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WORLD OCEAN DATABASE 1998 Volume 8: Temporal Distribution of Ocean Station Data Chlorophyll Profiles and Plankton Stations

Washington, D.C.
June 1998

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service

NOAA Atlas NESDIS 25



WORLD OCEAN DATABASE 1998 Volume 8: Temporal Distribution of Ocean Station Data Chlorophyll Profiles and Plankton Stations



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Silver Spring, MD
June 1998

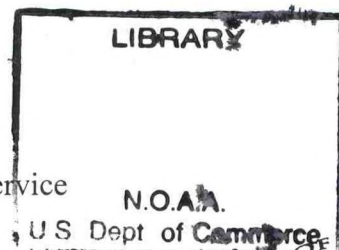


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PREFACE

The oceanographic databases described by this atlas series greatly expands on the *World Ocean Atlas 1994* (WOA94) database. Previous oceanographic databases including the NODC/WDC-A profile archives, and products derived from these databases, have proven to be of great utility to the international oceanographic, climate research, and operational environmental forecasting communities. In particular, the objectively analyzed fields of temperature and salinity derived from these databases have been used in a variety of ways. These include use as boundary and/or initial conditions in numerical ocean circulation models, for verification of numerical simulations of the ocean, as a form of "sea truth" for satellite measurements such as altimetric observations of sea surface height, and for planning oceanographic expeditions. The databases, and products based on these databases, are critical for support of international assessment programs such as the Intergovernmental Program on Climate Change (IPCC) of the United Nations.

We have expanded these earlier databases to include variables such as chlorophyll and plankton because:

- 1) there is a need for such databases to study the role of biogeochemical cycles in determining how the earth's climate system works, particularly the vulnerability of ocean ecosystems to climate change (IPCC, 1996);
- 2) the analysis of remotely sensed estimates of chlorophyll (SeaWiFS, ADEOS missions) requires knowledge of *in situ* variables such as chlorophyll and plankton;
- 3) our belief that the most comprehensive set of oceanographic databases should be available as a matter of course to the international research community.

It is well known that the amount of carbon dioxide in the earth's atmosphere will most likely double during the next century compared to CO₂ levels that occurred at the beginning of the Industrial Revolution. Regardless of one's scientific and/or political view of a possible "enhanced greenhouse warming" due to the increase of carbon dioxide, it is necessary that the international scientific community have access to the most complete historical oceanographic databases possible in order to study this problem, as well as other scientific and environmental problems. The science community should have access to the most complete oceanographic databases possible to fulfill its obligations.

The production of oceanographic databases is a major undertaking. Such work benefits from the input of many individuals and organizations. We have tried to structure the data sets in such a way as to encourage feedback from experts around the world who have knowledge that can improve the data and metadata contents of the database. It is only with such feedback that high quality global ocean databases can be prepared. Just as with scientific theories and numerical models of the ocean and atmosphere, the development of global ocean databases is not carried out in one giant step, but proceeds in an incremental fashion.

In the acknowledgment section of this publication we have expressed our view that creation of global ocean databases is only possible through the cooperation of scientists, data managers, and scientific administrators throughout the international community. I would also like to thank my colleagues and the staff of the Ocean Climate Laboratory of NODC for their dedication to the project leading to publication of this atlas series. Their integrity and thoroughness have made this database possible. It is my belief that the development and management of national and international oceanographic data archives is best performed by scientists who are actively working with the historical data.

Sydney Levitus
National Oceanographic Data Center
Silver Spring, MD
June 1998

IPCC, 1996: Impacts, Adaptations and Mitigation of Climate Change: Scientific Technical Analyses. Cambridge University Press, 872 pp.

Acknowledgments

This work was made possible by a grant from the NOAA Climate and Global Change Program which enabled the establishment of a research group at the National Oceanographic Data Center. The purpose of this group is to prepare research quality oceanographic databases, as well as to compute objective analyses of, and diagnostic studies based on, these databases.

The data made available as part of this atlas include the oceanographic data archives maintained by NODC/WDC-A as well as data acquired as a result of the NODC Oceanographic Data Archaeology and Rescue (NODAR) project and the IODE/IOC Global Oceanographic Data Archaeology and Rescue (GODAR) project. At NODC/WDC-A, "data archaeology and rescue" projects are supported with funding from the NOAA Environmental Science Data and Information Management (ESDIM) Program and NOAA Climate and Global Change Program. The majority of funding for these efforts is now provided by the ESDIM program. Support for some of the regional IOC/GODAR meetings was provided by the MAST program of the European Union (Levitus *et al.*, 1998).

We would like to acknowledge the scientists, technicians, and programmers who have submitted data to national and regional data centers as well as the managers and staff at the various data centers. Our database now allows for the storage of additional metadata including information about Principal Investigators to recognize their efforts as well as to provide information that may be useful in determining the quality of data.

The OCL expresses thanks to those who provided comments and helped develop an improved *World Ocean Database 1998* product. In particular, Dr. Steve Worley of NCAR, Dr. Harry Dooley of ICES, Dr. Norm Hall (NODC) for testing the CD-ROMs prior to distribution. John E. O'Reilly (NMFS/NOAA) contributed the program for converting from OCL ASCII format to IDL, Dr. Harry Dooley contributed the conversion program from OCL ASCII format to the ICES/OceanPC format. Any errors are the responsibility of the Ocean Climate Laboratory.

Ron Moffatt and Ervin Godfrey Trammell of the NODC International Data Exchange Team helped locate data in the WDC-A archives for digitization. The OCL would also like to acknowledge the help received over the last several years from colleagues in other NODC divisions. Francis Mitchell helped with all the code lists and accessions, Melanie Hamilton supplied GTSP data, J.D. Hardy researched and documented the correct status of many plankton names, Sheri Phillips helped Olga Baranova design our CD-ROM graphics, Mike Simmons, Carla Bazemore, and Maggie Dunklee wrote the NODC P3 format description presented in the documentation of WOD98.

Recent declassification of substantial amounts of naval oceanographic data by the Russian Naval Ocean Research Center, the United Kingdom Hydrographic Office, and the Argentine Navy is acknowledged. The Intergovernmental Oceanographic Commission has requested such declassification efforts in recent years.

References

- Levitus, S., M. Conkright, T.P. Boyer, R. Gelfeld, D. Johnson, I. Smolyar, C. Stephens, G. Trammell, R. Moffatt, T. O'Brien, L. Stathoplos, 1998: Results of the IOC Global Oceanographic Data Archaeology and Rescue (GODAR) project. NOAA NESDIS Technical Report.

World Ocean Database 1998, Volume 8: Temporal Distribution of Ocean Station Data Chlorophyll Profiles and Plankton Stations

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ABSTRACT

This atlas describes a collection of scientifically quality controlled ocean chlorophyll profiles and plankton stations. Yearly distributions for individual years of all chlorophyll profiles and plankton stations in the database are presented to provide information on the state of ocean profile observations.

1. INTRODUCTION

Ocean Station Data (OSD) has historically referred to measurements made from a stationary research ship using reversing thermometers to measure temperature and making measurements of other variables such as salinity, oxygen, nutrients, chlorophyll, *etc.* on seawater samples gathered using special bottles. The two most commonly used bottles are the Nansen and Niskin bottles. Data that are in the OSD files are frequently referred to as "bottle data" and the entire collection of data from these file may be alternatively referred to as the "Bottle Data File".

2. CHLOROPHYLL PROFILE and PLANKTON STATION DISTRIBUTIONS

Figure 1 shows the number of chlorophyll profiles contained in WOD98 for the world ocean as a function of year. Figures 2 and 3 show the time series for the northern and southern hemispheres respectively. Figure 4 shows the distribution of OSD chlorophyll profiles contained in WOD98 for the world ocean. There are a total of 135,458 chlorophyll profiles for the entire world ocean with 46,768 profiles (34.5%) measured in the southern hemisphere and 88,690 profiles (65.5%) measured in the northern hemisphere. Table 1 provides the number of chlorophyll profiles included in WOD98 as a function of year. Tables 2 and 3 show the time series for the northern and southern hemispheres respectively. The geographic distribution of chlorophyll profiles for individual years for 1955-1996 are shown in Appendix A, Figures A1-A42.

Figure 5 shows the number of plankton stations contained in WOD98 for the world ocean as a function of year. Figures 6 and 7 show the time series for the southern and northern hemispheres respectively. Figure 8 shows the distribution of OSD plankton stations contained in WOD98 for the world ocean. Figures 9-18 show the distribution of OSD plankton stations for: zooplankton, phytoplankton, plankton biomass, copepods, chaetognaths, diatoms, and dinoflagellates respectively. There are a total of 83,650 plankton stations for the entire world ocean with 9,228 profiles (11.0%) measured in the southern hemisphere and 74,422 profiles (89.0%) measured in the northern hemisphere. Table 4 provides the number of plankton stations included in WOD98 as a function of year. Tables 5 and 6 show the time series for the southern and northern hemispheres respectively. Tables 7-9 show the times series of zooplankton, phytoplankton and plankton biomass stations in WOD98 as a function of year respectively. The geographic distribution of plankton stations for individual years for 1928-1993 are shown in Appendix B, Figures B1-B55.

Most profiles have been made in the northern hemisphere, but the southern hemisphere coverage has been increased due to international data archaeology and rescue efforts and the World Ocean Database project (Levitus *et al.* 1994, 1998).

3. BIBLIOGRAPHY

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Levitus, S., M. Conkright, T.P. Boyer, R. Gelfeld, D. Johnson, I. Smolyar, C. Stephens, G. Trammell, R. Moffatt, T. O'Brien, L. Stathoplos, 1998: Results of the IOC Global Oceanographic Data Archaeology and Rescue (GODAR) project. NOAA NESDIS Technical Report.

Table 1 The number of Ocean Station Data (OSD) chlorophyll profiles in WOD98 as a function of year for the world ocean.

The total number of profiles = 131,598

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1955	119	1966	679	1977	2067	1987	6331
1956	122	1967	903	1978	6201	1988	4873
1957	283	1968	747	1979	13594	1989	6476
1958	526	1969	596	1980	7595	1990	5853
1959	448	1970	365	1981	8703	1991	2933
1960	578	1971	824	1982	10942	1992	3203
1961	410	1972	1215	1983	8499	1993	1861
1962	248	1973	1359	1984	8332	1994	1376
1963	868	1974	1316	1985	7823	1995	444
1964	1249	1975	1341	1986	7649	1996	131
1965	1098	1976	1418				

Table 2 The number of Ocean Station Data (OSD) chlorophyll profiles in WOD98 as a function of year for the southern hemisphere.

The total number of profiles = 46,760

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1955	42	1965	399	1975	265	1985	4173
1956	0	1966	239	1976	507	1986	3396
1957	20	1967	374	1977	705	1987	3530
1958	140	1968	265	1978	1597	1988	1600
1959	43	1969	134	1979	2733	1989	1550
1960	239	1970	56	1980	3521	1990	1539
1961	106	1971	122	1981	3400	1991	406
1962	125	1972	137	1982	4978	1992	670
1963	217	1973	251	1983	4867	1993	4
1964	217	1974	243	1984	3950		

Table 3 The number of Ocean Station Data (OSD) chlorophyll profiles in WOD98 as a function of year for the northern hemisphere.

The total number of profiles = 84,838

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1955	77	1966	440	1977	1362	1987	2801
1956	122	1967	529	1978	4604	1988	3273
1957	263	1968	482	1979	10861	1989	4926
1958	386	1969	462	1980	4074	1990	4314
1959	405	1970	309	1981	5303	1991	2527
1960	339	1971	702	1982	5964	1992	2533
1961	304	1972	1078	1983	3632	1993	1857
1962	123	1973	1108	1984	4382	1994	1376
1963	651	1974	1073	1985	3650	1995	444
1964	1032	1975	1076	1986	4253	1996	131
1965	699	1976	911				

Table 4 The number of Ocean Station Data (OSD) plankton stations in WOD98 as a function of year for the world ocean.

The total number of stations = 83,650

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1928	2	1945	0	1962	1779	1978	3394
1929	51	1946	6	1963	2391	1979	2836
1930	26	1947	24	1964	2439	1980	2685
1931	21	1948	0	1965	2326	1981	3422
1932	0	1949	98	1966	2912	1982	2072
1933	0	1950	509	1967	4872	1983	2125
1934	179	1951	1742	1968	2187	1984	2434
1935	0	1952	1853	1969	1936	1985	2329
1936	0	1953	2614	1970	320	1986	1886
1937	0	1954	3069	1971	907	1987	1198
1938	5	1955	2306	1972	2062	1988	1837
1939	0	1956	1972	1973	670	1989	1254
1940	2	1957	1789	1974	669	1990	431
1941	0	1958	2098	1975	1763	1991	869
1942	2	1959	2362	1976	771	1992	1051
1943	0	1960	2001	1977	1717	1993	183
1944	0	1961	1192				

Table 5 The number of Ocean Station Data (OSD) plankton stations in WOD98 as a function of year for the southern hemisphere.

The total number of stations = 9,228

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1946	6	1958	94	1970	61	1981	256
1947	23	1959	0	1971	335	1982	25
1948	0	1960	57	1972	309	1983	171
1949	0	1961	5	1973	206	1984	66
1950	0	1962	349	1974	128	1985	452
1951	0	1963	598	1975	164	1986	2
1952	0	1964	778	1976	189	1987	0
1953	0	1965	943	1977	73	1988	0
1954	0	1966	620	1978	84	1989	0
1955	178	1967	1829	1979	246	1990	0
1956	0	1968	808	1980	68	1991	46
1957	13	1969	46				

Table 6 The number of Ocean Station Data (OSD) plankton stations in WOD98 as a function of year for the northern hemisphere.

The total number of stations = 74,422

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1928	2	1945	0	1962	1430	1978	3310
1929	51	1946	0	1963	1793	1979	2590
1930	26	1947	1	1964	1661	1980	2617
1931	21	1948	0	1965	1383	1981	3166
1932	0	1949	98	1966	2292	1982	2047
1933	0	1950	509	1967	3043	1983	1954
1934	179	1951	1742	1968	1379	1984	2368
1935	0	1952	1853	1969	1890	1985	1877
1936	0	1953	2614	1970	259	1986	1884
1937	0	1954	3069	1971	572	1987	1198
1938	5	1955	2128	1972	1753	1988	1837
1939	0	1956	1972	1973	464	1989	1254
1940	2	1957	1776	1974	541	1990	431
1941	0	1958	2004	1975	1599	1991	823
1942	2	1959	2362	1976	582	1992	1051
1943	0	1960	1944	1977	1644	1993	183
1944	0	1961	1187				

Table 7 The number of Ocean Station Data (OSD) zooplankton stations in WOD98 as a function of year for the world ocean.

The total number of stations = 19,147

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1928	2	1945	0	1962	859	1978	514
1929	51	1946	0	1963	1366	1979	597
1930	26	1947	0	1964	1231	1980	670
1931	21	1948	0	1965	695	1981	845
1932	0	1949	0	1966	542	1982	713
1933	0	1950	4	1967	873	1983	744
1934	94	1951	16	1968	478	1984	645
1935	0	1952	0	1969	169	1985	688
1936	0	1953	1027	1970	19	1986	825
1937	0	1954	1461	1971	94	1987	376
1938	5	1955	247	1972	356	1988	791
1939	0	1956	9	1973	67	1989	704
1940	2	1957	183	1974	55	1990	8
1941	0	1958	16	1975	78	1991	9
1942	2	1959	26	1976	118	1992	0
1943	0	1960	190	1977	414	1993	30
1944	0	1961	192				

Table 8 The number of Ocean Station Data (OSD) phytoplankton stations in WOD98 as a function of year for the world ocean.

The total number of stations = 13,842

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1929	3	1946	6	1962	1	1978	1241
1930	12	1947	24	1963	31	1979	1478
1931	0	1948	0	1964	32	1980	1302
1932	0	1949	0	1965	42	1981	1082
1933	0	1950	0	1966	137	1982	1051
1934	120	1951	0	1967	126	1983	977
1935	0	1952	0	1968	95	1984	678
1936	0	1953	0	1969	120	1985	749
1937	0	1954	0	1970	14	1986	787
1938	0	1955	0	1971	32	1987	359
1939	0	1956	0	1972	145	1988	613
1940	0	1957	0	1973	133	1989	618
1941	0	1958	0	1974	146	1990	12
1942	0	1959	0	1975	123	1991	119
1943	0	1960	2	1976	515	1992	0
1944	0	1961	1	1977	913	1993	3
1945	0						

Table 9 The number of Ocean Station Data (OSD) plankton biomass stations in WOD98 as a function of year for the world ocean.

The total number of stations = 64,422

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1949	98	1960	1824	1971	810	1982	1269
1950	505	1961	1004	1972	1741	1983	1352
1951	1726	1962	1291	1973	515	1984	1964
1952	1853	1963	1739	1974	496	1985	1810
1953	1858	1964	1771	1975	1673	1986	1321
1954	1994	1965	1798	1976	409	1987	1056
1955	2305	1966	2244	1977	919	1988	1395
1956	1960	1967	4029	1978	2414	1989	415
1957	1782	1968	1804	1979	1482	1990	375
1958	2084	1969	1887	1980	1724	1991	369
1959	2362	1970	315	1981	2422	1992	258

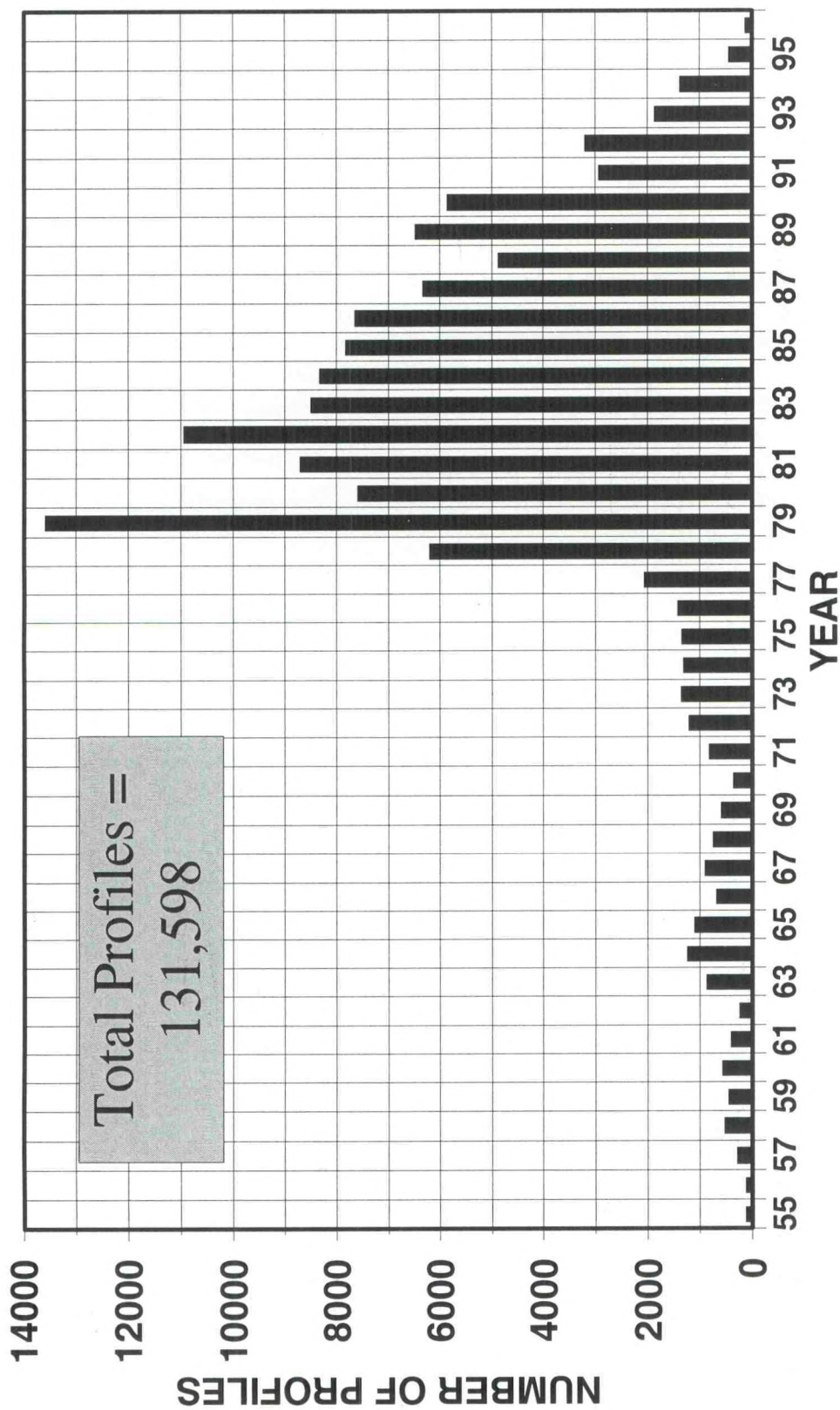


Fig. 1 Time series of Ocean Station Data (OSD) chlorophyll profiles in WOD98 for the world ocean as a function of year

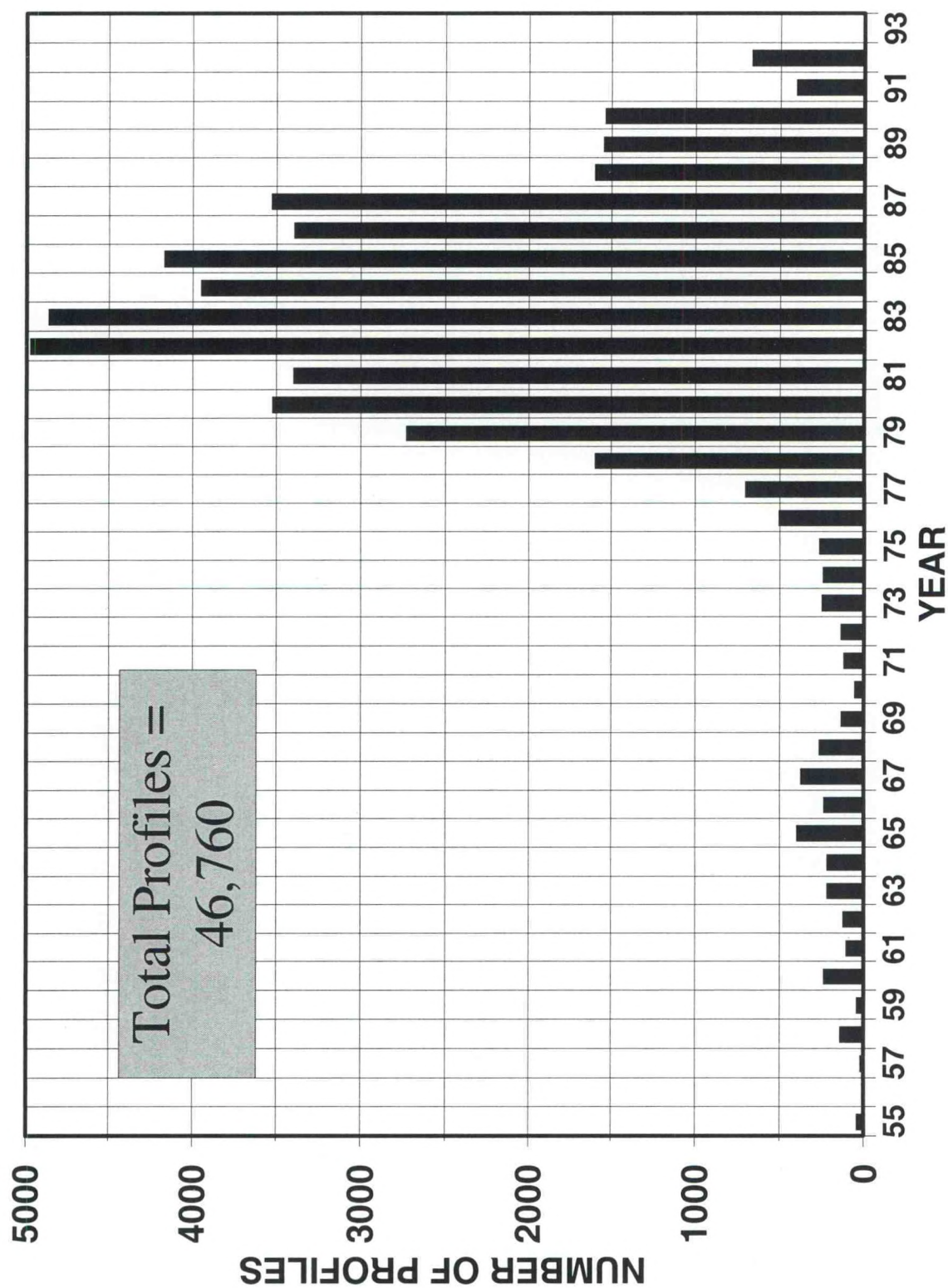


Fig. 2 Time series of Ocean Station Data (OSD) chlorophyll profiles in WOD98 for the southern hemisphere as a function of year

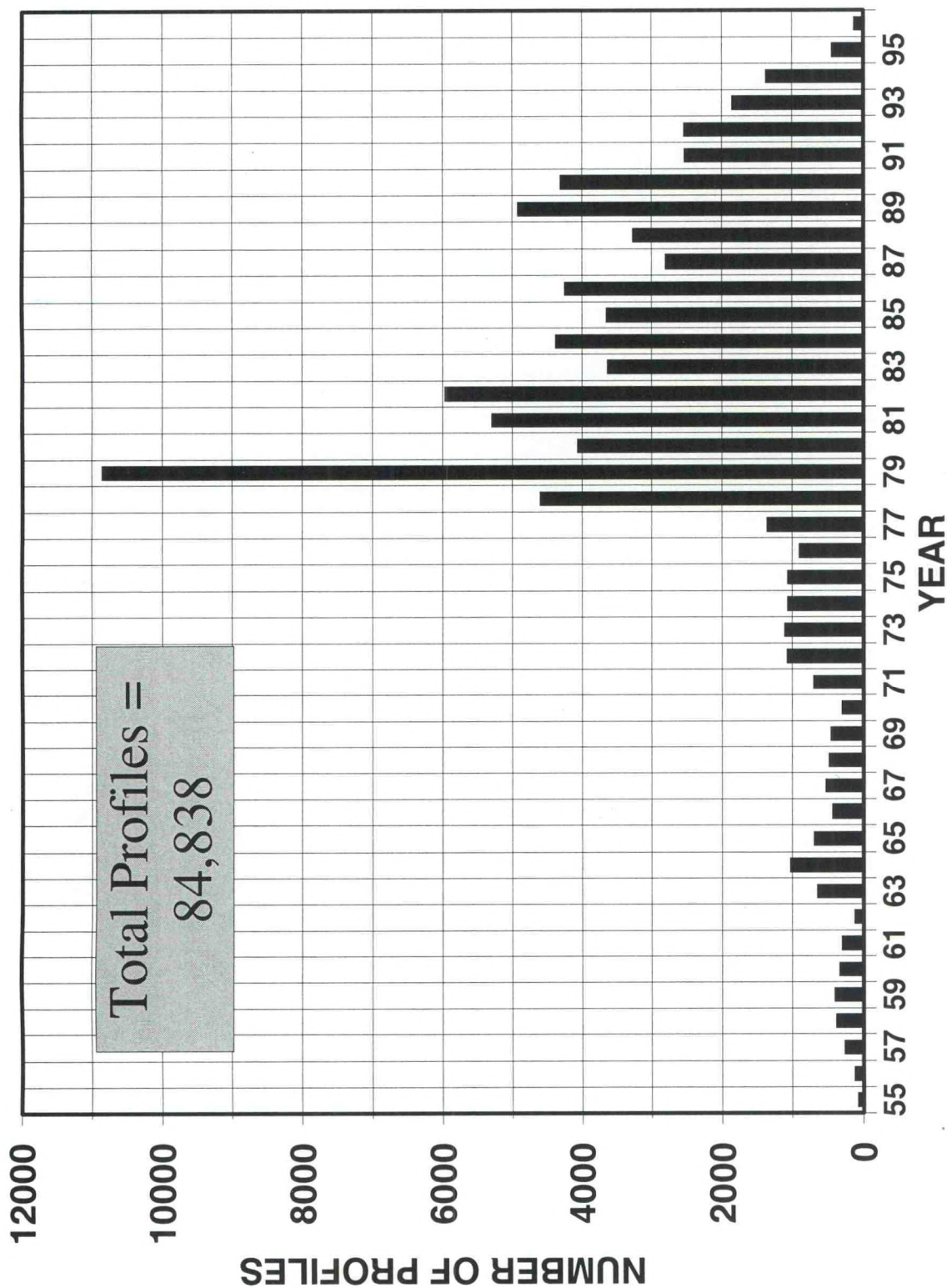


Fig. 3 Time series of Ocean Station Data (OSD) chlorophyll profiles in WOD98 for the northern hemisphere as a function of year

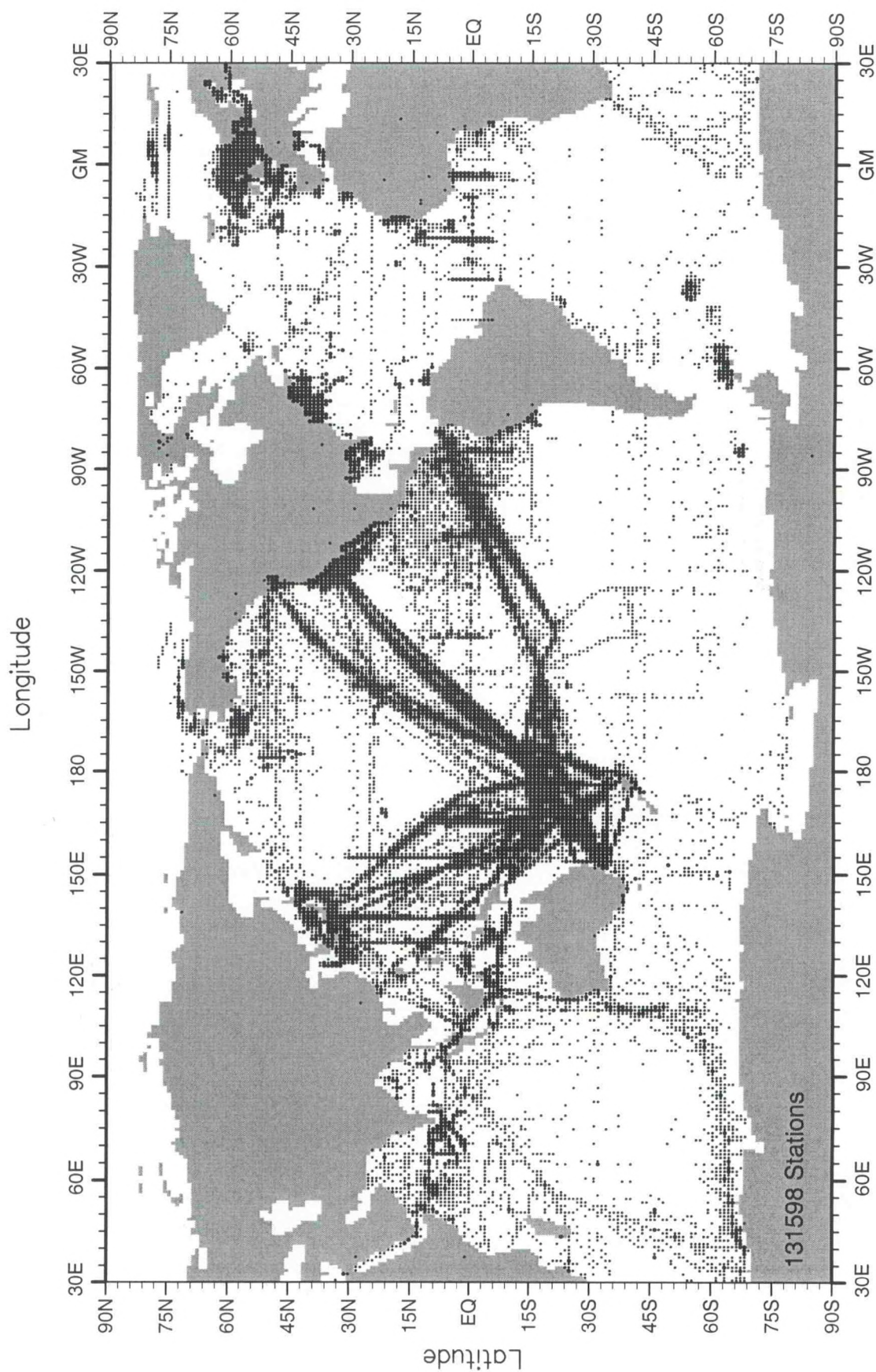


Fig. 4 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98

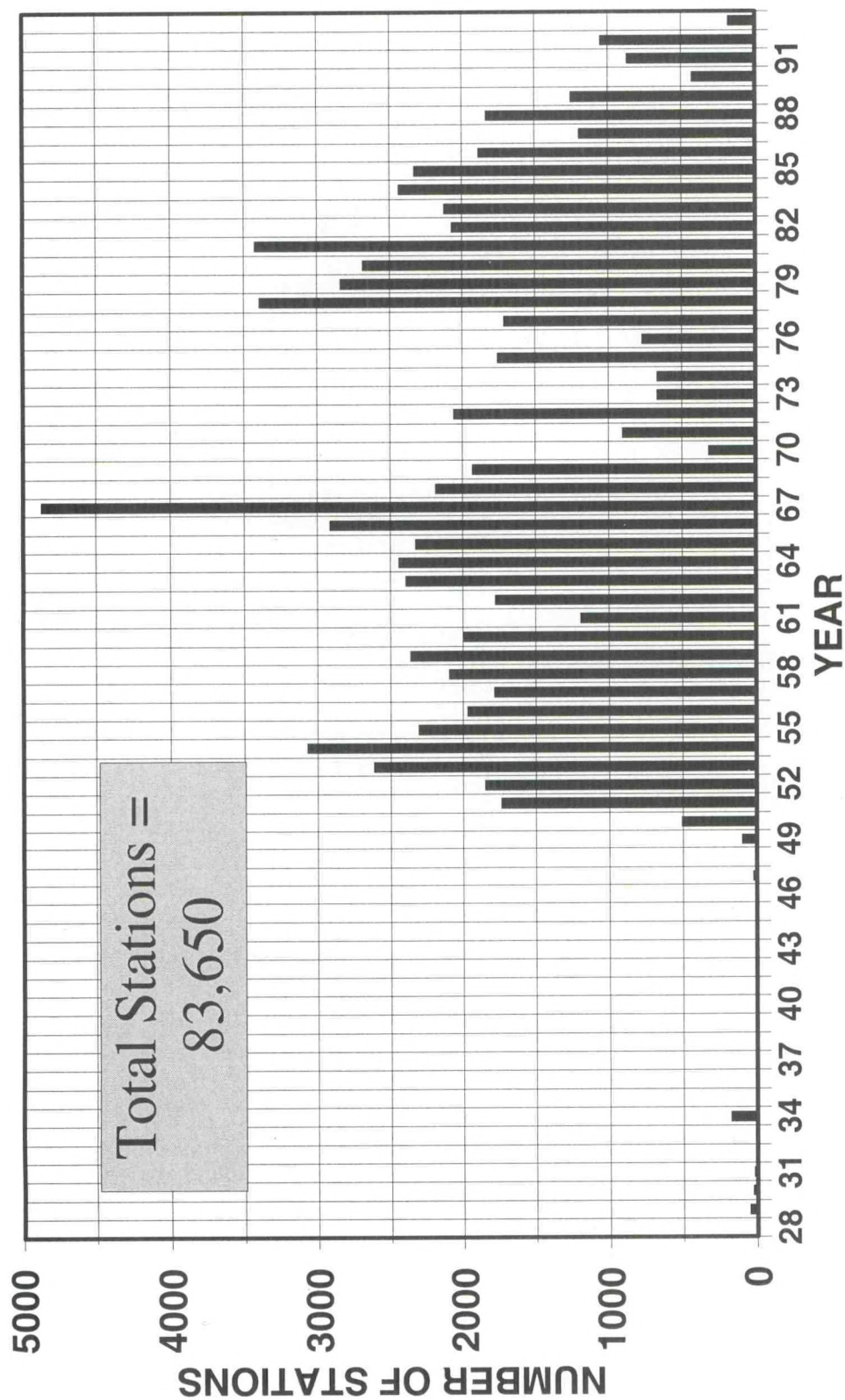


Fig. 5 Time series of Ocean Station Data (OSD) plankton stations in WOD98 for the world ocean as a function of year

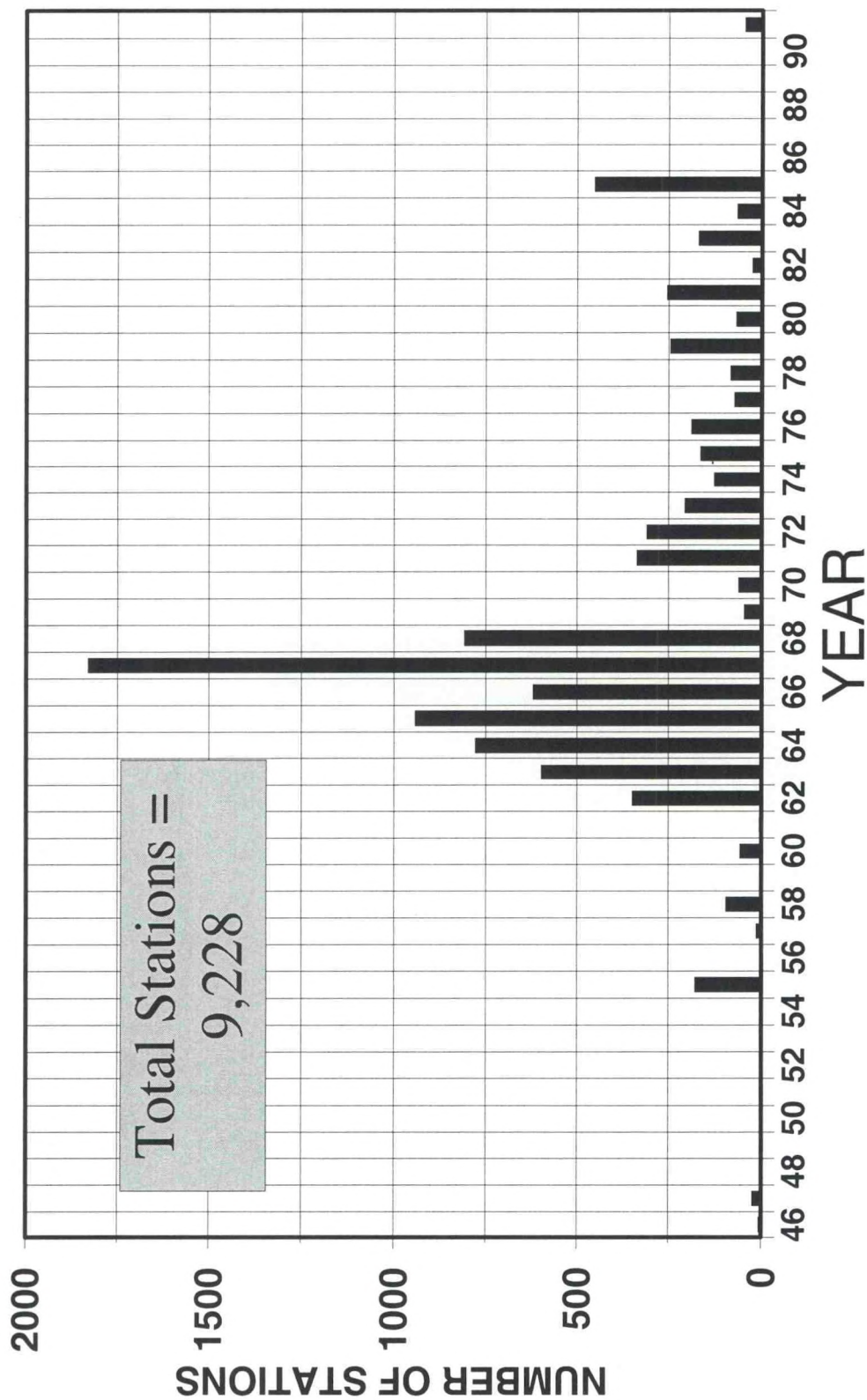


Fig. 6 Time series of Ocean Station Data (OSD) plankton stations in WOD98 for the southern hemisphere as a function of year

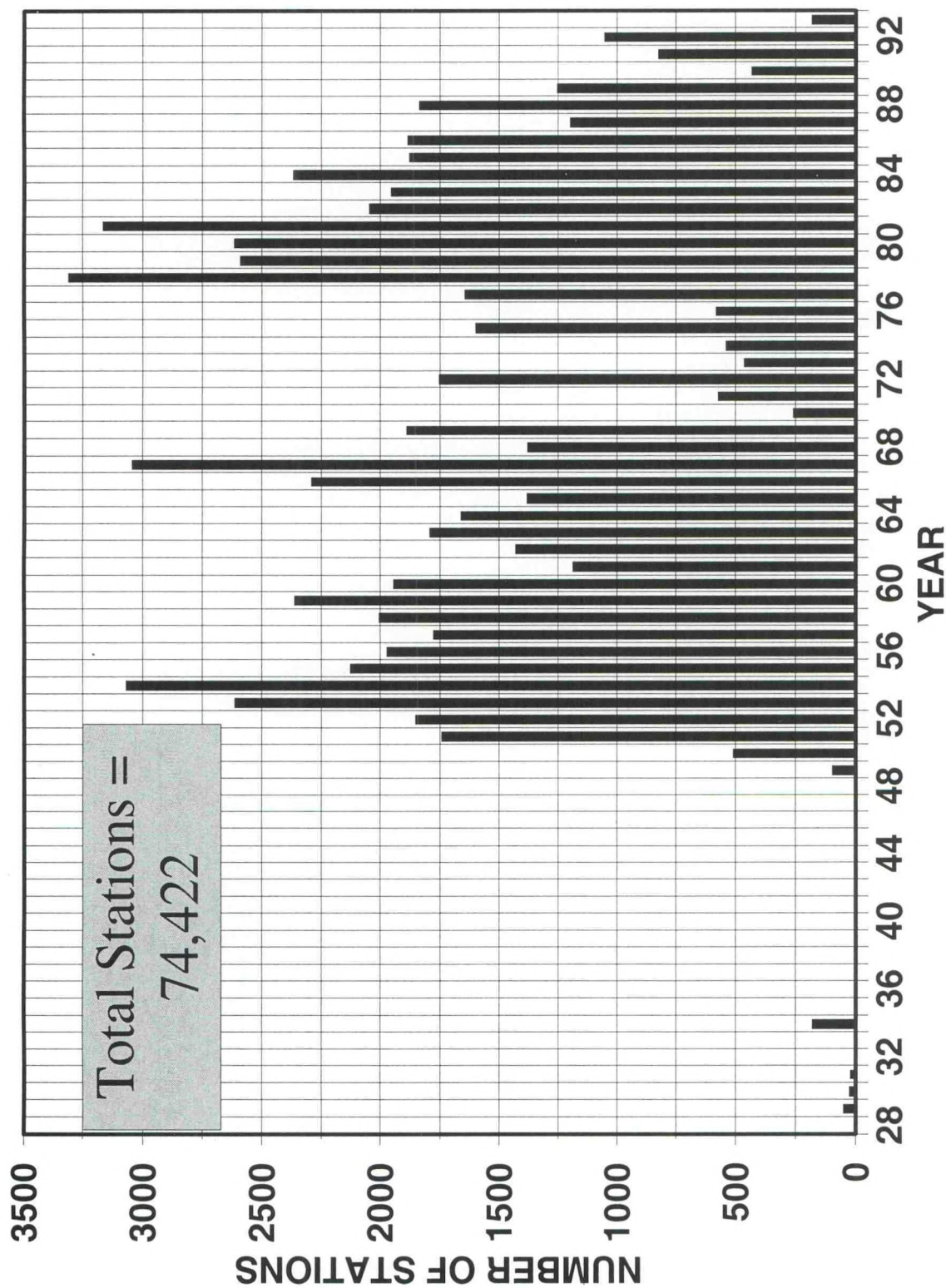


Fig. 7 Time series of Ocean Station Data (OSD) plankton stations in WOD98 for the northern hemisphere as a function of year

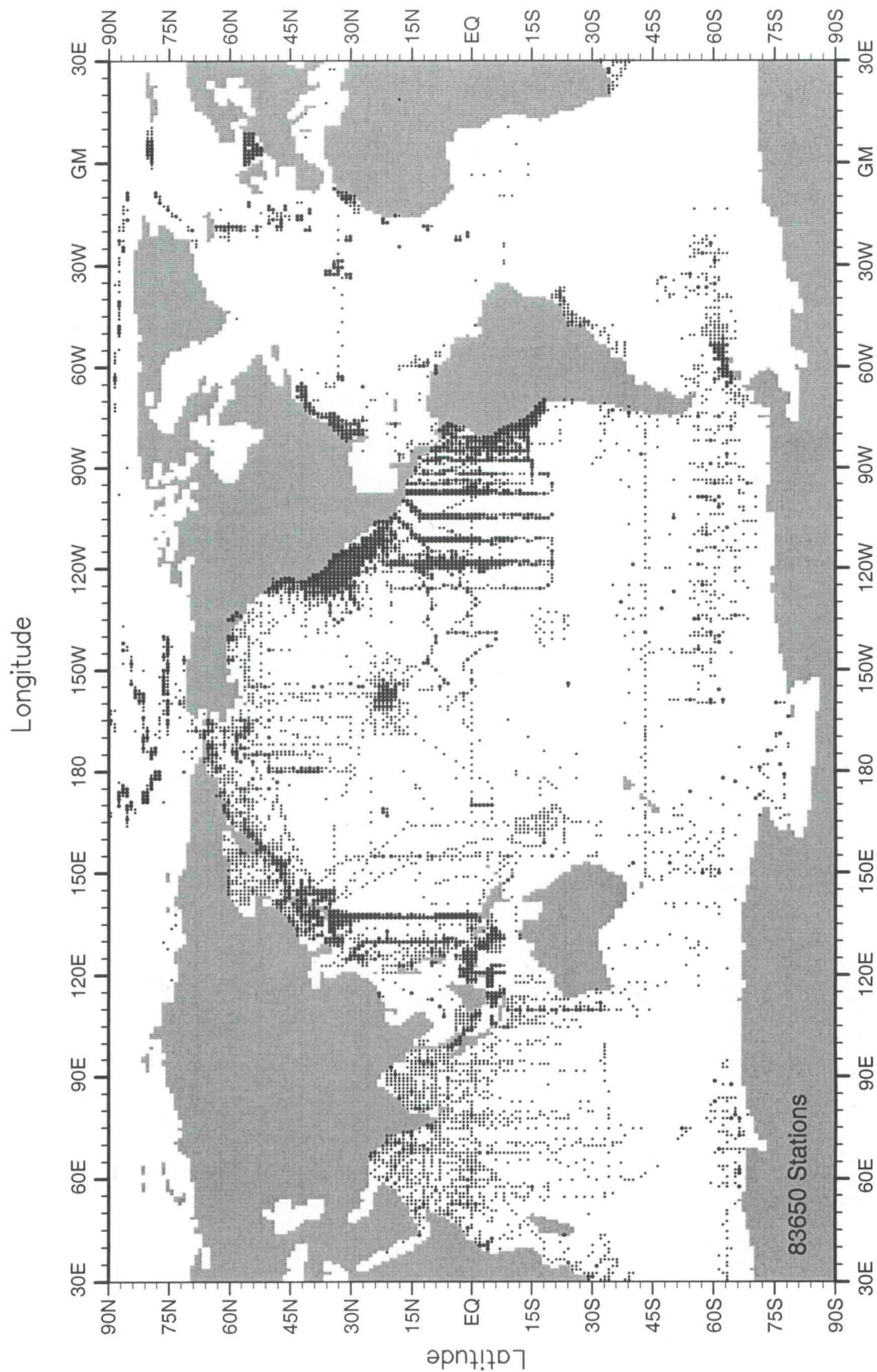


Fig. 8 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98

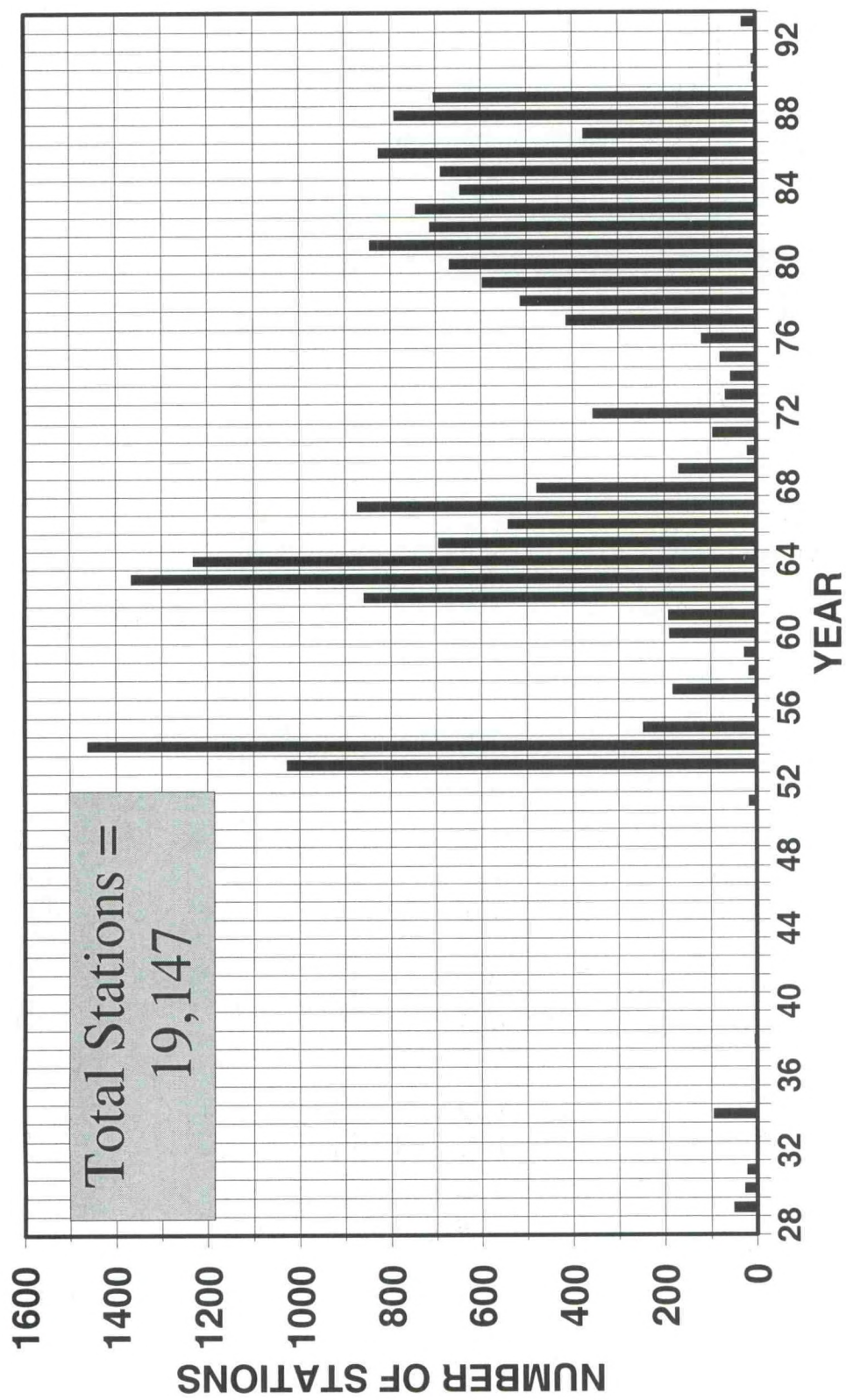


Fig. 9 Time series of Ocean Station Data (OSD) zooplankton stations in WOD98 for the world ocean as a function of year

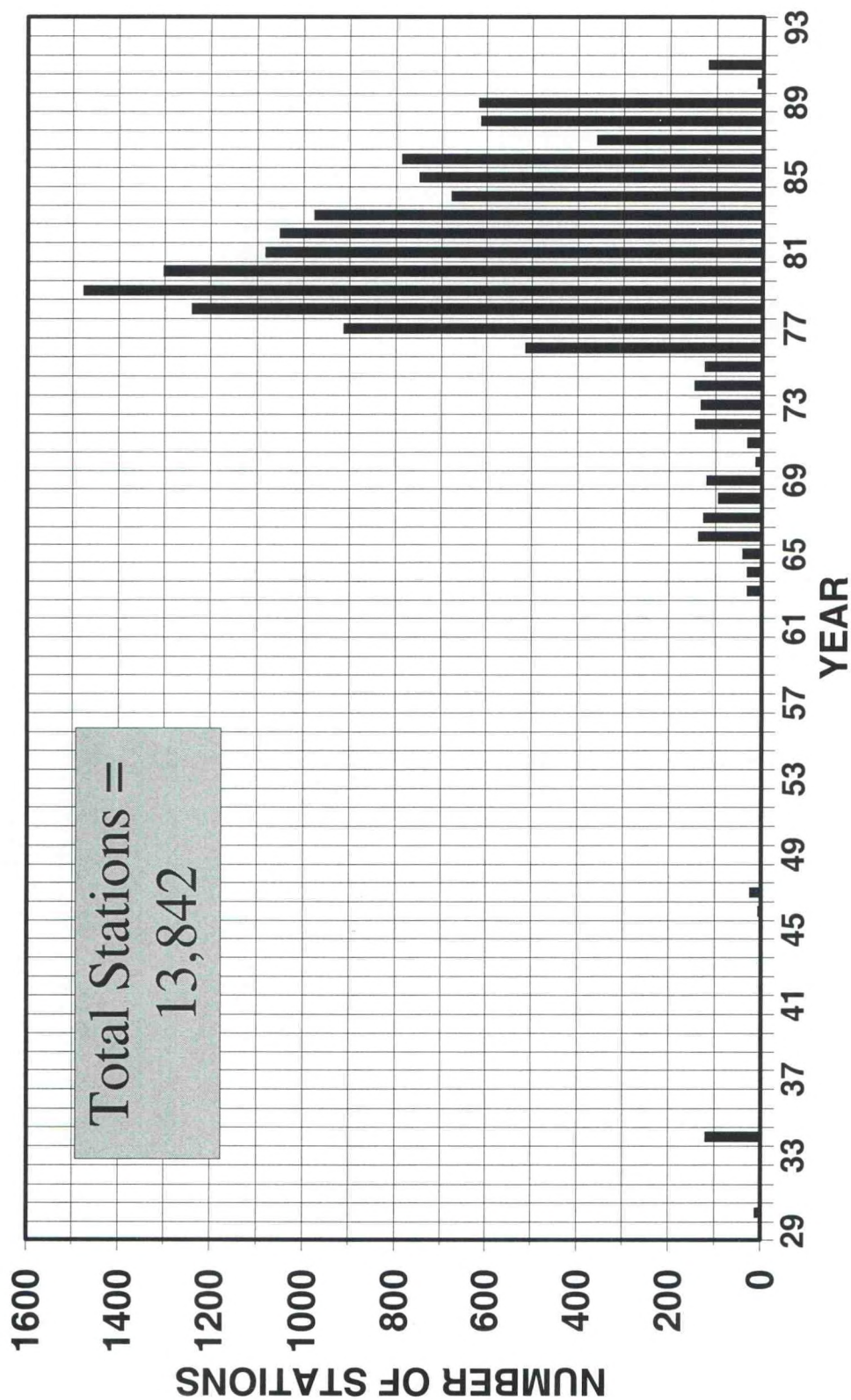


Fig. 10 Time series of Ocean Station Data (OSD) phytoplankton stations in WOD98 for the world ocean as a function of year

