

# NOAA Atlas NESDIS 48



## WORLD OCEAN DATABASE 2001 Volume 7: Temporal Distribution of Chlorophyll and Plankton Data



Todd D. O'Brien  
Margarita E. Conkright  
Timothy P. Boyer  
John I. Antonov  
Olga K. Baranova  
Hernan E. Garcia  
Robert Gelfeld  
Daphne Johnson  
Ricardo A. Locarnini  
Paulette P. Murphy  
Igor Smolyar  
Cathy Stephens



Editor: Sydney Levitus

National Oceanographic Data Center  
Ocean Climate Laboratory

Silver Spring, MD  
March 2002

**U.S. DEPARTMENT OF COMMERCE**  
**Donald L. Evans, Secretary**

**National Oceanic and Atmospheric Administration**  
Vice Admiral Conrad C. Lautenbacher, Jr., USN (Ret.), Under Secretary

National Environmental Satellite, Data, and Information Service  
Gregory W. Withee, Assistant Administrator

## National Oceanographic Data Center

Additional copies of this publication, as well as information about NODC data holdings, and services, are available on request directly from NODC. NODC information and data are also available over the Internet through the NODC World Wide Web site.

National Oceanographic Data Center  
User Services Team  
NOAA/NESDIS E/OC1  
SSMC-III, 4th Floor  
1315 East-West Highway  
Silver Spring, MD 20910-3282

Telephone: (301)713-3277

Fax: (301)713-3302

E-mail: [services@nodc.noaa.gov](mailto:services@nodc.noaa.gov)

NODC World Wide Web site: <http://www.nodc.noaa.gov/>

**For updates on the data, documentation and additional information about WOD01 please refer to:**

**<http://www.nodc.noaa.gov>**

**click on: Ocean Climate Laboratory**  
**click on: Products**

This publication should be cited as:

T. D. O'Brien, M. E. Conkright, T. P. Boyer, J. I. Antonov, O. K. Baranova, H. E. Garcia, R. Gelfeld, D. Johnson, R. A. Locarnini, P. P. Murphy, I. Smolyar, C. Stephens, 2002: *World Ocean Database 2001, Volume 7: Temporal Distribution of Chlorophyll and Plankton Data*. S. Levitus, Ed., NOAA Atlas NESDIS 48, U.S. Government Printing Office, Wash., D.C., 219 pp., CD-ROMs.

## Contents

|                                                                                                                             |     |
|-----------------------------------------------------------------------------------------------------------------------------|-----|
| Preface .....                                                                                                               | x   |
| Acknowledgments .....                                                                                                       | xi  |
| Abstract .....                                                                                                              | 1   |
| 1. Introduction .....                                                                                                       | 1   |
| 2. Chlorophyll and plankton distributions .....                                                                             | 1   |
| 3. Bibliography .....                                                                                                       | 31  |
| 4. Appendix A: Distributions for individual years of all Ocean Station Data (OSD)<br>chlorophyll profiles in WOD01 .....    | 32  |
| 5. Appendix B: Distributions for individual years of all Surface-only (SURF) chlorophyll data<br>in WOD01 .....             | 80  |
| 6. Appendix C: Distributions for individual years of all Ocean Station Data (OSD)<br>plankton abundance data in WOD01 ..... | 97  |
| 7. Appendix D: Distributions for individual years of all Ocean Station Data (OSD)<br>plankton biomass data in WOD01 .....   | 168 |

## LIST OF TABLES

|           |                                                                                                         |
|-----------|---------------------------------------------------------------------------------------------------------|
| Table 1.  | The number of OSD chlorophyll profiles in WOD01 as a function of year for the world ocean.              |
| Table 2.  | The number of OSD chlorophyll profiles in WOD01 as a function of year for the southern hemisphere.      |
| Table 3.  | The number of OSD chlorophyll profiles in WOD01 as a function of year for the northern hemisphere.      |
| Table 4.  | The number of Surface-only chlorophyll data in WOD01 as a function of year for the world ocean.         |
| Table 5.  | The number of Surface-only chlorophyll data in WOD01 as a function of year for the southern hemisphere. |
| Table 6.  | The number of Surface-only chlorophyll data in WOD01 as a function of year for the northern hemisphere. |
| Table 7.  | The number of OSD plankton abundance data in WOD01 as a function of year for the world ocean.           |
| Table 8.  | The number of OSD plankton abundance data in WOD01 as a function of year for the southern hemisphere.   |
| Table 9.  | The number of OSD plankton abundance data in WOD01 as a function of year for the northern hemisphere.   |
| Table 10. | The number of OSD plankton biomass data in WOD01 as a function of year for the world ocean.             |
| Table 11. | The number of OSD plankton biomass data in WOD01 as a function of year for the southern hemisphere.     |
| Table 12. | The number of OSD plankton biomass data in WOD01 as a function of year for the northern hemisphere.     |

## LIST OF FIGURES

|         |                                                                                                                             |
|---------|-----------------------------------------------------------------------------------------------------------------------------|
| Fig. 1  | Time series of Ocean Station Data (OSD) chlorophyll profiles in WOD01 for the world ocean as a function of year.            |
| Fig. 2  | Time series of Ocean Station Data (OSD) chlorophyll profiles in WOD01 for the southern hemisphere as a function of year.    |
| Fig. 3  | Time series of Ocean Station Data (OSD) chlorophyll profiles in WOD01 for the northern hemisphere as a function of year.    |
| Fig. 4  | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01.                                                 |
| Fig. 5  | Time series of Surface-only (SURF) chlorophyll data in WOD01 for the world ocean as a function of year.                     |
| Fig. 6  | Time series of Surface-only (SURF) chlorophyll data in WOD01 for the southern hemisphere as a function of year.             |
| Fig. 7  | Time series of Surface-only (SURF) chlorophyll data in WOD01 for the northern hemisphere as a function of year.             |
| Fig. 8  | Distribution of all Surface chlorophyll data in WOD01.                                                                      |
| Fig. 9  | Time series of Ocean Station Data (OSD) plankton abundance data in WOD01 for the world ocean as a function of year.         |
| Fig. 10 | Time series of Ocean Station Data (OSD) plankton abundance data in WOD01 for the southern hemisphere as a function of year. |
| Fig. 11 | Time series of Ocean Station Data (OSD) plankton abundance data in WOD01 for the northern hemisphere as a function of year. |
| Fig. 12 | Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01.                                              |
| Fig. 13 | Time series of Ocean Station Data (OSD) plankton biomass data in WOD01 for the world ocean as a function of year.           |
| Fig. 14 | Time series of Ocean Station Data (OSD) plankton biomass data in WOD01 for the southern hemisphere as a function of year.   |
| Fig. 15 | Time series of Ocean Station Data (OSD) plankton biomass data in WOD01 for the northern hemisphere as a function of year.   |
| Fig. 16 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01.                                                |

## APPENDIX A

|          |                                                                                      |
|----------|--------------------------------------------------------------------------------------|
| Fig. A1  | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1954. |
| Fig. A2  | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1955. |
| Fig. A2  | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1956. |
| Fig. A4  | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1957. |
| Fig. A5  | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1958. |
| Fig. A6  | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1959. |
| Fig. A7  | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1960. |
| Fig. A8  | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1961. |
| Fig. A9  | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1962. |
| Fig. A10 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1963. |
| Fig. A11 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1964. |
| Fig. A12 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1965. |
| Fig. A13 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1966. |
| Fig. A14 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1967. |
| Fig. A15 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1968. |
| Fig. A16 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1969. |
| Fig. A17 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1970. |
| Fig. A18 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1971. |
| Fig. A19 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1972. |
| Fig. A20 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1973. |
| Fig. A21 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1974. |
| Fig. A22 | Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for 1975. |









|          |                                                                                       |
|----------|---------------------------------------------------------------------------------------|
| Fig. D34 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1982. |
| Fig. D35 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1983. |
| Fig. D36 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1984. |
| Fig. D37 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1985. |
| Fig. D38 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1986. |
| Fig. D39 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1987. |
| Fig. D40 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1988. |
| Fig. D41 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1989. |
| Fig. D42 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1990. |
| Fig. D43 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1991. |
| Fig. D44 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1992. |
| Fig. D45 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1993. |
| Fig. D46 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1994. |
| Fig. D47 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1995. |
| Fig. D48 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1996. |
| Fig. D49 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1997. |
| Fig. D50 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1998. |
| Fig. D51 | Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for 1999. |

## PREFACE

The oceanographic databases described by this atlas series greatly expands on the *World Ocean Database 1998* (WOD98) product. We have expanded these earlier databases to include data from new instrument types such as profiling floats and new variables such as  $p\text{CO}_2$  and  $\text{TCO}_2$ . Previous oceanographic databases including the NODC/WDC 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. Increasingly nutrient fields are being used to initialize and/or verify biogeochemical models of the world ocean. 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.

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  $\text{CO}_2$  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 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 thank my colleagues at the Ocean Climate Laboratory of NODC for their dedication to the project leading to publication of this atlas series. Their commitment has 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 data.

Sydney Levitus

National Oceanographic Data Center/World Data Center for Oceanography- Silver Spring

Silver Spring, MD

March 2002

## 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, the Ocean Climate Laboratory (OCL), at the National Oceanographic Data Center. The purpose of the OCL 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 a part of the oceanographic data archives maintained by NODC/WDC as well as data acquired as a result of the IODE/IOC “Global Oceanographic Data Archaeology and Rescue” (GODAR) project. At NODC/WDC, “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 this work from joint NASA/NOAA and DOE/NOAA Global Change data management programs is appreciated. Support for some of the regional IOC/GODAR meetings was provided by the MAST program of the European Union.

We 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 allows for the storage of metadata including information about Principal Investigators to recognize their efforts.

The OCL expresses thanks to those who provided comments and helped develop an improved *World Ocean Database 2001* (WOD01) product. In particular, Dr. Steve Worley of NCAR, and Steve Hankin of PMEL for testing the CD-ROMs prior to distribution. Roy Lowry (BODC) and Tom Whitworth (TAMU) for suggestions. Any errors in WOD01 are the responsibility of the Ocean Climate Laboratory.

Ervin Godfrey Trammell and Charlotte Sazama of the NODC International Data Exchange Team helped locate data in the WDC archives for digitization. We thank Mike Chepurin, Igor Minin, Dan Smolyar, Alexandra Grodsky, and Carla Forgy of the OCL for their work in data digitization and their assistance in quality control of the data and metadata in WOD01. Renee Tatusko identified many missing metadata. The OCL acknowledges 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.

Declassification of naval oceanographic data by various navies is acknowledged. The Intergovernmental Oceanographic Commission has requested such declassification efforts in recent years.

# **World Ocean Database 2001, Volume 7: Temporal Distribution of Chlorophyll and Plankton Data**

*T. D. O'Brien, M. E. Conkright, T. P. Boyer, J. I. Antonov, O. K. Baranova, H. E. Garcia, R. Gelfeld, D. Johnson, R. A. Locarnini, P. P. Murphy, I. Smolyar, C. Stephens*

*Ocean Climate Laboratory  
National Oceanographic Data Center / NOAA  
Silver Spring, MD*

## **ABSTRACT**

This atlas describes a collection of scientifically quality controlled chlorophyll and plankton data. Yearly distributions for individual years of all chlorophyll and plankton data in the database are presented to provide information on the state of ocean OSD profile and surface 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. 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”. Plankton may also be sampled at or near this station, by bottle or by towing a plankton net. Because of the relationship between the plankton and the other variables measured at a station, all plankton data are included in the “bottle data file”. WOD01 includes measurements of temperature, salinity, oxygen, nitrate, phosphate, silicate, pH, alkalinity, chlorophyll and plankton biomass and abundance for various taxonomic groups. Surface-only data are from underway or ship of opportunity.

## **2. CHLOROPHYLL and PLANKTON DISTRIBUTIONS**

Figure 1 shows the number of OSD chlorophyll profiles contained in WOD01 for the world ocean as a function of year. Figures 2 and 3 show the time series of OSD chlorophyll profiles for the southern and northern hemispheres respectively. Figure 4 shows the distribution of OSD chlorophyll profiles contained in WOD01 for the world ocean. There are a total of 128,488 OSD chlorophyll profiles for the entire world ocean with 18,339 profiles (14.3%) measured in the southern hemisphere and 110,149 profiles (85.7%) measured in the northern hemisphere. Table 1 provides the number of OSD chlorophyll profiles included in WOD01 for the world ocean as a function of year. Table 2 and 3 show the number of OSD chlorophyll profiles for the southern and northern hemispheres respectively. The geographic distribution of OSD chlorophyll profiles for individual years for 1900-2000 are shown in Appendix A, Figures A1-A47.

Figure 5 shows the number of Surface-only chlorophyll data contained in WOD01 for the world ocean

as a function of year. Figures 6 and 7 show the time series of Surface-only chlorophyll data for the southern and northern hemispheres respectively. Figure 8 shows the distribution of Surface-only chlorophyll data contained in WOD01 for the world ocean. There are a total of 44,256 Surface chlorophyll data for the entire world ocean with 32,636 profiles (73.7%) measured in the southern hemisphere and 11,620 profiles (26.3%) measured in the northern hemisphere. Table 4 provides the number of Surface-only chlorophyll data included in WOD01 for the world ocean as a function of year. Table 5 and 6 show the number of Surface-only chlorophyll profiles for the southern and northern hemispheres respectively. The geographic distribution of Surface-only chlorophyll data for individual years for 1900-2000 are shown in Appendix B, Figures B1-B16.

Figure 9 shows the number of OSD plankton abundance data contained in WOD01 for the world ocean as a function of year. Figures 10 and 11 show the time series of OSD plankton abundance data for the southern and northern hemispheres respectively. Figure 12 shows the distribution of OSD plankton abundance data contained in WOD01 for the world ocean. There are a total of 100,405 OSD plankton abundance data for the entire world ocean with 5,295 profiles (5.3%) measured in the southern hemisphere and 95,110 profiles (94.7%) measured in the northern hemisphere. Table 7 provides the number of OSD plankton abundance data included in WOD01 for the world ocean as a function of year. Table 8 and 9 show the number of OSD plankton abundance data for the southern and northern hemispheres respectively. The geographic distribution of OSD plankton abundance data for individual years for 1913-1999 are shown in Appendix C, Figures C1-C70.

Figure 13 shows the number of OSD plankton biomass data contained in WOD01 for the world ocean as a function of year. Figures 14 and 15 show the time series of OSD plankton biomass data for the southern and northern hemispheres respectively. Figure 16 shows the distribution of OSD plankton biomass data contained in WOD01 for the world ocean. There are a total of 98,612 OSD plankton biomass data for the entire world ocean with 7,618 profiles (7.7%) measured in the southern hemisphere and 90,994 profiles (92.3%) measured in the northern hemisphere. Table 10 provides the number of OSD plankton biomass data included in WOD01 for the world ocean as a function of year. Table 11 and 12 show the number of OSD plankton biomass data for the southern and northern hemispheres respectively. The geographic distribution of OSD plankton biomass data for individual years for 1949-1999 are shown in Appendix D, Figures D1-D51.

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, 2002).

