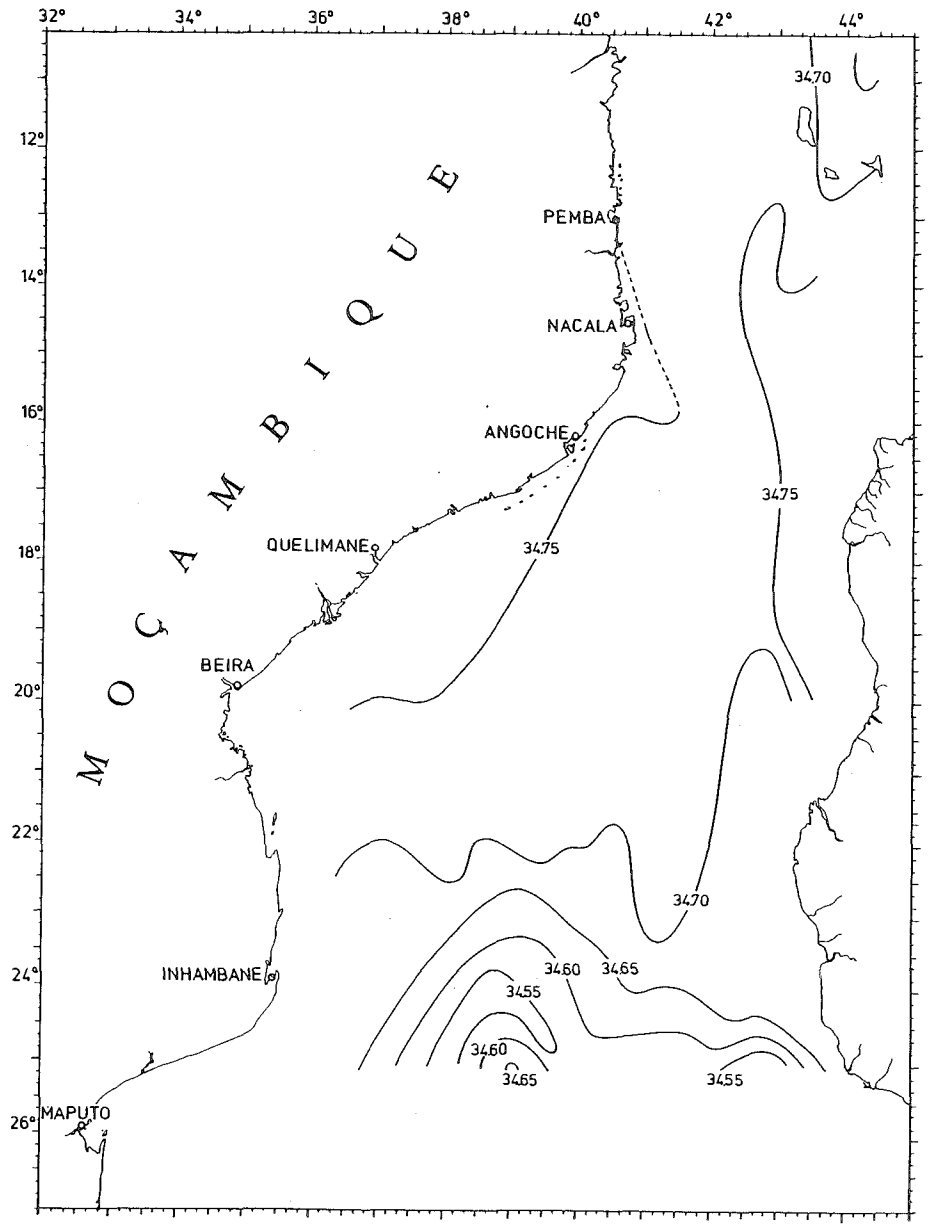

Fig. 36. COMMANDANT ROBERT GIRAUD 1962.
Salinity at intermediate salinity minimum.

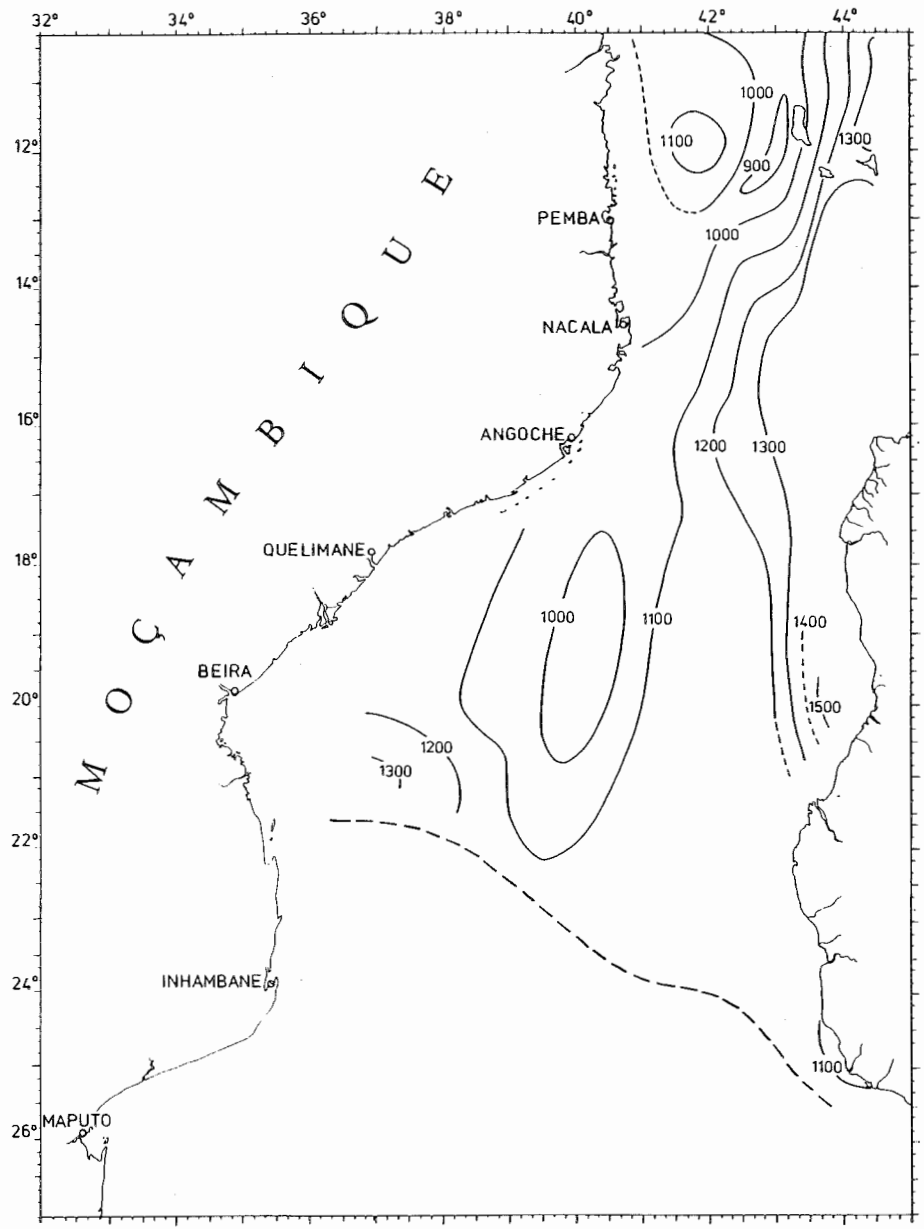

Fig. 37. COMMANDANT ROBERT GIRAUD 1962. Depth of intermediate salinity maximum. No maximum observed

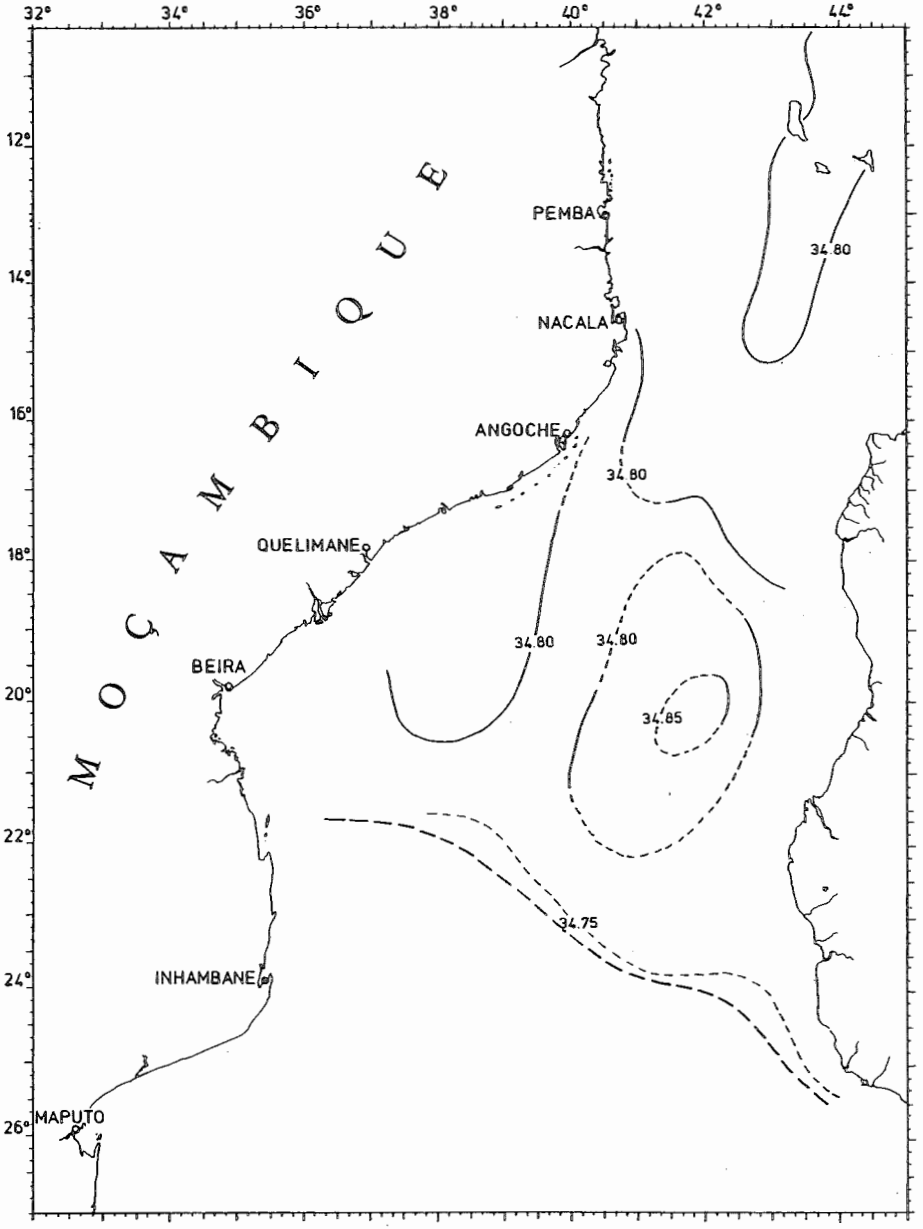

Fig. 38. COMMANDANT ROBERT GIRAUD 1962. Salinity at intermediate salinity maximum. No maximum observed

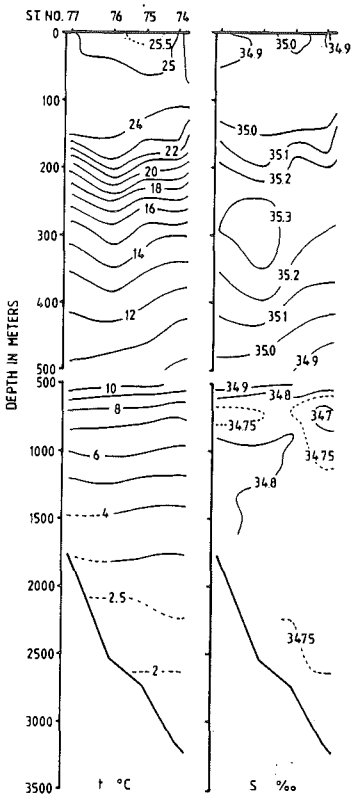

Fig. 39. COMMANDANT ROBERT GIRAUD 1962. t°C and S°/oo, 20-21 Sep.

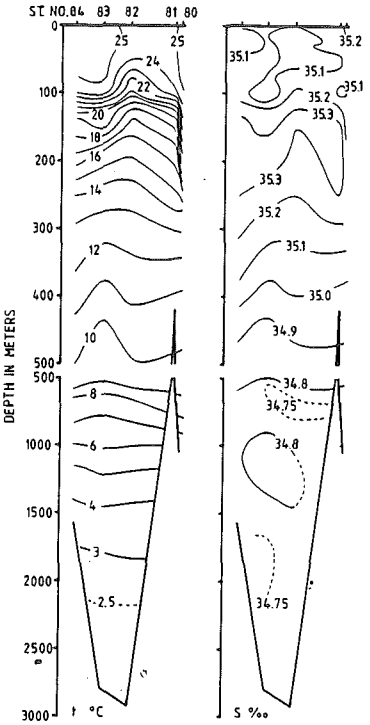

Fig. 40. COMMANDANT ROBERT GIRAUD 1962. t°C and S°/oo, 22-26 Sep.

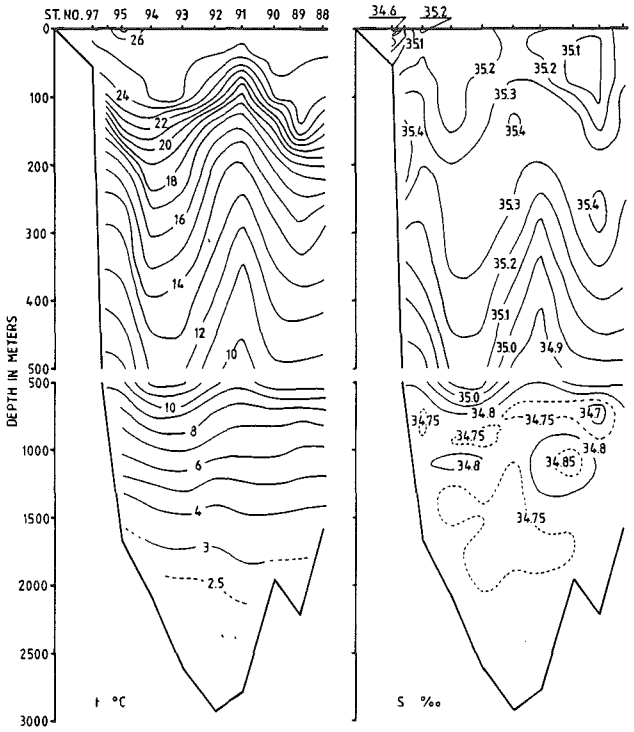

Fig. 41. COMMANDANT ROBERT GIRAUD 1962. t°C and S°/oo, 28-30 Sep.

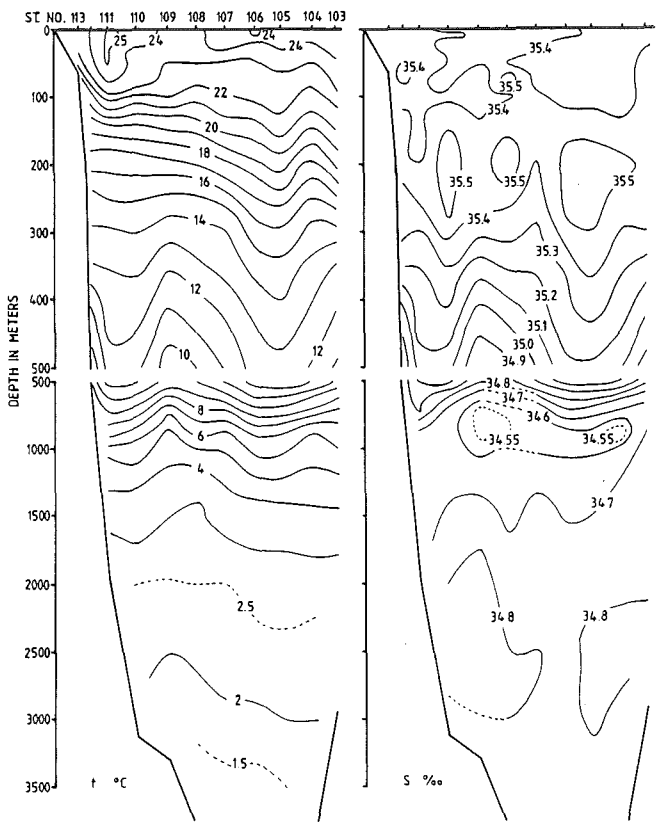

Fig. 42. COMMANDANT ROBERT GIRAUD 1962. t°C and S°/oo, 7-10 Oct.

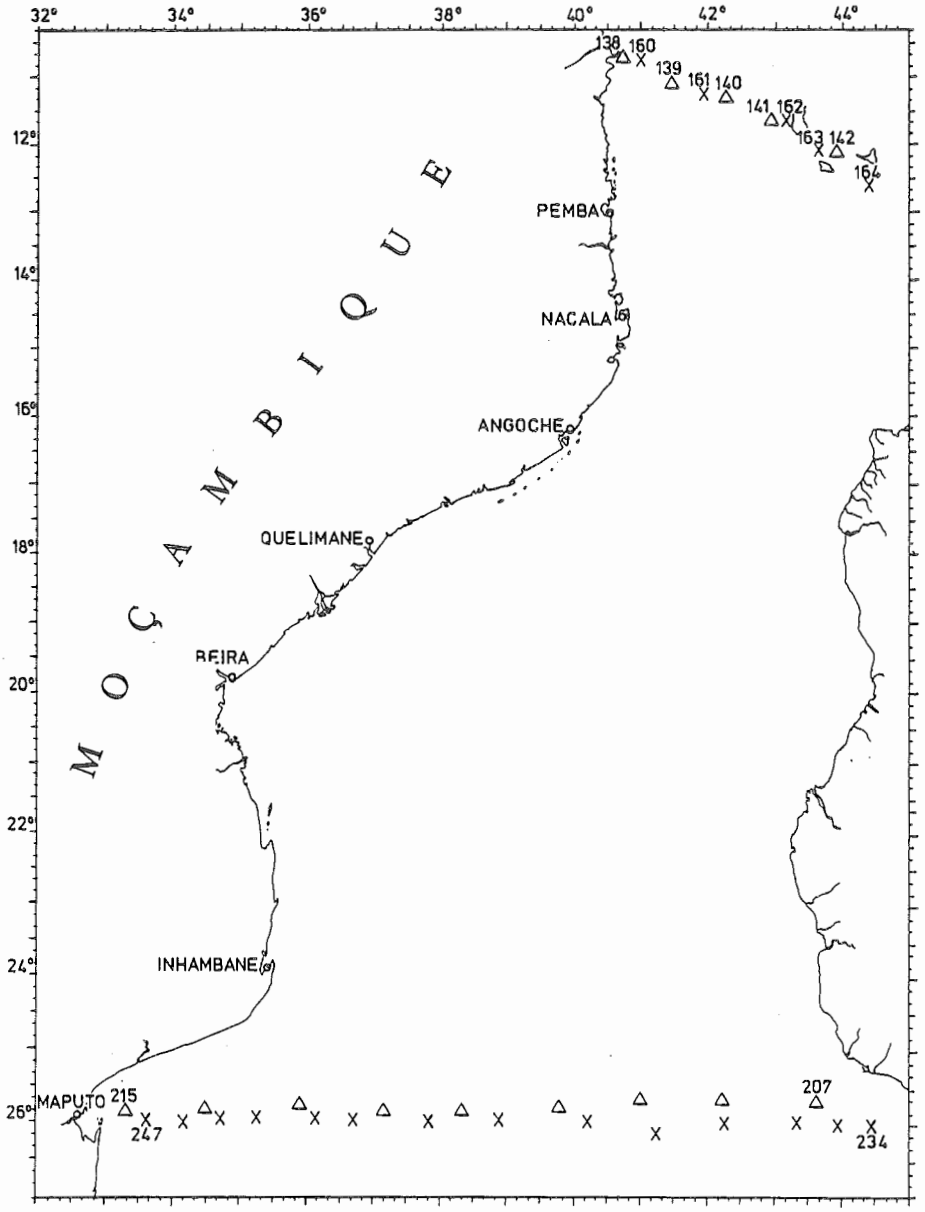

Fig. 43. ATLANTIS II, Oct.-Nov. 1963 and May-Jun. 1965. Grid of stations. △ 1963, × 1965.

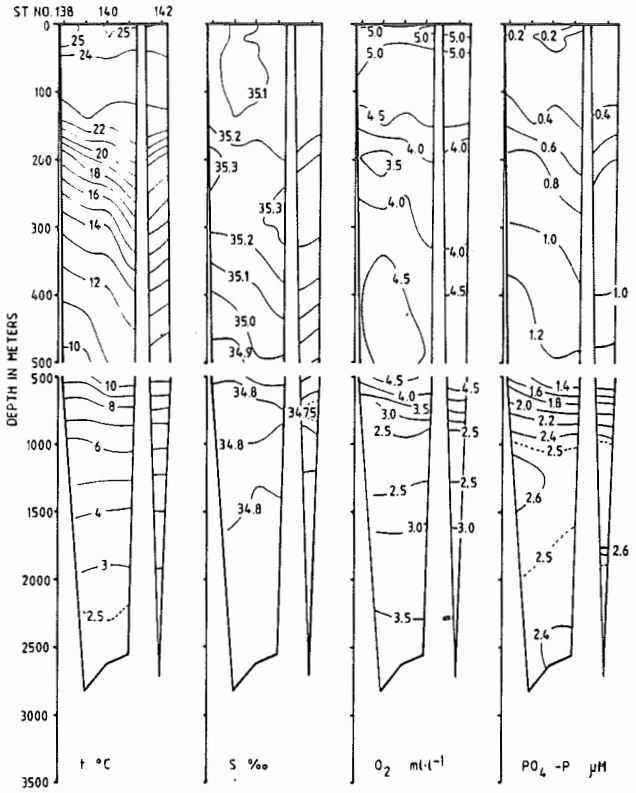

Fig. 44. ATLANTIS II 1963. t°C, S°/oo, O_2 ml/l and PO_4-PµM, 5-6. Oct.

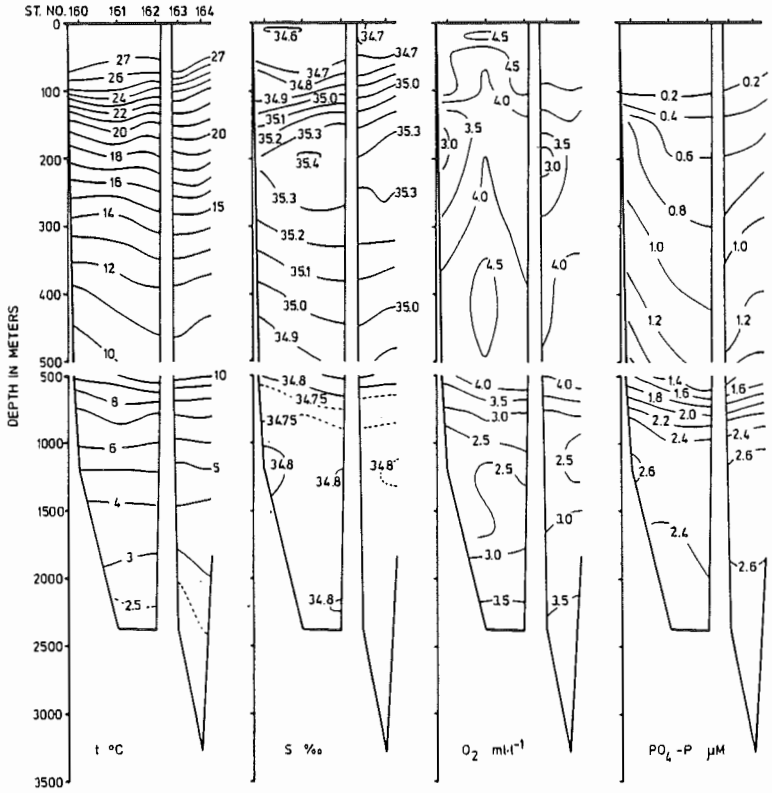

Fig. 45. ATLANTIS II 1965. t°C, S°/oo, O_2 ml/l and PO_4-PµM, 5-8 May.

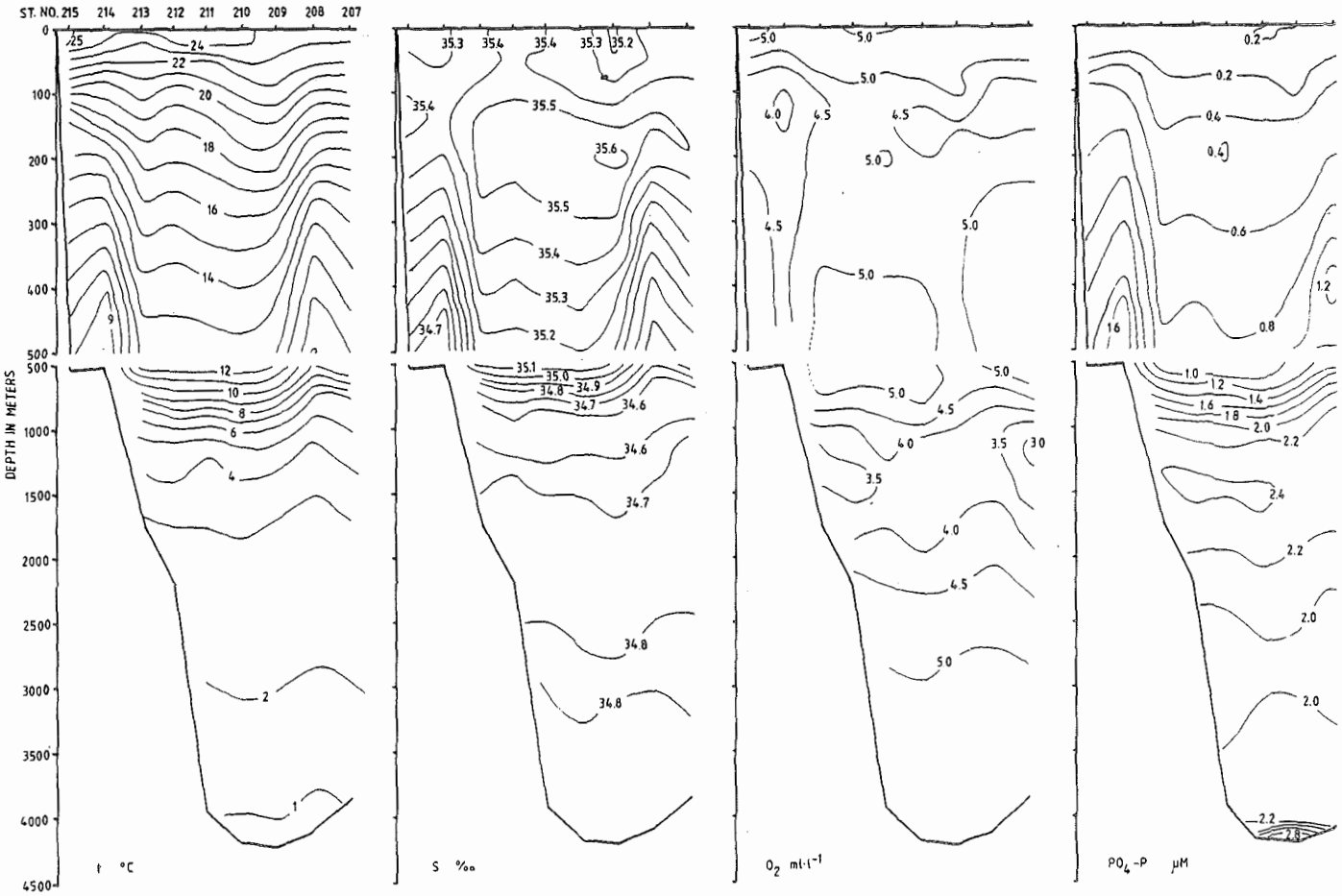

Fig. 46. ATLANTIS II 1963. $t^{\circ}C$, S°/oo, O_2 ml/l and PO_4-PµM, 9–12 Nov.

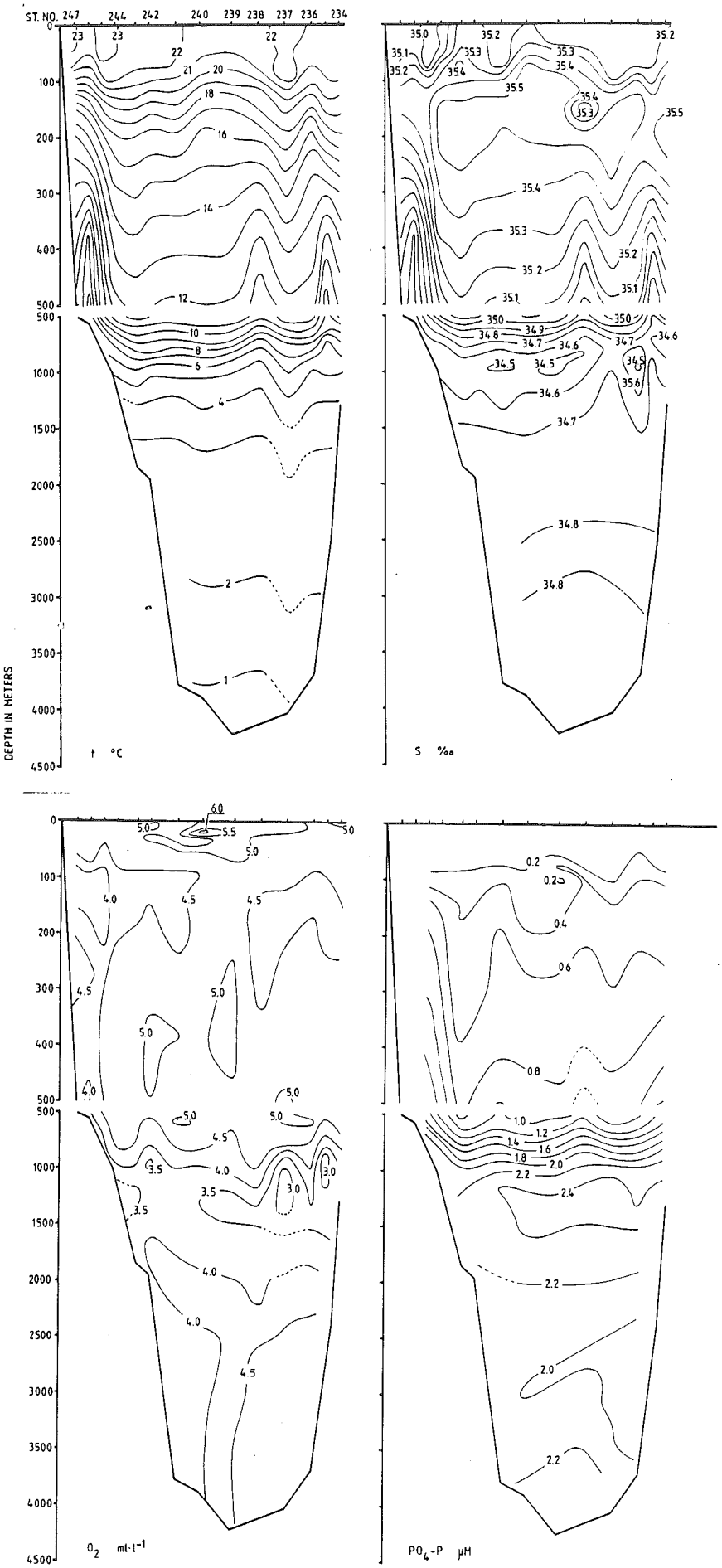

Fig. 47. ATLANTIS II 1965. t°C, S°/oo, O_2 ml/l and PO_4-PµM, 17-20 Jun.

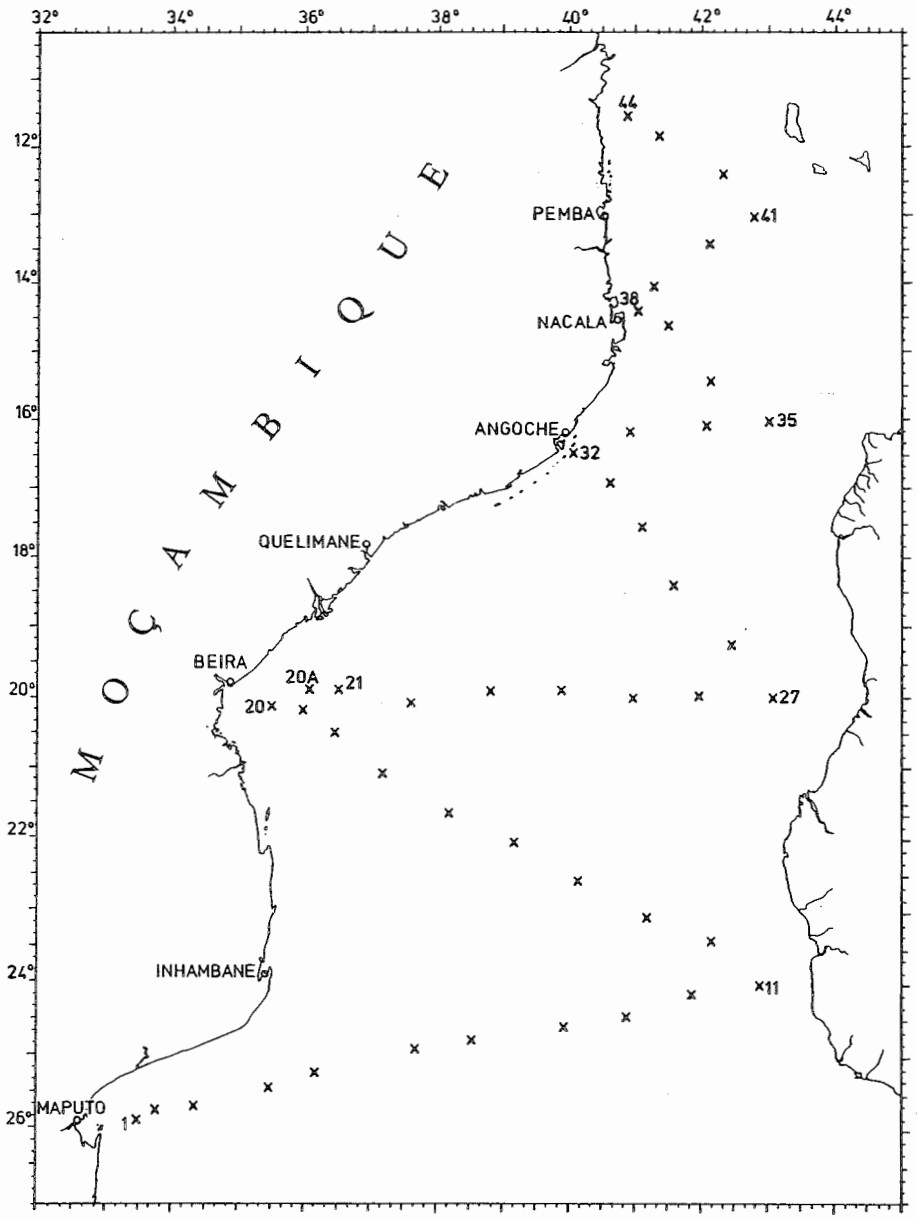

Fig. 48. ALMIRANTE LACERDA, 11 Apr.-12 May 1964. Grid of stations.

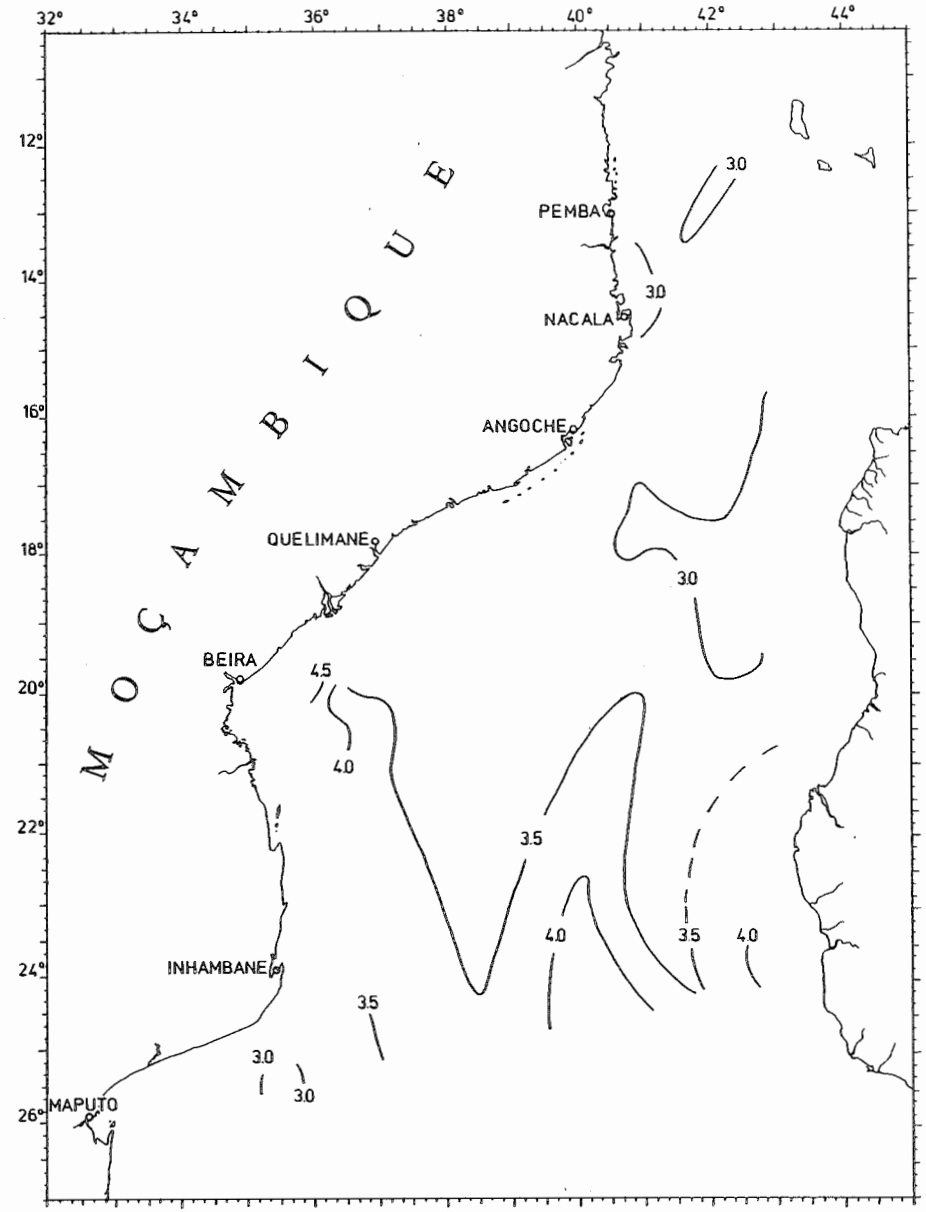

Fig. 49. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at subsurface oxygen minimum.