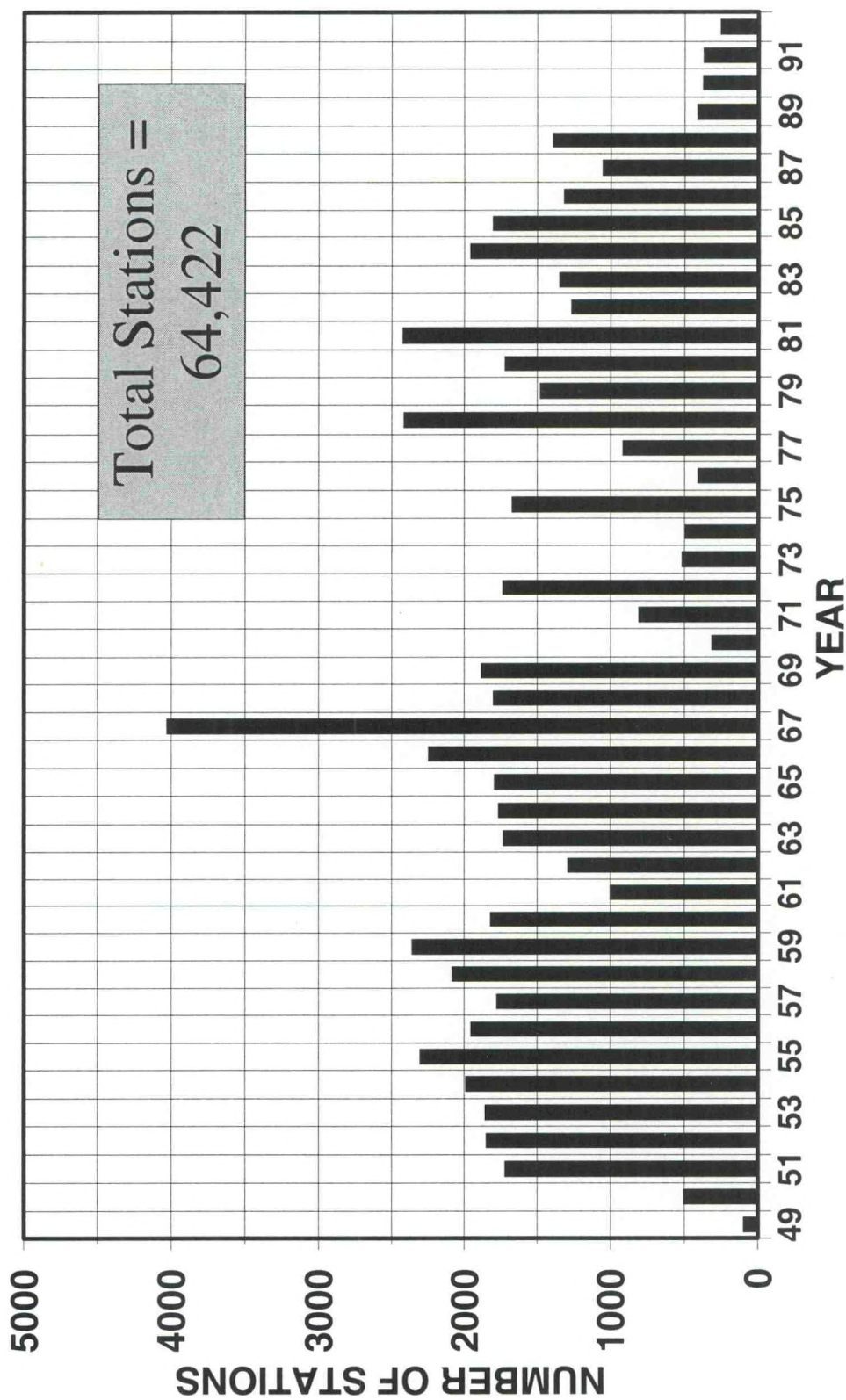


Fig. 11 Time series of Ocean Station Data (OSD) plankton biomass stations in WOD98 for the world ocean as a function of year

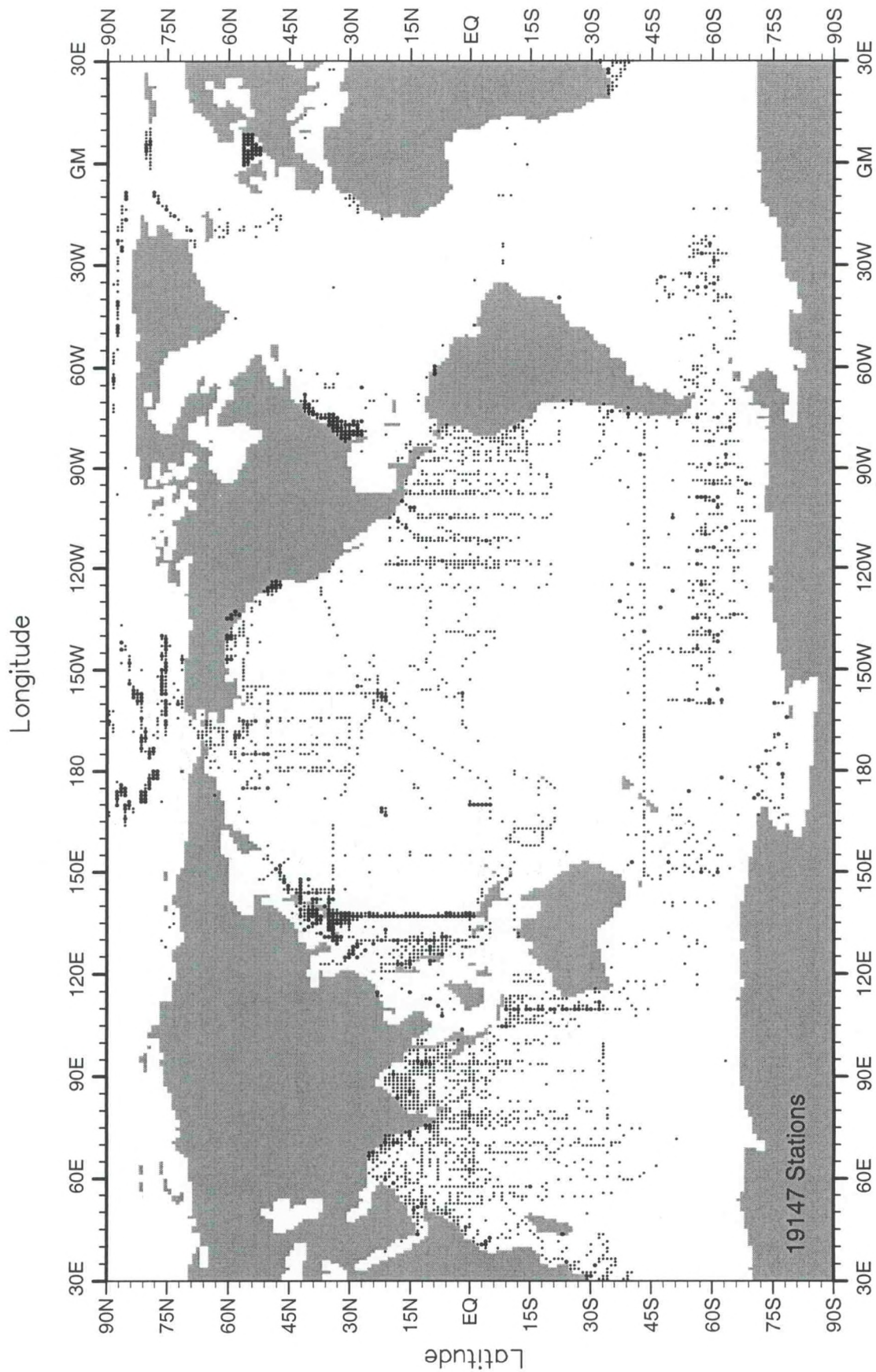


Fig. 12 Distribution of all Ocean Station Data (OSD) zooplankton stations in WOD98

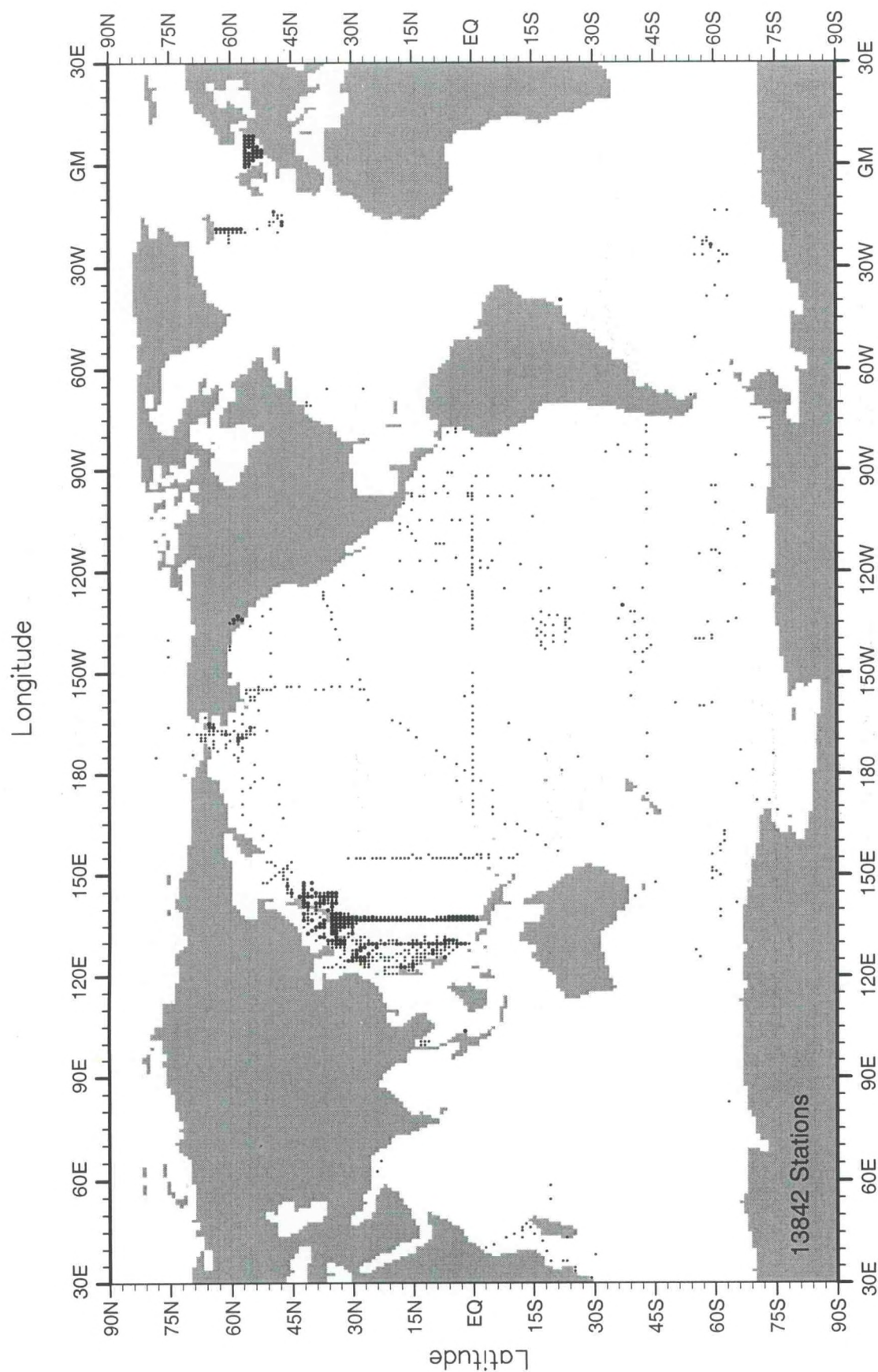


Fig. 13 Distribution of all Ocean Station Data (OSD) phytoplankton stations in WOD98

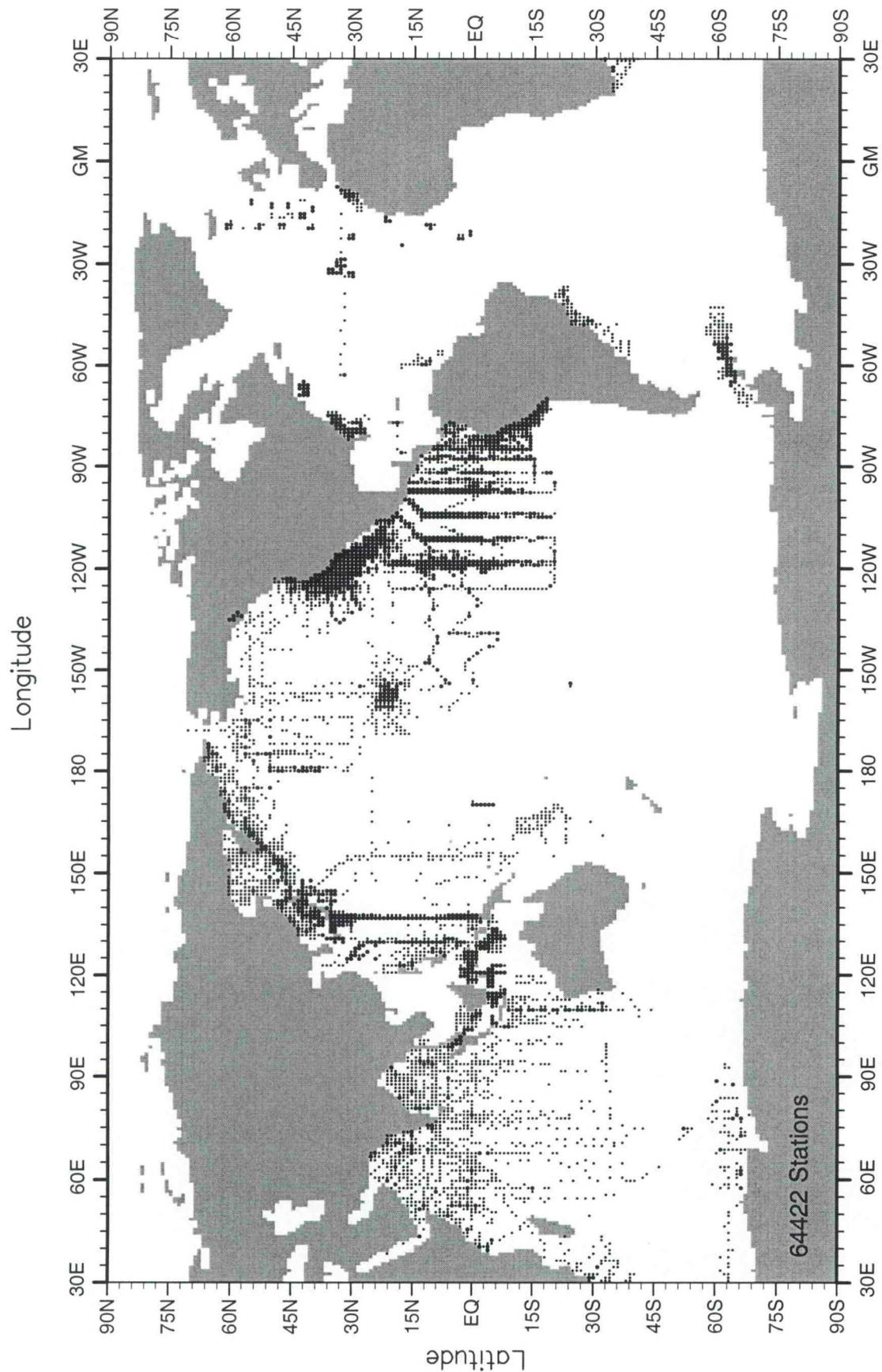


Fig. 14 Distribution of all Ocean Station Data (OSD) plankton biomass stations in WOD98

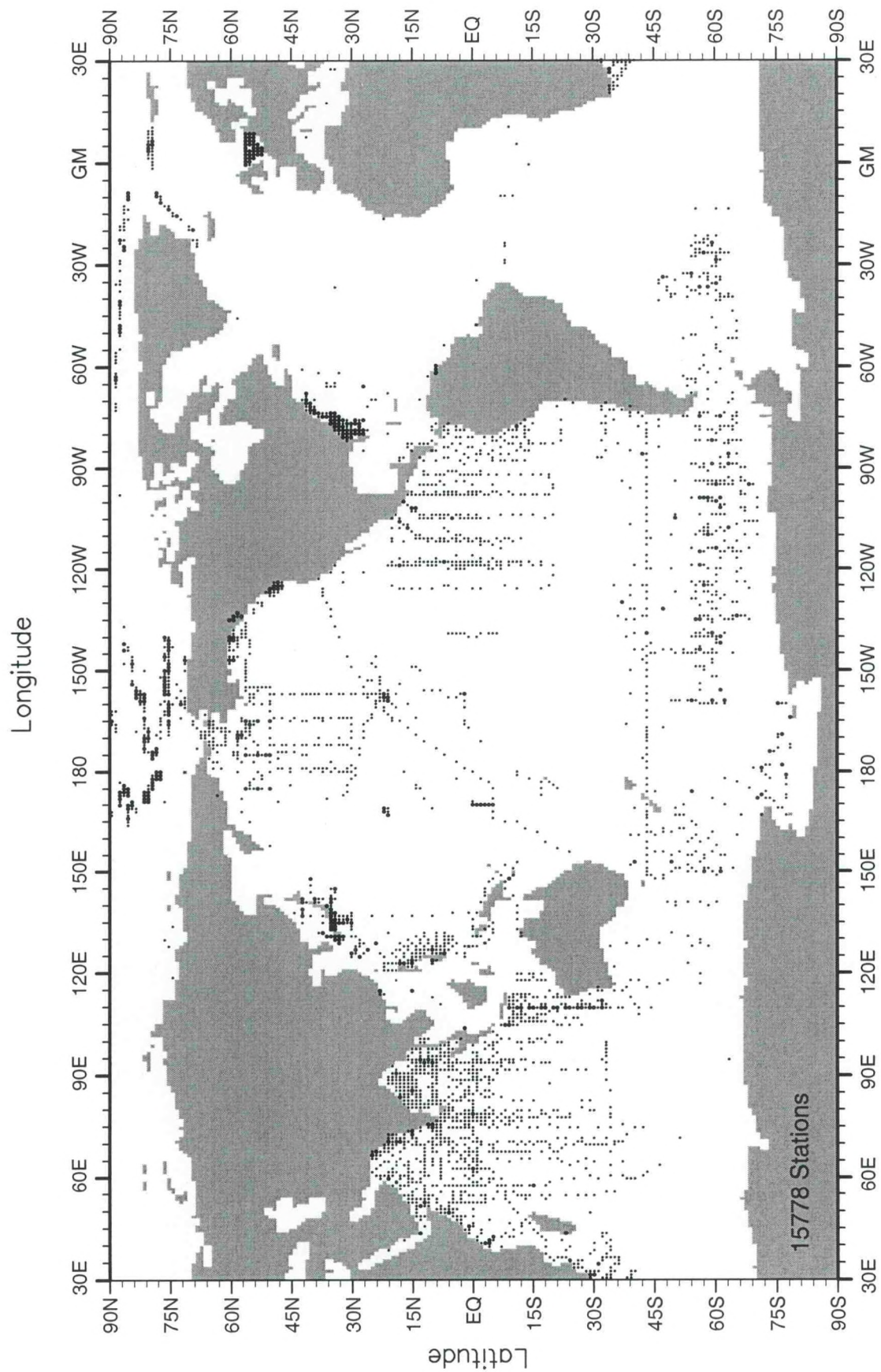


Fig. 15 Distribution of all Ocean Station Data (OSD) copepod stations in WOD98

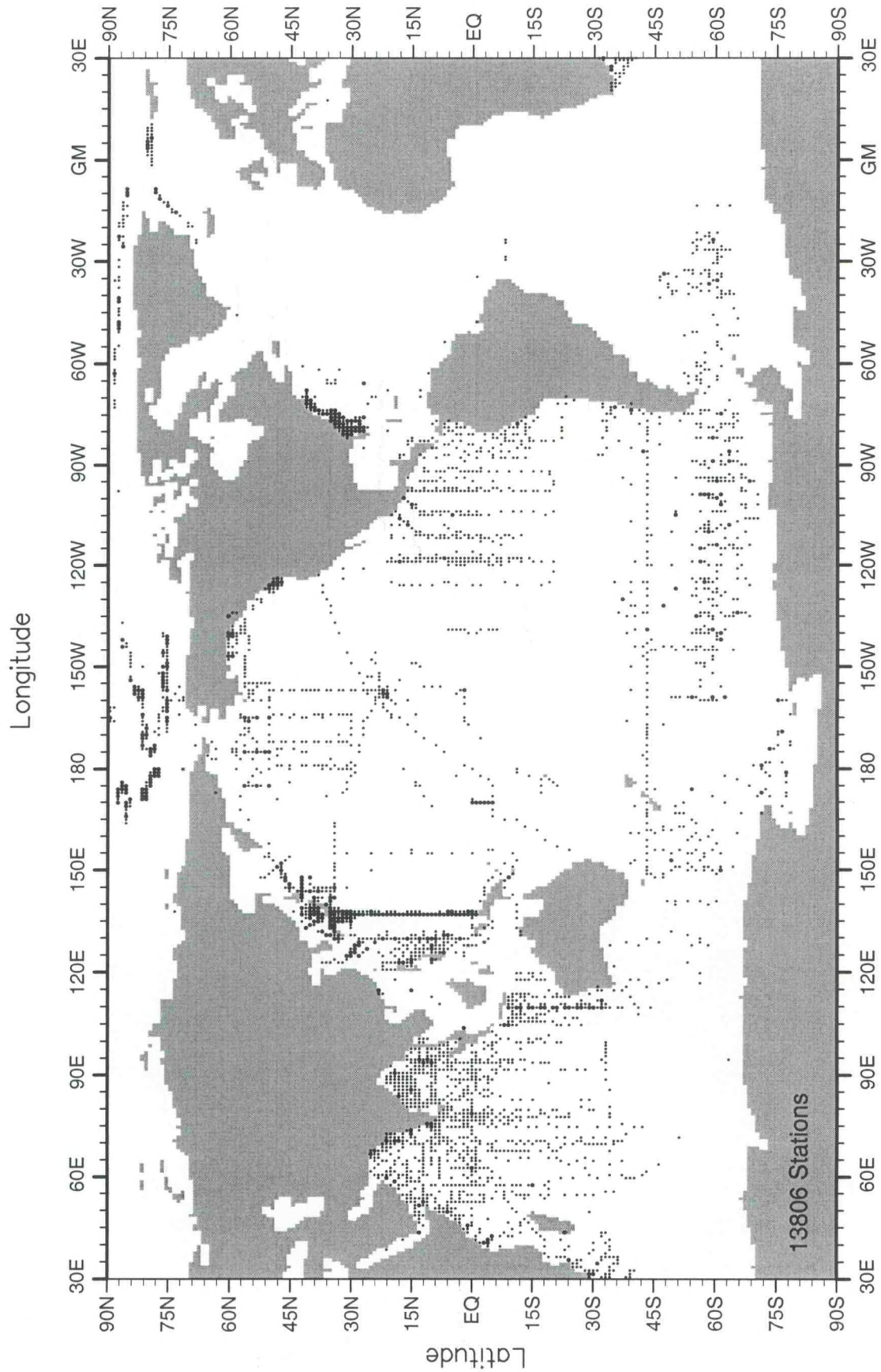


Fig. 16 Distribution of all Ocean Station Data (OSD) chaetognath stations in WOD98

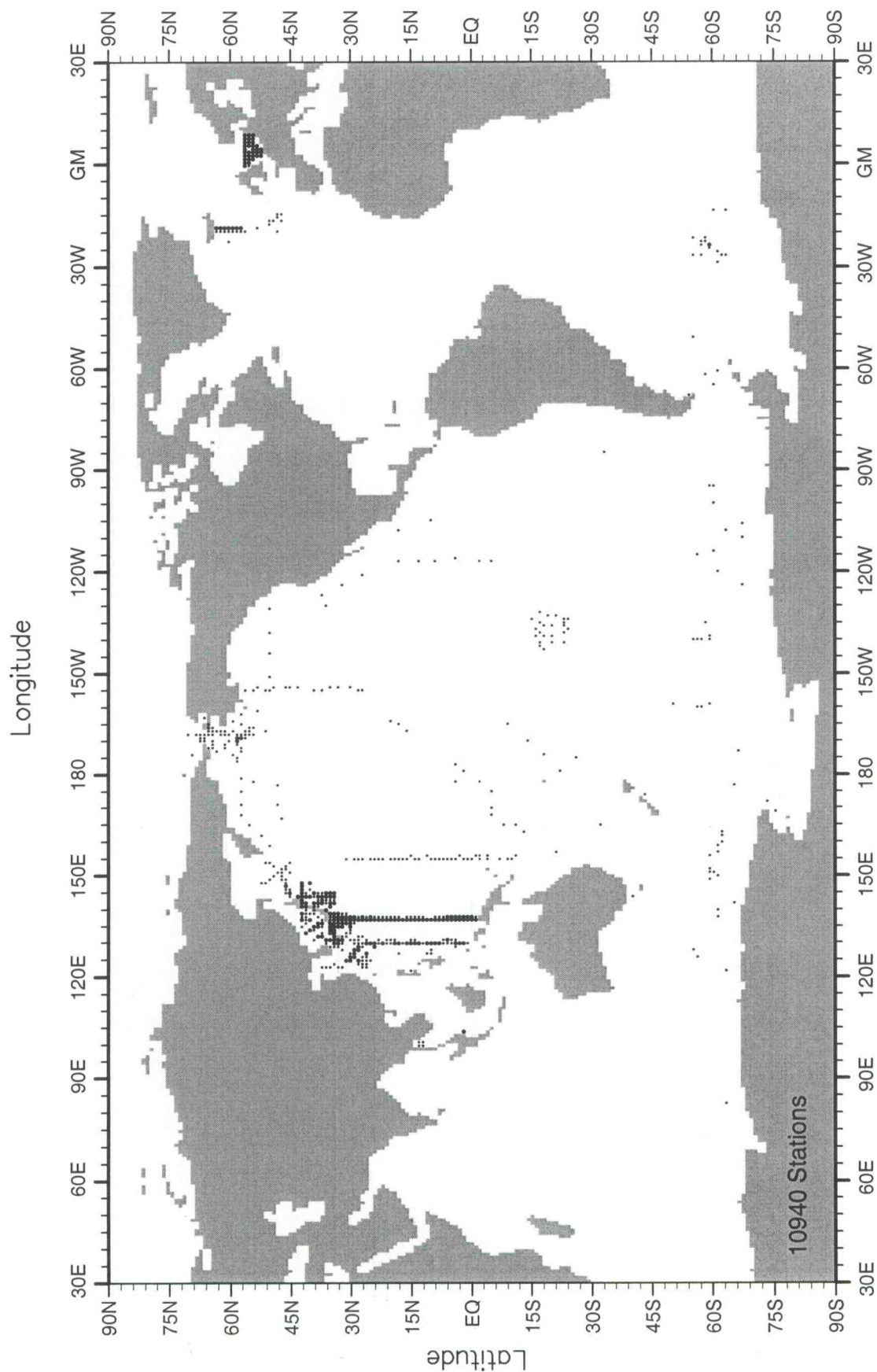


Fig. 17 Distribution of all Ocean Station Data (OSD) diatom stations in WOD98

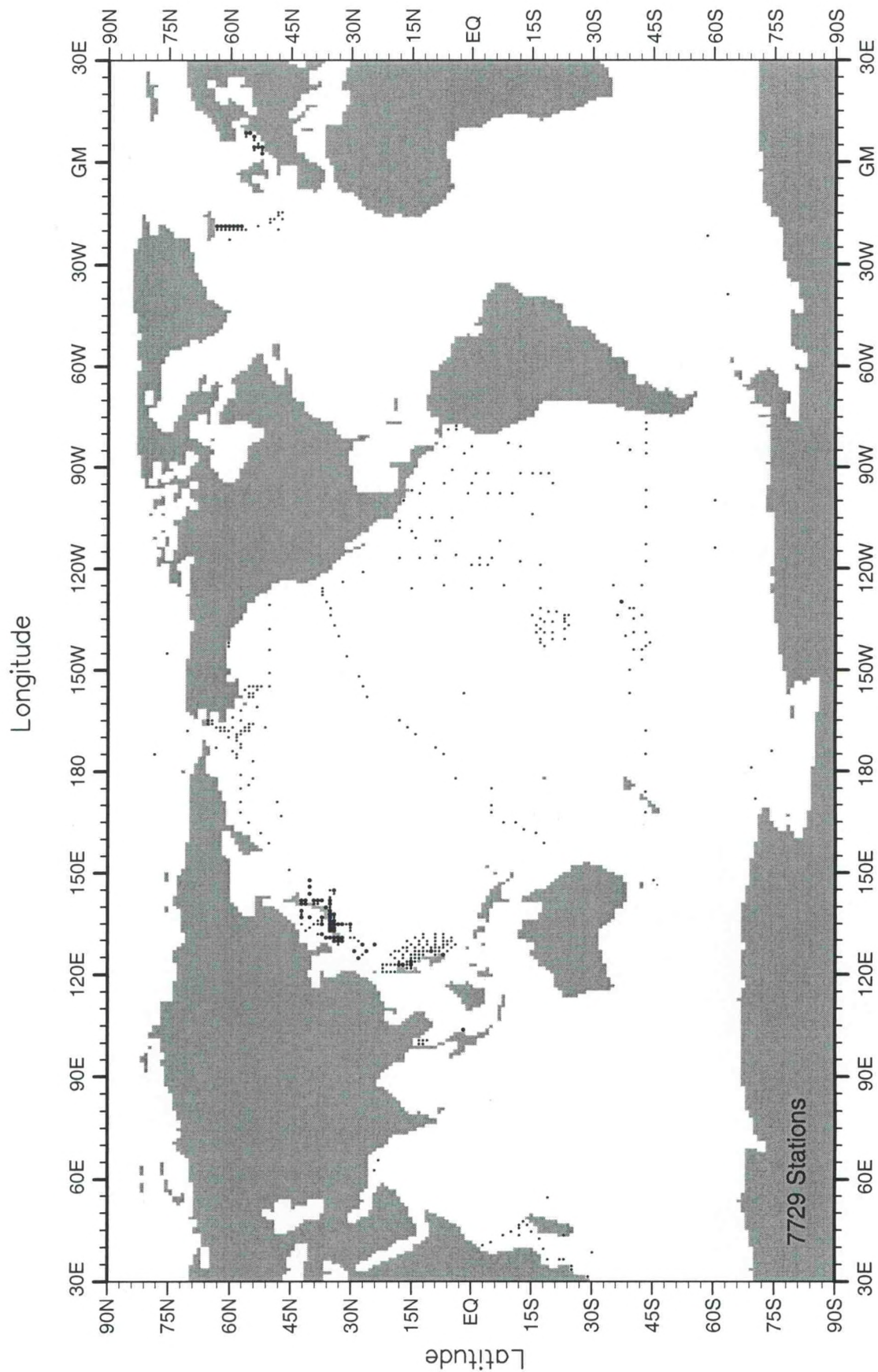


Fig. 18 Distribution of all Ocean Station Data (OSD) dinoflagellate stations in WOD98

4. APPENDIX A: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL OSD CHLOROPHYLL PROFILES IN WOD98

This appendix contains yearly distributions of all OSD chlorophyll profiles contained in WOD98. These maps provide some history of the observational progress of the field of oceanography. They also serve as indicators of whether or not a particular data set from a scientist or institution is part of the NODC/WDC-A archive. The exchange of information provided by the publication of such maps has provided us with valuable information about deficiencies in the database. The locations of all WOD98 OSD chlorophyll profiles are plotted including stations that may be erroneously located over land. However, WOD98 contains some stations from various lakes so care should be exercised in the use of these stations and the determination as to whether they represent errors in locations.

For all figures in Appendix A, a small dot indicates a one-degree square containing from one to four stations and a large dot indicates five or more stations.