Table 1 The number of OSD chlorophyll profiles in WOD01 as a function of year for the World Ocean. The total number of profiles = 128,488

| YEAR | PROFILE | YEAR | PROFILE |
|------|---------|------|---------|
| 1954 | 98      | 1978 | 5551    |
| 1955 | 232     | 1979 | 12923   |
| 1956 | 188     | 1980 | 4589    |
| 1957 | 436     | 1981 | 6519    |
| 1958 | 619     | 1982 | 6980    |
| 1959 | 504     | 1983 | 3501    |
| 1960 | 572     | 1984 | 5087    |
| 1961 | 506     | 1985 | 4518    |
| 1962 | 340     | 1986 | 5551    |
| 1963 | 810     | 1987 | 4666    |
| 1964 | 1208    | 1988 | 5041    |
| 1965 | 1187    | 1989 | 5667    |
| 1966 | 936     | 1990 | 5476    |
| 1967 | 1001    | 1991 | 3933    |
| 1968 | 865     | 1992 | 4373    |
| 1969 | 1077    | 1993 | 4255    |
| 1970 | 670     | 1994 | 2804    |
| 1971 | 914     | 1995 | 4113    |
| 1972 | 1320    | 1996 | 2773    |
| 1973 | 2099    | 1997 | 3054    |
| 1974 | 1708    | 1998 | 1743    |
| 1975 | 2028    | 1999 | 1365    |
| 1976 | 1787    | 2000 | 205     |
| 1977 | 2696    |      |         |

Table 2 The number of OSD chlorophyll profiles in WOD01 as a function of year for the southern hemisphere. The total number of profiles = 18,339

| YEAR | PROFILE | YEAR | PROFILE |
|------|---------|------|---------|
| 1955 | 42      | 1978 | 505     |
| 1956 | 0       | 1979 | 696     |
| 1957 | 20      | 1980 | 413     |
| 1958 | 140     | 1981 | 616     |
| 1959 | 43      | 1982 | 434     |
| 1960 | 238     | 1983 | 751     |
| 1961 | 146     | 1984 | 933     |
| 1962 | 184     | 1985 | 1266    |
| 1963 | 205     | 1986 | 984     |
| 1964 | 232     | 1987 | 1318    |
| 1965 | 375     | 1988 | 1095    |
| 1966 | 253     | 1989 | 406     |
| 1967 | 370     | 1990 | 560     |
| 1968 | 270     | 1991 | 186     |
| 1969 | 154     | 1992 | 1286    |
| 1970 | 56      | 1993 | 687     |
| 1971 | 118     | 1994 | 103     |
| 1972 | 154     | 1995 | 162     |
| 1973 | 252     | 1996 | 206     |
| 1974 | 248     | 1997 | 356     |
| 1975 | 303     | 1998 | 99      |
| 1976 | 668     | 1999 | 12      |
| 1977 | 794     |      |         |

Table 3 The number of OSD chlorophyll profiles in WOD01 as a function of year for the northern hemisphere. The total number of profiles = 110,149

| YEAR | PROFILE | YEAR | PROFILE |
|------|---------|------|---------|
| 1954 | 98      | 1978 | 5046    |
| 1955 | 190     | 1979 | 12227   |
| 1956 | 188     | 1980 | 4176    |
| 1957 | 416     | 1981 | 5903    |
| 1958 | 479     | 1982 | 6546    |
| 1959 | 461     | 1983 | 2750    |
| 1960 | 334     | 1984 | 4154    |
| 1961 | 360     | 1985 | 3252    |
| 1962 | 156     | 1986 | 4567    |
| 1963 | 605     | 1987 | 3348    |
| 1964 | 976     | 1988 | 3946    |
| 1965 | 812     | 1989 | 5261    |
| 1966 | 683     | 1990 | 4916    |
| 1967 | 631     | 1991 | 3747    |
| 1968 | 595     | 1992 | 3087    |
| 1969 | 923     | 1993 | 3568    |
| 1970 | 614     | 1994 | 2701    |
| 1971 | 796     | 1995 | 3951    |
| 1972 | 1166    | 1996 | 2567    |
| 1973 | 1847    | 1997 | 2698    |
| 1974 | 1460    | 1998 | 1644    |
| 1975 | 1725    | 1999 | 1353    |
| 1976 | 1119    | 2000 | 205     |
| 1977 | 1902    |      |         |



Table 4 The number of Surface-only data in WOD01 as a function of year for the World Ocean. The total number of observations = 44,256

| YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS |
|------|--------------|------|--------------|------|--------------|------|--------------|
| 1978 | 1605         | 1984 | 3304         | 1989 | 1792         | 1994 | 0            |
| 1979 | 2883         | 1985 | 3689         | 1990 | 1756         | 1995 | 0            |
| 1980 | 4244         | 1986 | 3184         | 1991 | 561          | 1996 | 0            |
| 1981 | 4010         | 1987 | 3856         | 1992 | 2559         | 1997 | 0            |
| 1982 | 4236         | 1988 | 1603         | 1993 | 0            | 1998 | 47           |
| 1983 | 4927         |      |              |      |              |      |              |

Table 5 The number of Surface-only data in WOD01 as a function of year for the southern hemisphere. The total number of observations = 32,636

| YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS |
|------|--------------|------|--------------|------|--------------|------|--------------|
| 1978 | 1167         | 1984 | 2386         | 1989 | 1269         | 1994 | 0            |
| 1979 | 2329         | 1985 | 2705         | 1990 | 1168         | 1995 | 0            |
| 1980 | 3285         | 1986 | 2274         | 1991 | 346          | 1996 | 0            |
| 1981 | 3024         | 1987 | 3151         | 1992 | 1445         | 1997 | 0            |
| 1982 | 3279         | 1988 | 1223         | 1993 | 0            | 1998 | 47           |
| 1983 | 3538         |      |              |      |              |      |              |

Table 6 The number of Surface-only data in WOD01 as a function of year for the northern hemisphere. The total number of observations = 11,620

| YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS |
|------|--------------|------|--------------|------|--------------|------|--------------|
| 1978 | 438          | 1984 | 918          | 1989 | 523          | 1994 | 0            |
| 1979 | 554          | 1985 | 984          | 1990 | 588          | 1995 | 0            |
| 1980 | 959          | 1986 | 910          | 1991 | 215          | 1996 | 0            |
| 1981 | 986          | 1987 | 705          | 1992 | 1114         | 1997 | 0            |
| 1982 | 957          | 1988 | 380          | 1993 | 0            | 1998 | 0            |
| 1983 | 1389         |      |              |      |              |      |              |

Table 7 The number of OSD plankton abundance data in WOD01 as a function of year for the World Ocean. The total number of observations = 100,405

| YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS |
|------|--------------|------|--------------|------|--------------|------|--------------|
| 1913 | 6            | 1935 | 0            | 1957 | 1812         | 1979 | 3048         |
| 1914 | 5            | 1936 | 123          | 1958 | 1996         | 1980 | 2777         |
| 1915 | 9            | 1937 | 0            | 1959 | 2247         | 1981 | 3869         |
| 1916 | 0            | 1938 | 6            | 1960 | 2324         | 1982 | 1988         |
| 1917 | 0            | 1939 | 10           | 1961 | 1279         | 1983 | 1758         |
| 1918 | 0            | 1940 | 2            | 1962 | 1890         | 1984 | 2326         |
| 1919 | 0            | 1941 | 0            | 1963 | 2403         | 1985 | 1858         |
| 1920 | 0            | 1942 | 2            | 1964 | 2687         | 1986 | 1926         |
| 1921 | 17           | 1943 | 0            | 1965 | 1875         | 1987 | 992          |
| 1922 | 0            | 1944 | 0            | 1966 | 2689         | 1988 | 1425         |
| 1923 | 0            | 1945 | 0            | 1967 | 1224         | 1989 | 1339         |
| 1924 | 0            | 1946 | 6            | 1968 | 901          | 1990 | 966          |
| 1925 | 17           | 1947 | 24           | 1969 | 2038         | 1991 | 835          |
| 1926 | 0            | 1948 | 0            | 1970 | 429          | 1992 | 1418         |
| 1927 | 16           | 1949 | 0            | 1971 | 803          | 1993 | 921          |
| 1928 | 2            | 1950 | 4            | 1972 | 2670         | 1994 | 1118         |
| 1929 | 71           | 1951 | 1386         | 1973 | 1033         | 1995 | 2917         |
| 1930 | 46           | 1952 | 1650         | 1974 | 990          | 1996 | 2055         |
| 1931 | 36           | 1953 | 2634         | 1975 | 2440         | 1997 | 3240         |
| 1932 | 18           | 1954 | 3296         | 1976 | 1700         | 1998 | 2884         |
| 1933 | 19           | 1955 | 2331         | 1977 | 2556         | 1999 | 2595         |
| 1934 | 179          | 1956 | 1542         | 1978 | 6707         |      |              |

Table 8 The number of OSD plankton abundance data in WOD01 as a function of year for the southern hemisphere. The total number of observations = 5,295

| YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS |
|------|--------------|------|--------------|------|--------------|------|--------------|
| 1946 | 6            | 1960 | 183          | 1974 | 5            | 1988 | 0            |
| 1947 | 24           | 1961 | 52           | 1975 | 20           | 1989 | 0            |
| 1948 | 0            | 1962 | 411          | 1976 | 0            | 1990 | 46           |
| 1949 | 0            | 1963 | 571          | 1977 | 20           | 1991 | 116          |
| 1950 | 0            | 1964 | 779          | 1978 | 19           | 1992 | 547          |
| 1951 | 0            | 1965 | 424          | 1979 | 147          | 1993 | 0            |
| 1952 | 0            | 1966 | 425          | 1980 | 6            | 1994 | 0            |
| 1953 | 0            | 1967 | 427          | 1981 | 33           | 1995 | 0            |
| 1954 | 0            | 1968 | 142          | 1982 | 15           | 1996 | 32           |
| 1955 | 63           | 1969 | 46           | 1983 | 11           | 1997 | 271          |
| 1956 | 0            | 1970 | 5            | 1984 | 42           | 1998 | 144          |
| 1957 | 0            | 1971 | 5            | 1985 | 8            | 1999 | 4            |
| 1958 | 90           | 1972 | 132          | 1986 | 2            |      |              |
| 1959 | 0            | 1973 | 22           | 1987 | 0            |      |              |

Table 9 The number of OSD plankton abundance data in WOD01 as a function of year for the northern hemisphere. The total number of observations = 95,110

| YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS |
|------|--------------|------|--------------|------|--------------|------|--------------|
| 1913 | 6            | 1935 | 0            | 1957 | 1812         | 1979 | 2901         |
| 1914 | 5            | 1936 | 123          | 1958 | 1906         | 1980 | 2771         |
| 1915 | 9            | 1937 | 0            | 1959 | 2247         | 1981 | 3836         |
| 1916 | 0            | 1938 | 6            | 1960 | 2141         | 1982 | 1973         |
| 1917 | 0            | 1939 | 10           | 1961 | 1227         | 1983 | 1747         |
| 1918 | 0            | 1940 | 2            | 1962 | 1479         | 1984 | 2284         |
| 1919 | 0            | 1941 | 0            | 1963 | 1832         | 1985 | 1850         |
| 1920 | 0            | 1942 | 2            | 1964 | 1908         | 1986 | 1924         |
| 1921 | 17           | 1943 | 0            | 1965 | 1451         | 1987 | 992          |
| 1922 | 0            | 1944 | 0            | 1966 | 2264         | 1988 | 1425         |
| 1923 | 0            | 1945 | 0            | 1967 | 797          | 1989 | 1339         |
| 1924 | 0            | 1946 | 0            | 1968 | 759          | 1990 | 920          |
| 1925 | 17           | 1947 | 0            | 1969 | 1992         | 1991 | 719          |
| 1926 | 0            | 1948 | 0            | 1970 | 424          | 1992 | 871          |
| 1927 | 16           | 1949 | 0            | 1971 | 798          | 1993 | 921          |
| 1928 | 2            | 1950 | 4            | 1972 | 2538         | 1994 | 1118         |
| 1929 | 71           | 1951 | 1386         | 1973 | 1011         | 1995 | 2917         |
| 1930 | 46           | 1952 | 1650         | 1974 | 985          | 1996 | 2023         |
| 1931 | 36           | 1953 | 2634         | 1975 | 2420         | 1997 | 2969         |
| 1932 | 18           | 1954 | 3296         | 1976 | 1700         | 1998 | 2740         |
| 1933 | 19           | 1955 | 2268         | 1977 | 2536         | 1999 | 2591         |
| 1934 | 179          | 1956 | 1542         | 1978 | 6688         |      |              |

Table 10 The number of OSD plankton biomass data in WOD01 as a function of year for the World Ocean. The total number of observations = 98,612

| YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS |
|------|--------------|------|--------------|------|--------------|------|--------------|
| 1949 | 98           | 1962 | 1702         | 1975 | 2358         | 1988 | 2172         |
| 1950 | 505          | 1963 | 2320         | 1976 | 1649         | 1989 | 775          |
| 1951 | 2073         | 1964 | 2330         | 1977 | 2216         | 1990 | 1144         |
| 1952 | 2116         | 1965 | 2356         | 1978 | 6072         | 1991 | 369          |
| 1953 | 2347         | 1966 | 2840         | 1979 | 2635         | 1992 | 901          |
| 1954 | 2446         | 1967 | 4745         | 1980 | 2216         | 1993 | 307          |
| 1955 | 2838         | 1968 | 2090         | 1981 | 4508         | 1994 | 407          |
| 1956 | 2418         | 1969 | 2186         | 1982 | 3308         | 1995 | 420          |
| 1957 | 2342         | 1970 | 676          | 1983 | 2295         | 1996 | 467          |
| 1958 | 2703         | 1971 | 1528         | 1984 | 2568         | 1997 | 557          |
| 1959 | 3372         | 1972 | 2615         | 1985 | 2410         | 1998 | 205          |
| 1960 | 2317         | 1973 | 1421         | 1986 | 2022         | 1999 | 180          |
| 1961 | 1406         | 1974 | 983          | 1987 | 1708         |      |              |

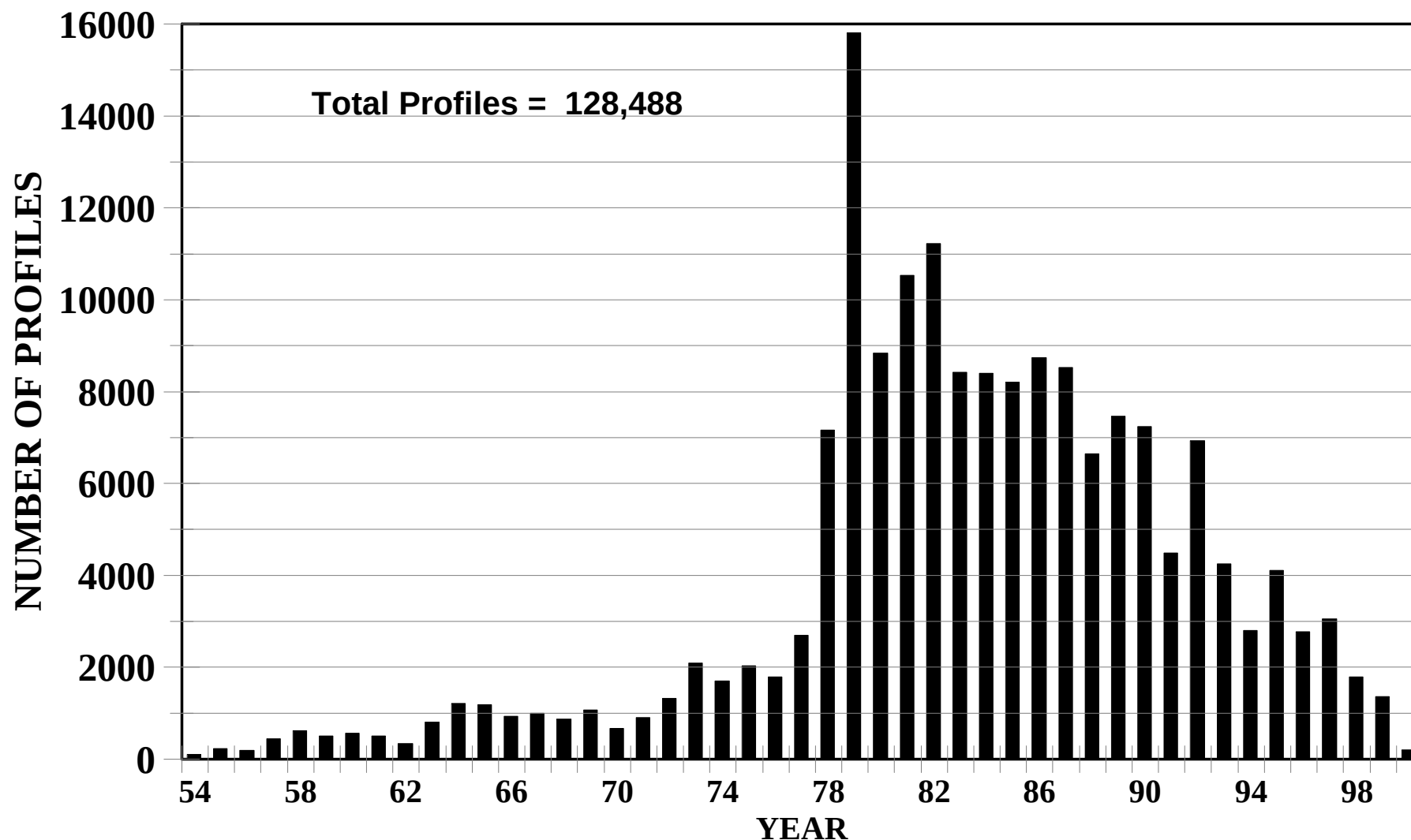
Table 11 The number of OSD plankton biomass data in WOD01 as a function of year for the southern hemisphere. The total number of observations = 7,618

| YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS |
|------|--------------|------|--------------|------|--------------|------|--------------|
| 1955 | 204          | 1967 | 1457         | 1979 | 201          | 1991 | 6            |
| 1956 | 0            | 1968 | 666          | 1980 | 34           | 1992 | 328          |
| 1957 | 13           | 1969 | 0            | 1981 | 274          | 1993 | 16           |
| 1958 | 92           | 1970 | 56           | 1982 | 38           | 1994 | 0            |
| 1959 | 0            | 1971 | 315          | 1983 | 169          | 1995 | 0            |
| 1960 | 14           | 1972 | 205          | 1984 | 64           | 1996 | 38           |
| 1961 | 21           | 1973 | 209          | 1985 | 448          | 1997 | 81           |
| 1962 | 398          | 1974 | 130          | 1986 | 1            | 1998 | 30           |
| 1963 | 496          | 1975 | 175          | 1987 | 0            | 1999 | 2            |
| 1964 | 350          | 1976 | 191          | 1988 | 0            |      |              |
| 1965 | 569          | 1977 | 57           | 1989 | 0            |      |              |
| 1966 | 195          | 1978 | 75           | 1990 | 0            |      |              |