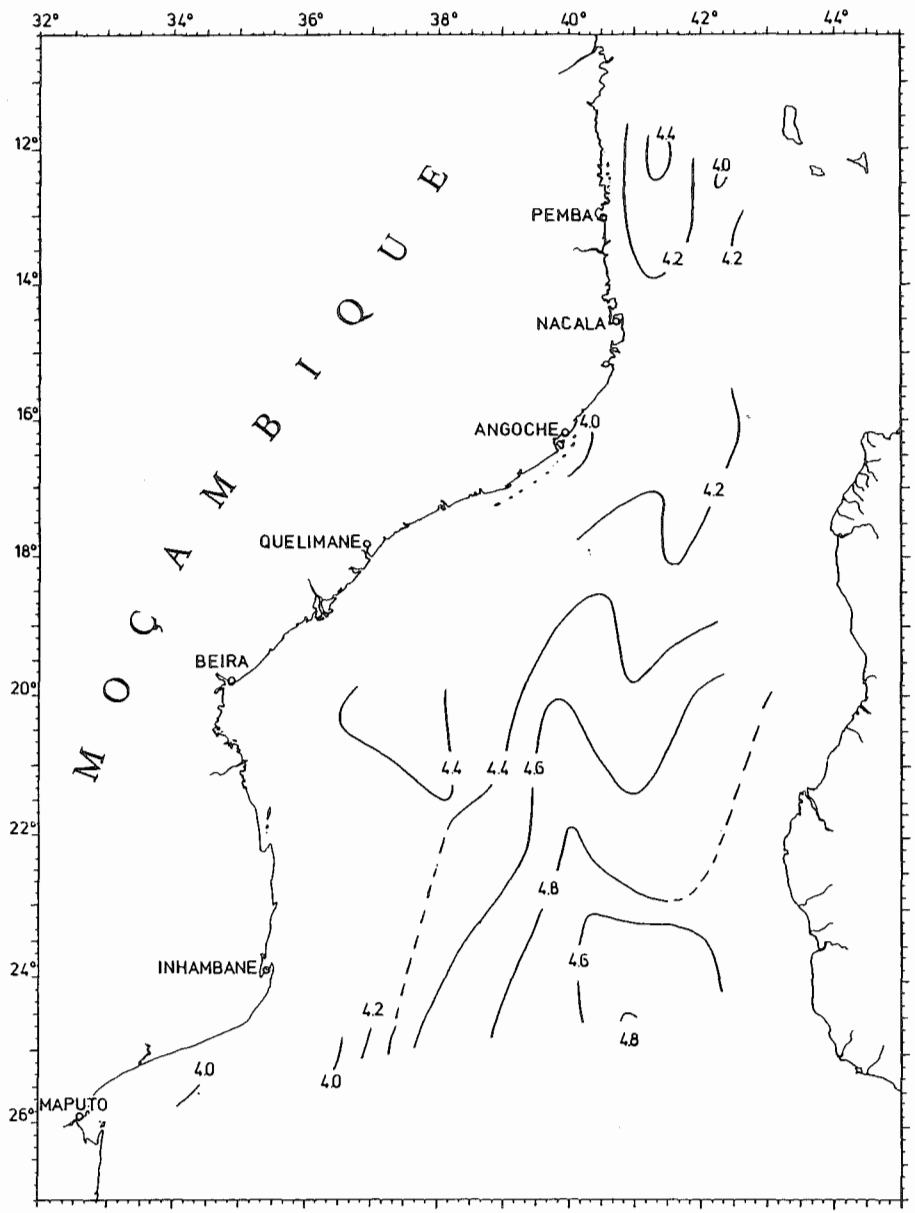

Fig. 50. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at intermediate oxygen maximum.

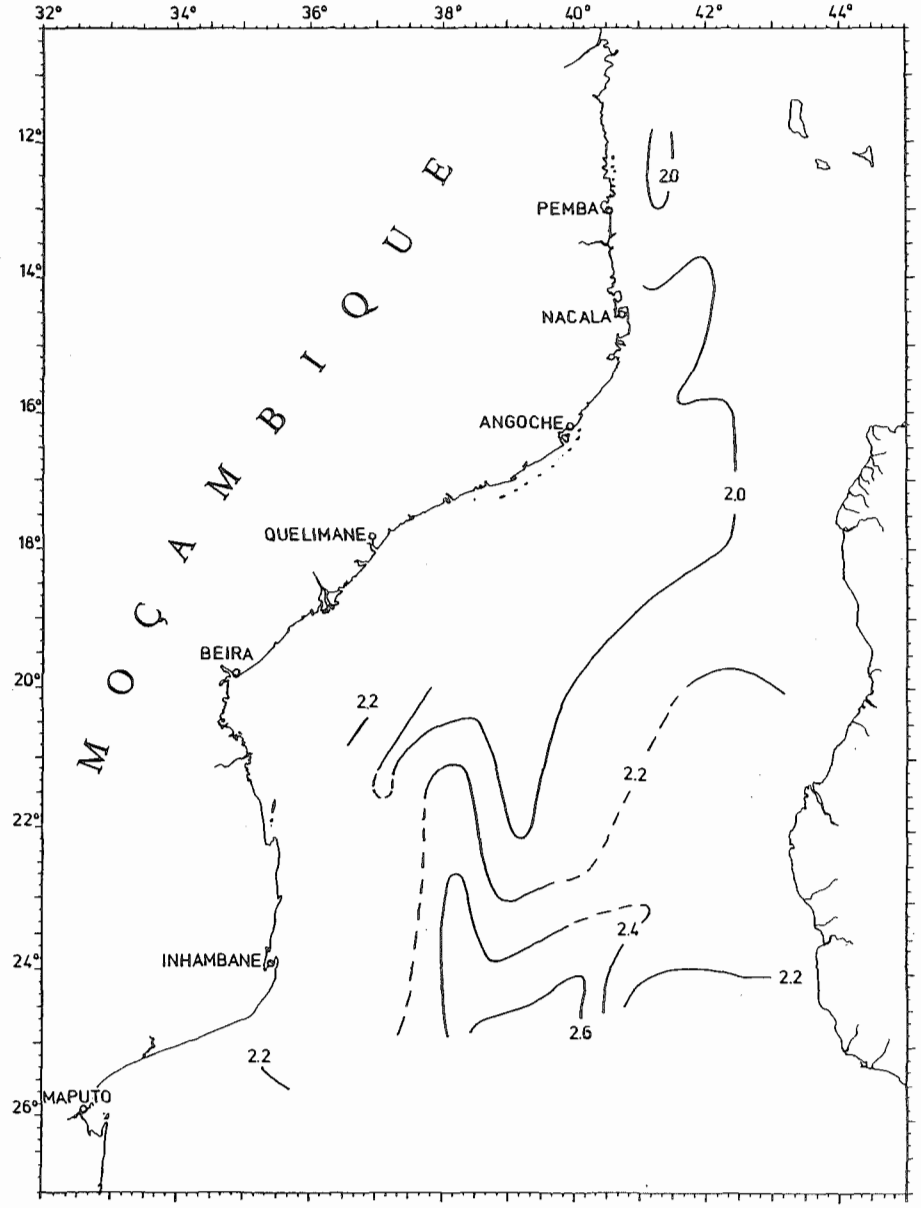

Fig. 51. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at deep oxygen minimum.

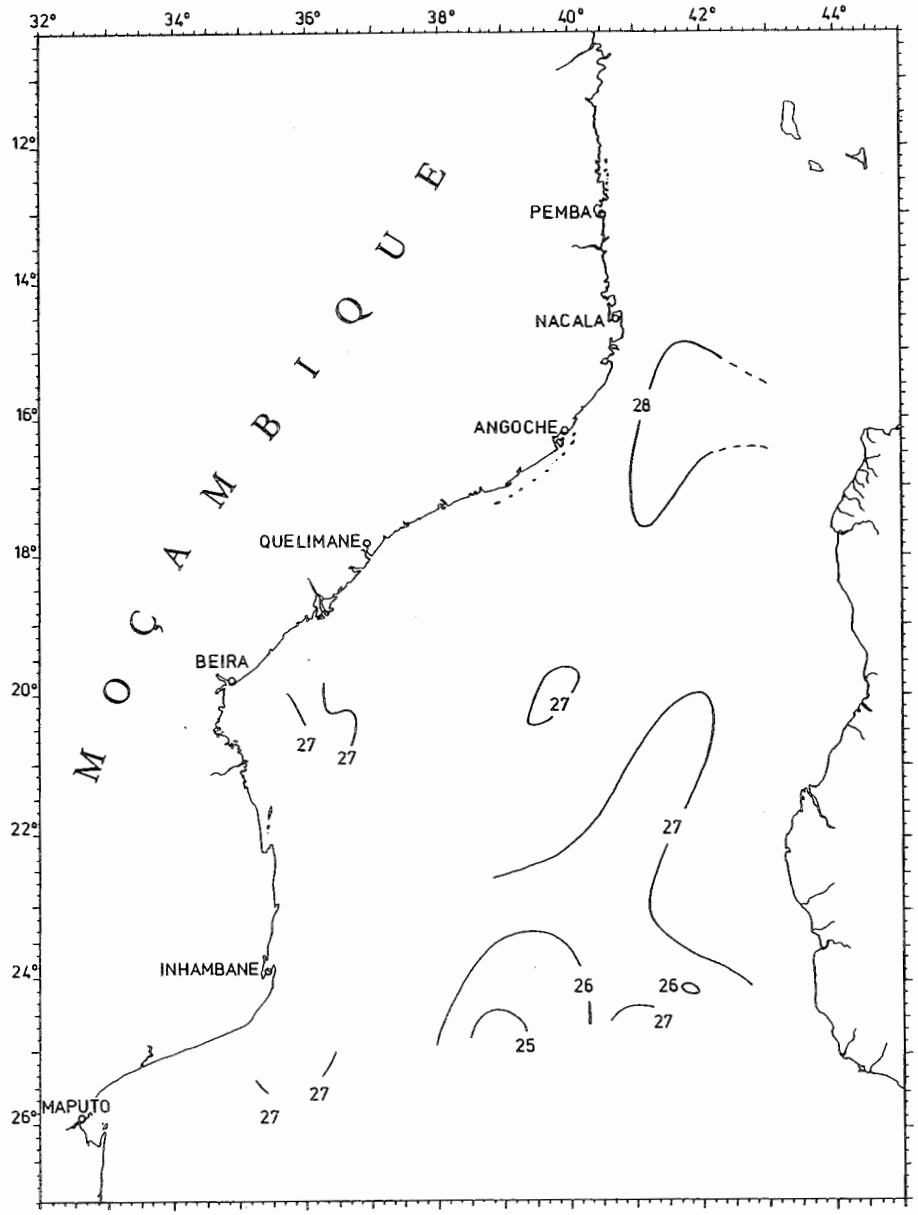

Fig. 52. ALMIRANTE LACERDA 1964. Surface temperature.

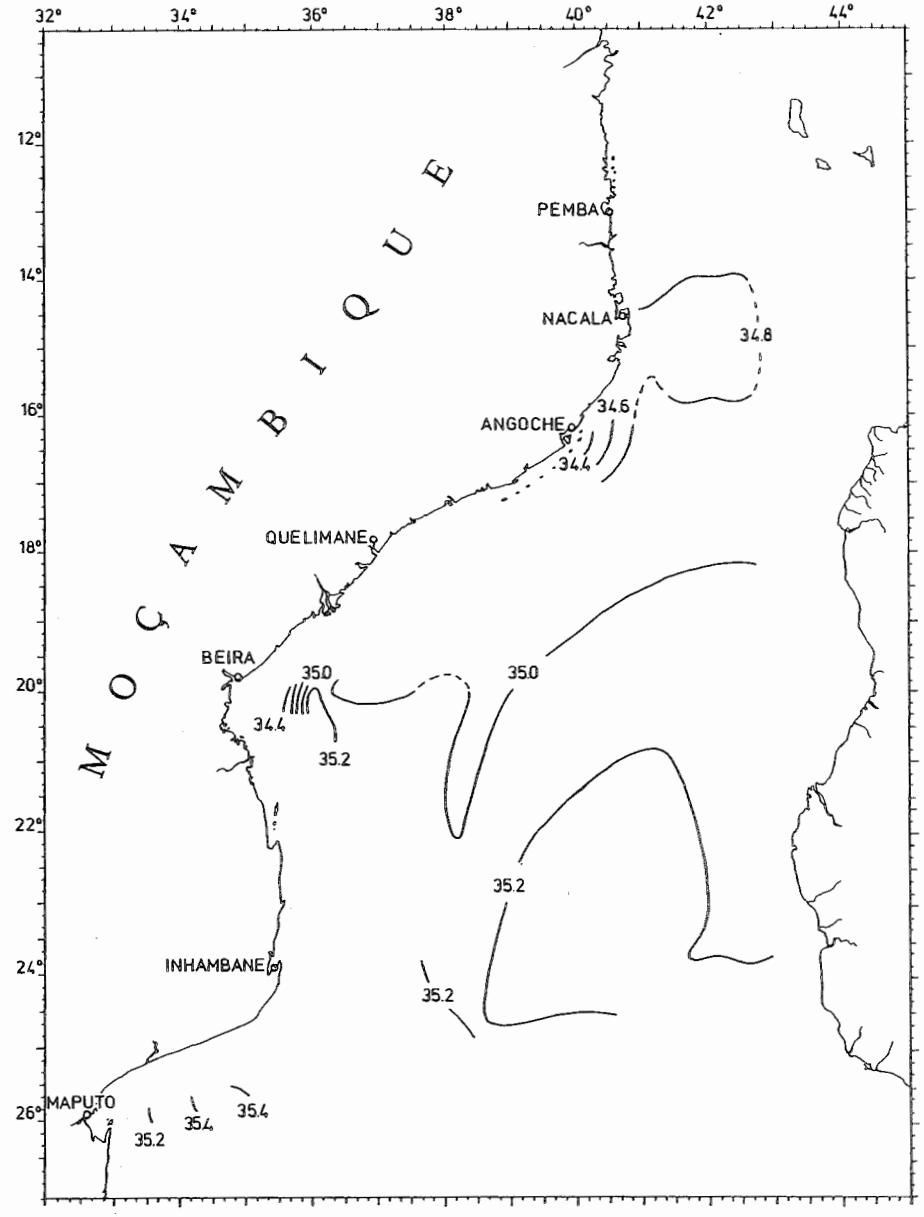

Fig. 53. ALMIRANTE LACERDA 1964. Surface salinity.

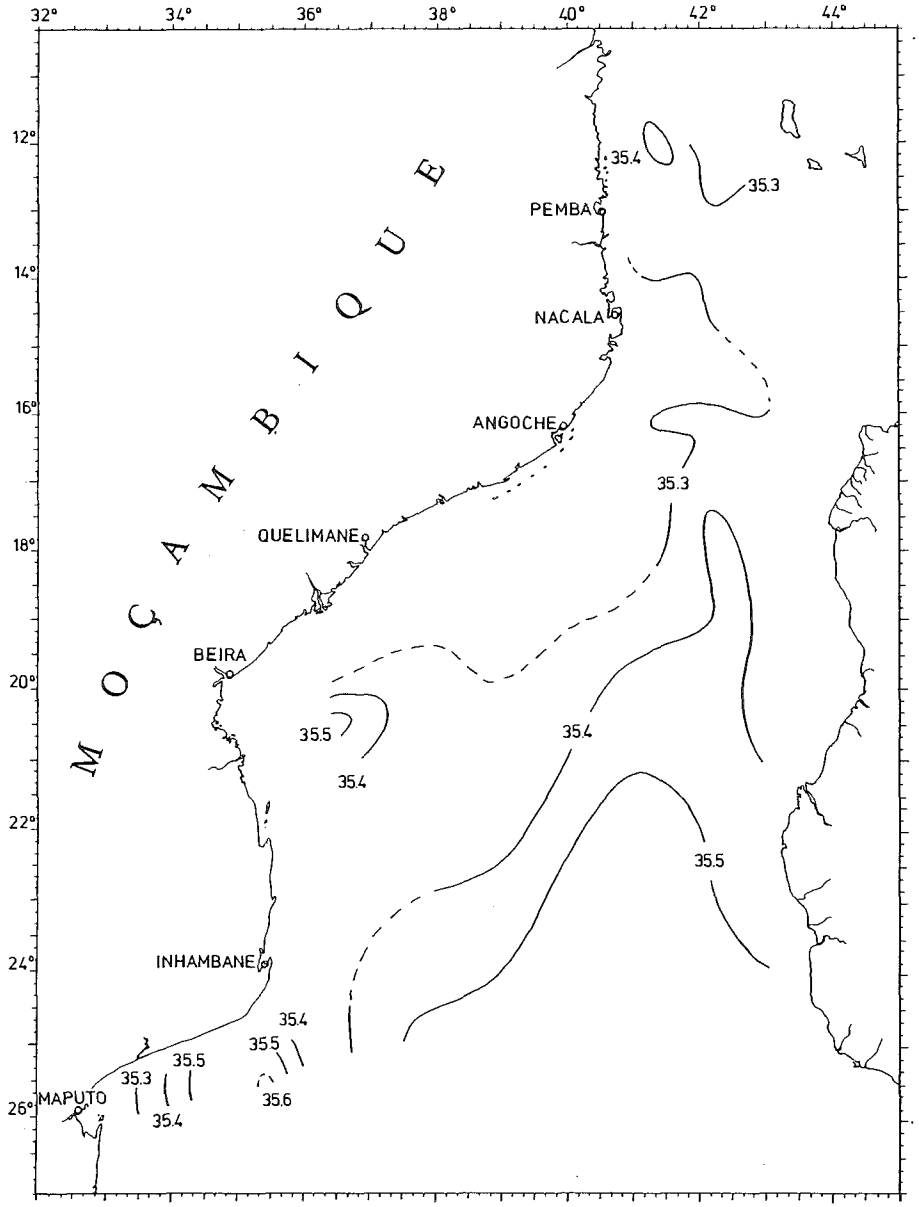

Fig. 54. ALMIRANTE LACERDA 1964. Salinity at subsurface salinity maximum.

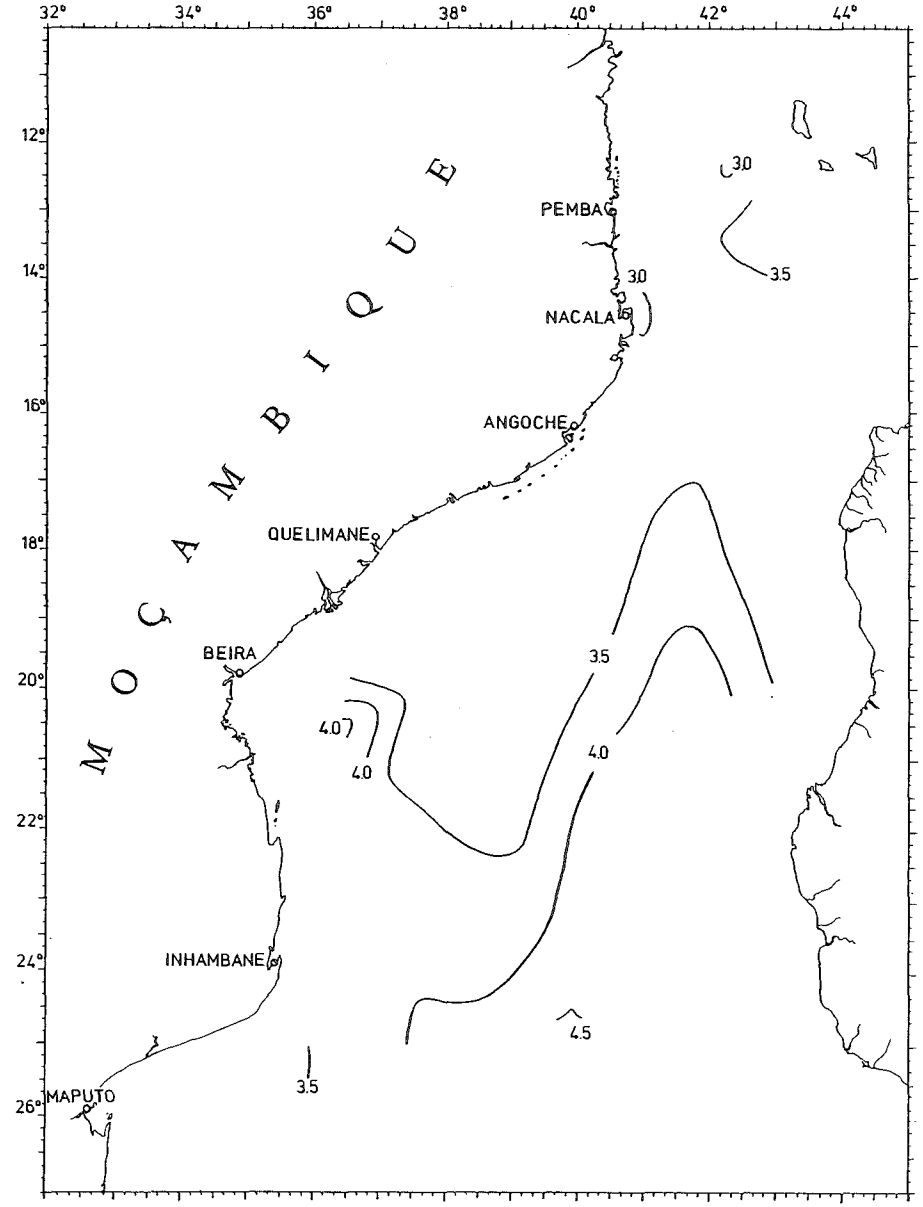

Fig. 55. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at subsurface salinity maximum.

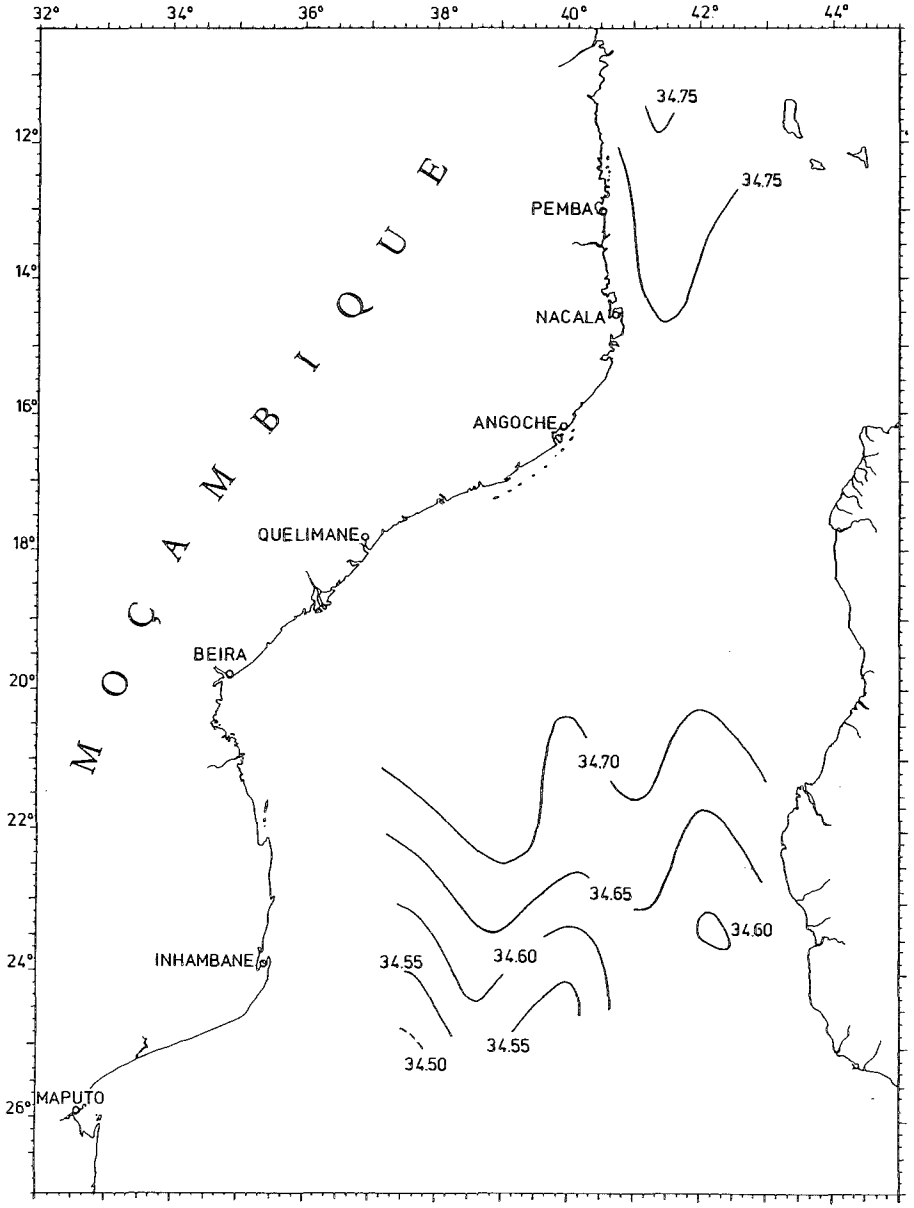

Fig. 56. ALMIRANTE LACERDA 1964. Salinity at intermediate salinity minimum.

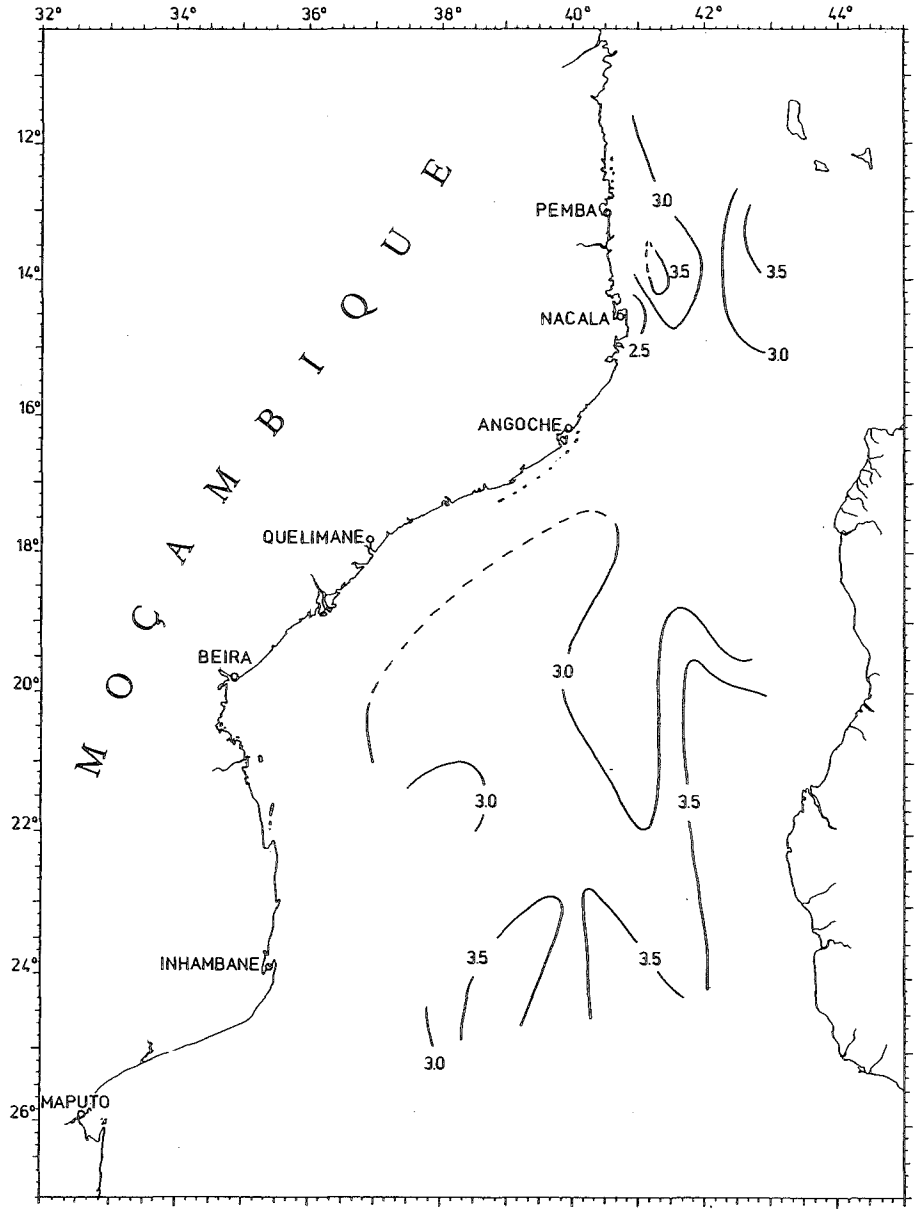

Fig. 57. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at intermediate salinity minimum.

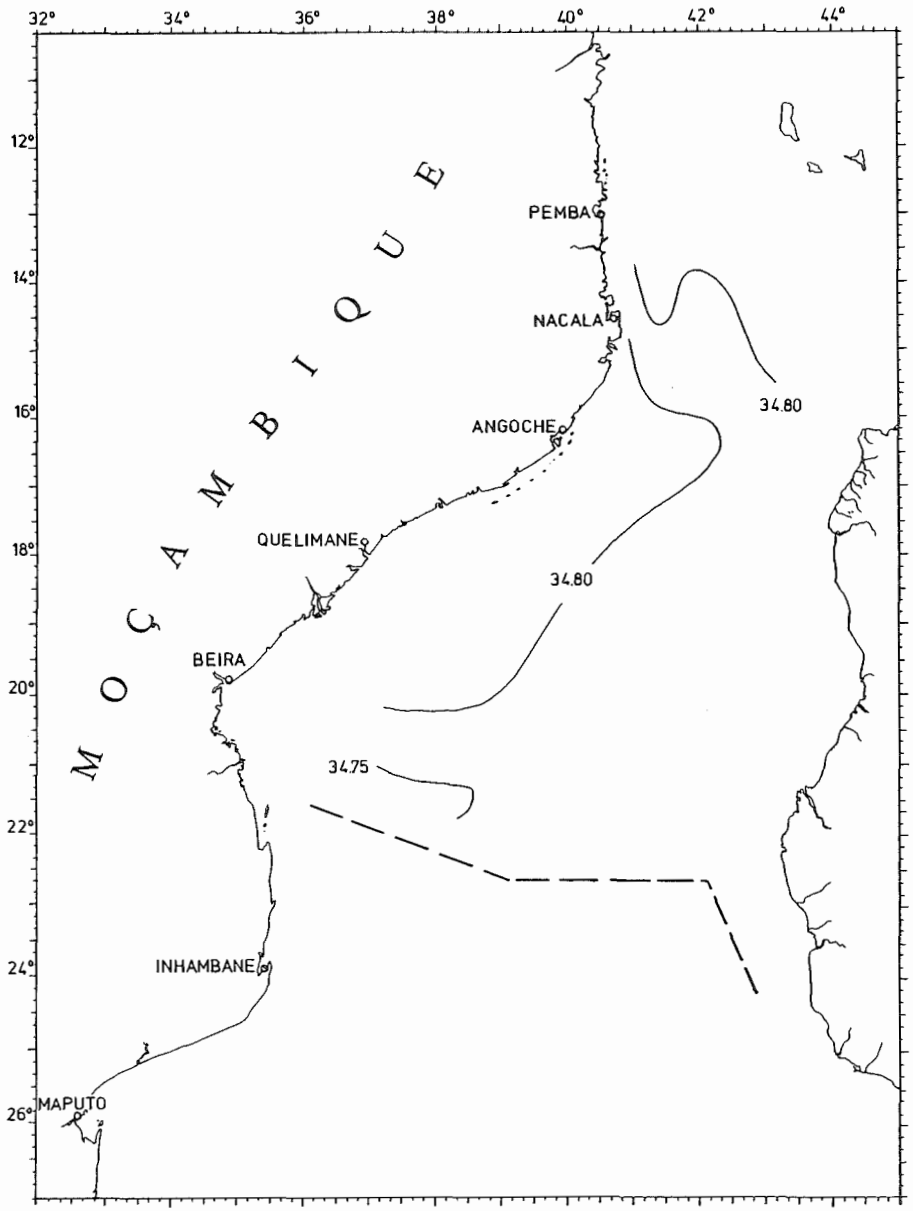

Fig. 58. ALMIRANTE LACERDA 1964. Salinity at intermediate salinity maximum. No maximum observed south of heavy dotted line.

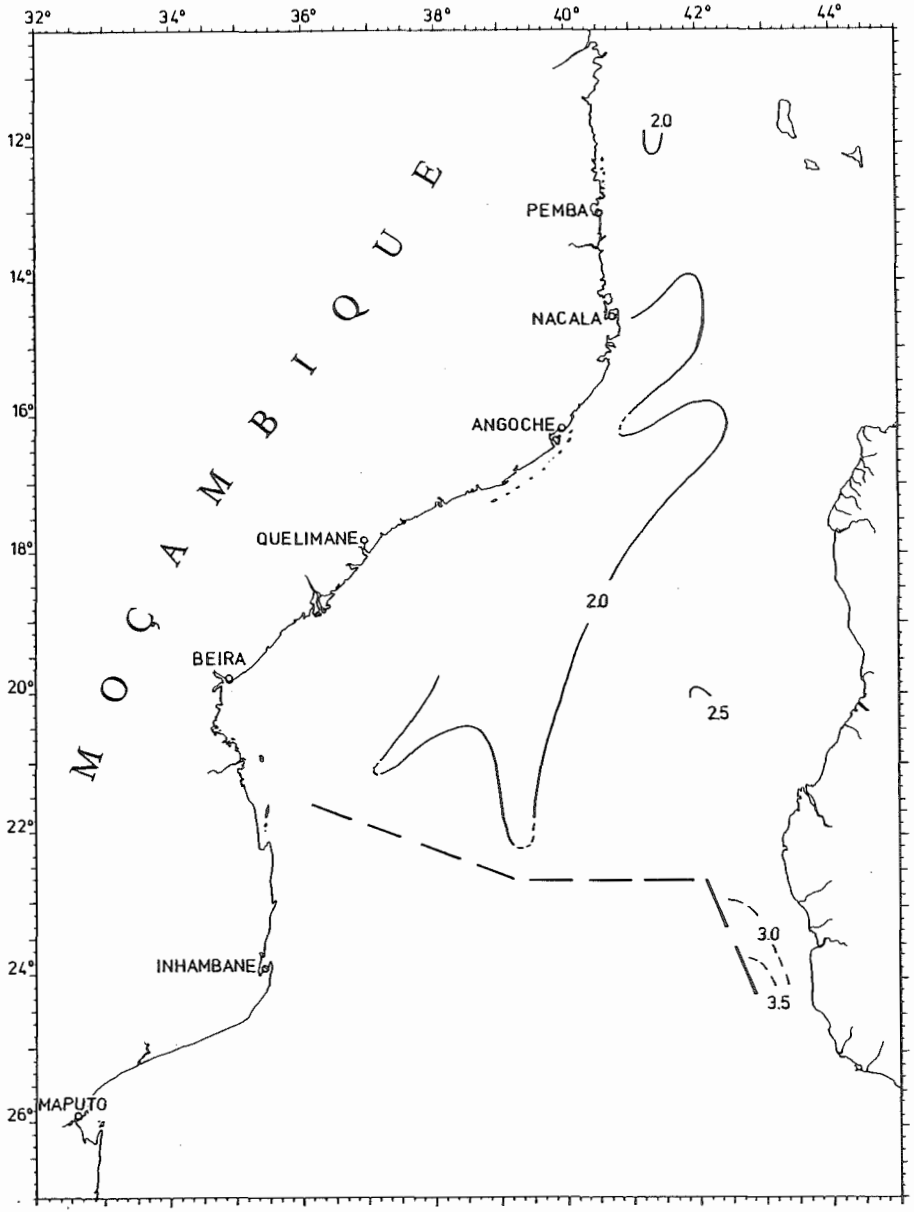

Fig. 59. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at intermediate salinity maximum. No maximum observed south of heavy dotted line.

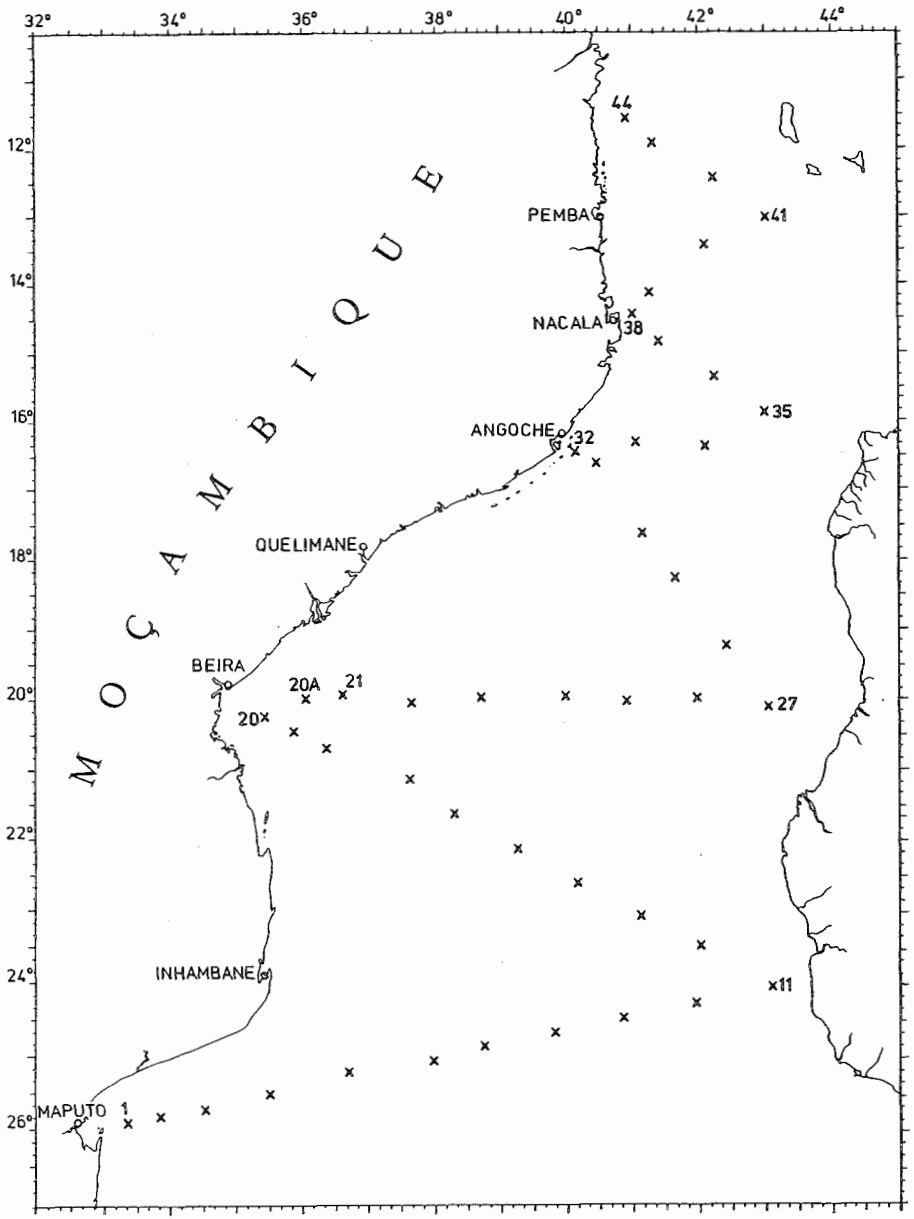

Fig. 60. ALMIRANTE LACERDA, 7 Sep.-9 Oct. 1964.
Grid og stations.