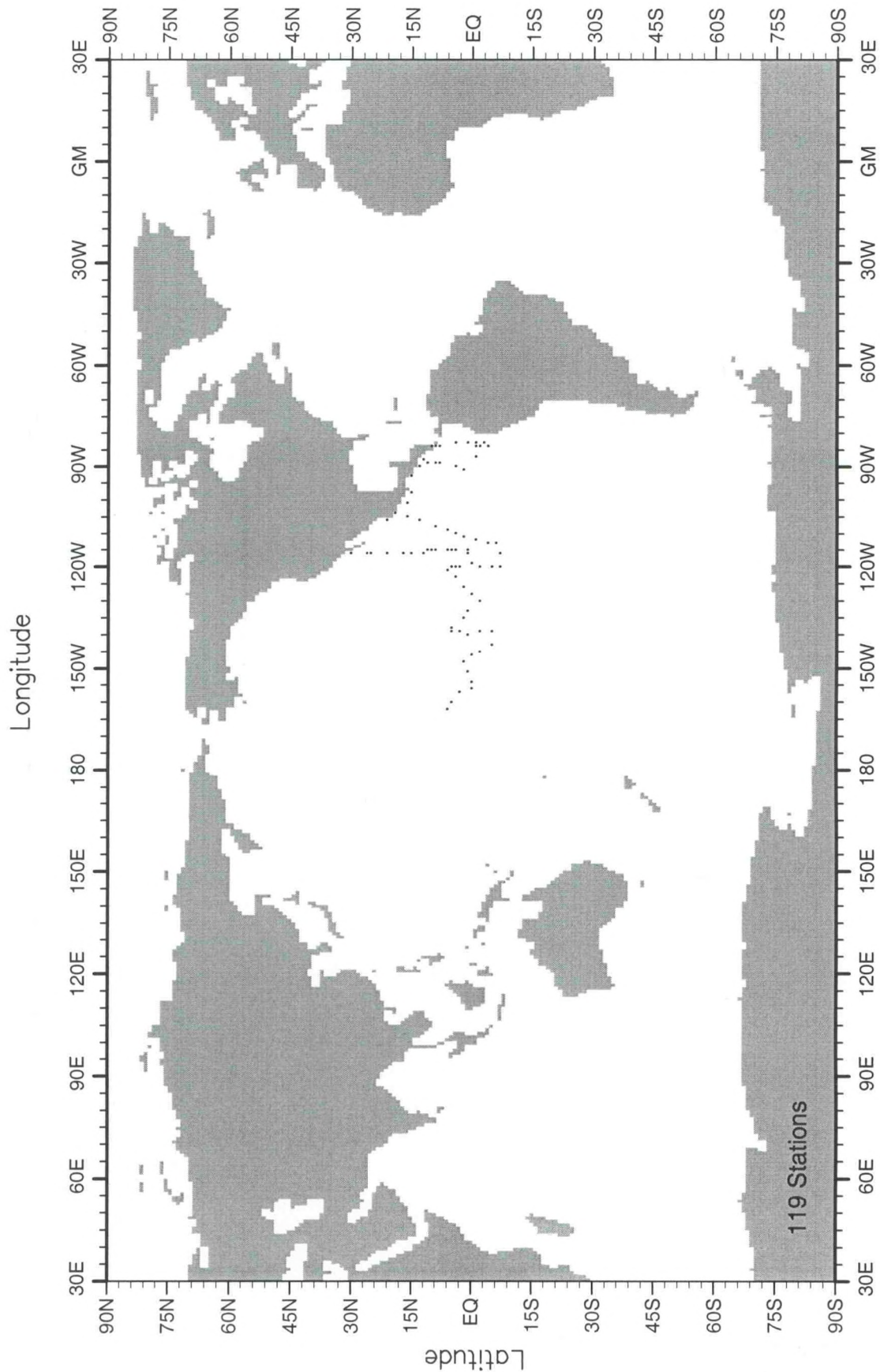


Fig. A1 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1955

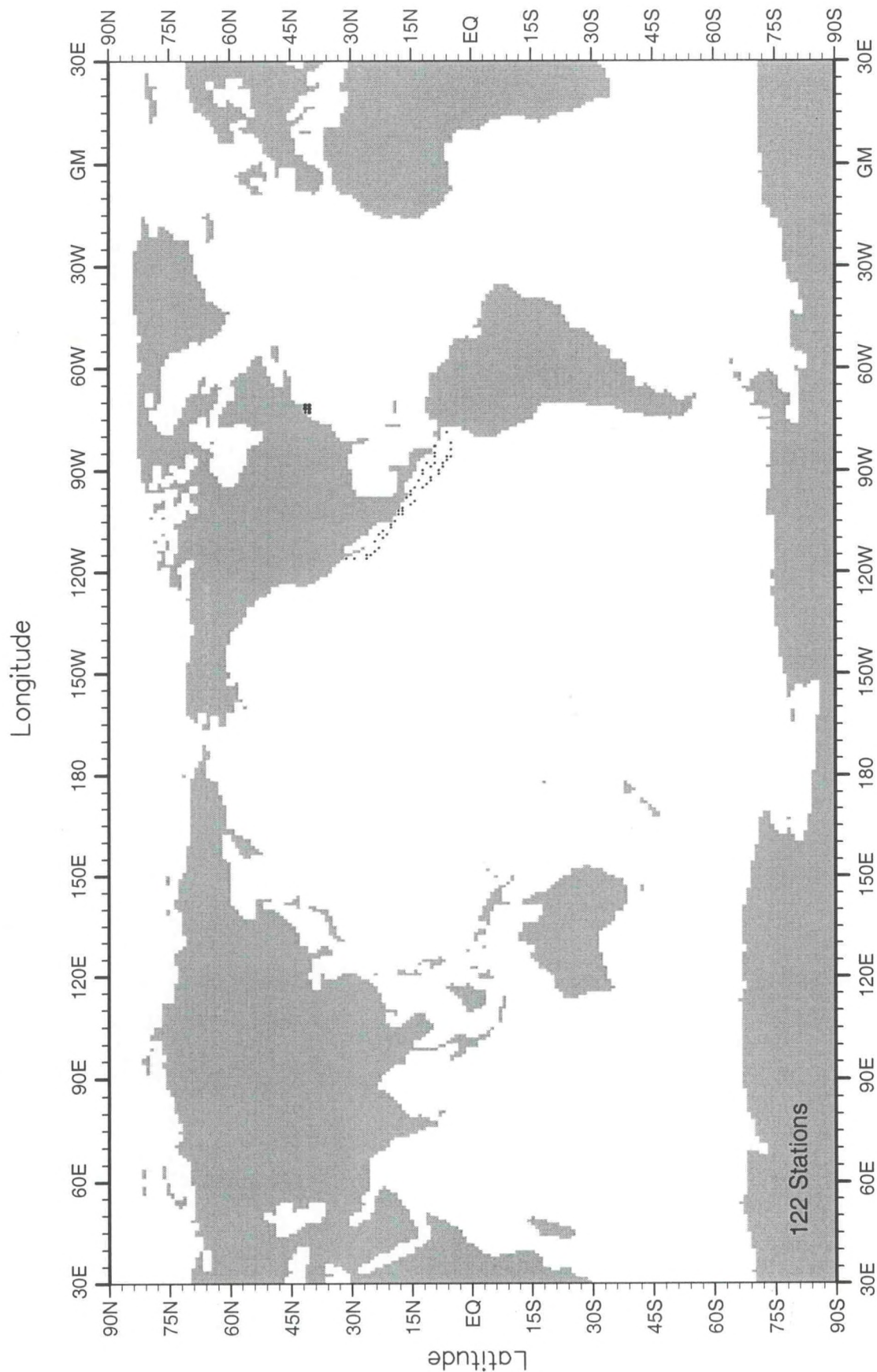


Fig. A2 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1956

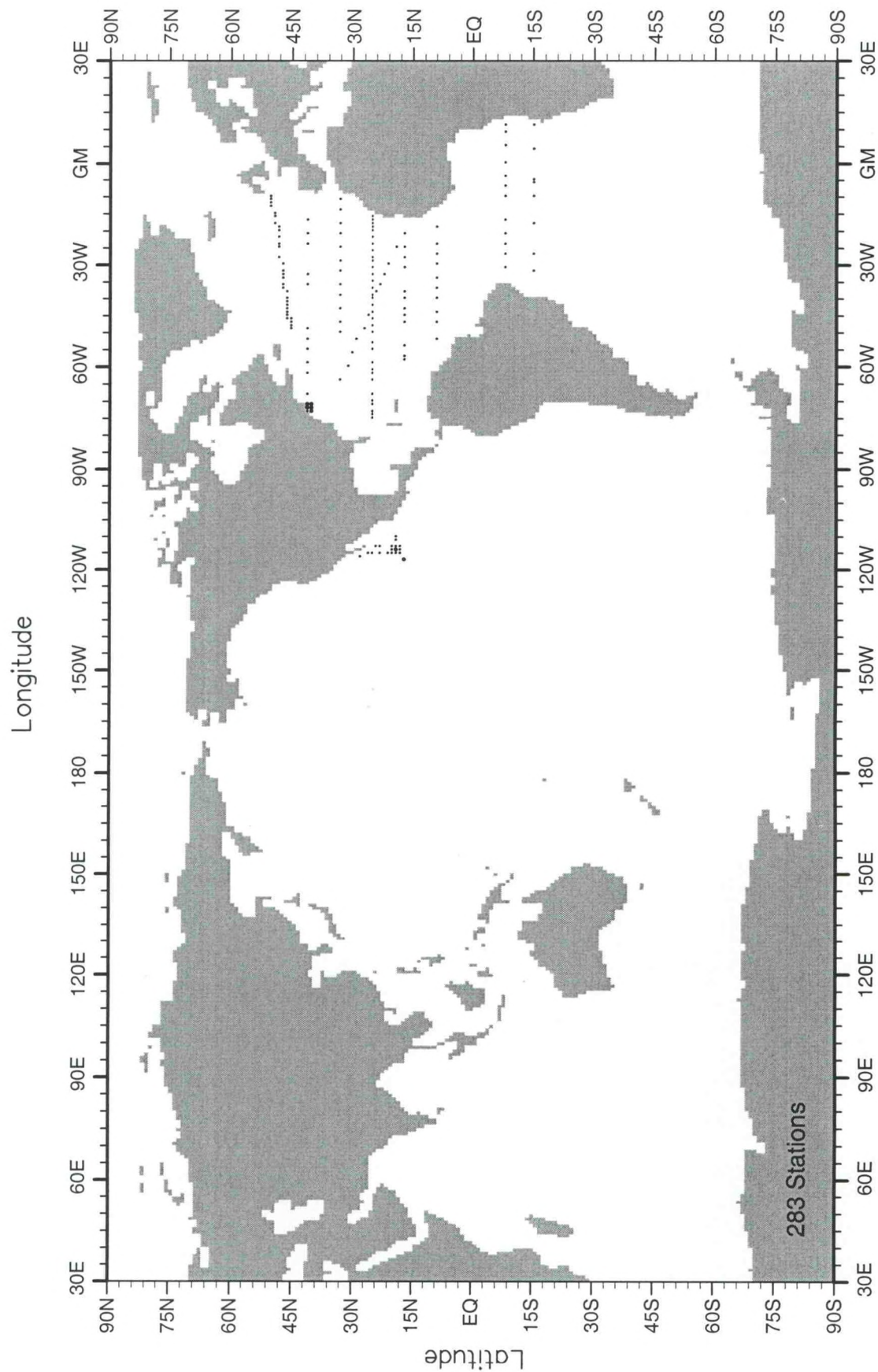


Fig. A3 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1957

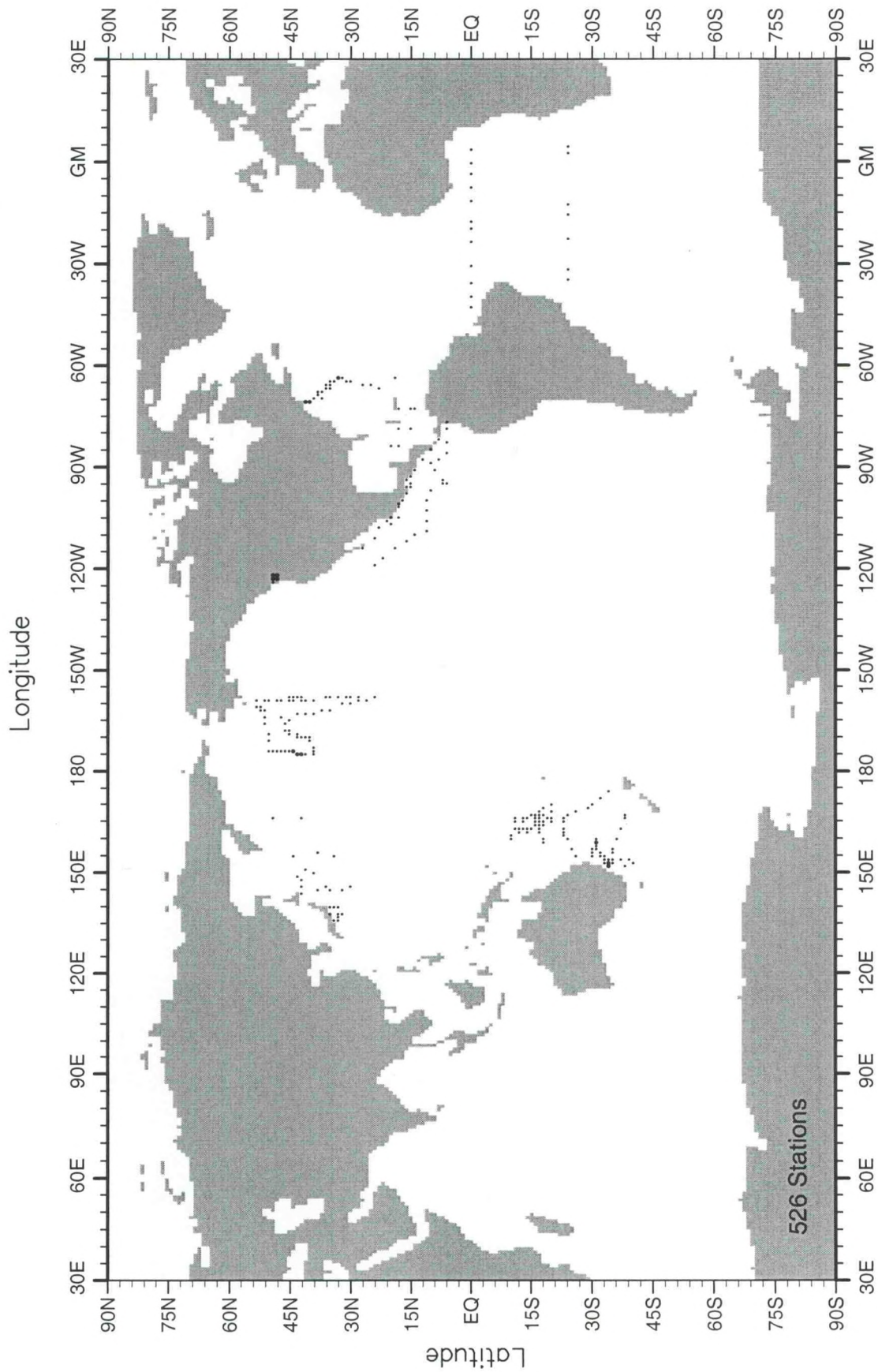


Fig. A4 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1958

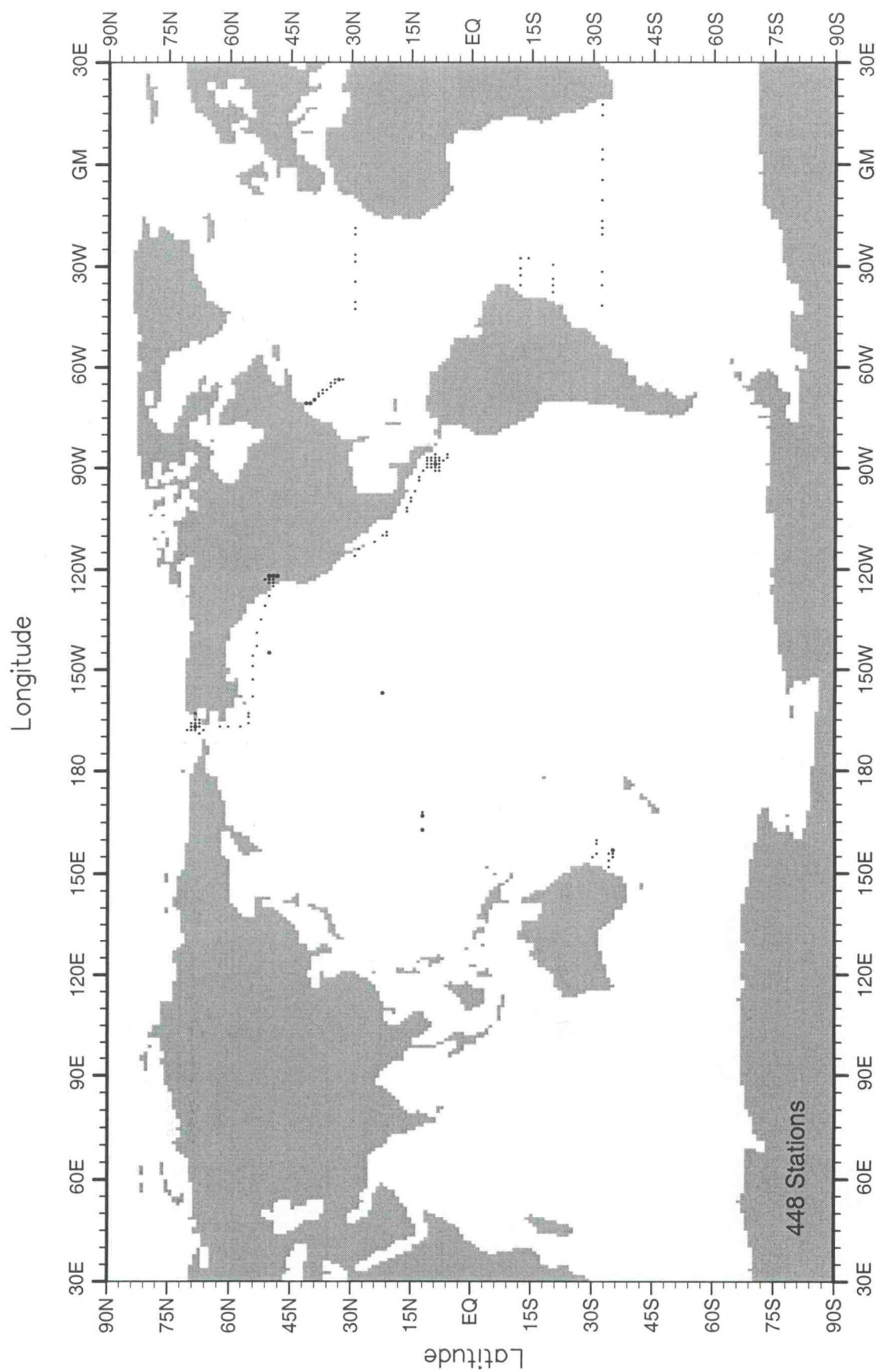


Fig. A5 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1959

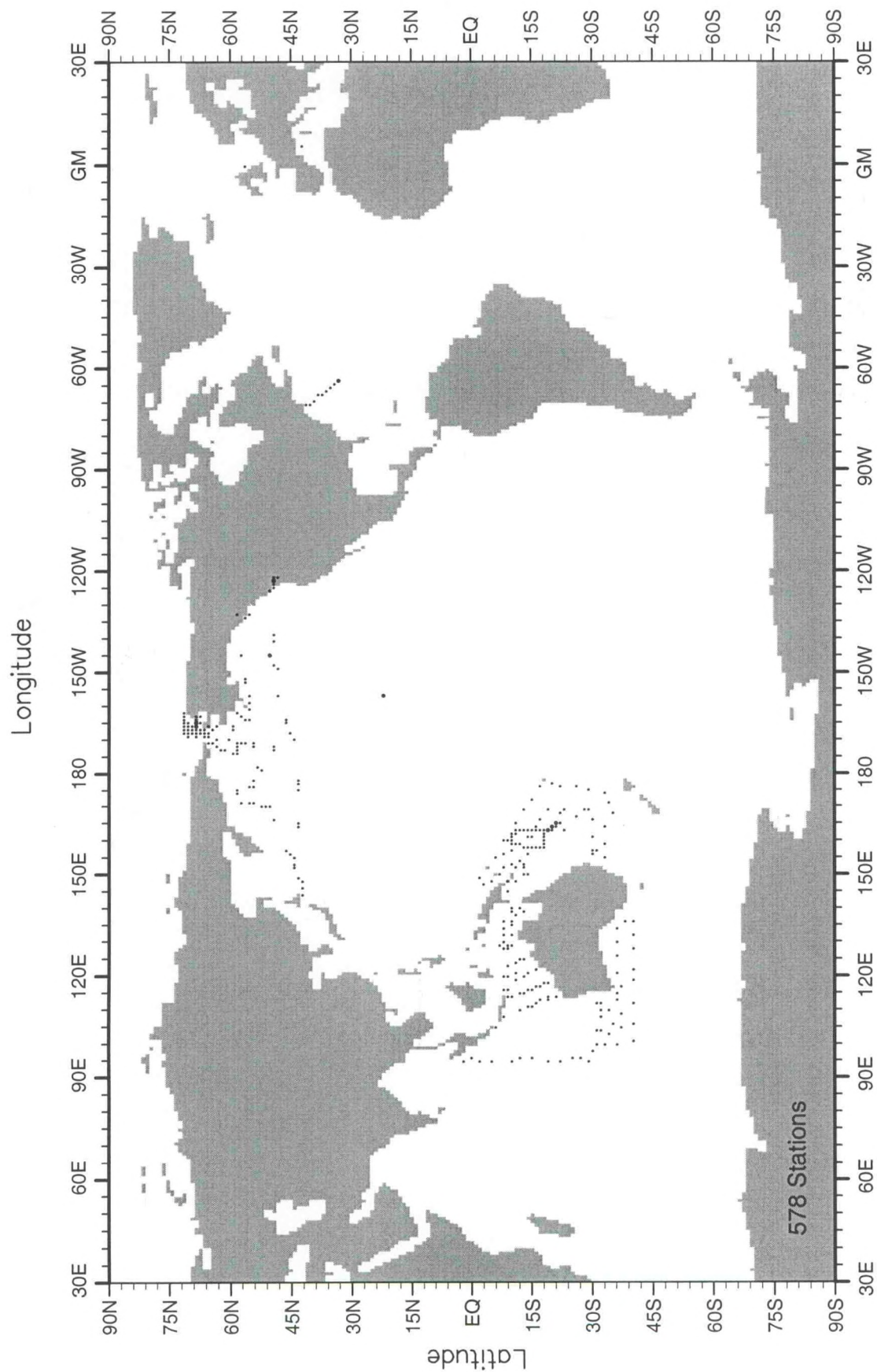


Fig. A6 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1960

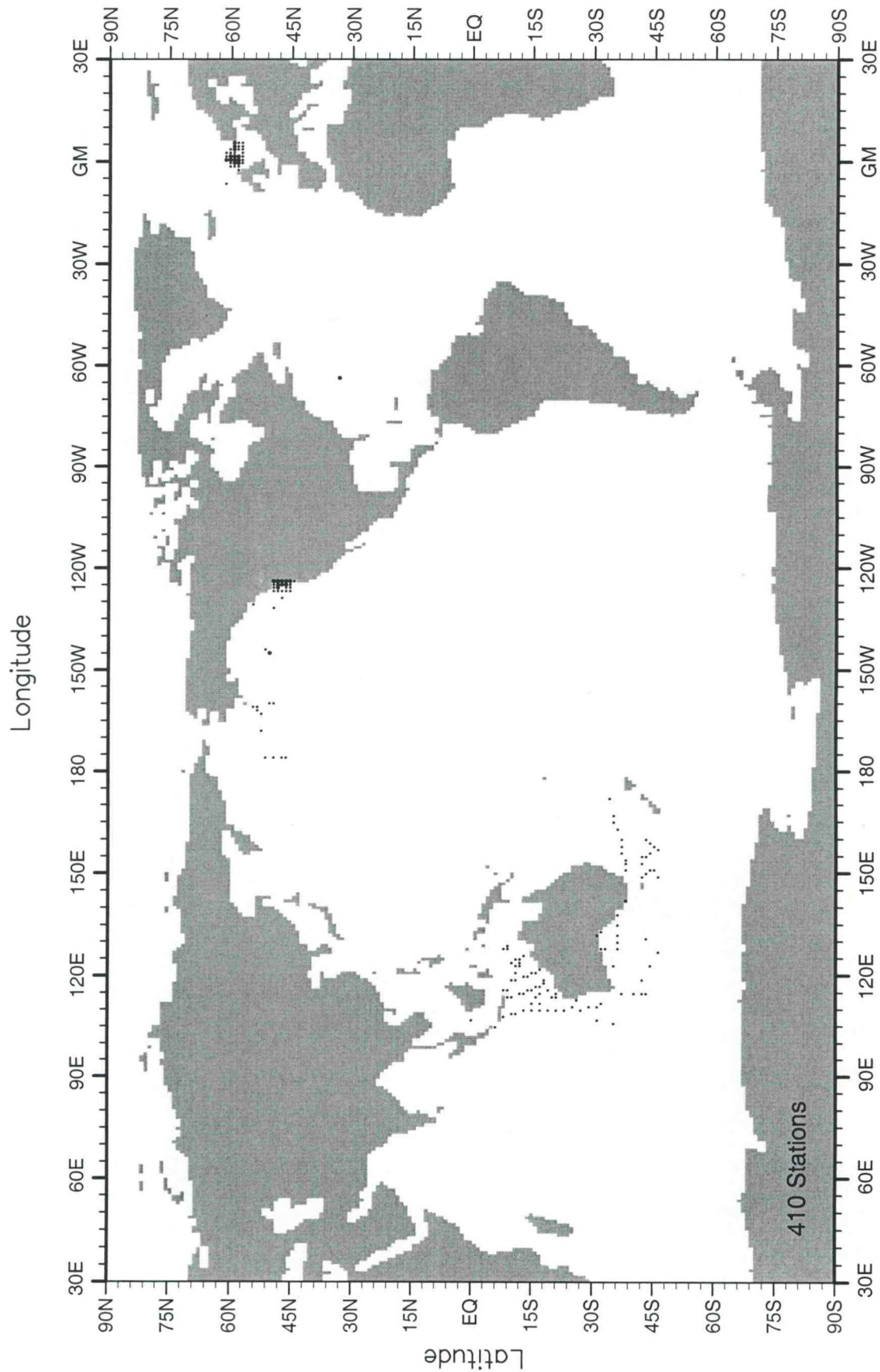


Fig. A7 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1961

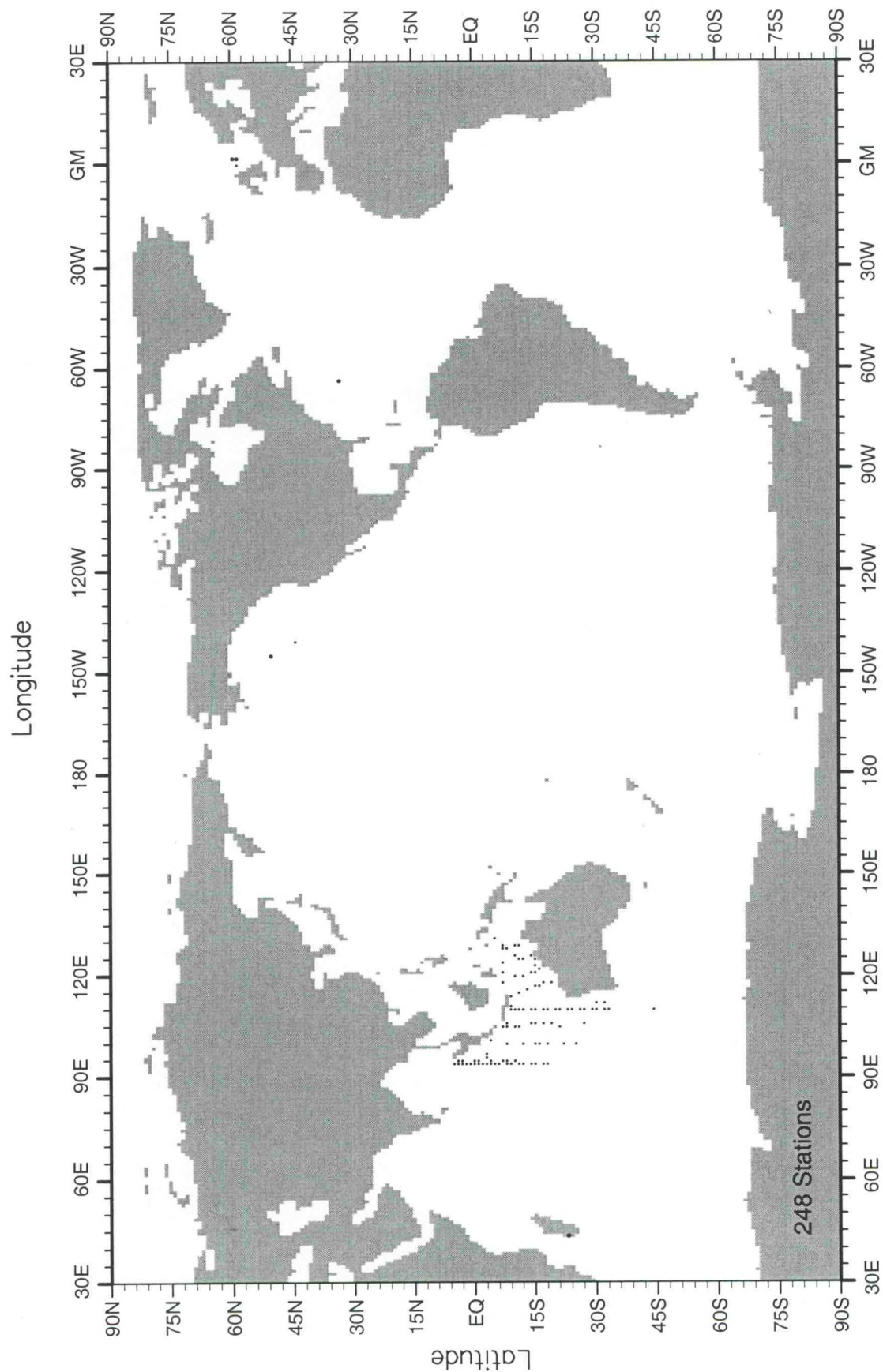


Fig. A8 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1962

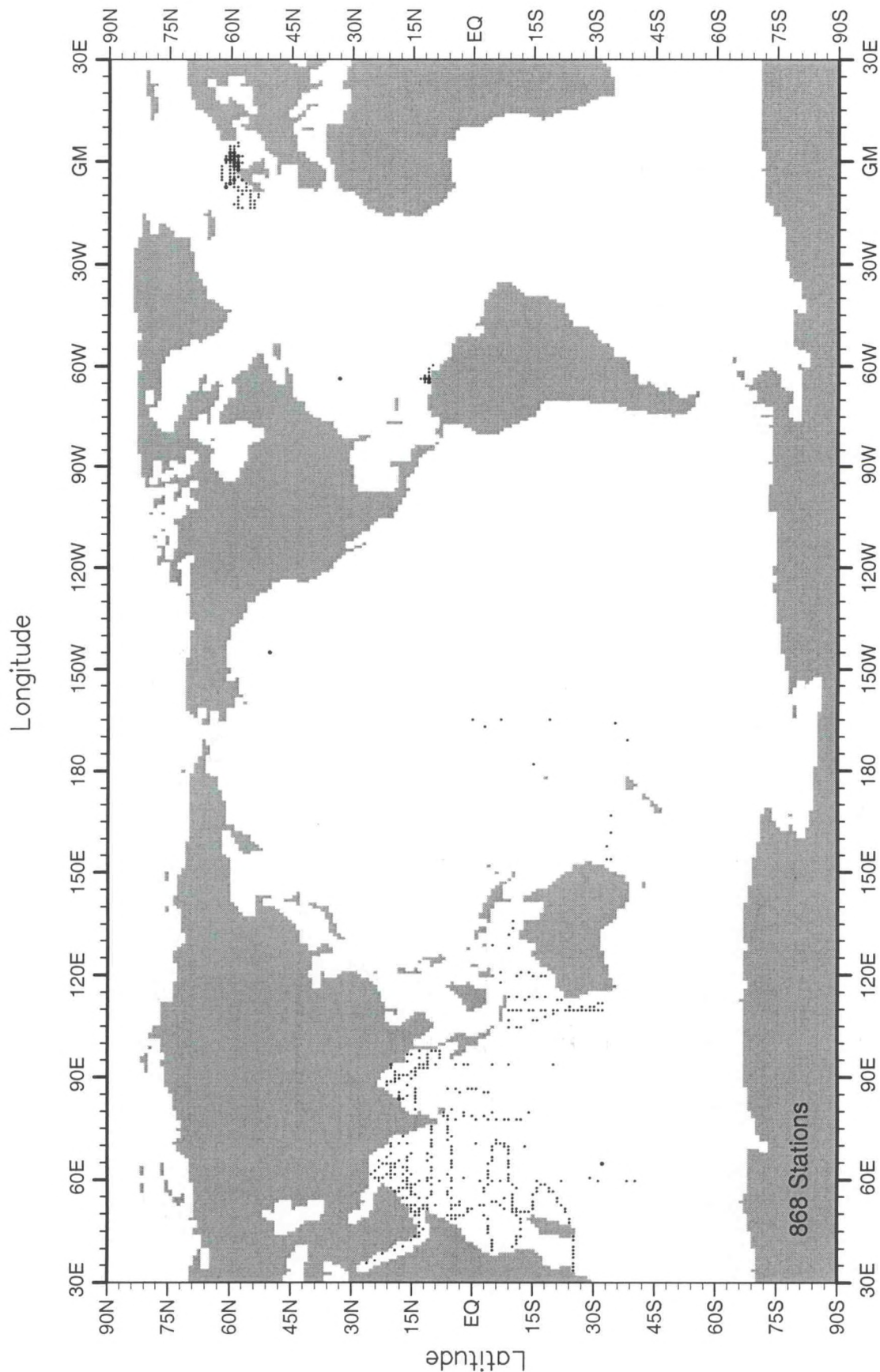


Fig. A9 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1963

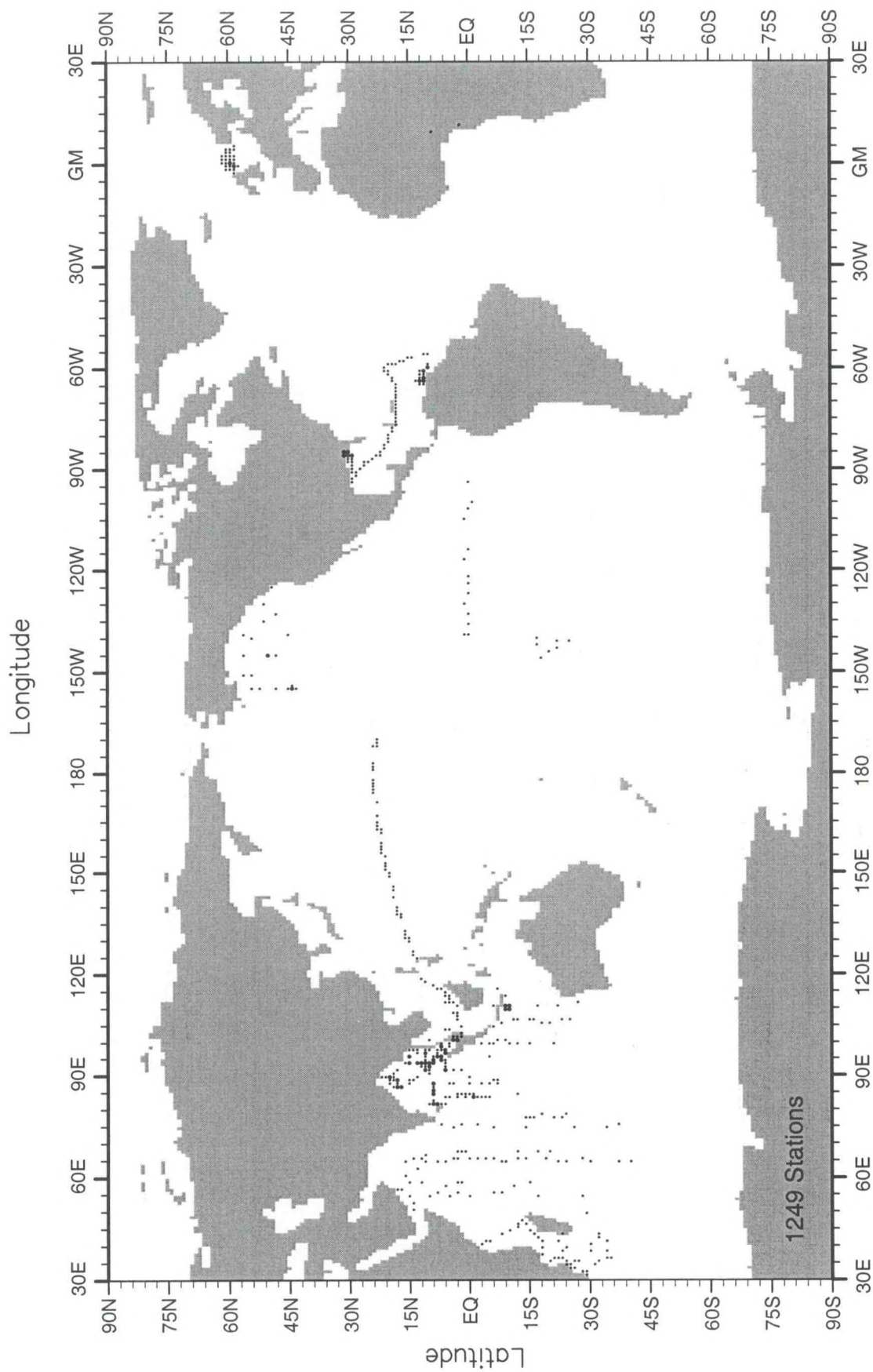


Fig. A10 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1964

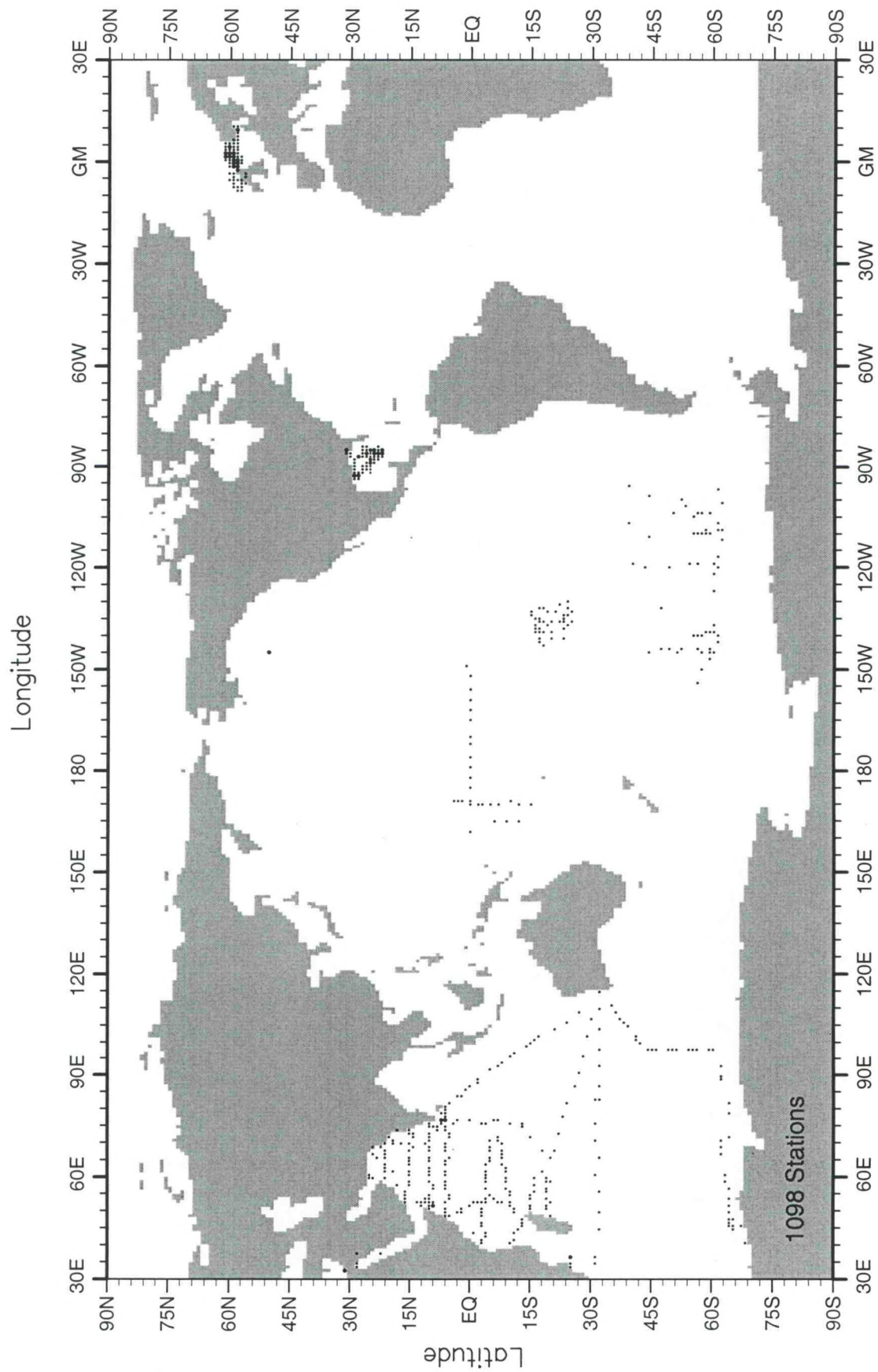


Fig. A11 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1965

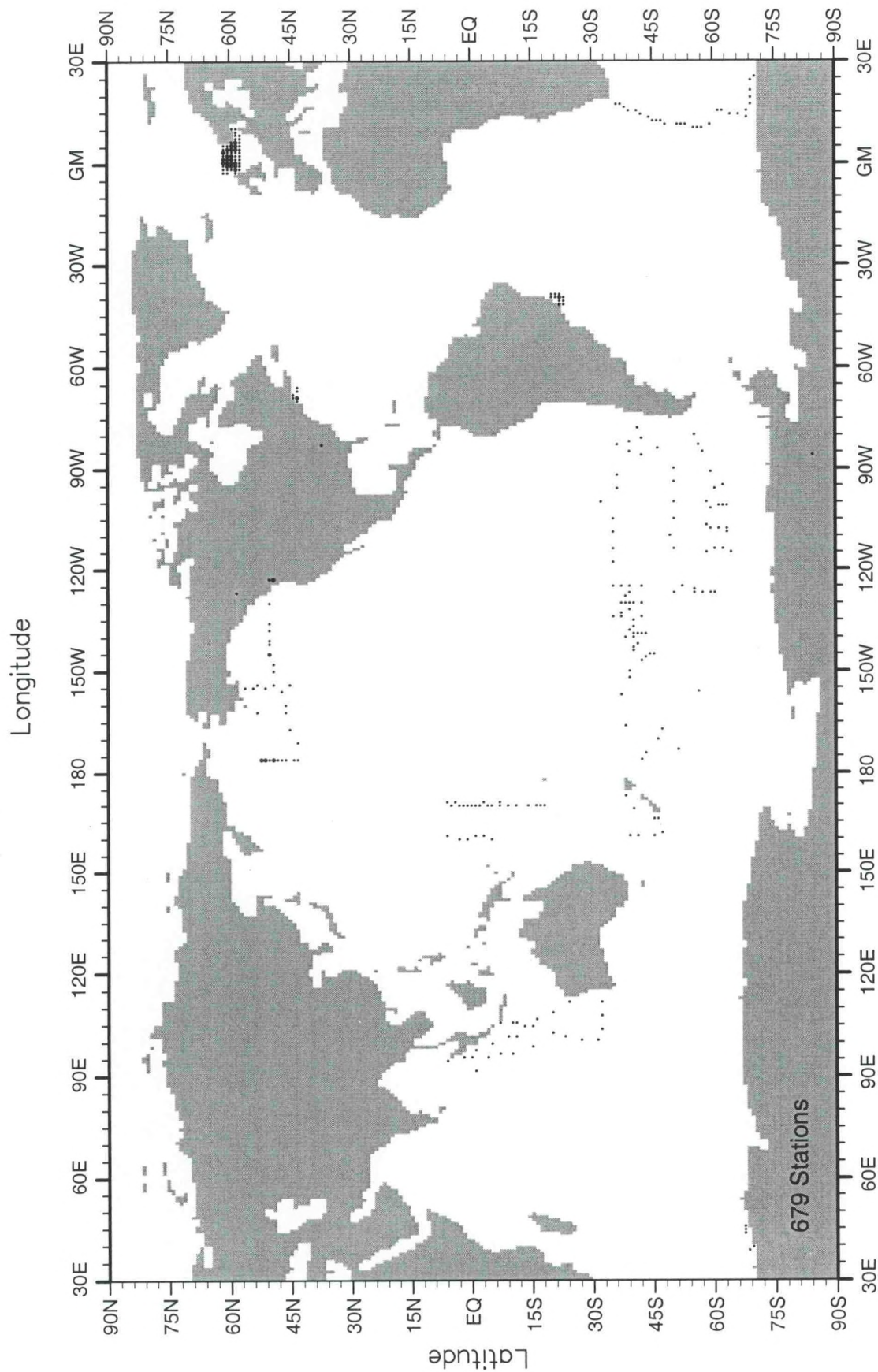


Fig. A12 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1966

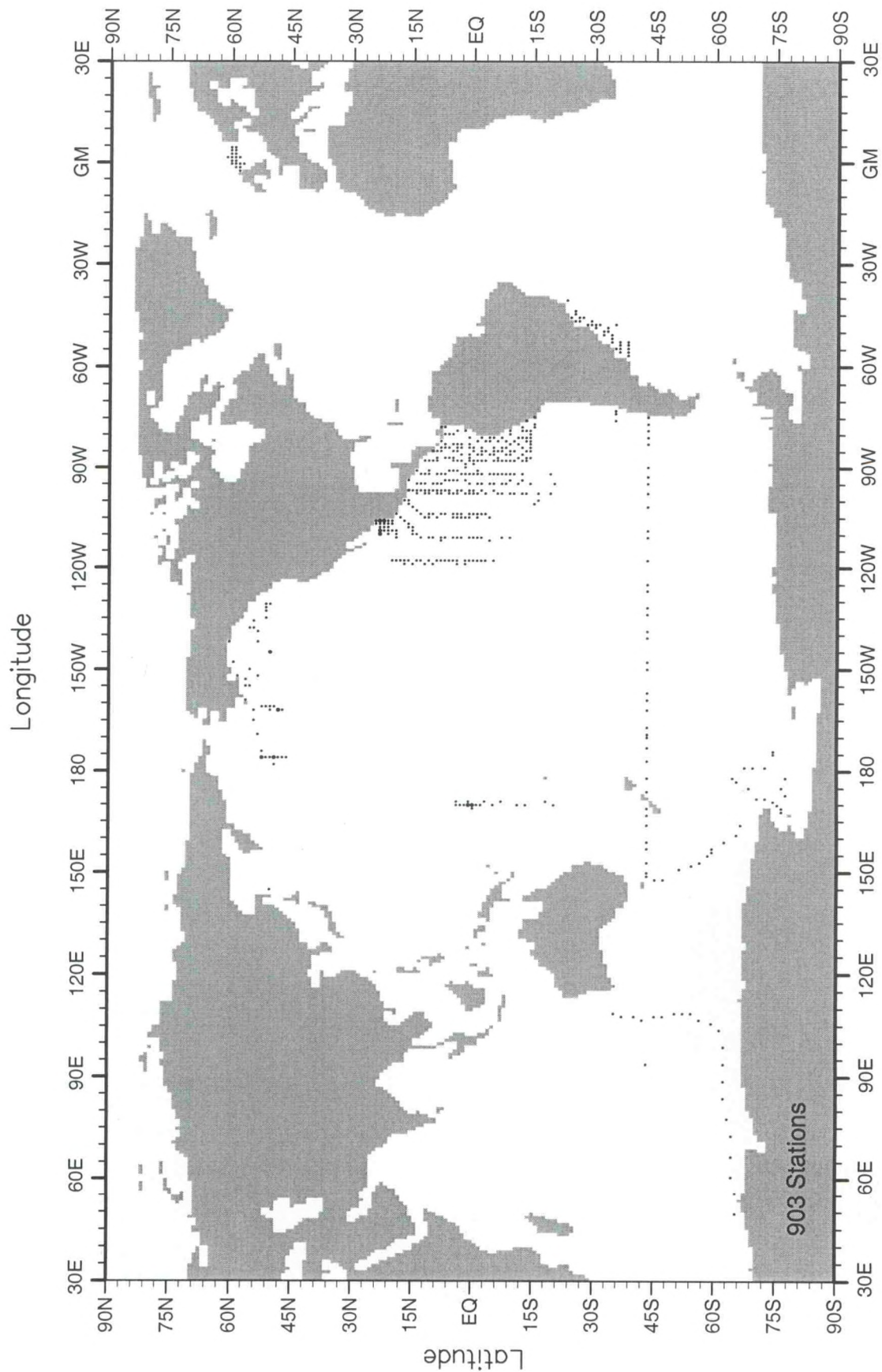


Fig. A13 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1967