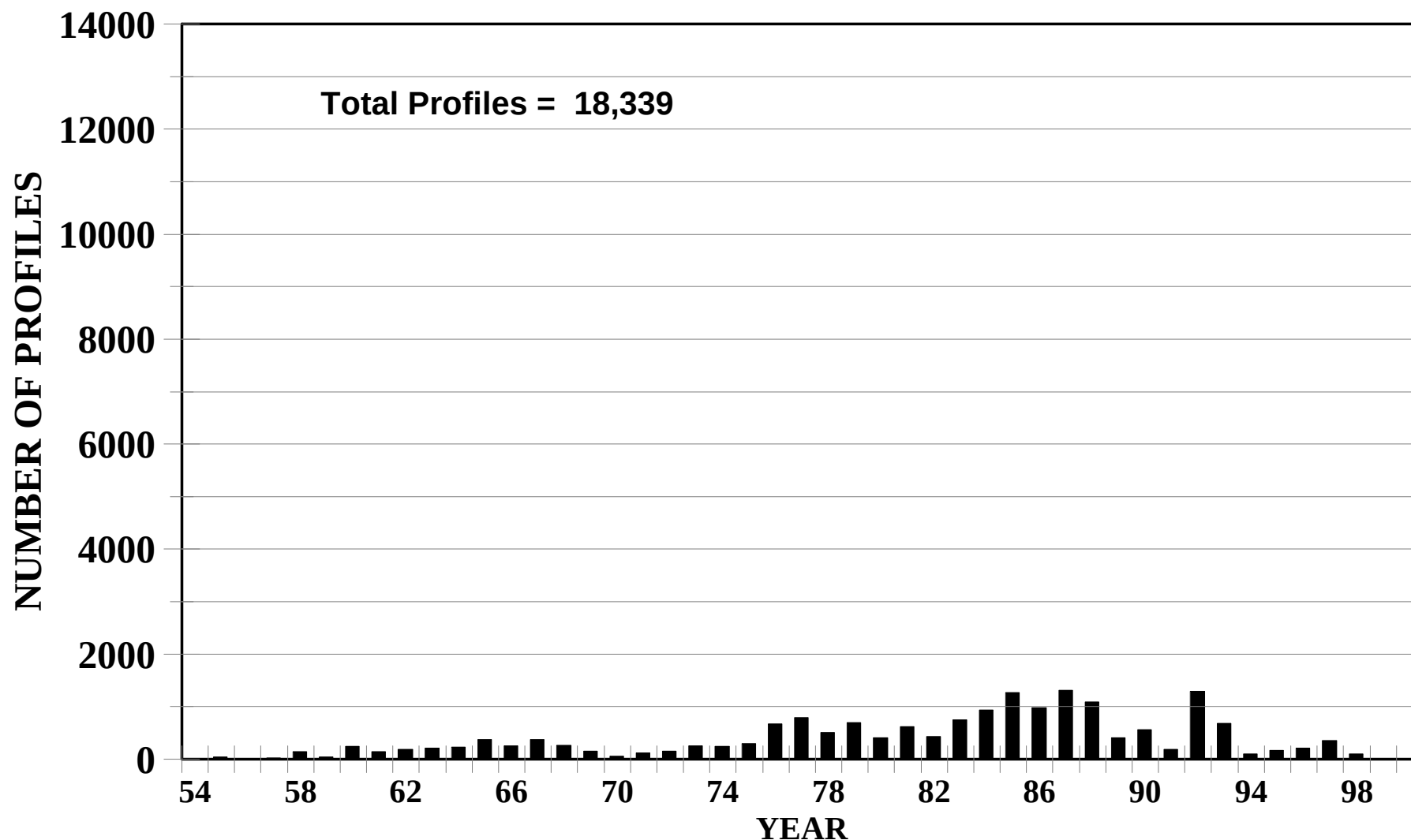


Table 12 The number of OSD plankton biomass data in WOD01 as a function of year for the northern hemisphere. The total number of observations = 90,994

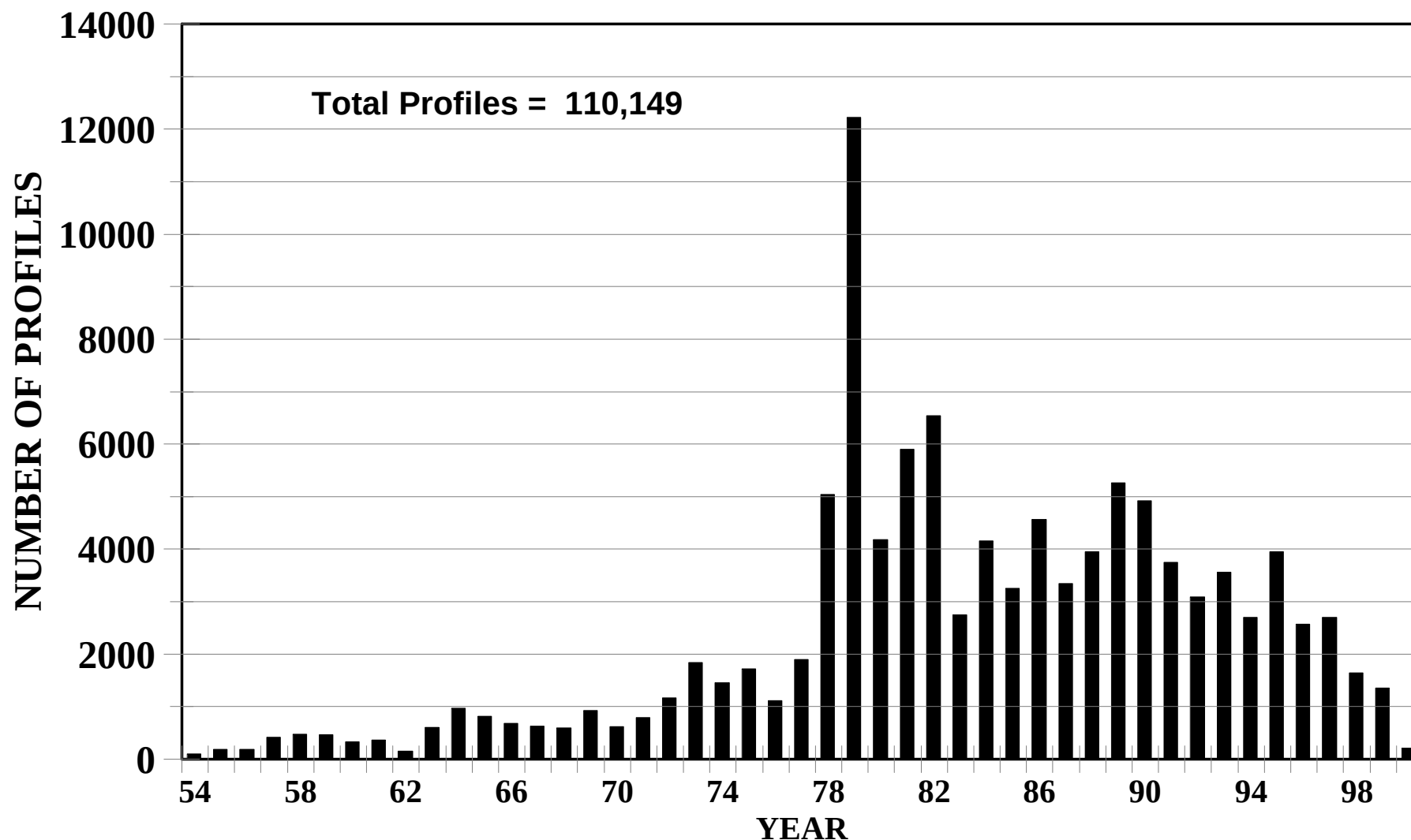
| YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS | YEAR | OBSERVATIONS |
|------|--------------|------|--------------|------|--------------|------|--------------|
| 1949 | 98           | 1962 | 1304         | 1975 | 2183         | 1988 | 2142         |
| 1950 | 505          | 1963 | 1824         | 1976 | 1458         | 1989 | 775          |
| 1951 | 2073         | 1964 | 1980         | 1977 | 2159         | 1990 | 1144         |
| 1952 | 2116         | 1965 | 1787         | 1978 | 5997         | 1991 | 363          |
| 1953 | 2347         | 1966 | 2645         | 1979 | 5997         | 1992 | 573          |
| 1954 | 2446         | 1967 | 3288         | 1980 | 2434         | 1993 | 291          |
| 1955 | 2634         | 1968 | 1424         | 1981 | 4234         | 1994 | 407          |
| 1956 | 2418         | 1969 | 2186         | 1982 | 3270         | 1995 | 420          |
| 1957 | 2329         | 1970 | 620          | 1983 | 2126         | 1996 | 429          |
| 1958 | 2611         | 1971 | 1213         | 1984 | 2504         | 1997 | 476          |
| 1959 | 3372         | 1972 | 2410         | 1985 | 1962         | 1998 | 175          |
| 1960 | 2303         | 1973 | 1212         | 1986 | 2021         | 1999 | 178          |
| 1961 | 1385         | 1974 | 853          | 1987 | 1708         |      |              |



**Fig. 1** Time series of Ocean Station Data (OSD) chlorophyll profiles in WOD01 for the world ocean as a function of year.



**Fig. 2** Time series of Ocean Station Data (OSD) chlorophyll profiles in WOD01 for the southern hemisphere as a function of year.



**Fig. 3** Time series of Ocean Station Data (OSD) chlorophyll profiles in WOD01 for the northern hemisphere as a function of year.

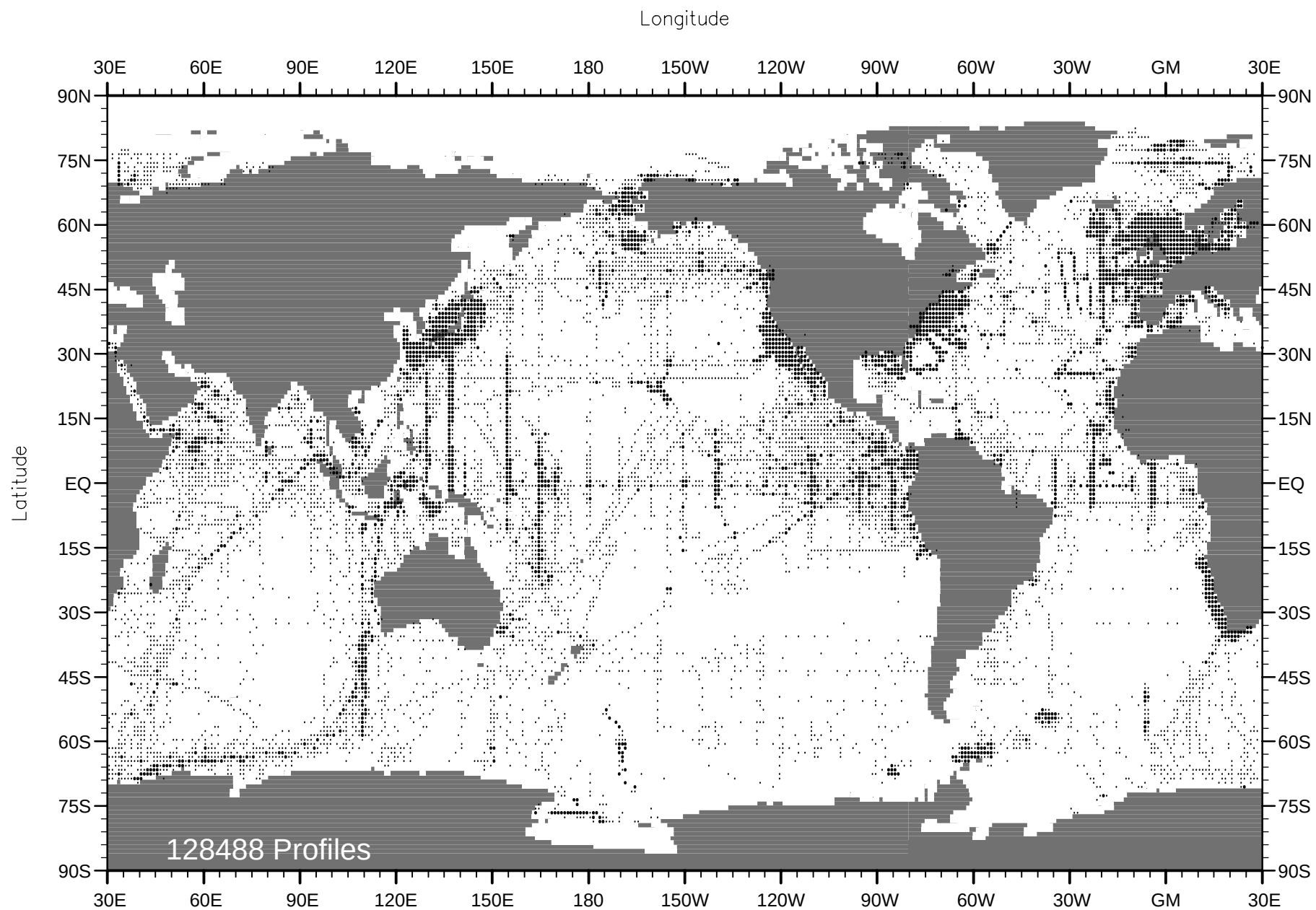
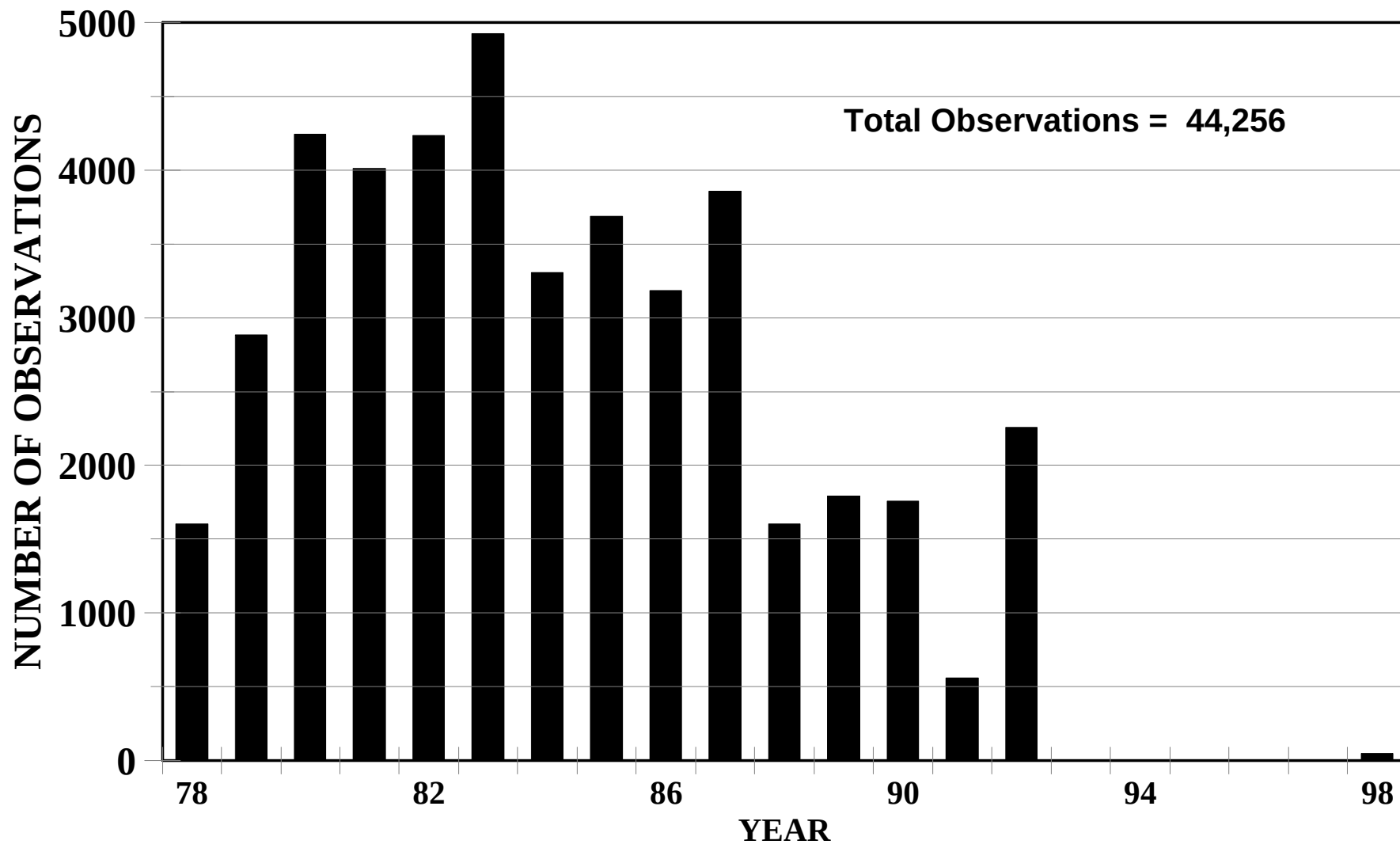
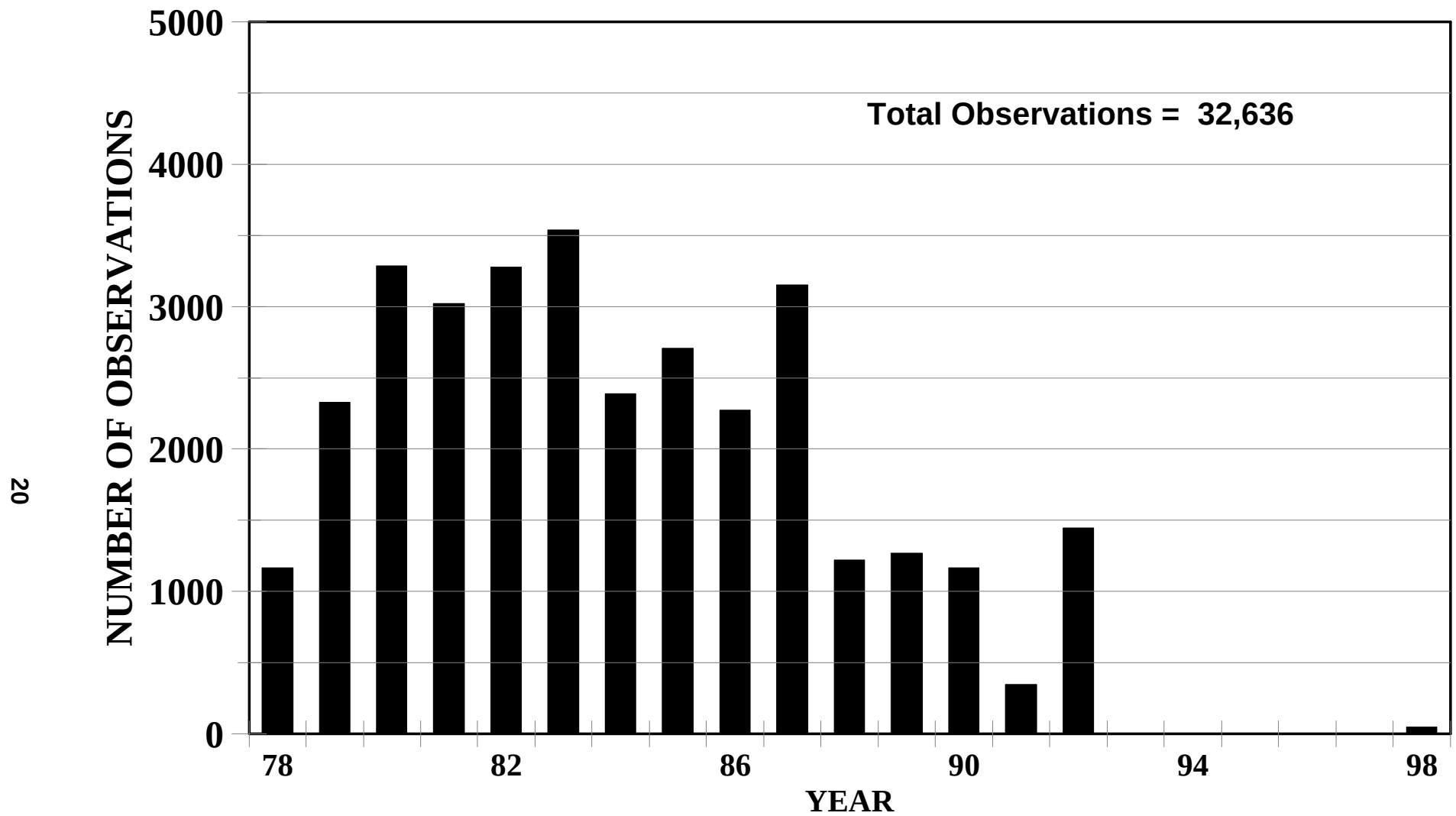