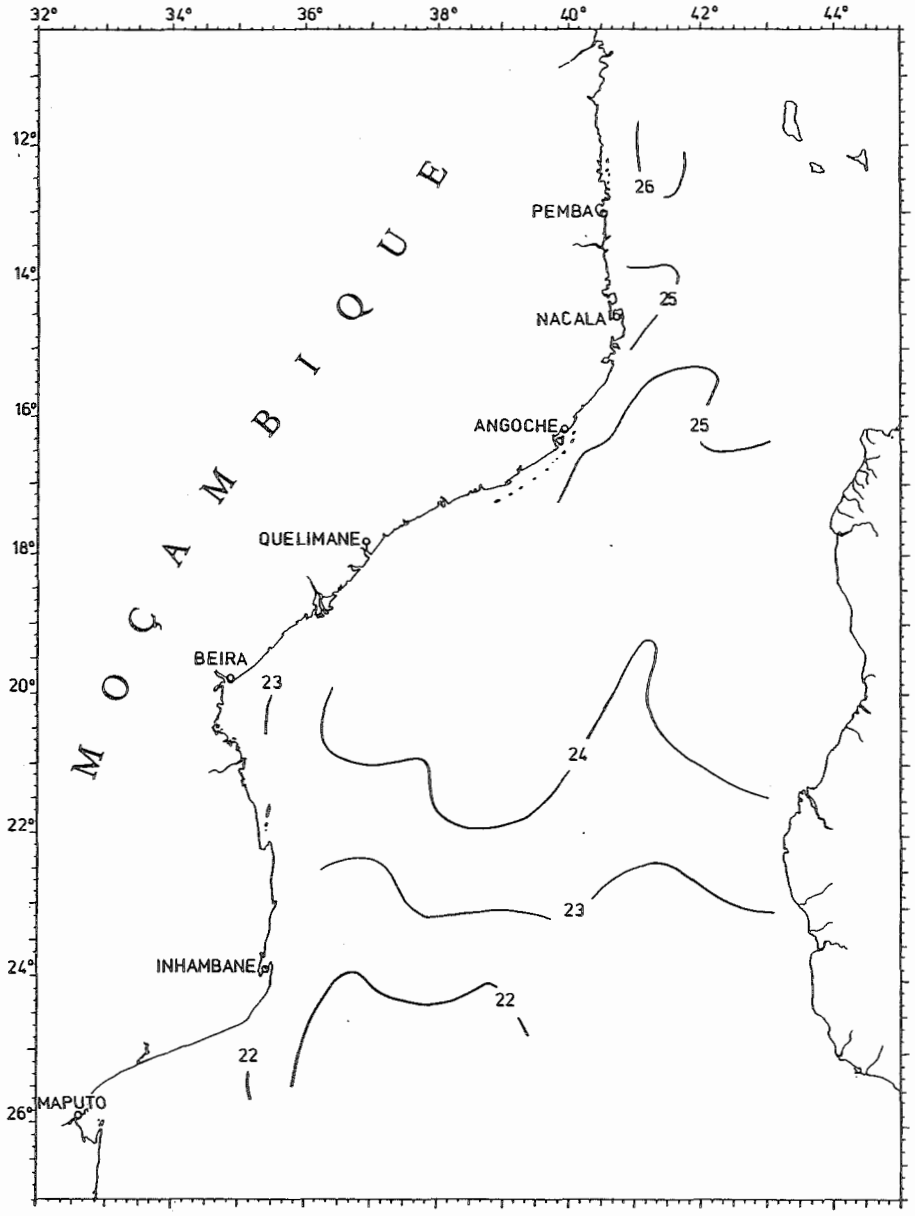

Fig. 61. ALMIRANTE LACERDA 1964. Surface temperature.

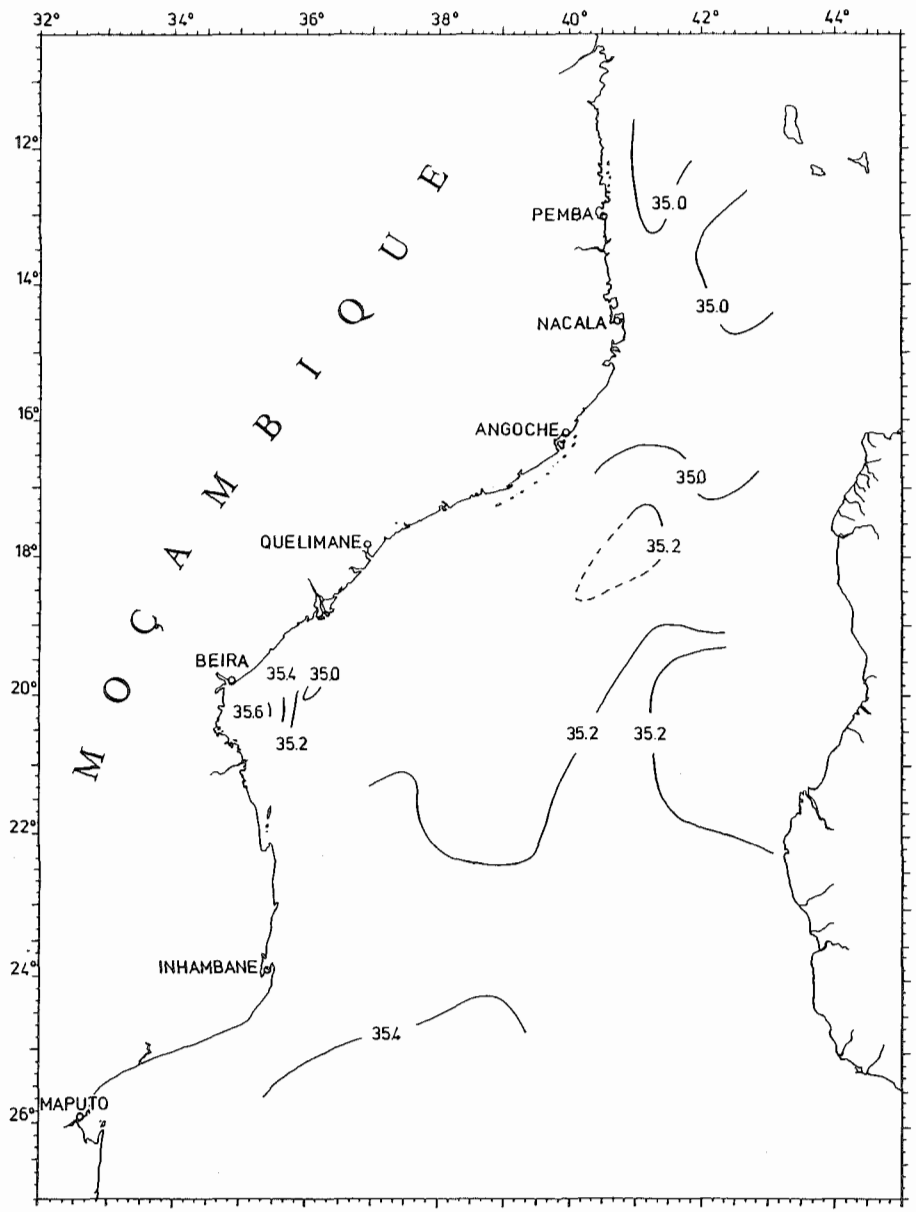

Fig. 62. ALMIRANTE LACERDA 1964. Surface salinity.

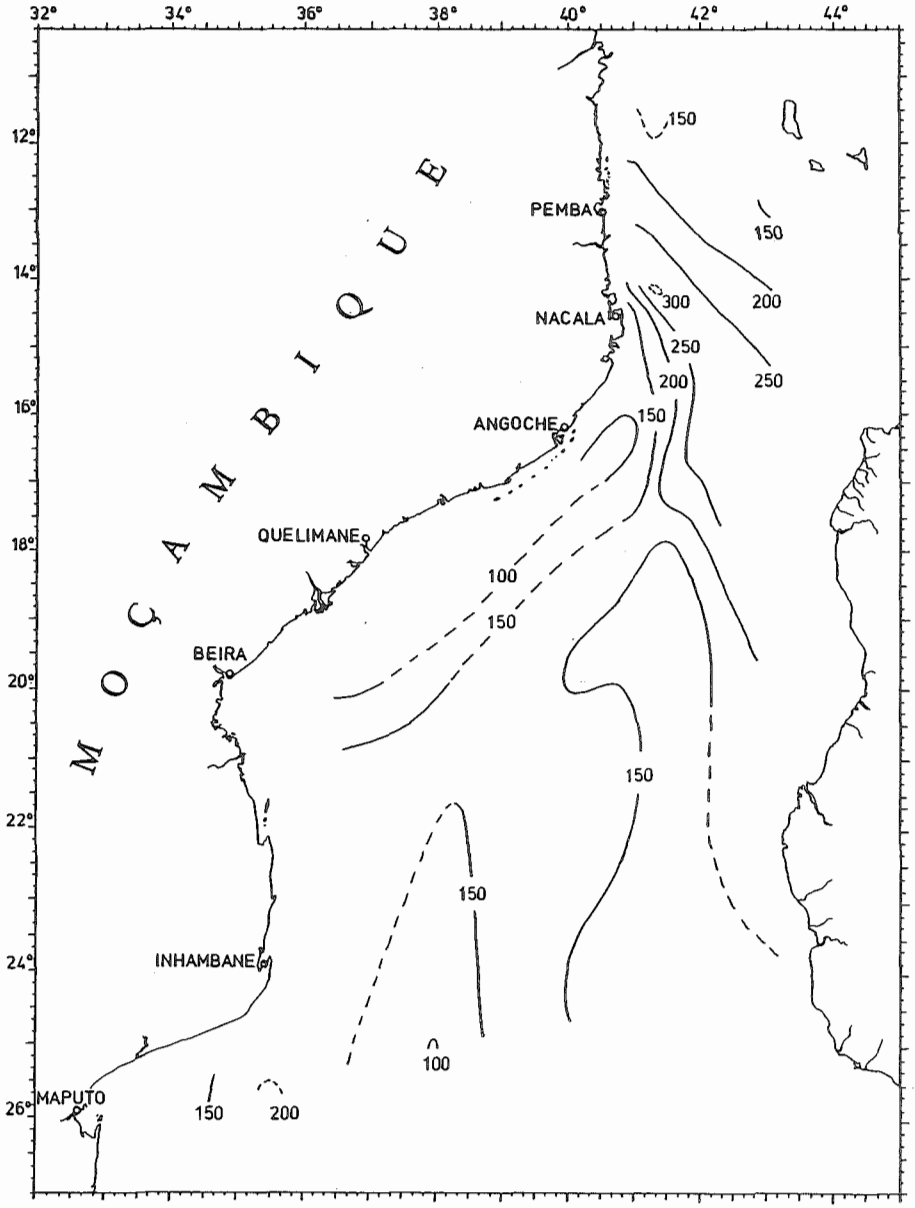

Fig. 63. ALMIRANTE LACERDA 1964. Depth of subsurface oxygen minimum.

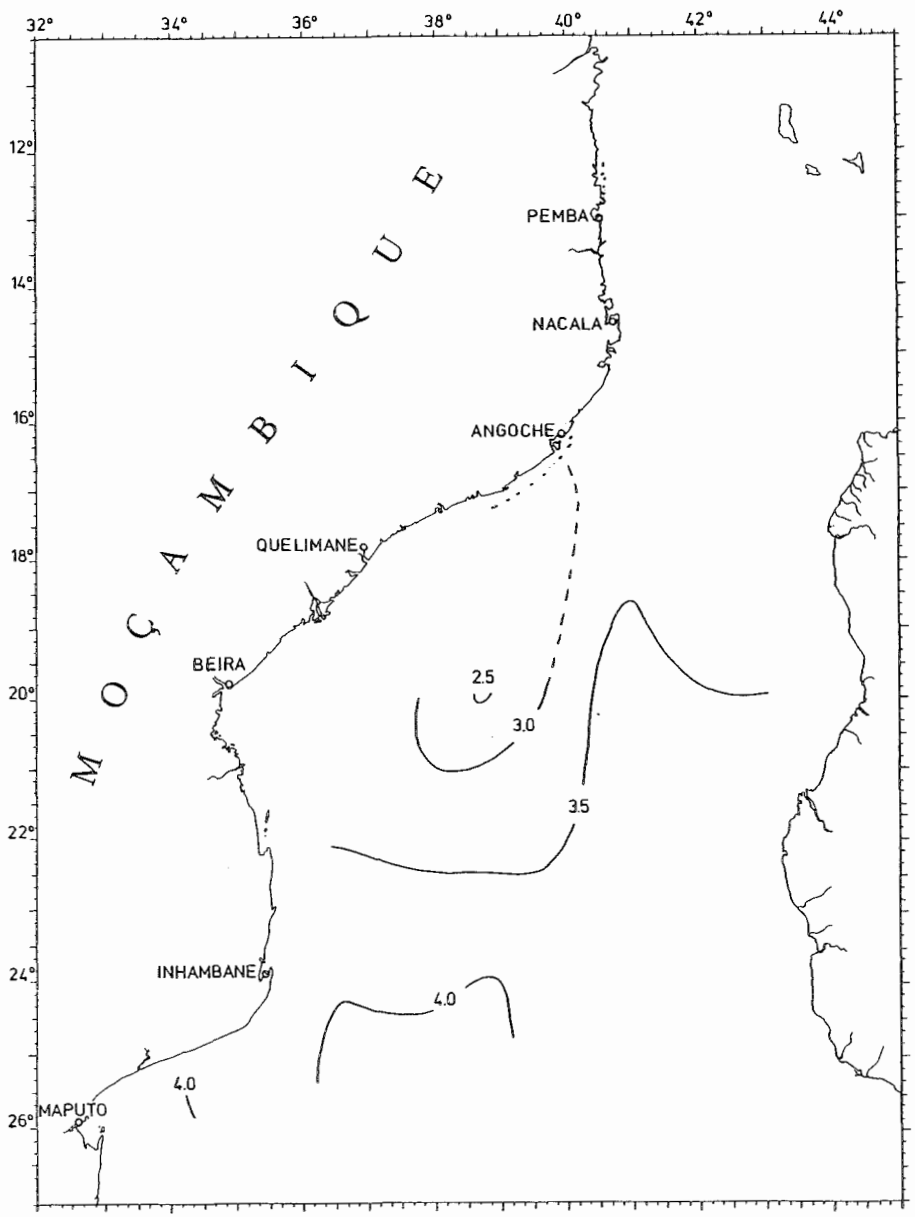

Fig. 64. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at subsurface oxygen minimum.

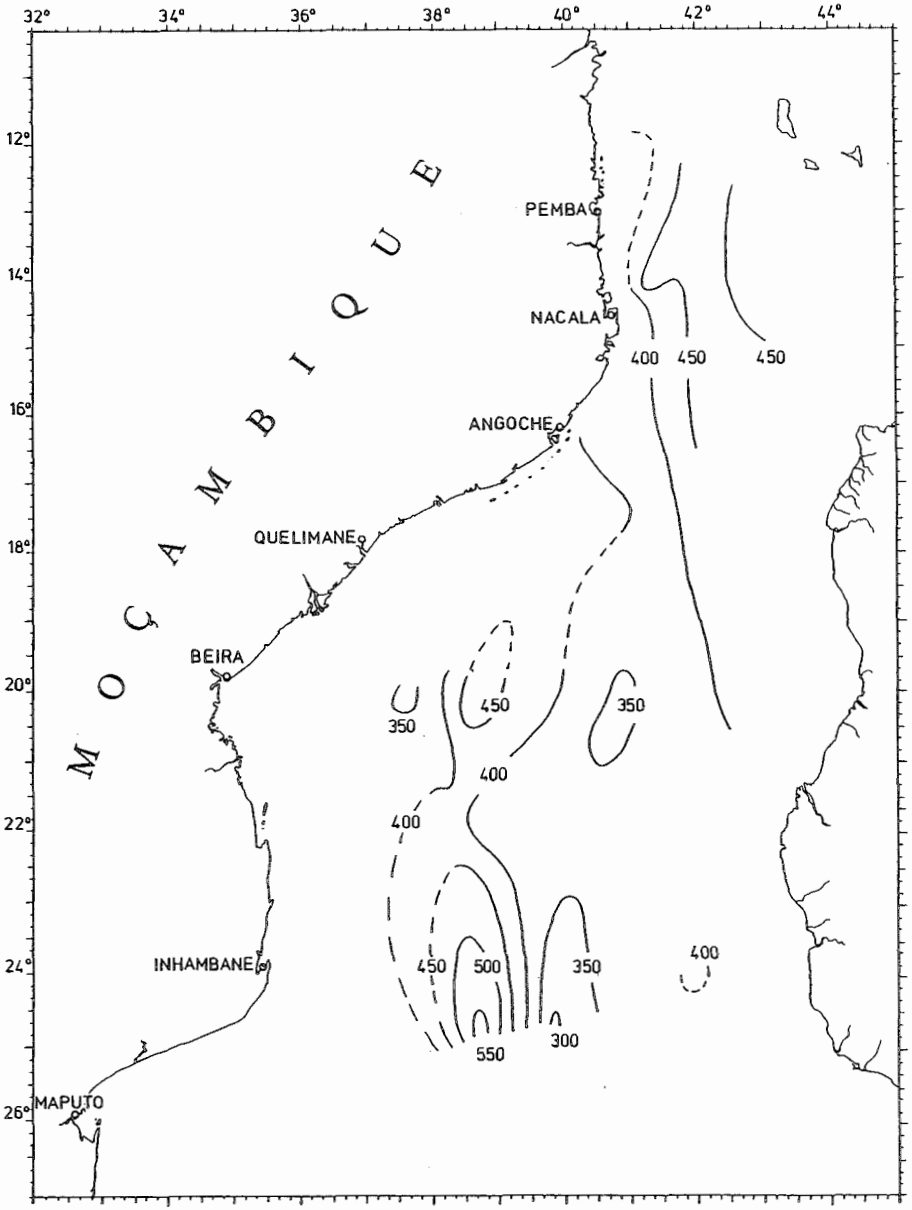

Fig. 65. ALMIRANTE LACERDA 1964. Depth of intermediate oxygen maximum.

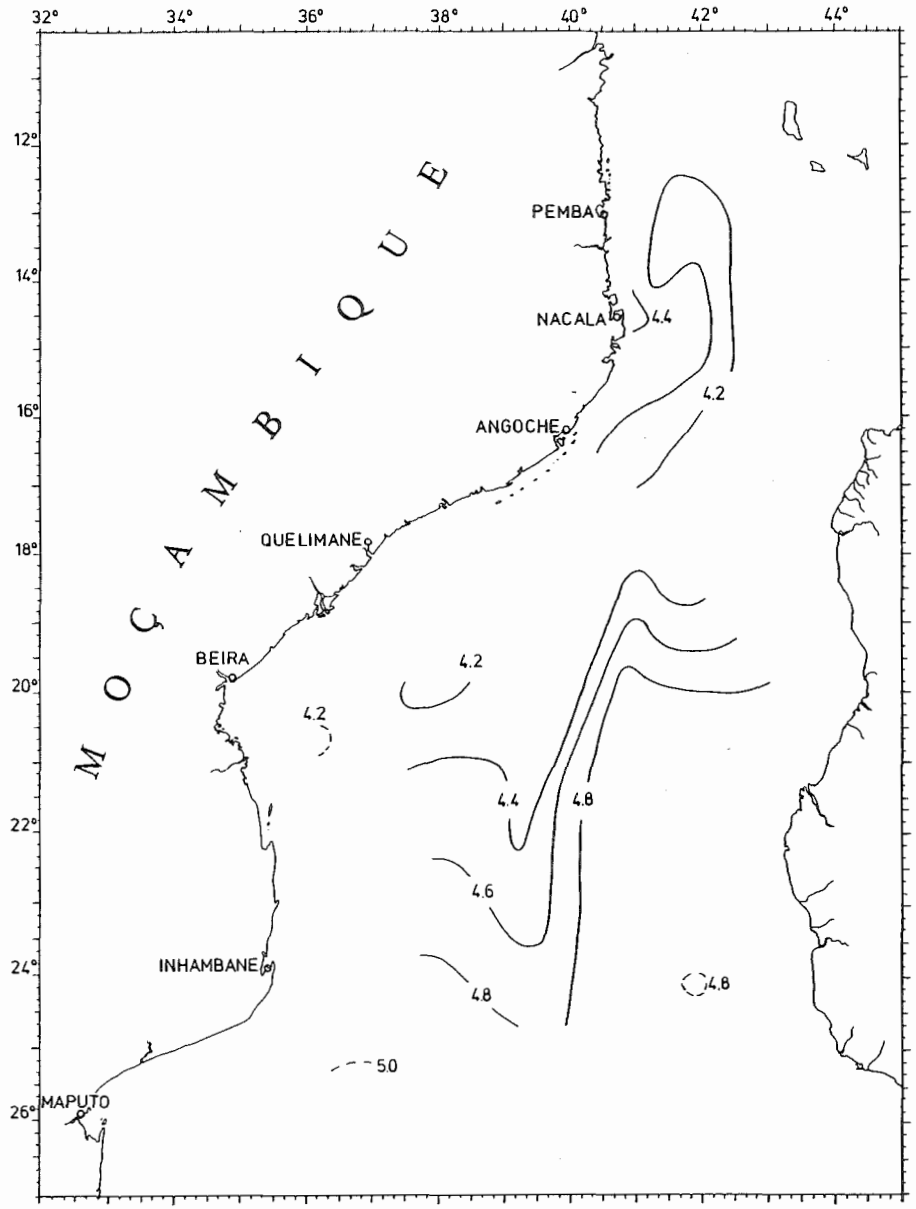

Fig. 66. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at intermediate oxygen maximum.

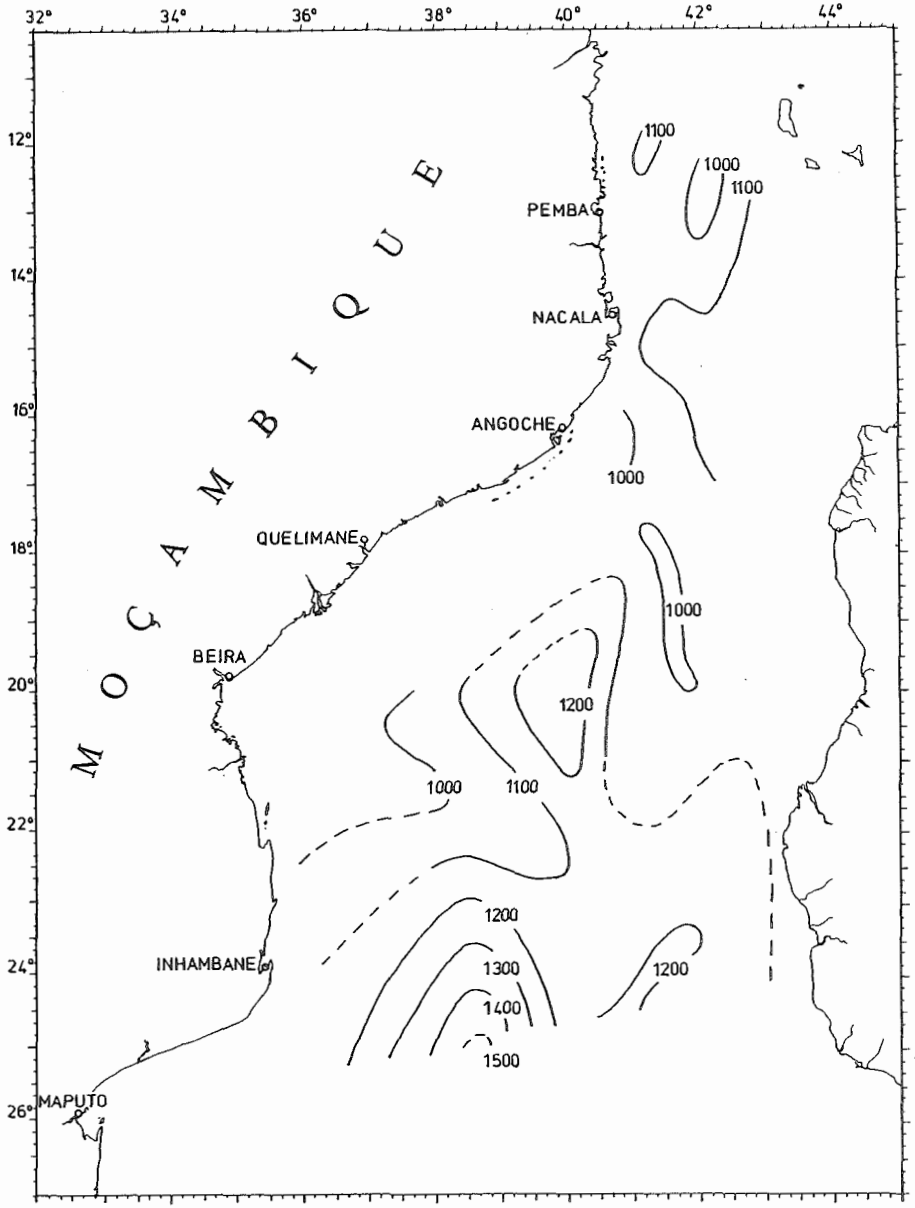

Fig. 67. ALMIRANTE LACERDA 1964. Depth of the deep oxygen minimum.

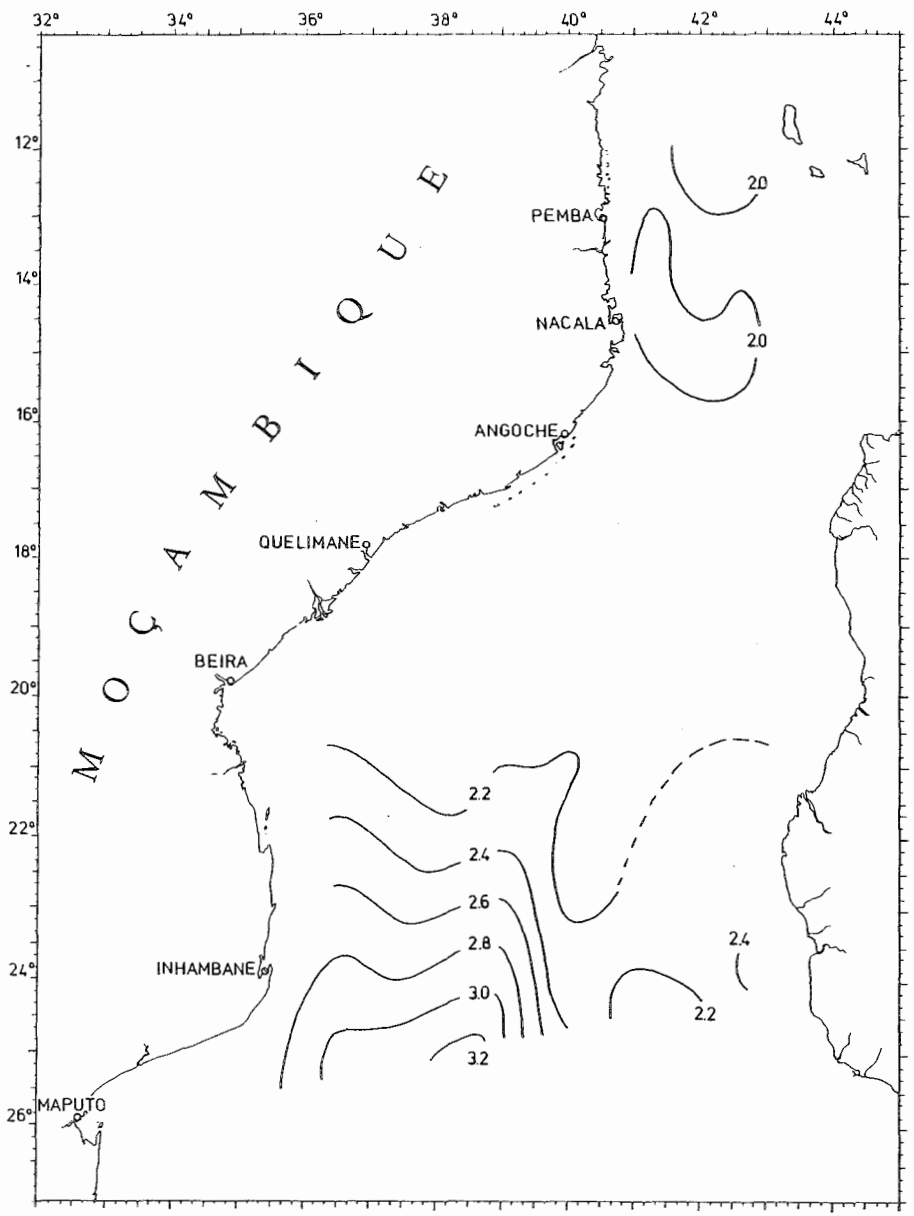

Fig. 68. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at the deep oxygen minimum.

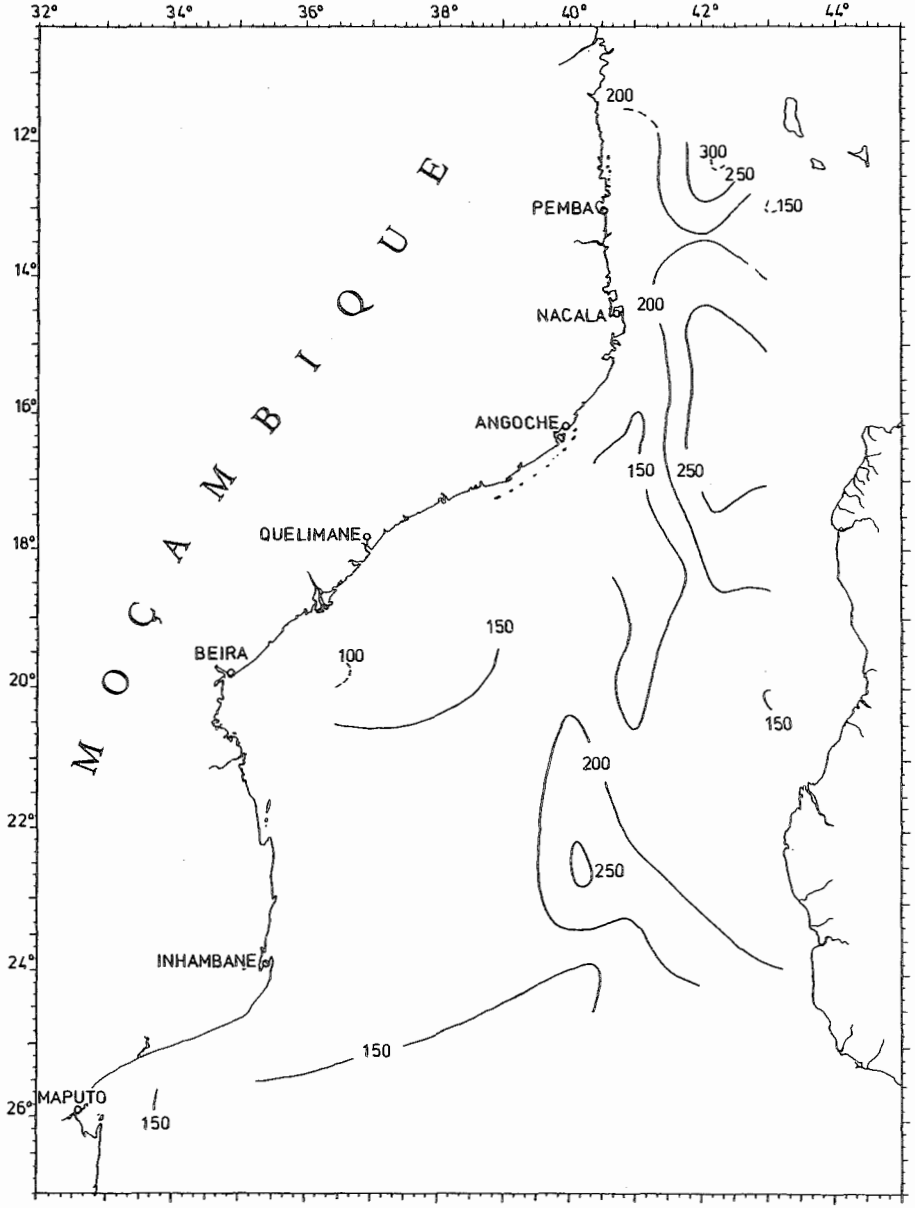

Fig. 69. ALMIRANTE LACERDA 1964. Depth of the sub-surface salinity maximum.

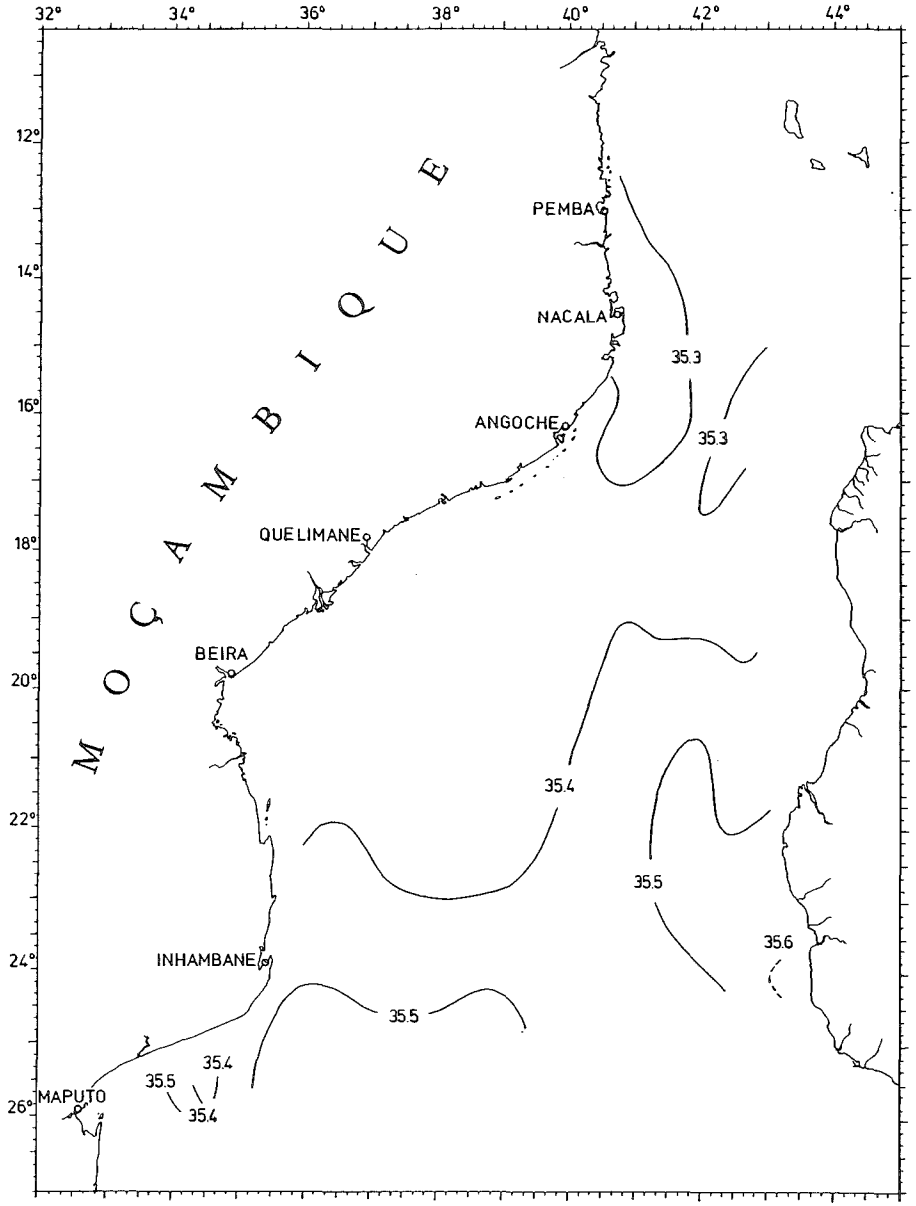

Fig. 70. ALMIRANTE LACERDA 1964. Salinity at the subsurface salinity maximum.