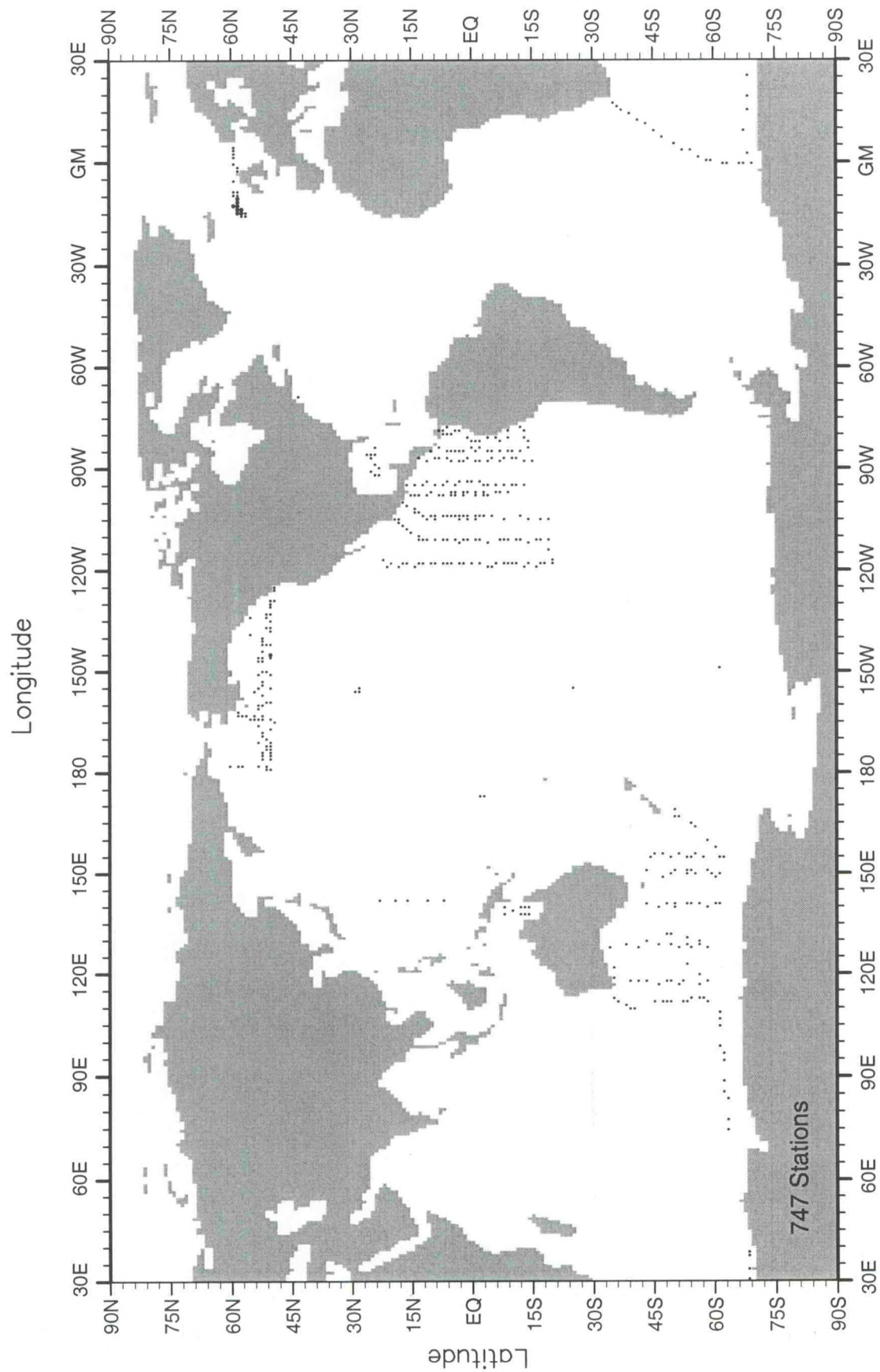


Fig. A14 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1968

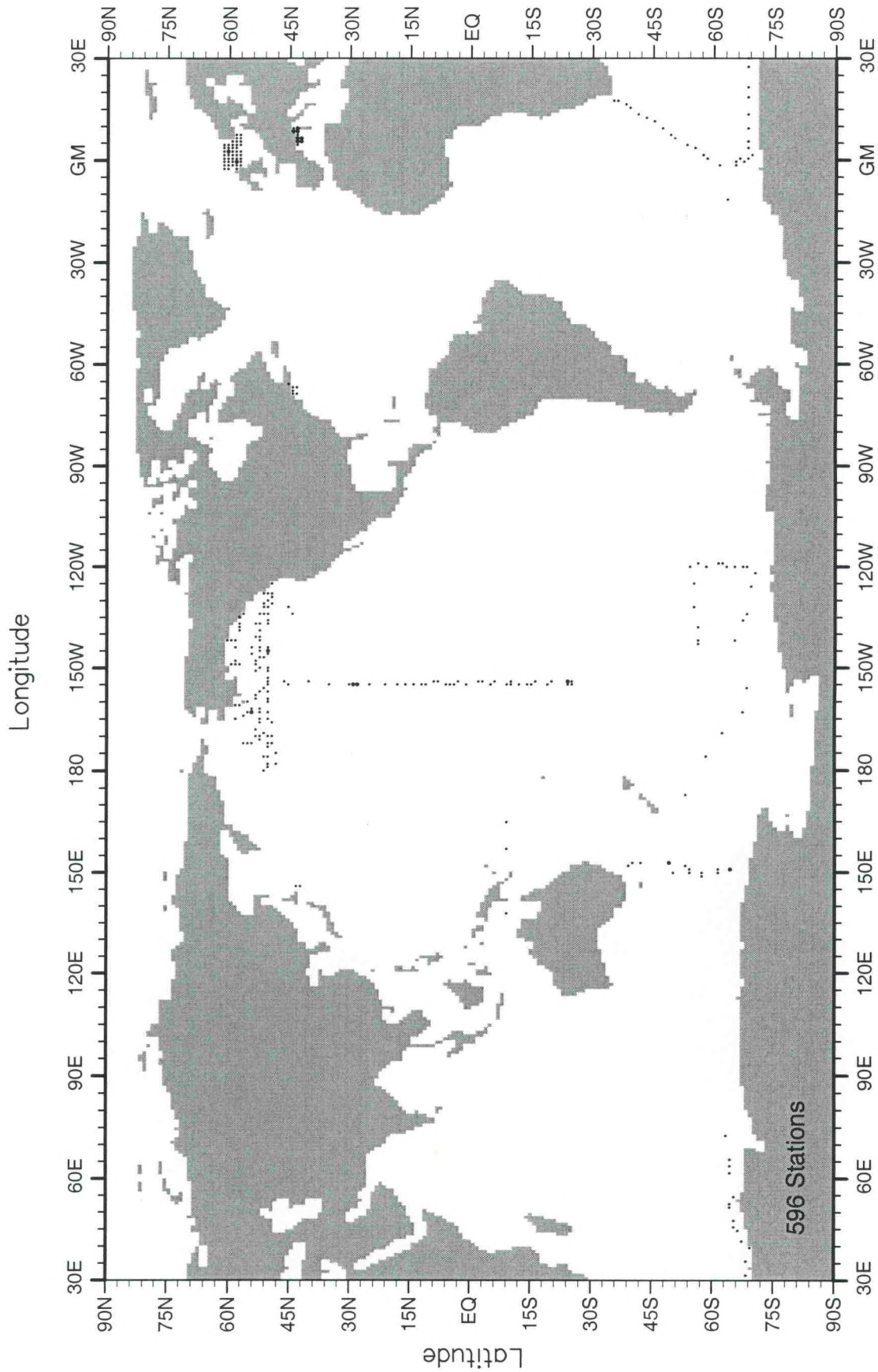


Fig. A15 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1969

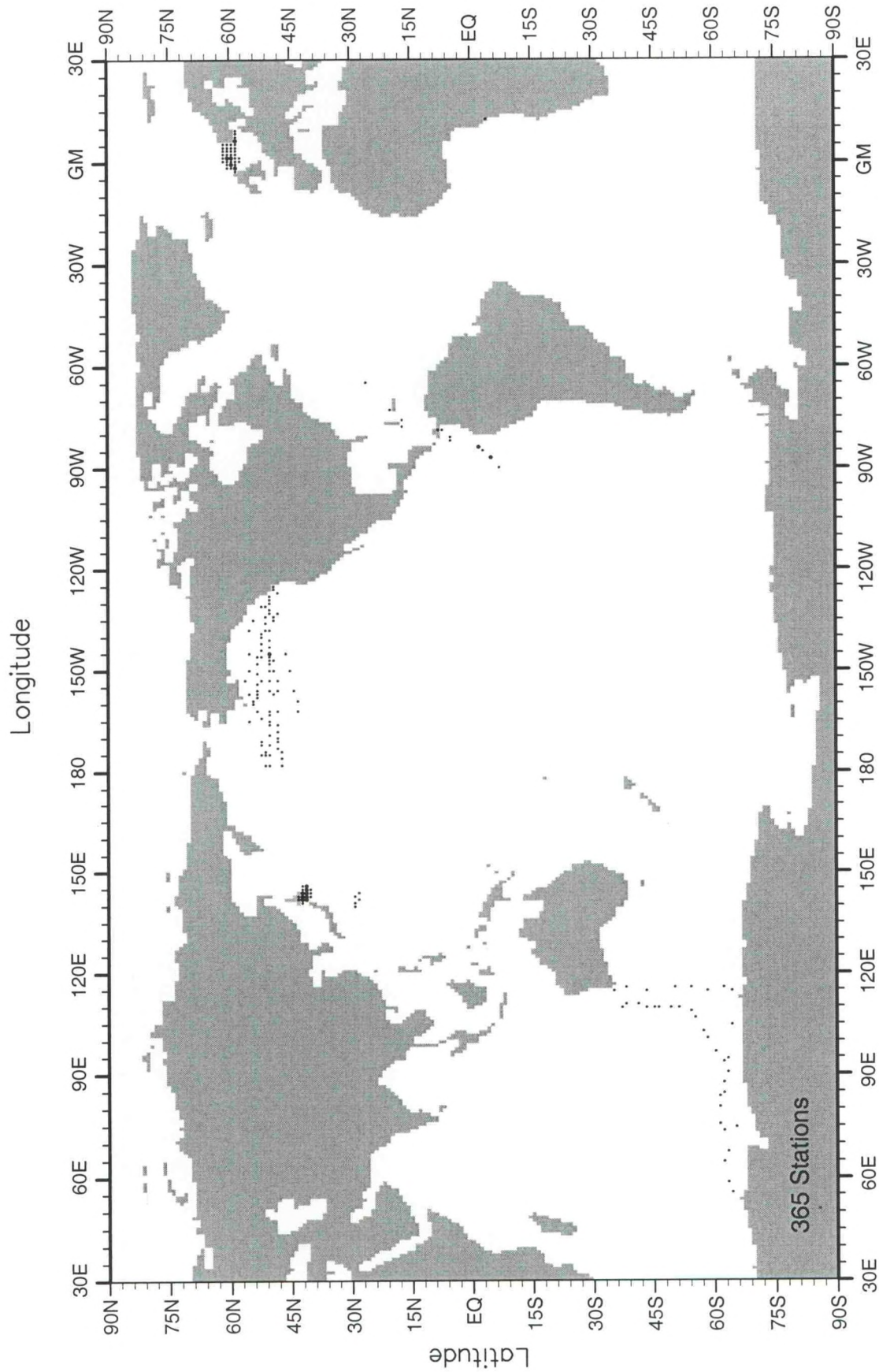


Fig. A16 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1970

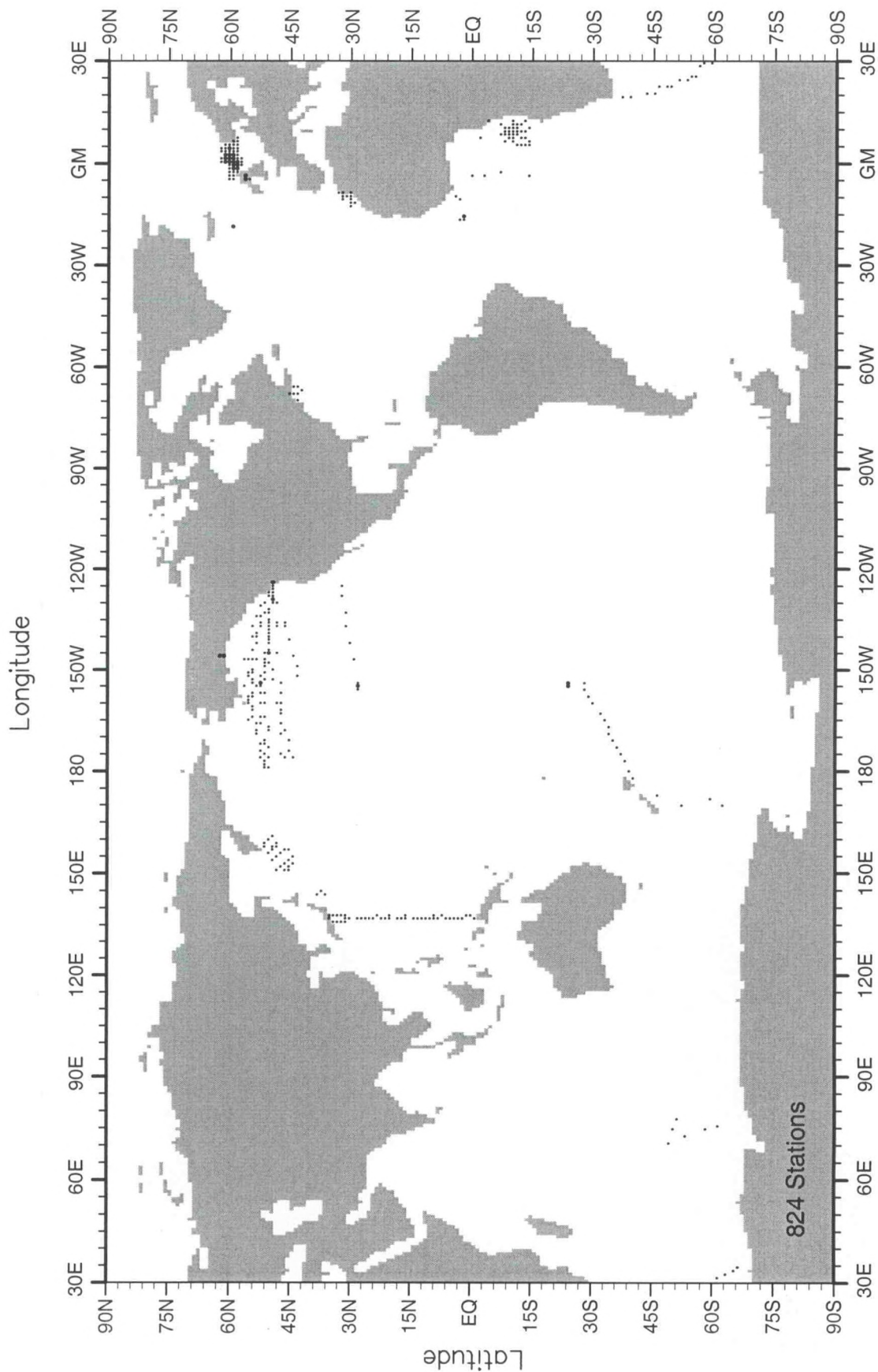


Fig. A17 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1971

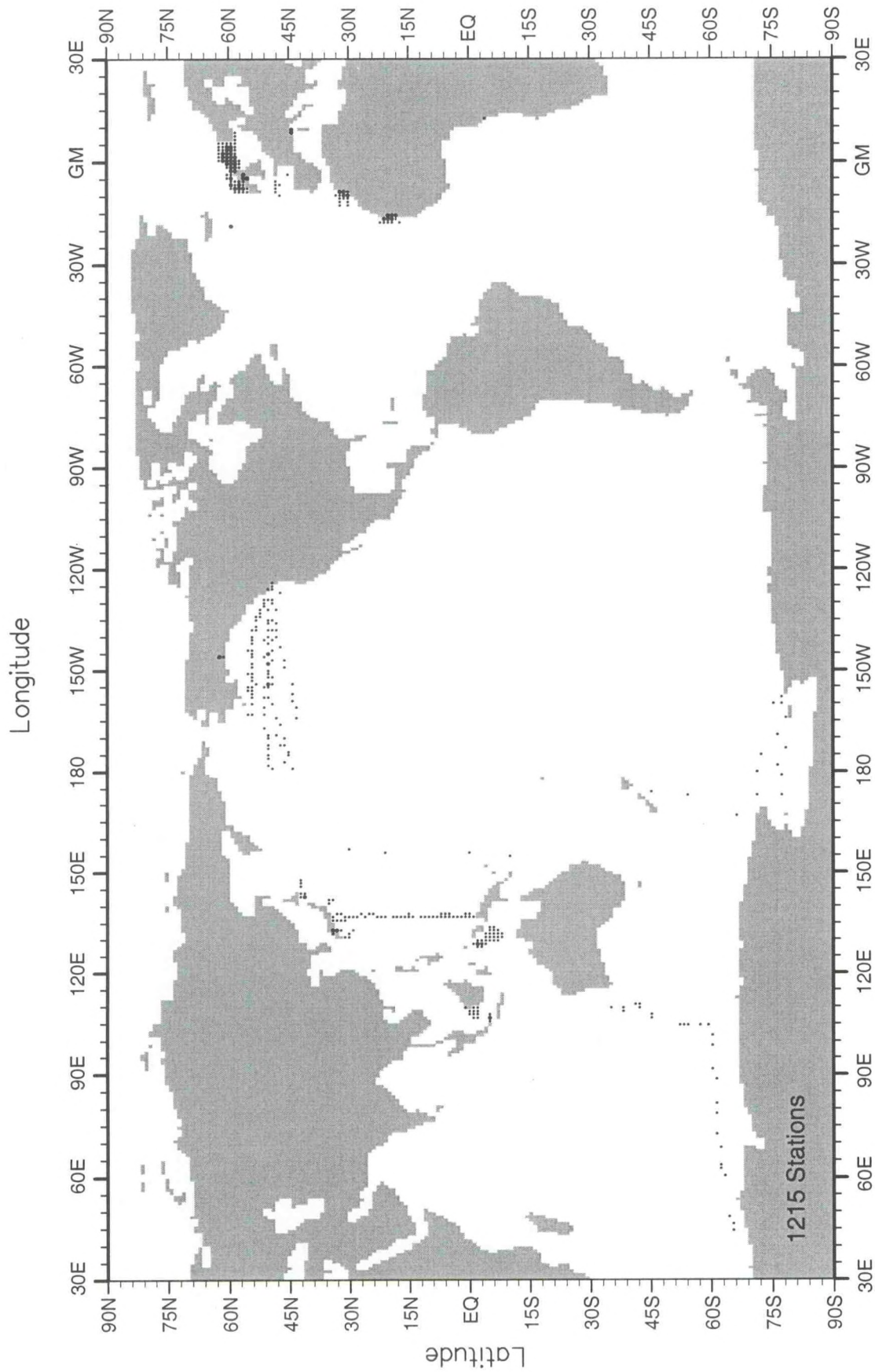


Fig. A18 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1972

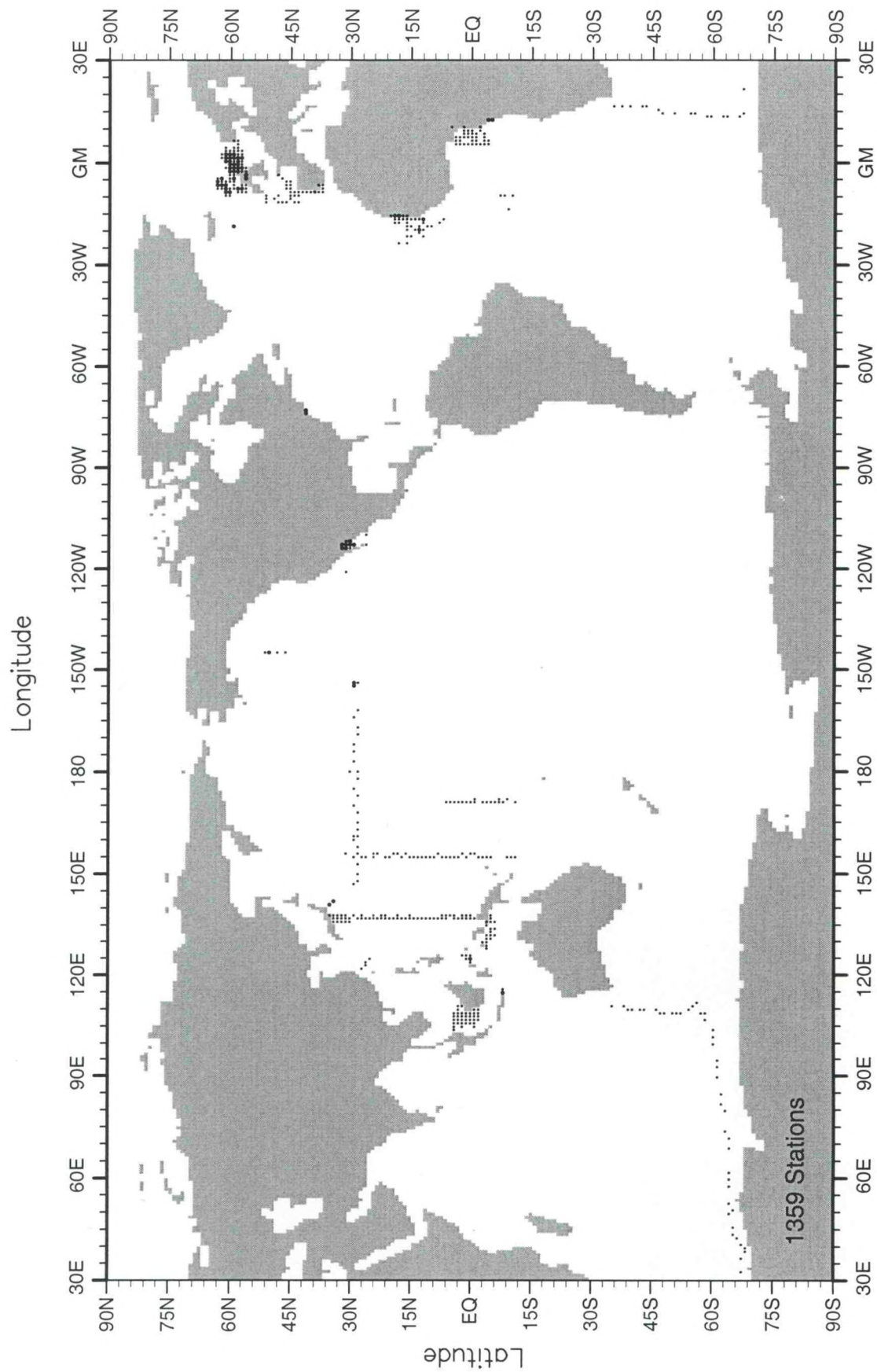


Fig. A19 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1973

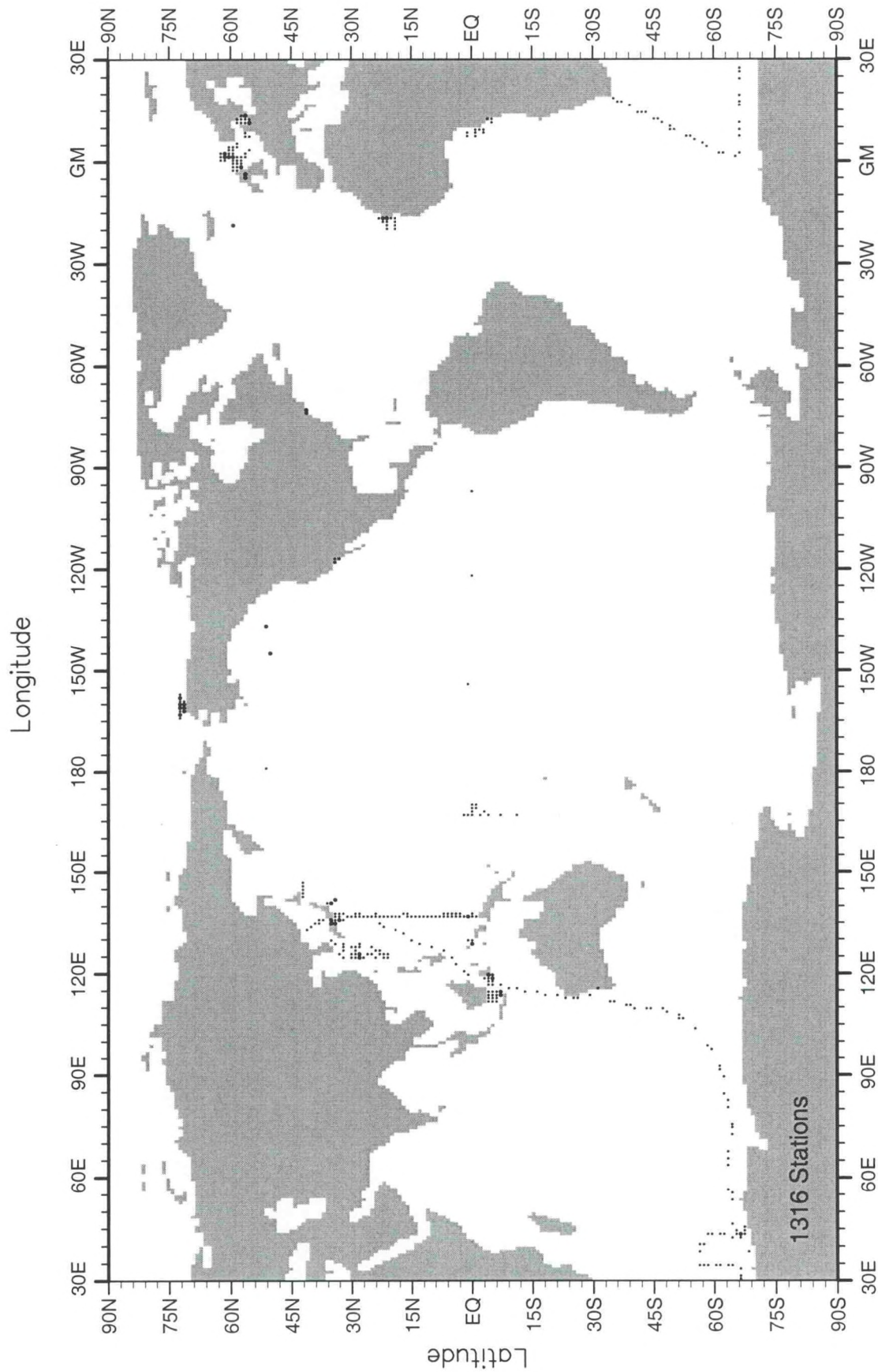


Fig. A20 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1974

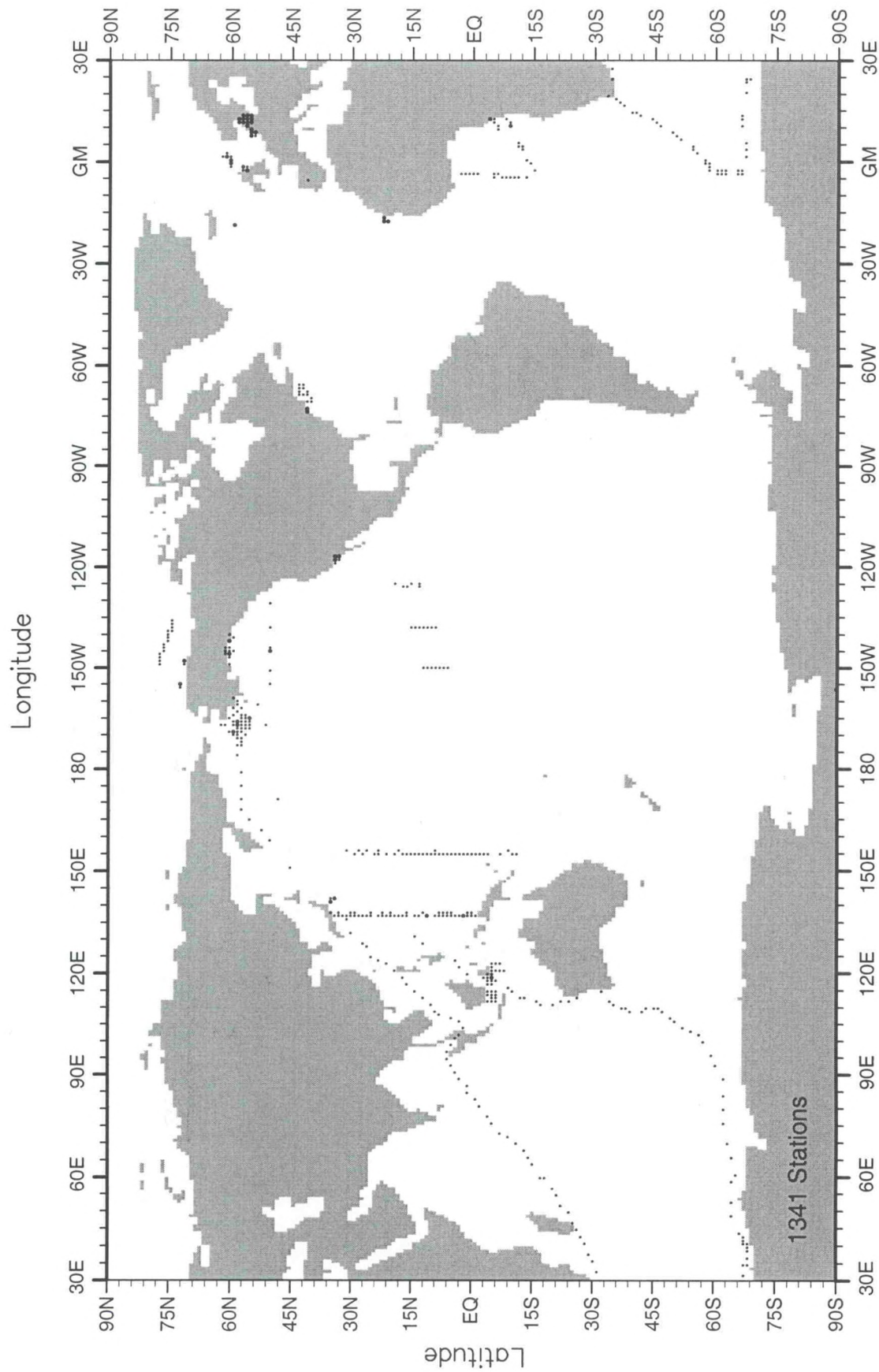


Fig. A21 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1975

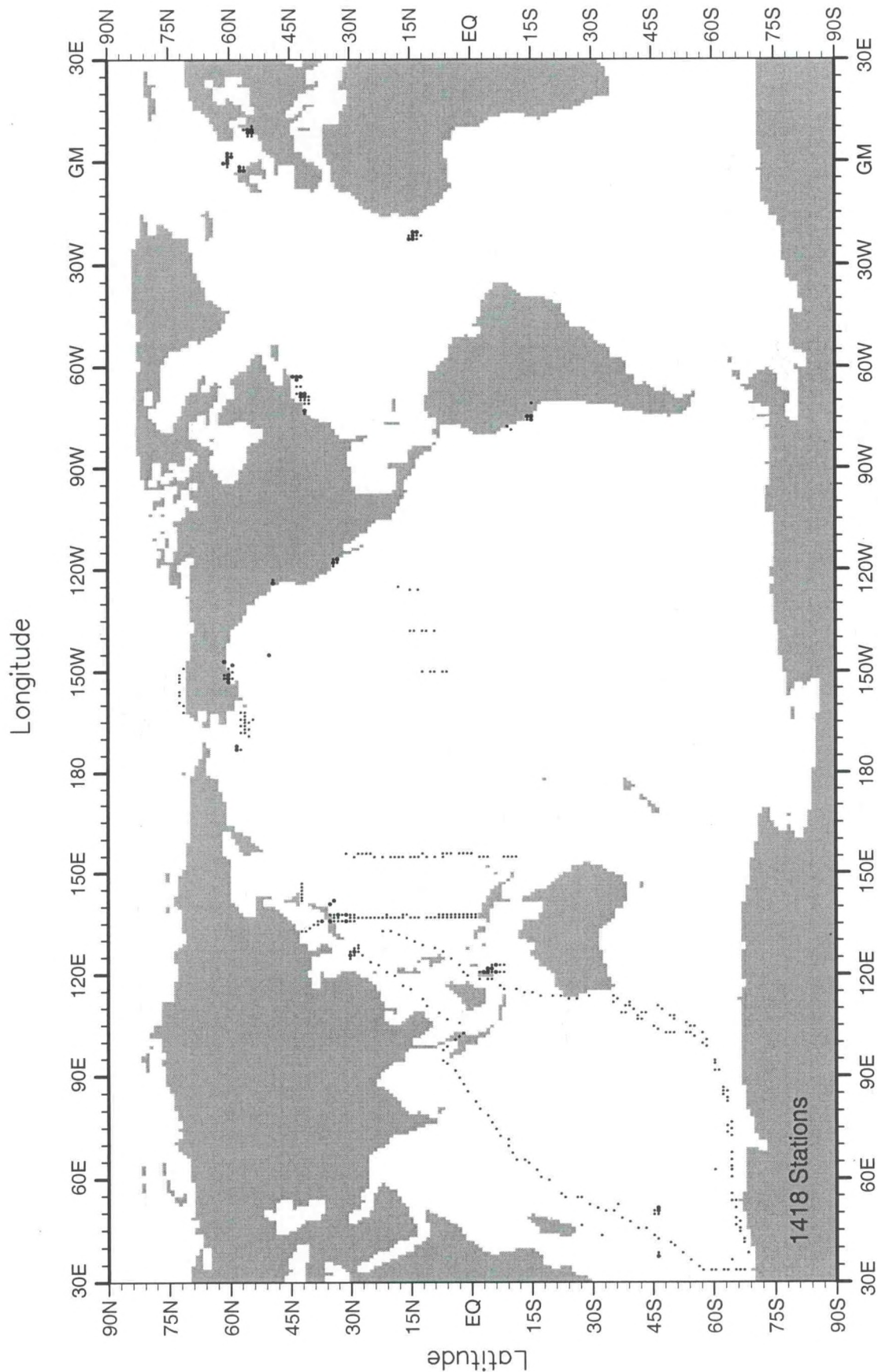


Fig. A22 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1976

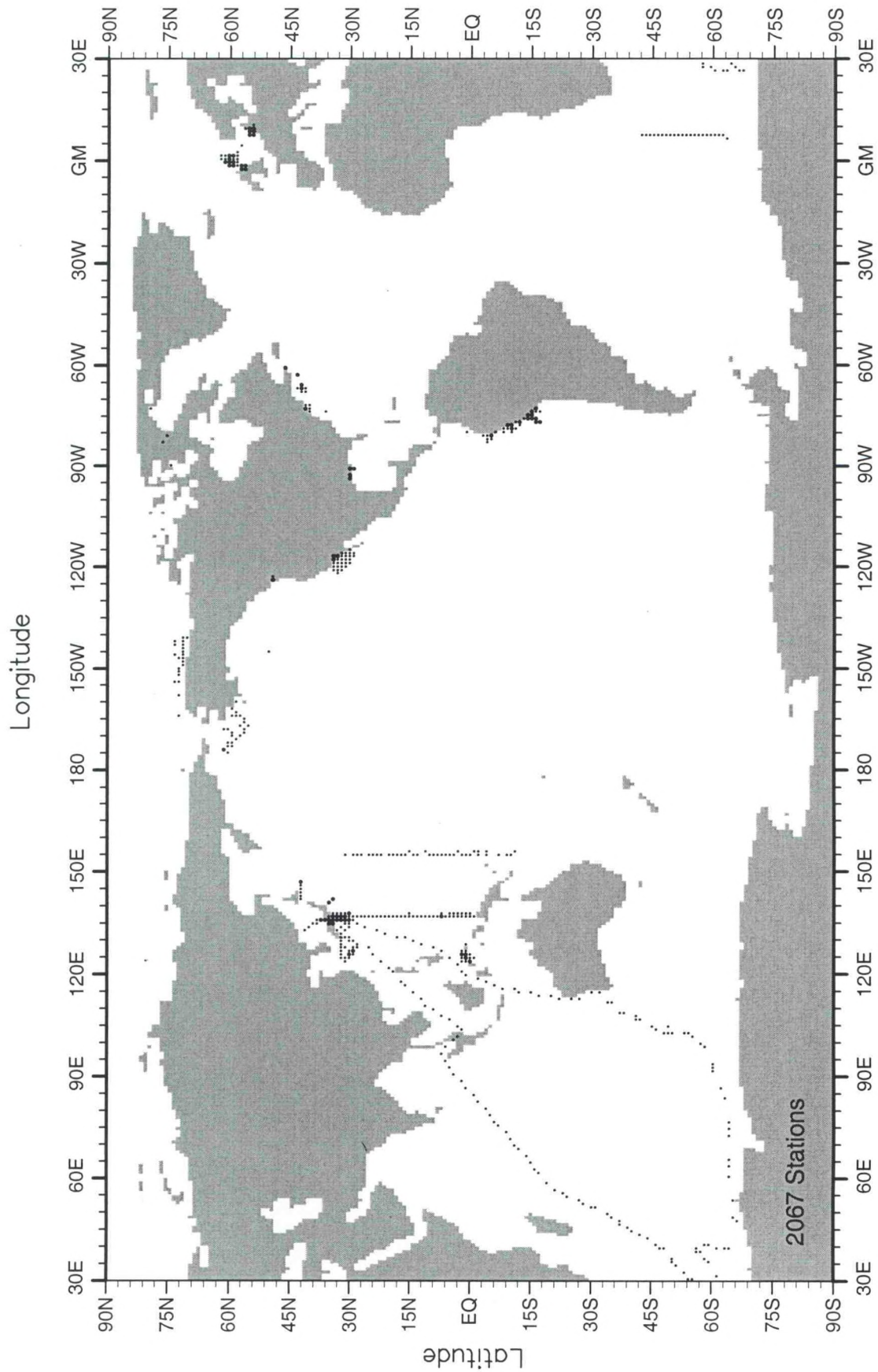


Fig. A23 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1977

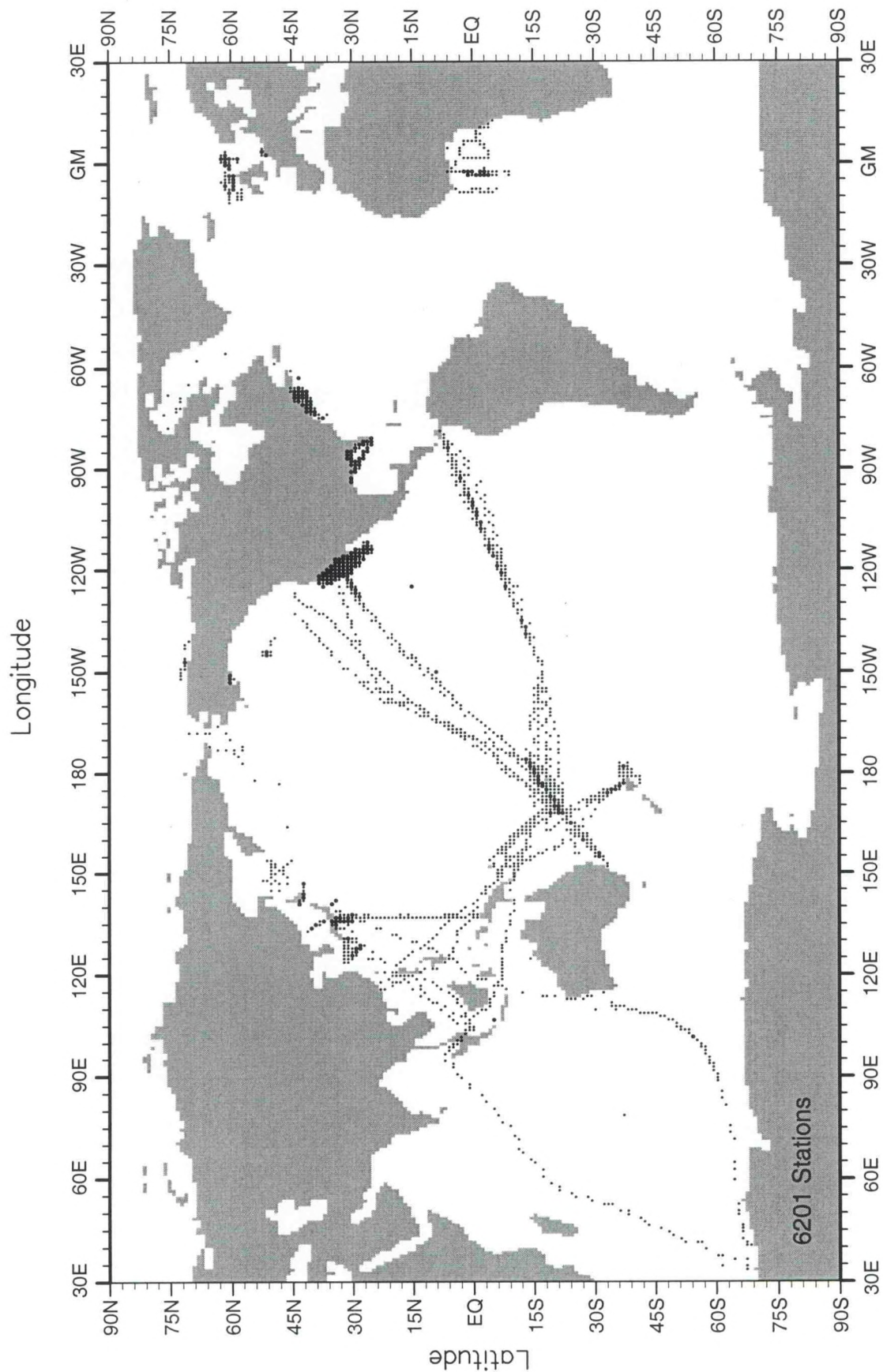


Fig. A24 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1978

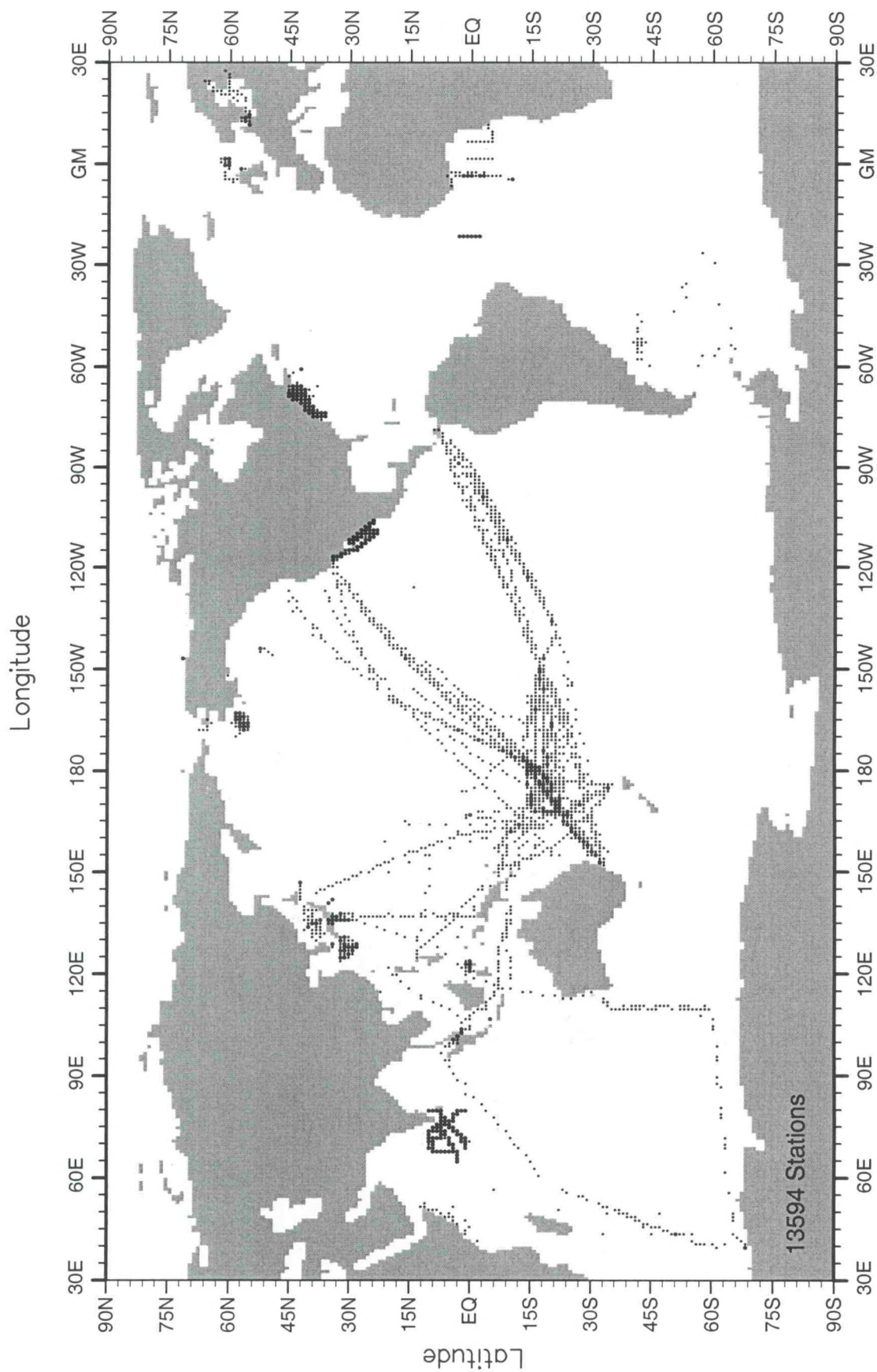


Fig. A25 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1979

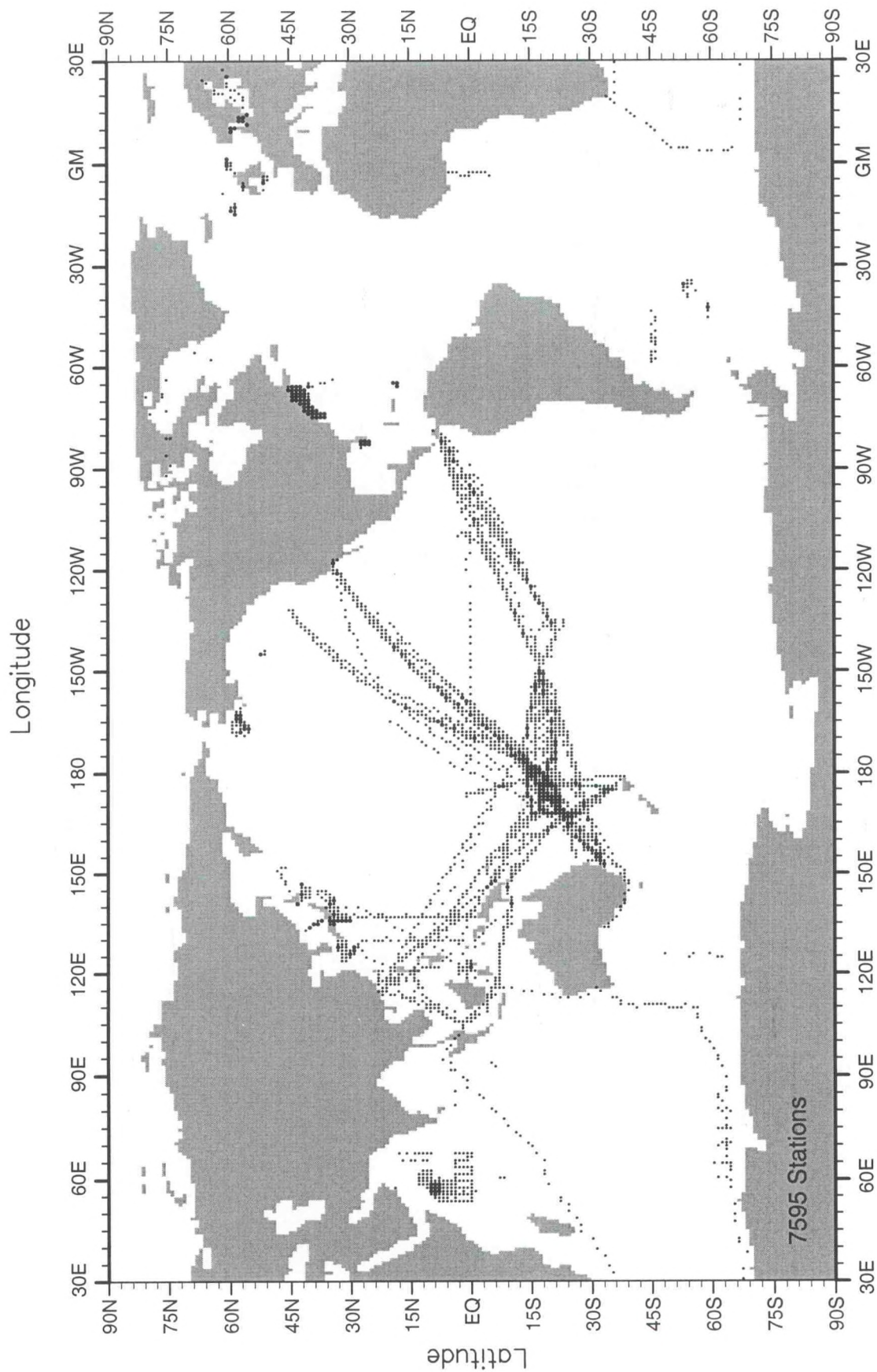
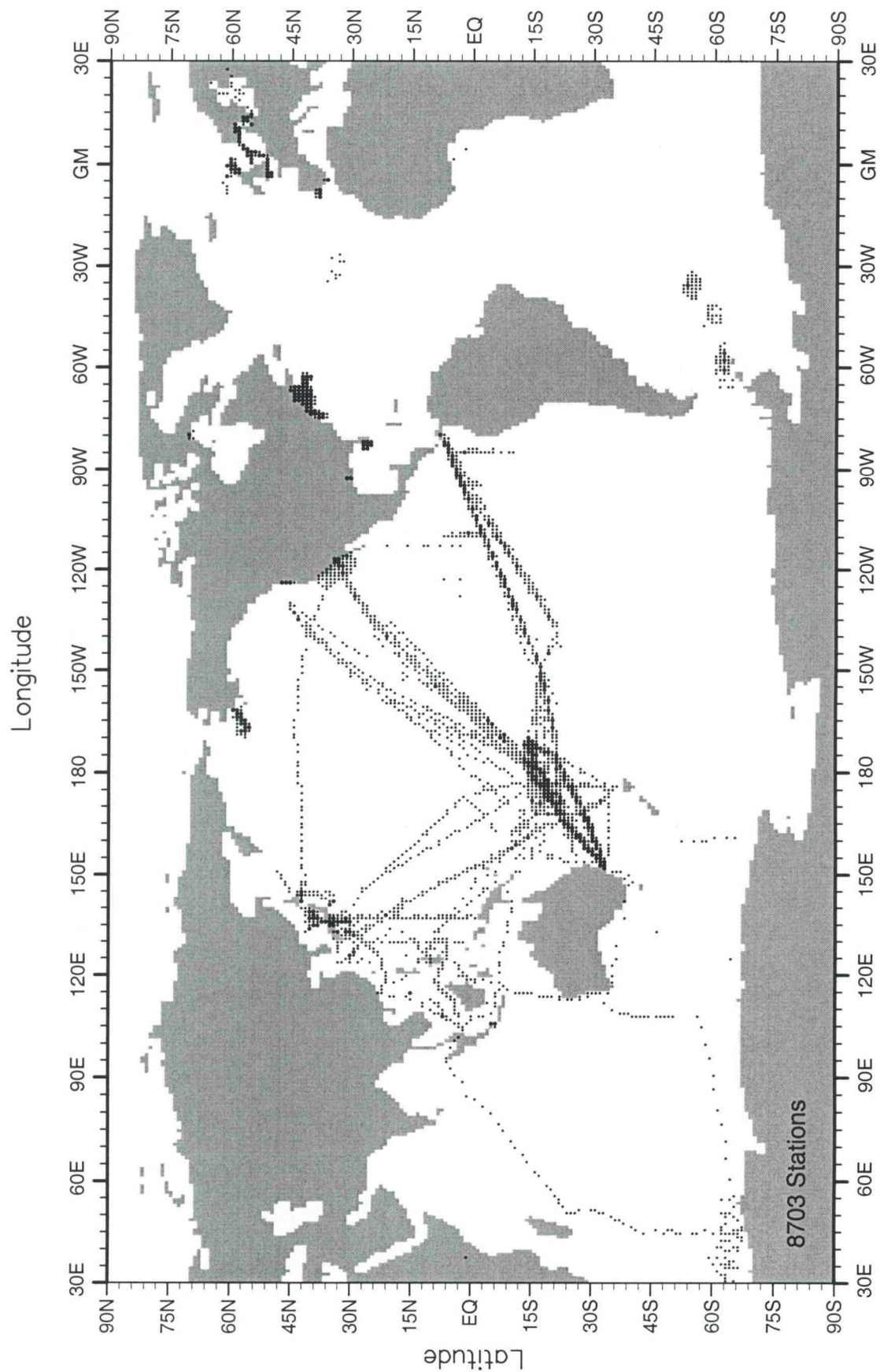