Fig. 4 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01.

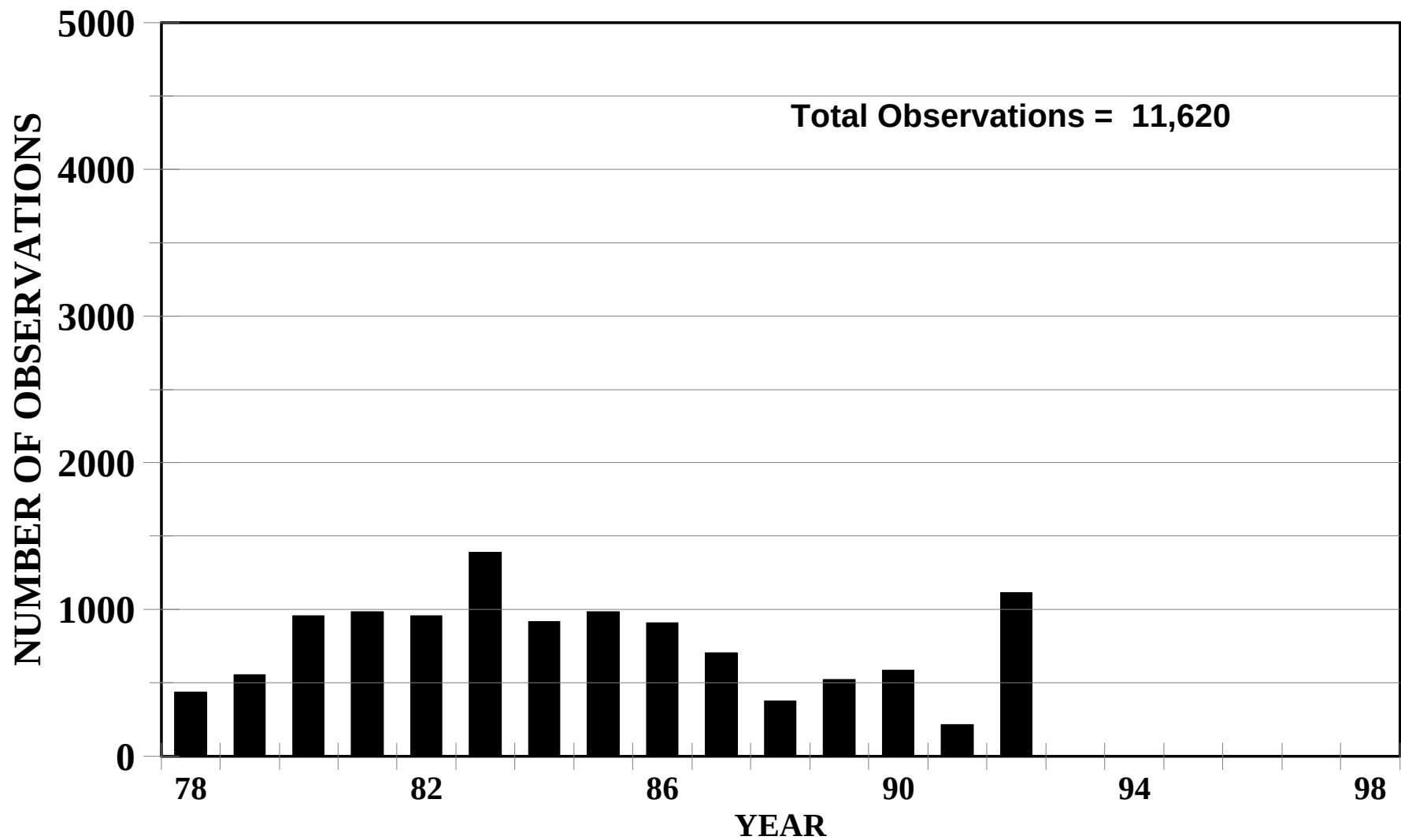
Dots show location of 1-degree squares containing any data.



**Fig. 5** Time series of Surface-only (SURF) chlorophyll observations in WOD01 for the world ocean as a function of year.



**Fig. 6** Time series of Surface-only (SURF) chlorophyll observations in WOD01 for the southern hemisphere as a function of year.



**Fig. 7** Time series of Surface-only (SURF) chlorophyll observations in WOD01 for the northern hemisphere as a function of year.



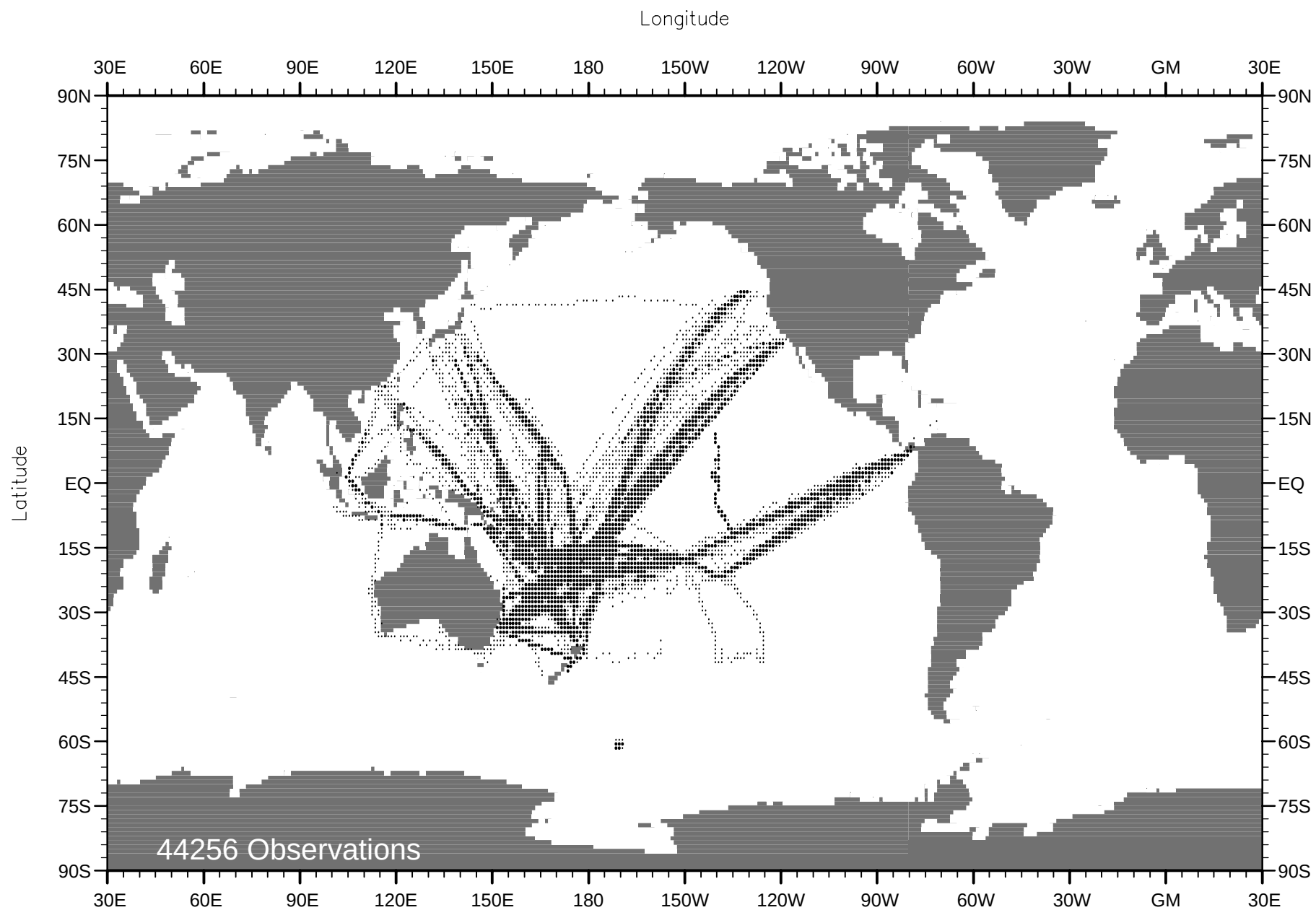
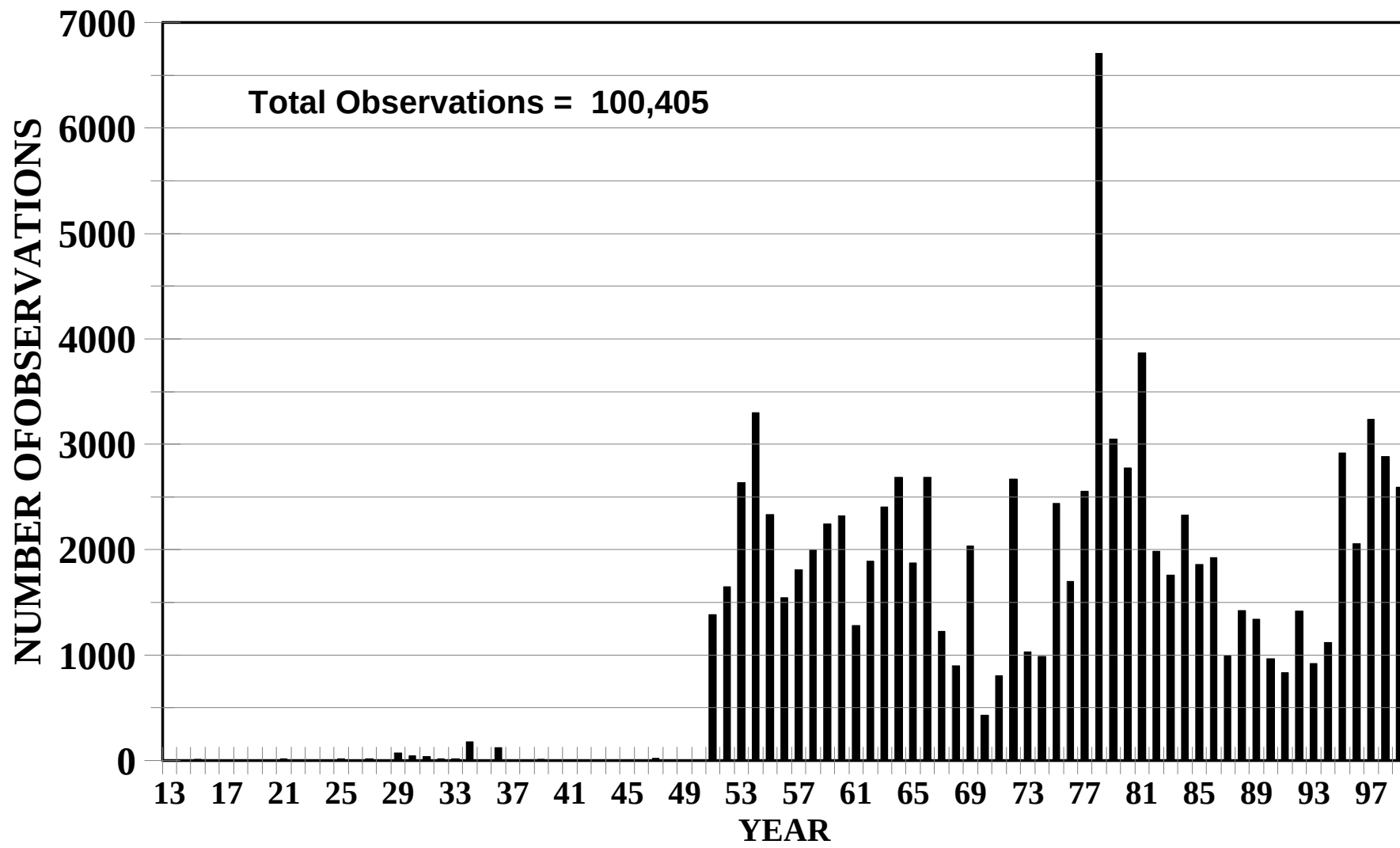
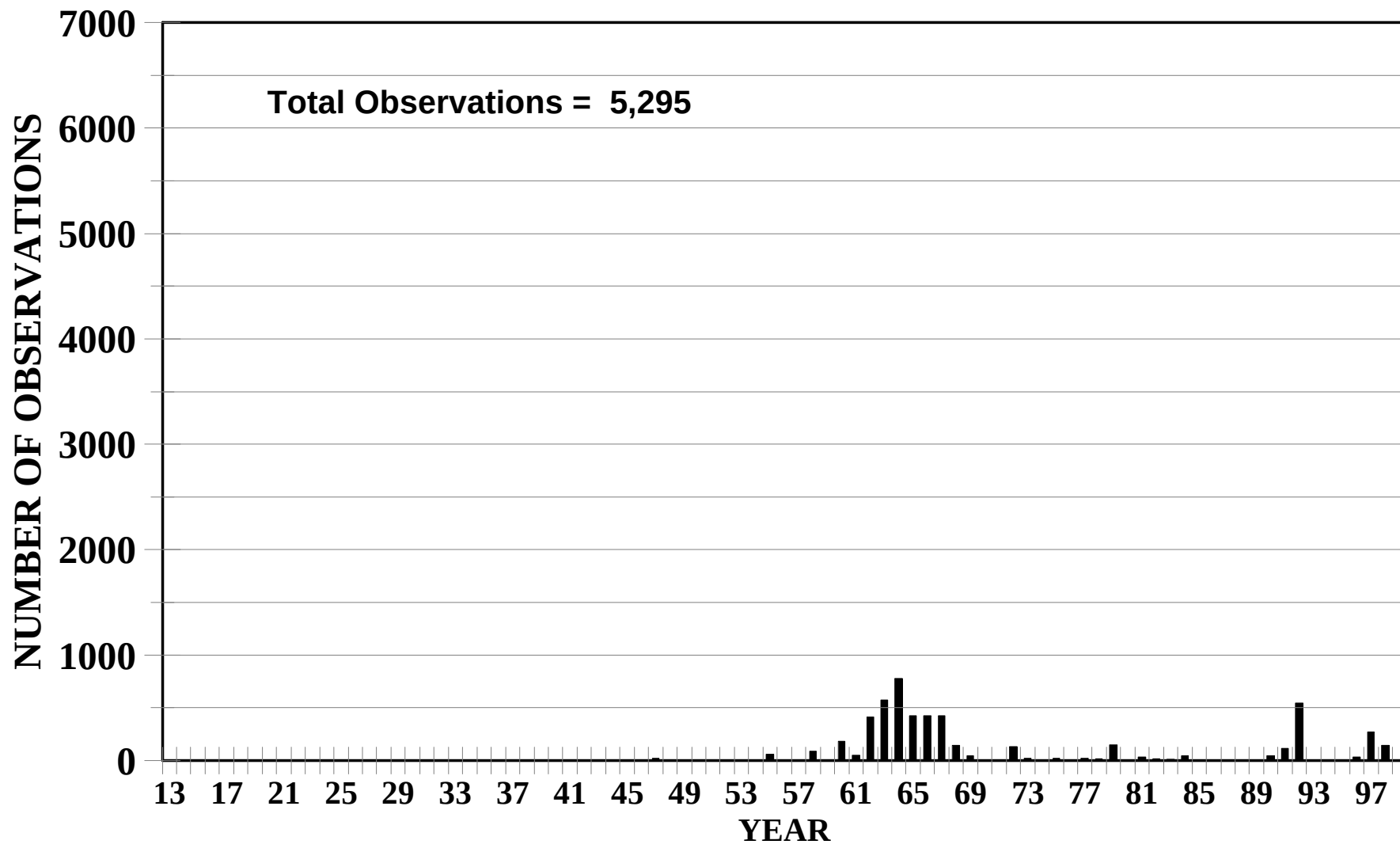


Fig. 8 Distribution of all Surface-only (SURF) chlorophyll observations in WOD01.