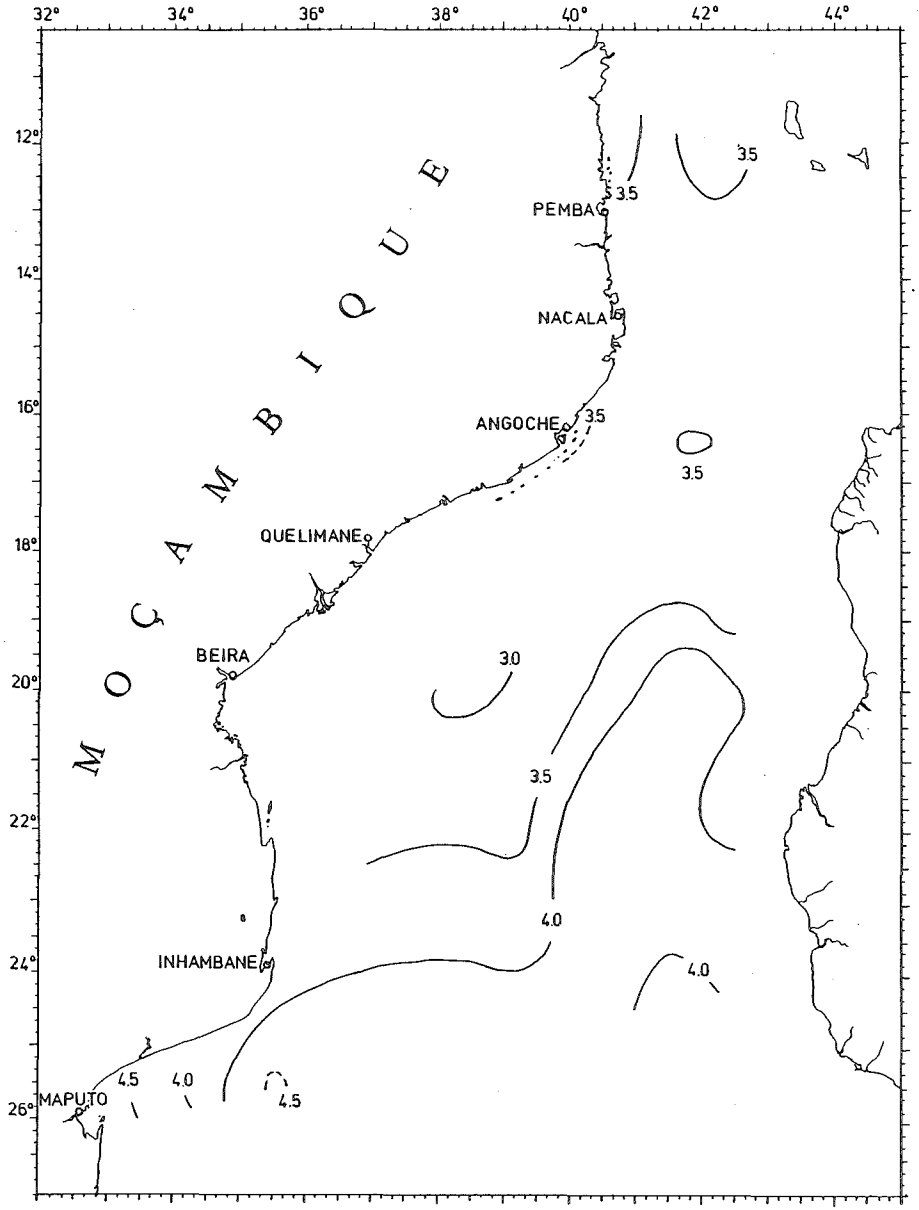

Fig. 71. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at the subsurface salinity maximum.

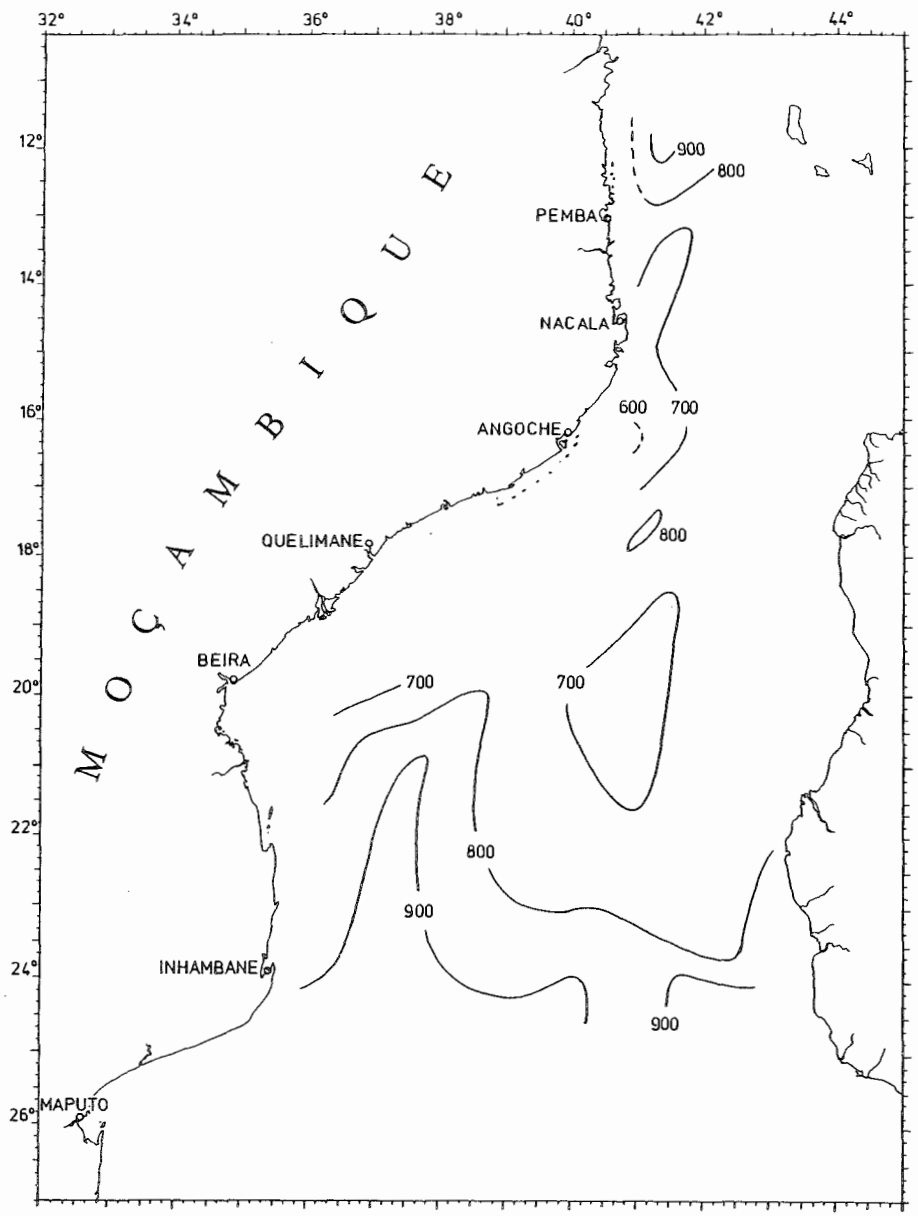

Fig. 72. ALMIRANTE LACERDA 1964. Depth of the intermediate salinity minimum.

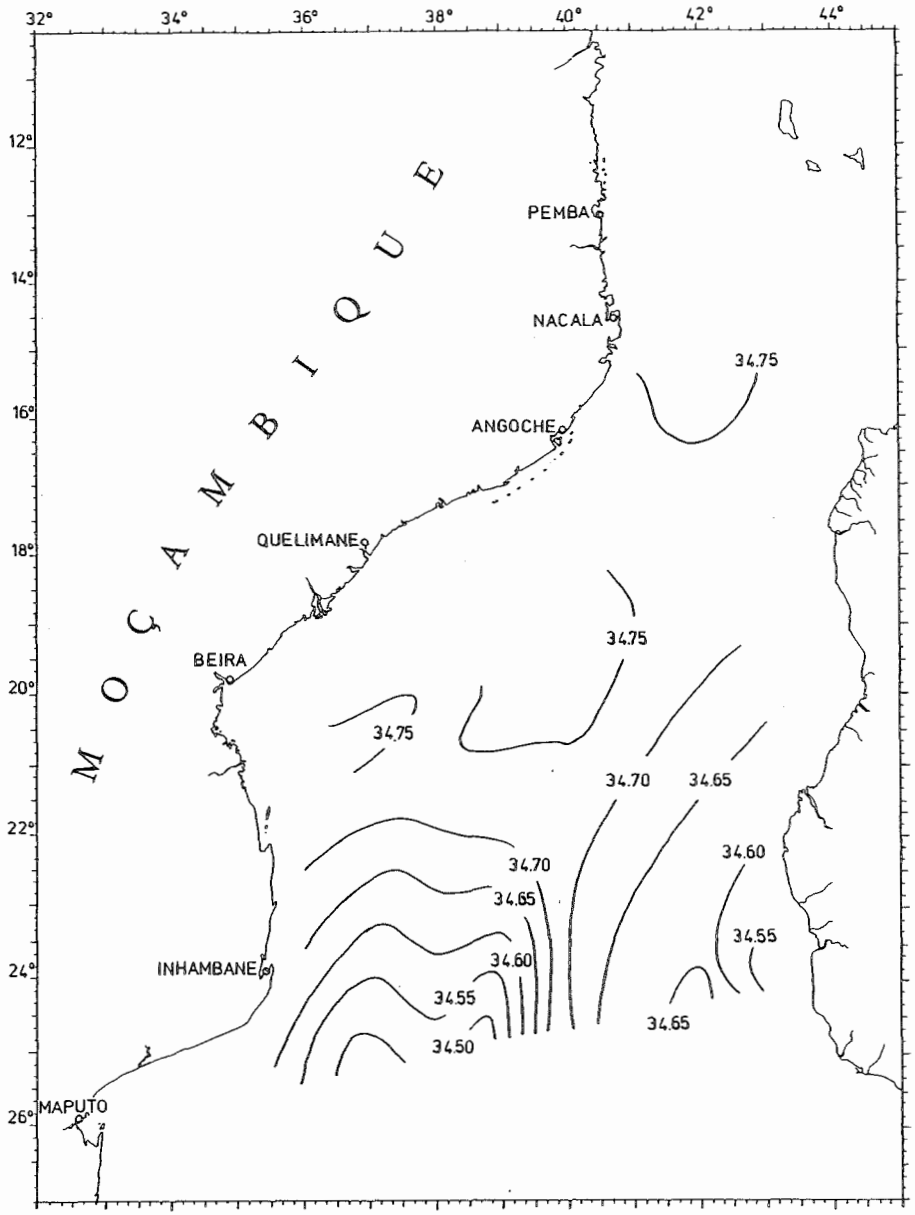

Fig. 73. ALMIRANTE LACERDA 1964. Salinity at the intermediate salinity minimum.

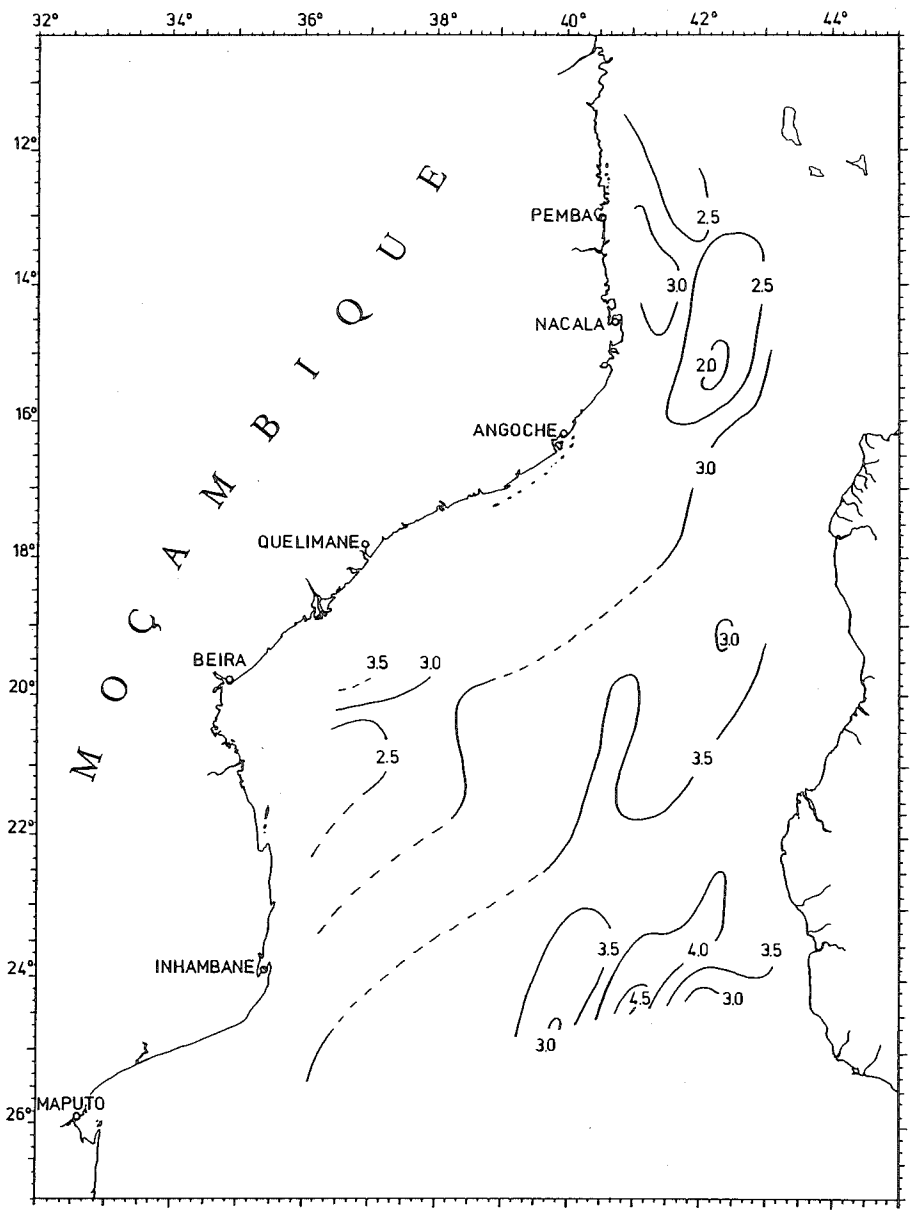

Fig. 74. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at the intermediate salinity minimum.

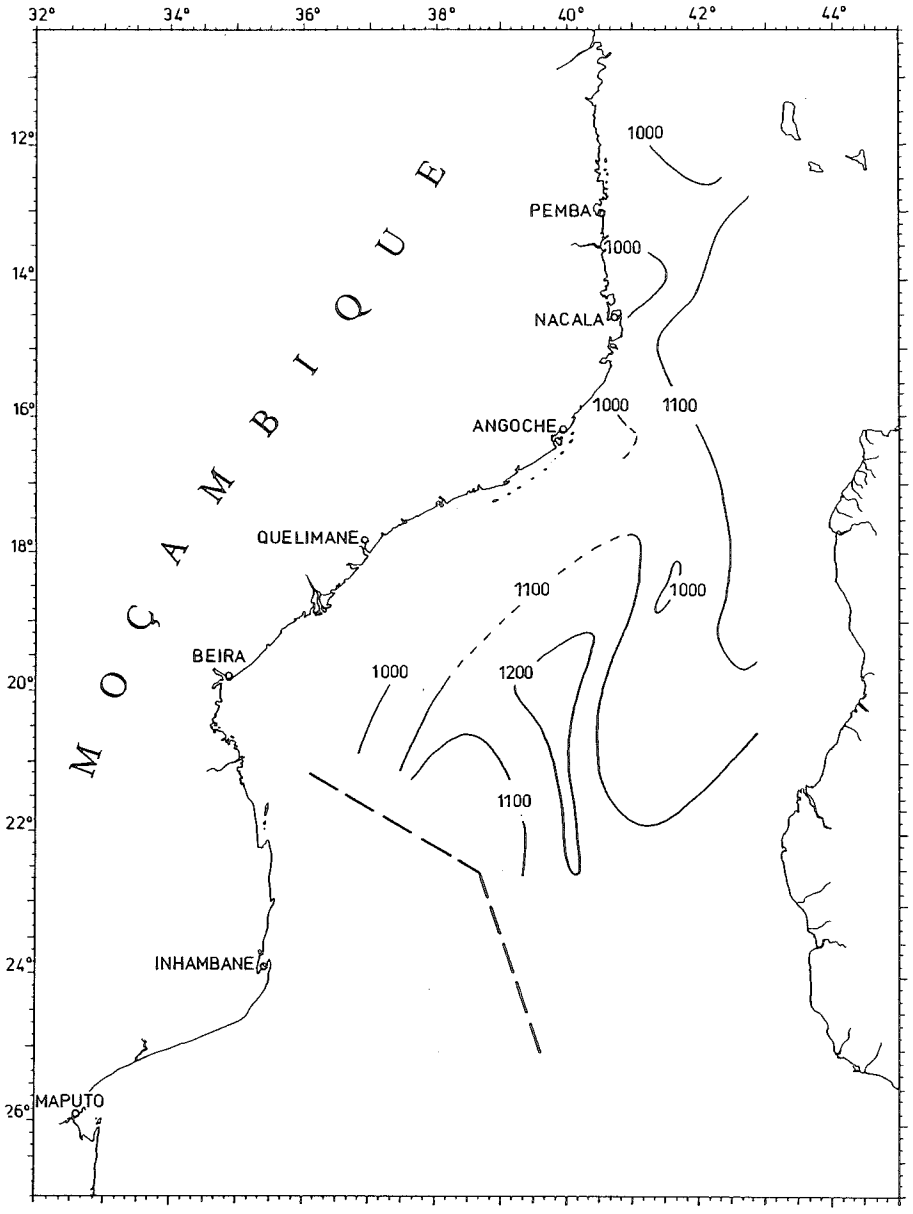

Fig. 75. ALMIRANTE LACERDA 1964. Depth of the intermediate salinity maximum. No maximum observed south of heavy dotted line.

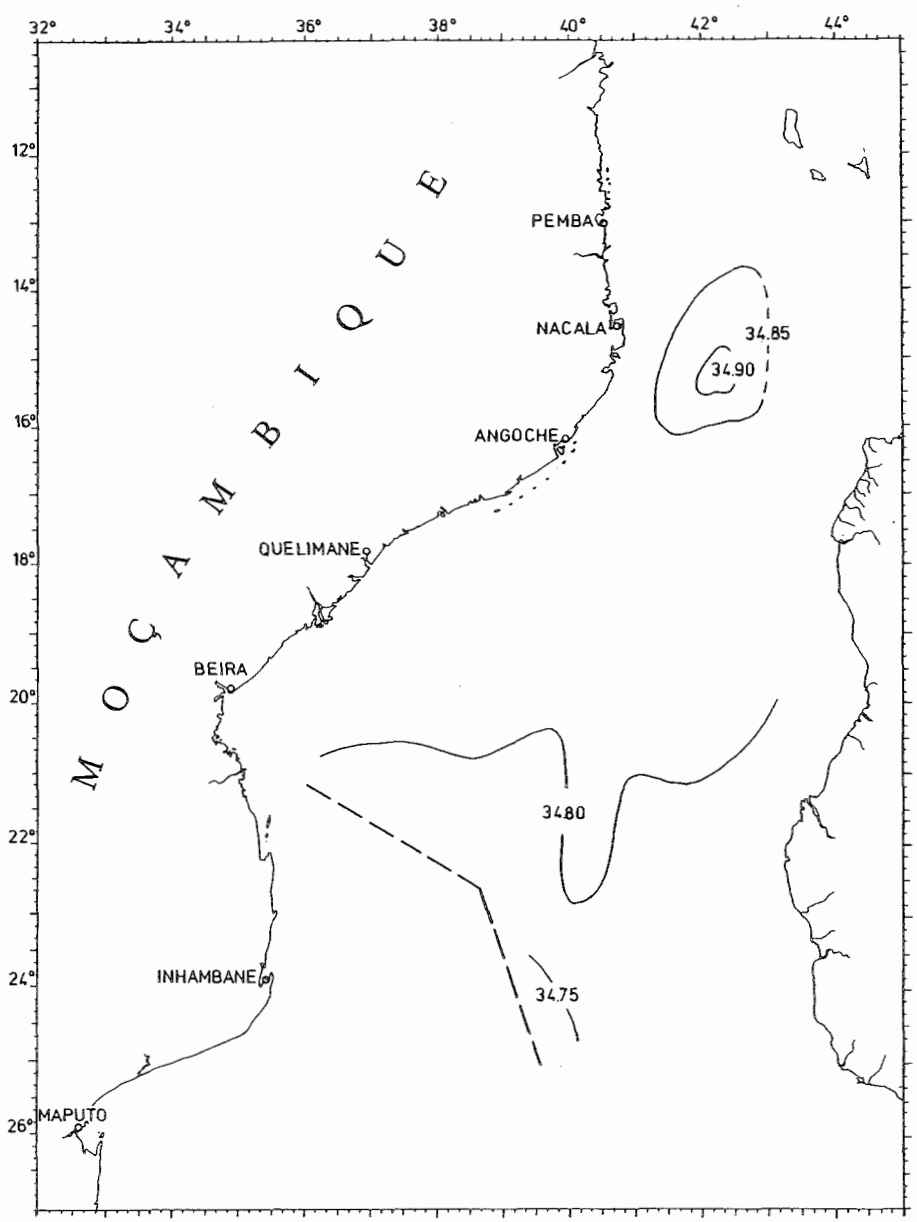

Fig. 76. ALMIRANTE LACERDA 1964. Salinity at intermediate salinity maximum. No maximum observed south of heavy dotted line.

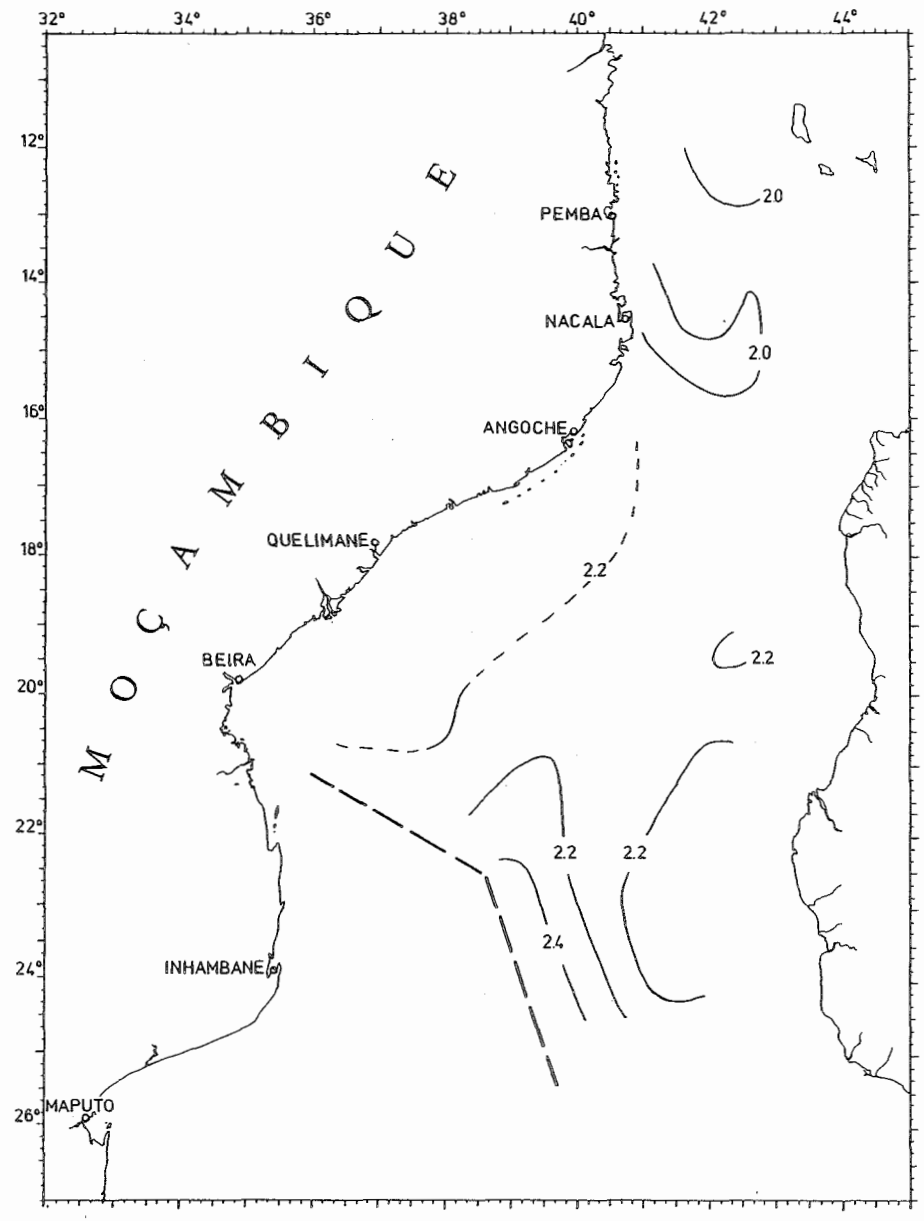

Fig. 77. ALMIRANTE LACERDA 1964. Oxygen (ml/l) at the intermediate salinity maximum. No maximum observed south of heavy dotted line.

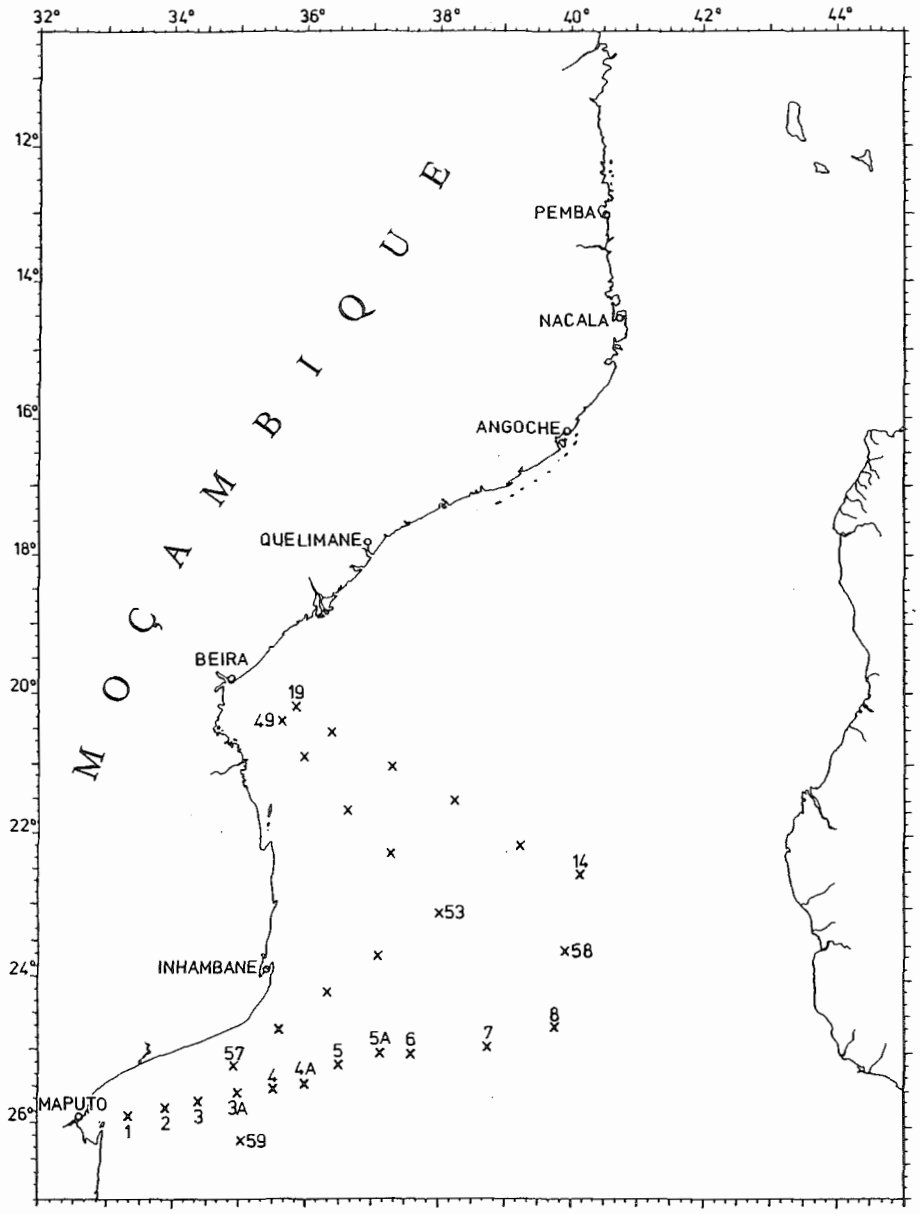

Fig. 78. ALMIRANTE LACERDA, 16 Apr.-6 May 1965.
Grid of stations.

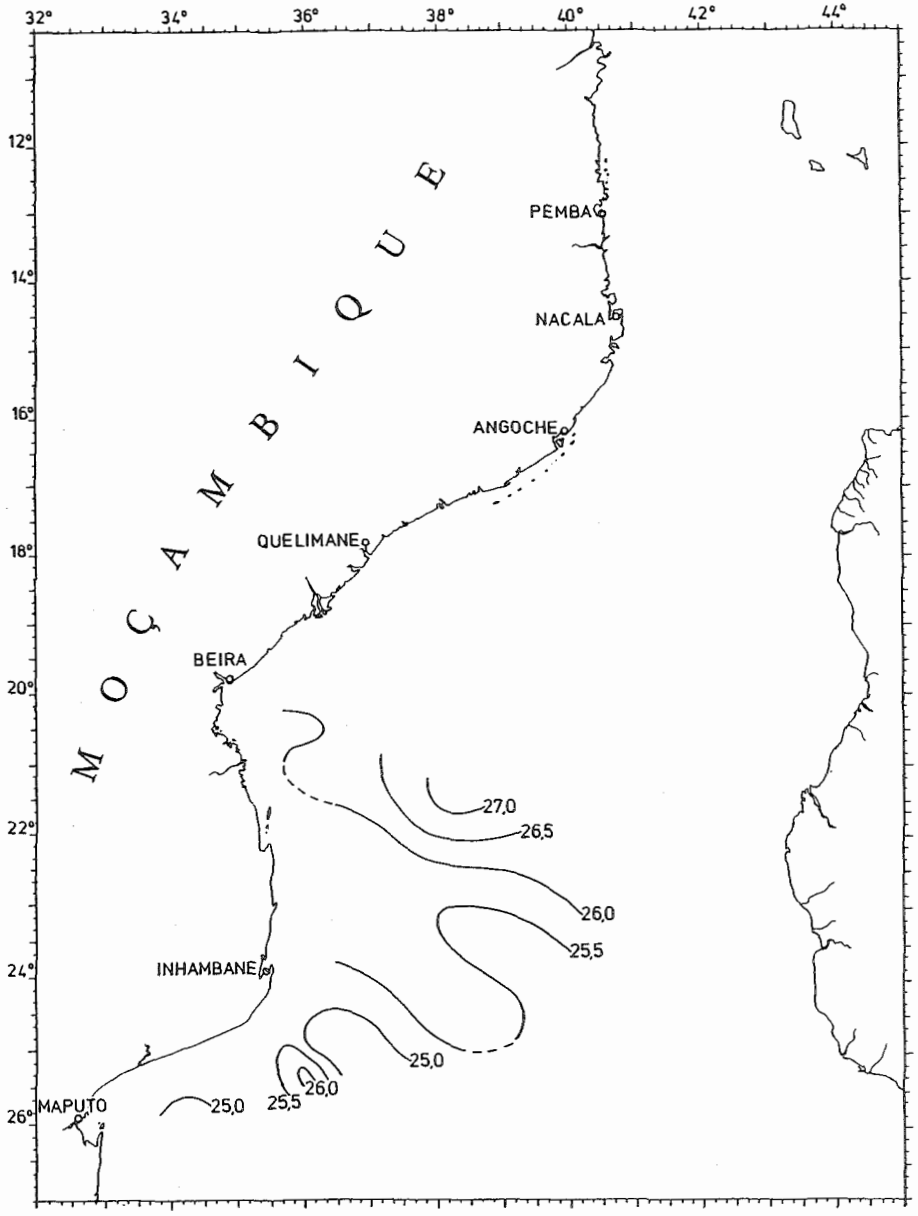

Fig. 79. ALMIRANTE LACERDA 1965. Surface temperature.

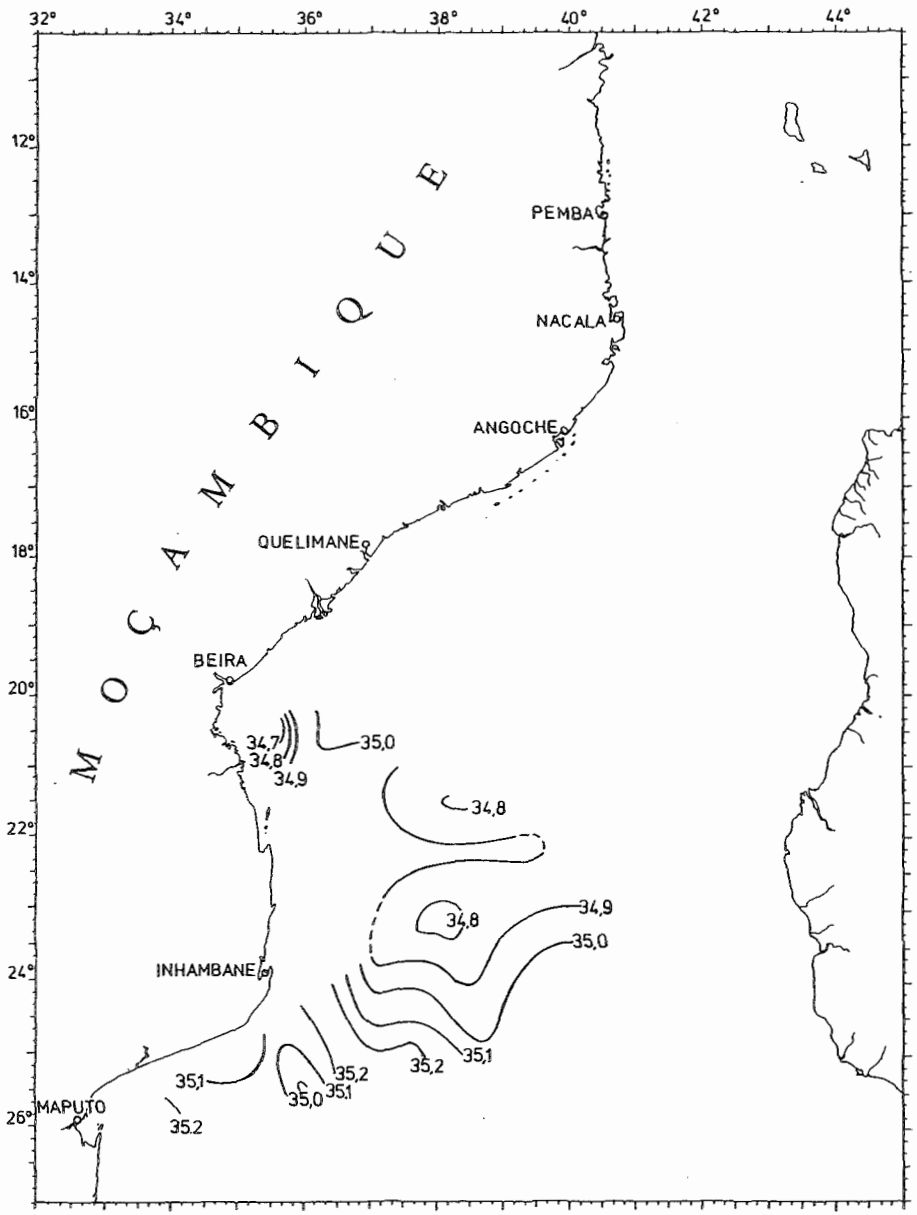

Fig. 80. ALMIRANTE LACERDA 1965. Surface salinity.

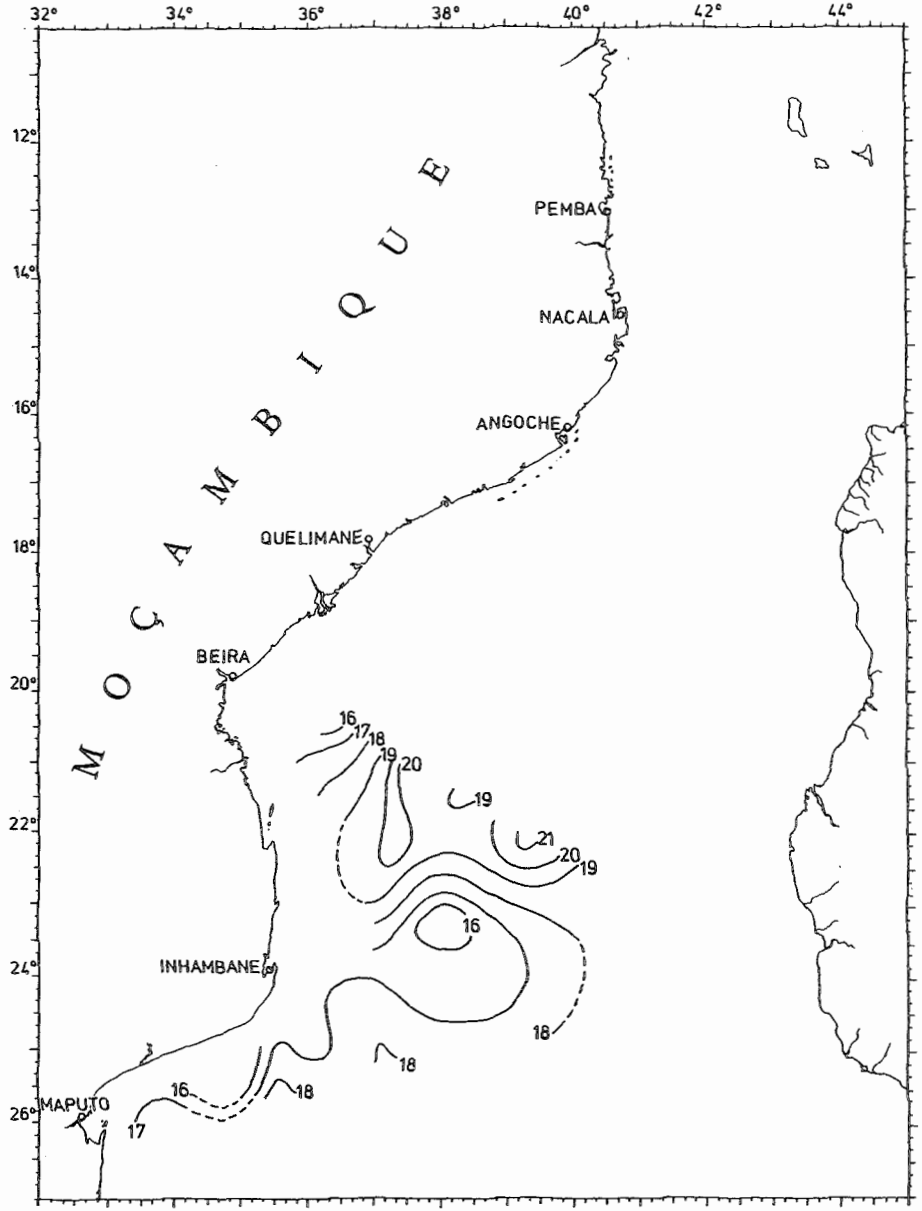

Fig. 81. ALMIRANTE LACERDA 1965. Temperature in 150 m.