Fig. A26 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1980



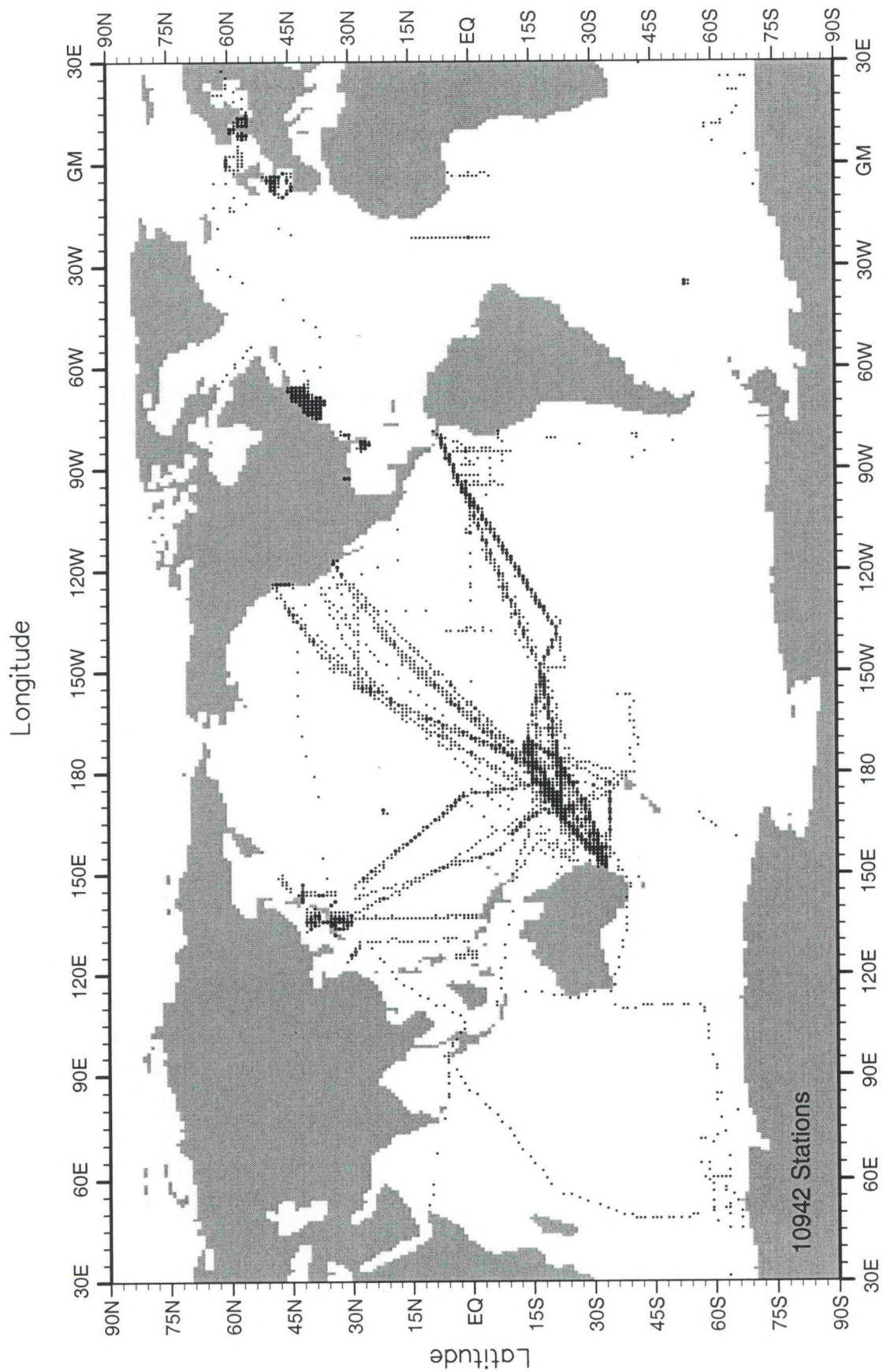


Fig. A28 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1982

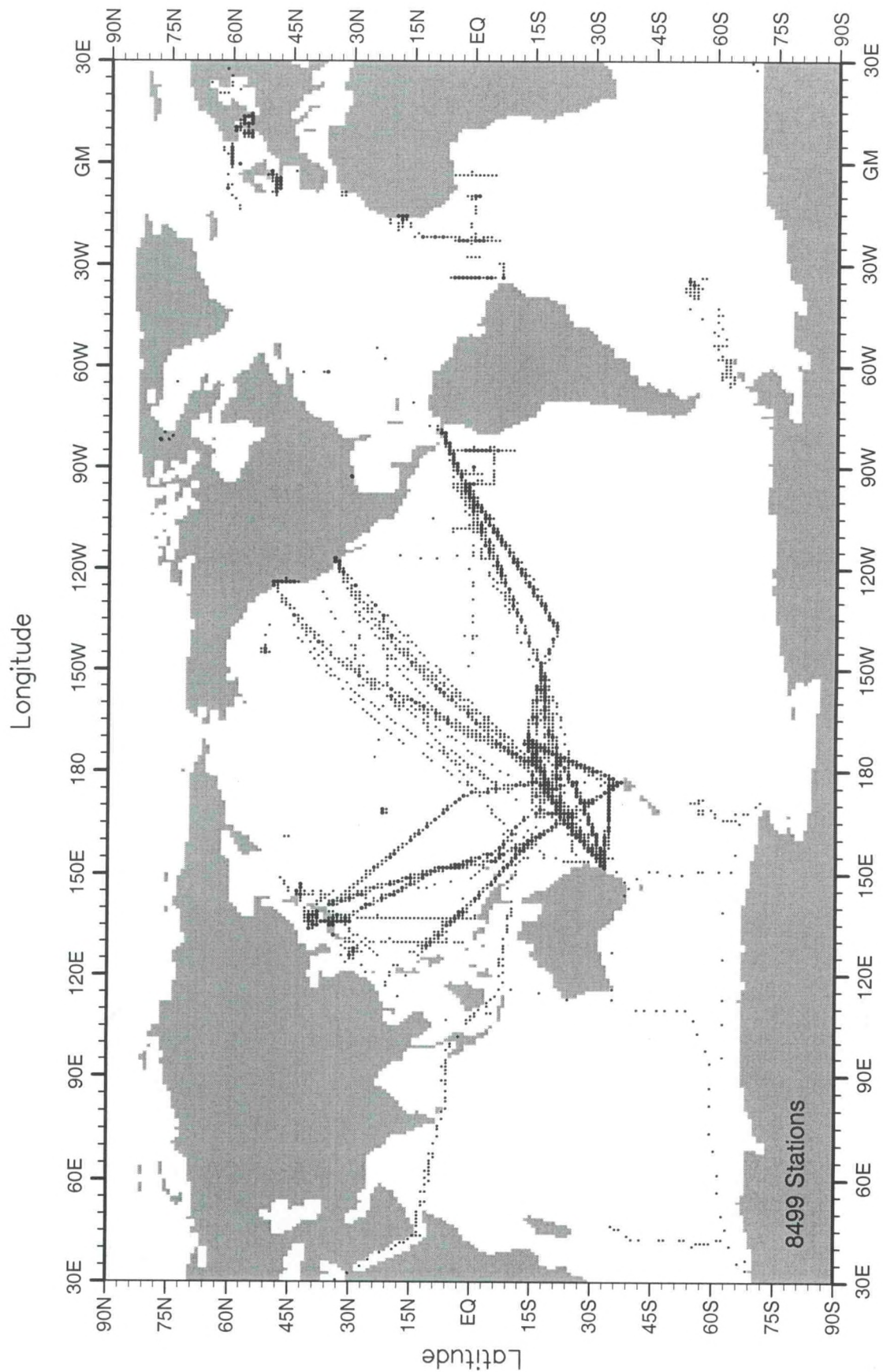


Fig. A29 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1983

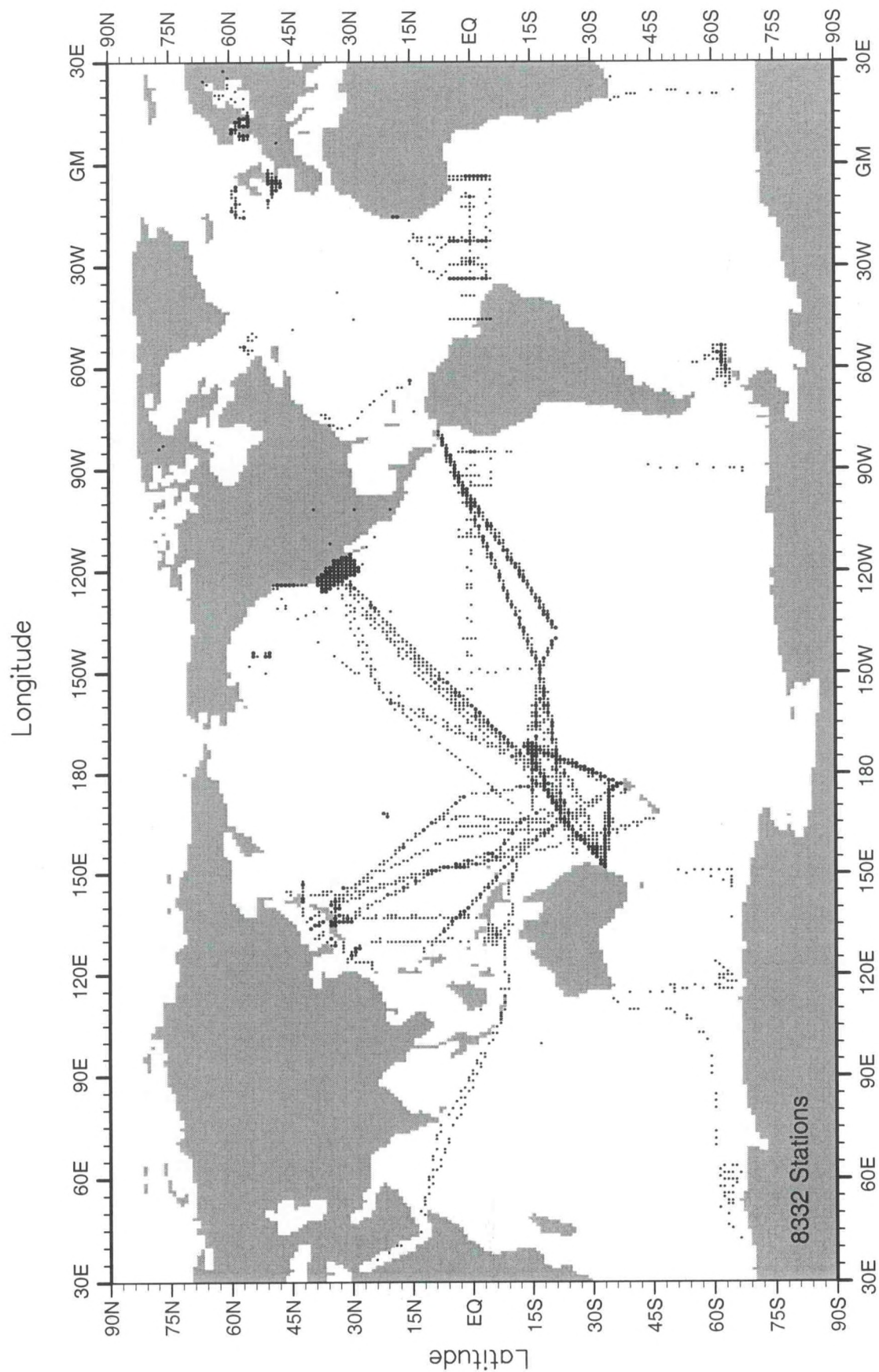


Fig. A30 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1984

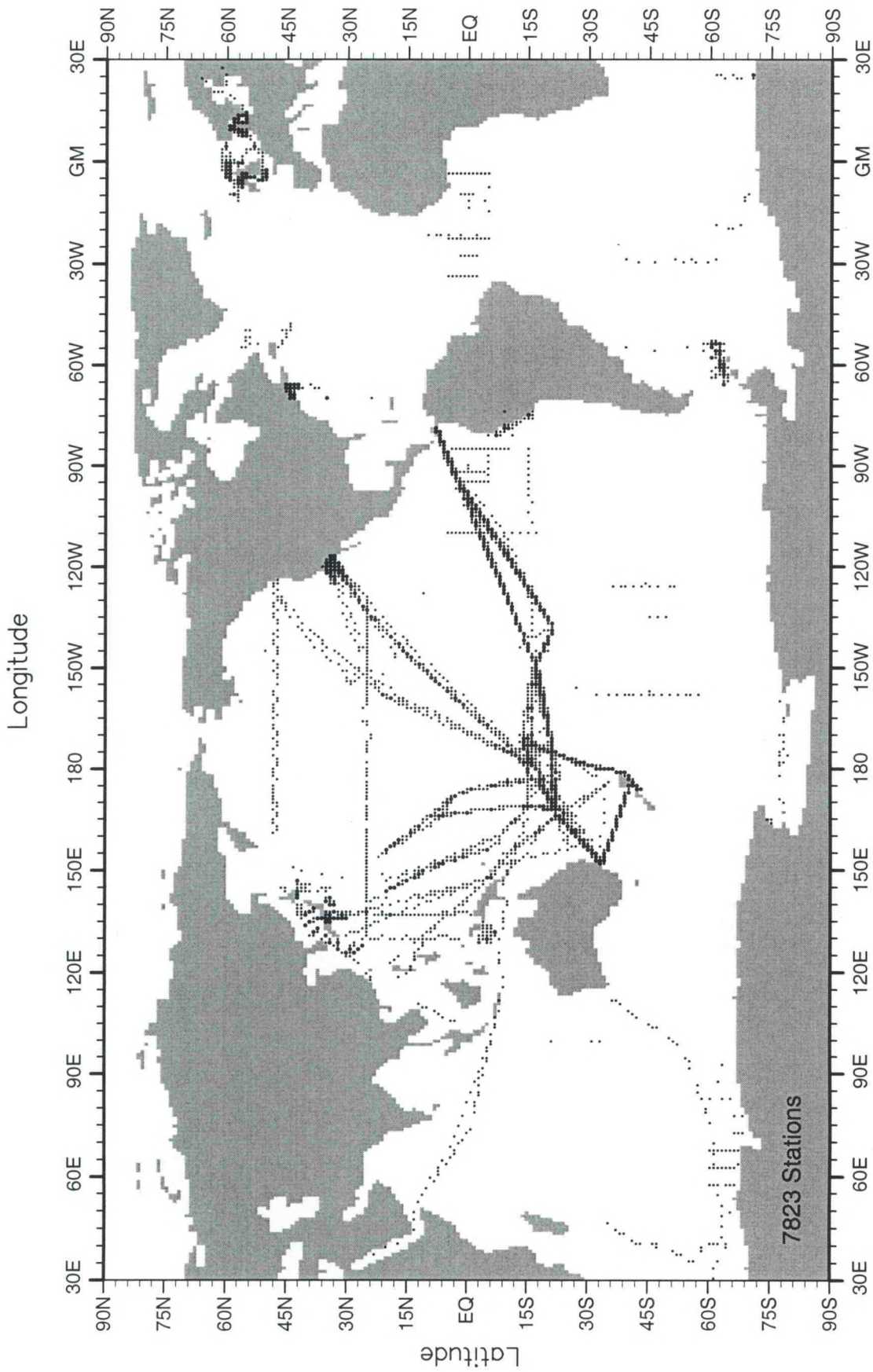


Fig. A31 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1985

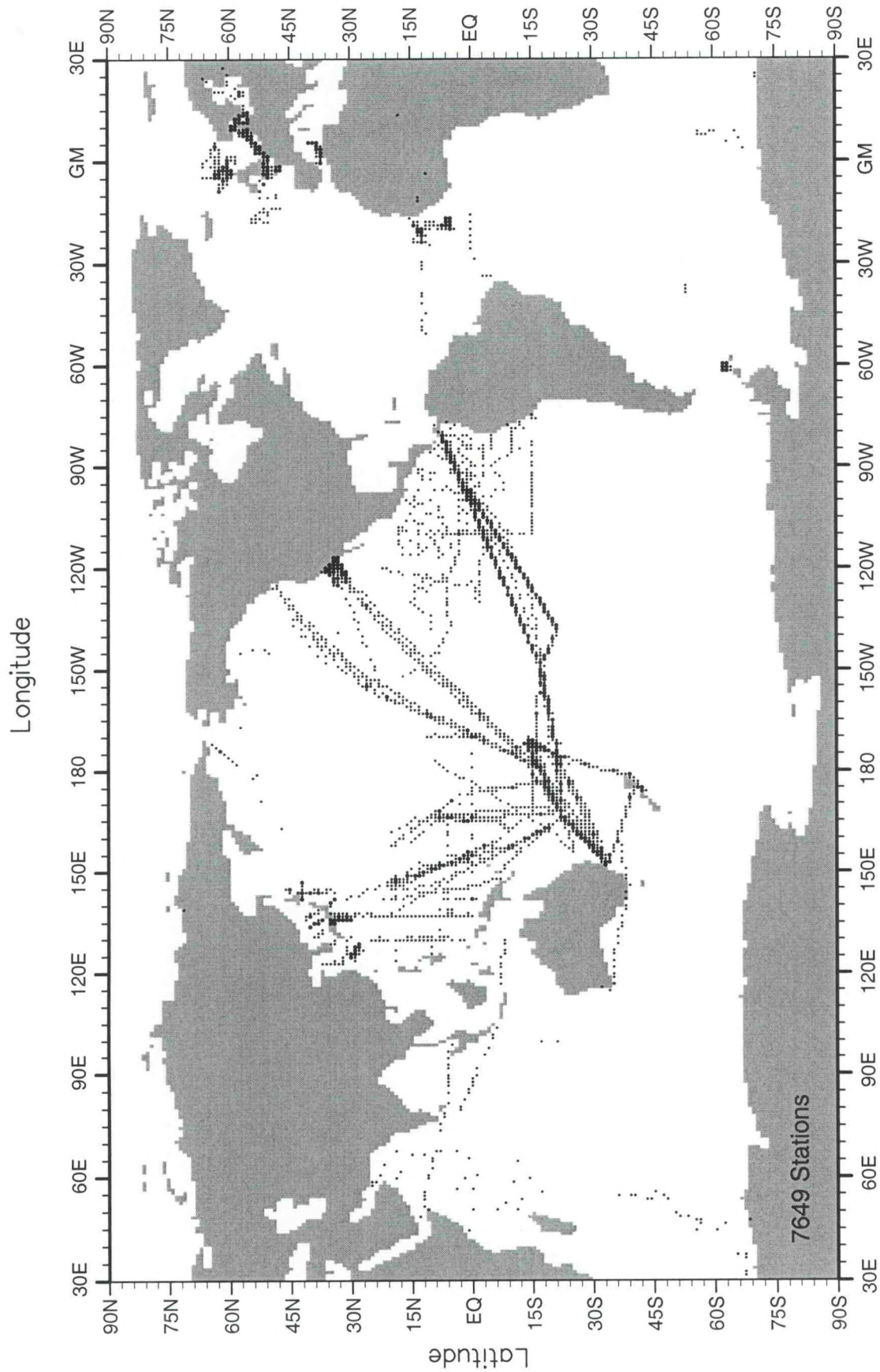


Fig. A32 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1986

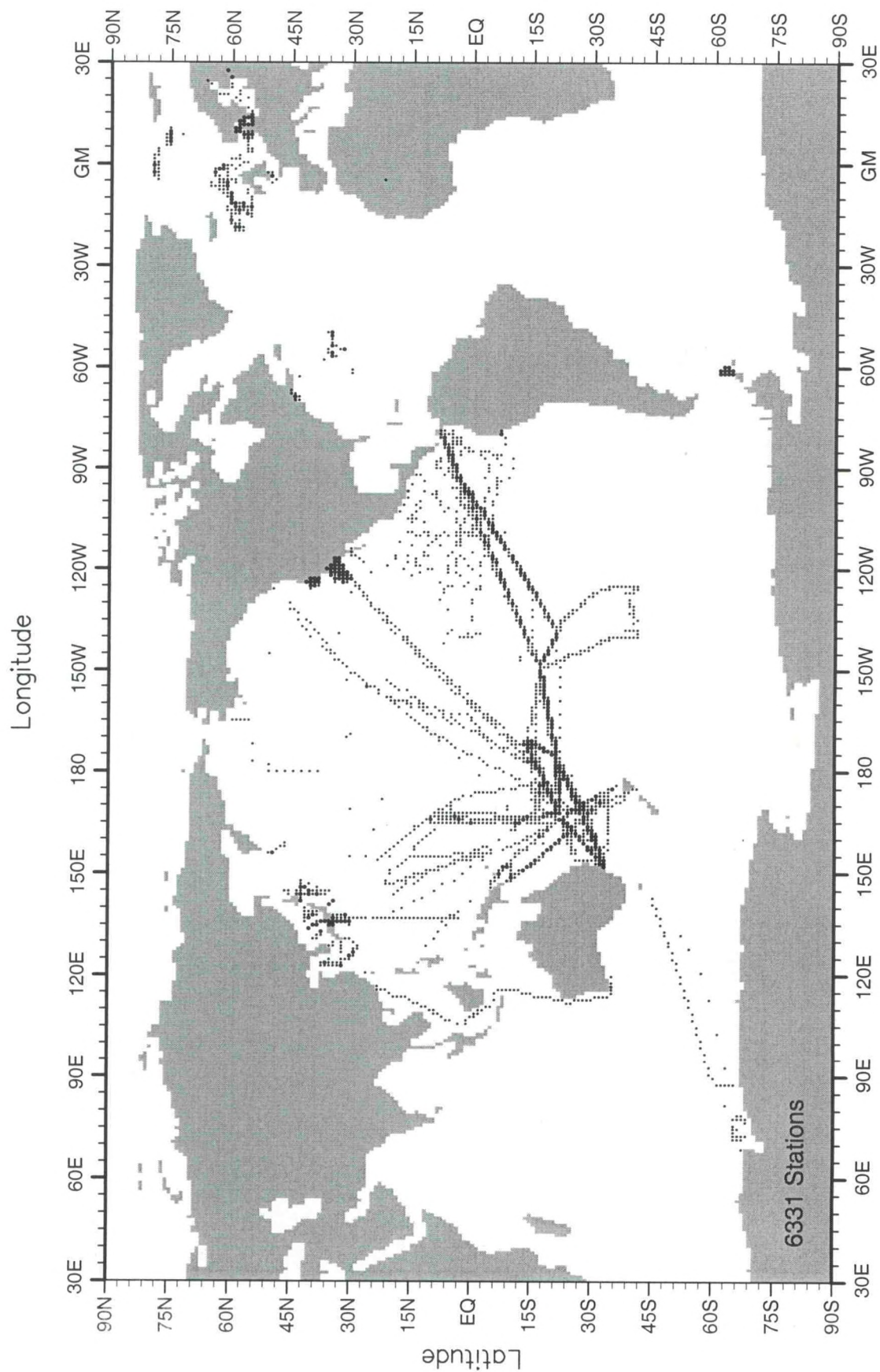


Fig. A33 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1987

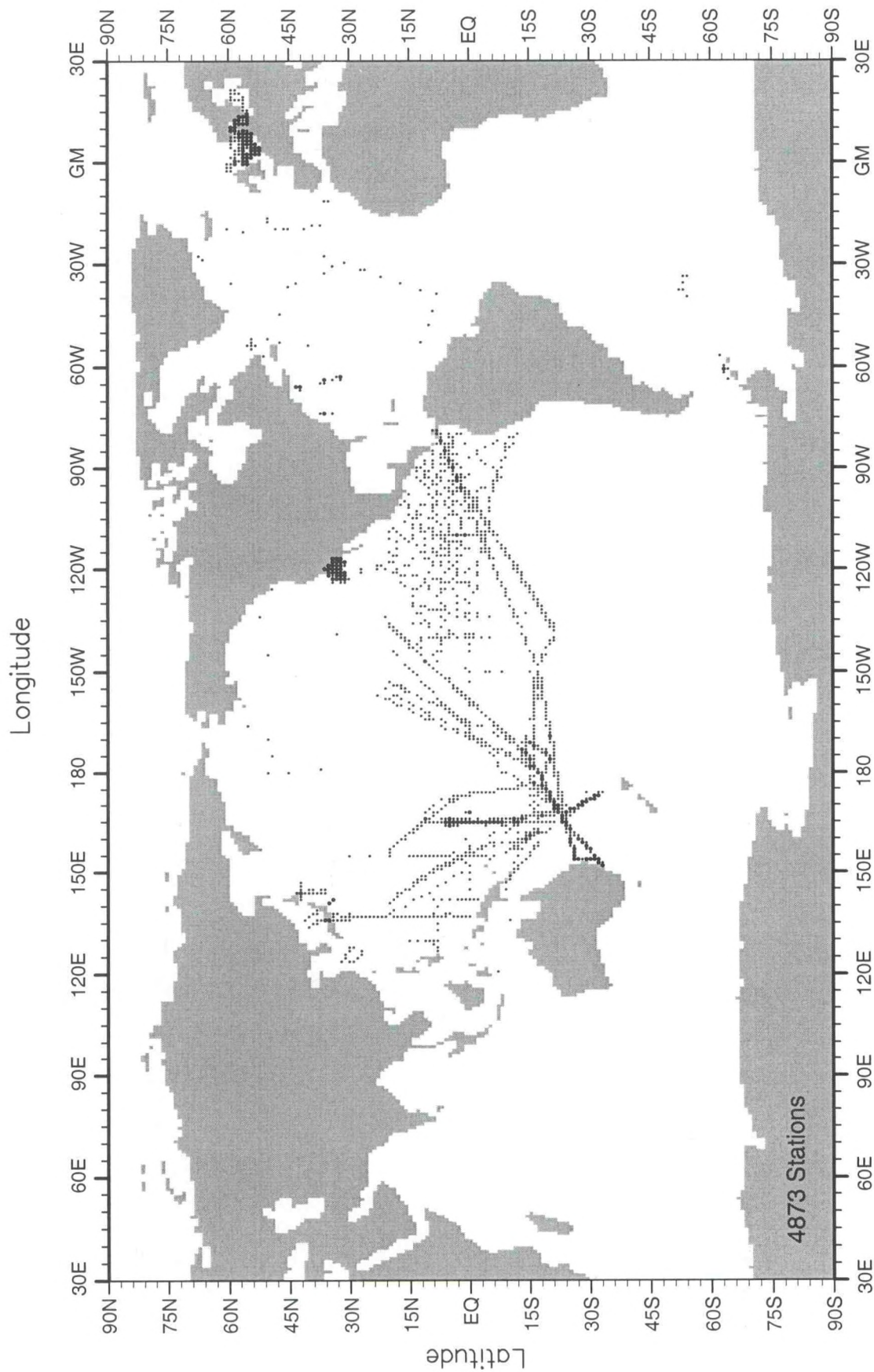


Fig. A34 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1988

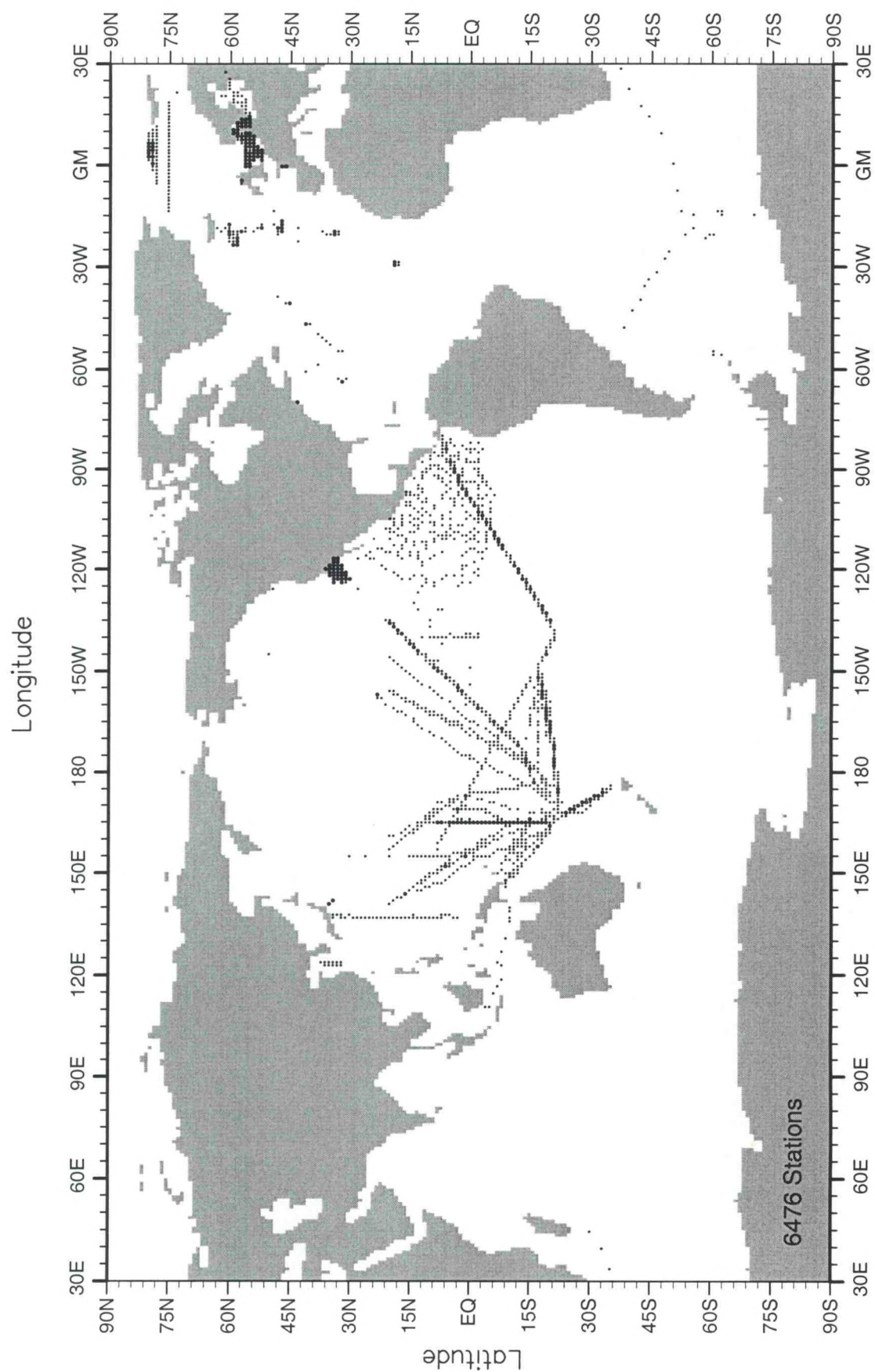


Fig. A35 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1989

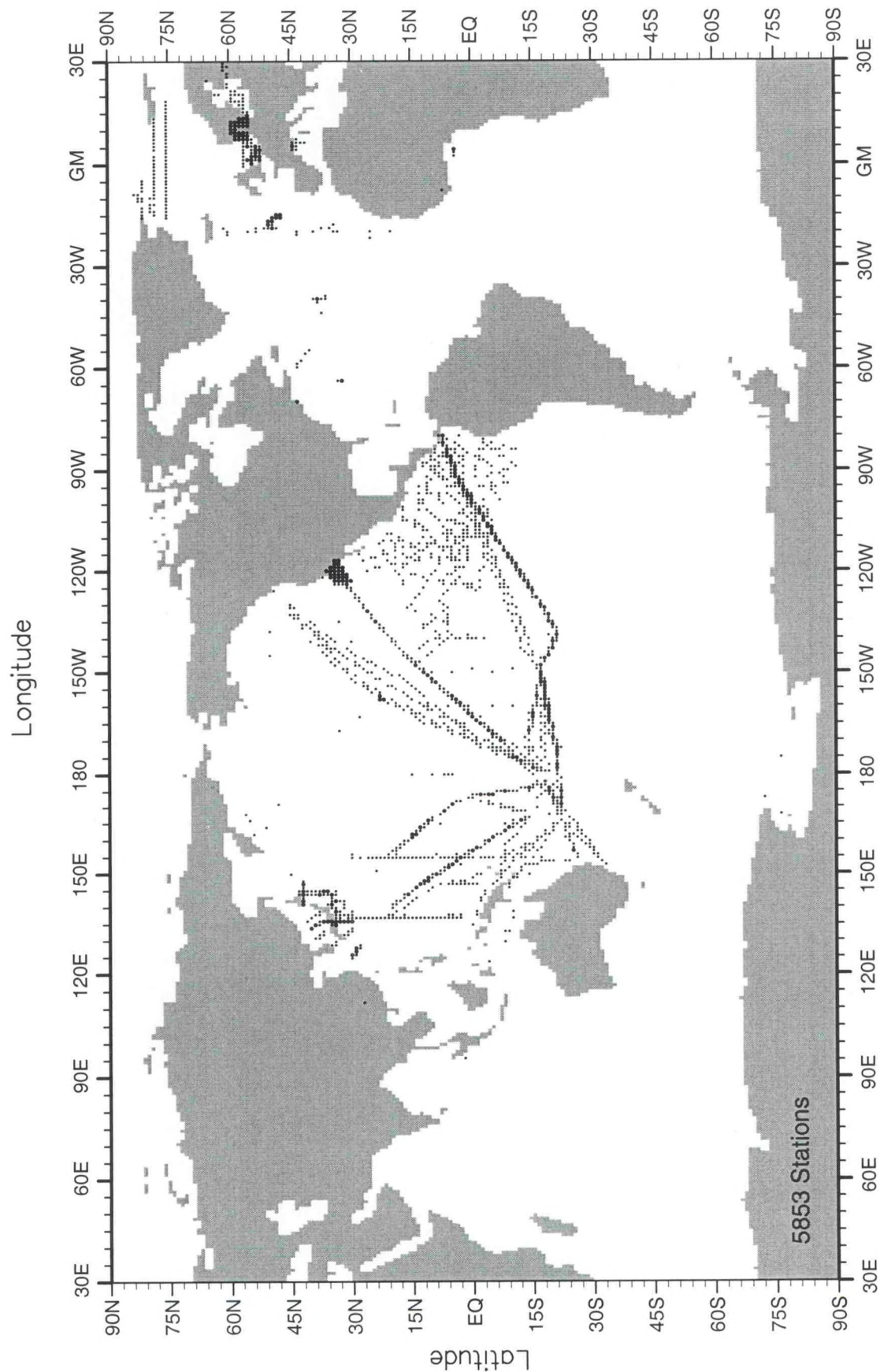


Fig. A36 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1990

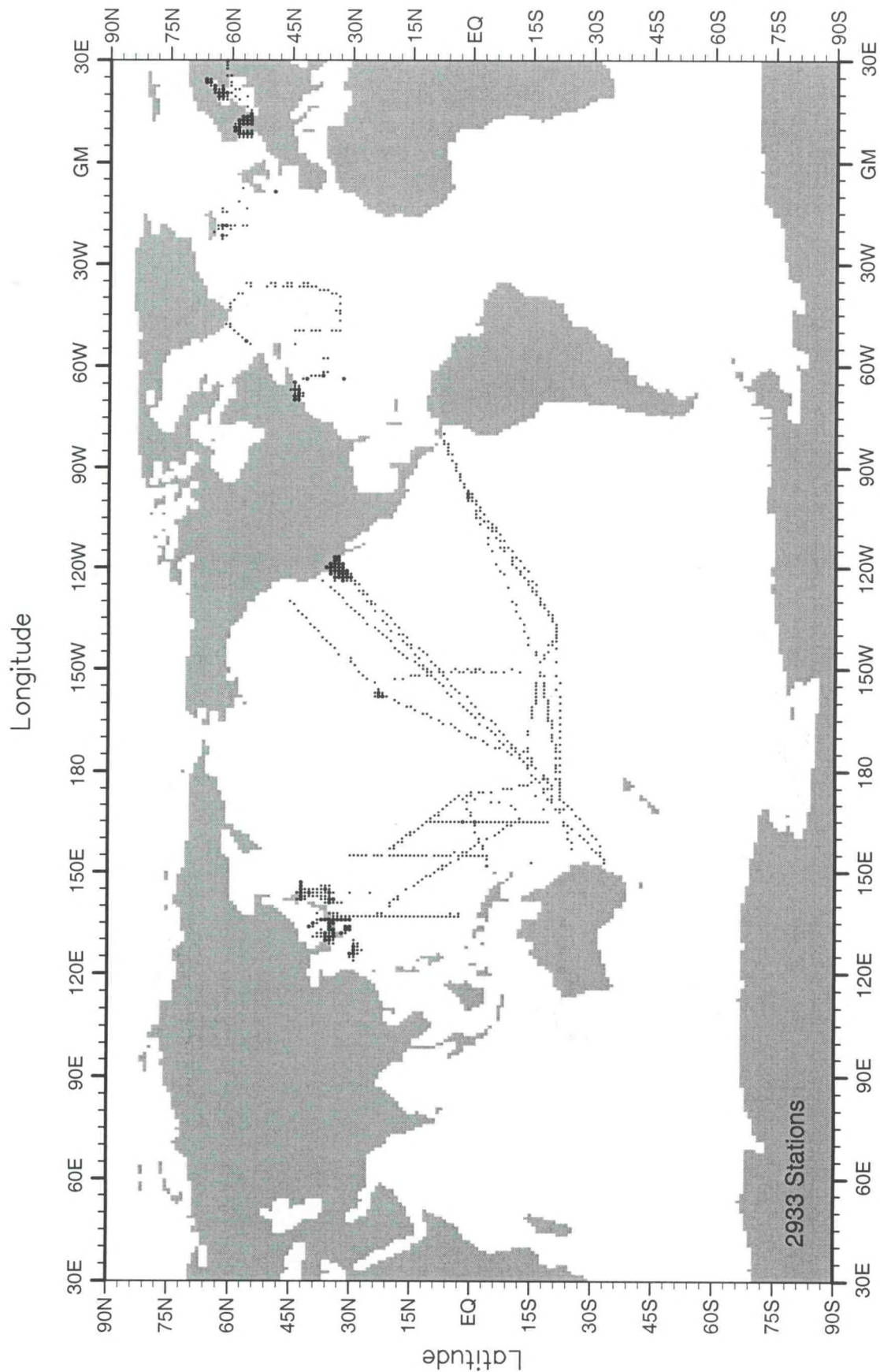


Fig. A37 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1991

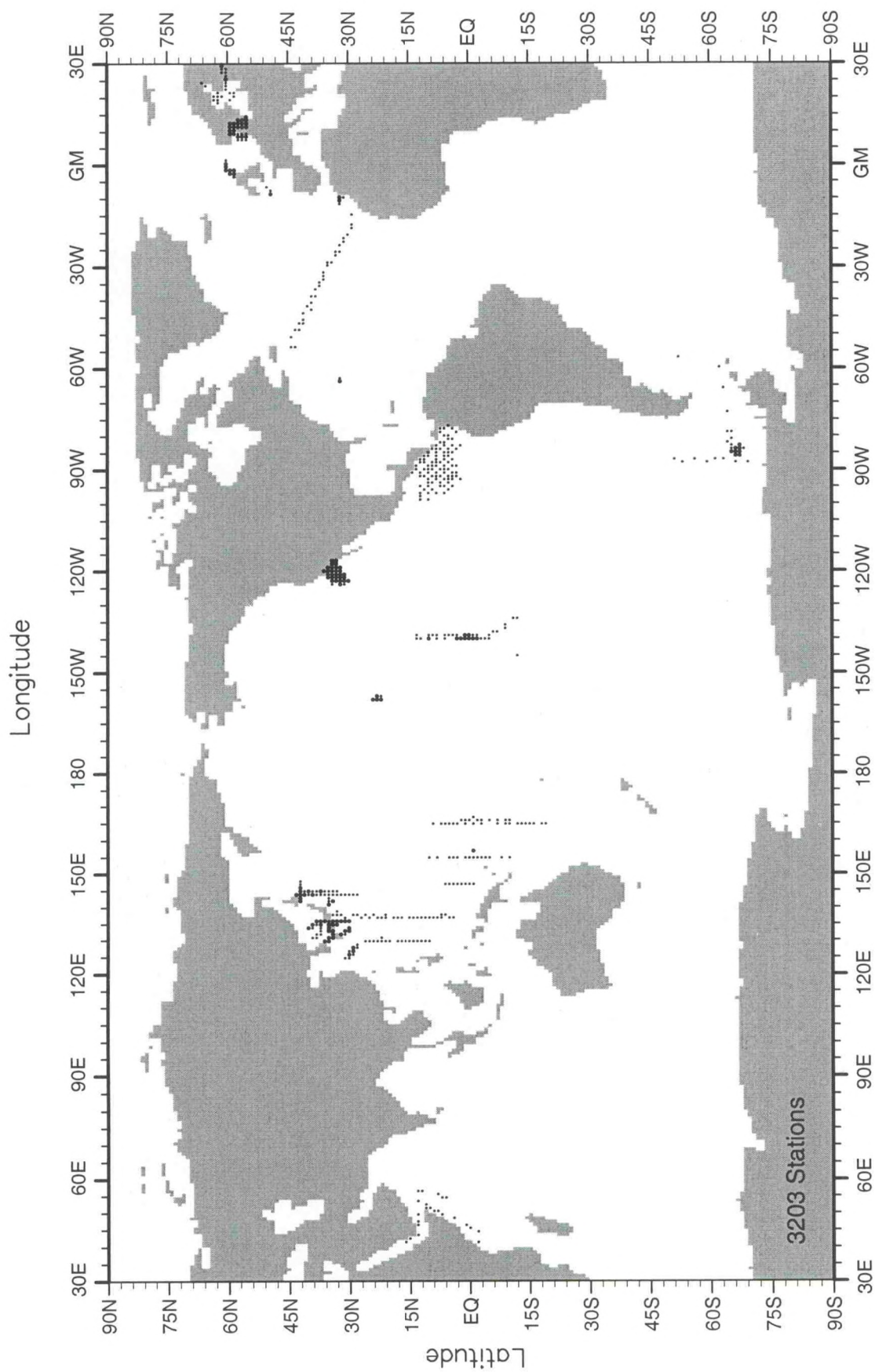


Fig. A38 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1992

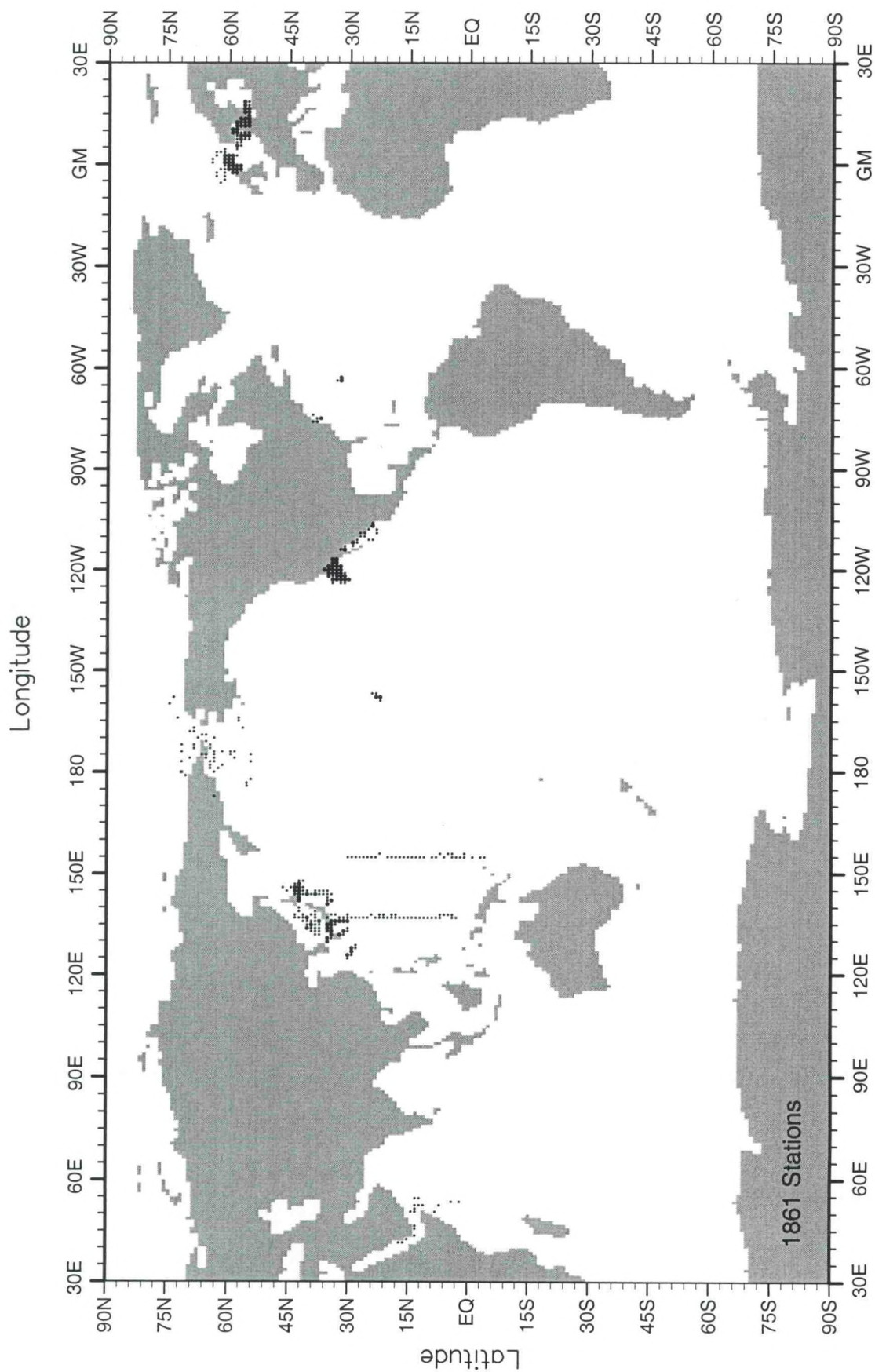


Fig. A39 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1993

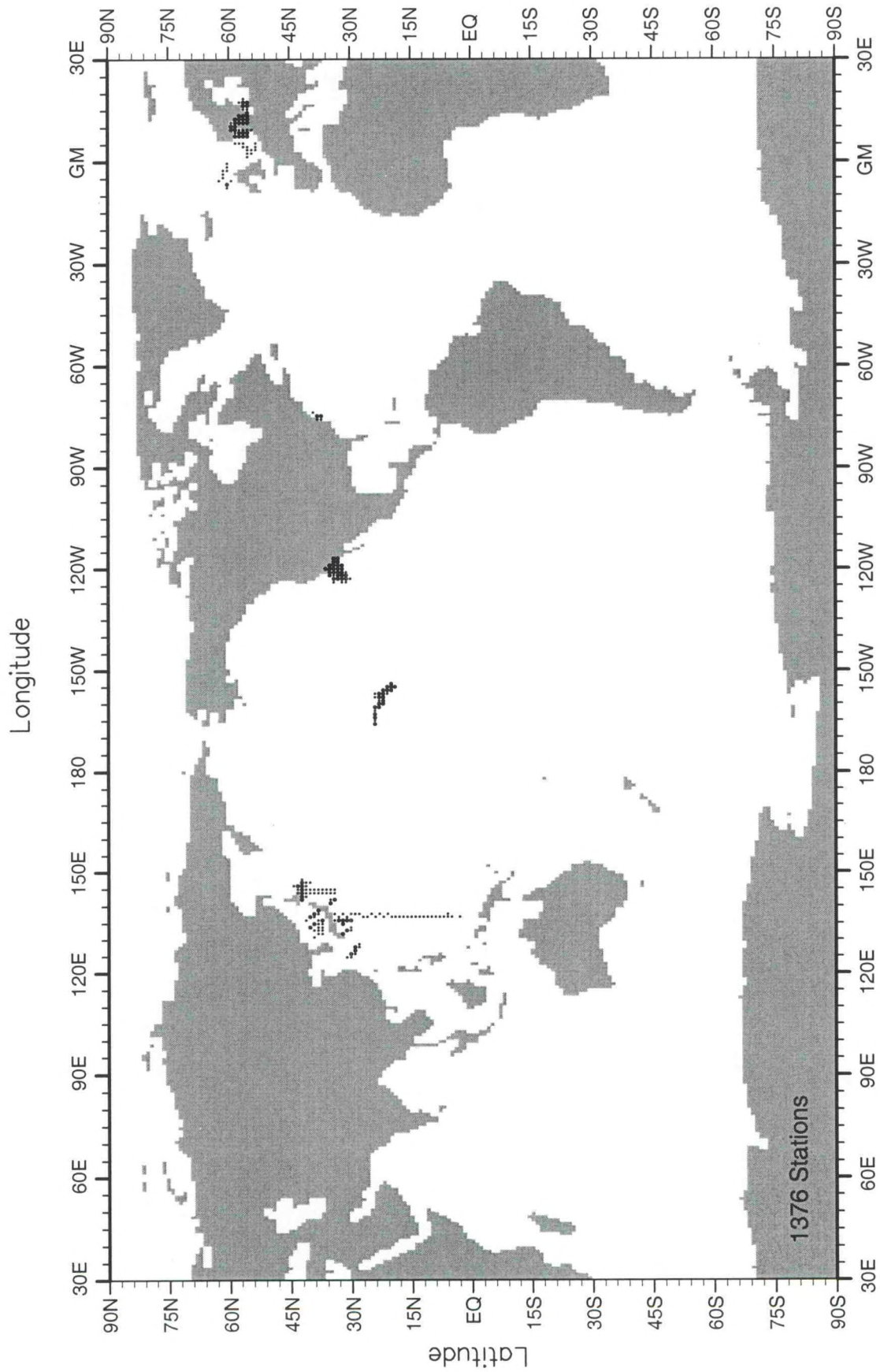


Fig. A40 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1994

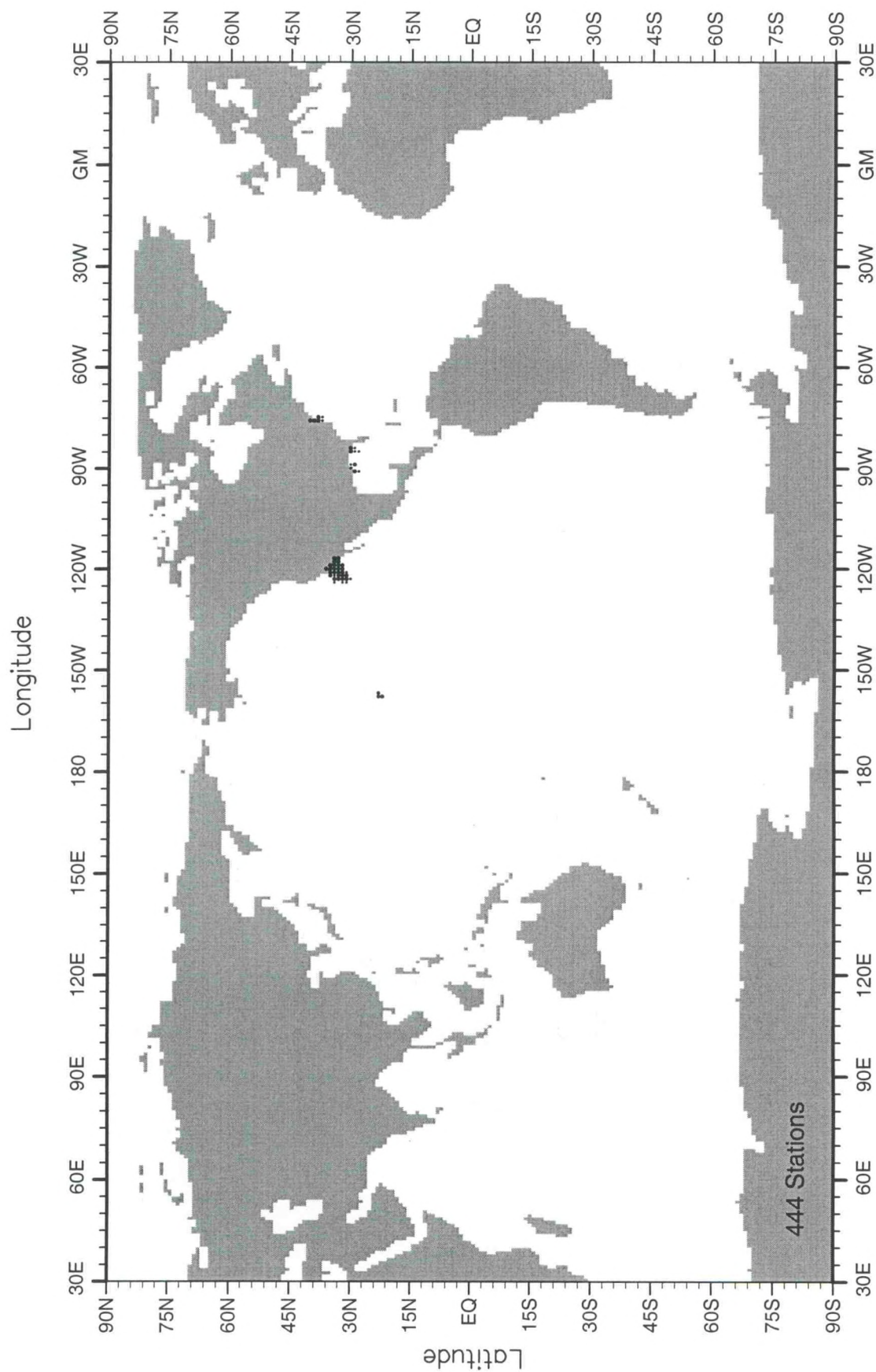


Fig. A41 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1995

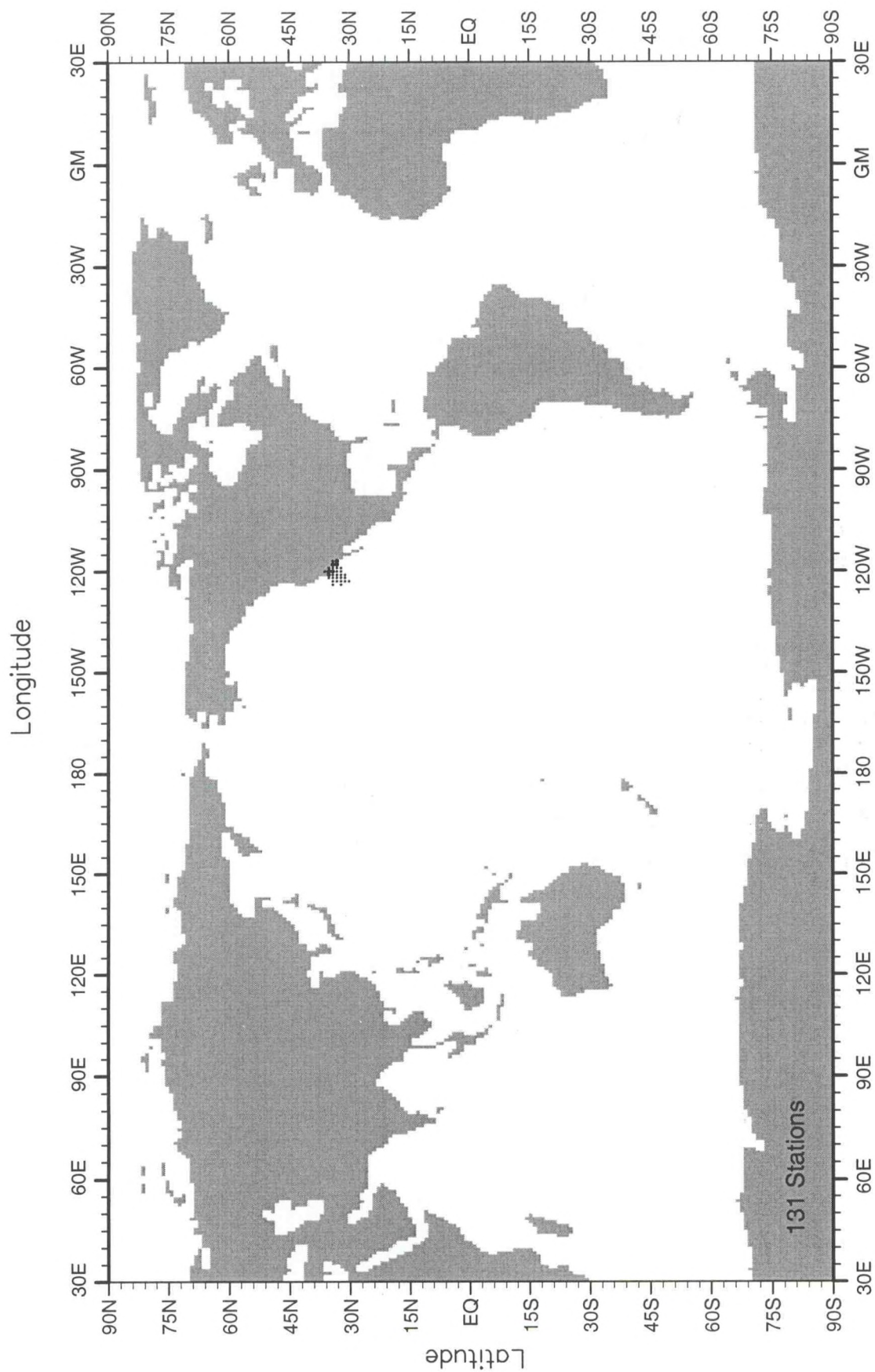


Fig. A42 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD98 for 1996

5. APPENDIX B: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL OSD PLANKTON STATIONS IN WOD98

This appendix contains yearly distributions of all OSD plankton stations contained in WOD98. If no data appear for a year, there is no data distribution map. These maps provide some history of the observational progress of the field of oceanography. They also serve as indicators of whether or not a particular data set from a scientist or institution is part of the NODC/WDC-A archive. The exchange of information provided by the publication of such maps has provided us with valuable information about deficiencies in the database. The locations of all WOD98 OSD plankton stations are plotted including stations that may be erroneously located over land. However, WOD98 contains some stations from various lakes so care should be exercised in the use of these stations and the determination as to whether they represent errors in locations.

For all figures in Appendix B, a small dot indicates a one-degree square containing from one to four stations and a large dot indicates five or more stations.