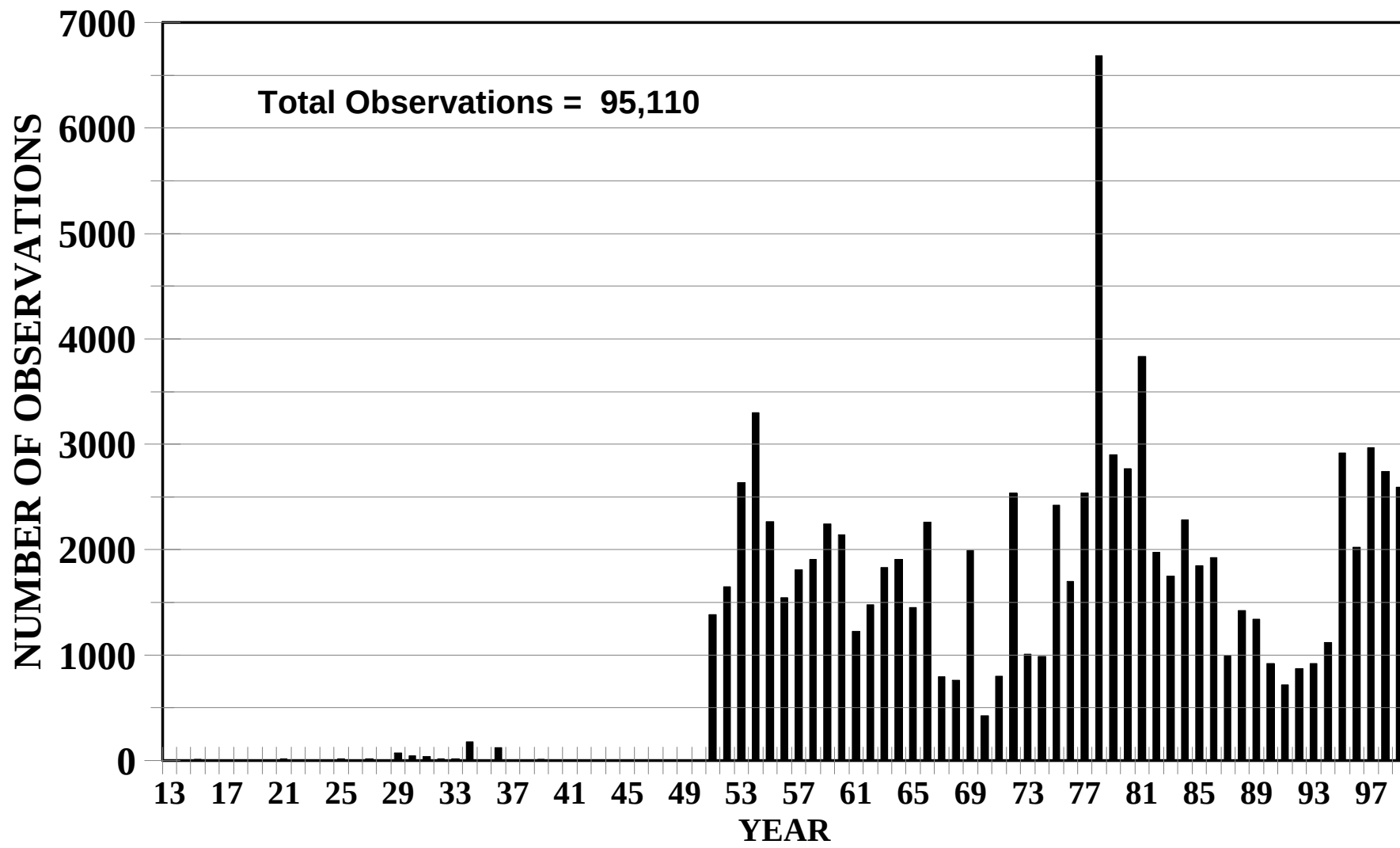
Dots show location of 1-degree squares containing any data.



**Fig. 9** Time series of Ocean Station Data (OSD) plankton abundance data in WOD01 for the world ocean as a function of year.



**Fig. 10** Time series of Ocean Station Data (OSD) plankton abundance data in WOD01 for the southern hemisphere as a function of year.



**Fig. 11** Time series of Ocean Station Data (OSD) plankton abundance data in WOD01 for the northern hemisphere as a function of year.

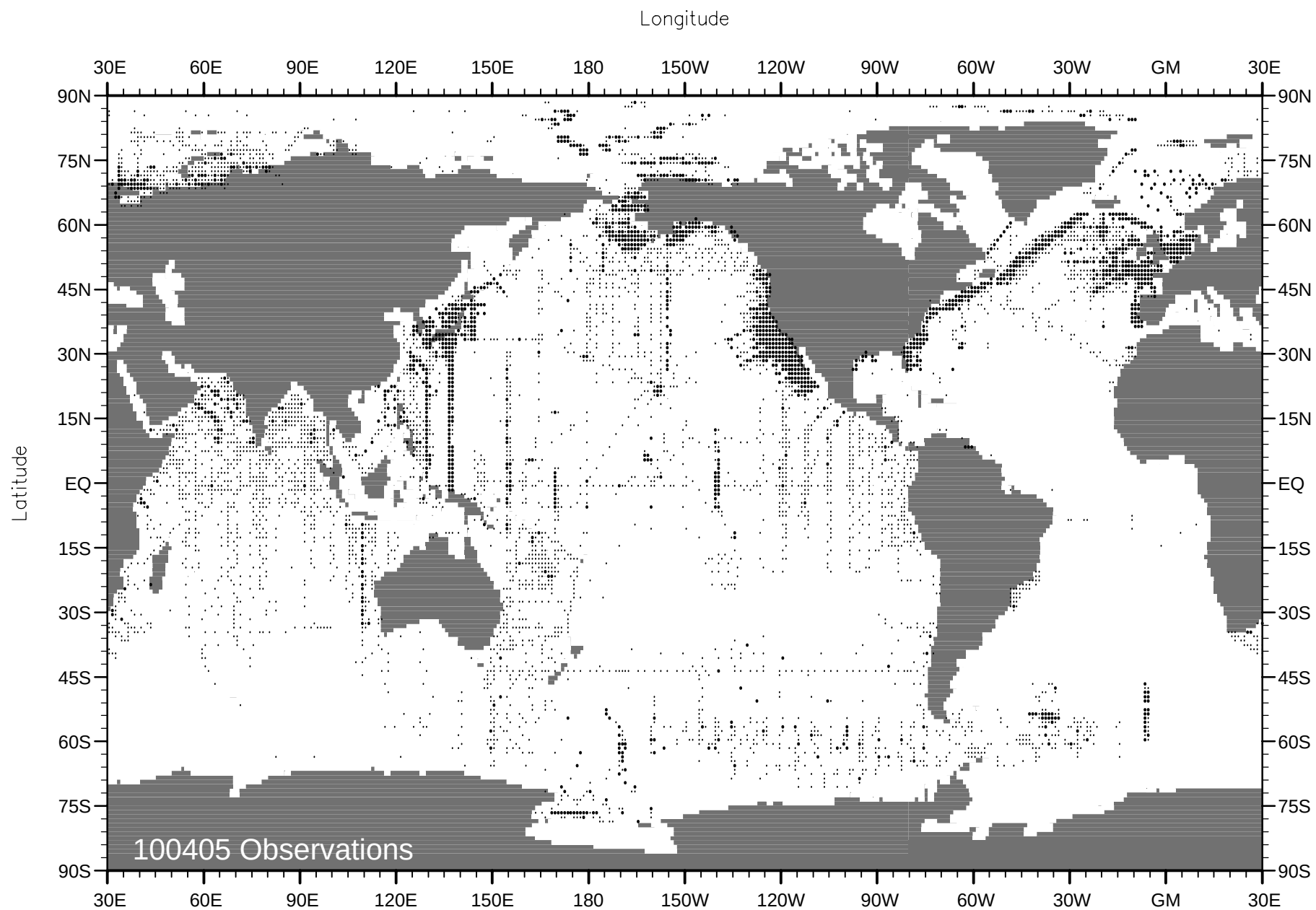
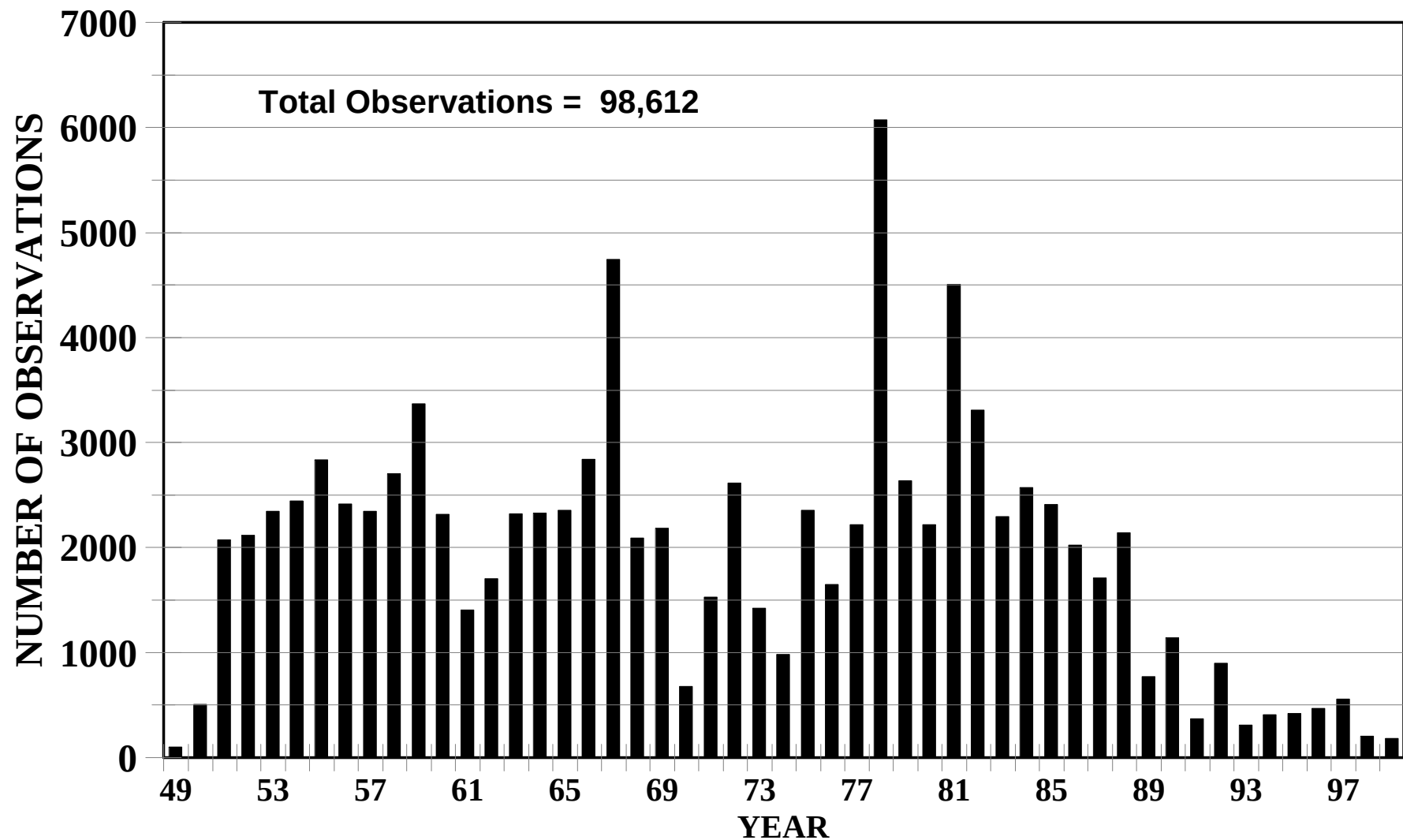
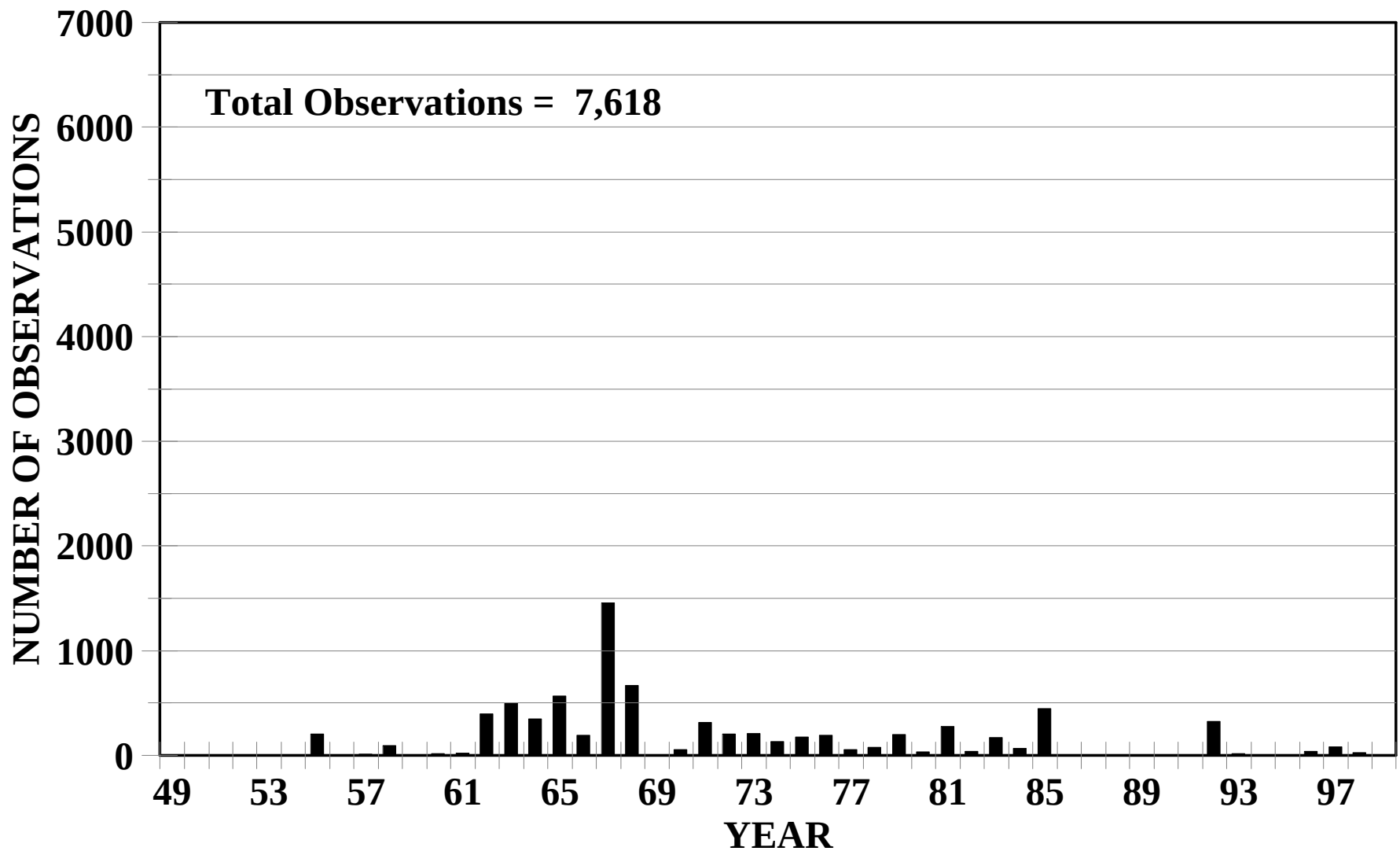


Fig. 12 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01.