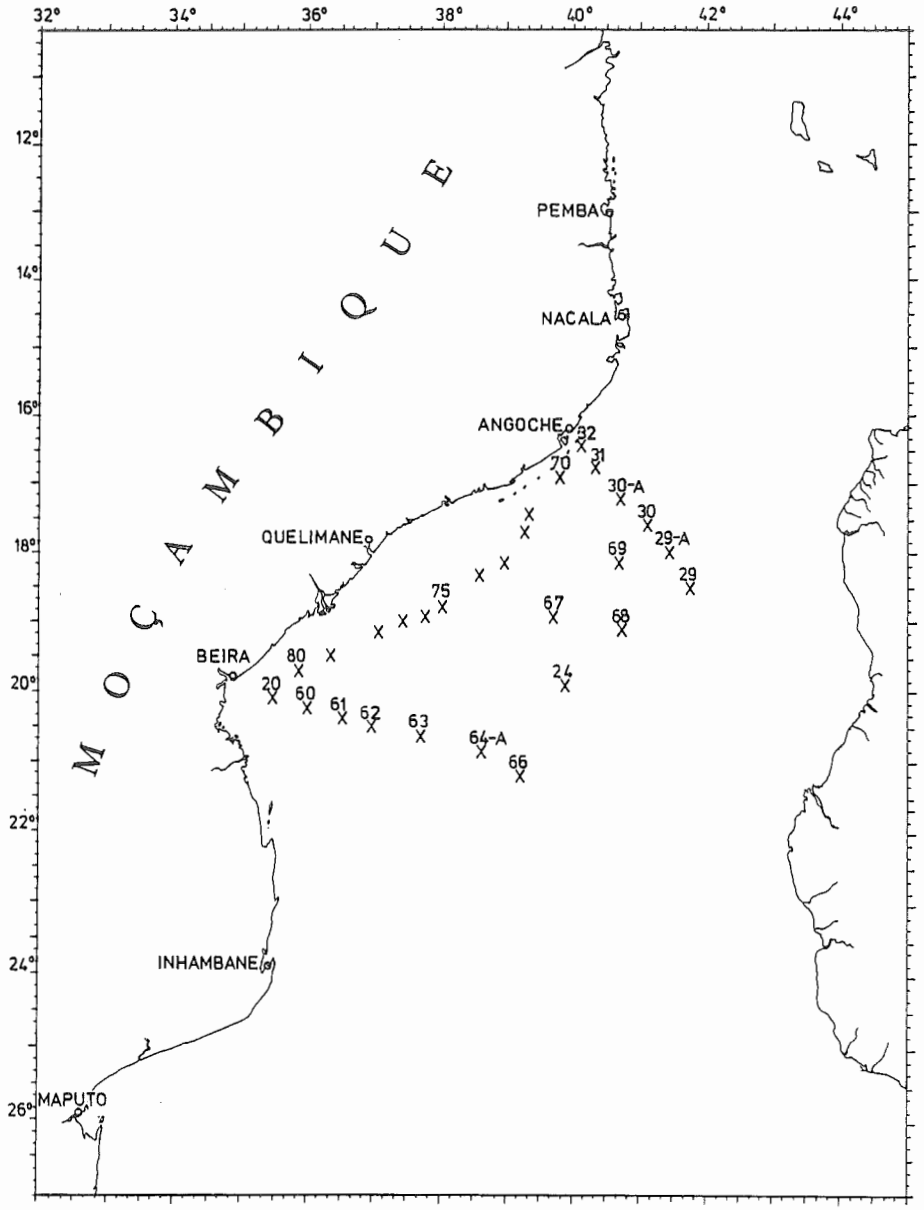

Fig. 82. ALMIRANTE LACERDA, 12-21 Jul. 1966.
Grid of stations.

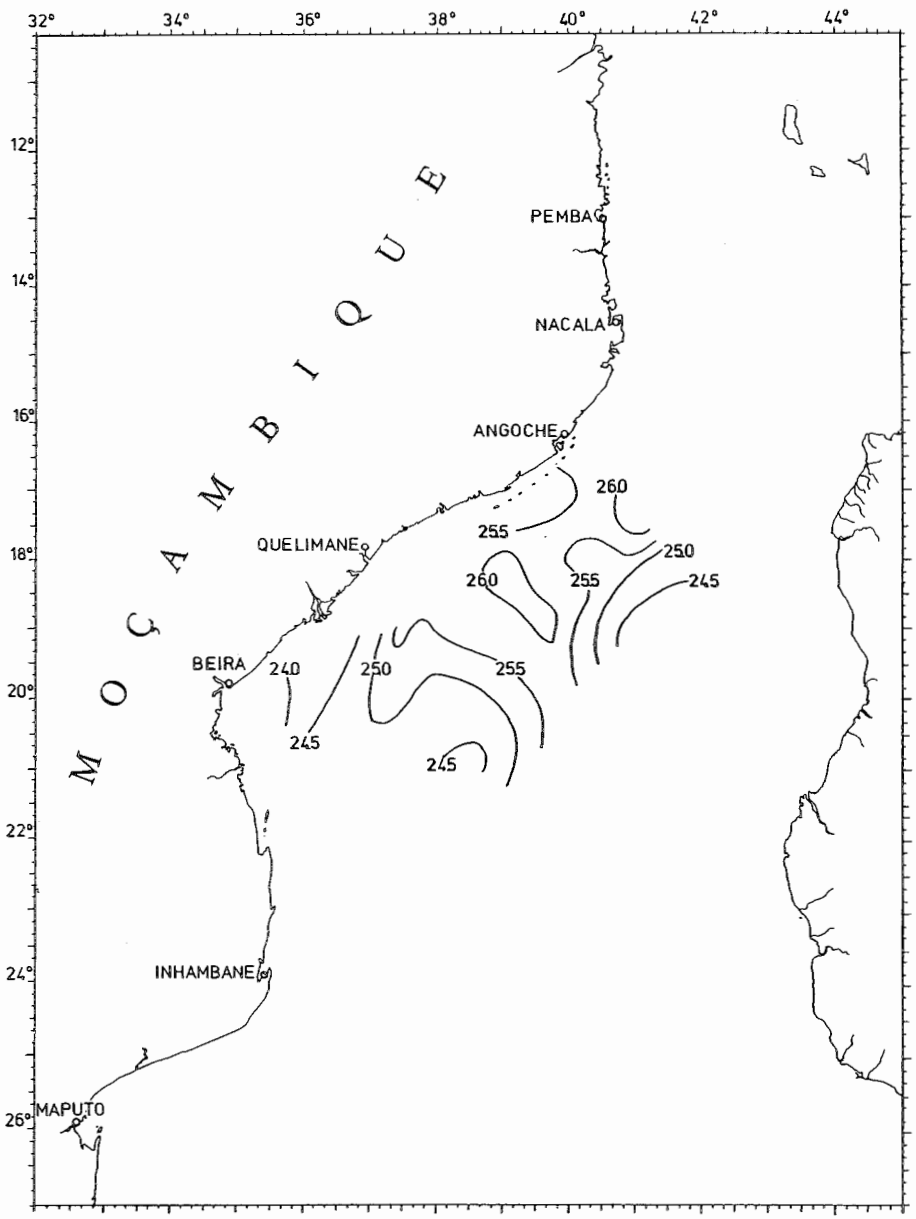

Fig. 83. ALMIRANTE LACERDA 1966. Surface temperature.

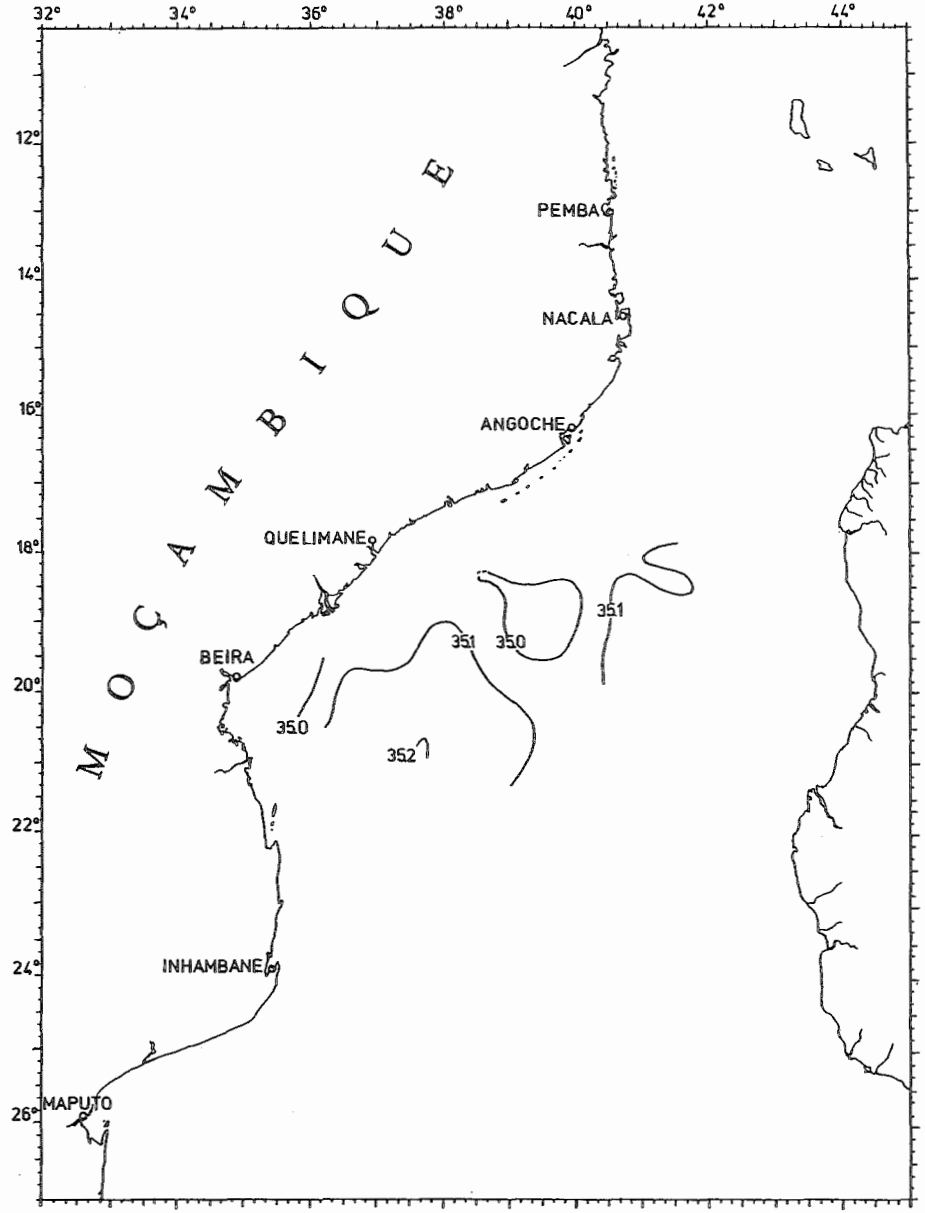

Fig. 84. ALMIRANTE LACERDA 1966. Surface salinity.

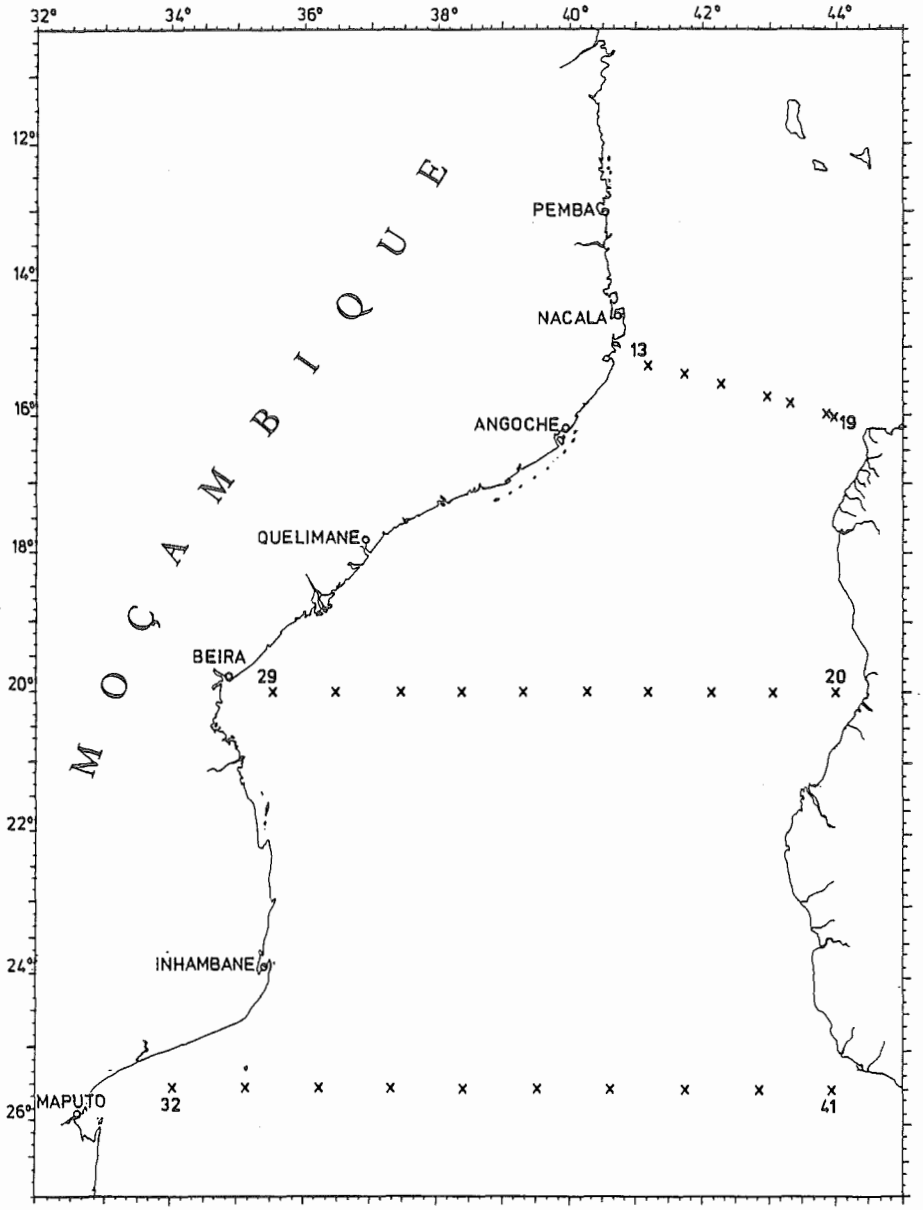

Fig. 85. ARIEL, 24 Jul.-5 Aug. 1968. Grid of stations.

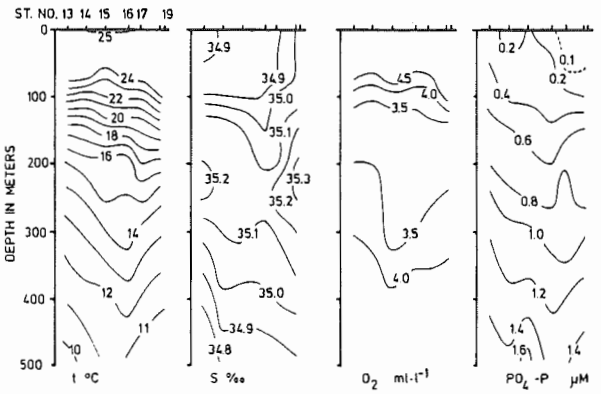

Fig. 86. ARIEL 1968. t°C, S°/oo, O_2 ml/l and PO_4-PµM st. nos. 13-19.

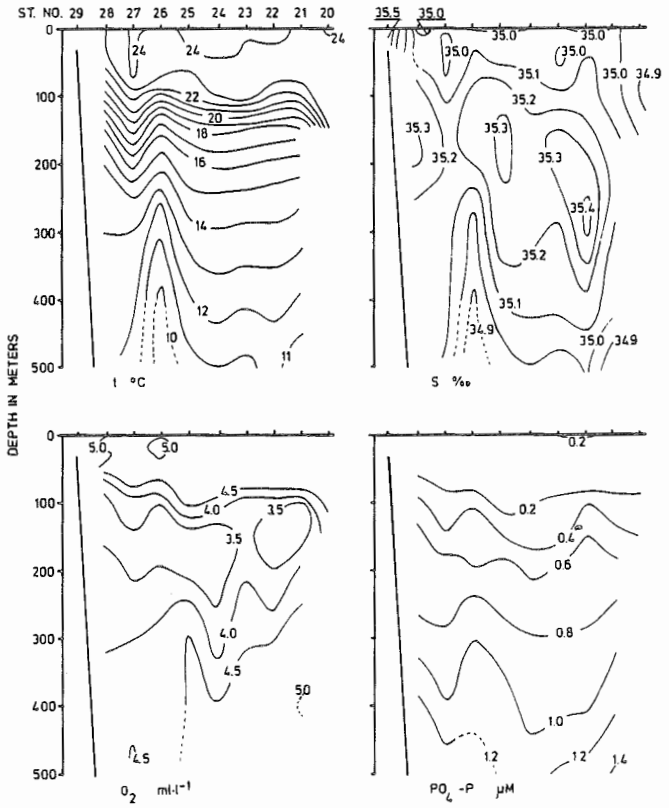

Fig. 87. ARIEL 1968. t°C, S°/oo, O_2 ml/l and PO_4-PµM st. nos. 20-29.

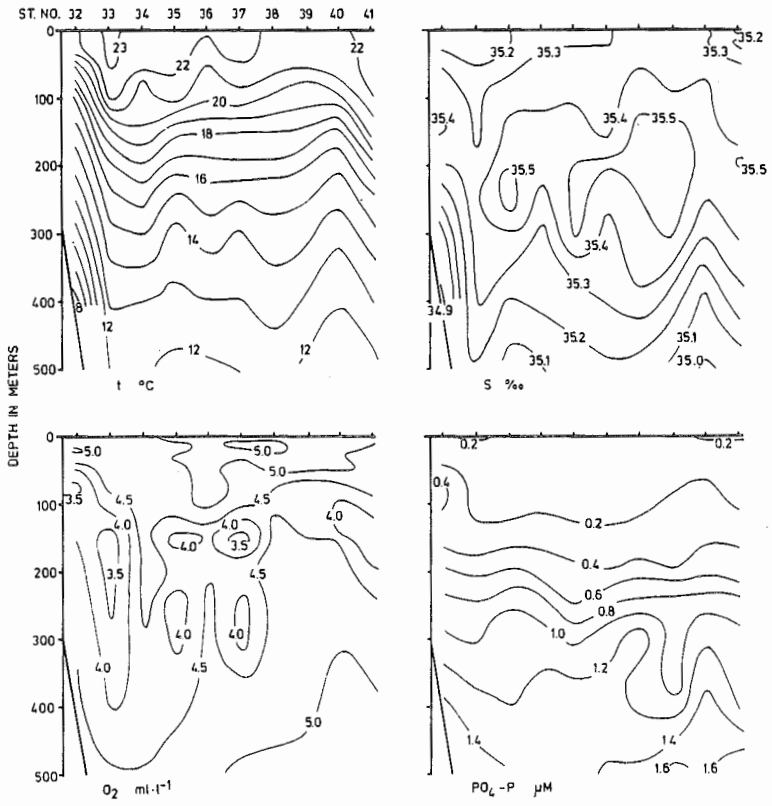

Fig. 88. ARIEL 1968. t°C, S°/oo, O_2 ml/l and PO_4-PµM st. nos. 32-41.

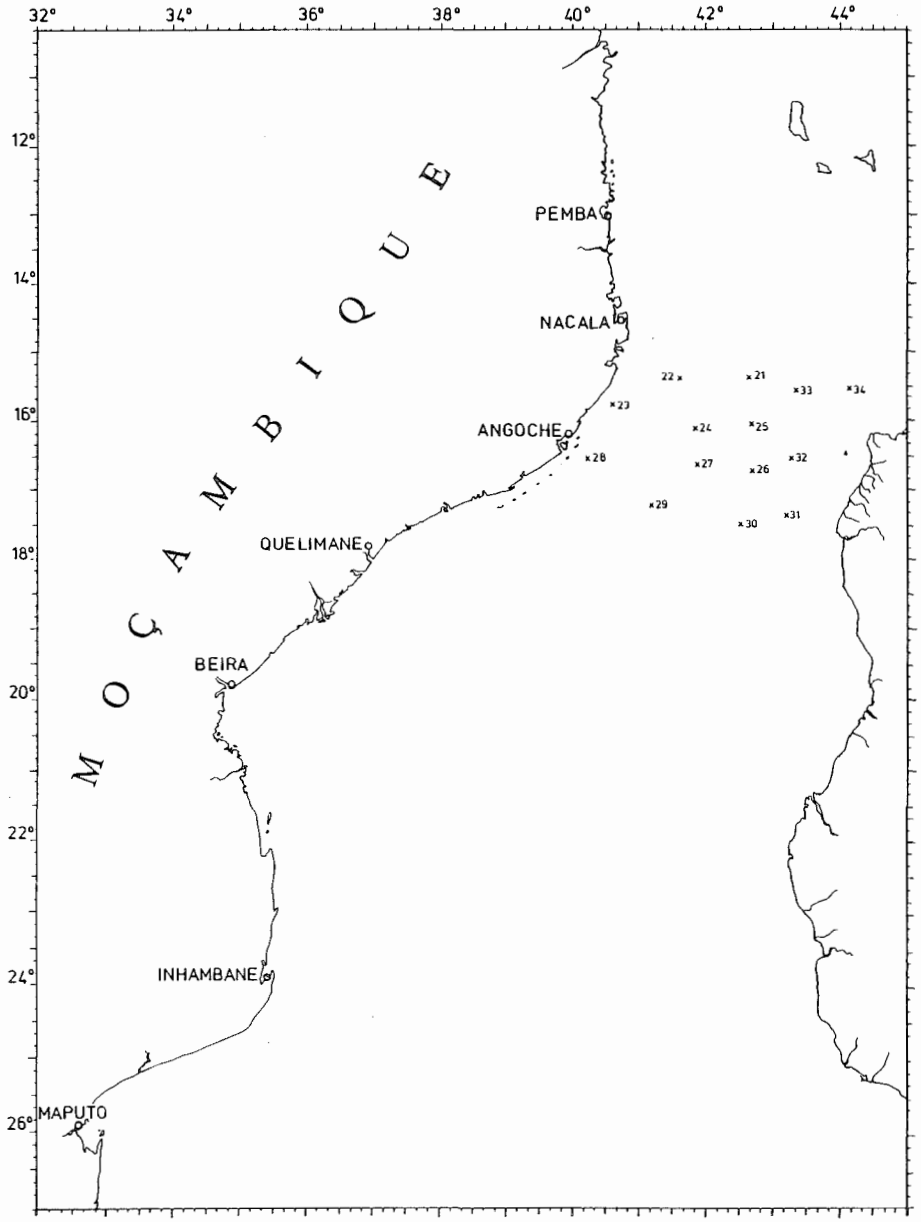

Fig. 89. VAUBAN, 20-26 Mar. 1973. Grid of stations.

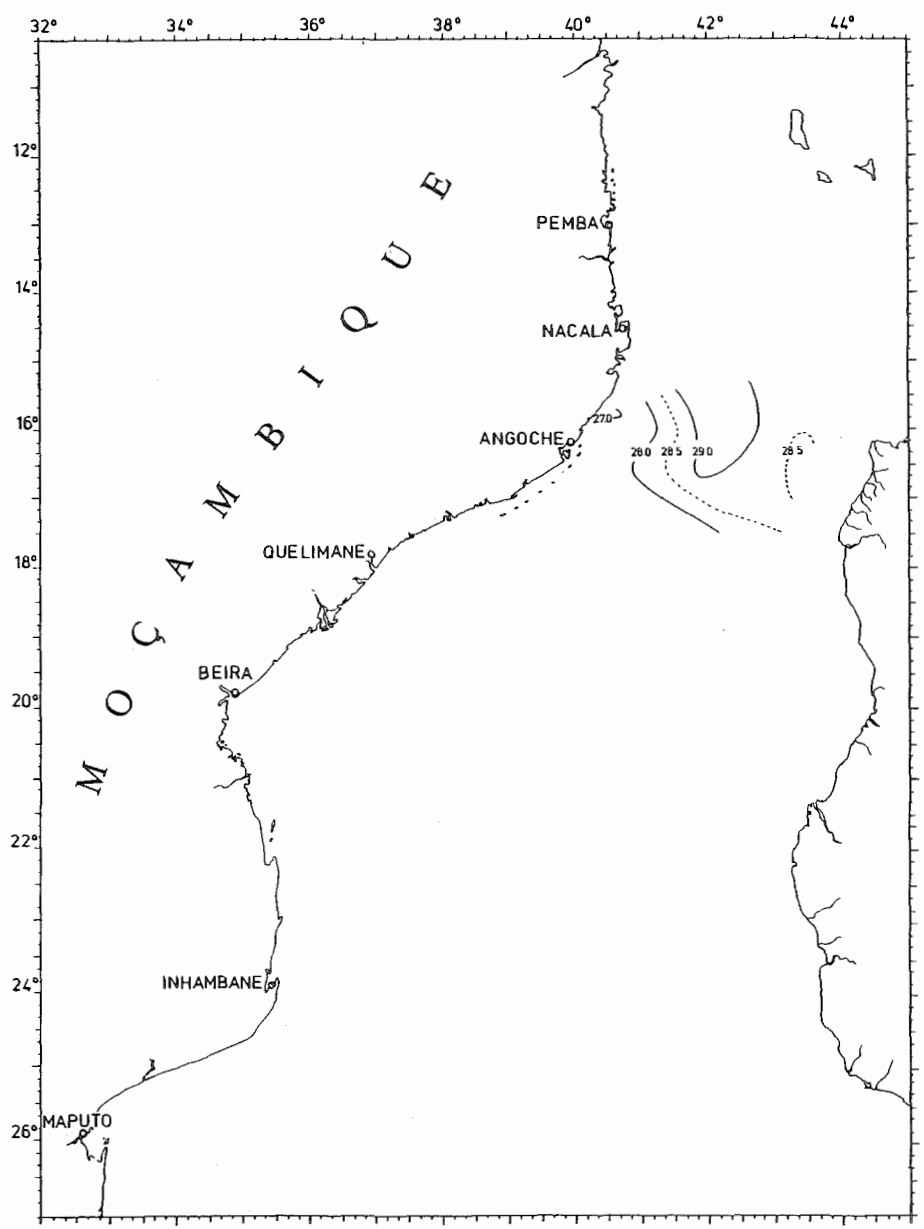

Fig. 90. VAUBAN 1973. Surface temperature.

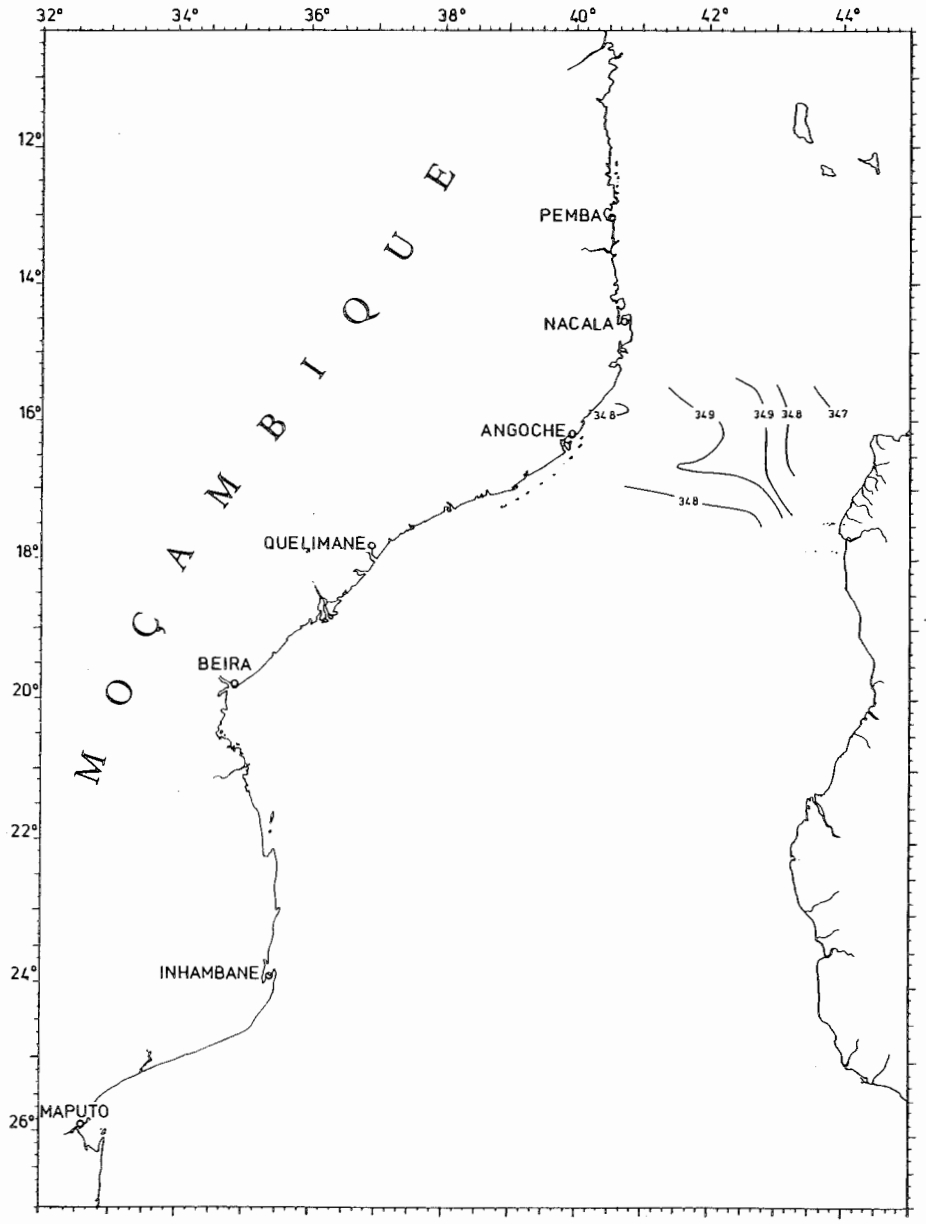

Fig. 91. VAUBAN 1973. Surface salinity.

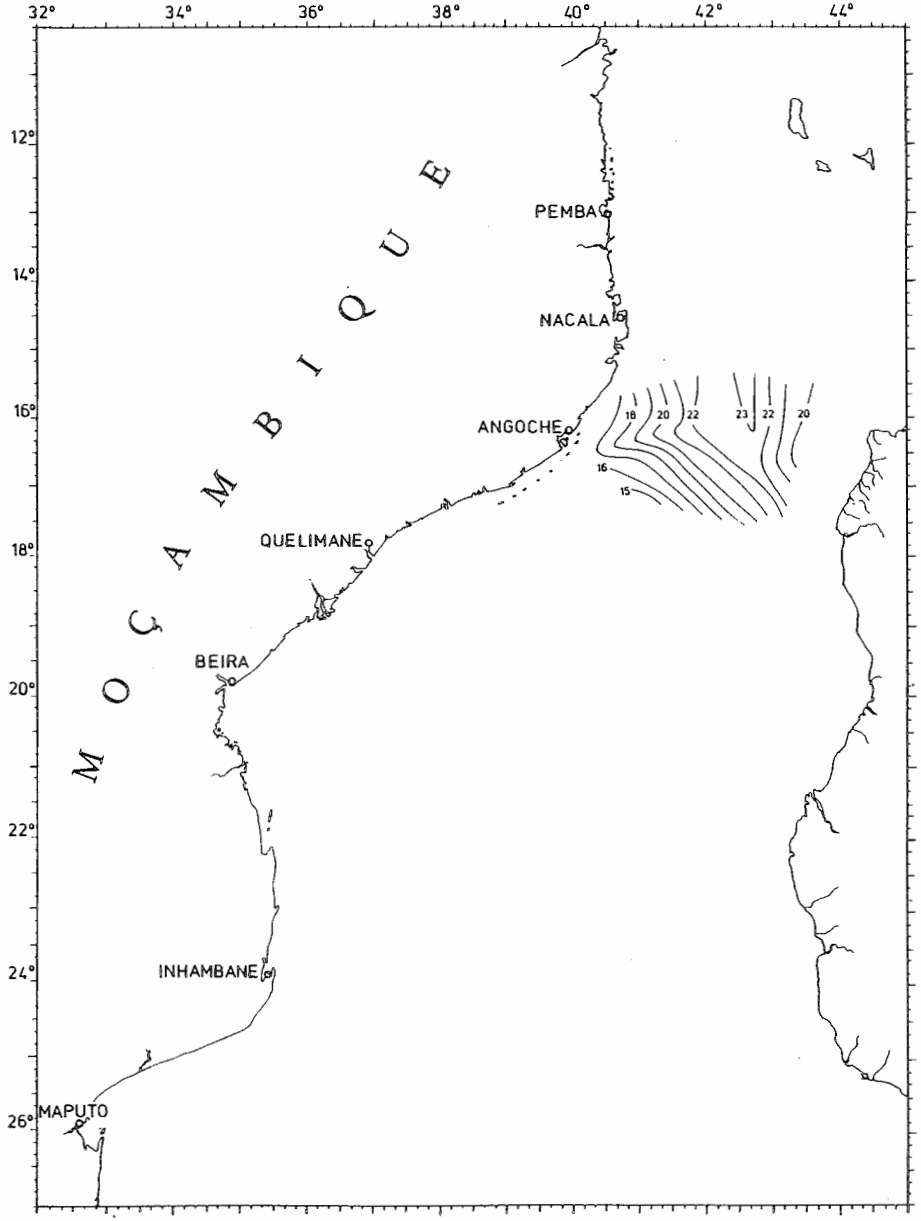

Fig. 92. VAUBAN 1973. Temperature in 150 m.

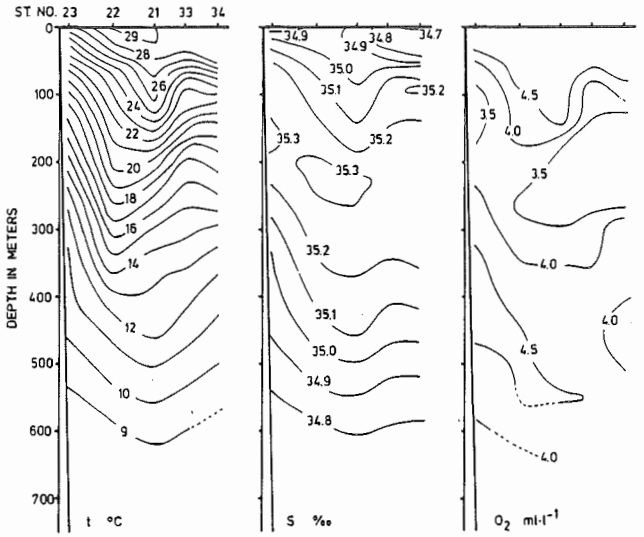

Fig. 93. VAUBAN 1973. t°C, S°/oo and O_2 ml/l - E-W section.

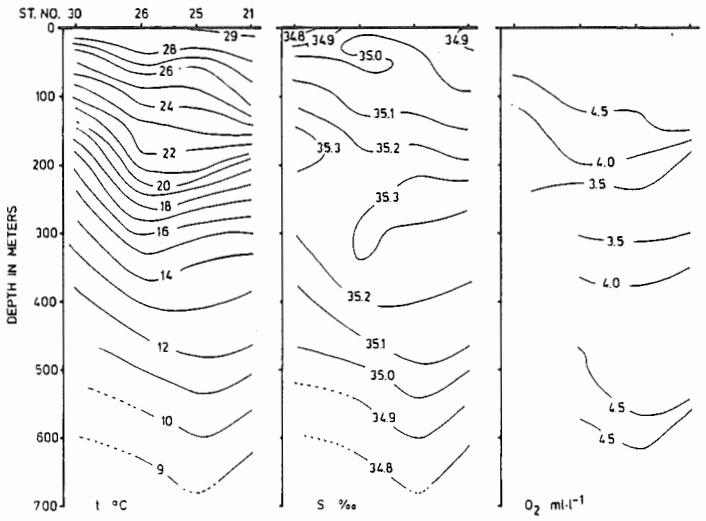

Fig. 94. VAUBAN 1973. t°C, S°/oo and O_2 ml/l - N-S section.

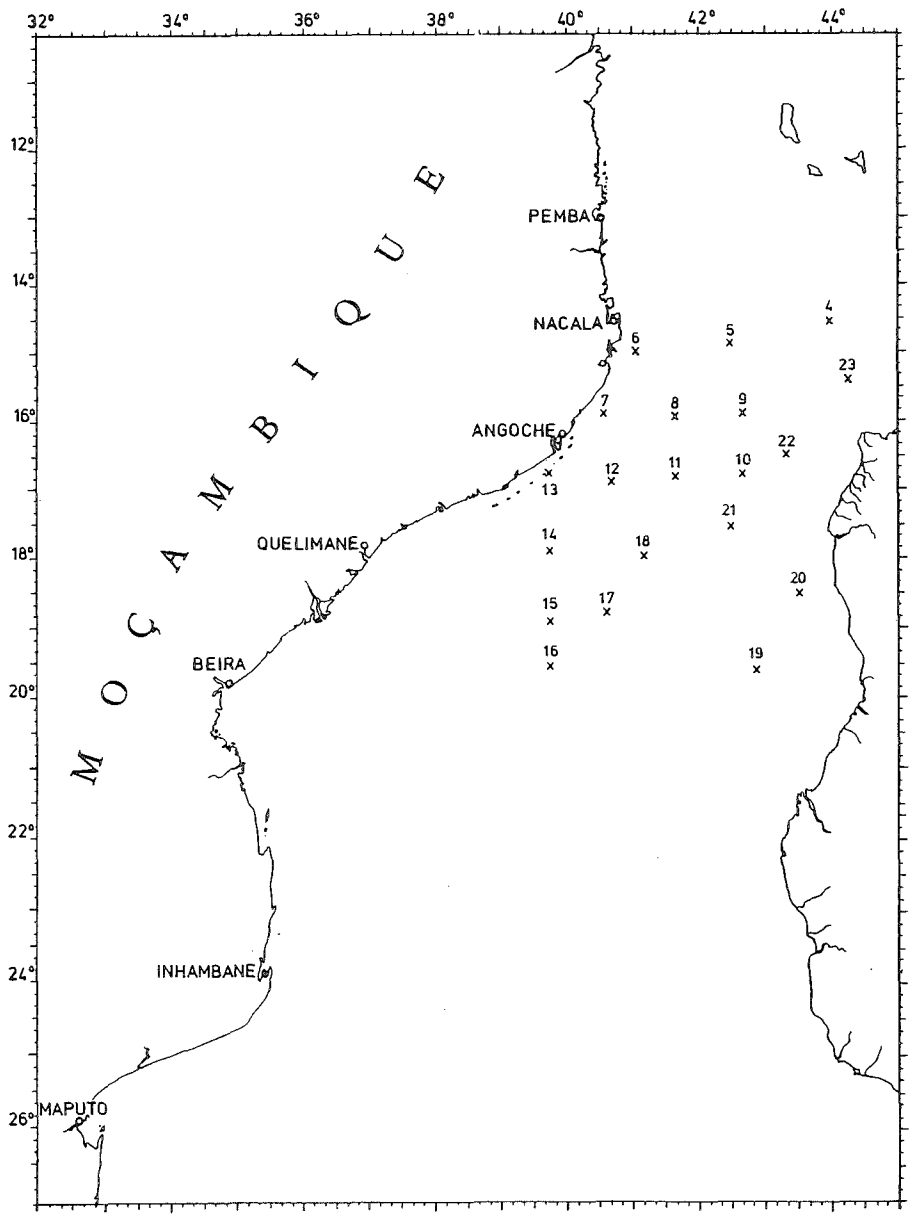

Fig. 95. VAUBAN, 7-20 Mar. 1975. Grid of stations.