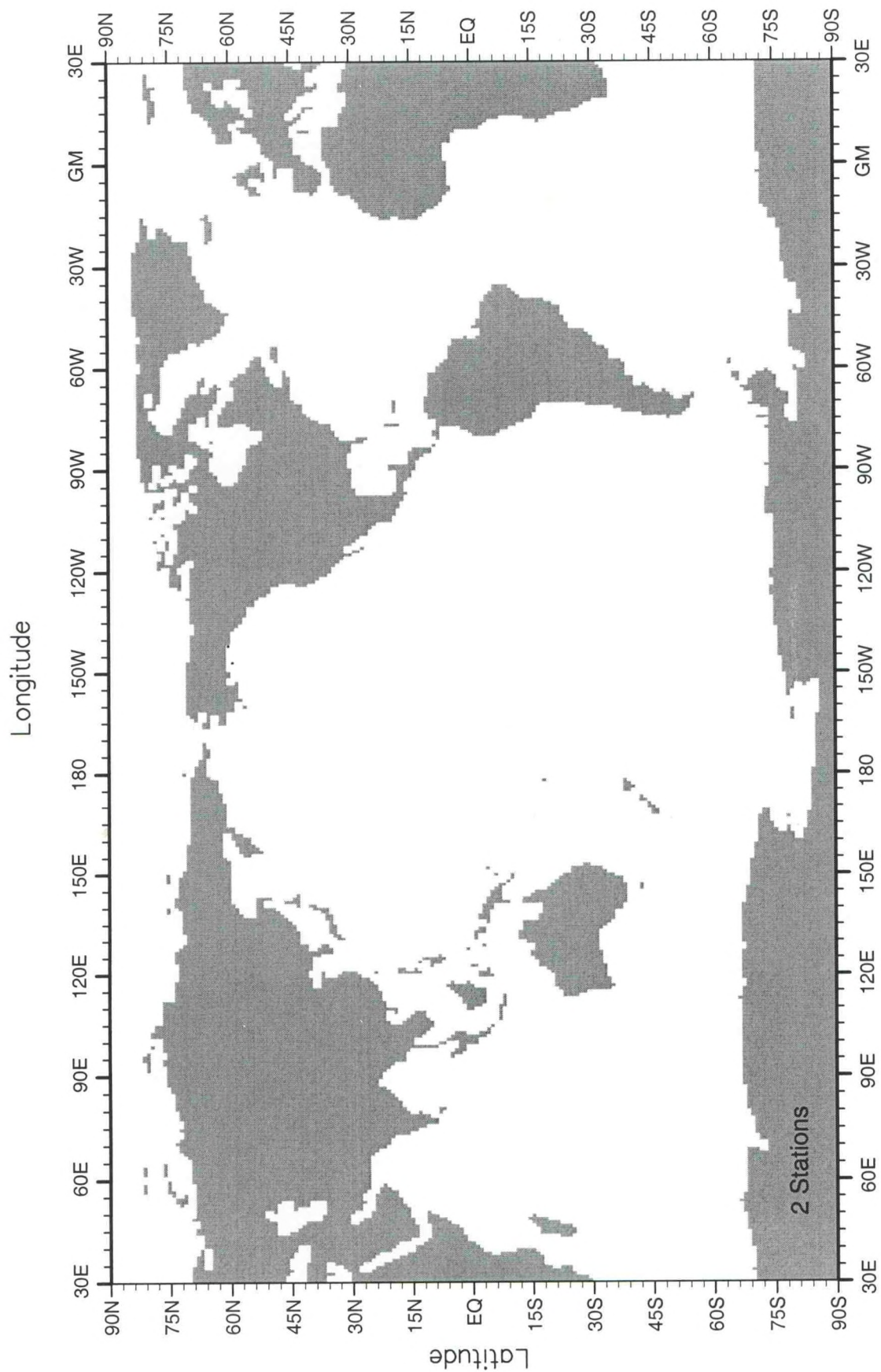


Fig. B1 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1928

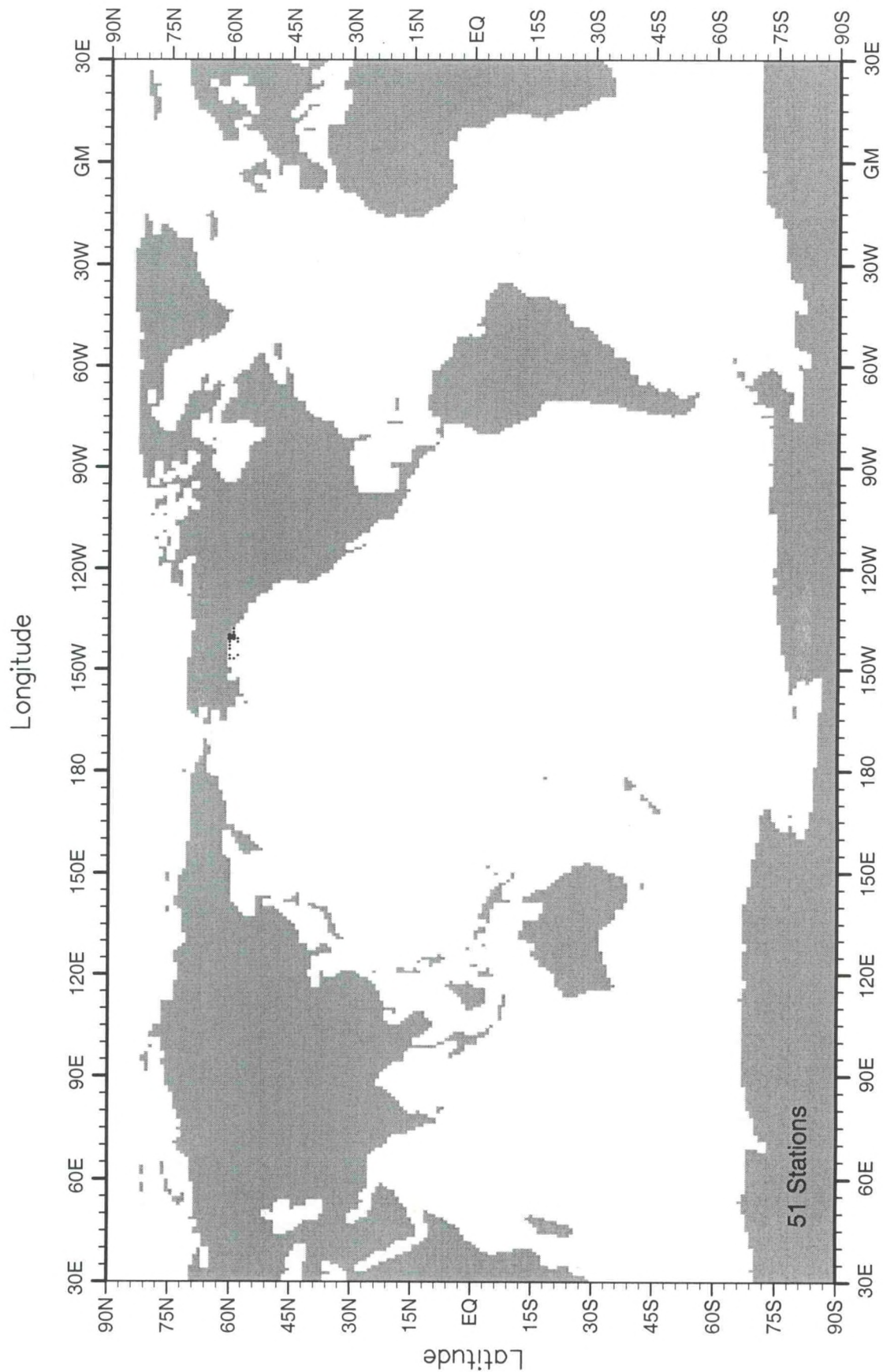


Fig. B2 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1929

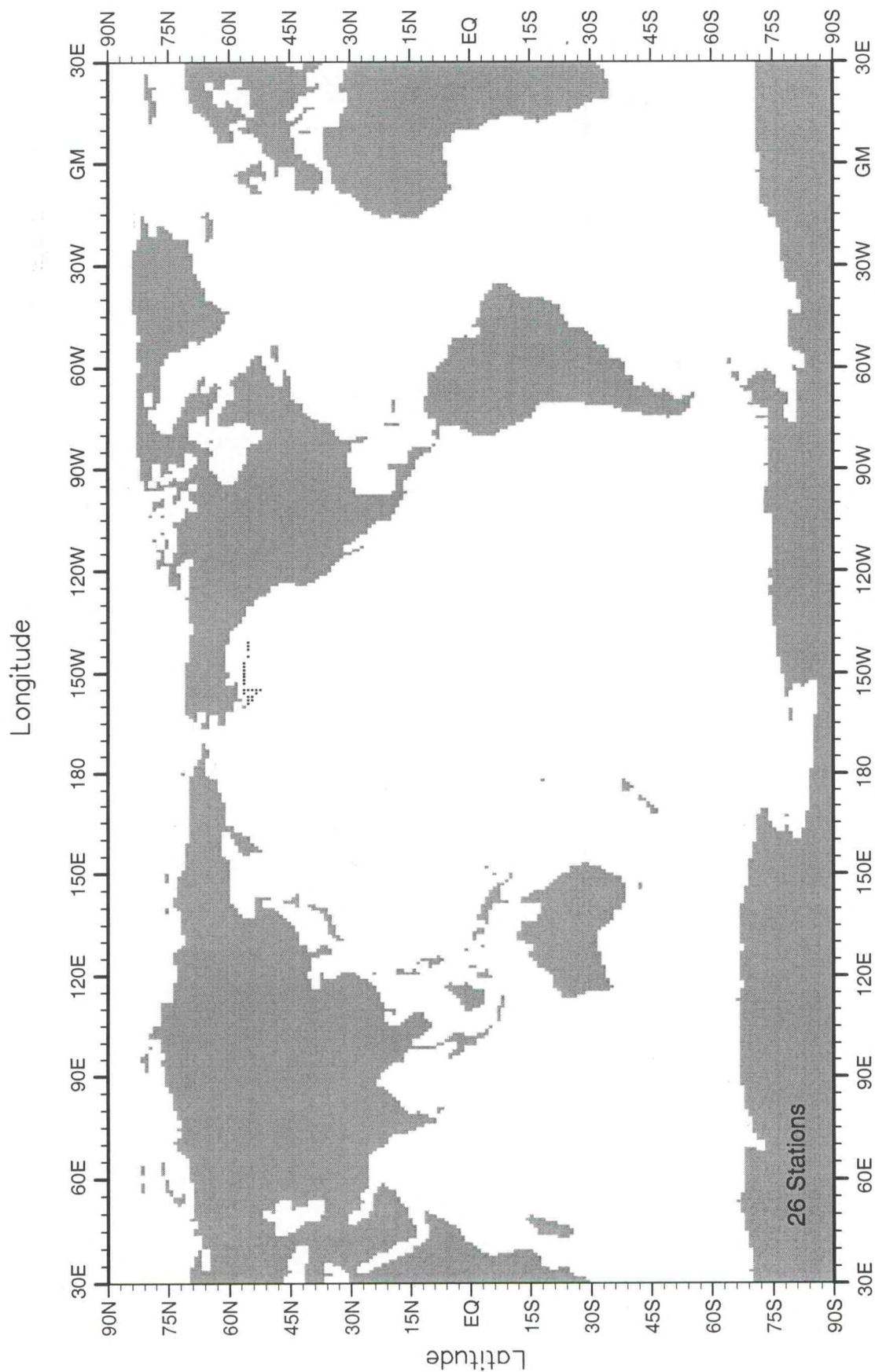


Fig. B3 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1930

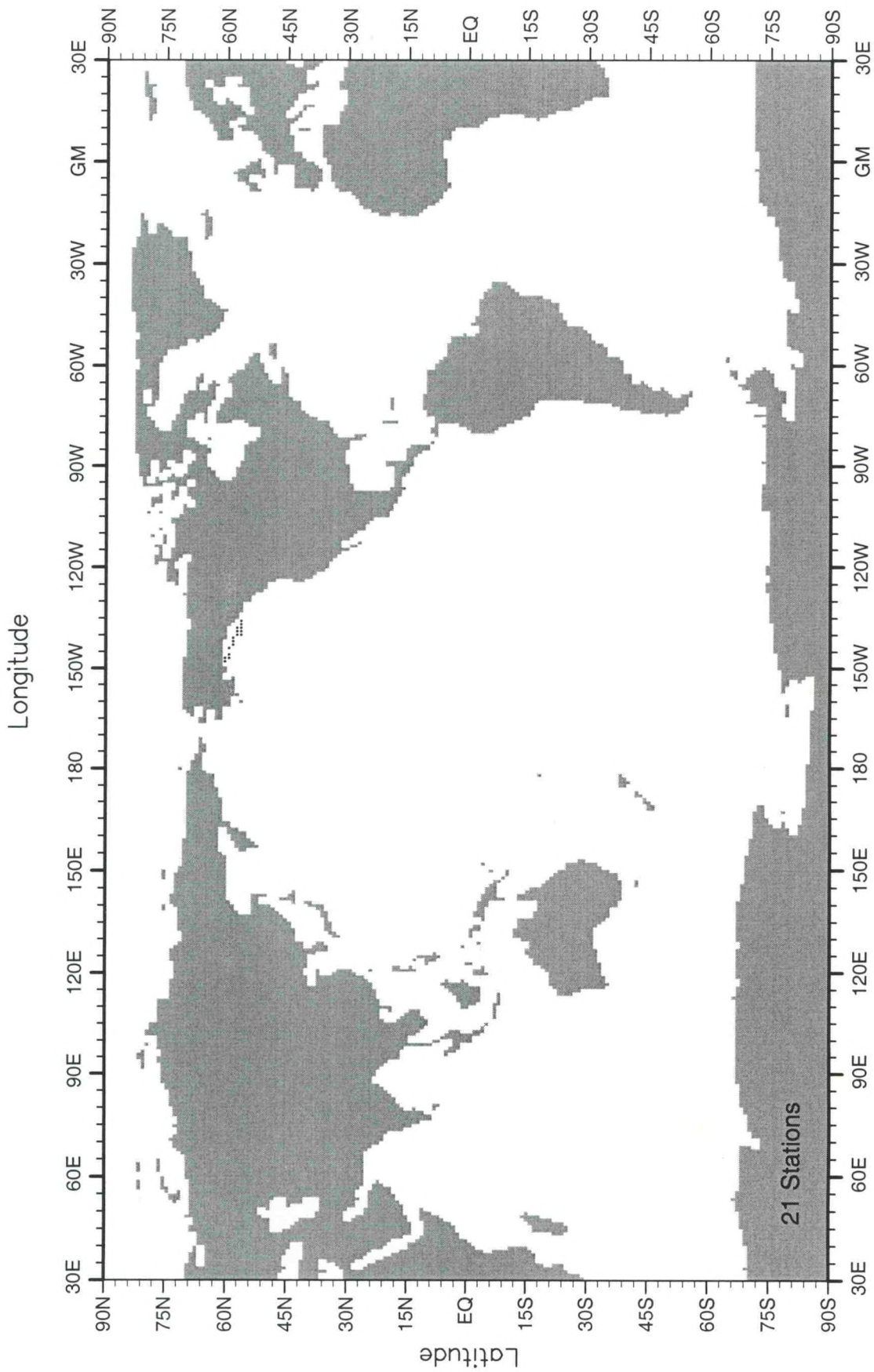


Fig. B4 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1931

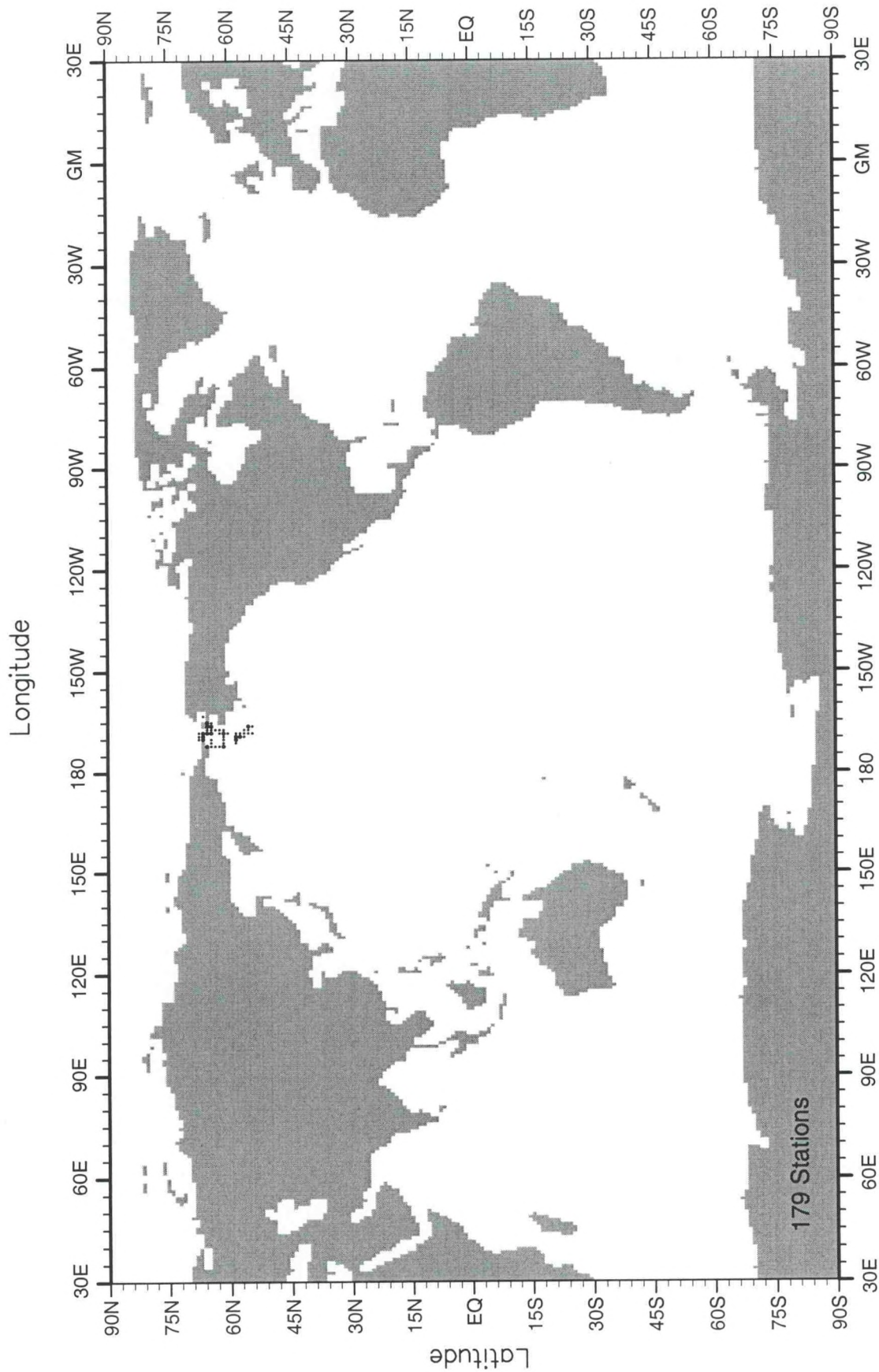


Fig. B5 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1934

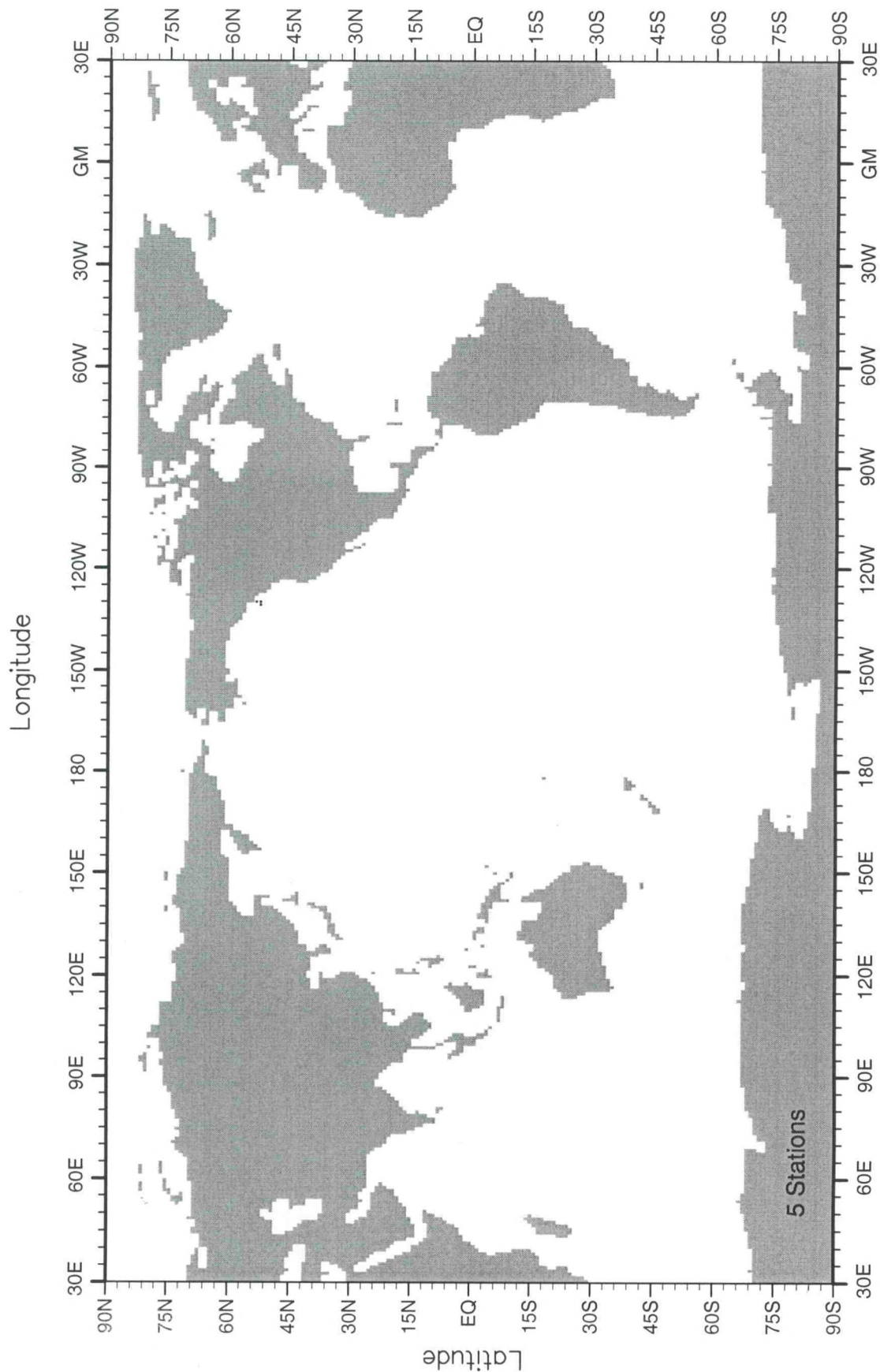


Fig. B6 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1938

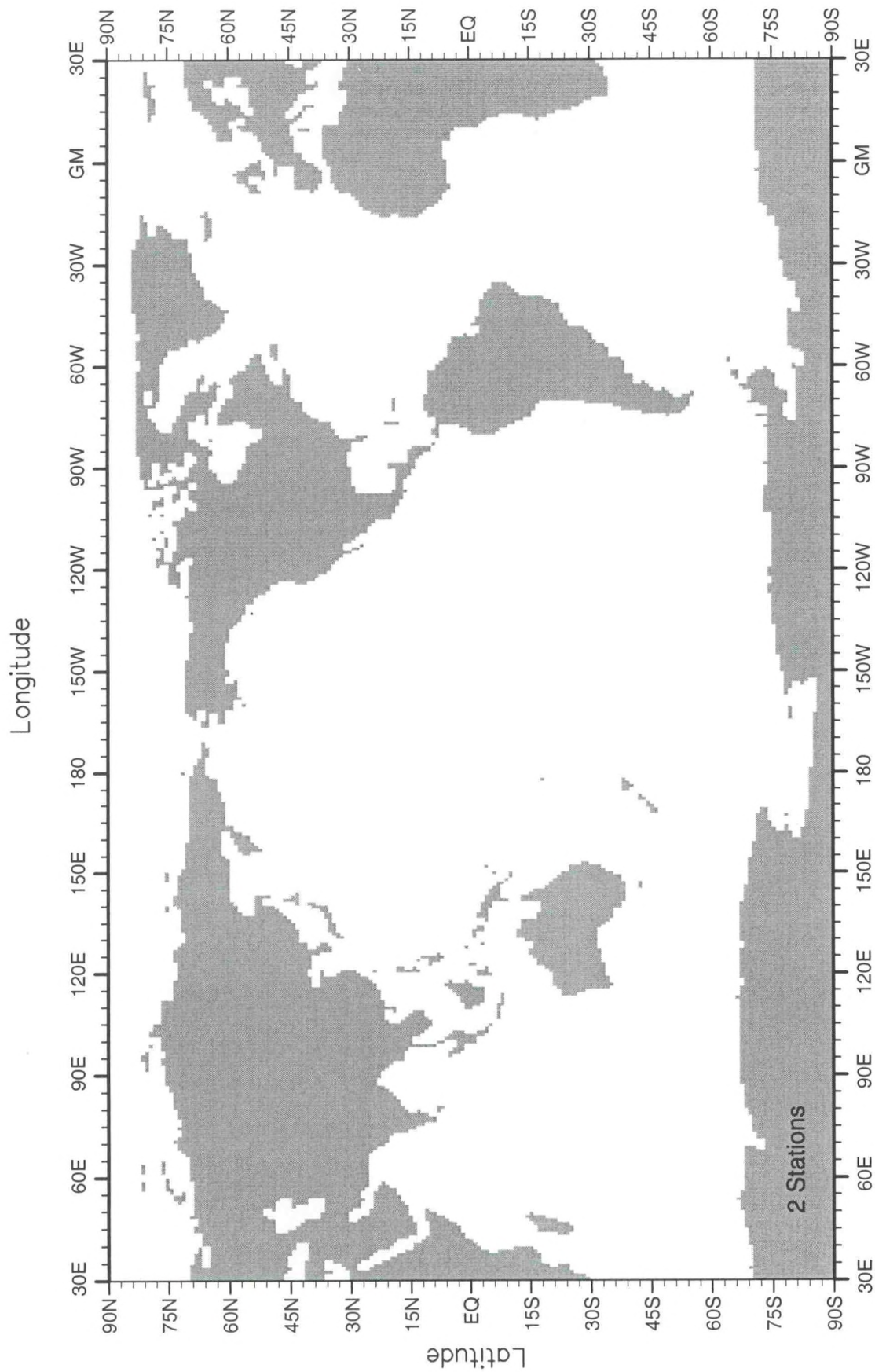


Fig. B7 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1940

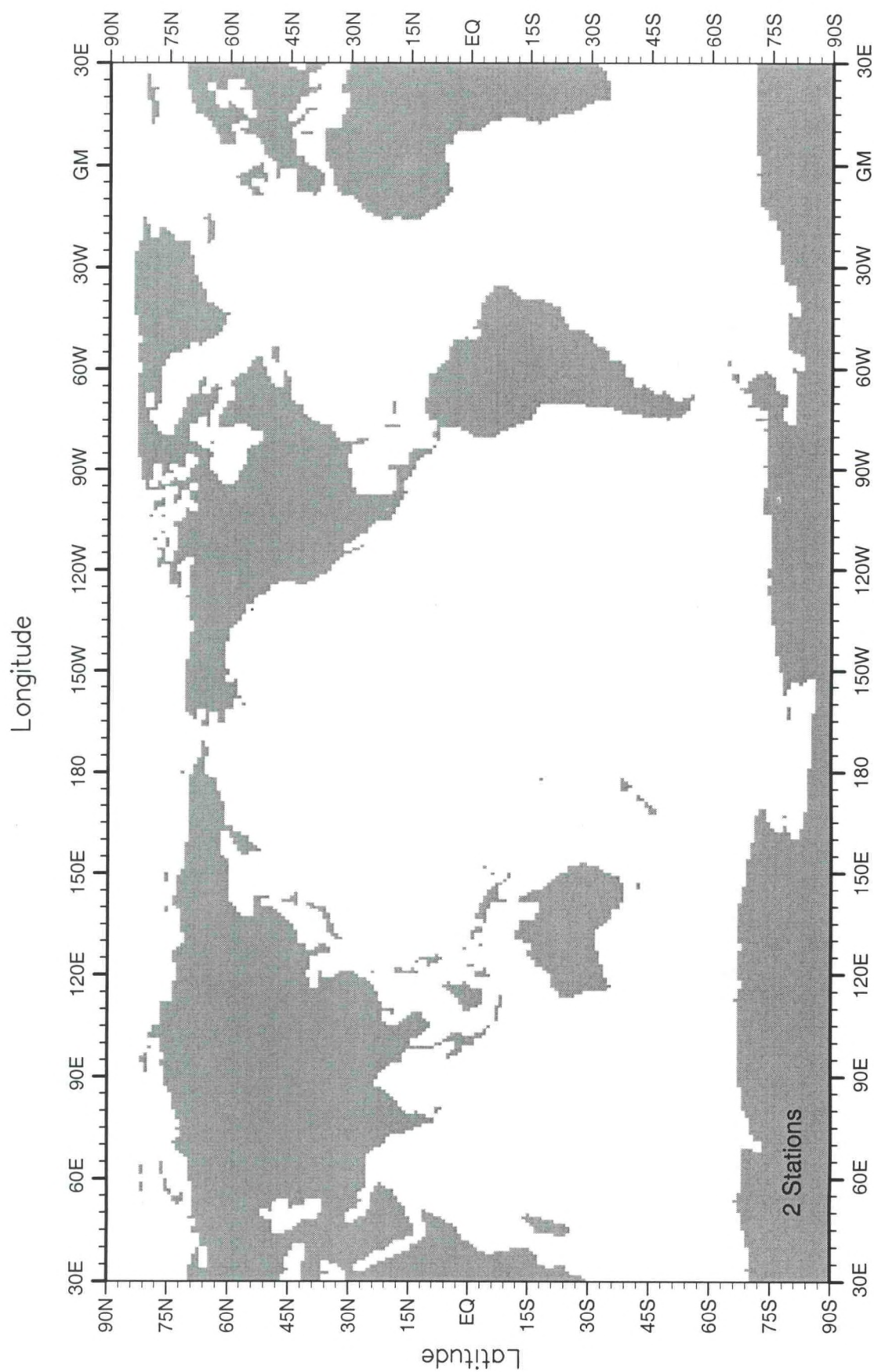


Fig. B8 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1942

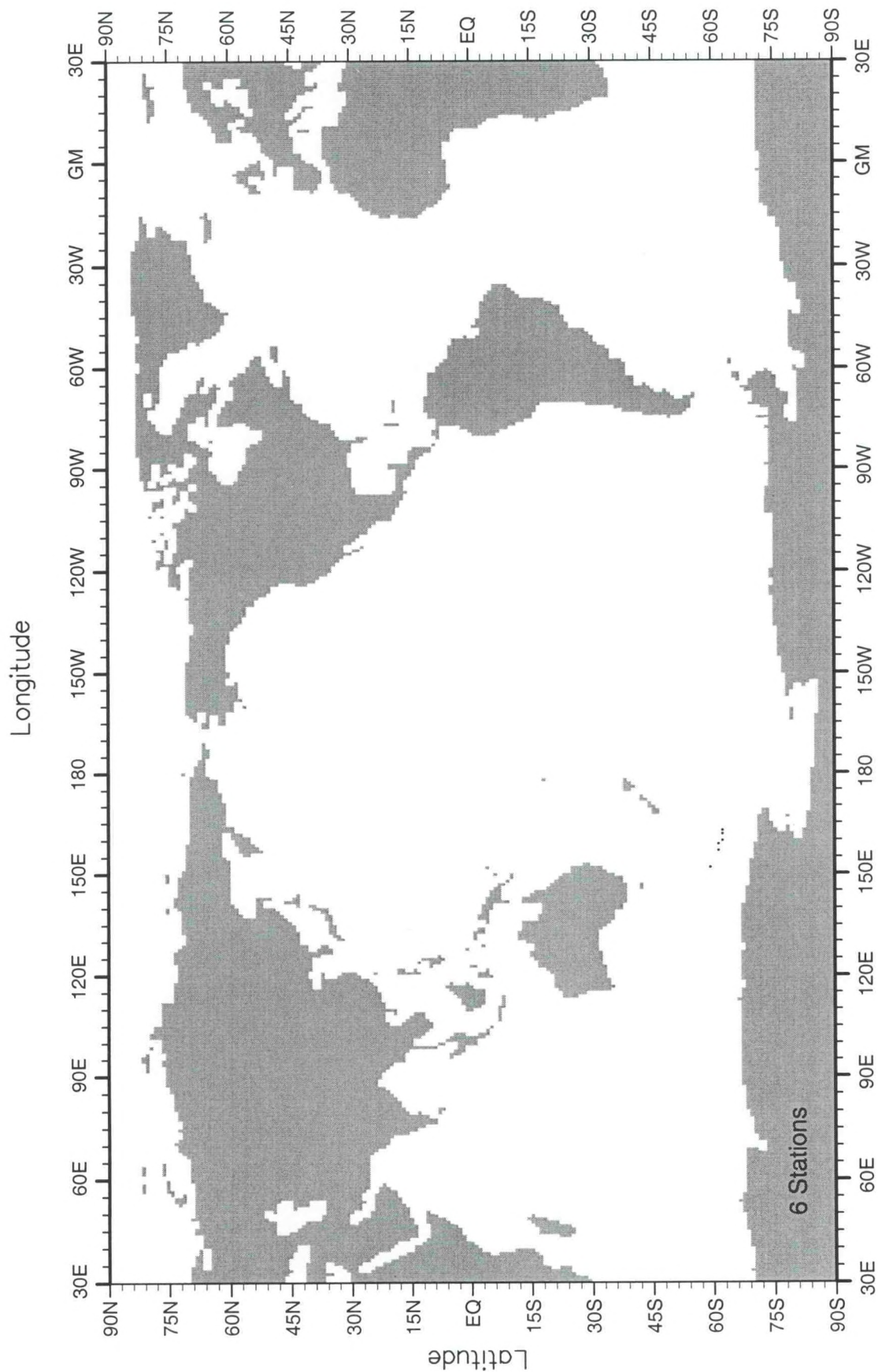


Fig. B9 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1946

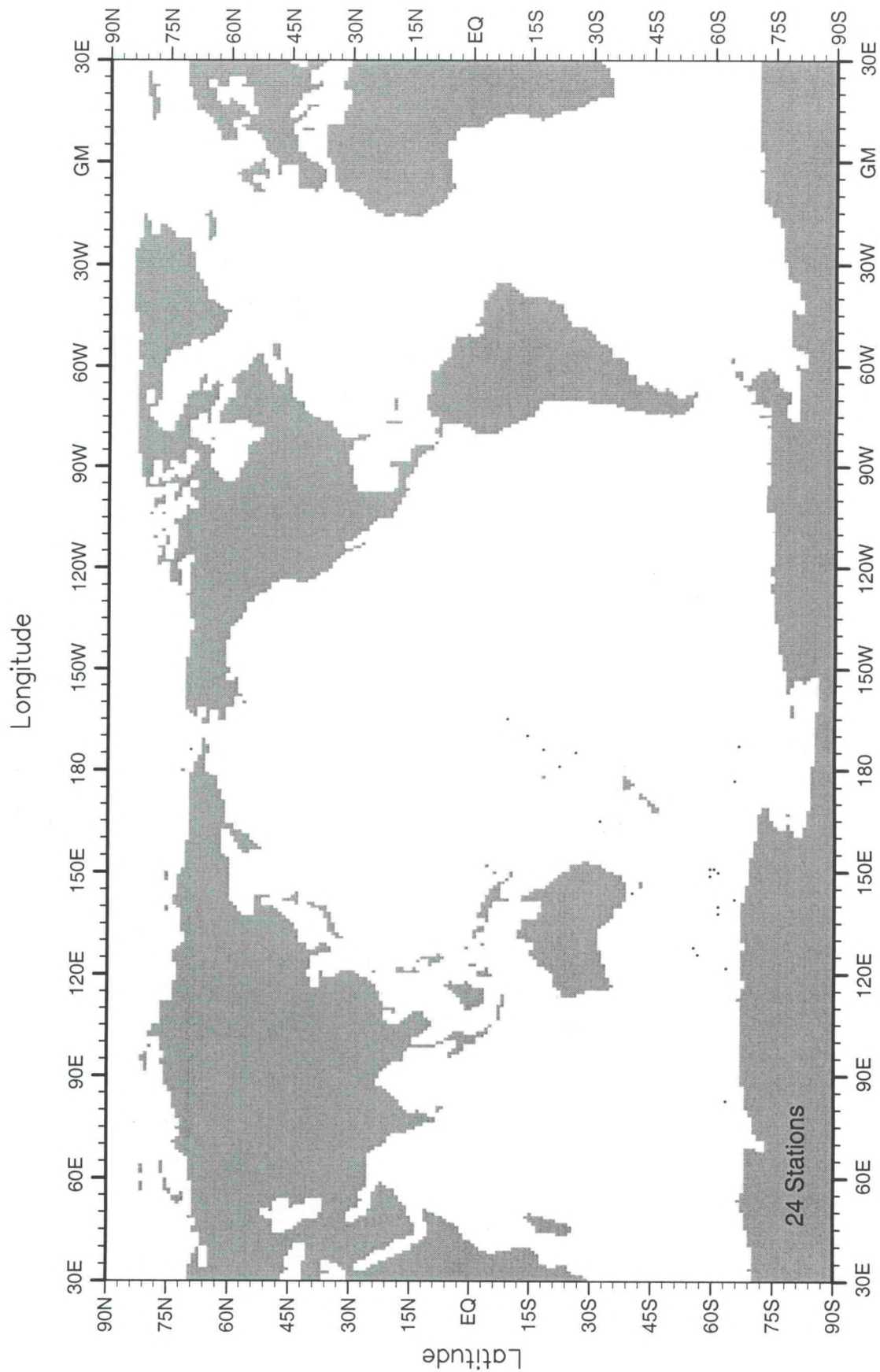


Fig. B10 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1947

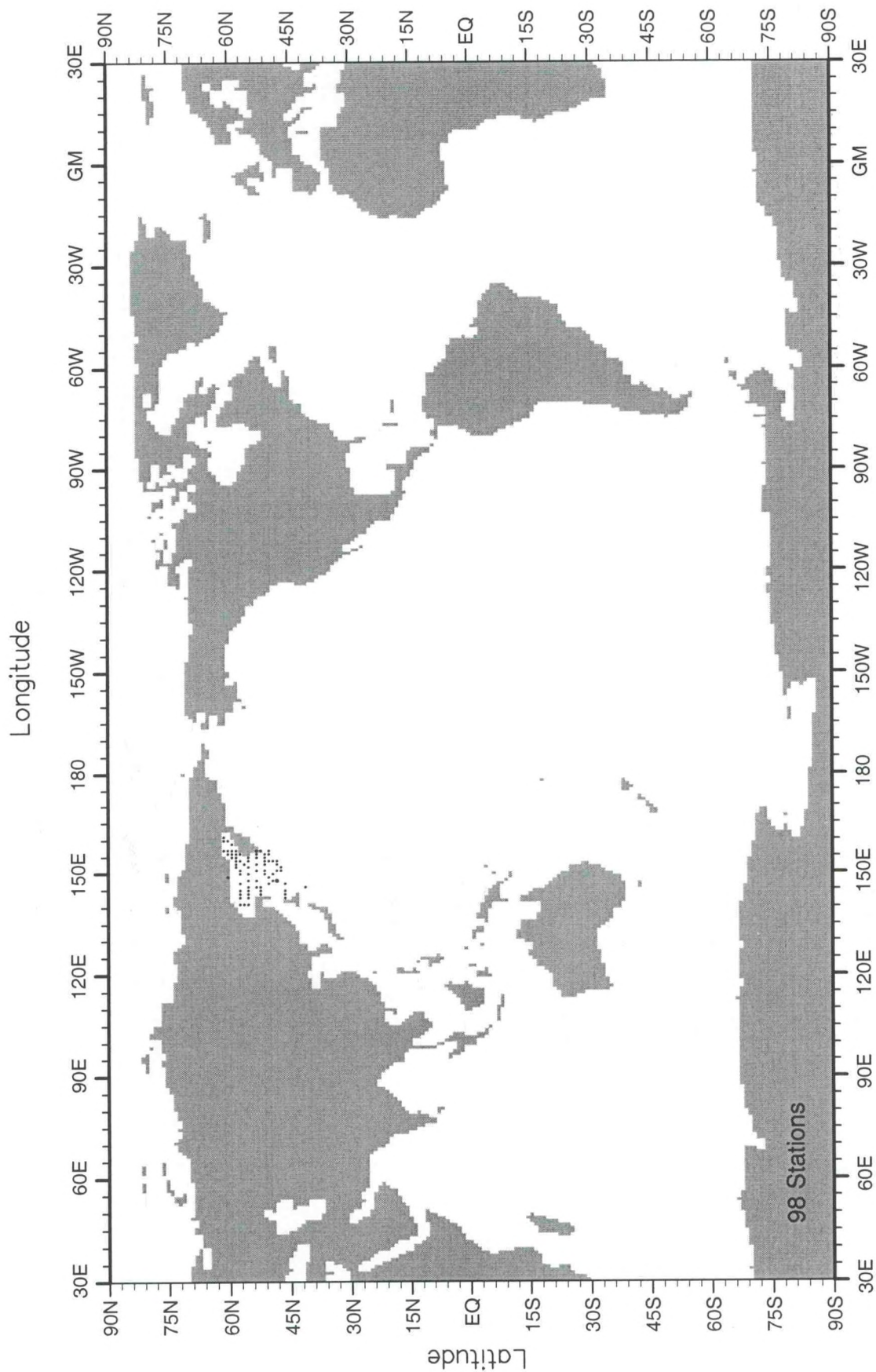


Fig. B11 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1949

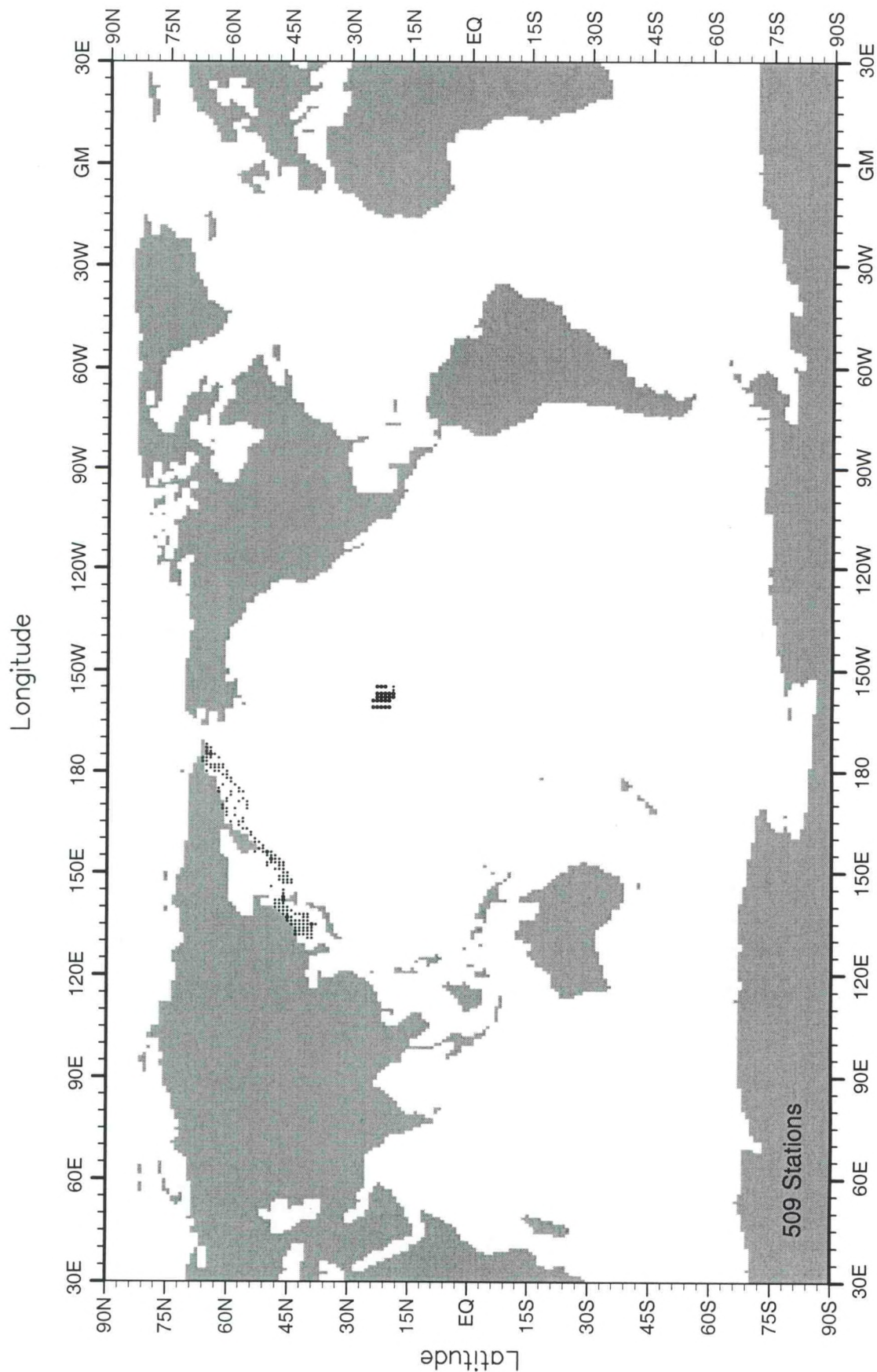


Fig. B12 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1950

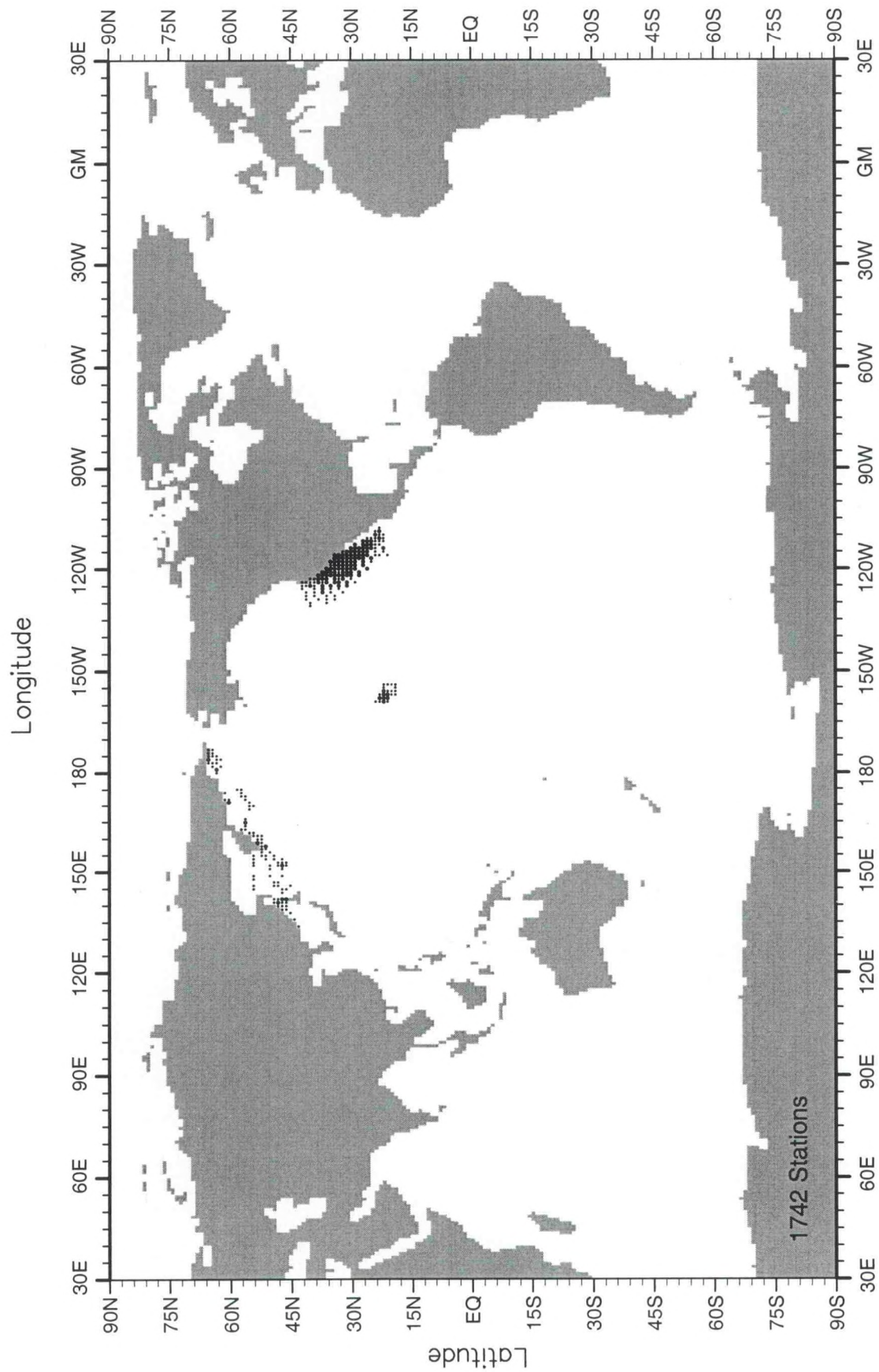


Fig. B13 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1951

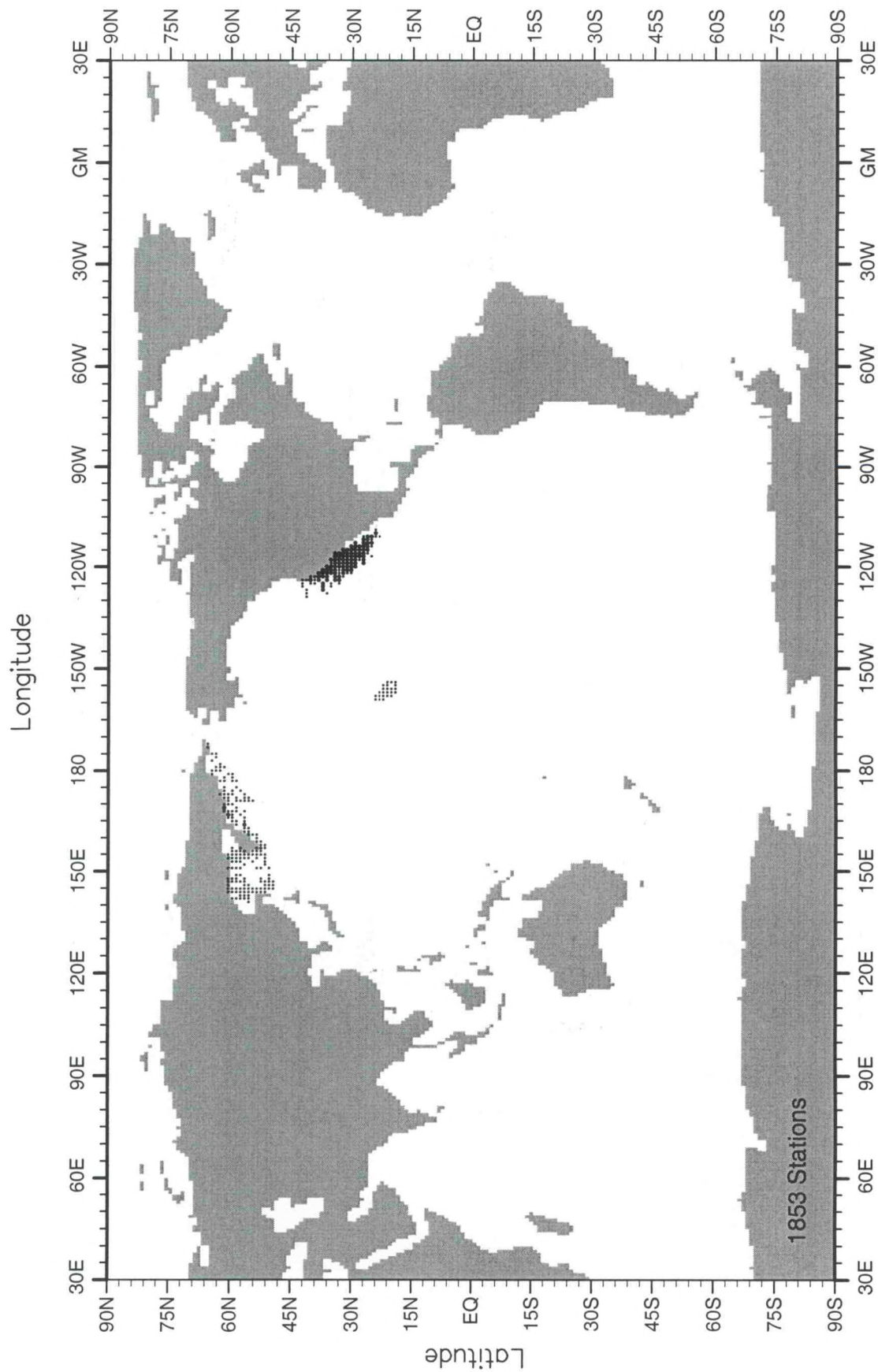


Fig. B14 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1952

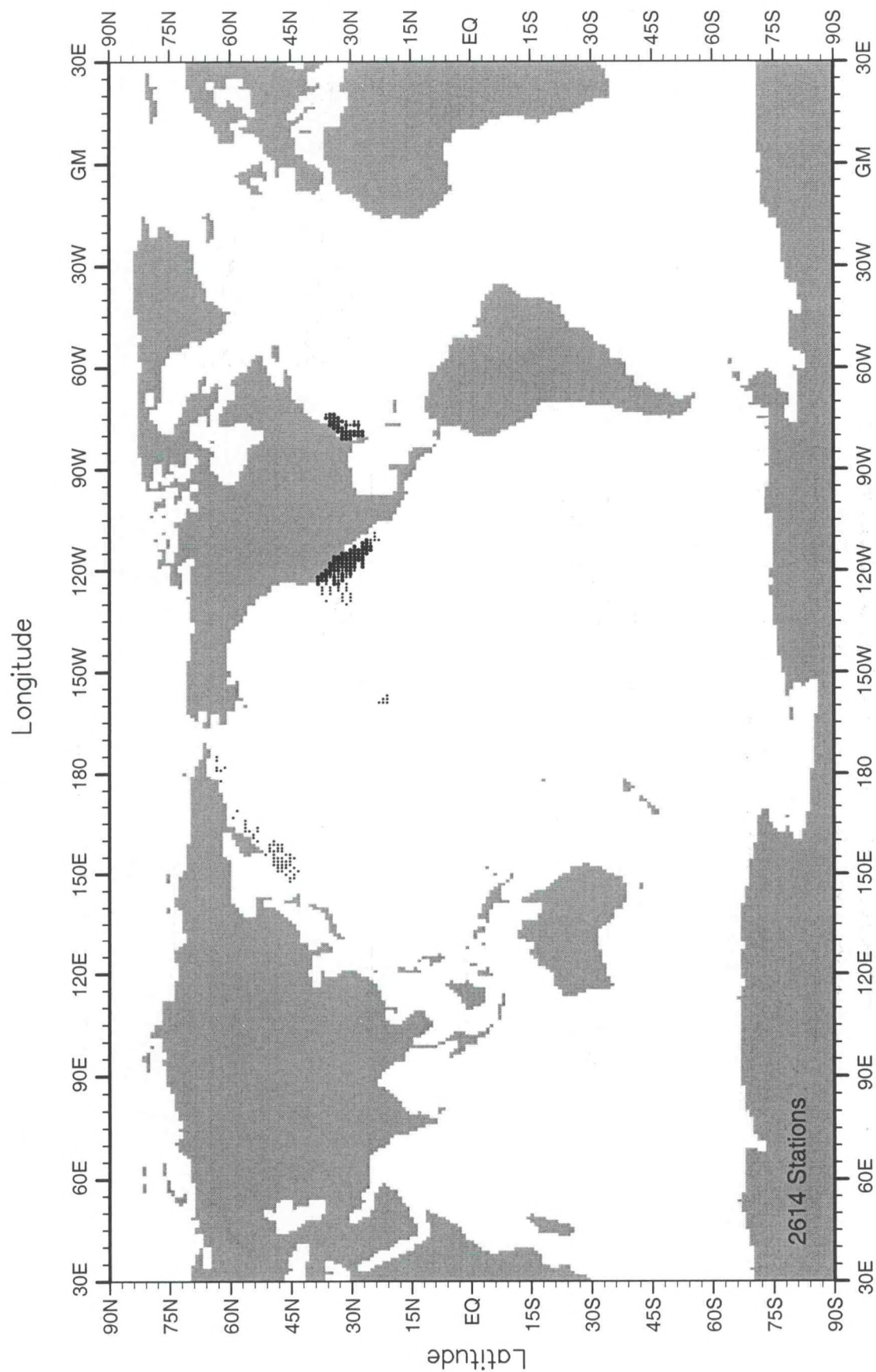


Fig. B15 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1953

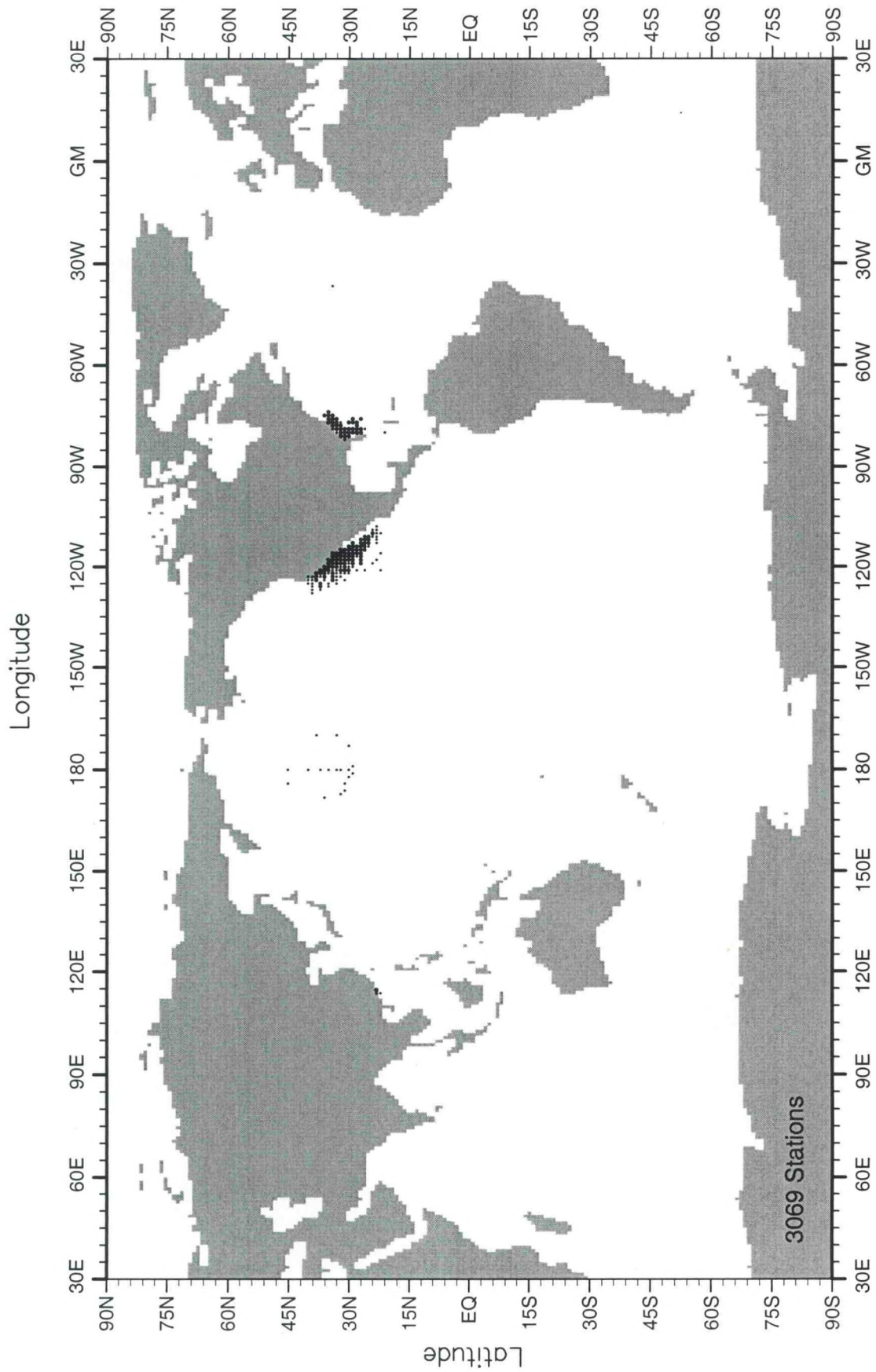


Fig. B16 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1954

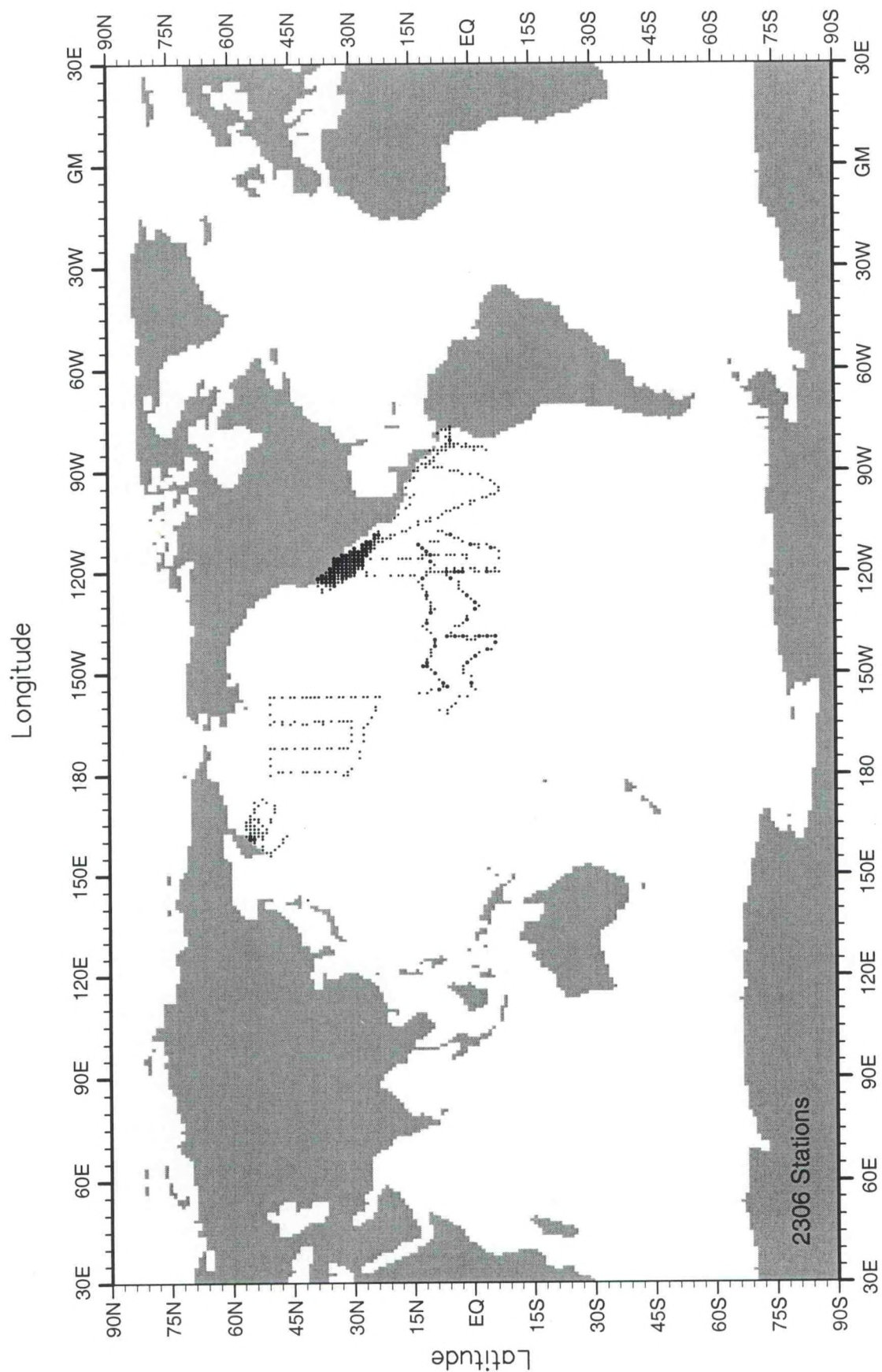


Fig. B17 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1955

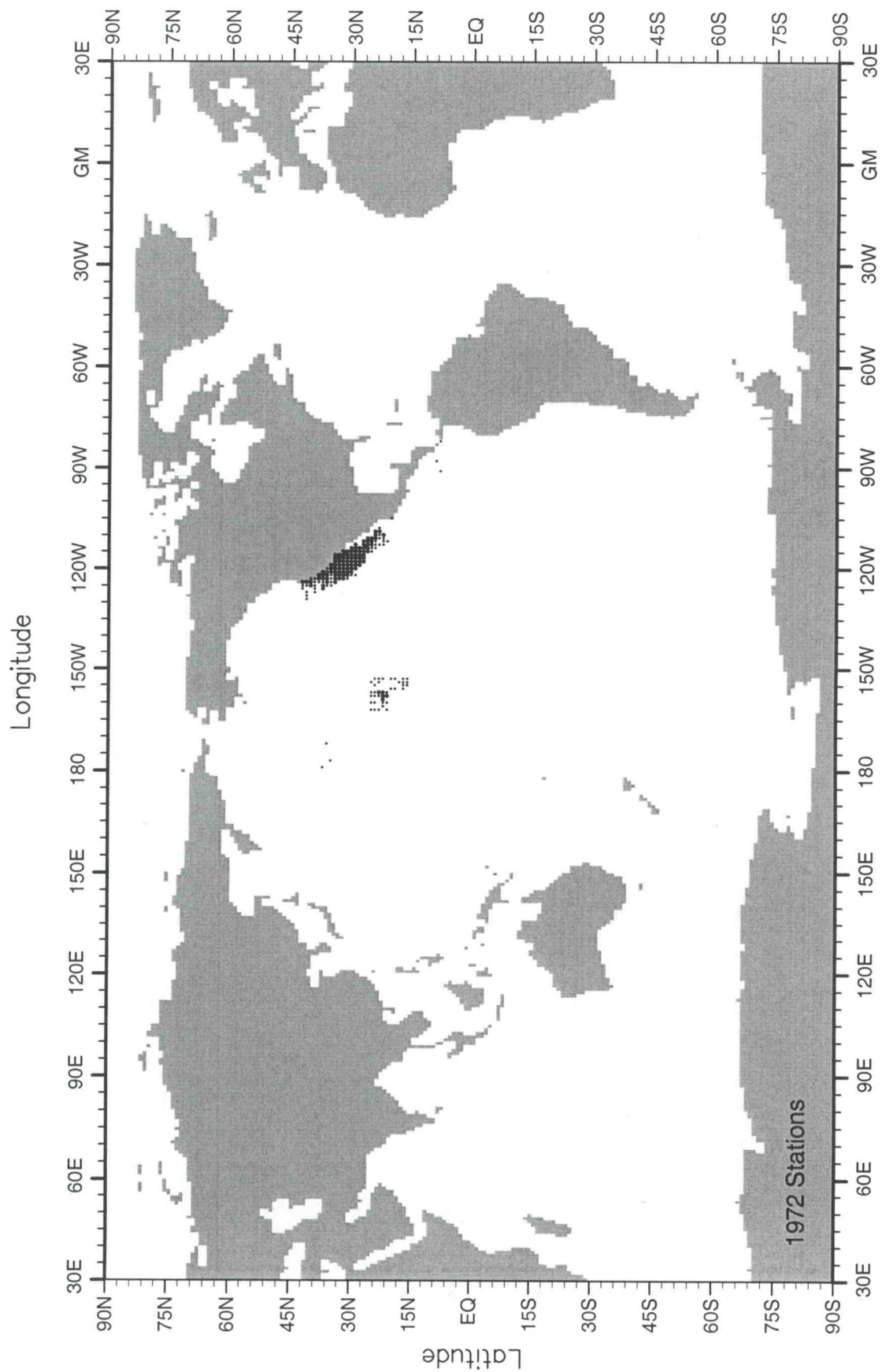


Fig. B18 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1956

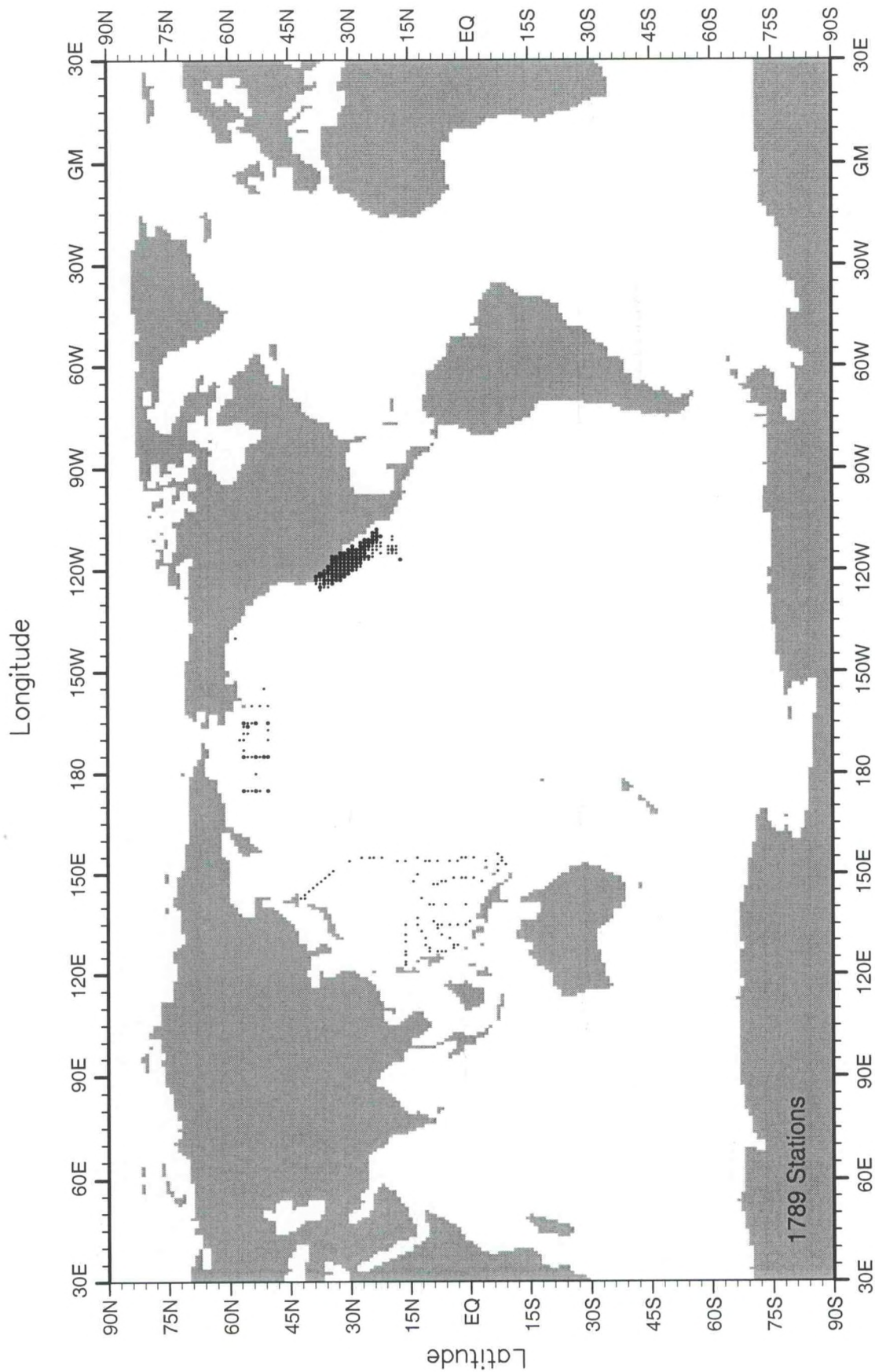