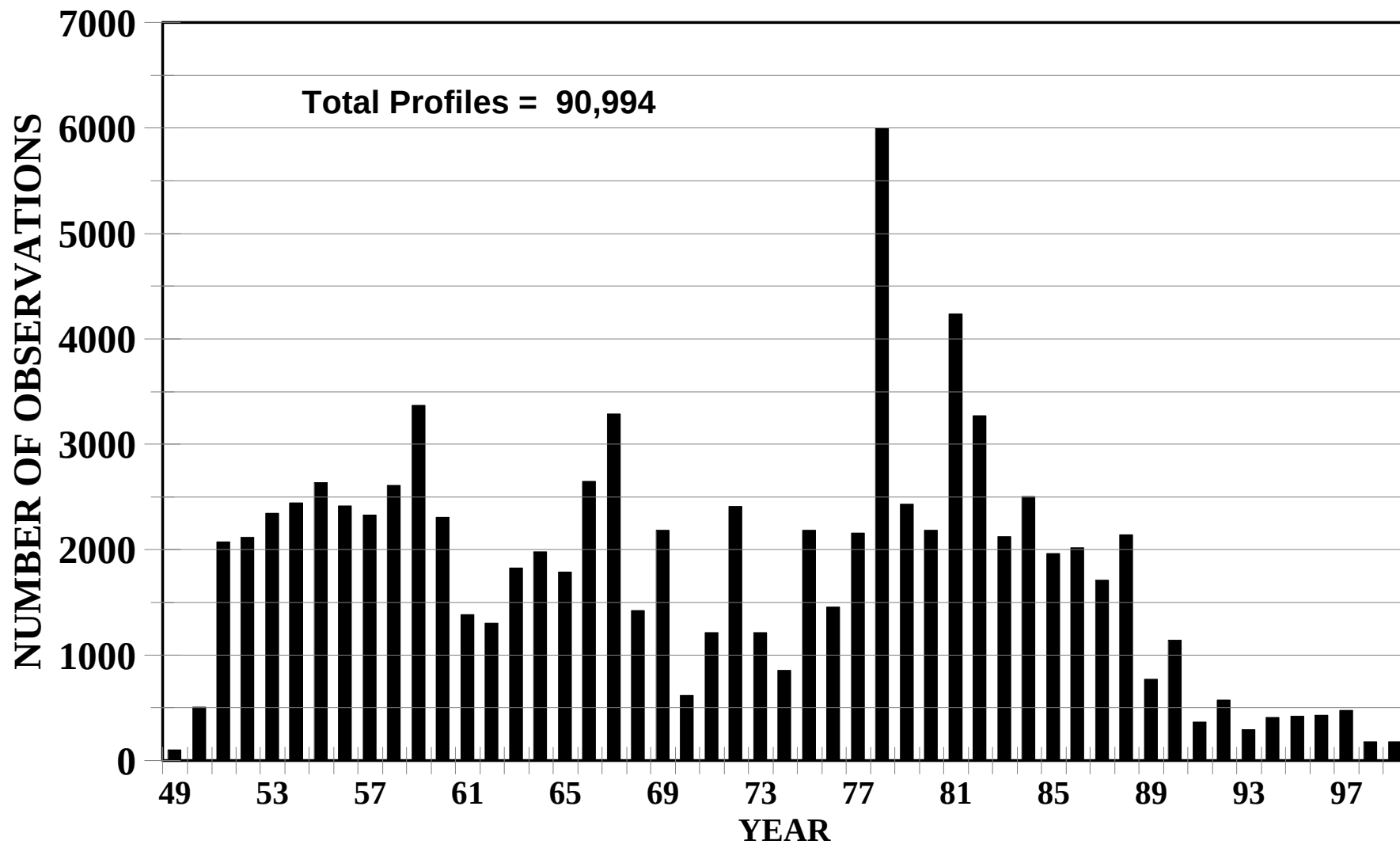
Dots show location of 1-degree squares containing any data.



**Fig. 13** Time series of Ocean Station Data (OSD) plankton biomass data in WOD01 for the world ocean as a function of year.



**Fig. 14** Time series of Ocean Station Data (OSD) plankton biomass data in WOD01 for the southern hemisphere as a function of year.



**Fig. 15** Time series of Ocean Station Data (OSD) plankton biomass data in WOD01 for the northern hemisphere as a function of year.



Latitude

Longitude

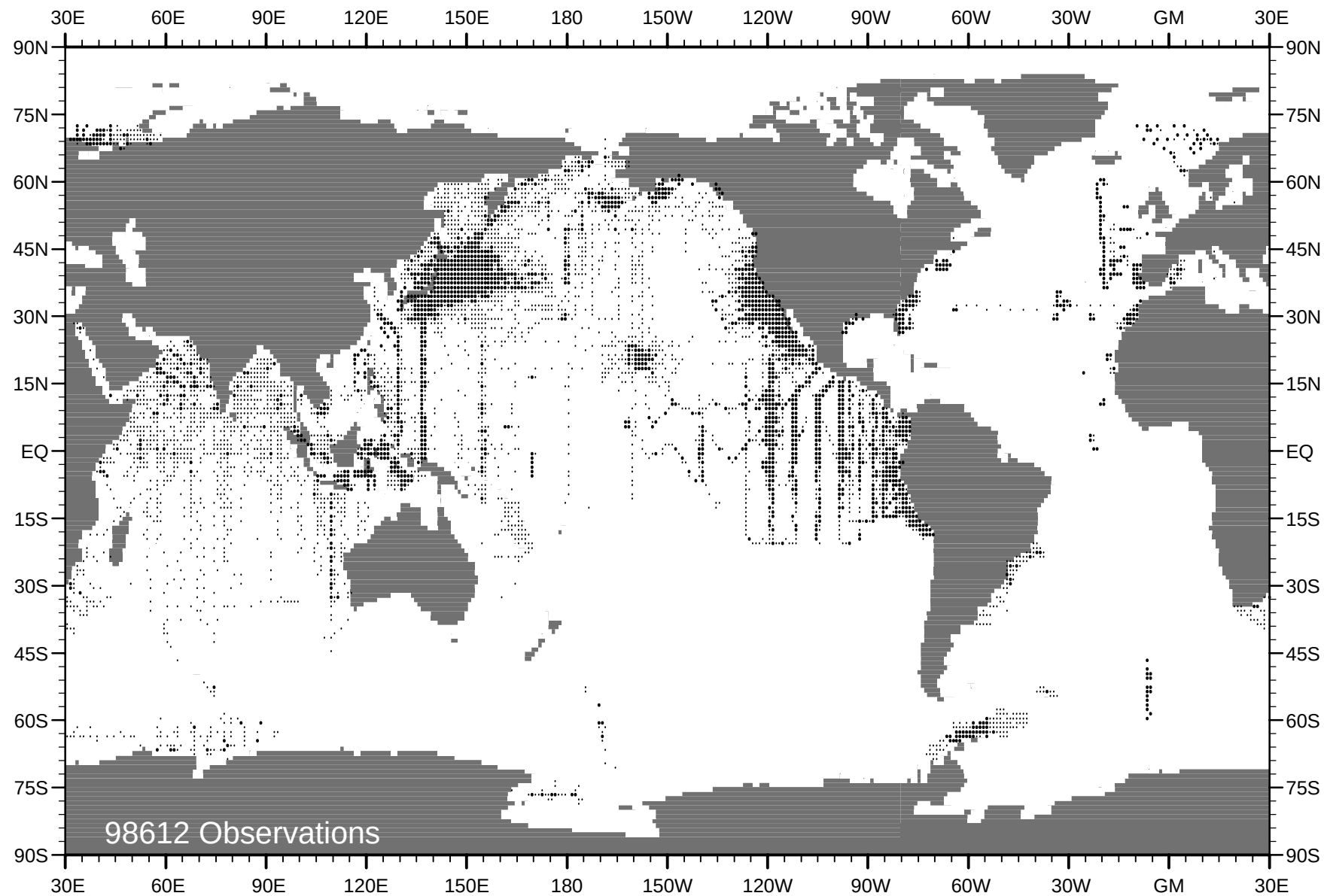


Fig. 16 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01.

Dots show location of 1-degree squares containing any data.

### 3. BIBLIOGRAPHY

- Levitus, S., R. Gelfeld, T. Boyer, and D. Johnson, 1994: *Results of the NODC and IOC Data Archaeology and Rescue projects. Key to Oceanographic Records Documentation No. 19*, National Oceanographic Data Center, Washington, D.C., 67 pp.
- Levitus, S., R. Gelfeld, M. Conkright, T.P. Boyer, D. Johnson, I. Smolyar, C. Jones, G. Trammell, R. Moffatt, T. O'Brien, O. Baranova, C. Forgy, 2002: *Results of the NODC and IOC Oceanographic Data Archaeology and Rescue Projects*. In preparation.

#### **4. APPENDIX A: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL OCEAN STATION DATA (OSD) CHLOROPHYLL PROFILES IN WOD01**

This appendix contains yearly distributions of all OSD chlorophyll profiles contained in WOD01. 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 WOD01 OSD chlorophyll profiles are plotted including stations that may be erroneously located over land. However, WOD01 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.

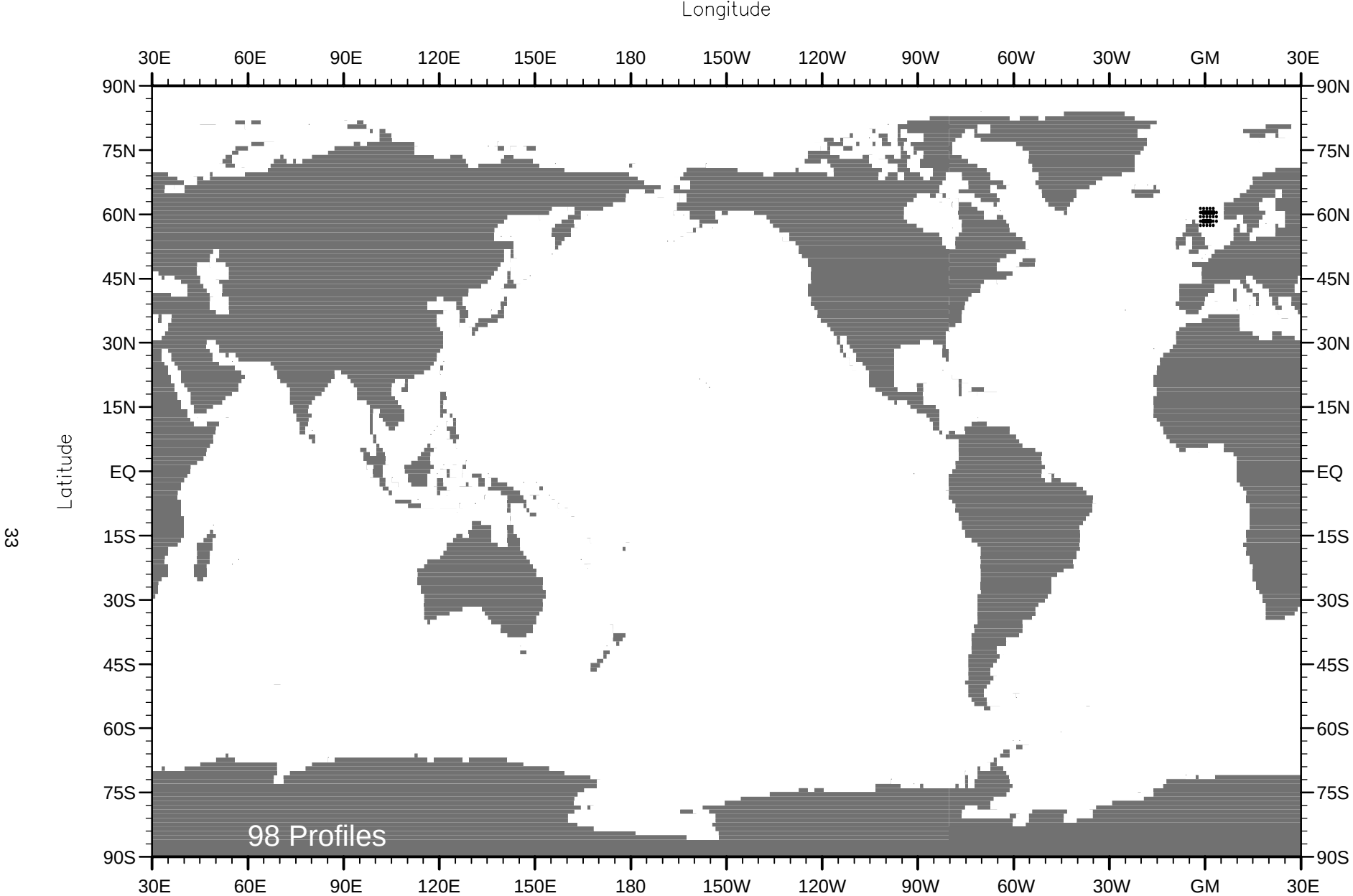


Fig. A1 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1954 .

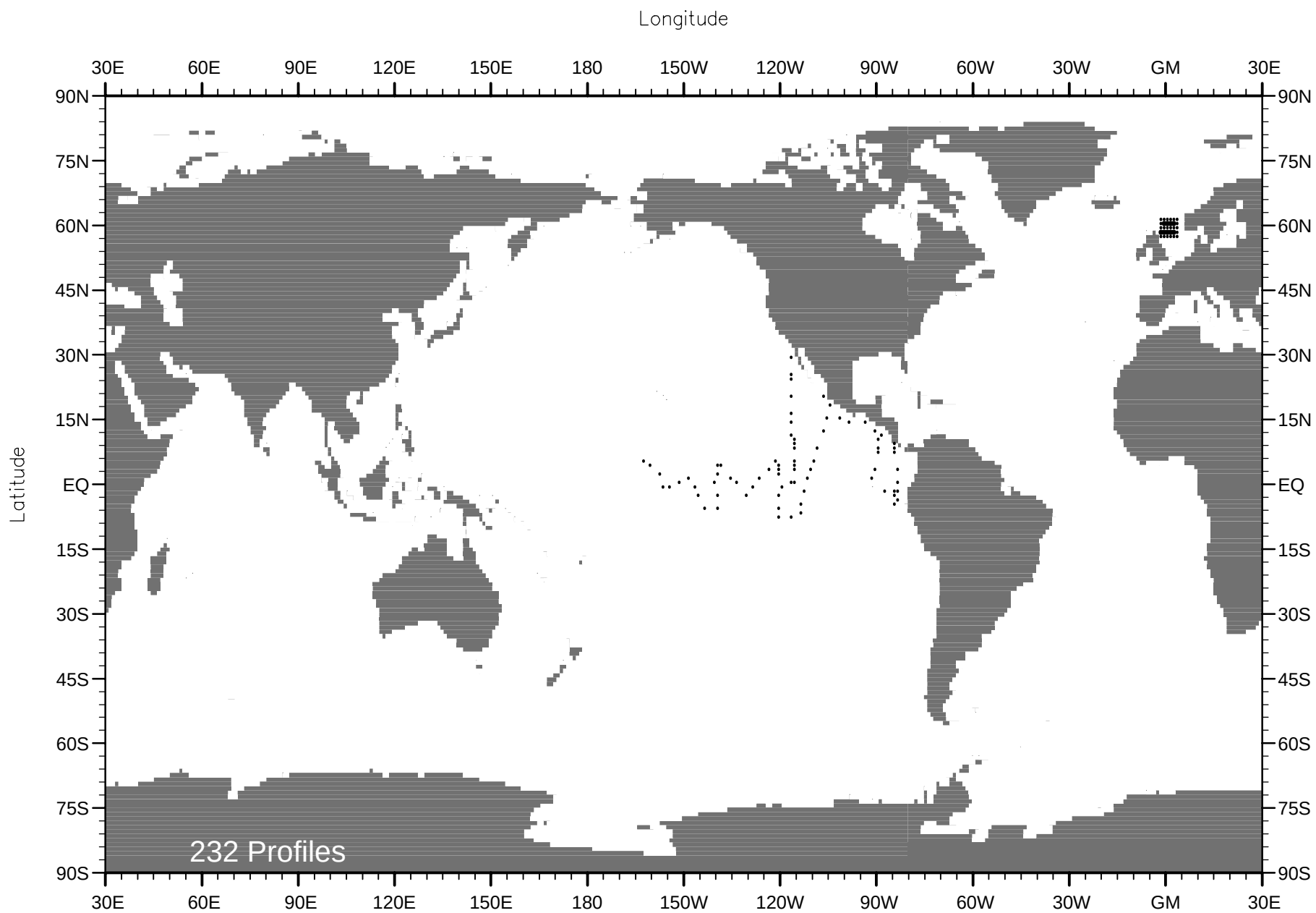


Fig. A2 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1955 .