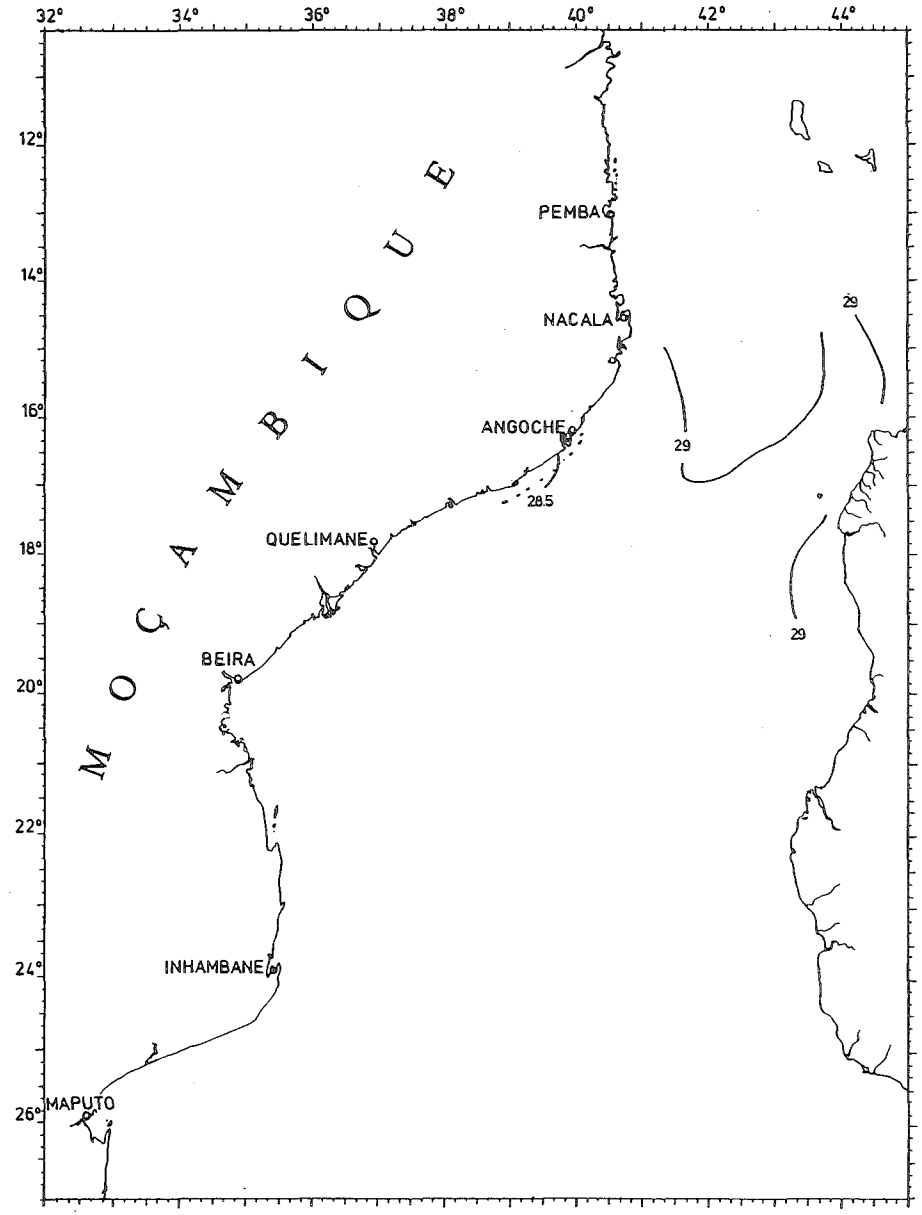

Fig. 96. VAUBAN 1975. Surface temperature.

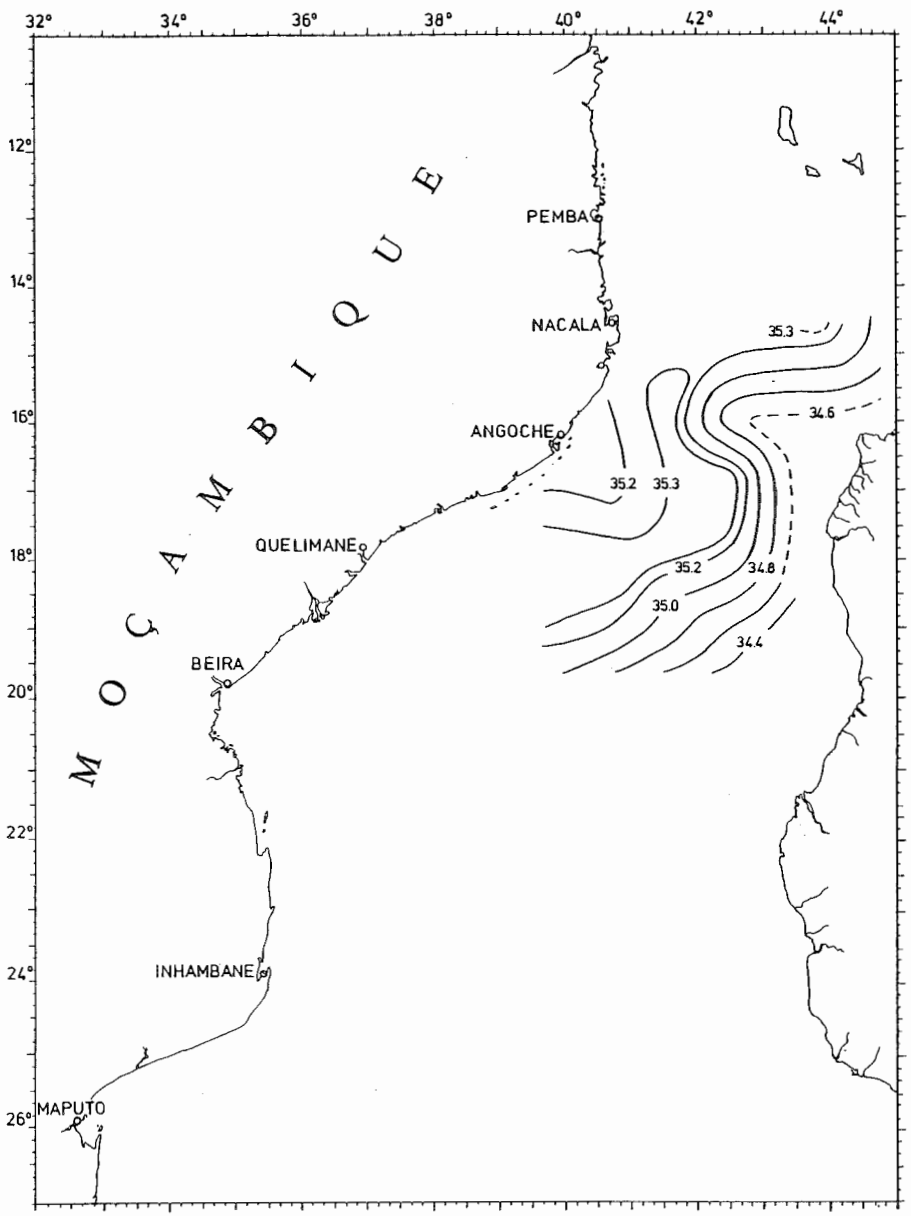

Fig. 97. VAUBAN 1975. Surface salinity.

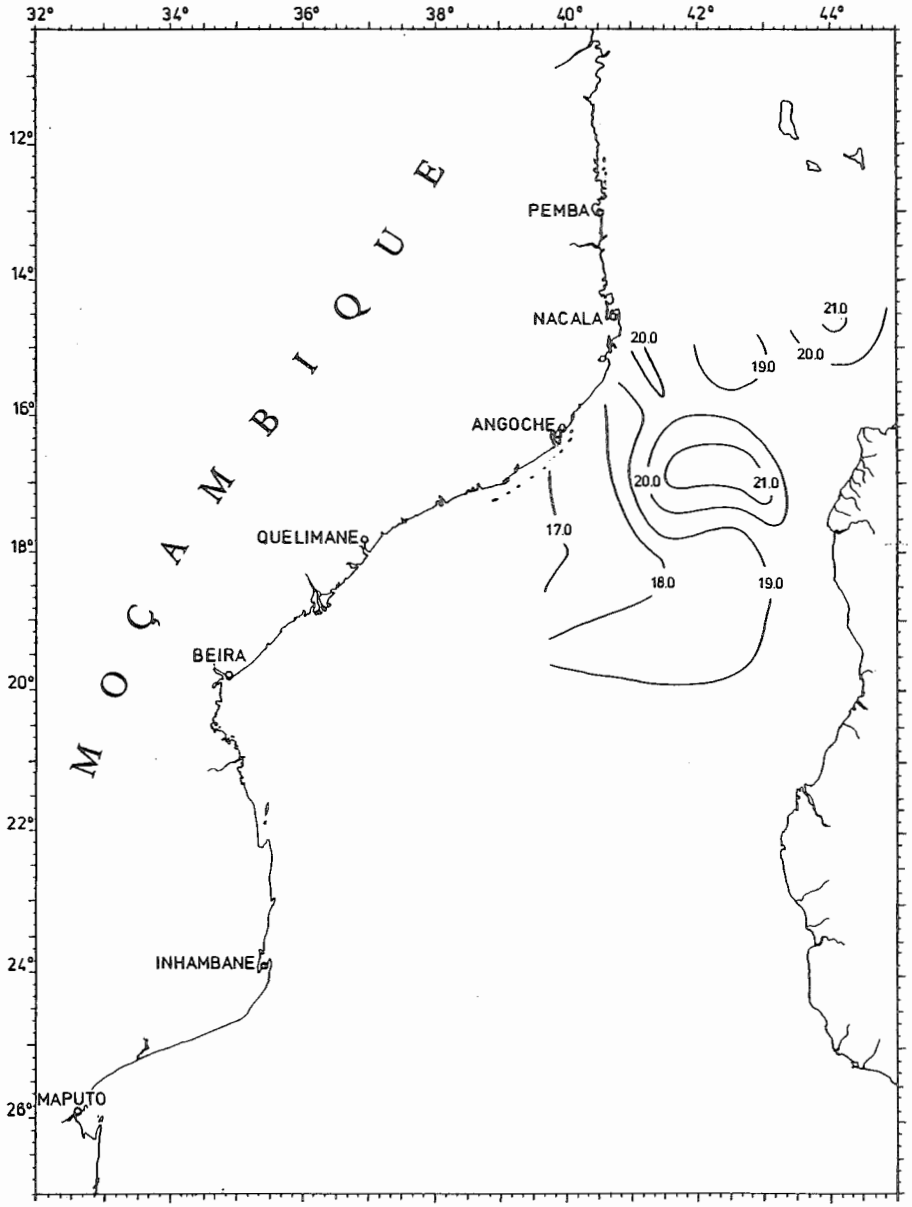

Fig. 98. VAUBAN 1975. Temperature in 150 m.

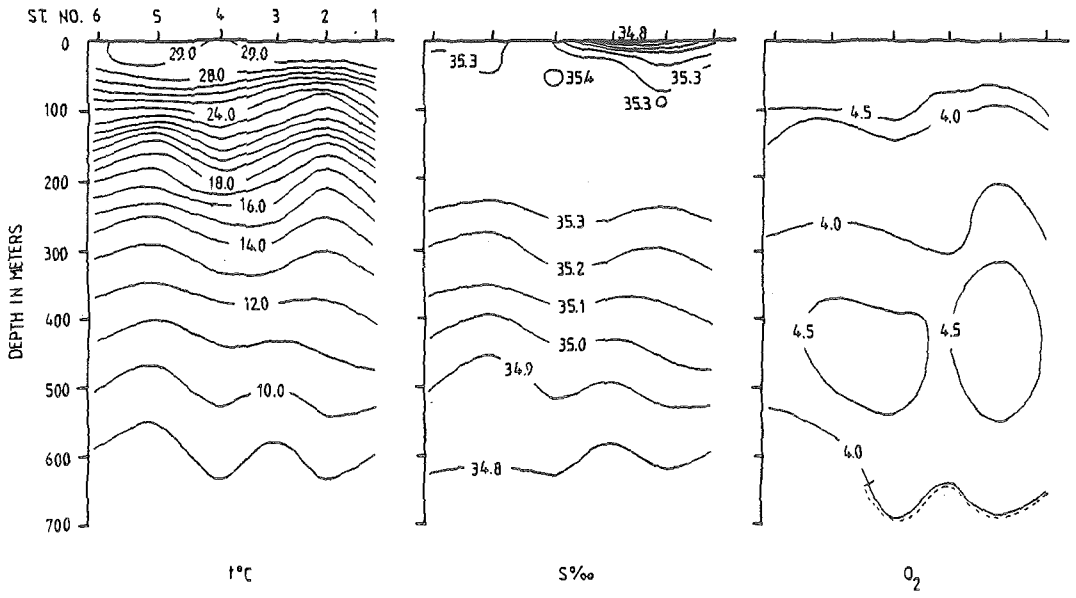

Fig. 99. VAUBAN 1975. t°C, S°/oo and O_2 ml/l.

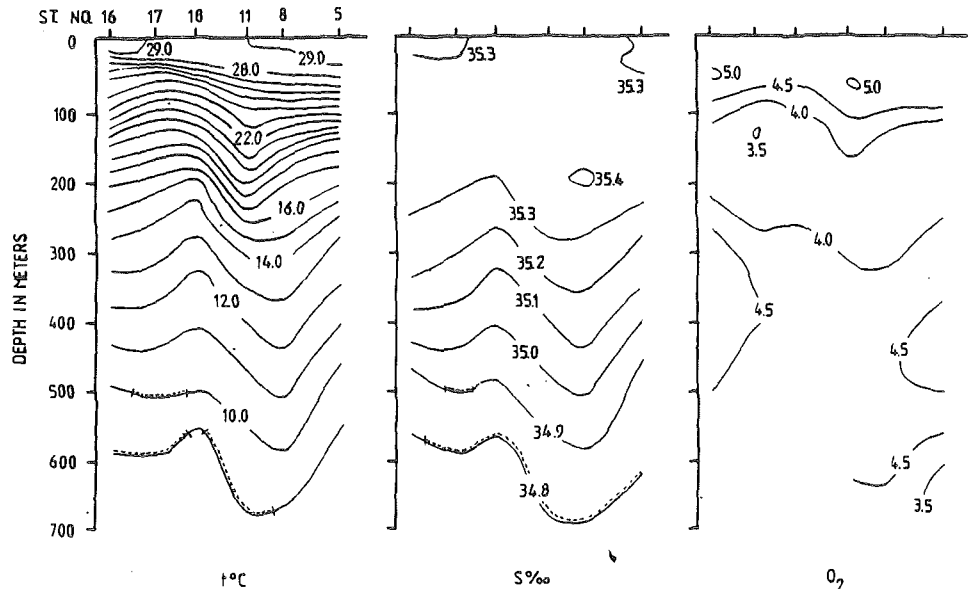

Fig. 100. VAUBAN 1975. t°C, S°/oo and O_2 ml/l.

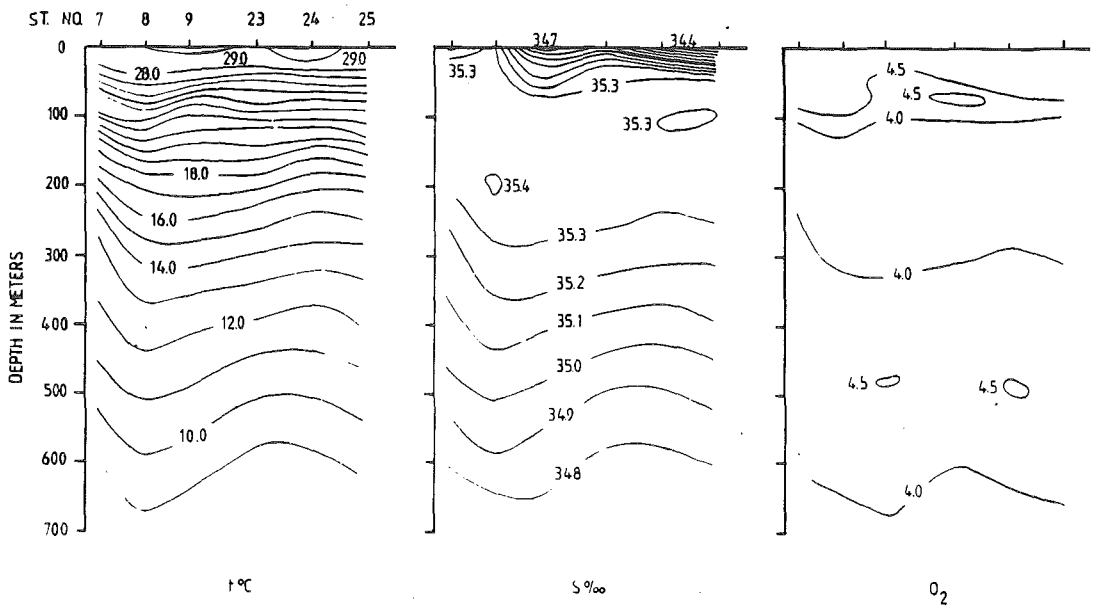

Fig. 101. VAUBAN 1975. t°C, S°/oo and O_2 ml/l.

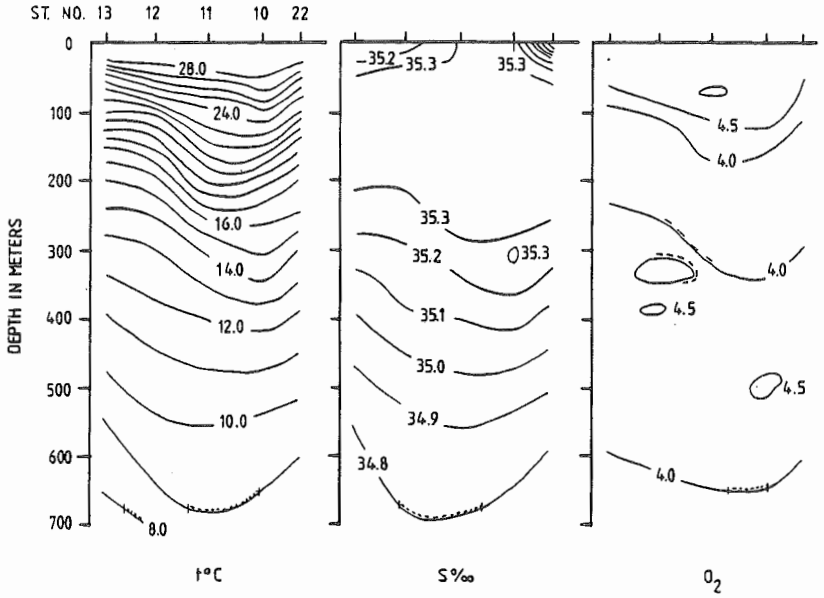

Fig. 102. VAUBAN 1975. $t^{\circ}C$, S°/oo and O_2 ml/l.

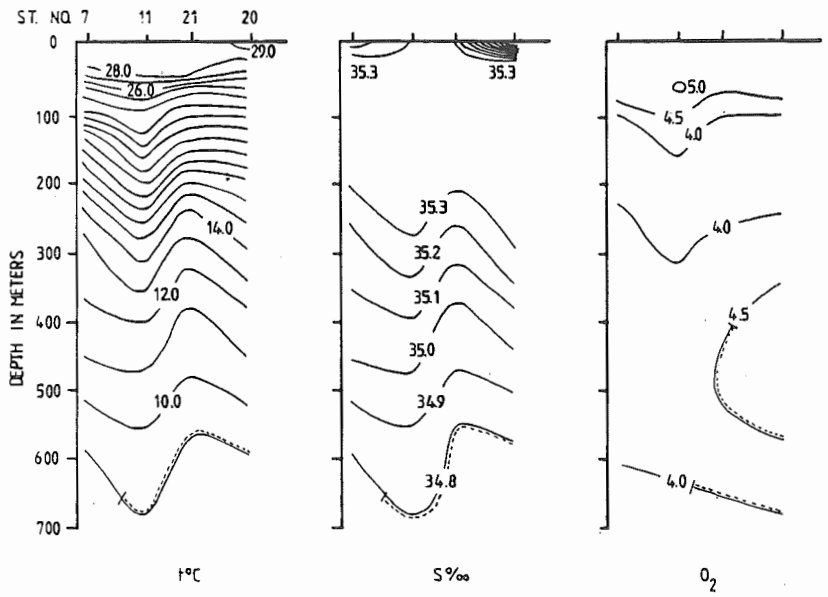

Fig. 103. VAUBAN 1975. $t^{\circ}C$, S°/oo and O_2 ml/l.

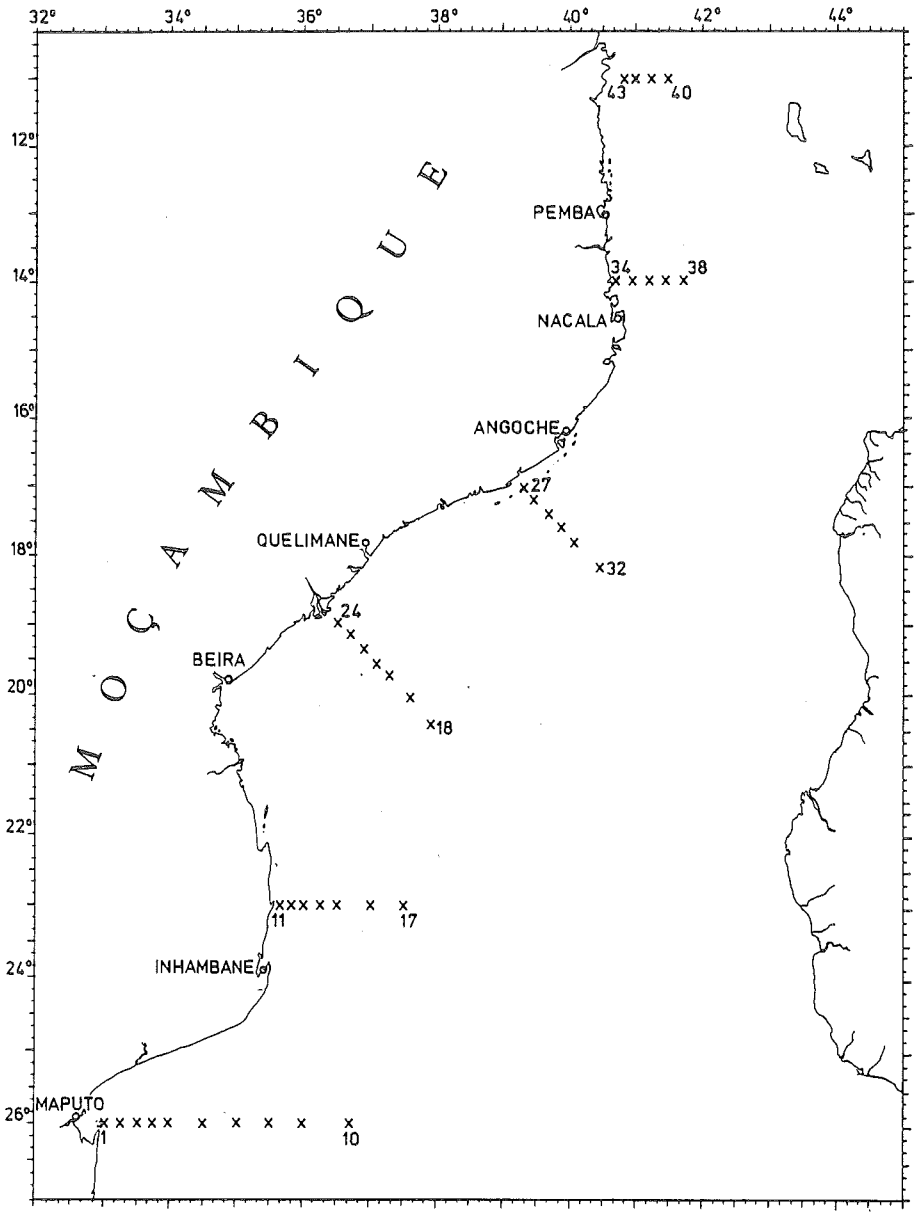

Fig. 104. ERNST HAECKEL. 8-20 Mar. 1979.
Grid of stations.

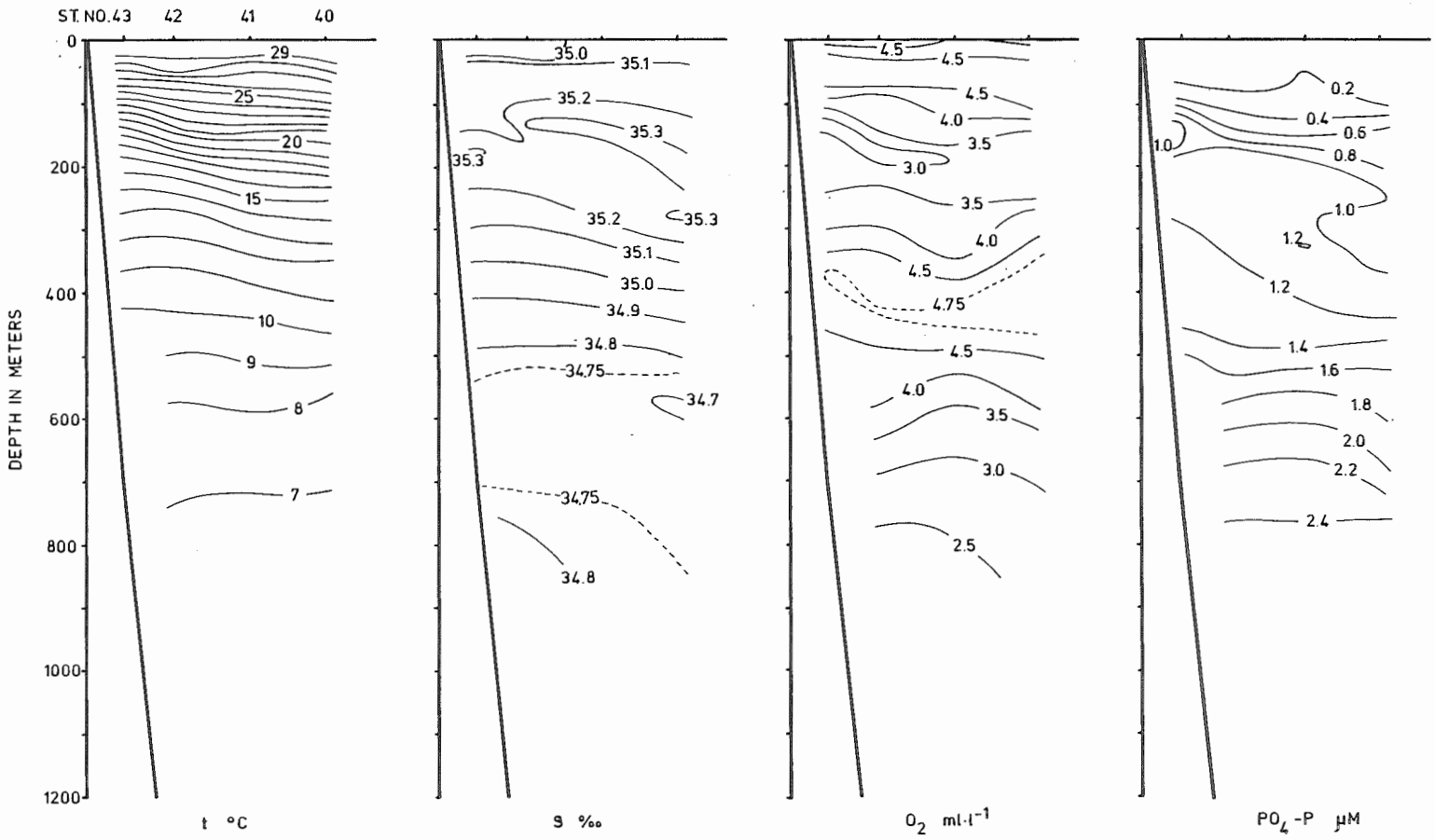

Fig. 105. ERNST HAECKEL 1979. Section I, 19-20 Mar.

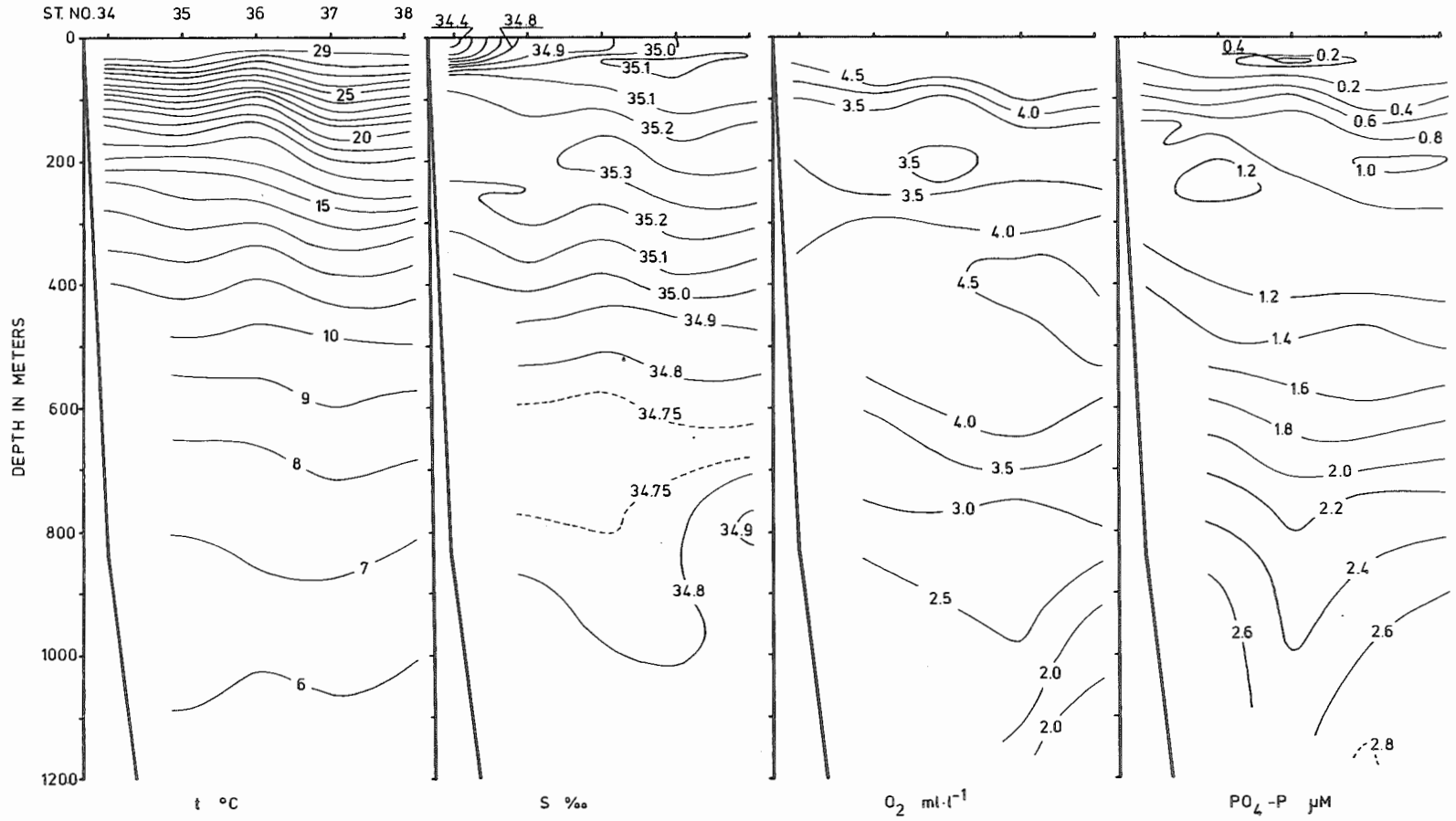

Fig. 106. ERNST HAECKEL 1979. Section II, 17-18 Mar.

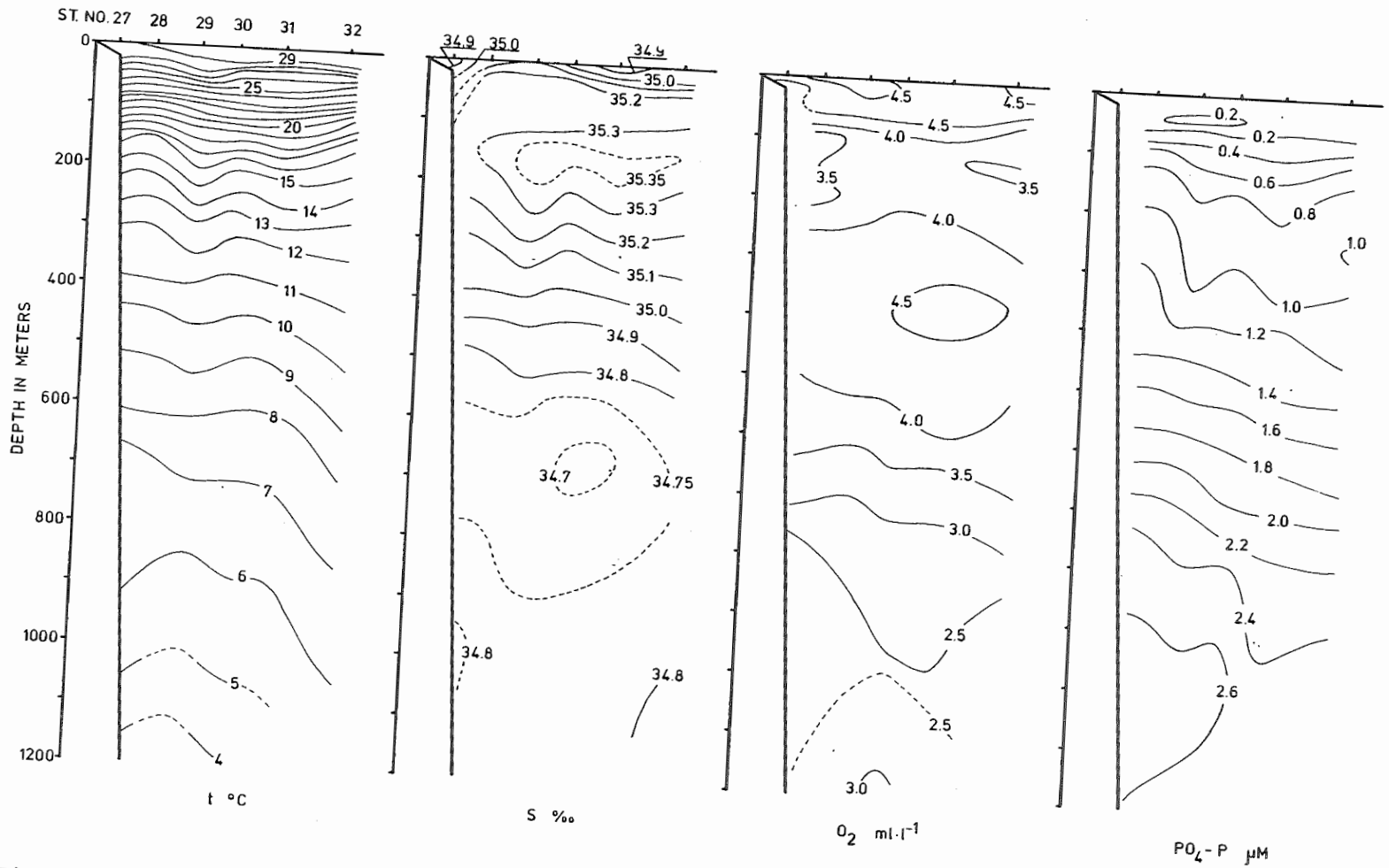

Fig. 107. ERNST HAECKEL 1979. Section III, 15-16 Mar.