Fig. B19 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1957

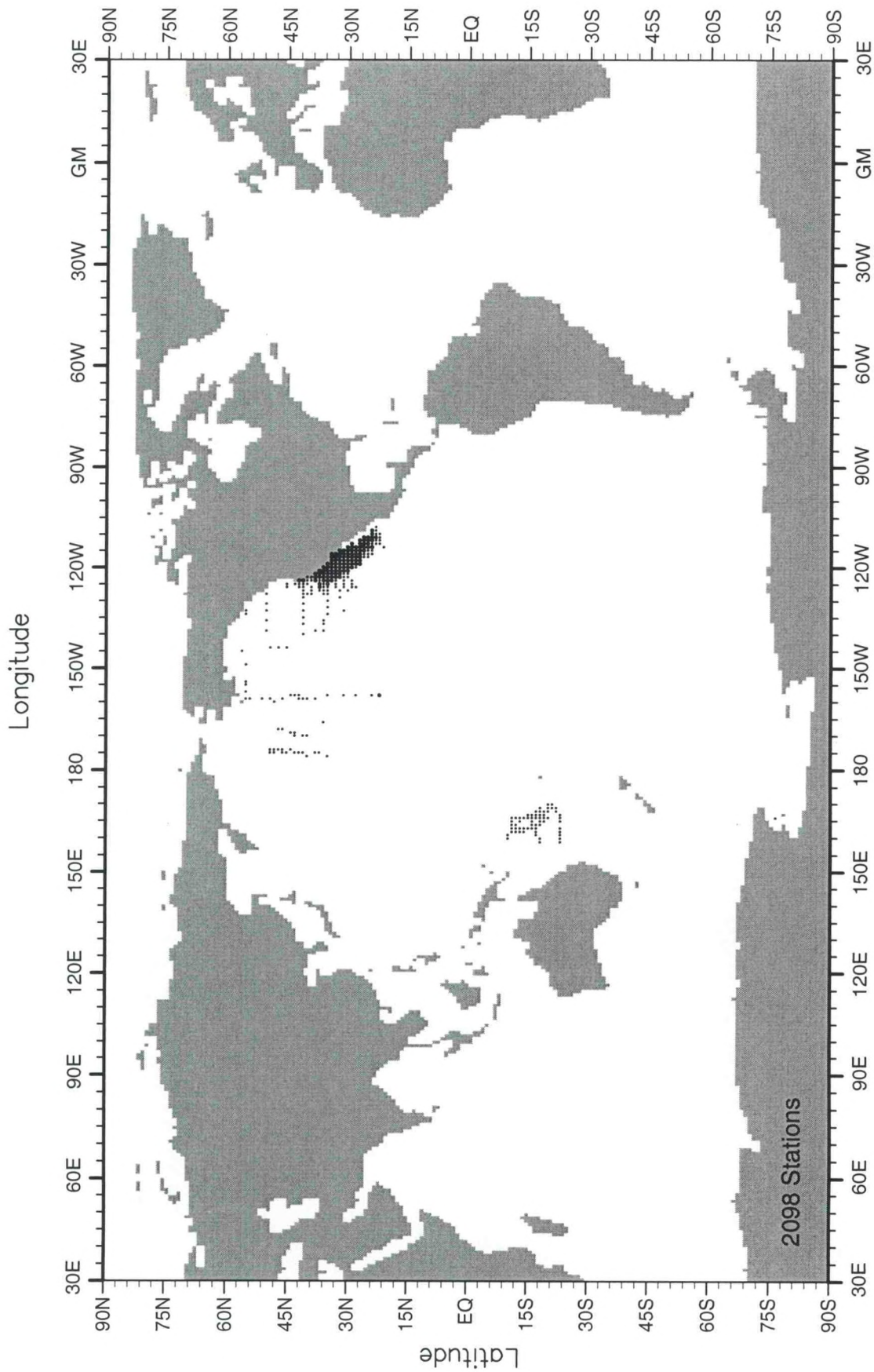


Fig. B20 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1958

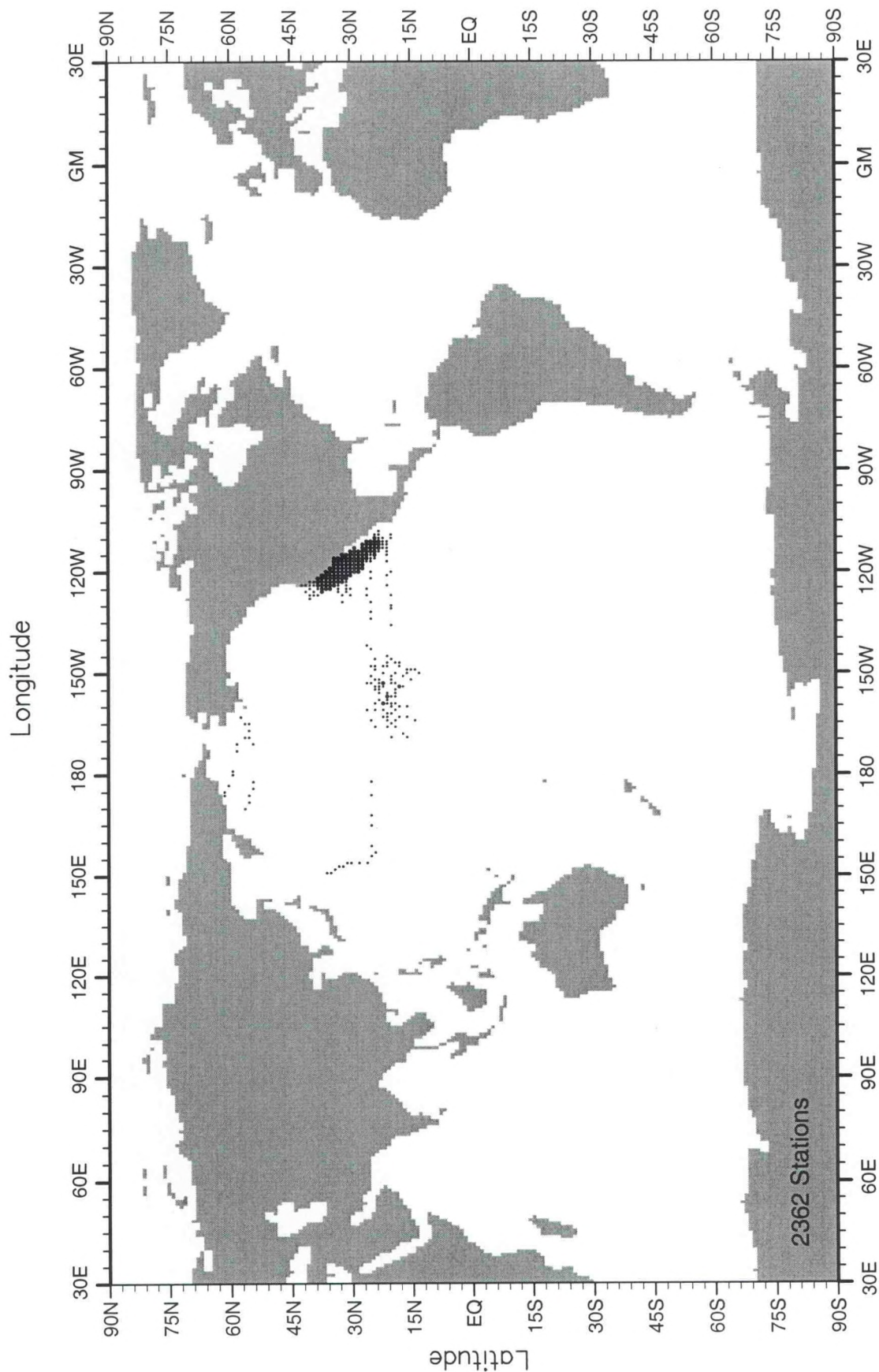


Fig. B21 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1959

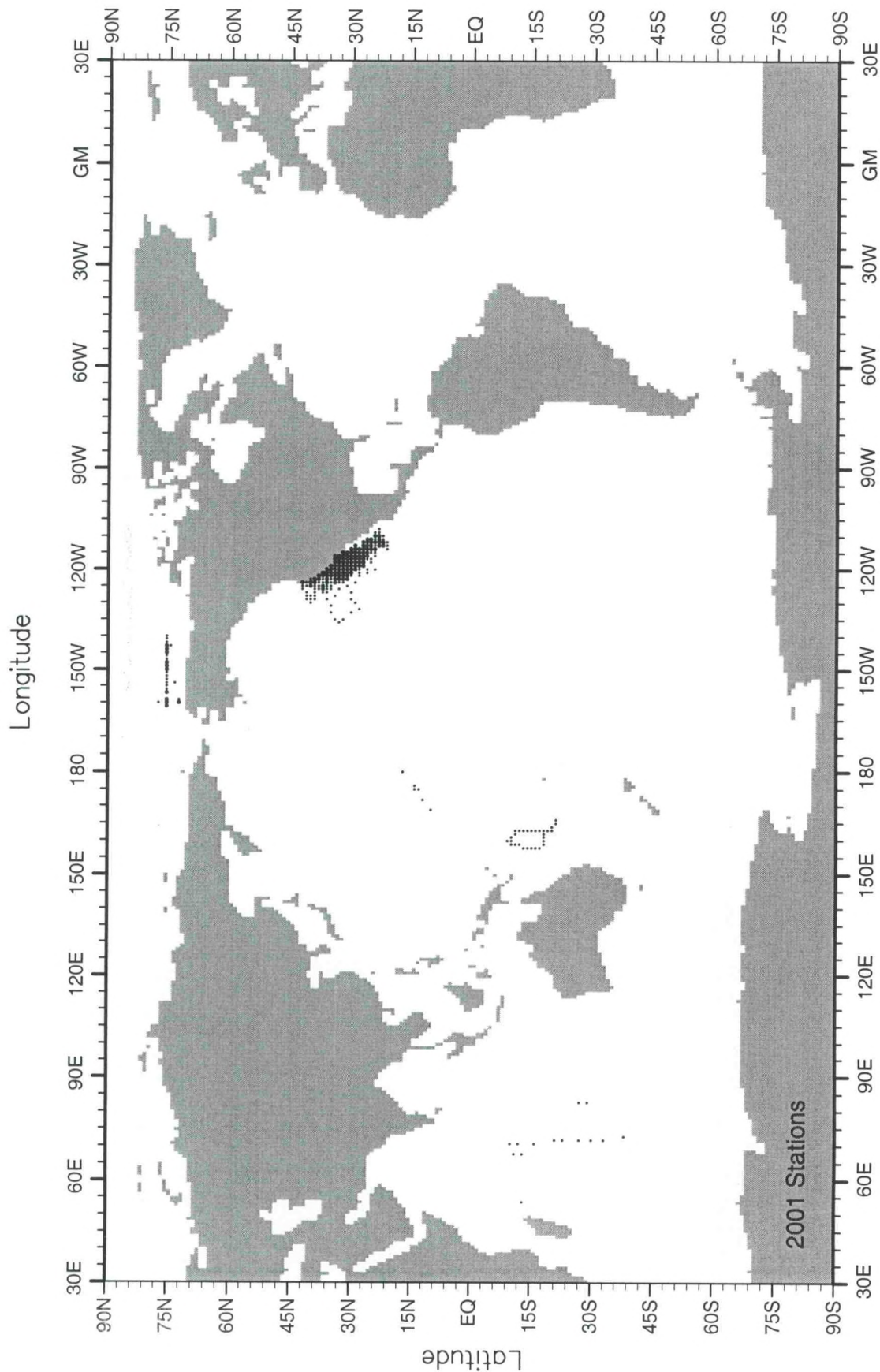


Fig. B22 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1960

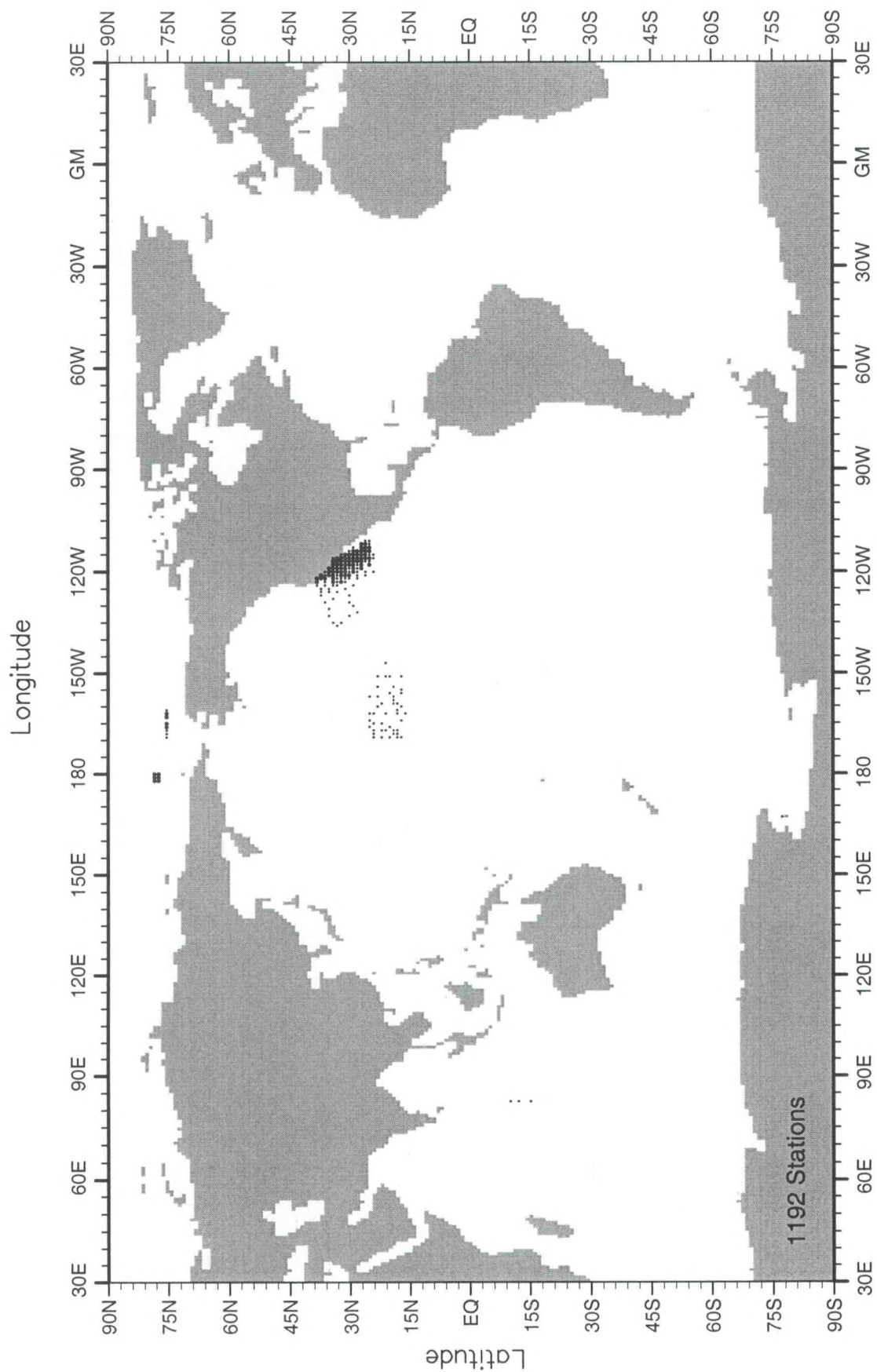


Fig. B23 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1961

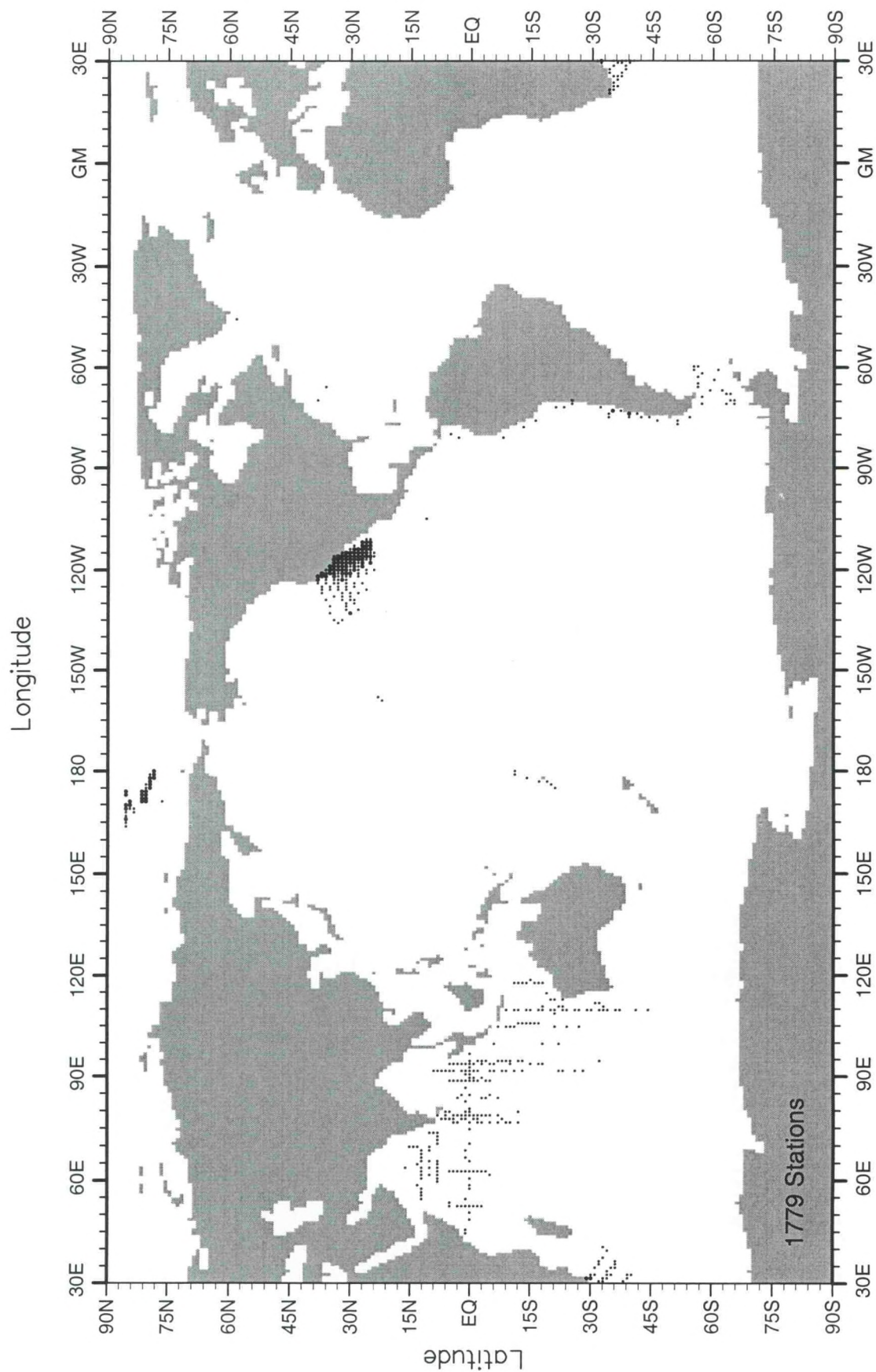


Fig. B24 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1962

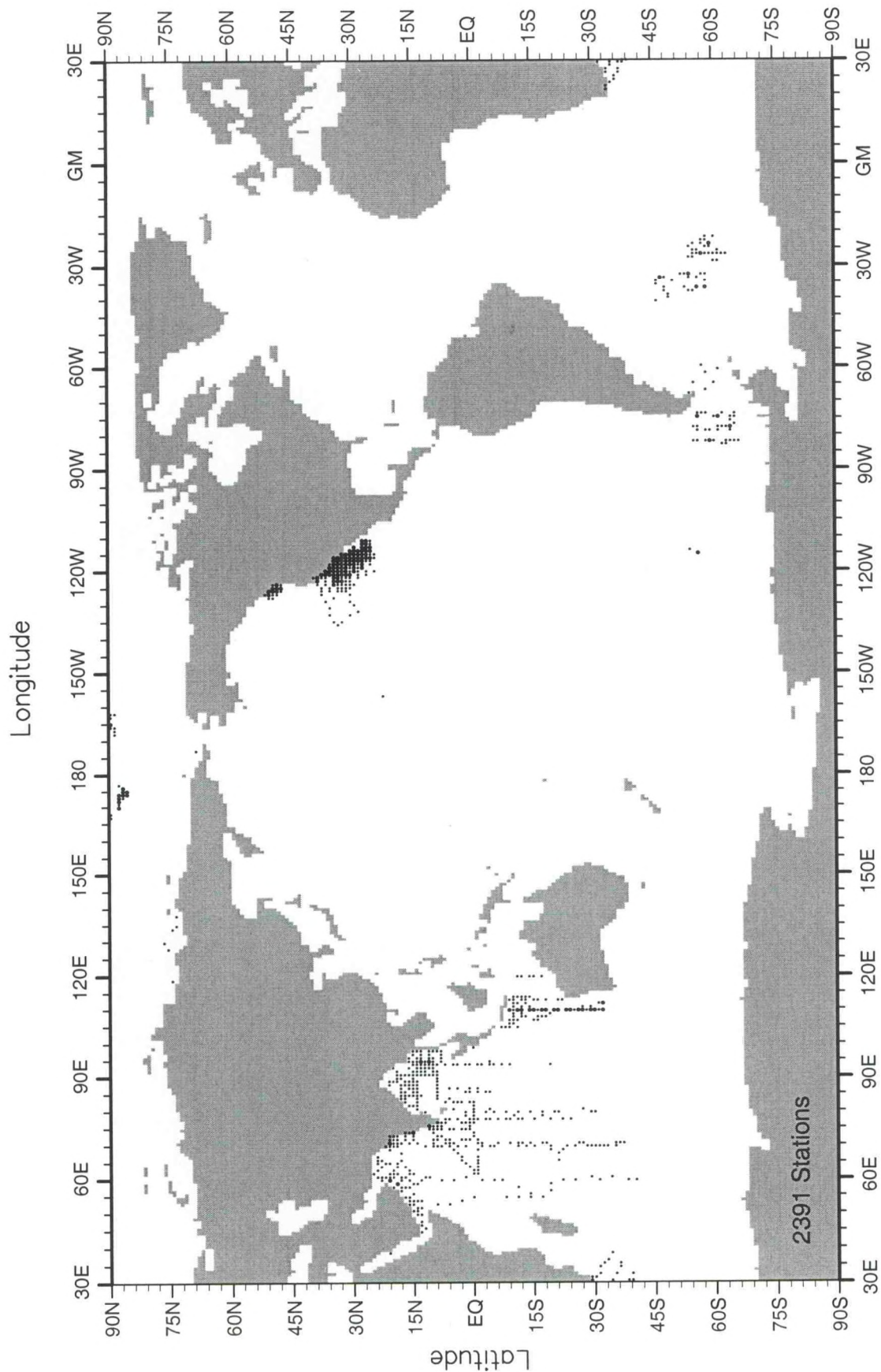


Fig. B25 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1963

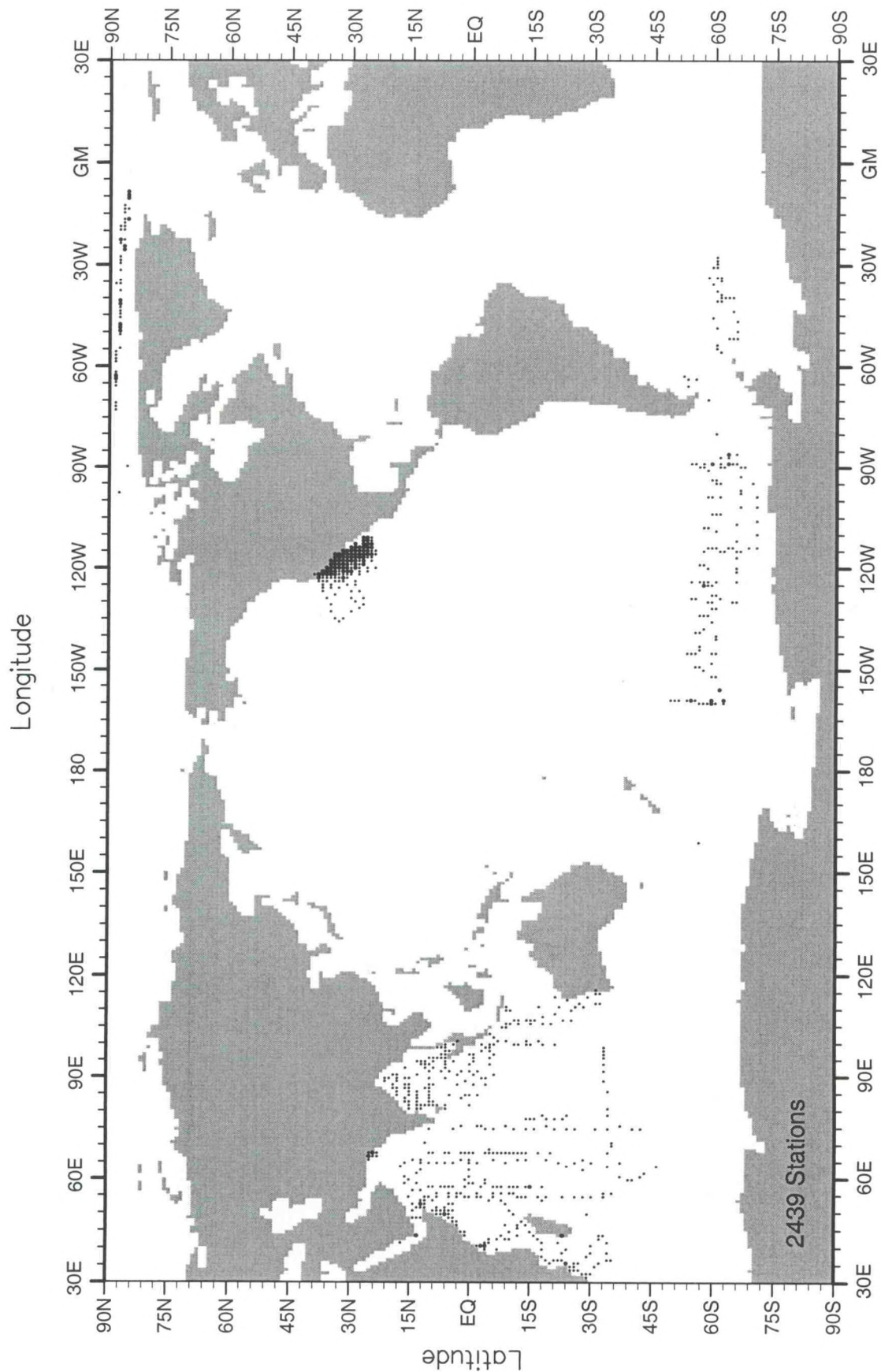


Fig. B26 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1964

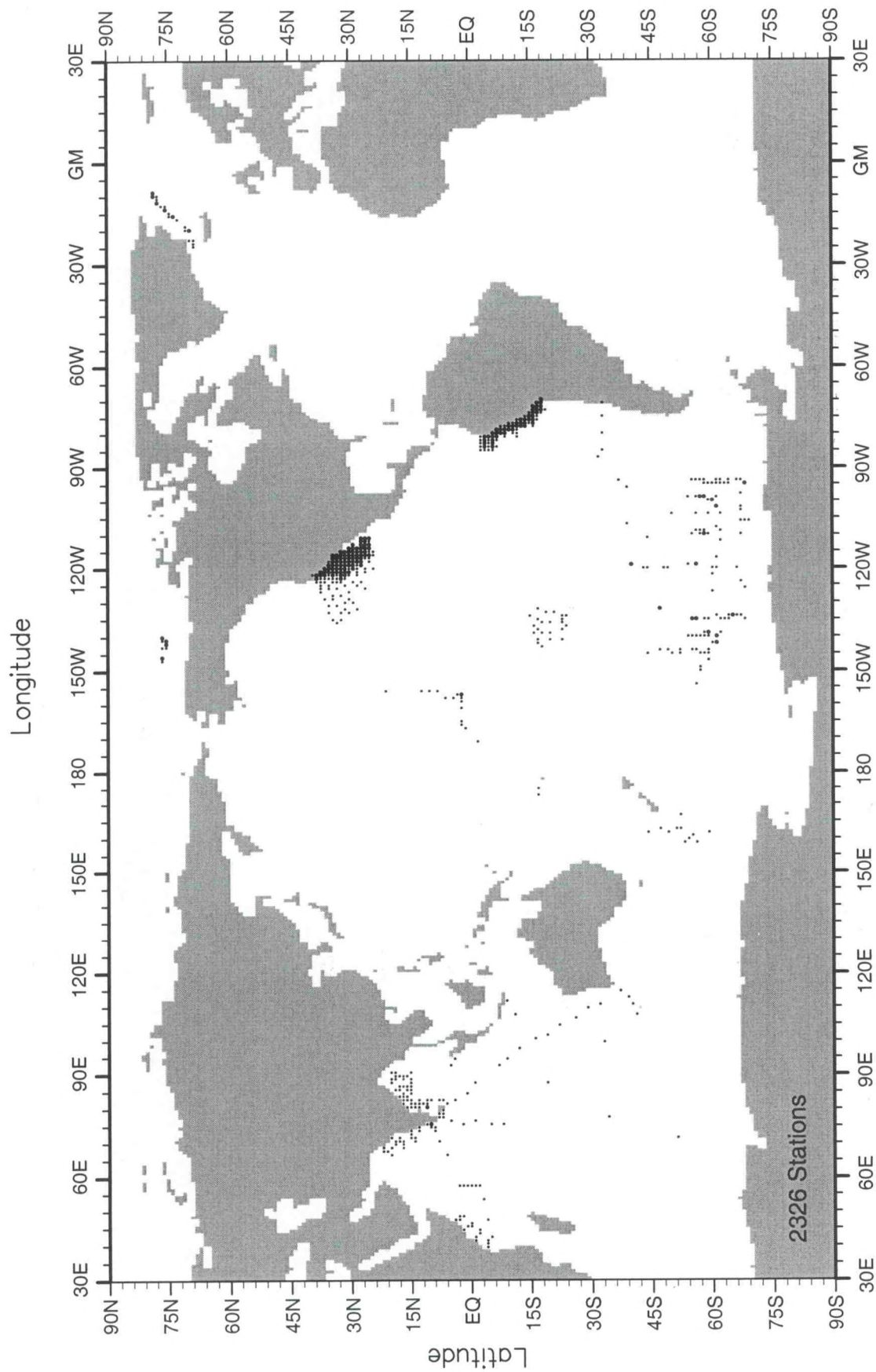


Fig. B27 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1965

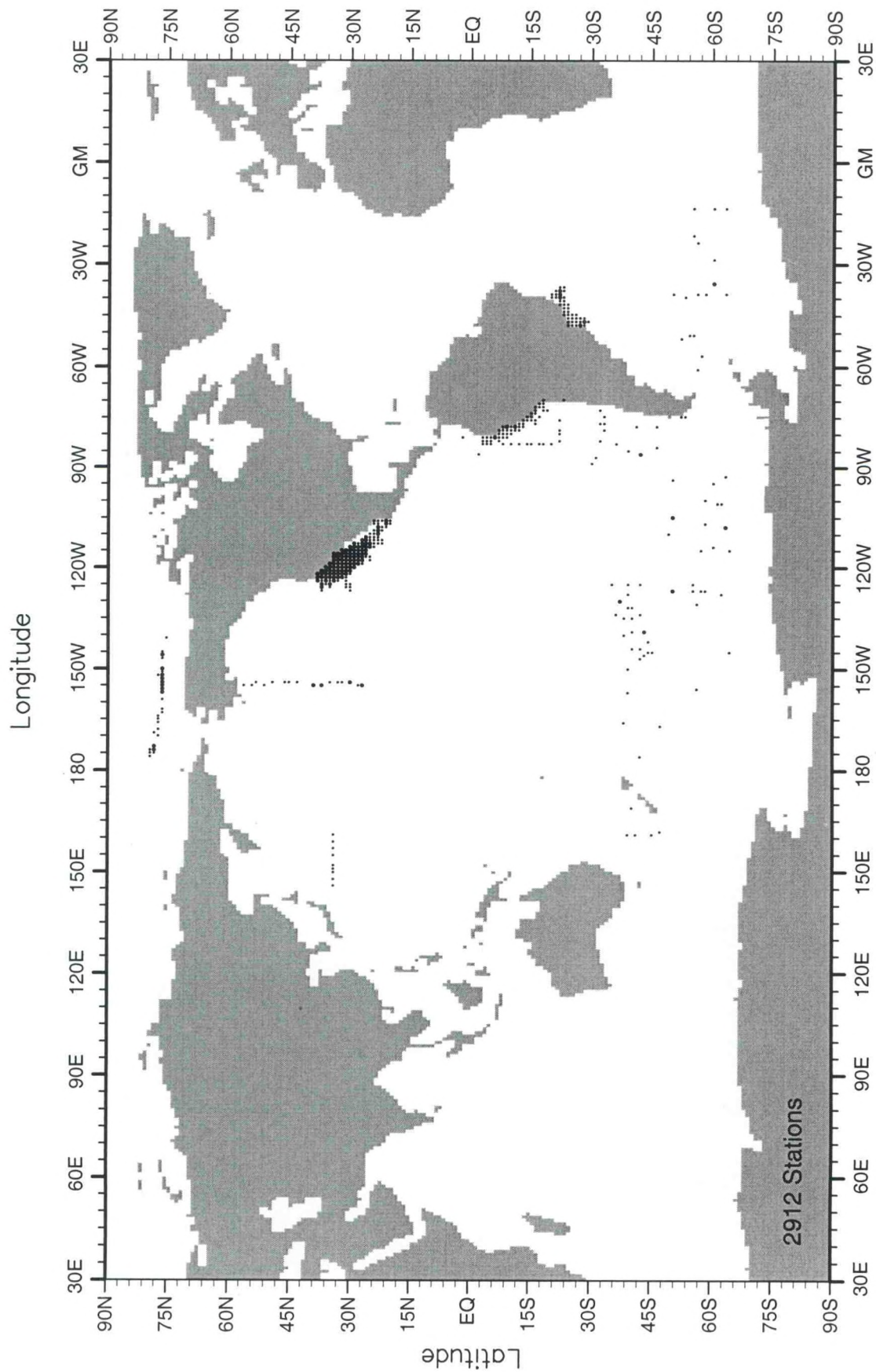


Fig. B28 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1966

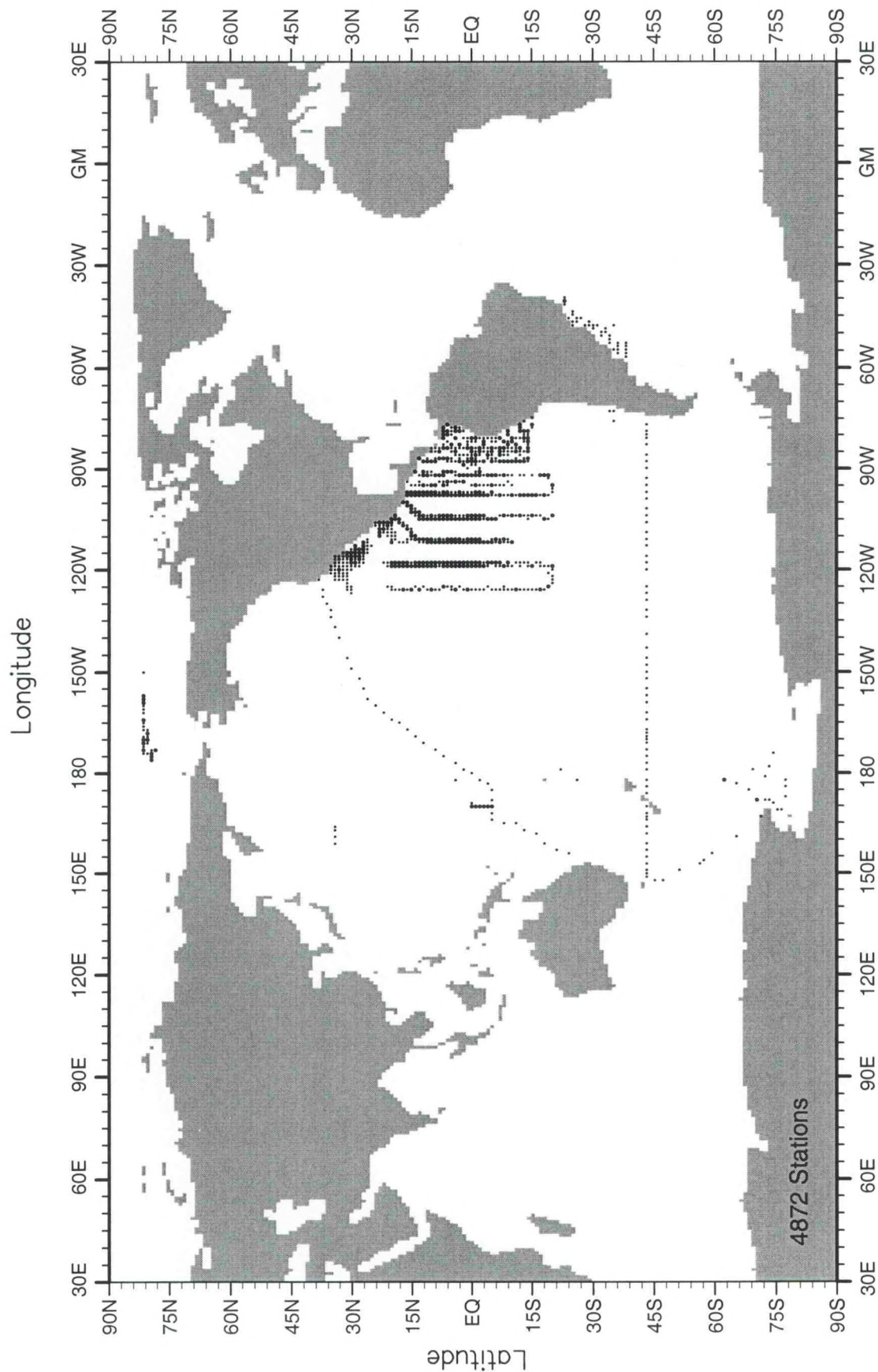


Fig. B29 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1967

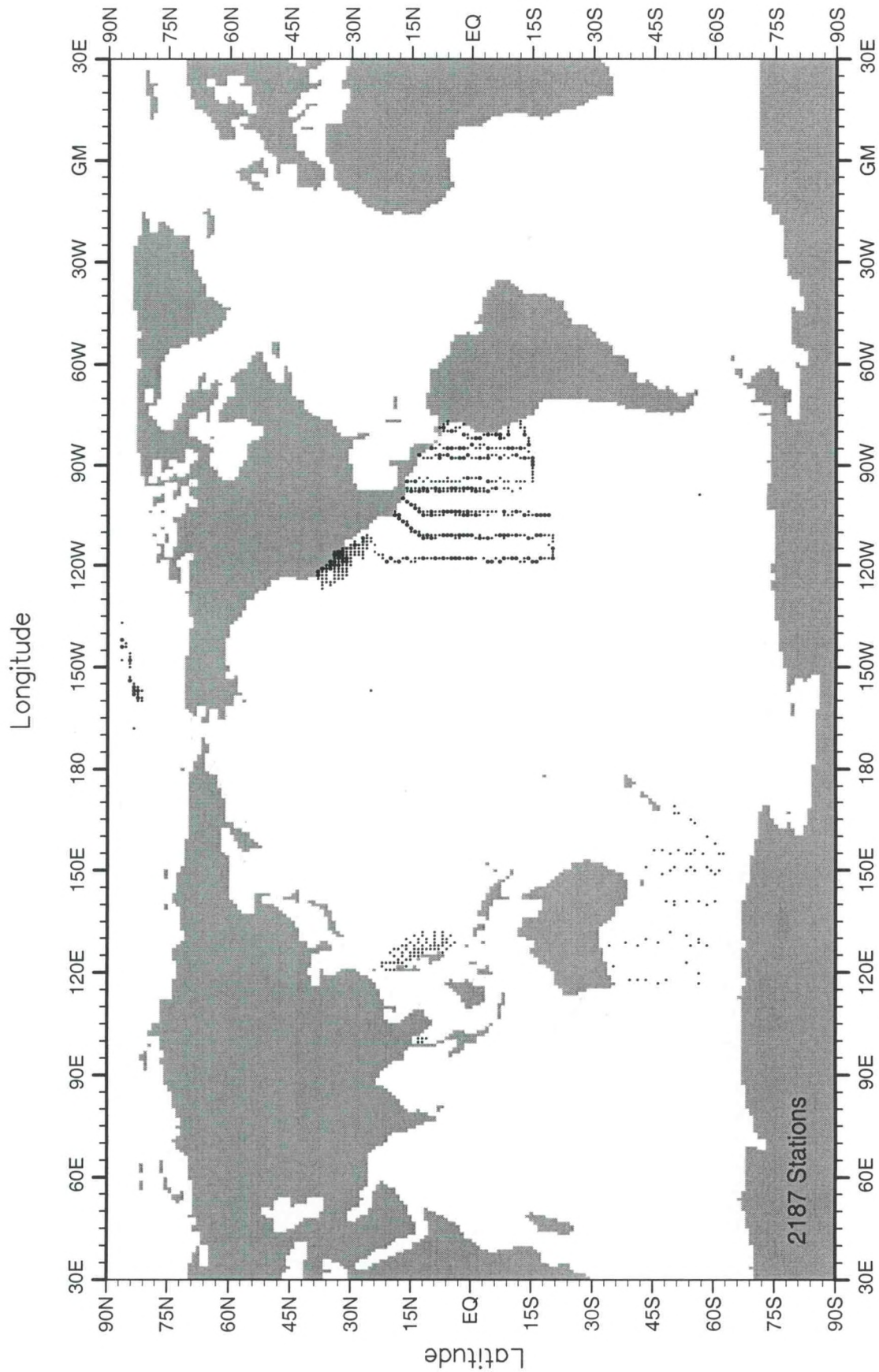


Fig. B30 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1968

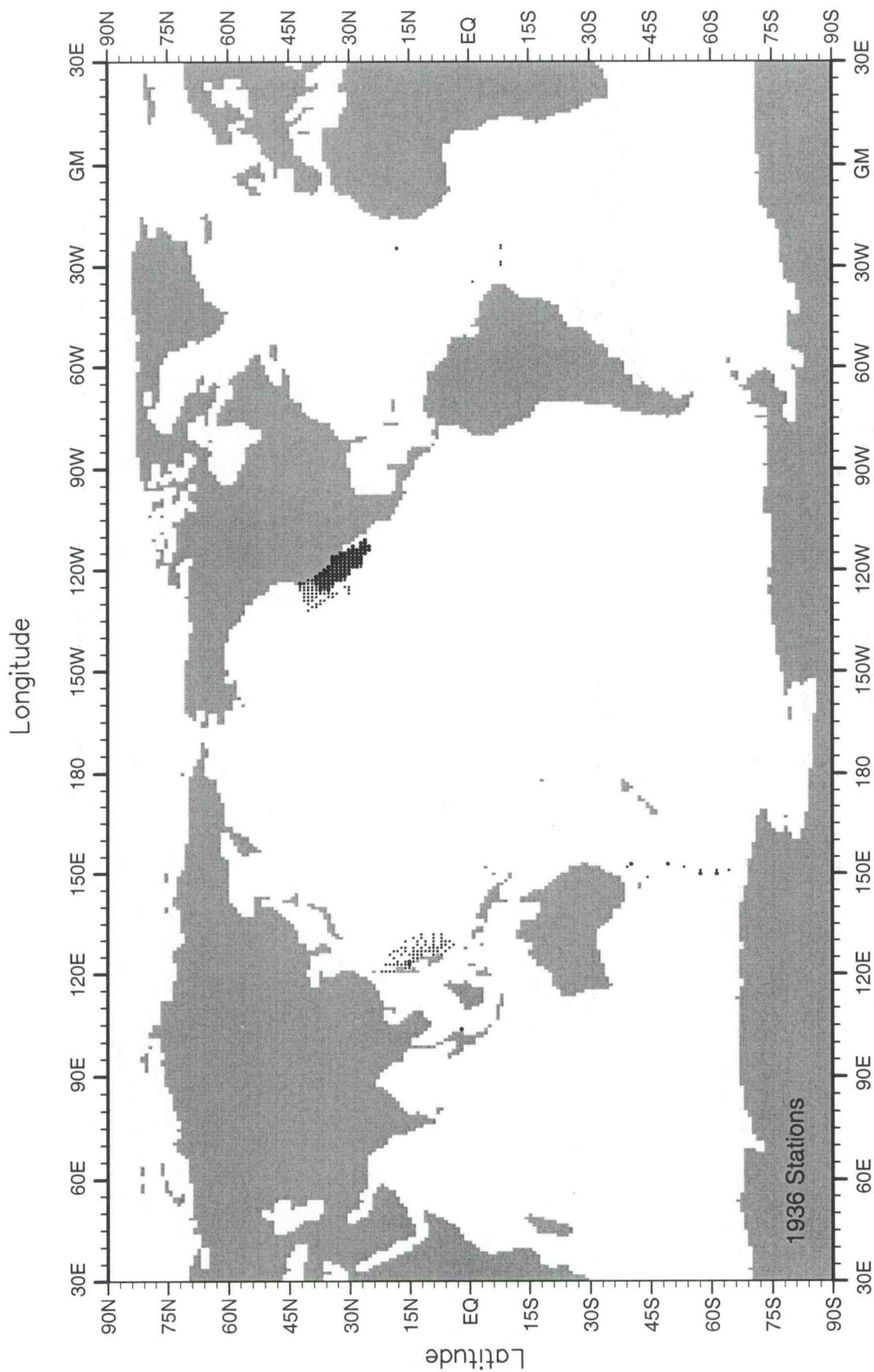


Fig. B31 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1969

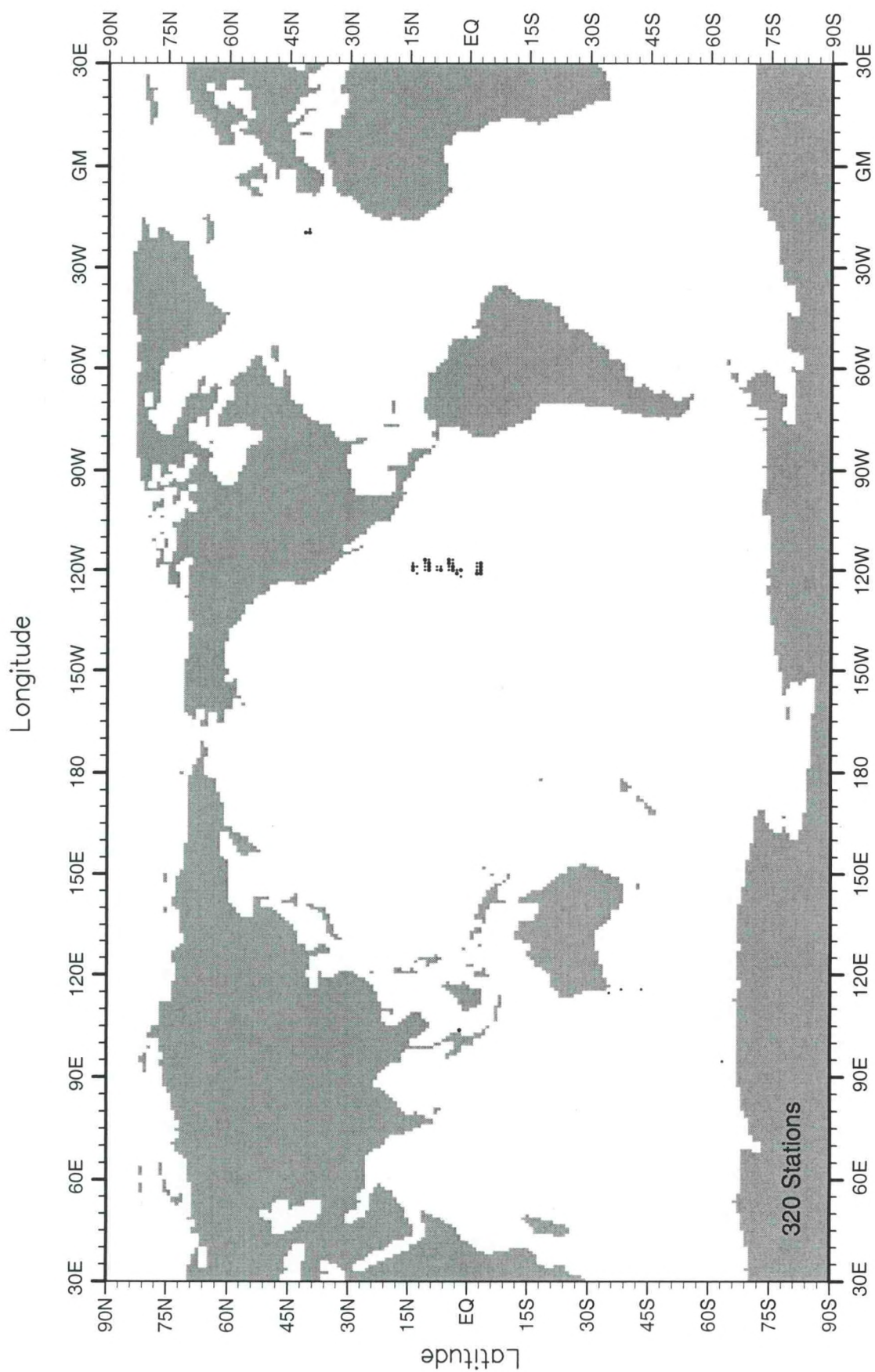


Fig. B32 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1970

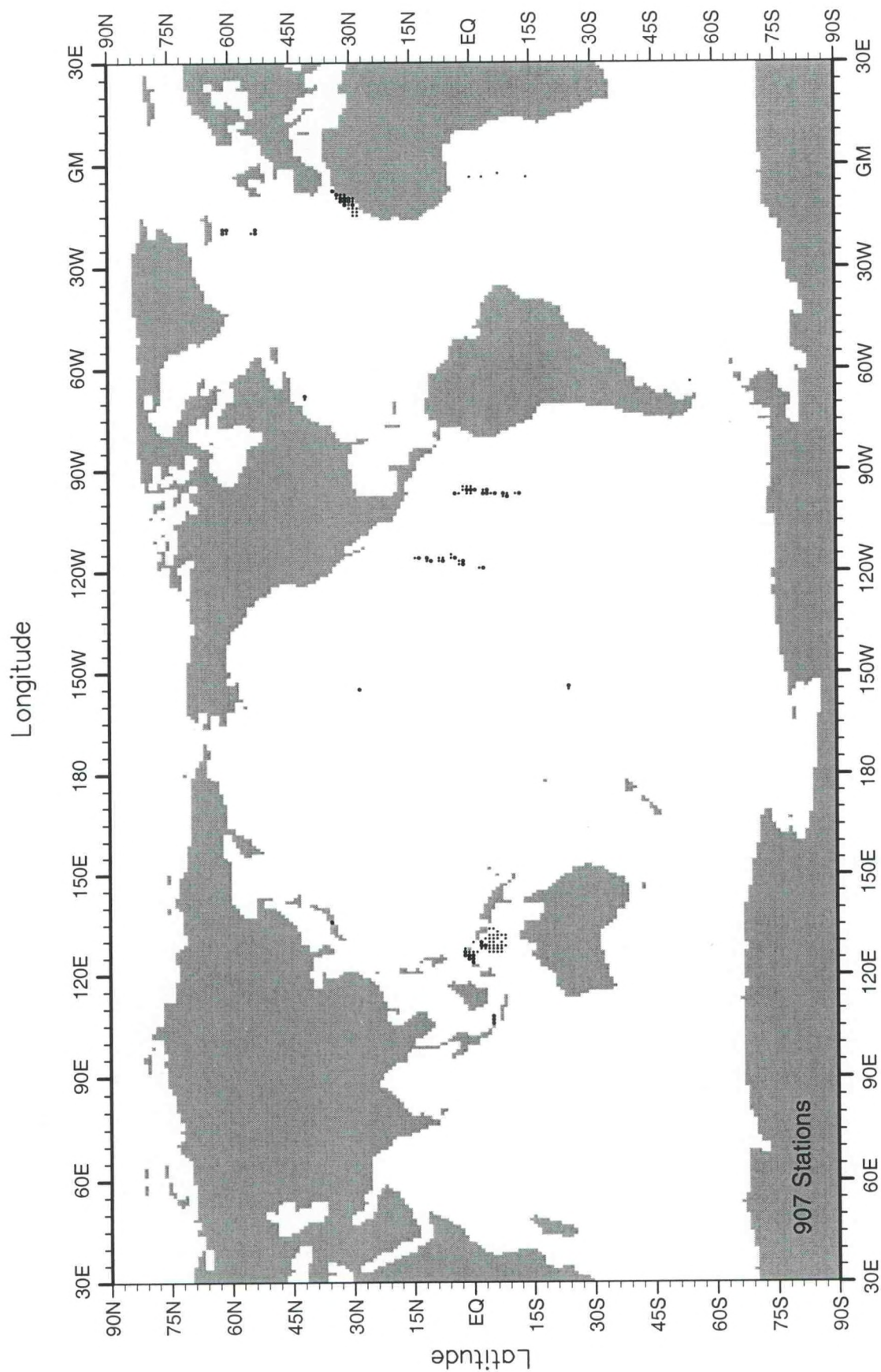


Fig. B33 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1971

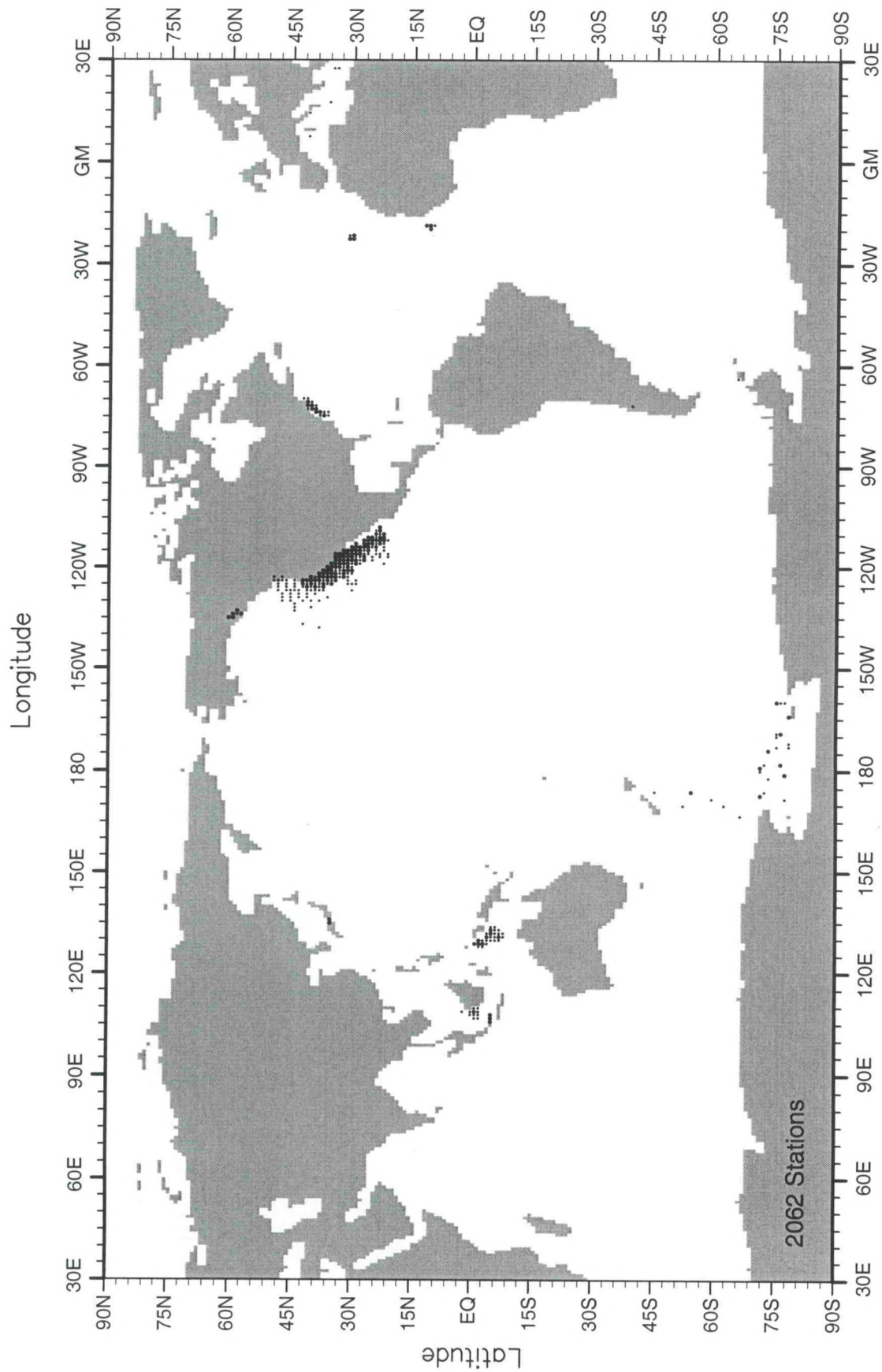


Fig. B34 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1972

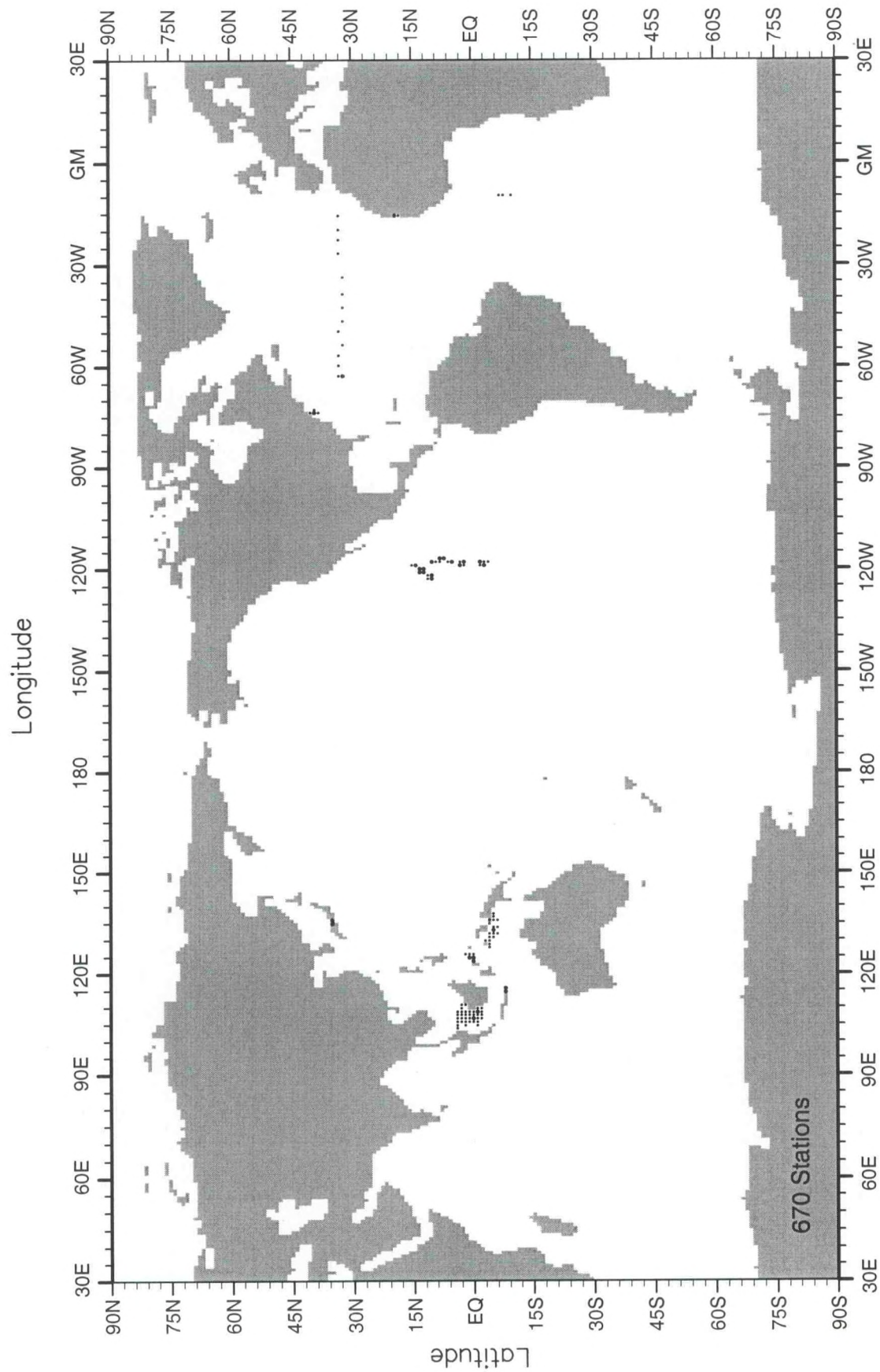


Fig. B35 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1973

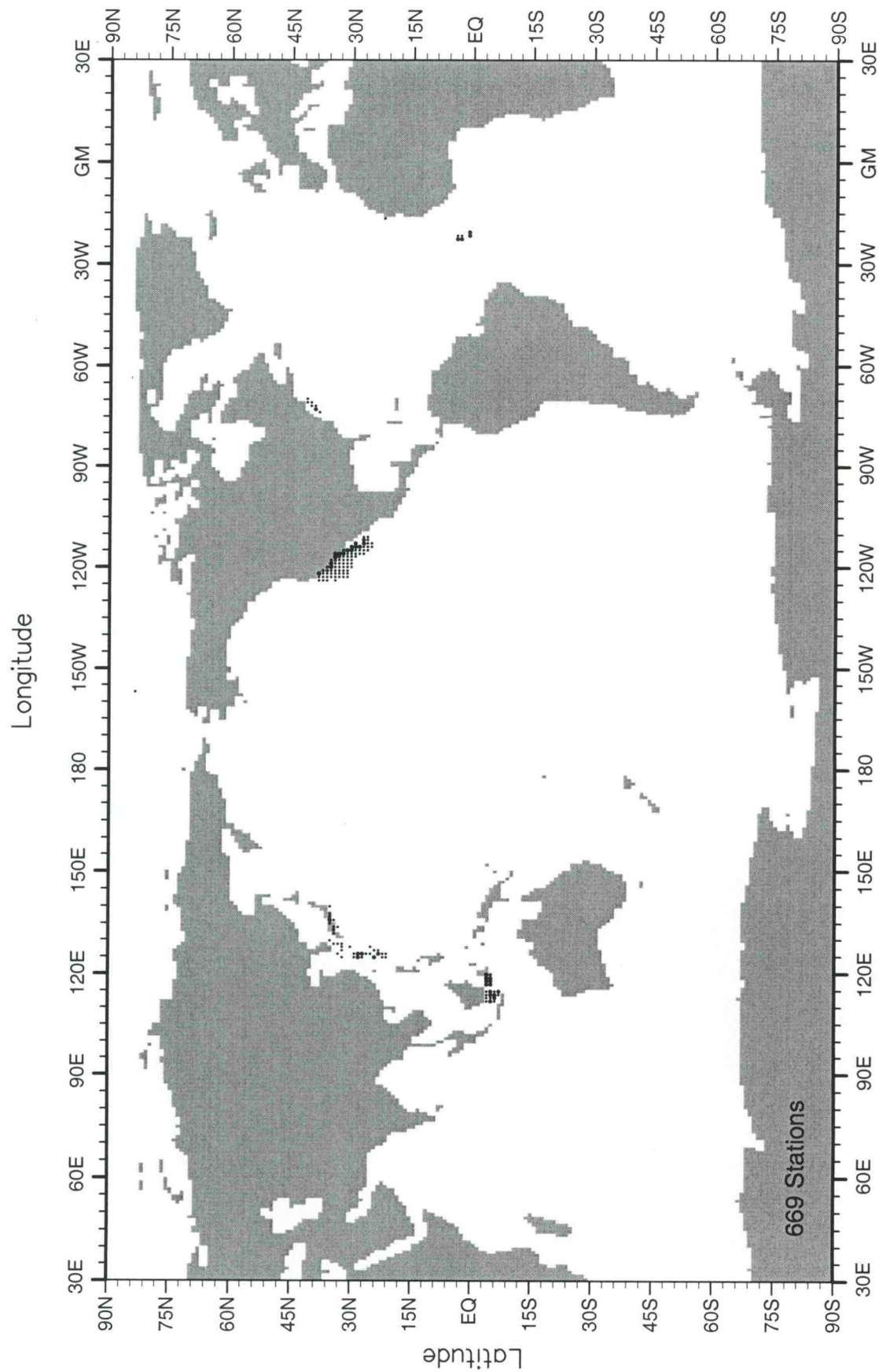


Fig. B36 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1974

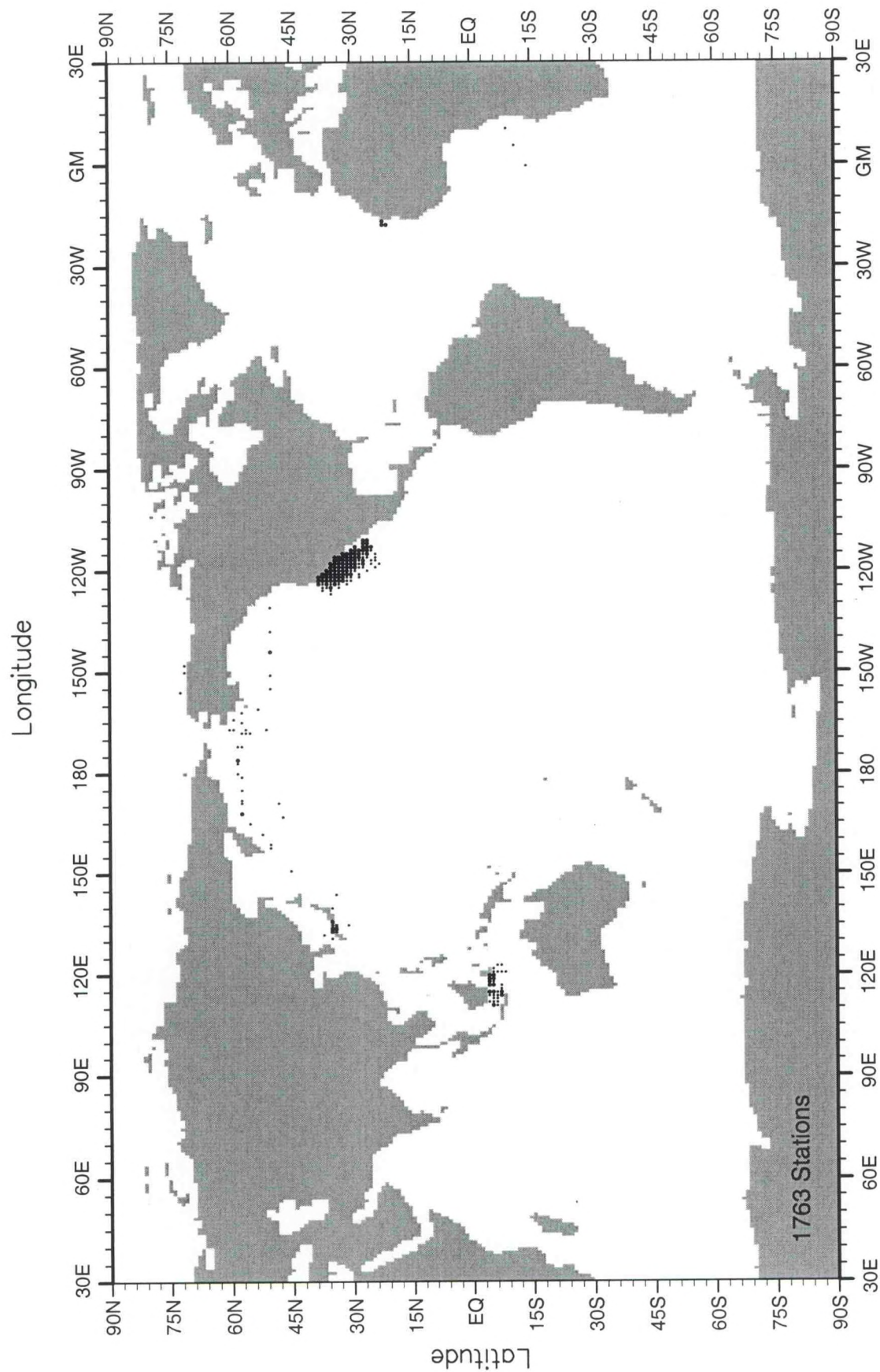


Fig. B37 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1975