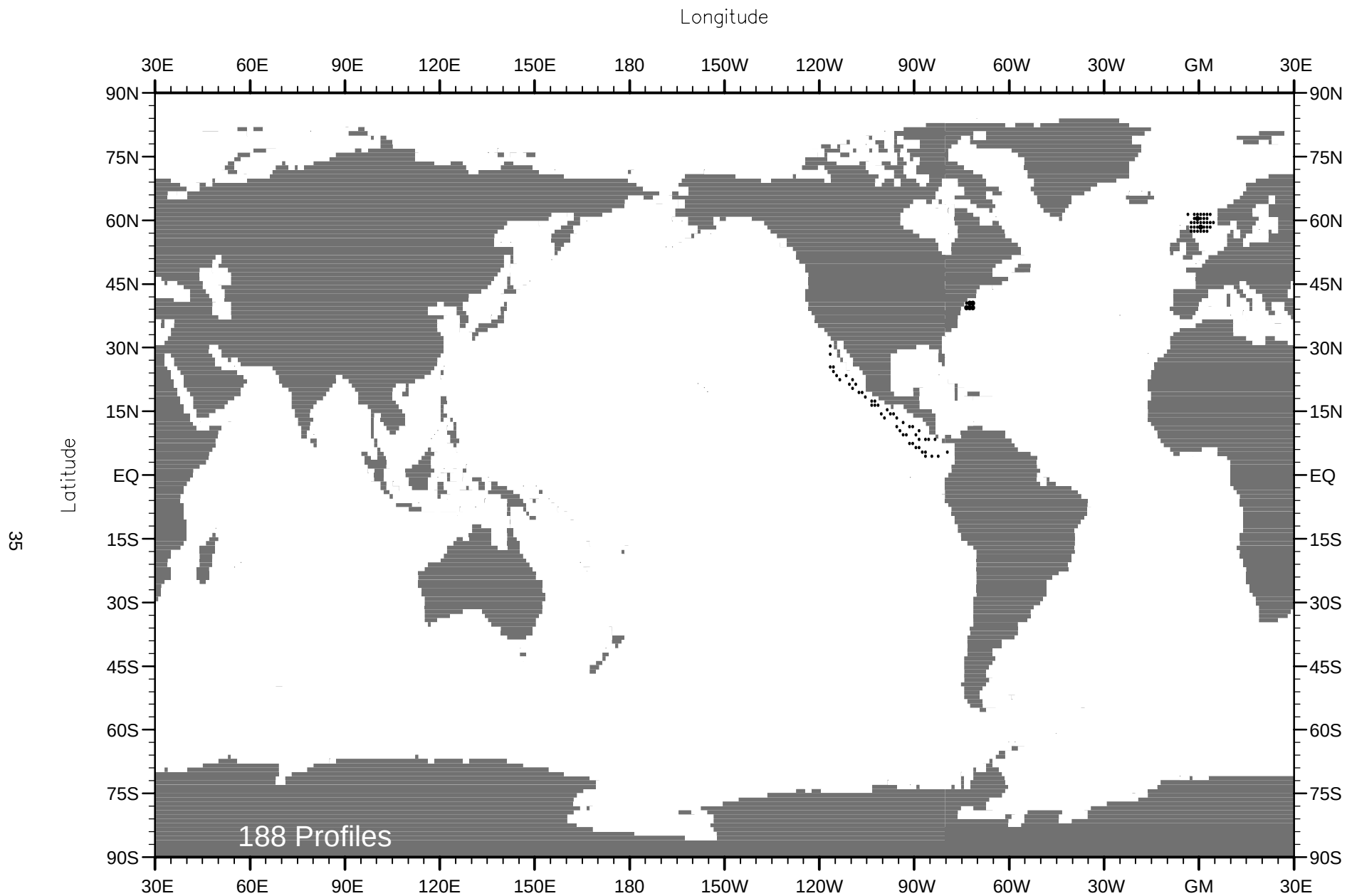


Fig. A3 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1956 .

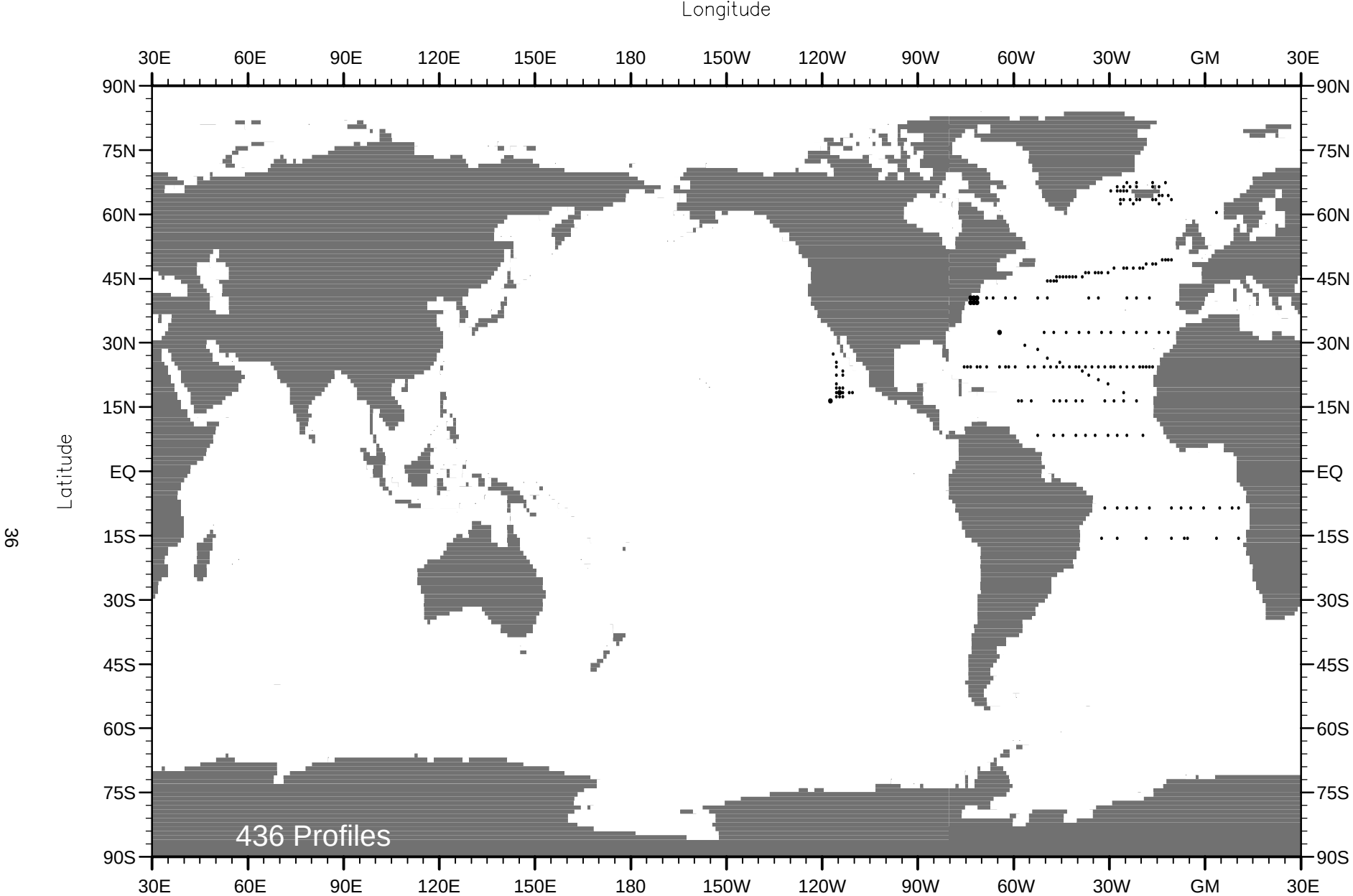


Fig. A4 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1957 .

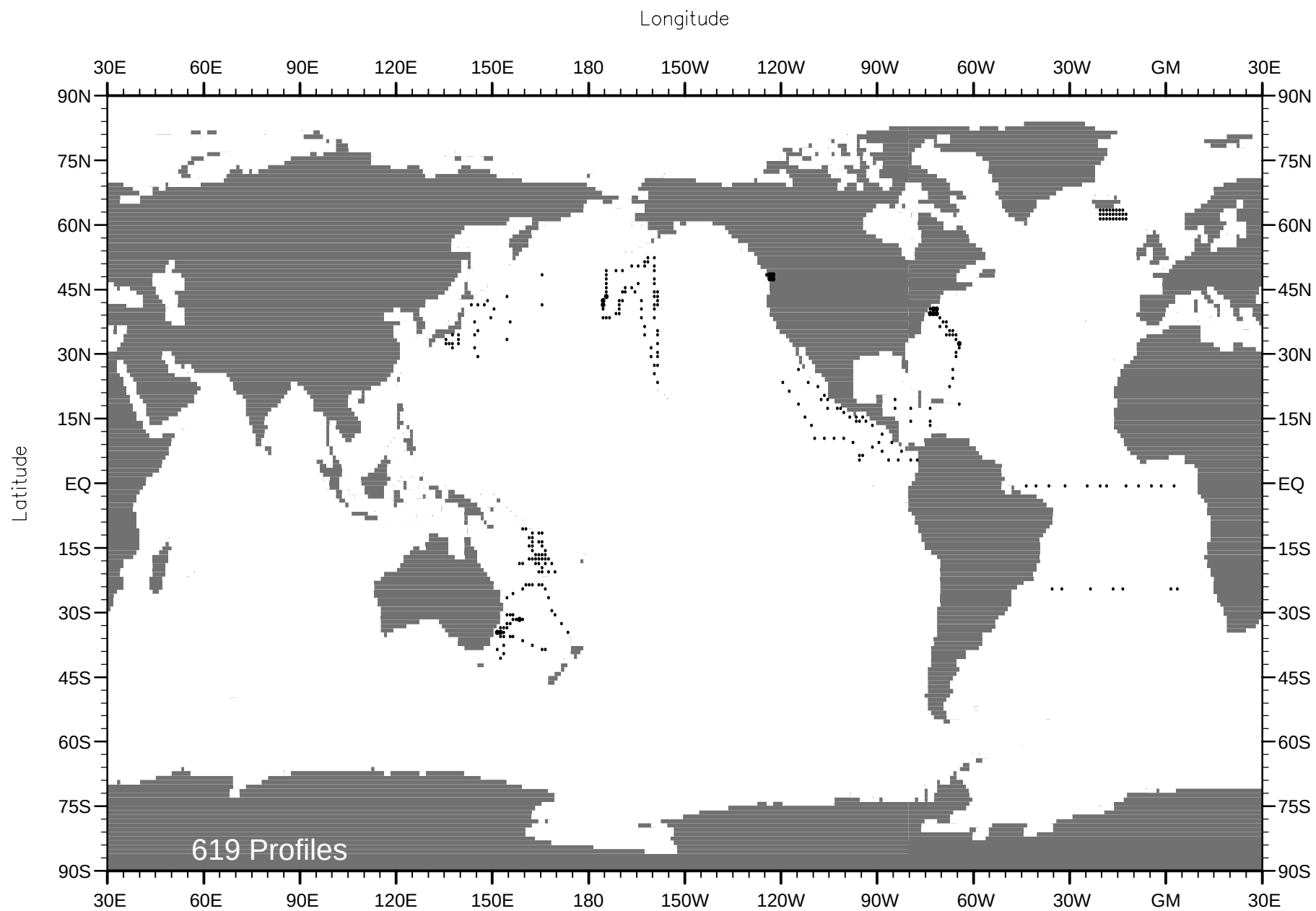


Fig. A5 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1958 .



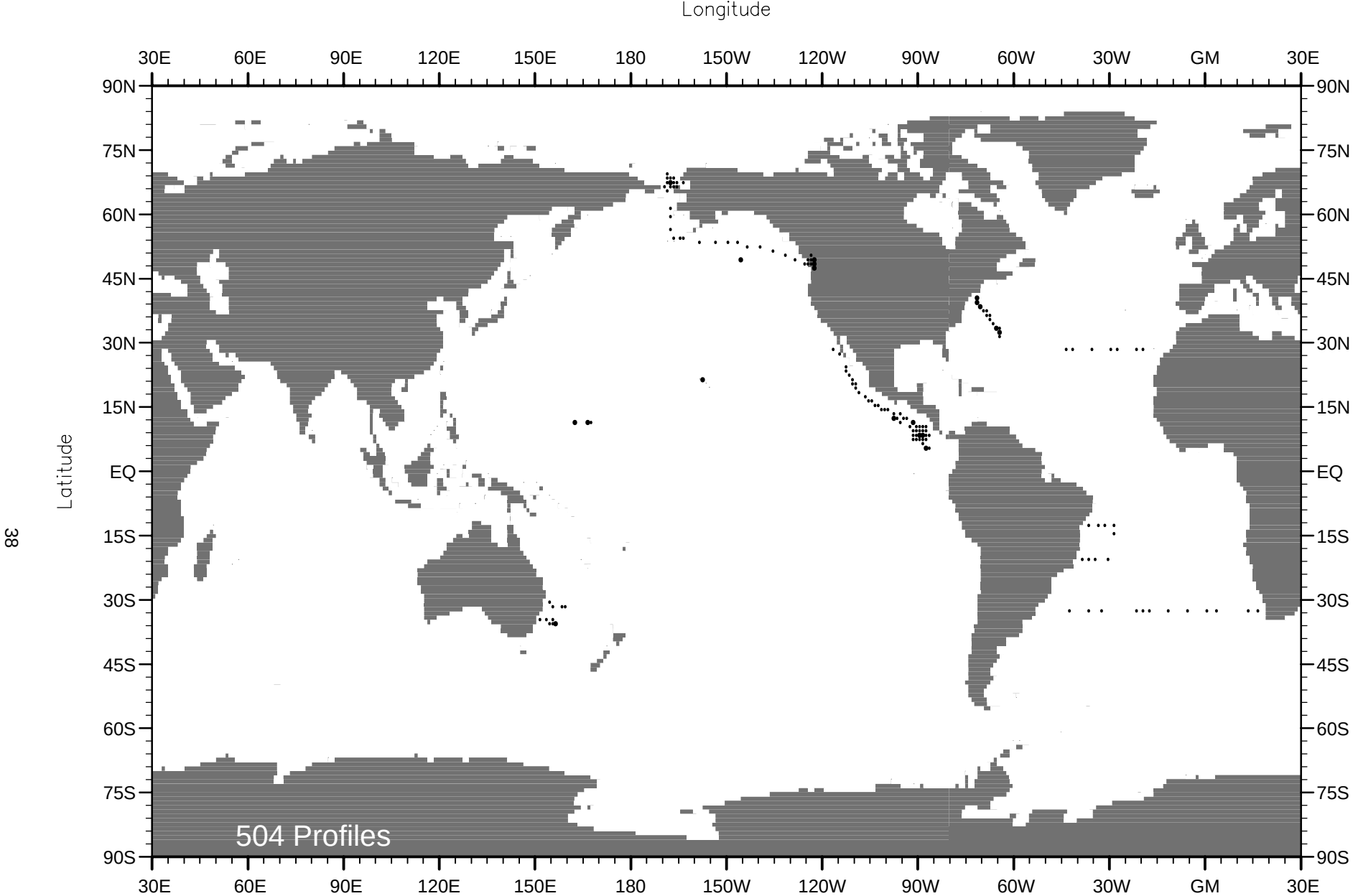


Fig. A6 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1959 .

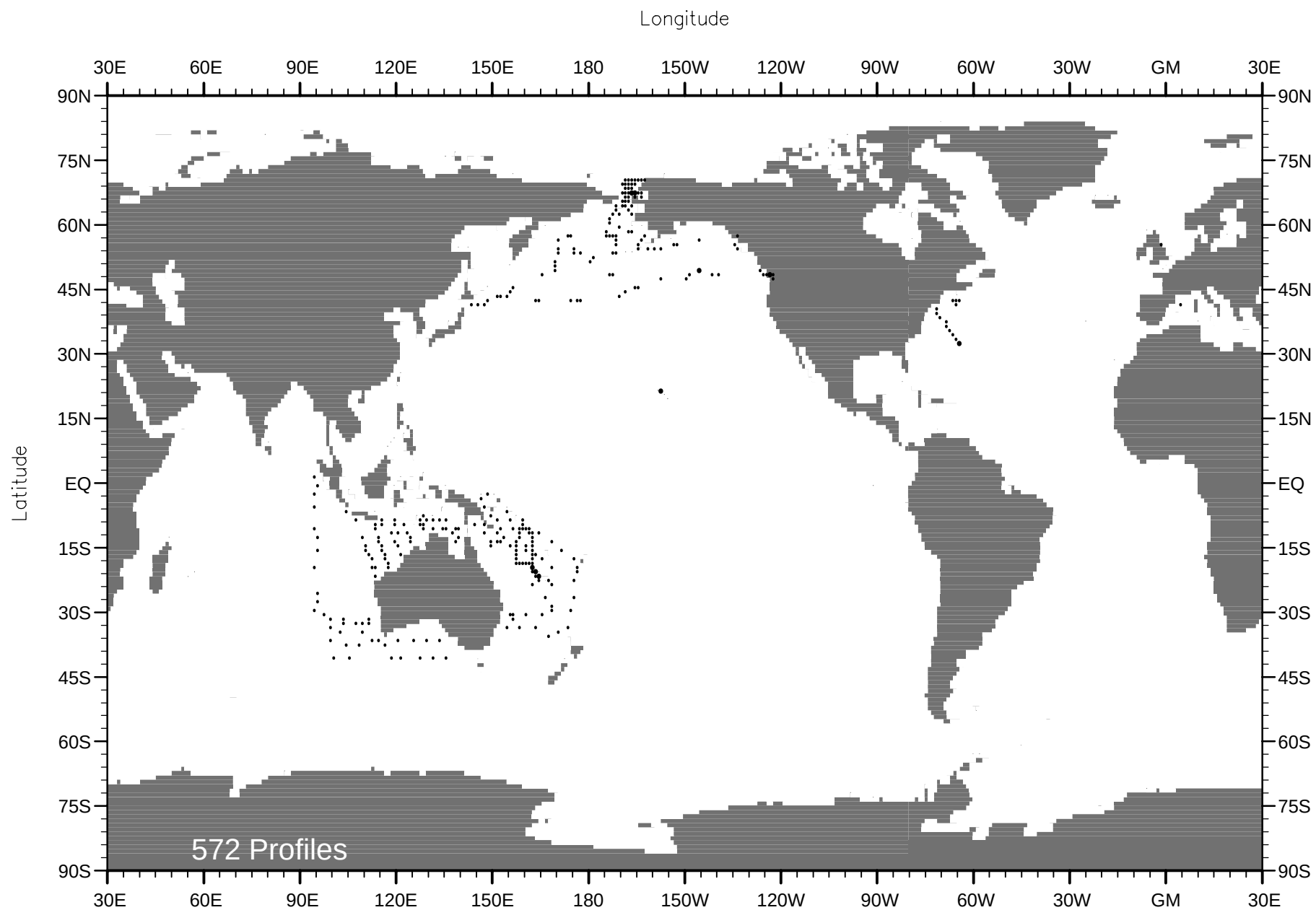


Fig. A7 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1960 .