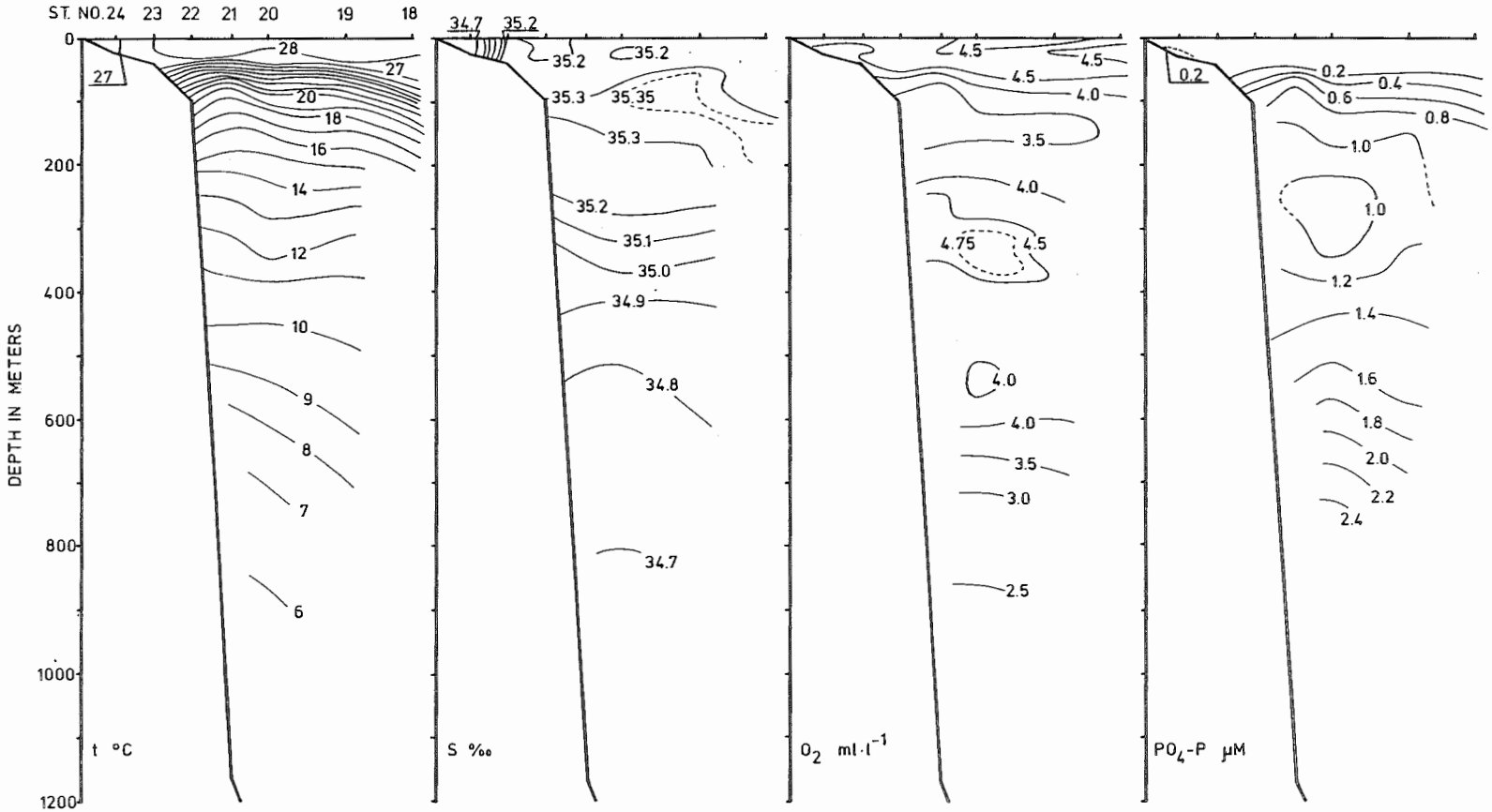

Fig. 108. ERNST HAECKEL 1979. Section IV, 13-14 Mar.

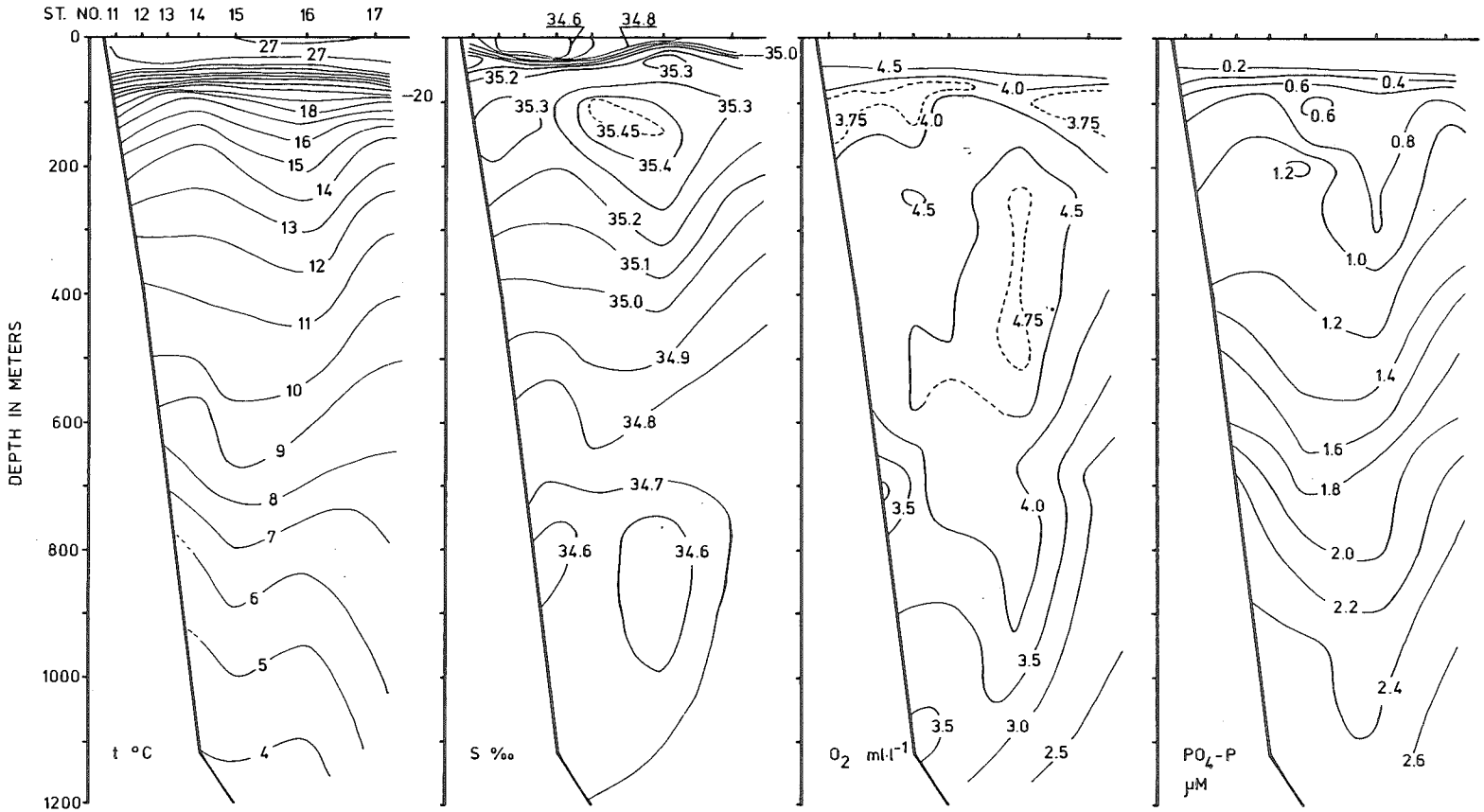

Fig. 109. ERNST HAECKEL 1979. Section V, 11-12 Mar.

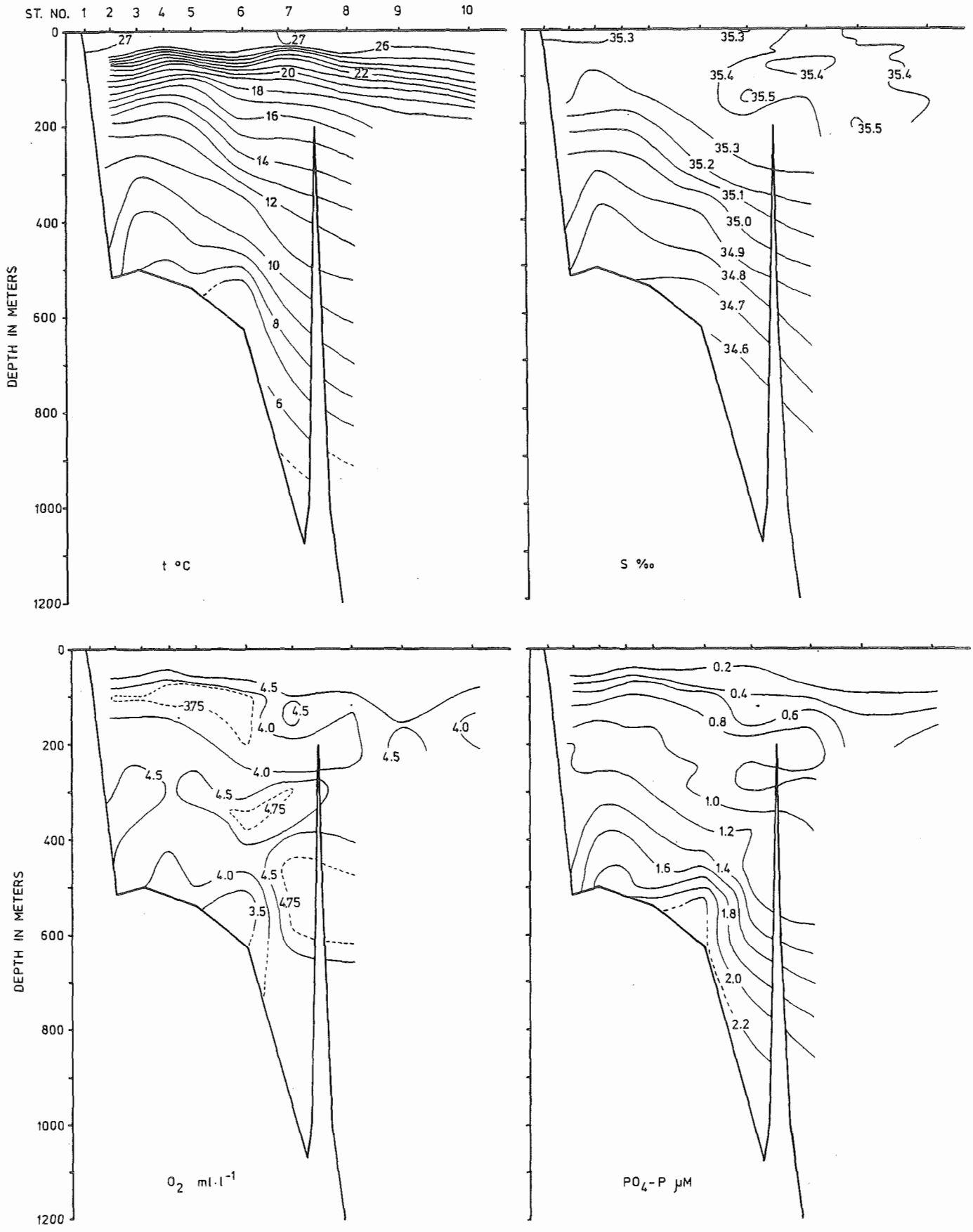

Fig. 110. ERNST HAECKEL 1979. Section VI, 8-10 Mar.

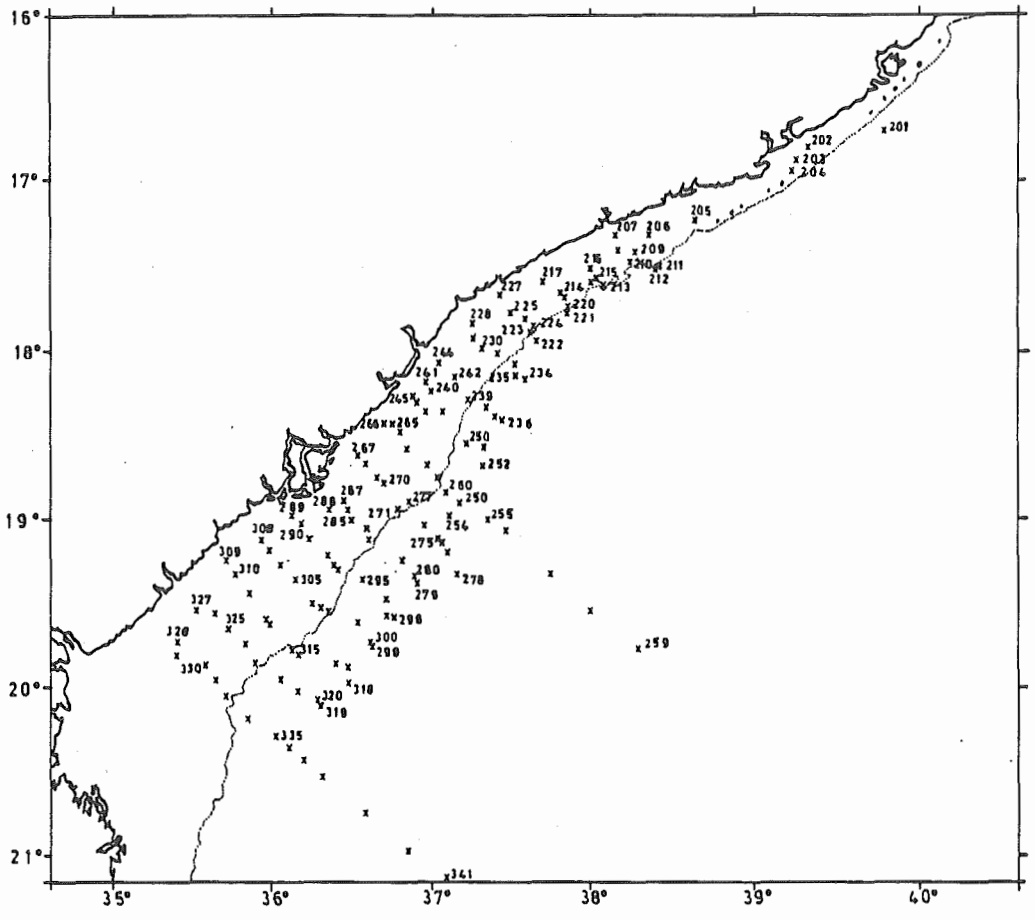

Fig. 111. ERNST HAECKEL, 13 Jul.-2 Aug. 1980. Grid of stations at Sofala Bank.

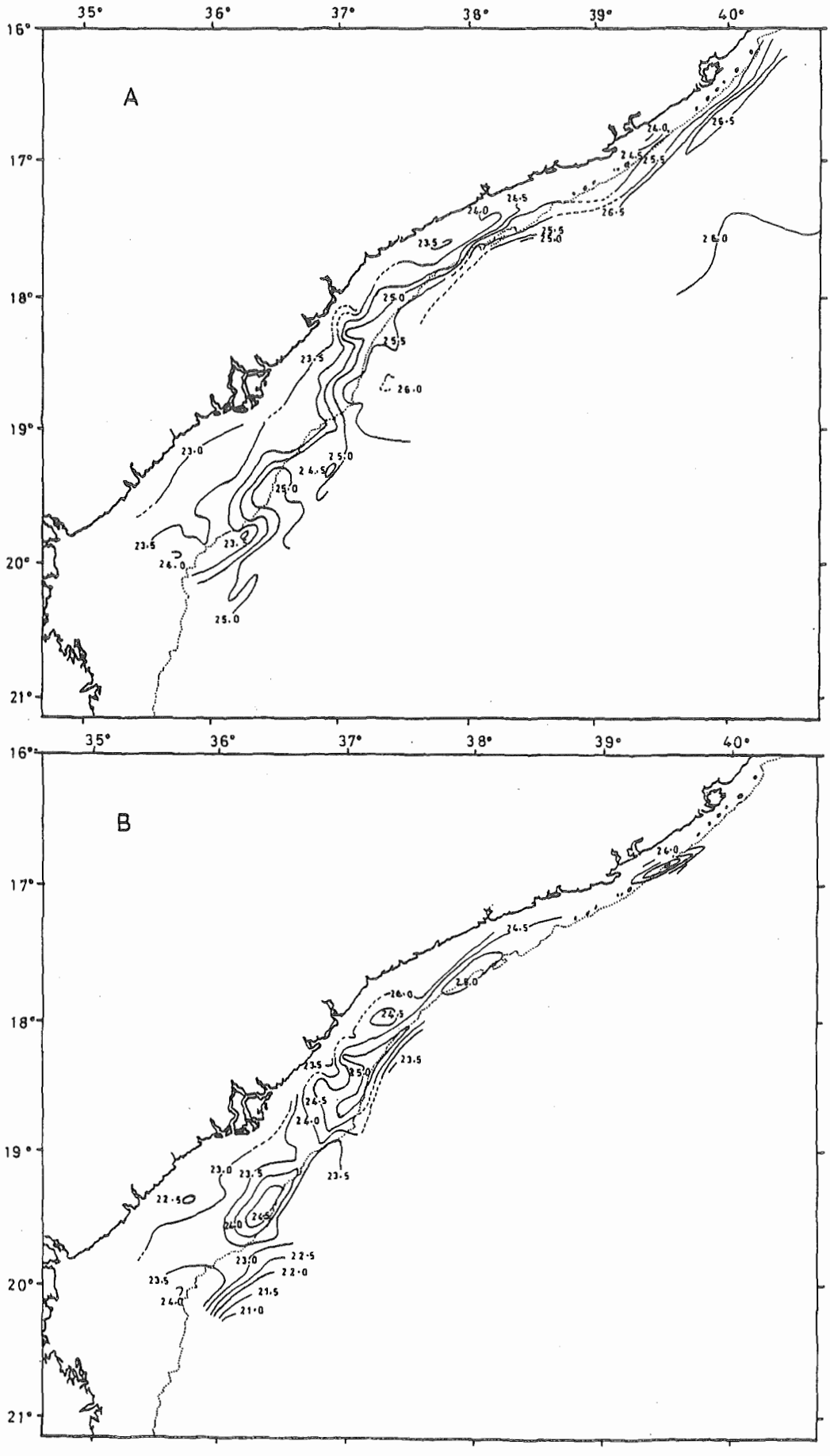

Fig. 112. ERNST HAECKEL 1980.
A) Surface temperature
B) Bottom temperature.

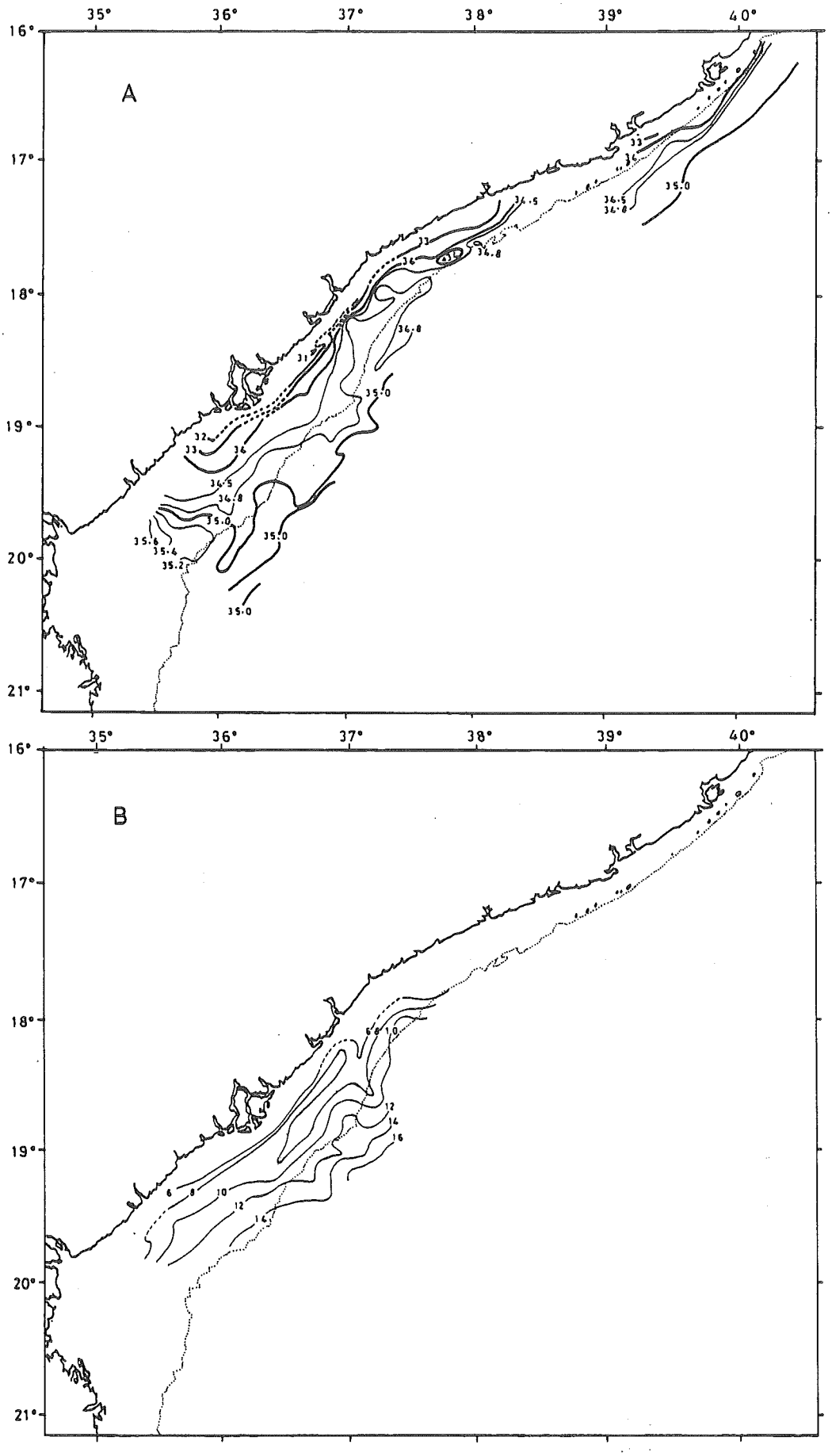

Fig. 113. ERNST HAECKEL 1980.
A) Surface salinity.
B) Secchi depth (m).

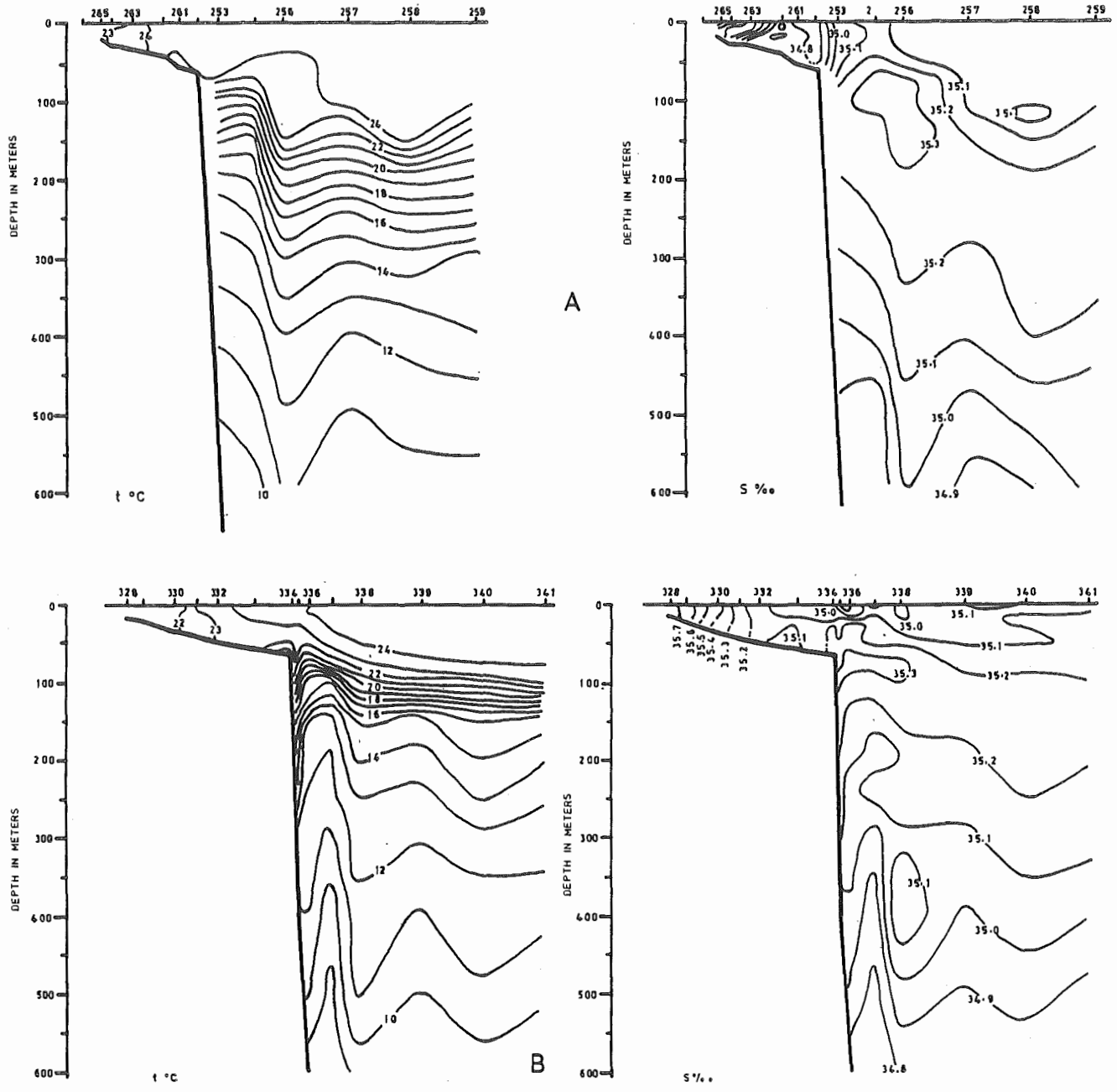

Fig. 114. ERNST HAECKEL 1980.
A) Section VIII 21-22 Jul.
B) Section IX 1-2 Aug.

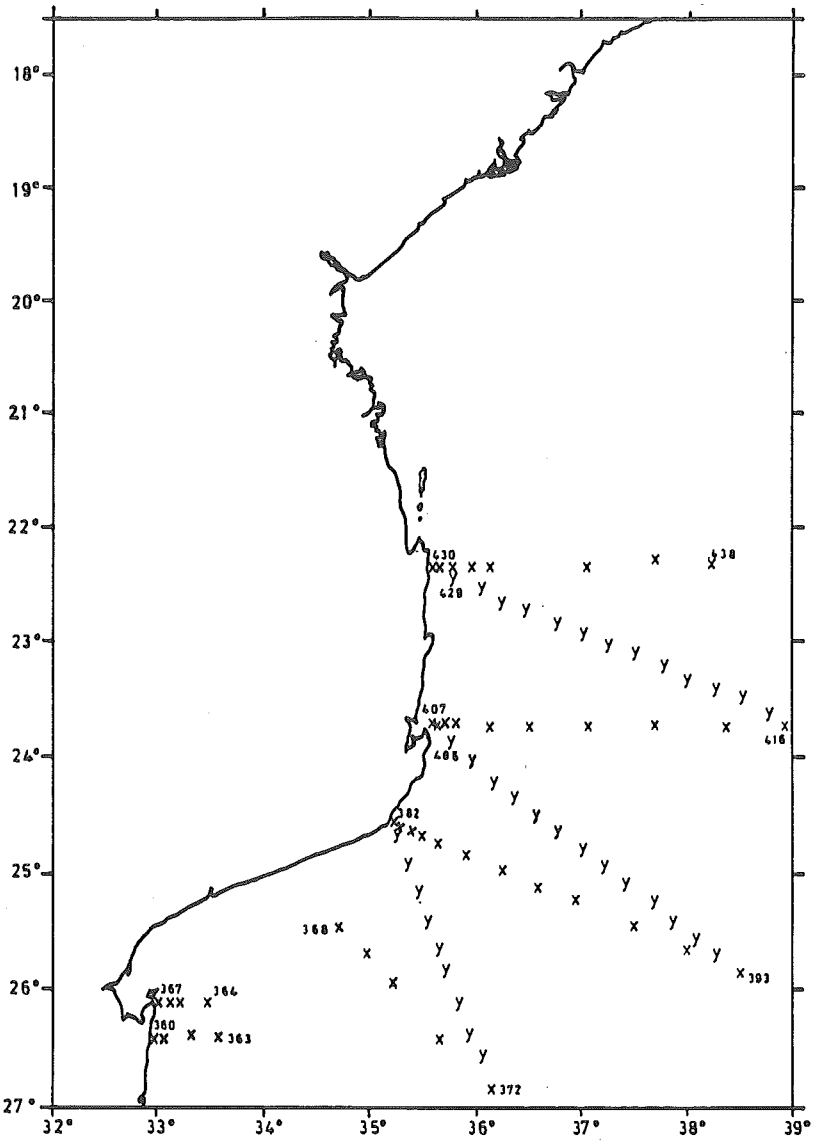

Fig. 115. ERNST HAECKEL, 11-21 Aug. 1980.
Grid of stations.
x - Hydrographic station.
y - Bathythermograph station.

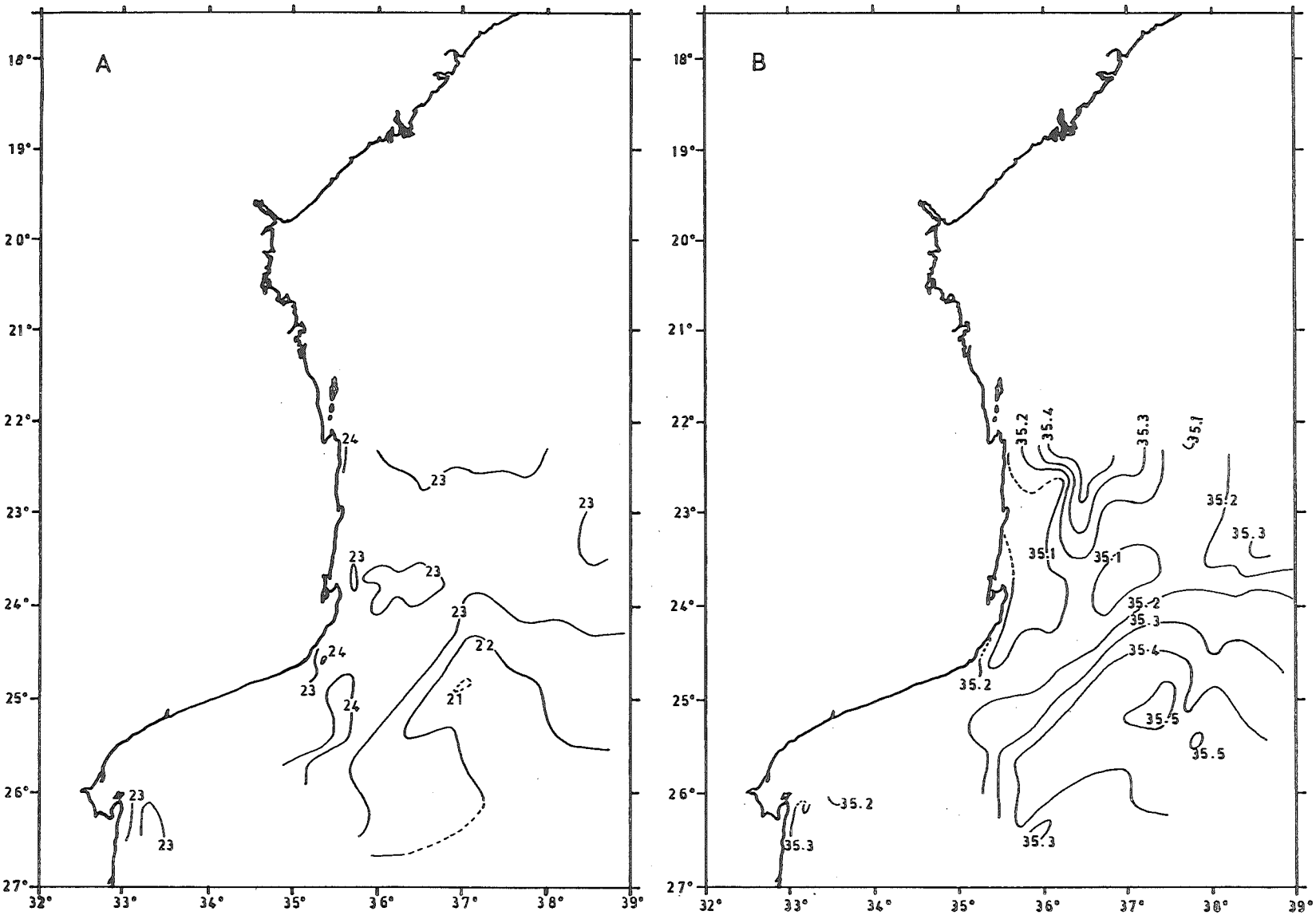

Fig. 116. ERNST HAECKEL 1980. A) Surface temperature. B) Surface salinity.

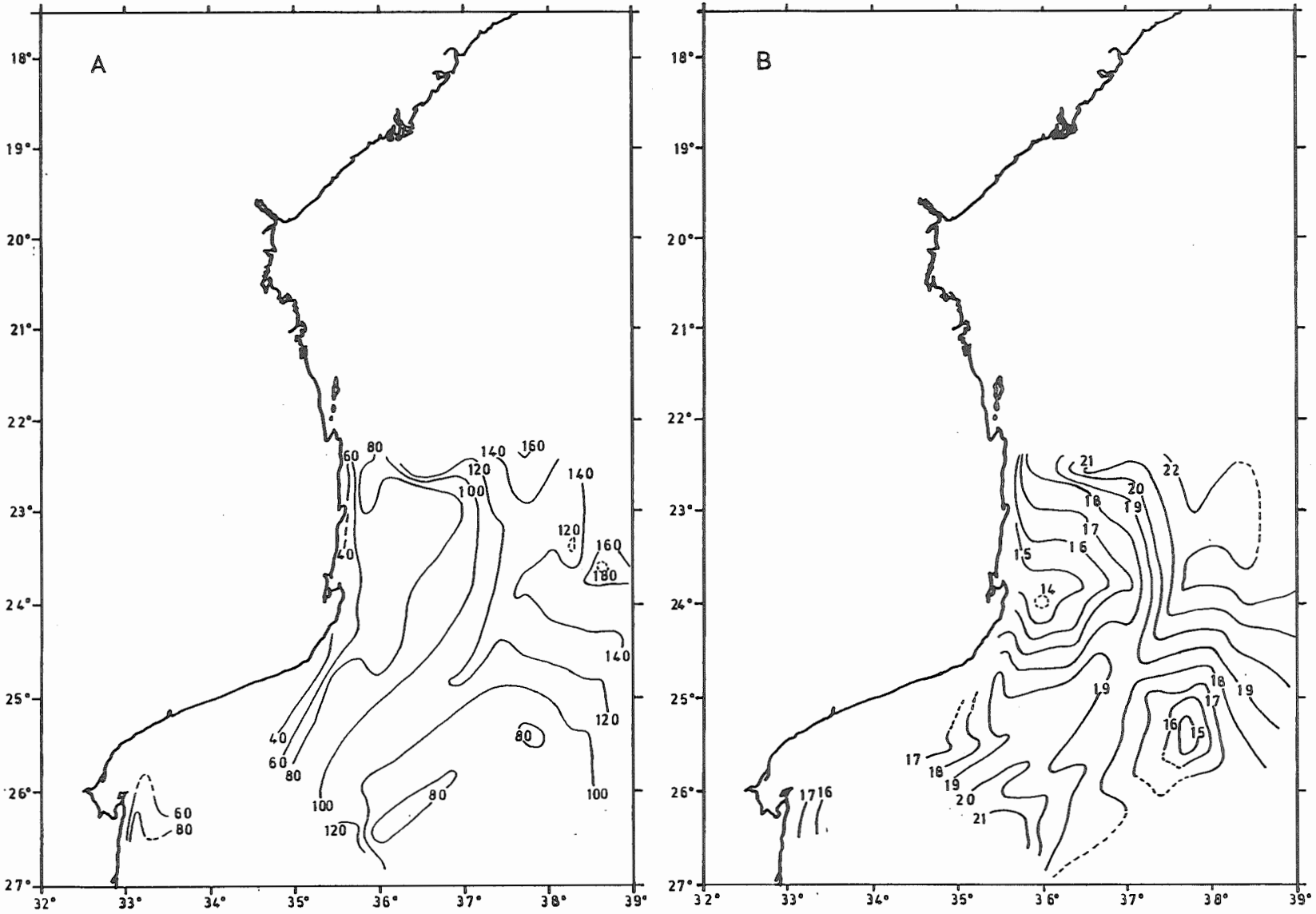

Fig. 117. ERNST HAECKEL 1980. A) Depth of mixed layer. B) Temperature at 150 m.

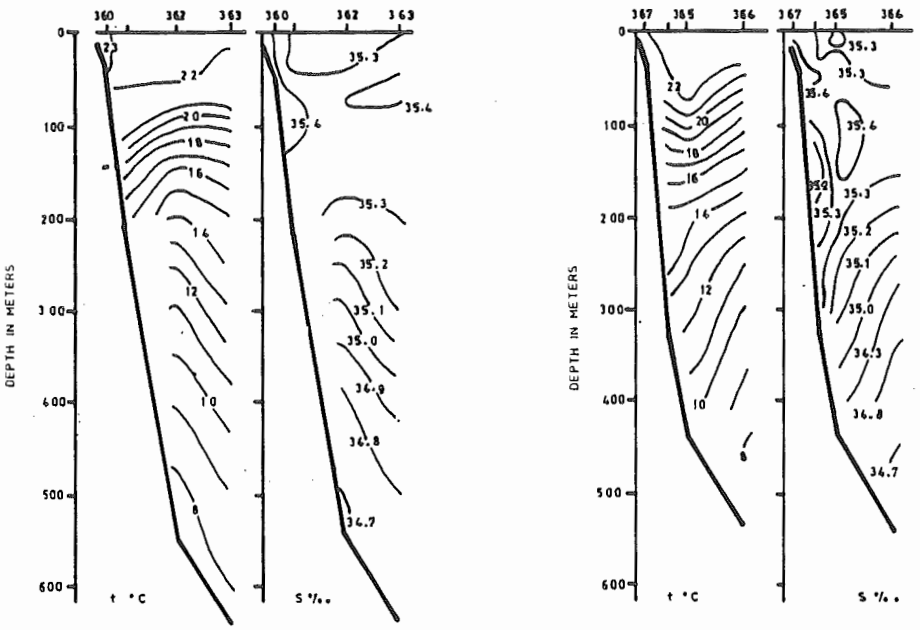

Fig. 118. ERNST HAECKEL 1980.
A) Section X, 11 Aug.
B) Section XI, 12 Aug.