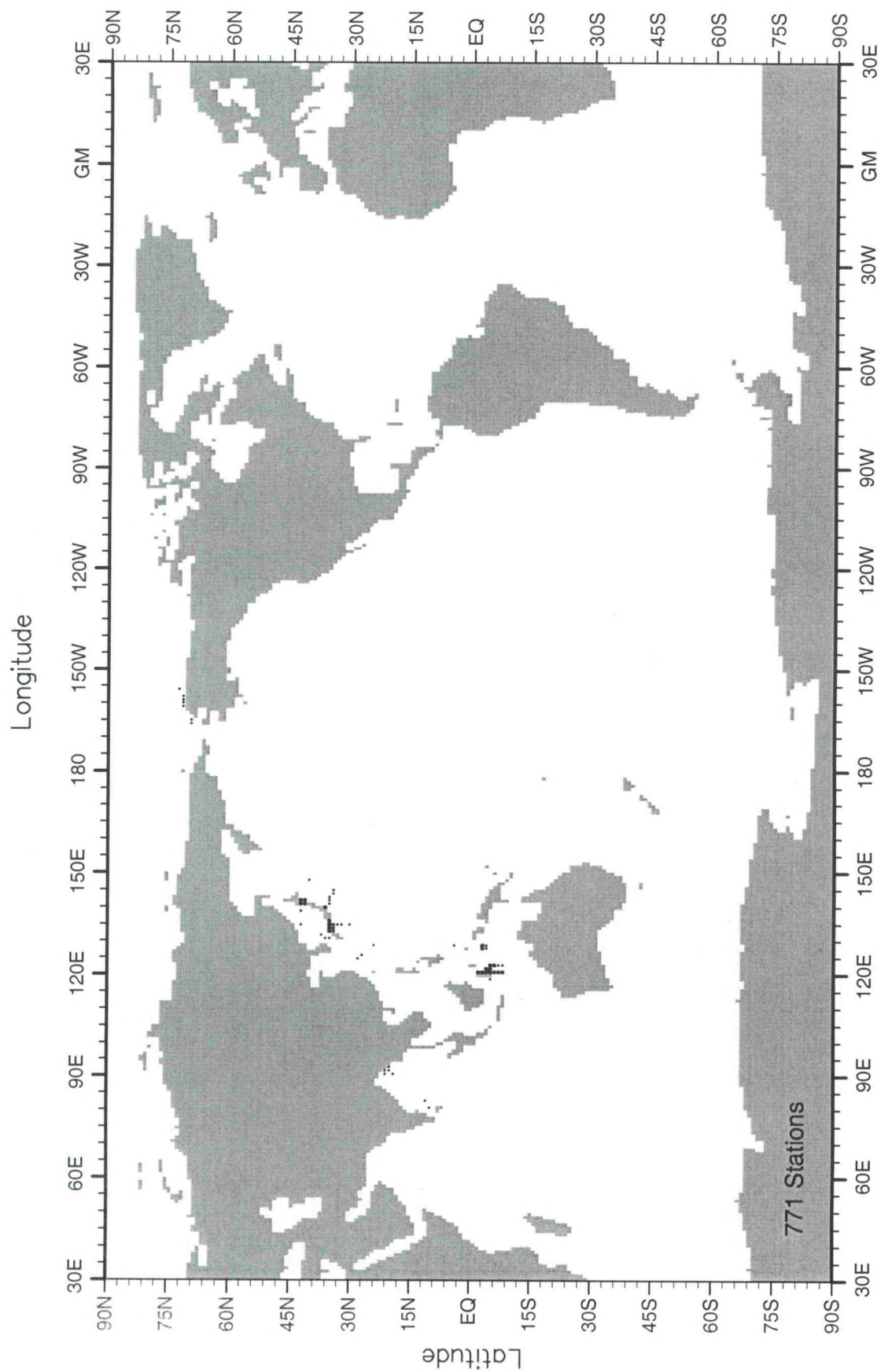


Fig. B38 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1976

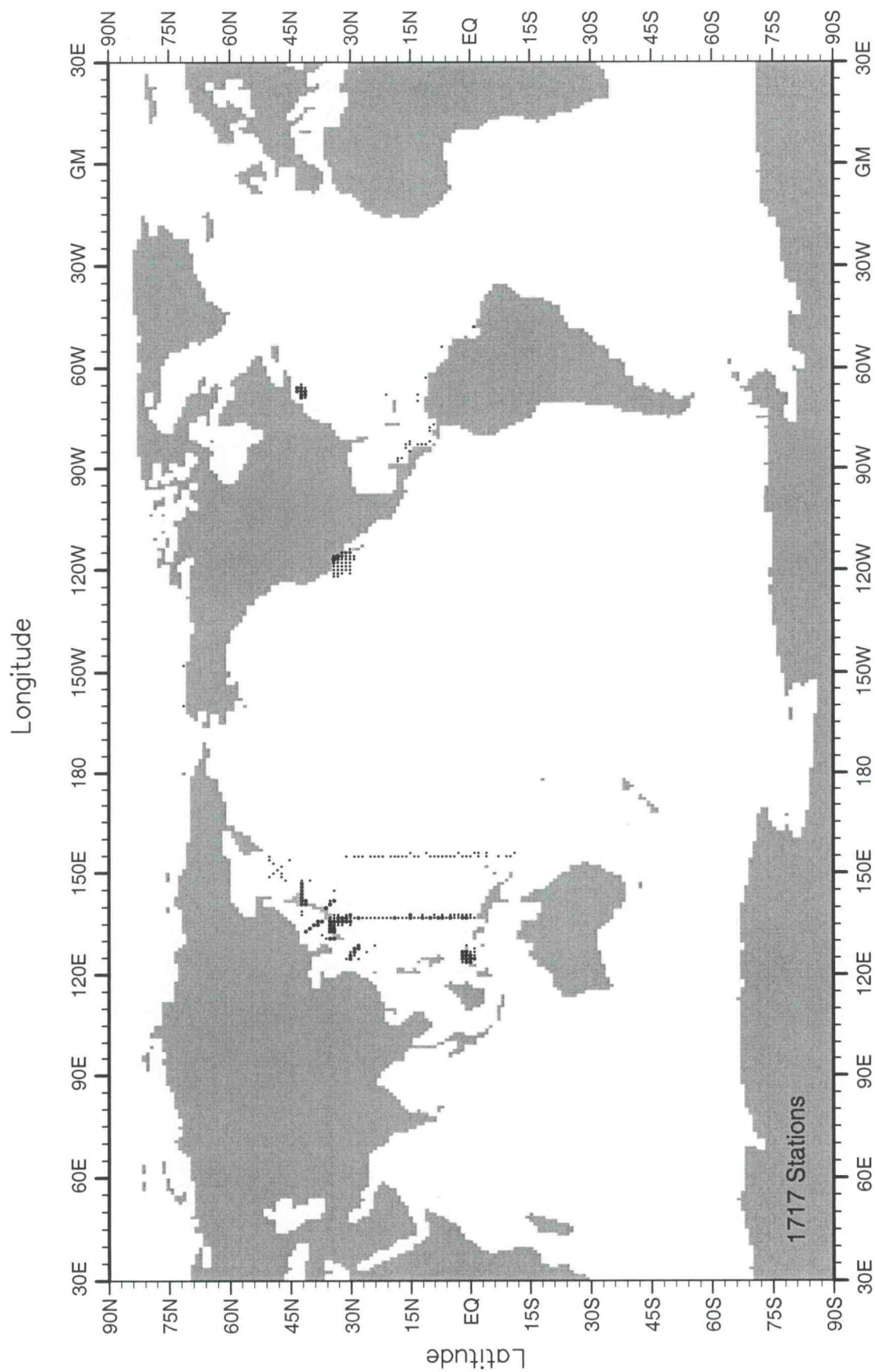


Fig. B39 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1977

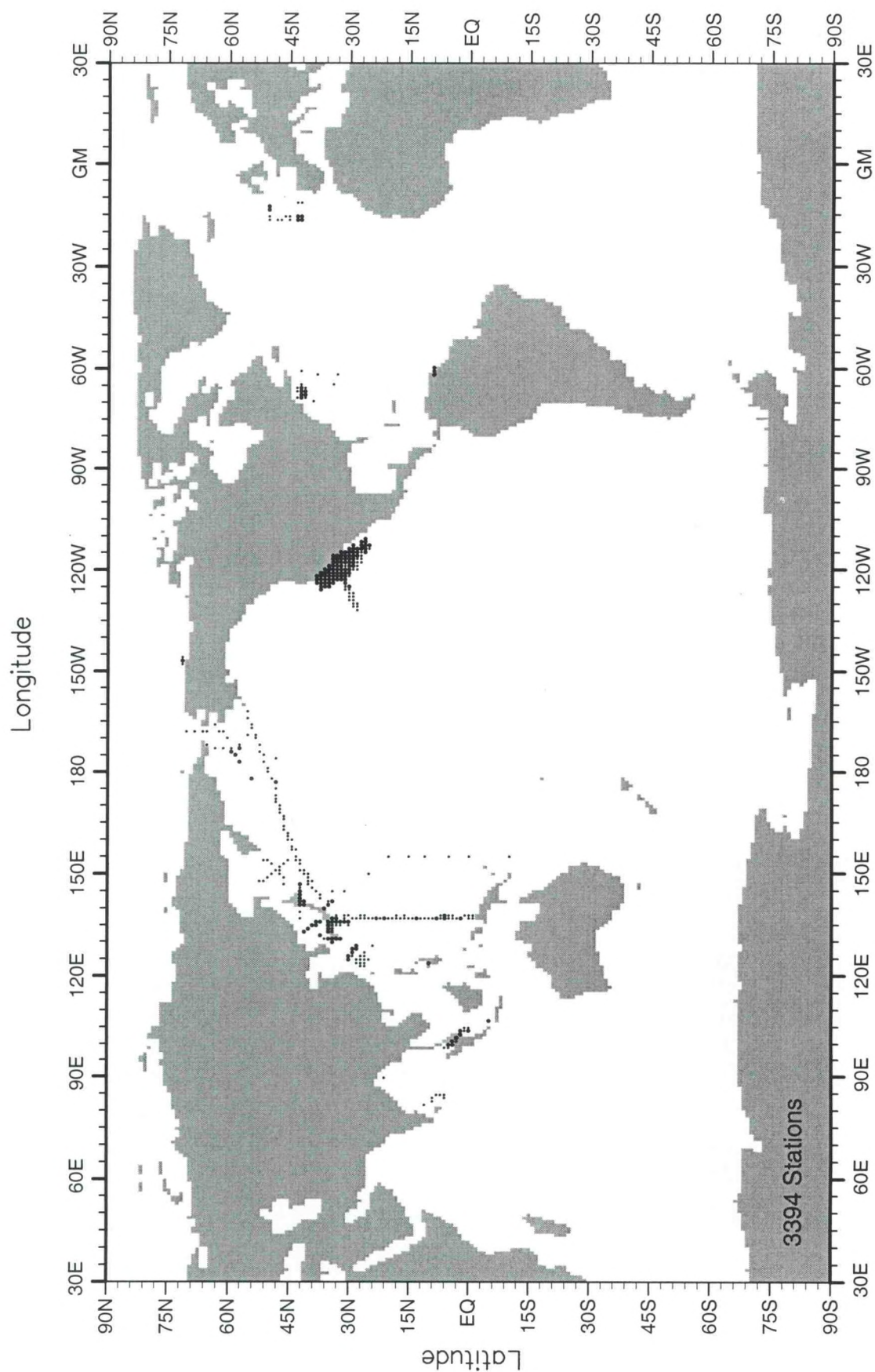


Fig. B40 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1978

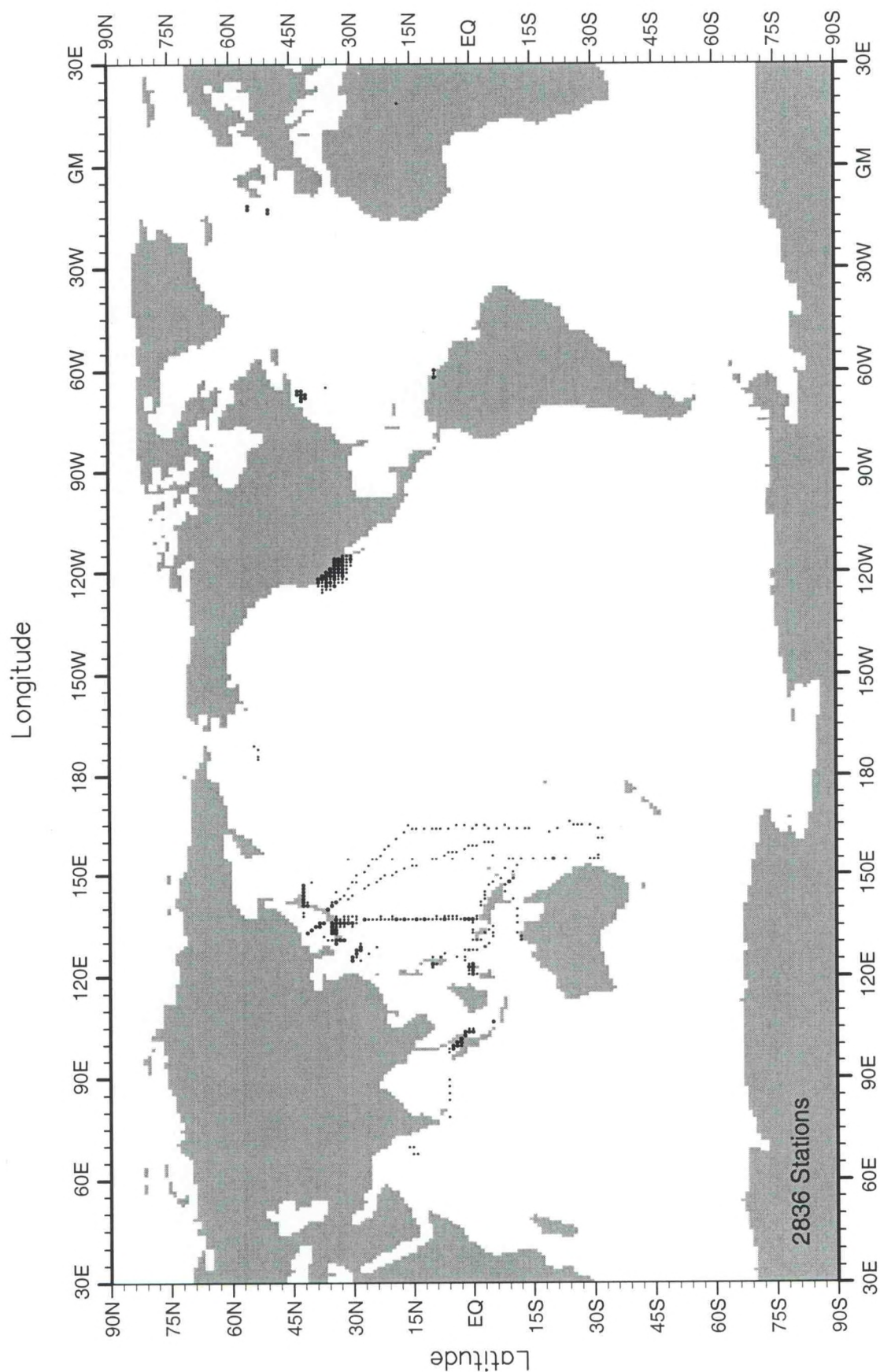


Fig. B41 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1979

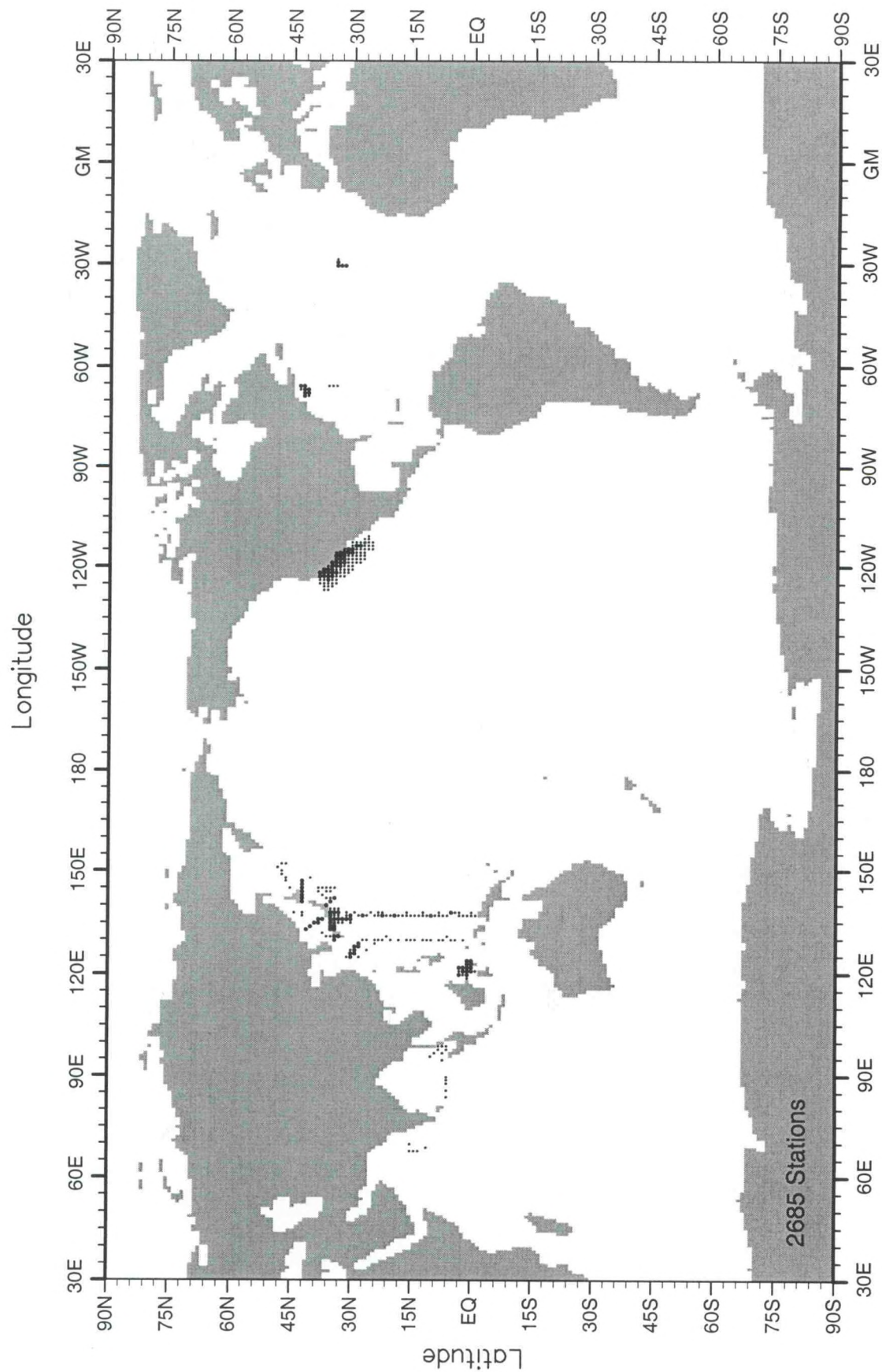


Fig. B42 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1980

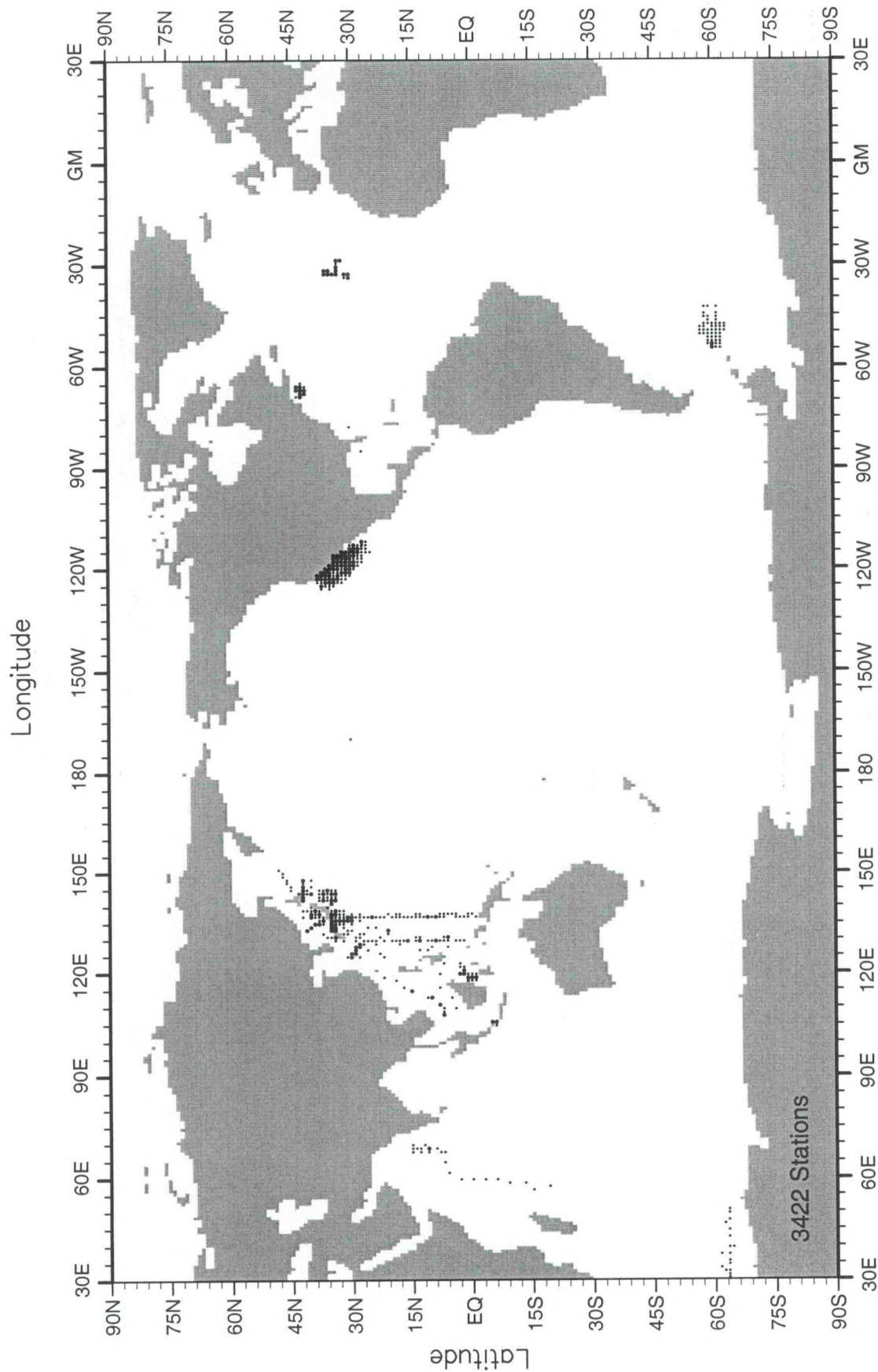


Fig. B43 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1981

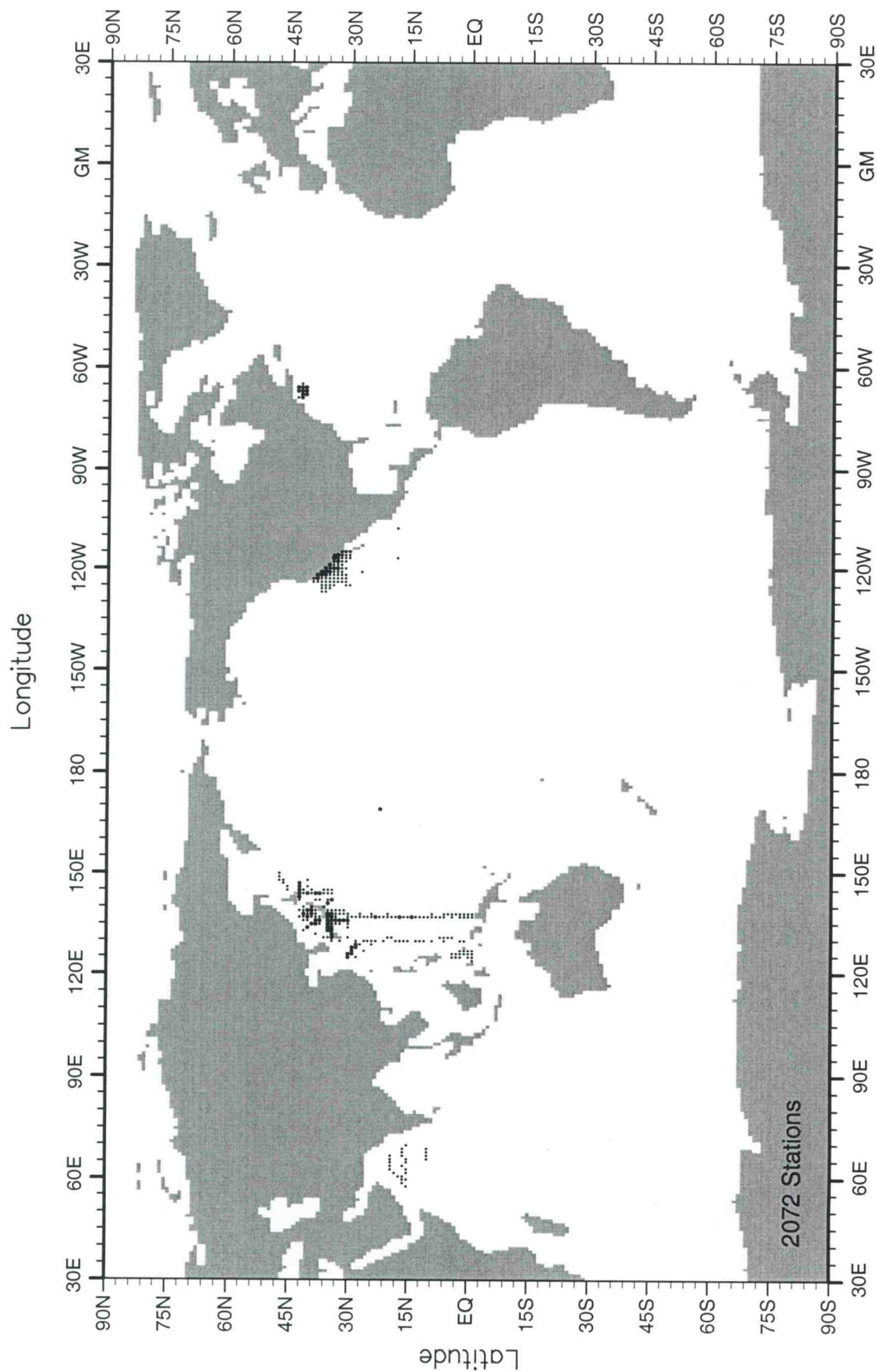


Fig. B44 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1982

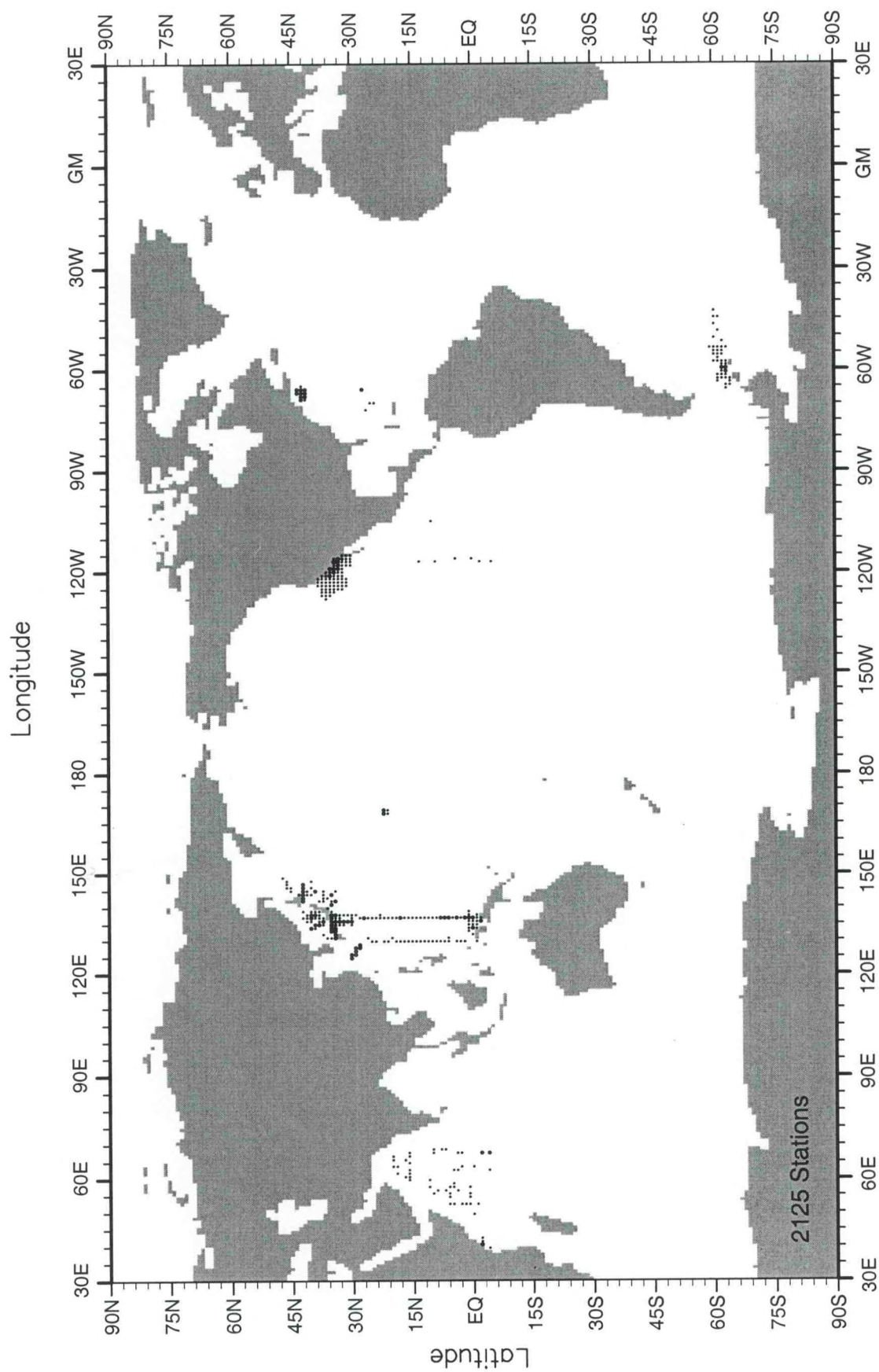


Fig. B45 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1983

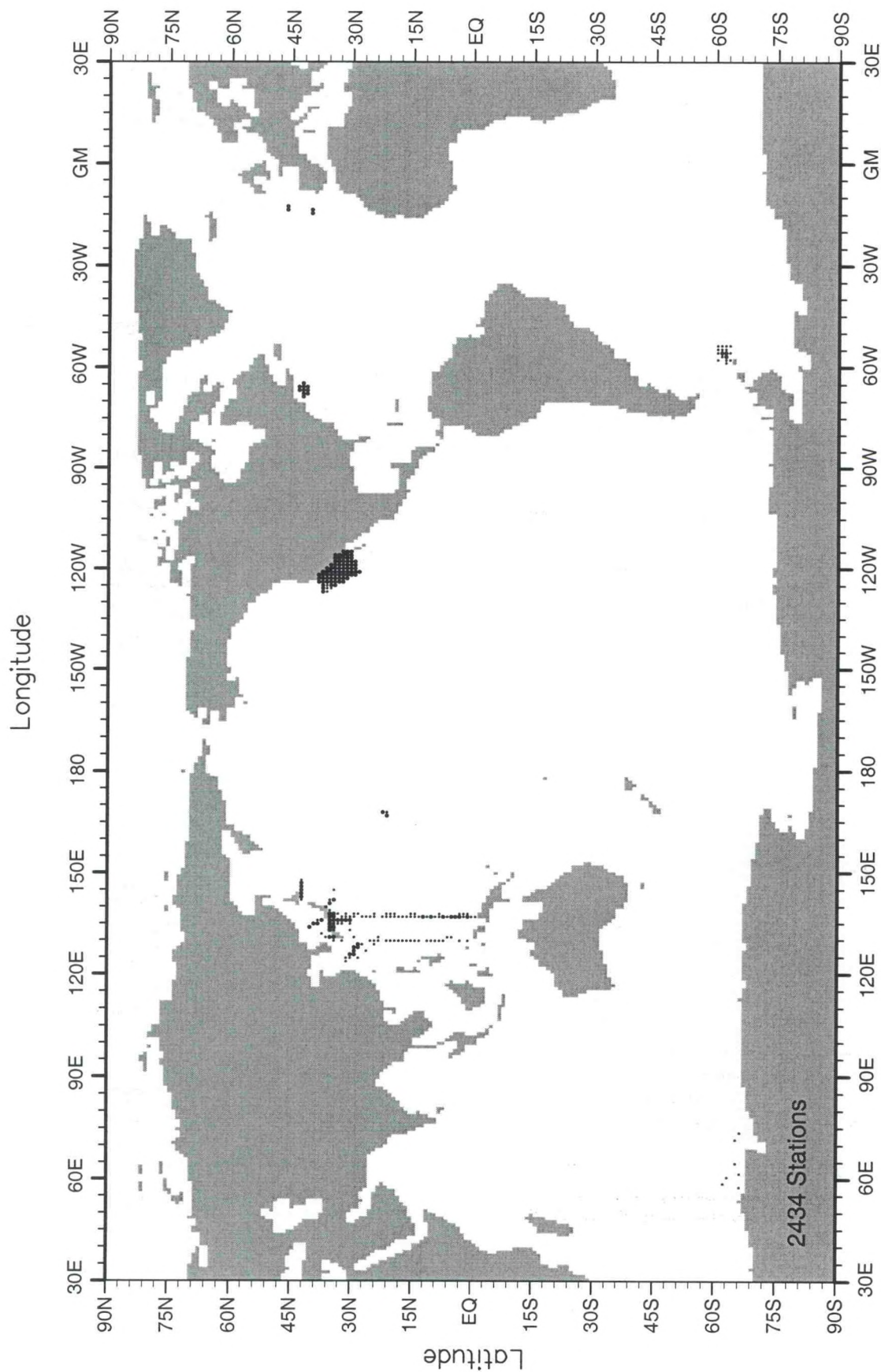


Fig. B46 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1984

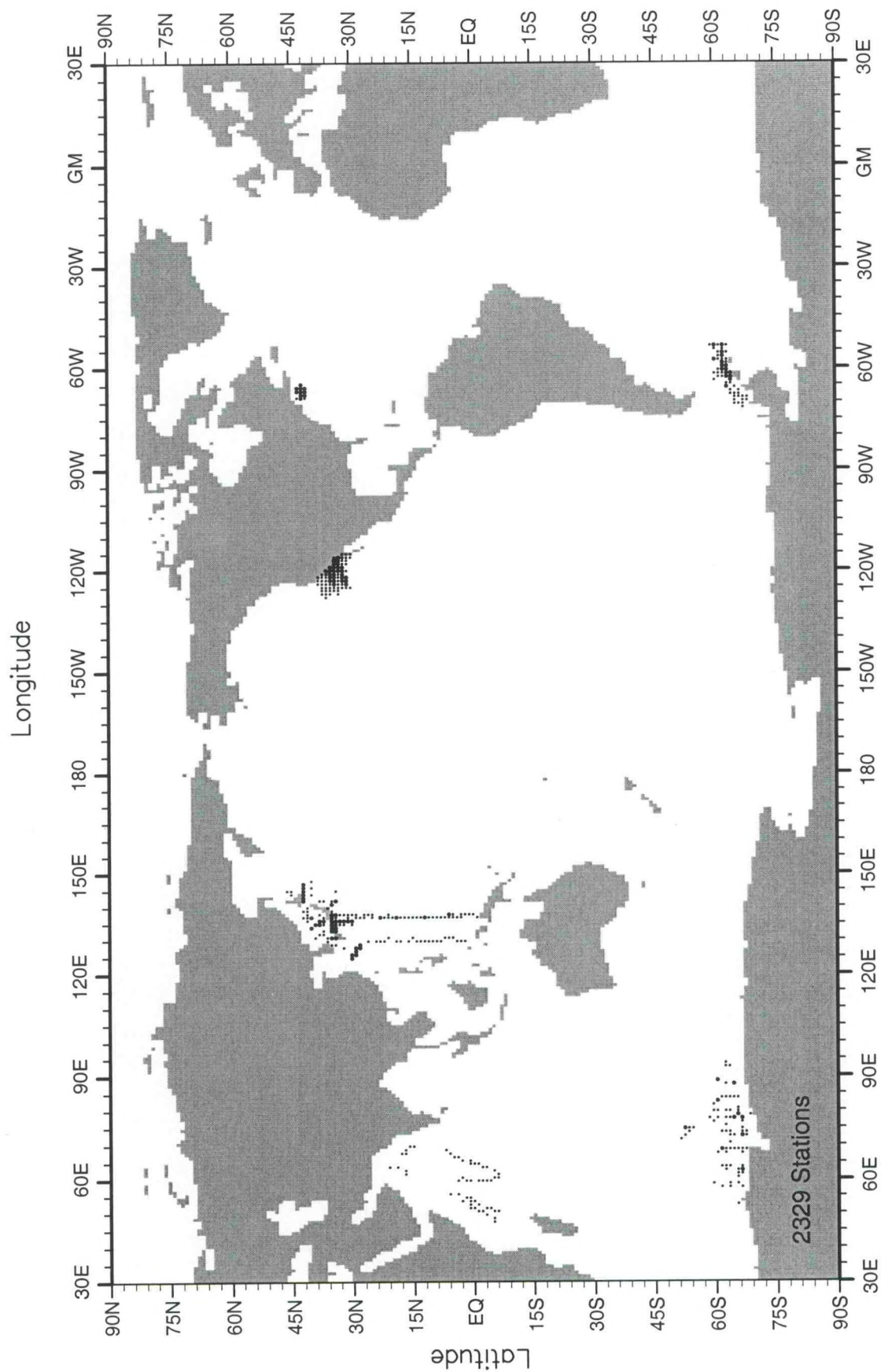


Fig. B47 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1985

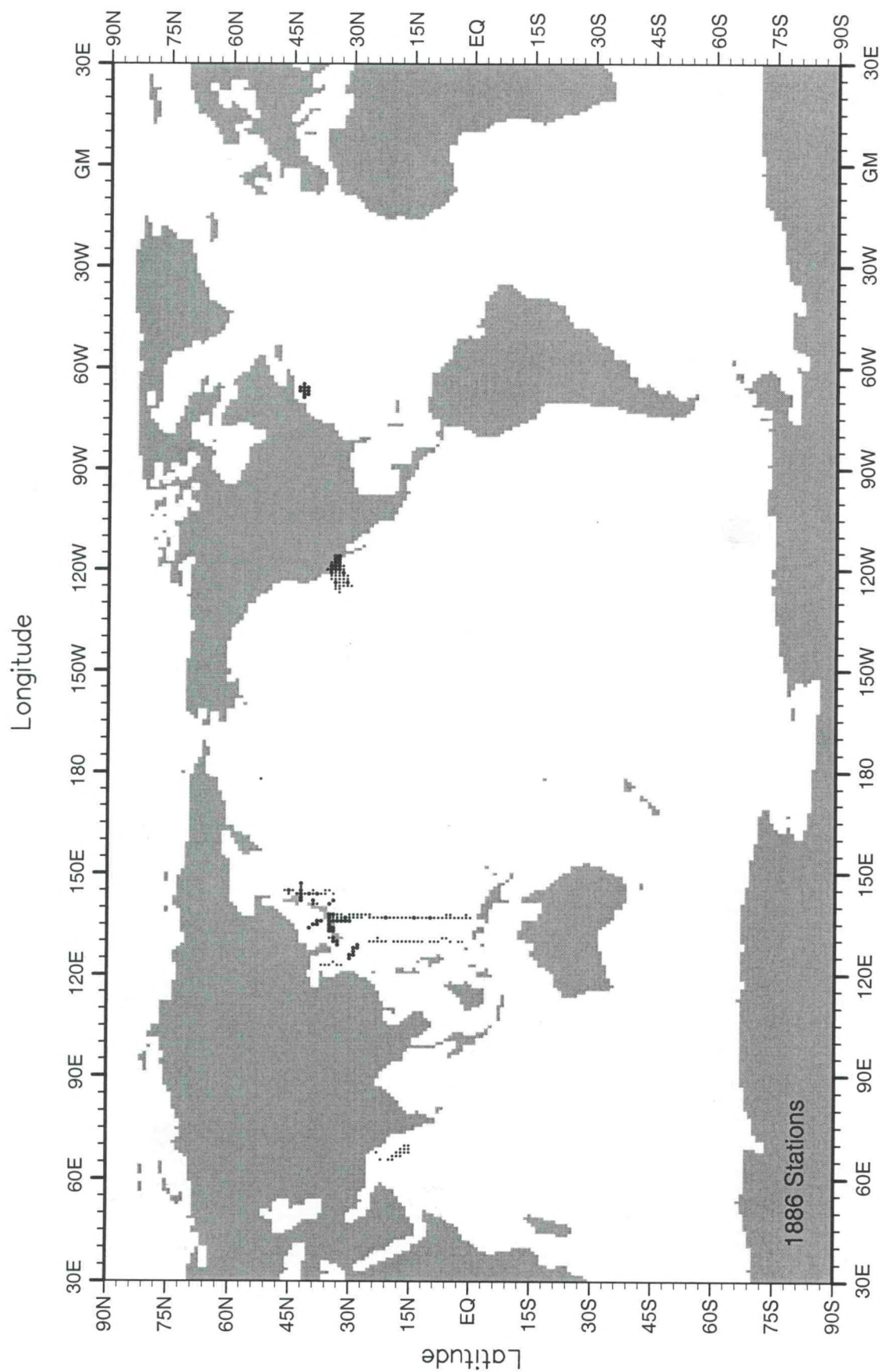


Fig. B48 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1986

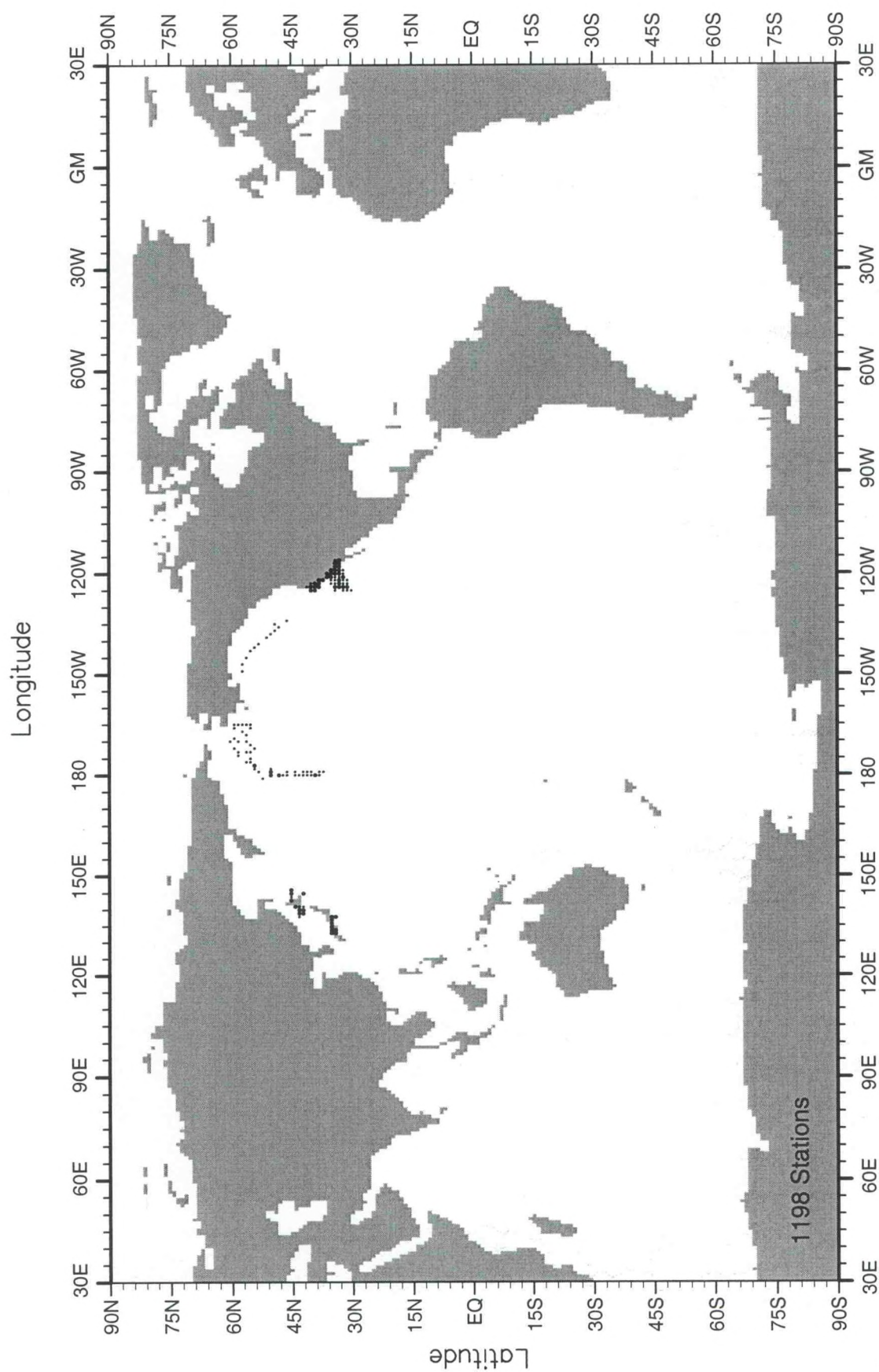


Fig. B49 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1987

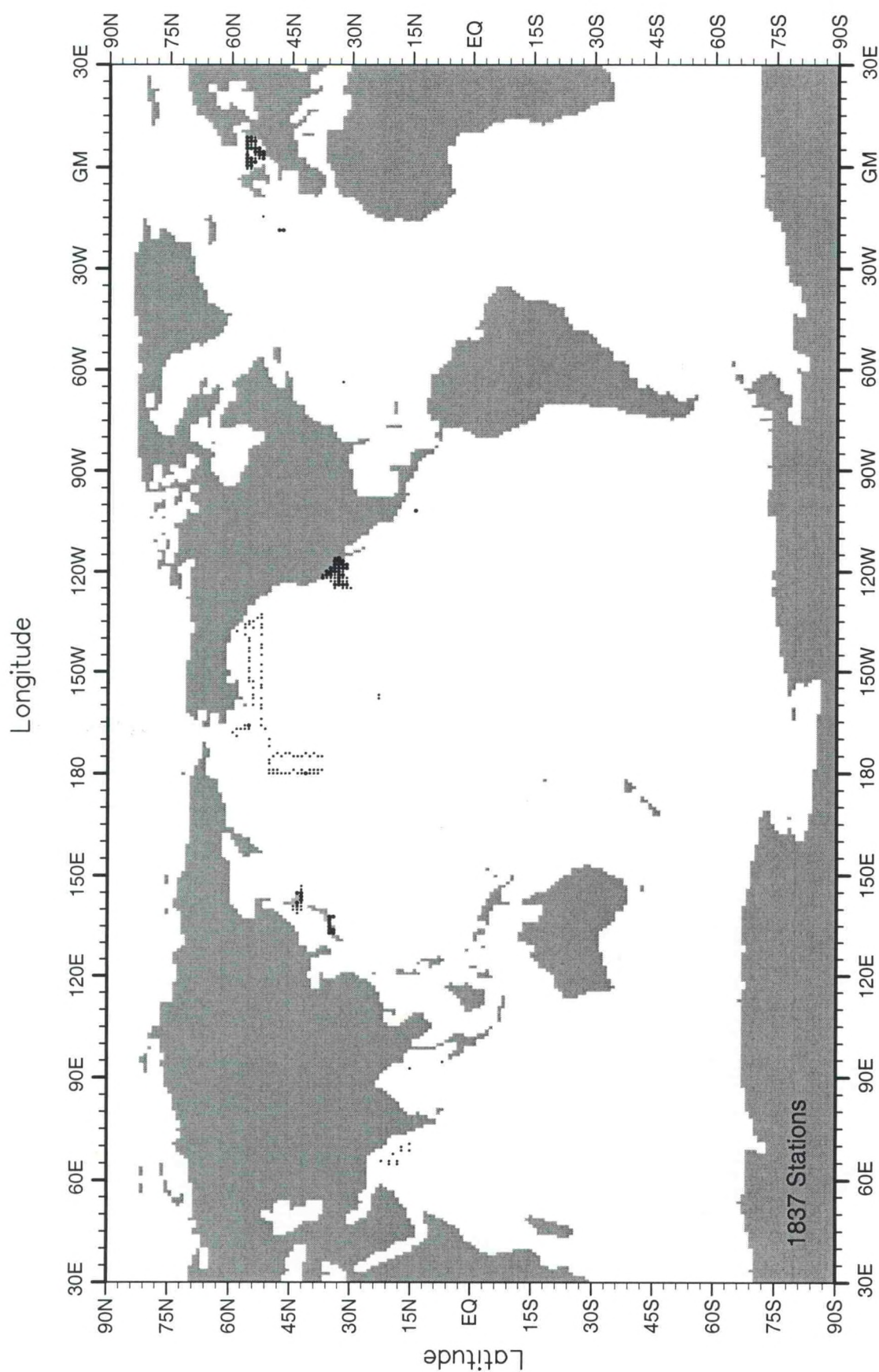


Fig. B50 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1988

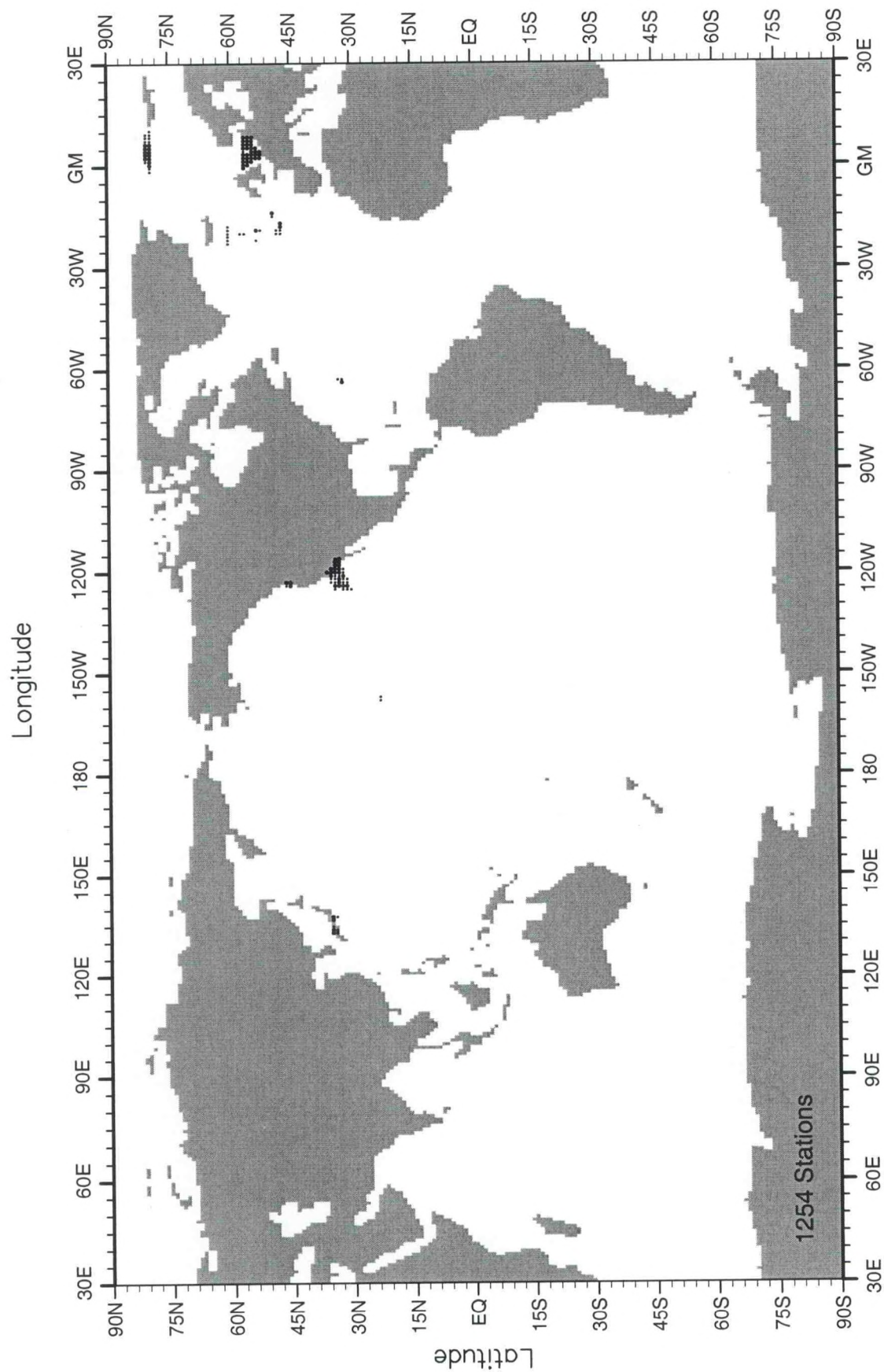


Fig. B51 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1989

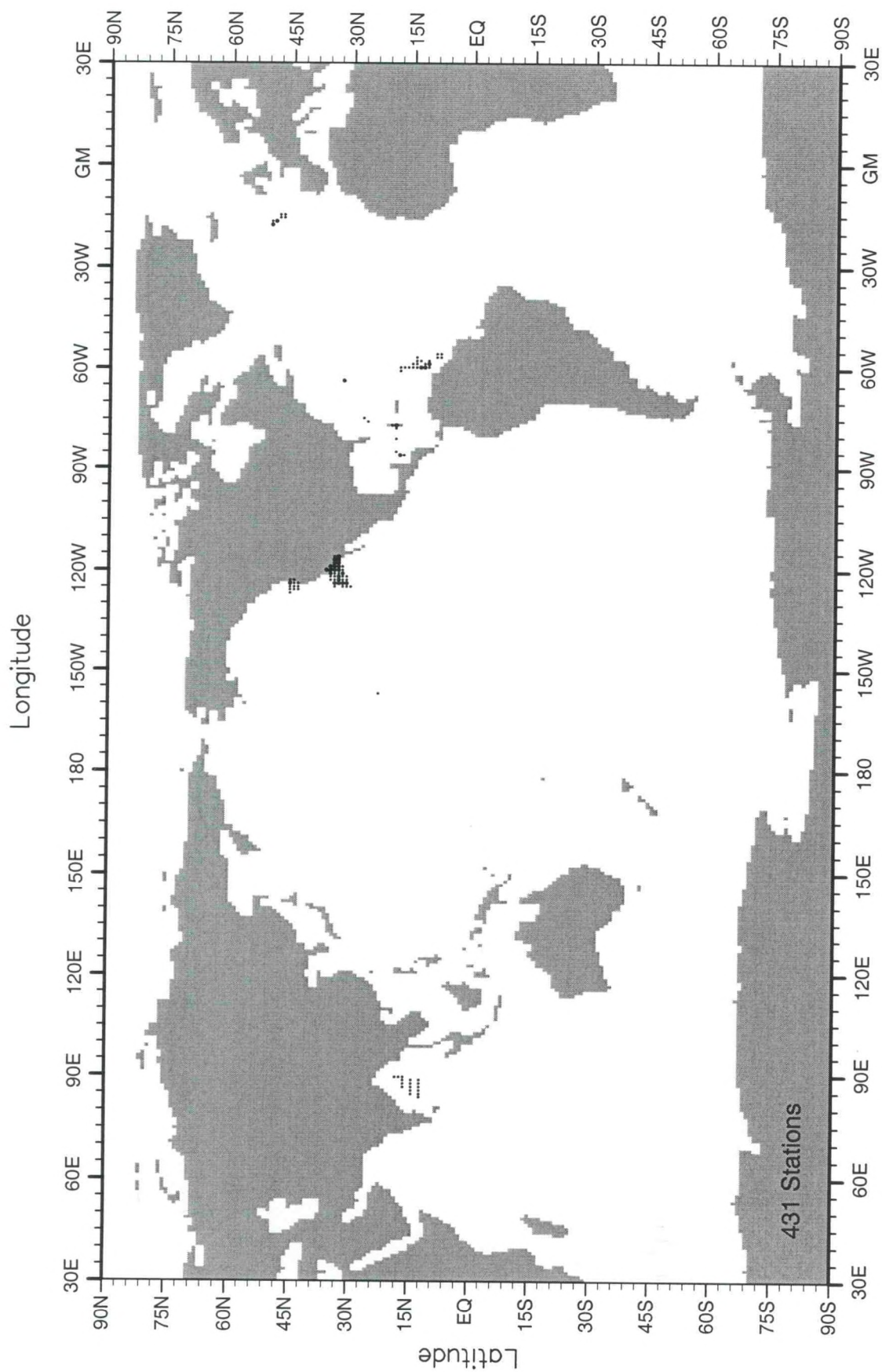


Fig. B52 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1990

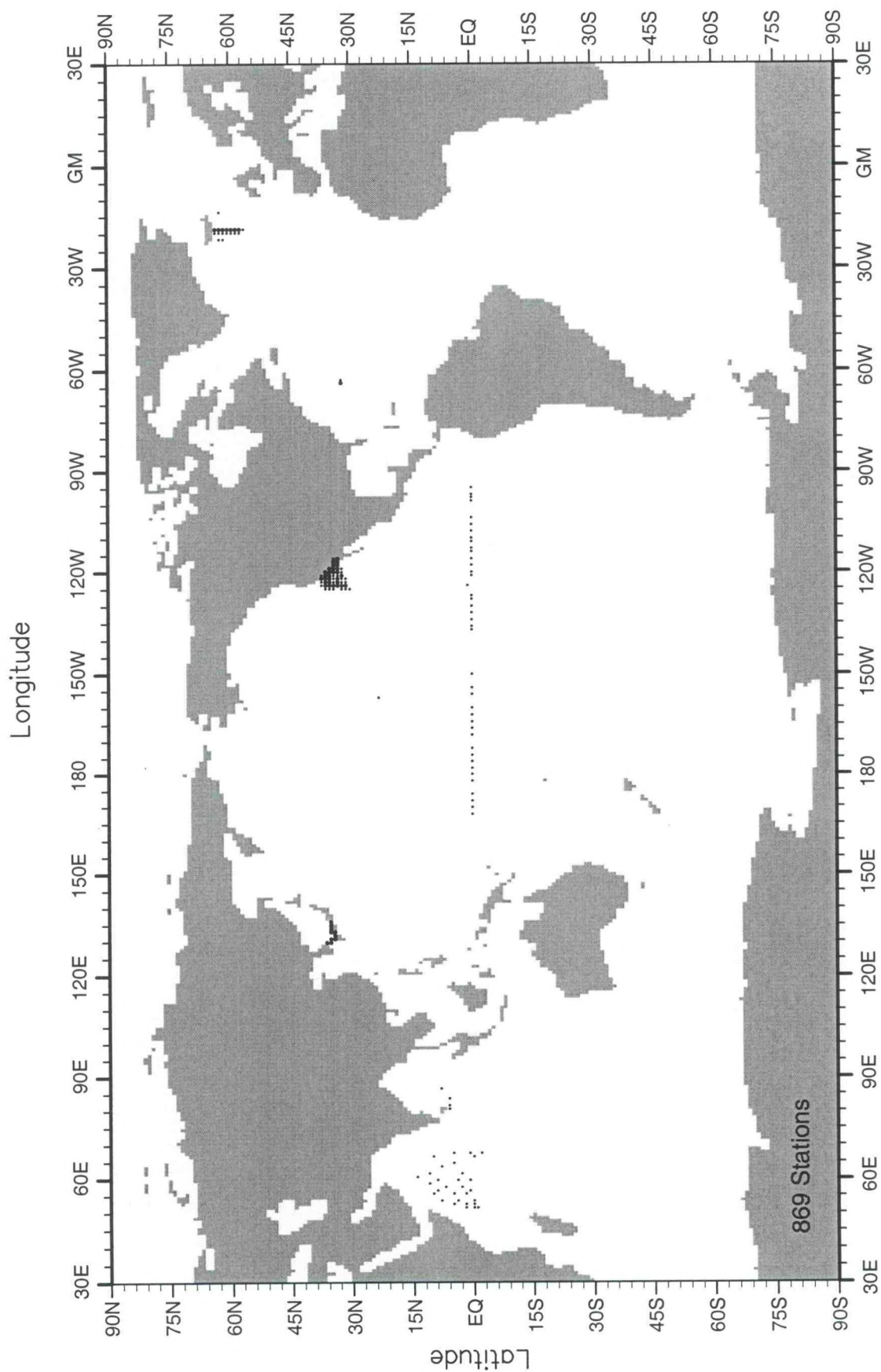


Fig. B53 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1991

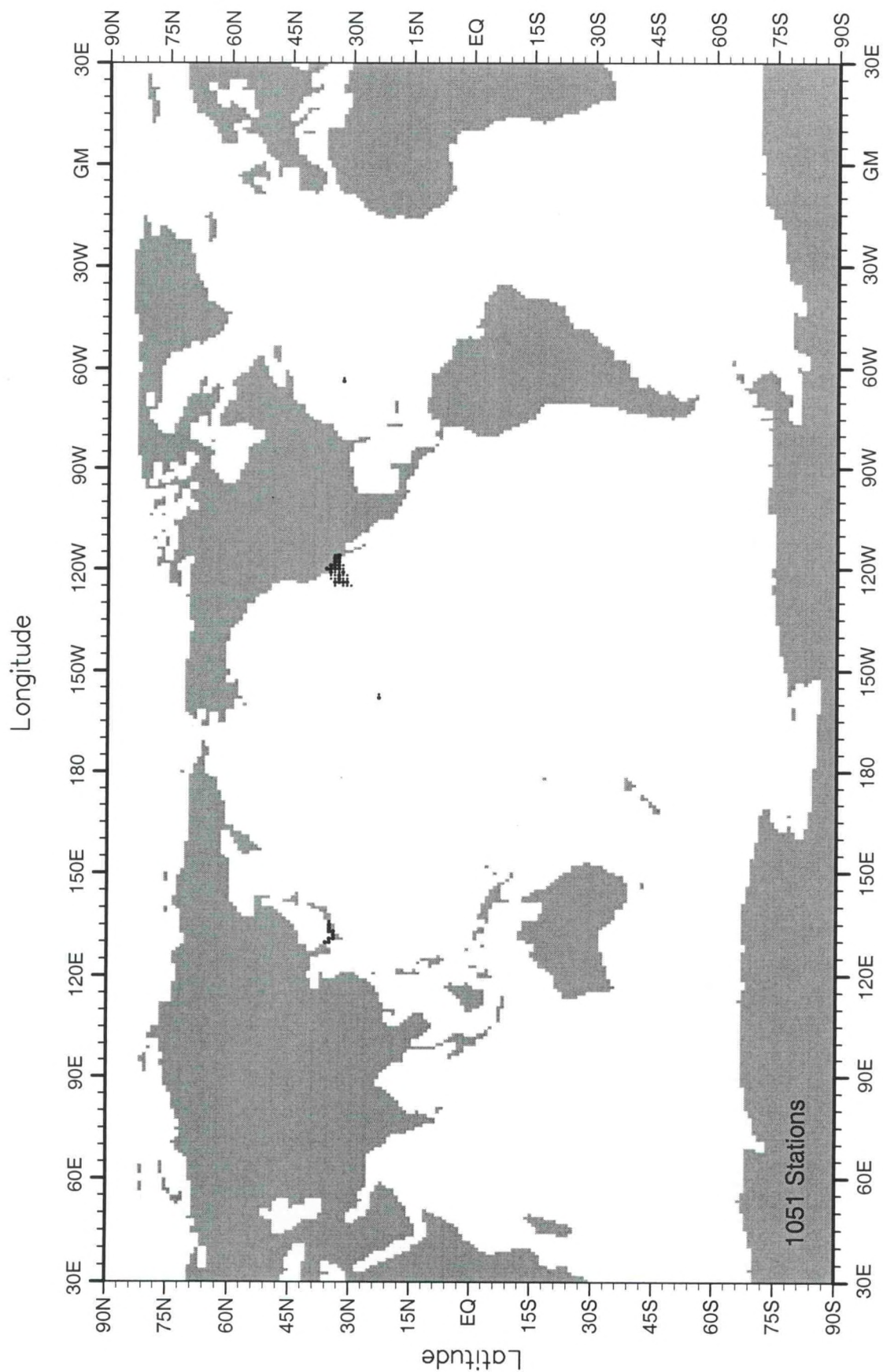


Fig. B54 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1992

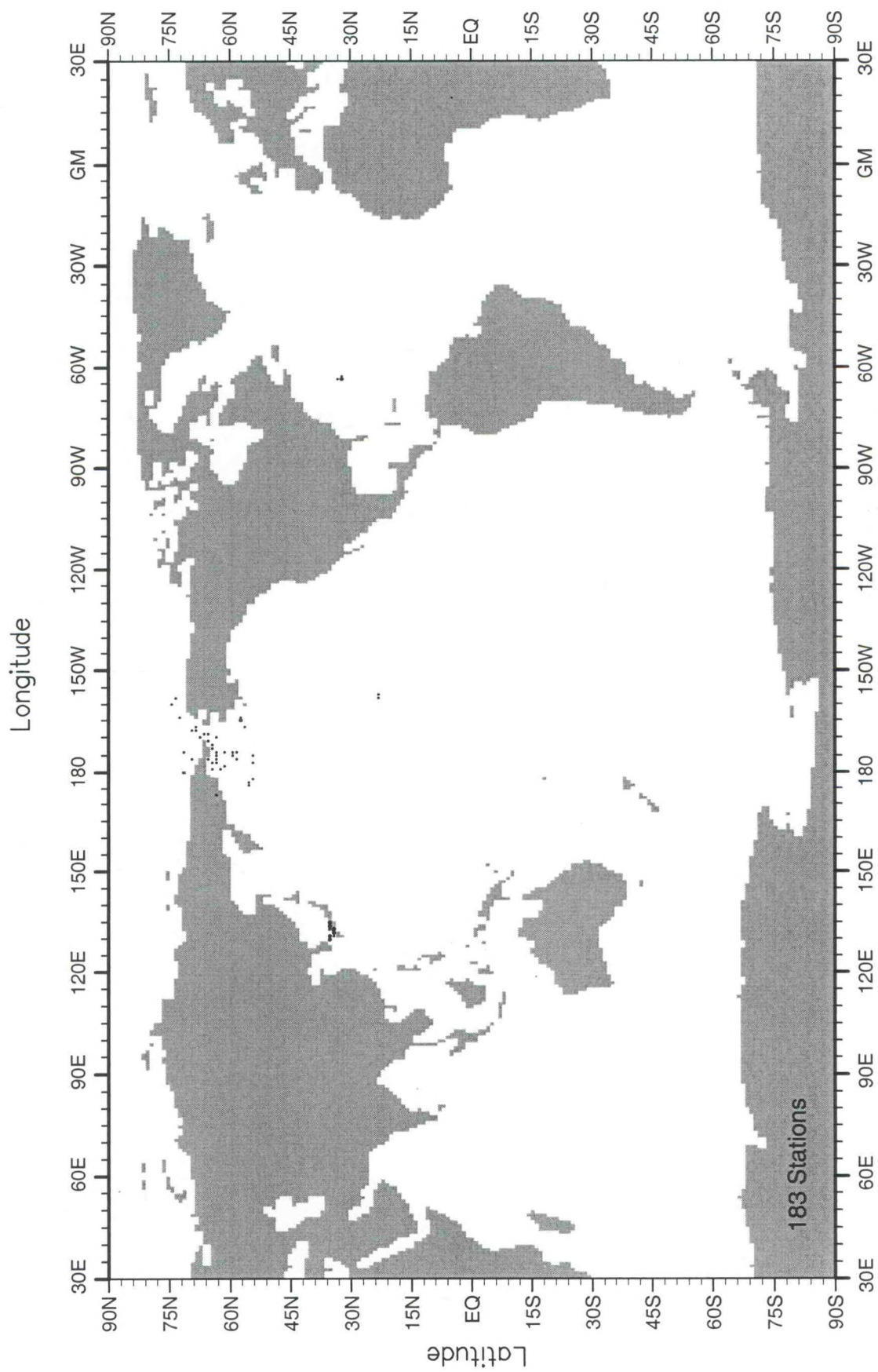


Fig. B55 Distribution of all Ocean Station Data (OSD) plankton stations in WOD98 for 1993

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