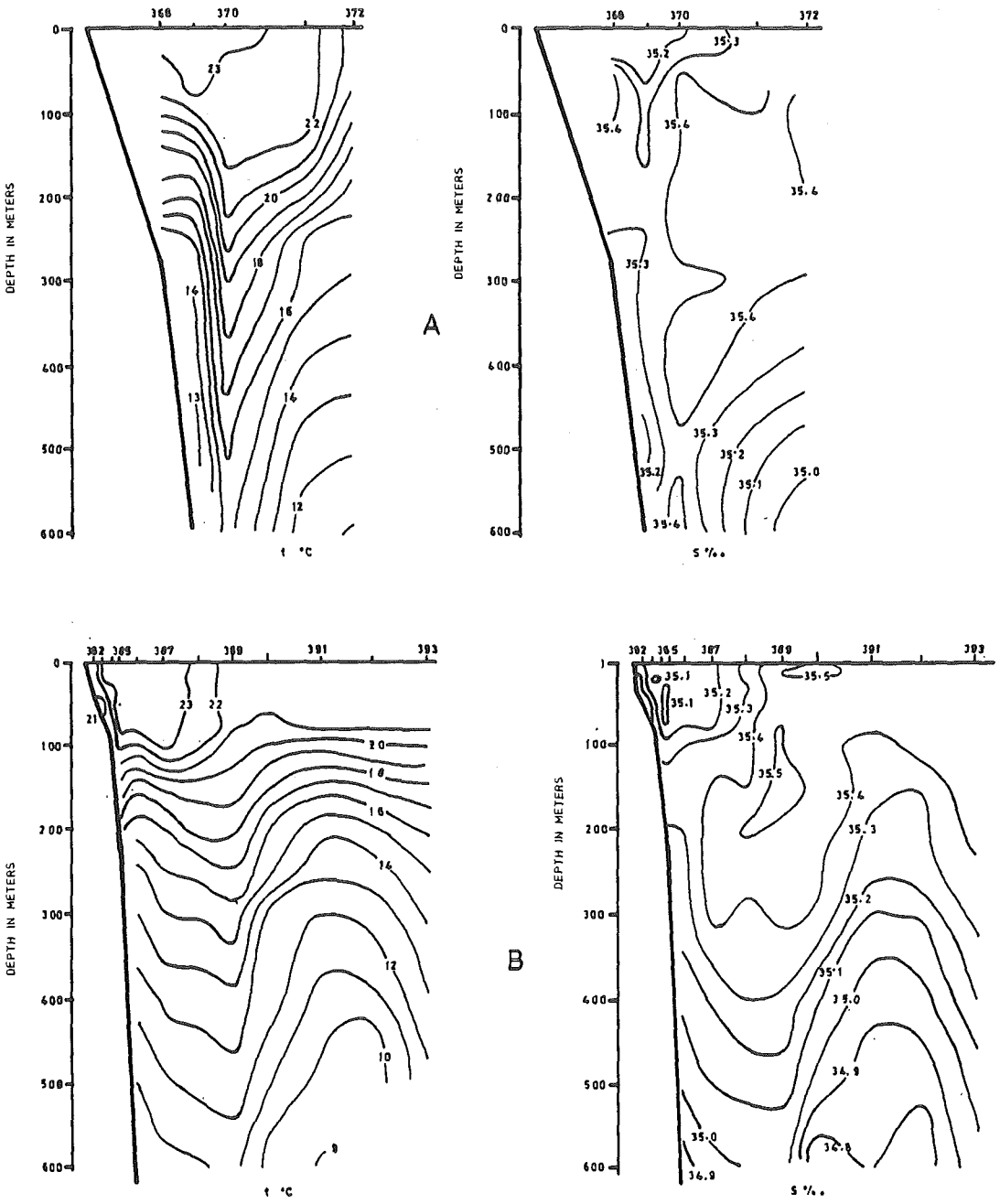

Fig. 119. ERNST HAECKEL 1980.
A) Section XII, 13 Aug.
B) Section XIV, 14-16 Aug.

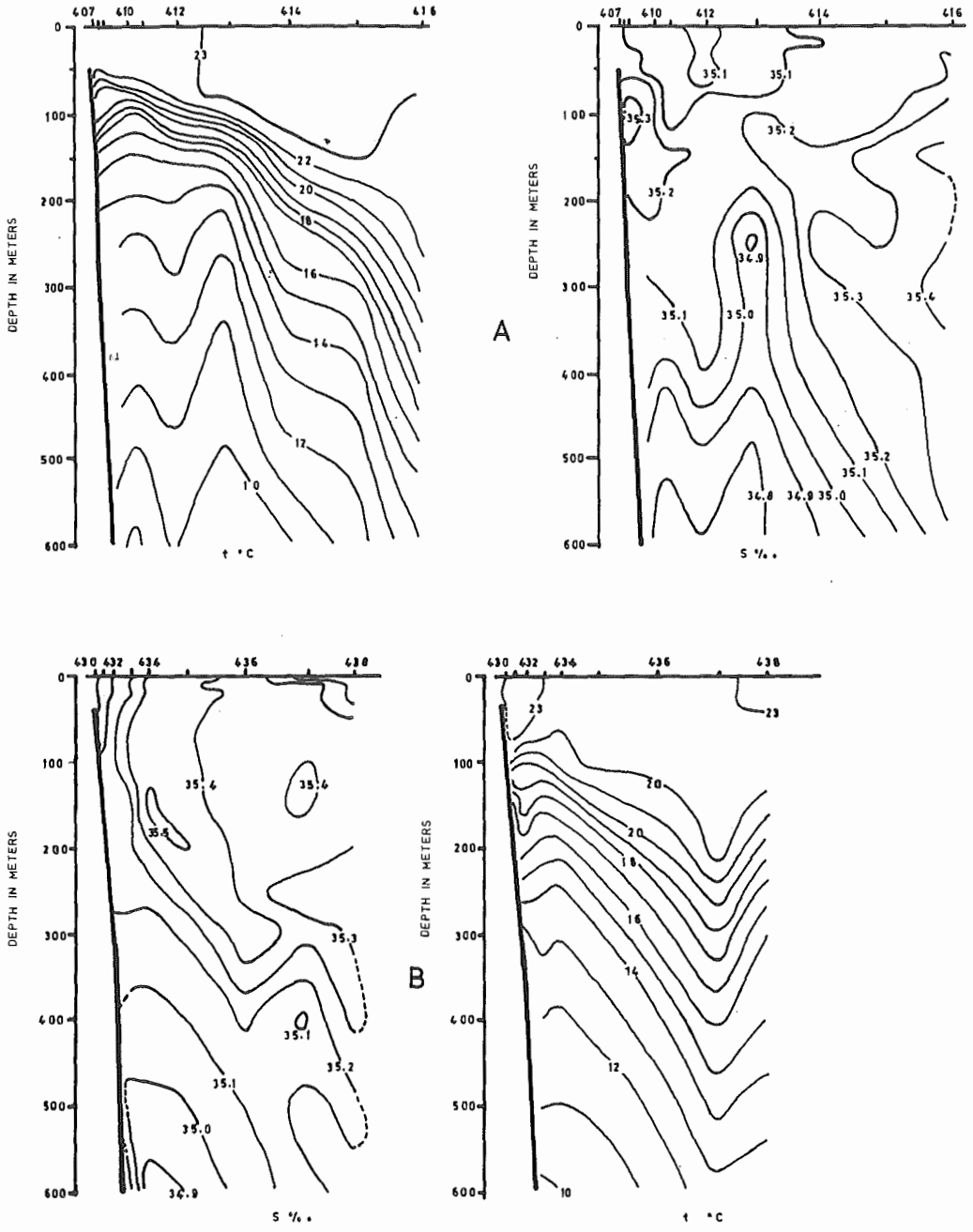

Fig. 120. ERNST HAECKEL 1980.
A) Section XVI, 17-18 Aug.
B) Section XVIII, 19-21 Aug.

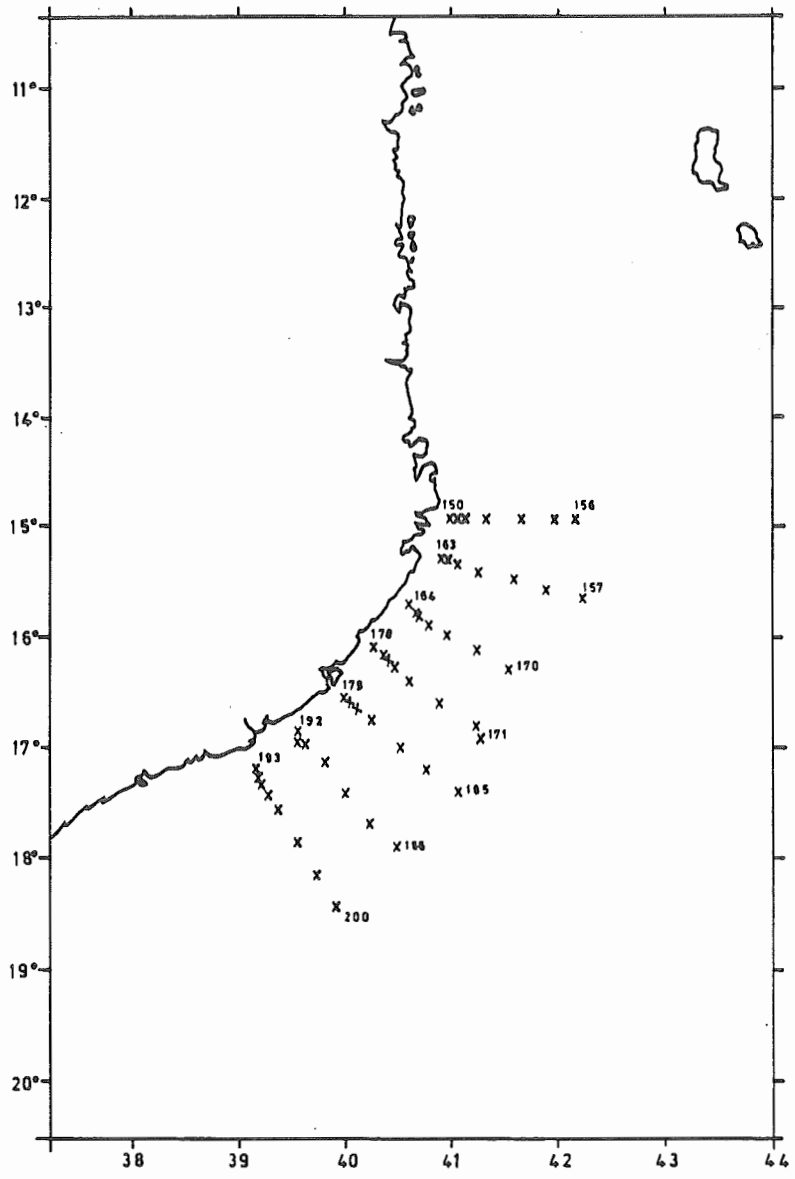

Fig. 121. ERNST HAECKEL, 5-12 Jul. 1980.
Grid of stations.

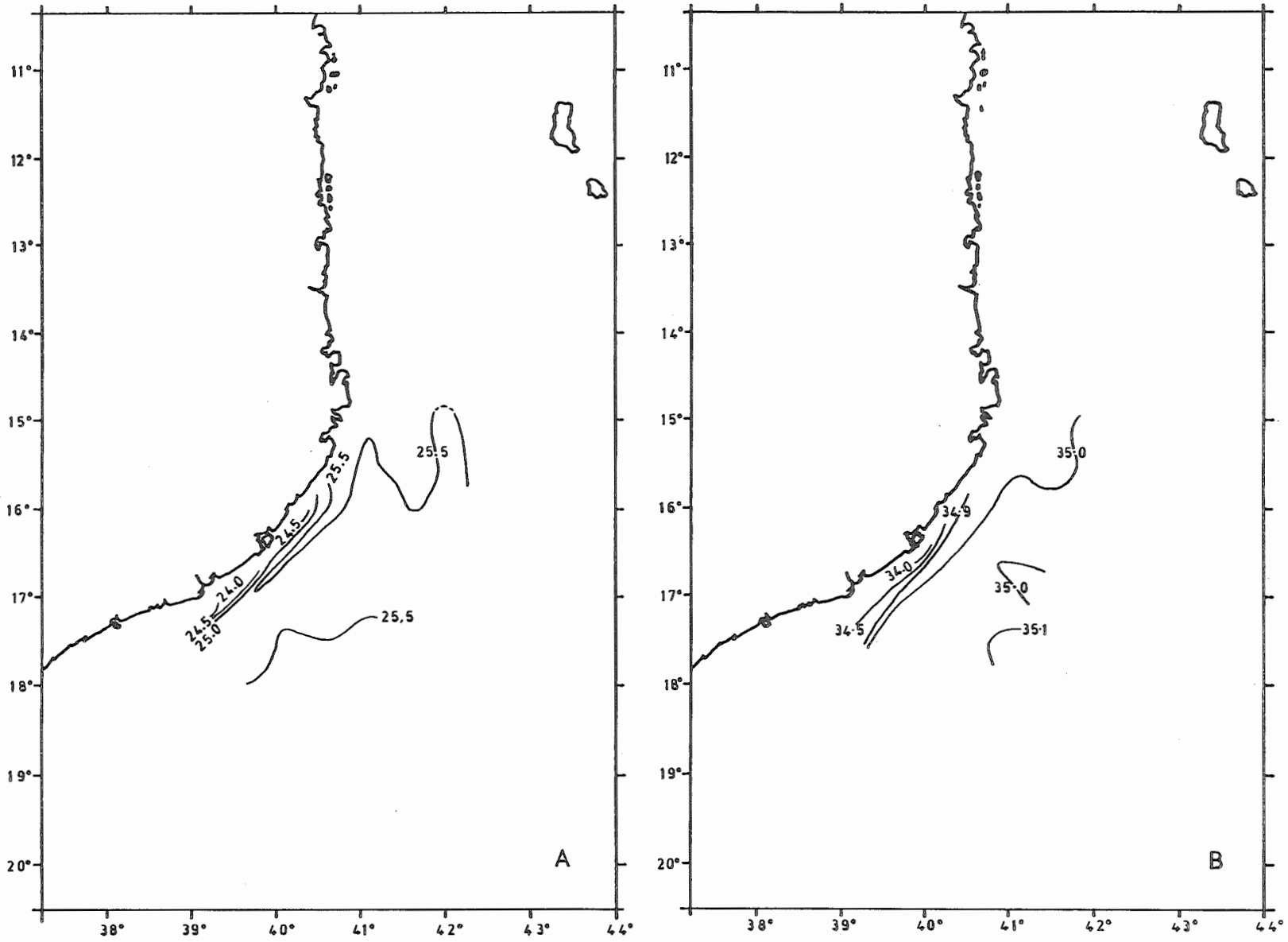

Fig. 122. ERNST HAECKEL 1980. A) Surface temperature. B) Surface salinity.

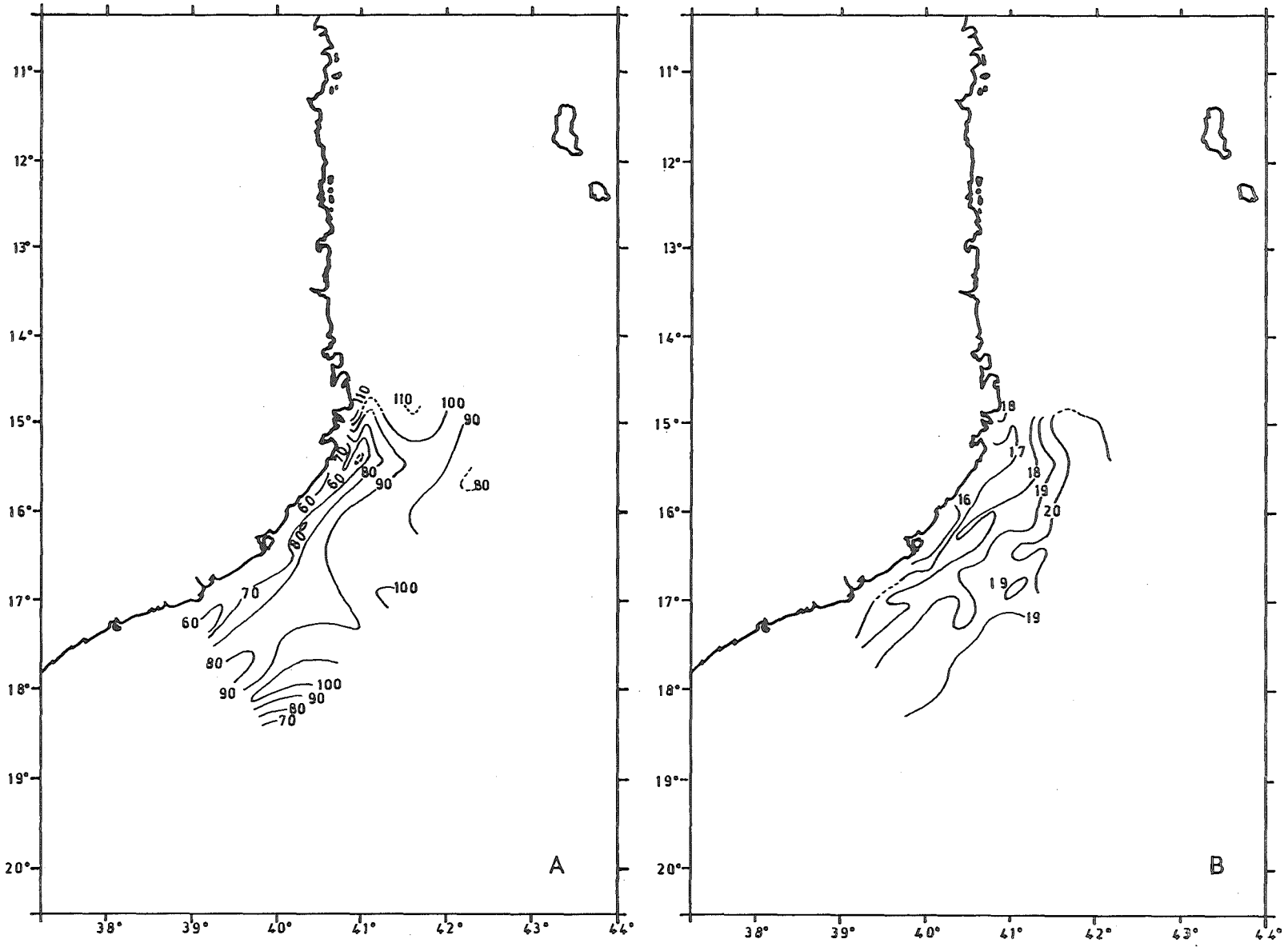

Fig. 123. ERNST HAECKEL 1980. A) Depth of mixed layer. B) Temperature in 150 m.

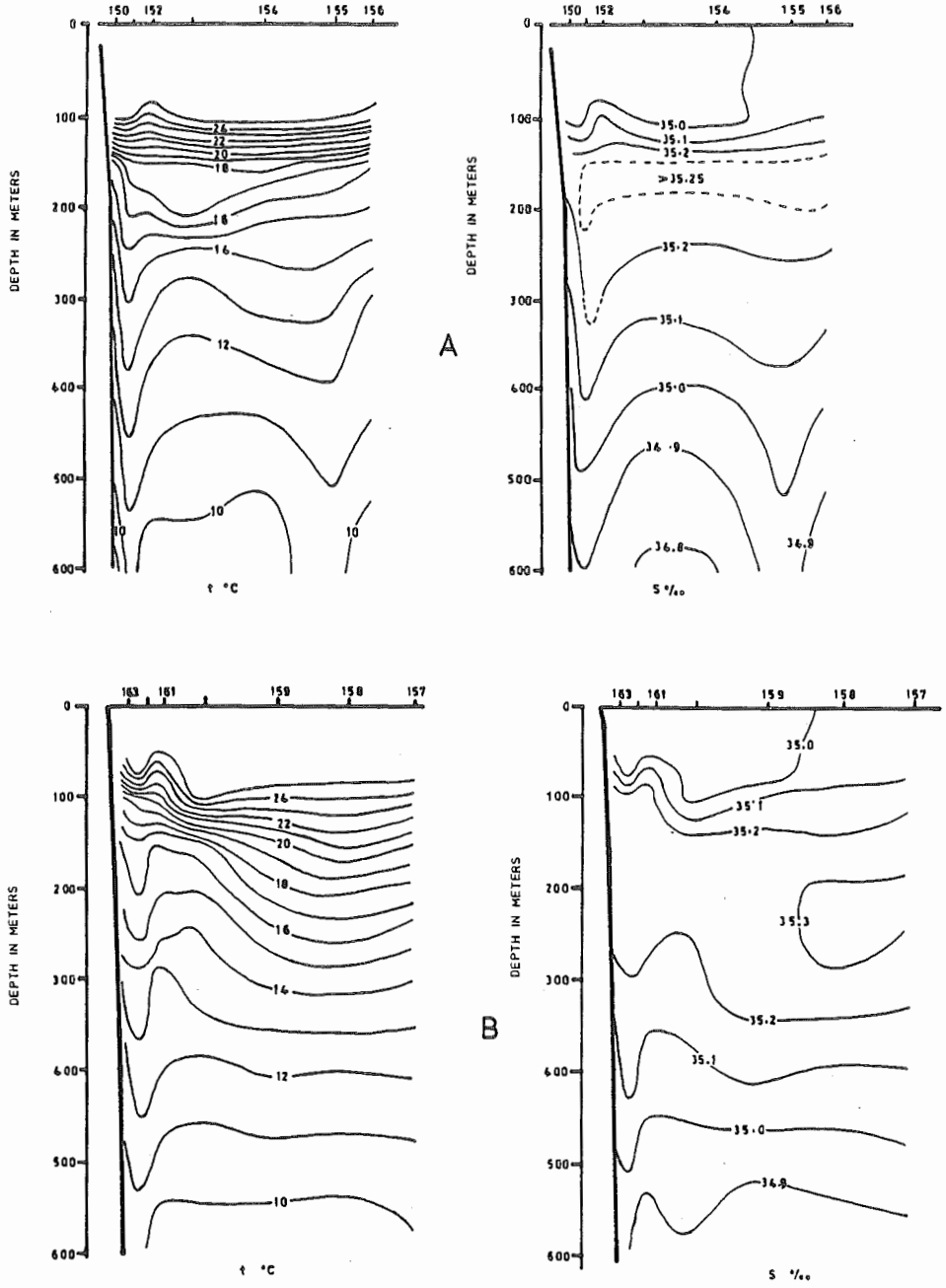

Fig. 124. ERNST HAECKEL 1980.
A) Section I, 5-6 Jul.
B) Section II, 6-7 Jul.

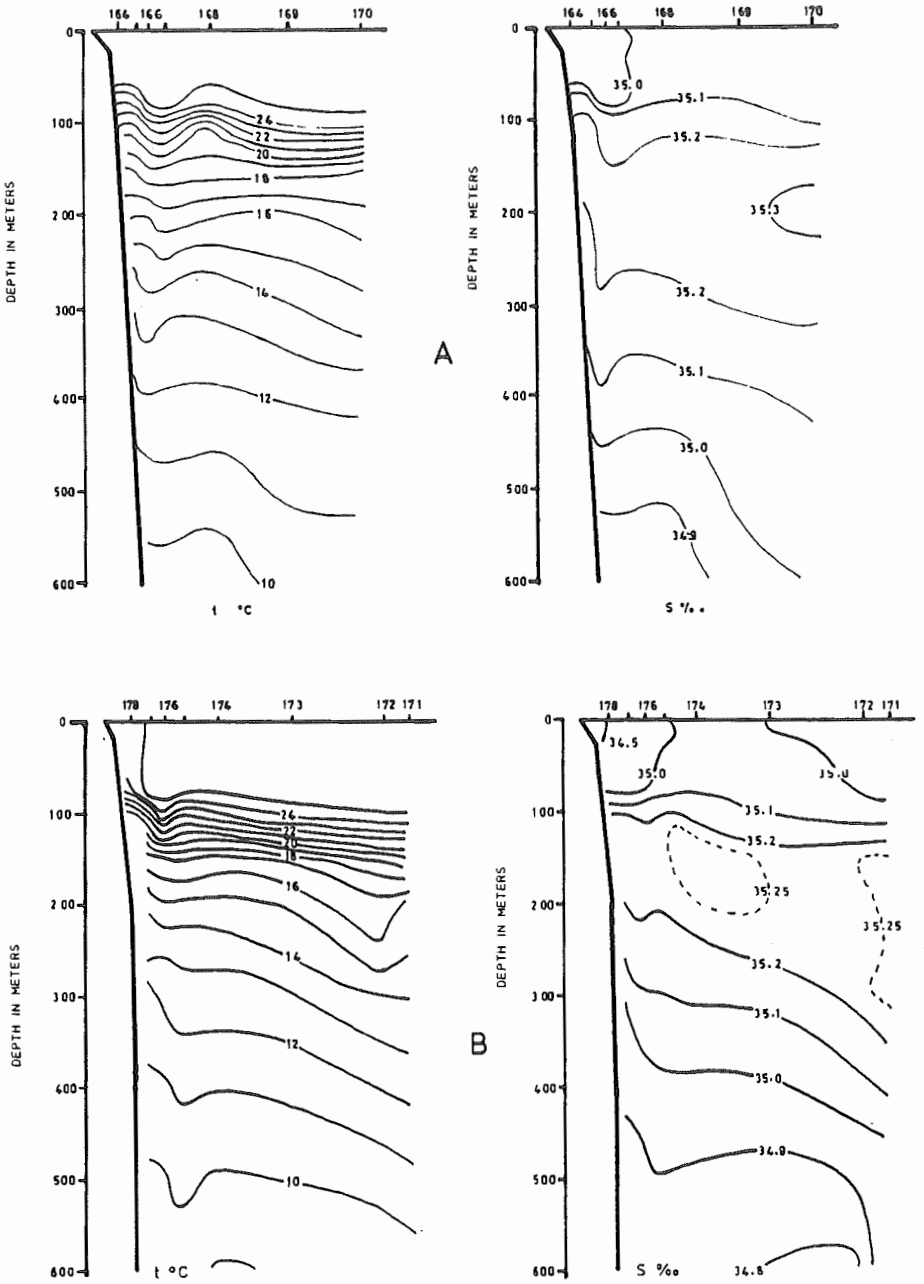

Fig. 125. ERNST HAECKEL 1980.
A) Section III, 7-8 Jul.
B) Section IV, 8-9 Jul.

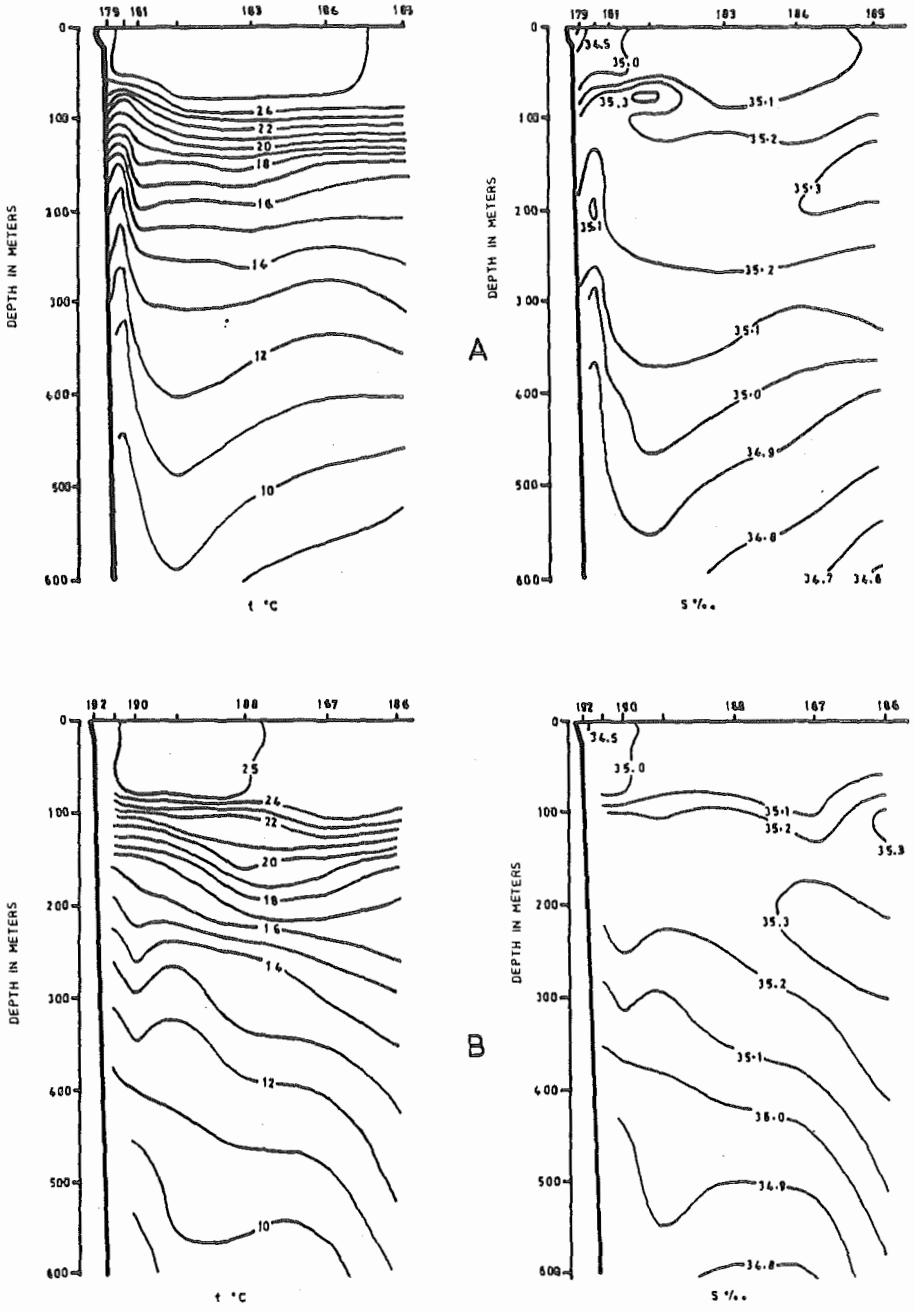

Fig. 126. ERNST HAECKEL 1980.
A) Section V, 9-10 Jul.
B) Section VI, 10-11 Jul.

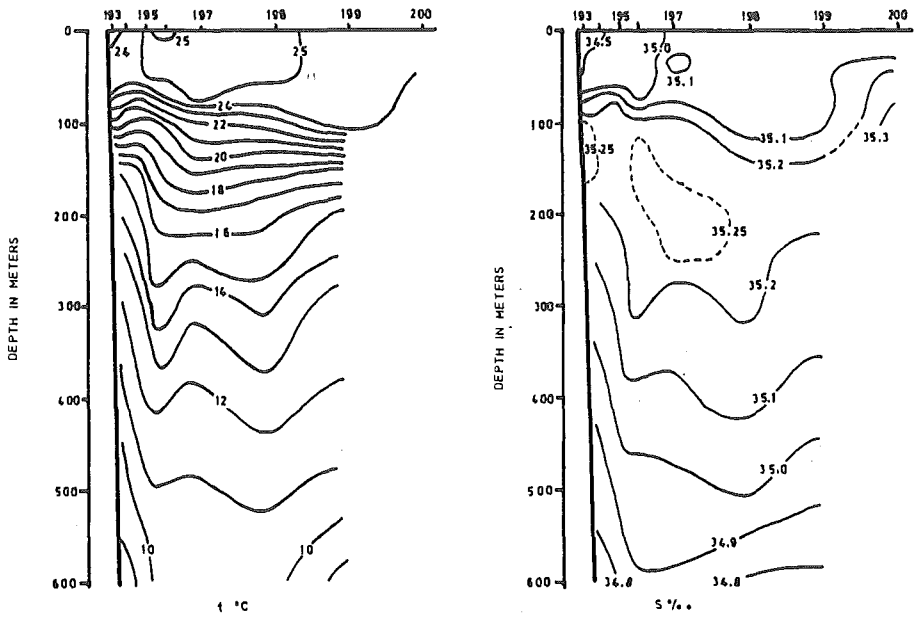

Fig. 127. ERNST HAECKEL 1980. Section VII, 11-12 Jul.

REFERENCES

ANON. (1960) Travaux océanographiques de l'aviso "Commandant Robert Giraud" dans l'Océan Indien em 1960. Cah. Océanogr., 12(9): 621.

ANON. (1963) Informations. Quatrième campagne océanographique du "Commandant Robert Giraud". Cah. Océanogr., 15(5): 287-8.

ANON. (1965) Resultados das observações oceanográficas no canal de Moçambique. Cruzeiro AL 1/64: Abril - Maio 1964. Publ. Inst. Hidrogr., 1, Ministério da Marinha, Lisboa: 73 pp.

ANON. (1967) Resultados das observações oceanográficas no canal de Moçambique. Cruzeiro AL 2/64: Setembro - Outubro 1964. Publ. Inst. Hidr., 3, Ministério da Marinha, Lisboa: 107 pp.

ANON. (1973a) Cooperação na Expedição Internacional ao Oceano Indico: resultados das observações oceanográficas no canal de Moçambique. Cruzeiro AL 3/65: Abril - Maio 1965. Publ. Inst. Hidr., 7, Ministério da Marinha, Lisboa: 57 pp.

ANON. (1973b) Resultados das observações oceanográficas no canal de Moçambique. Cruzeiro AL 4/66: Julho 1966. Publ. Inst. Hidr., 8, Ministério da Marinha, Lisboa: 57 pp.

ANON. (1978) Relatório preliminar da 1.ª parte da Expedição Conjunta Moçambicano - Soviética de Investigação Científica no Domínio das Pescas realizada a bordo do SRTM "Myslitel" de Agosto a Novembro de 1978. Serviço de Investigações Pesquiras, Maputo: 27 pp.

ANON. (1979) Relatório preliminar da 2.ª parte da Expedição Conjunta Moçambicano - Soviética de Investigação Científica no Domínio das Pescas realizada a bordo do SRTM "Nikolay Reshetnyak" de Novembro de 1978 a Março de 1979. Serviço de Investigações Pesqueiras, Maputo: 12 pp.

ANON. (1981) Relatório preliminar da 3ª. parte da Expedição Conjunta Moçambicano - Soviética de Investigação Científica no Domínio das Pescas realizada a bordo do SRTM "Nikolay Reshetnyak" de Maio a Agosto de 1979. Instituto de Desenvolvimento Pesqueiro, Maputo. [In press]

ANON. (1981) Relatório do cruzeiro realizado no Banco de Sofala pelo arrastão camaroneiro "Muleve" em Julho - Agosto de 1979. Instituto de Desenvolvimento Pesqueiro, Maputo. [In press]

BUDNICHENKO, V.A., LEDNICHENKO, V.A., MIROSHNIKOV, V.S., PORTSEV, P.I. and SAVICH, M.S. (1977) Results obtained from the "Aelita" exploratory surveys undertaken in the shelf and open waters continuous to the coast of the People's Republic of Mozambique (May 1976 through August 1977). AzcherNIRO, Kerch.

CITEAU, J., PITON, B. et MAGNIER (1973) Observations physico-chimiques faites par le "Vauban" dans l'Océan Indien au large du cape d'Ambre et de Juan de Nova de Mai 1971 a Mars 1972. Doc. Sci. Centre Nosy-Bé, 34.

CLOWES, A.J. (1950) An Introduction to the hydrology of South African waters. Investl Rep. Fish. mar. biol. Surv. Div. Un.S. Afr., 12: 42 pp.

CLOWES, A.J. and DEACON, G.E.R. (1935) The Deep-water circulation of the Indian Ocean. Nature, 136(3450): 936-8.

CREPON, M. (1964) Présentation d'observations faites à G.E.K. en 1962. Cah. Océanogr., 16(10): 869-74.

DONGUY, J.R. et PITON, B. (1969) Aperçu des conditions hydrologiques de la partie nord du Canal de Mozambique. Cah. ORSTOM, sér. Océanogr., 7(2): 3-26.

EROFEEVA, E.S. (1970) On the seasonal variation of oceanographic conditions in the Boa Paz Bank area (East Africa). Trudi AzcherNIRO, 29: 34-44.

EROFEEVA, E.S. and RJONSNITSKY, V.B. (1970) Some peculiarities of the oceanographic regime of the Mozambique channel. Trudi AzcherNIRO, 29: 54-64.

ISAENKO, L.A., LANIN, V.I., TYULEVA, L.S. and KORZUN, Y.V. (1980) Report on the work of the Second Soviet-Mozambican Expedition on Fisheries Research (August 1978 to September 1979). AzcherNIRO, Kerch.

KHIMITSA, V.A. (1968) On the water masses and hydrochemistry of the Mozambique channel. Okeanol. issled., 19: 180-188.

LUTJEHARMS, J.R.E. (1968) A critical analysis of the dynamic and isentropic methods of computing ocean currents as applied to the Mozambique channel. Unpublished B. Sc. (Hon.) Project, Dept Oceanogr. Univ. Cape Town: 26 pp.

LUTJEHARMS, J.R.E. (1972) The south west Indian Ocean - a guide to oceanological research. Dept. Oceanogr. Univ. Cape Town.

MAGNIER, Y. et PITON, B. (1974) Les particularités de la couche 0-600 m dans l'ouest de l'Océan Indien sud-équatorial. Cah. ORSTOM, sér. Océanogr., 12(3): 173-7.

MAGNIER, Y., PITON, B. et CITEAU, J. (1972) Observations physico-chimiques faites par le "Vauban" dans l'Océan Indien de Novembre 1970 à Mars 1971. Doc. Sci. Centre Nosy-Bé, 26.

MAGNIER, Y, PITON, B. et CITEAU, J. (1973) Bathythermogrames recueillis par le "Vauban" de 1968 à 1972 dans l'ouest de l'Océan Indien sud-équatorial. En avant-propos: aperçu thérmique de la region et remarques sur la thérmocline. Doc. Sci. Centre Nosy-Bé, 30.

MÉNACHÉ, M. (1961) Découverte d'un phénomène de remontée d'eaux profondes au sud do canal de Mozambique. Mém. Inst. scient. Madagascar, F-4: 167-74.

MÉNACHÉ, M. (1963) Première campagne océanographique du "Commandant Robert Giraud" dans le canal de Mozambique, 11 Octobre - 28 Novembre 1957. Cah. Océanogr., 15(4): 224-35.

MOSTERT, S.A. (1966) Distribution of inorganic phosphate and dissolved oxygen in the south west Indian Ocean. Investl Rep. Div. Sea Fish. S. Afr., 54: 24 pp.

ORREN, M.J. (1963) Hydrological observations in the south west Indian Ocean. Investl Rep. Div. Sea Fish. S. Afr., 45: 61 pp.

PITON, B. et MAGNIER, Y. (1975) Remarques sur la circulation et les caractéristiques hydrologiques de la couche superficielle entre Madagascar et l'équateur. Cah. ORSTOM, Sér Océanogr., 13(2): 117-132.

SÆTRE, R. and PAULA E SILVA, R. (1979) The marine fish resources of Mozambique. Reports on surveys with the R/V "Dr. Fridtjof Nansen". Serviço de Investigacões Pesqueiras, Maputo. Institute of Marine Research, Bergen: 179 pp.

VISSER, G.A. and VAN NIEKERK, M.M. (1965) Ocean currents and water masses at 1,000, 1,500 and 3,000 metres in the south-west Indian Ocean. Investl Rep. Div. Sea Fish. S. Afr., 52: 46 pp.