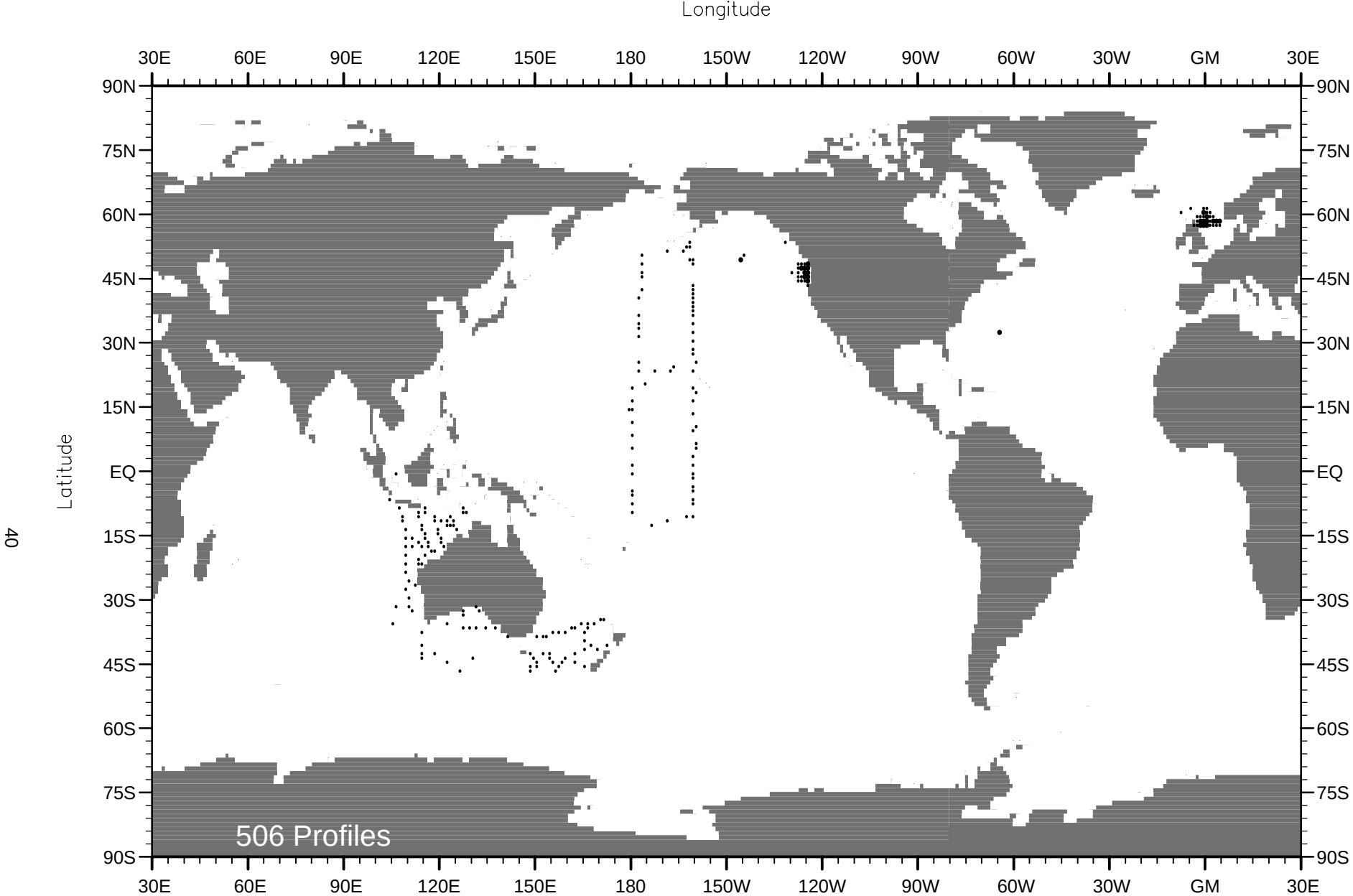


Fig. A8 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1961 .

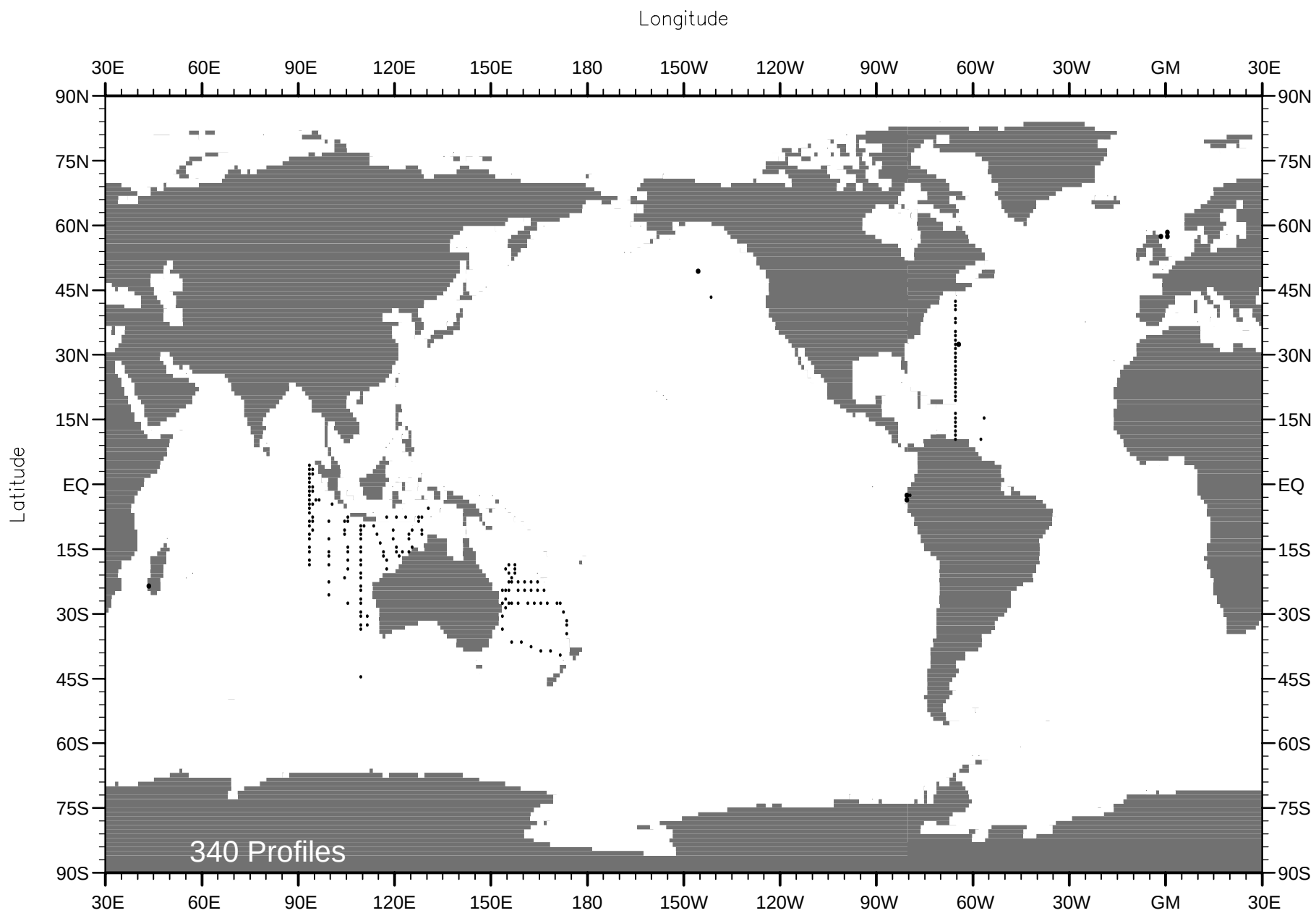


Fig. A9 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1962 .

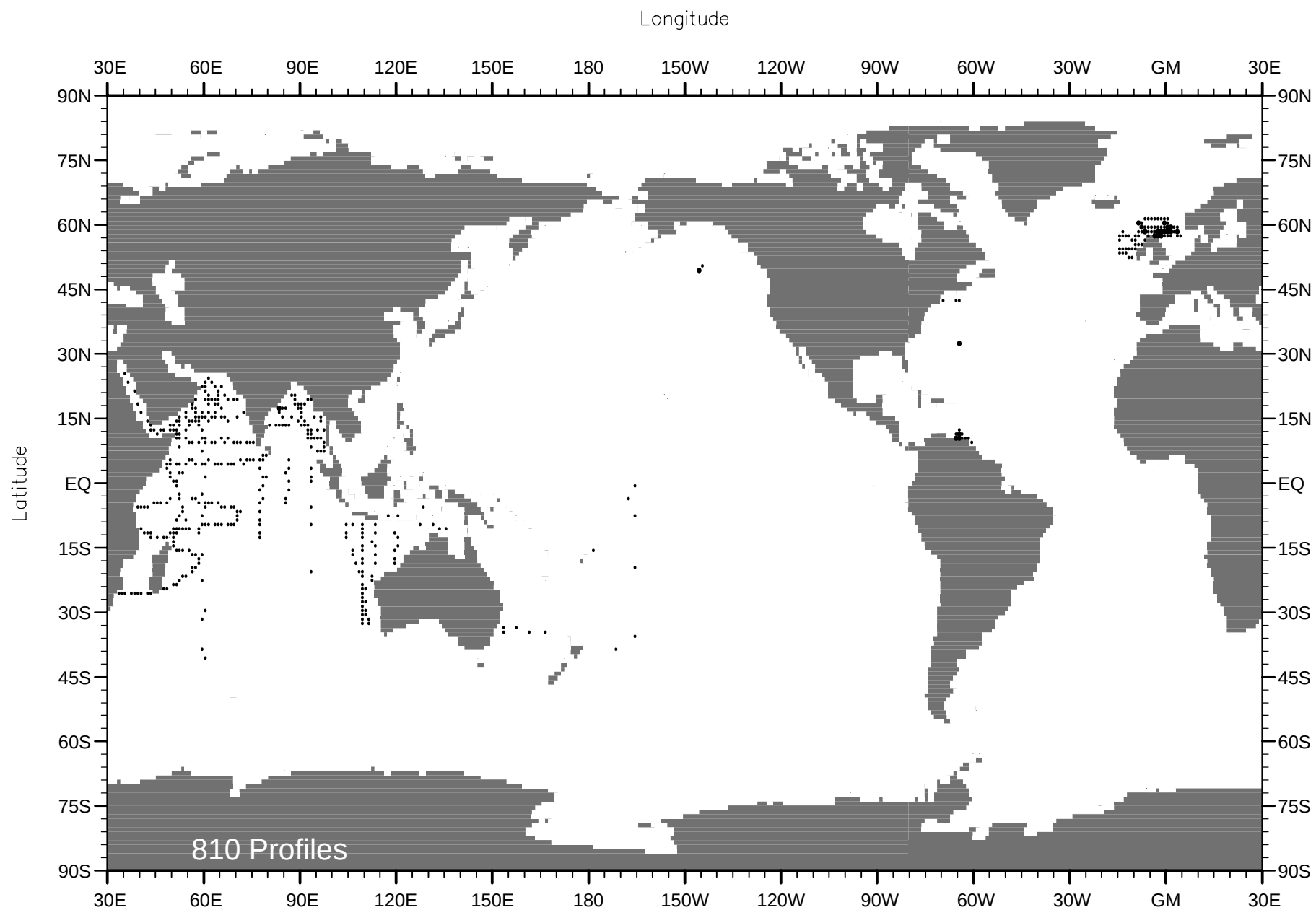


Fig. A10 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1963 .

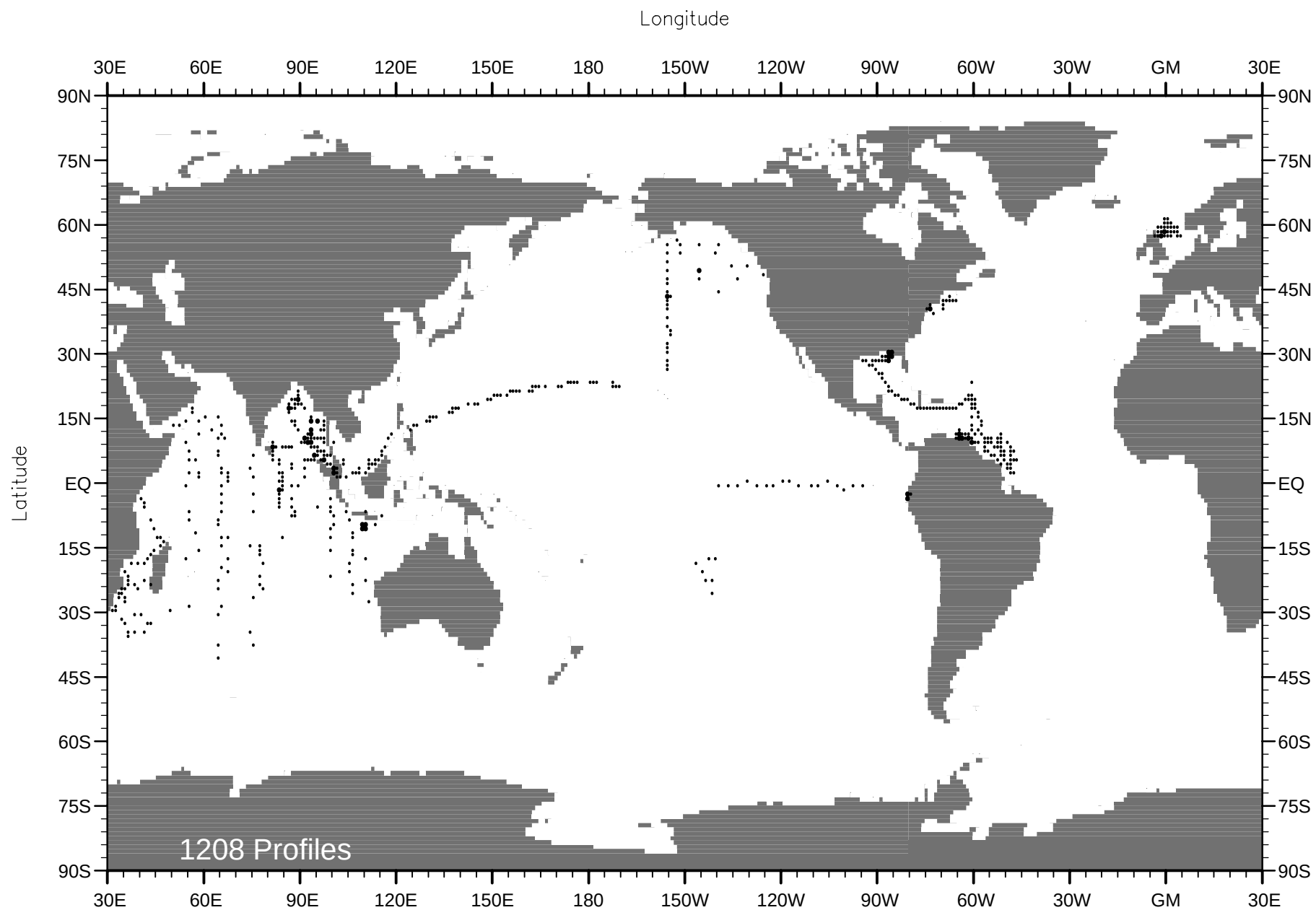


Fig. A11 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1964 .

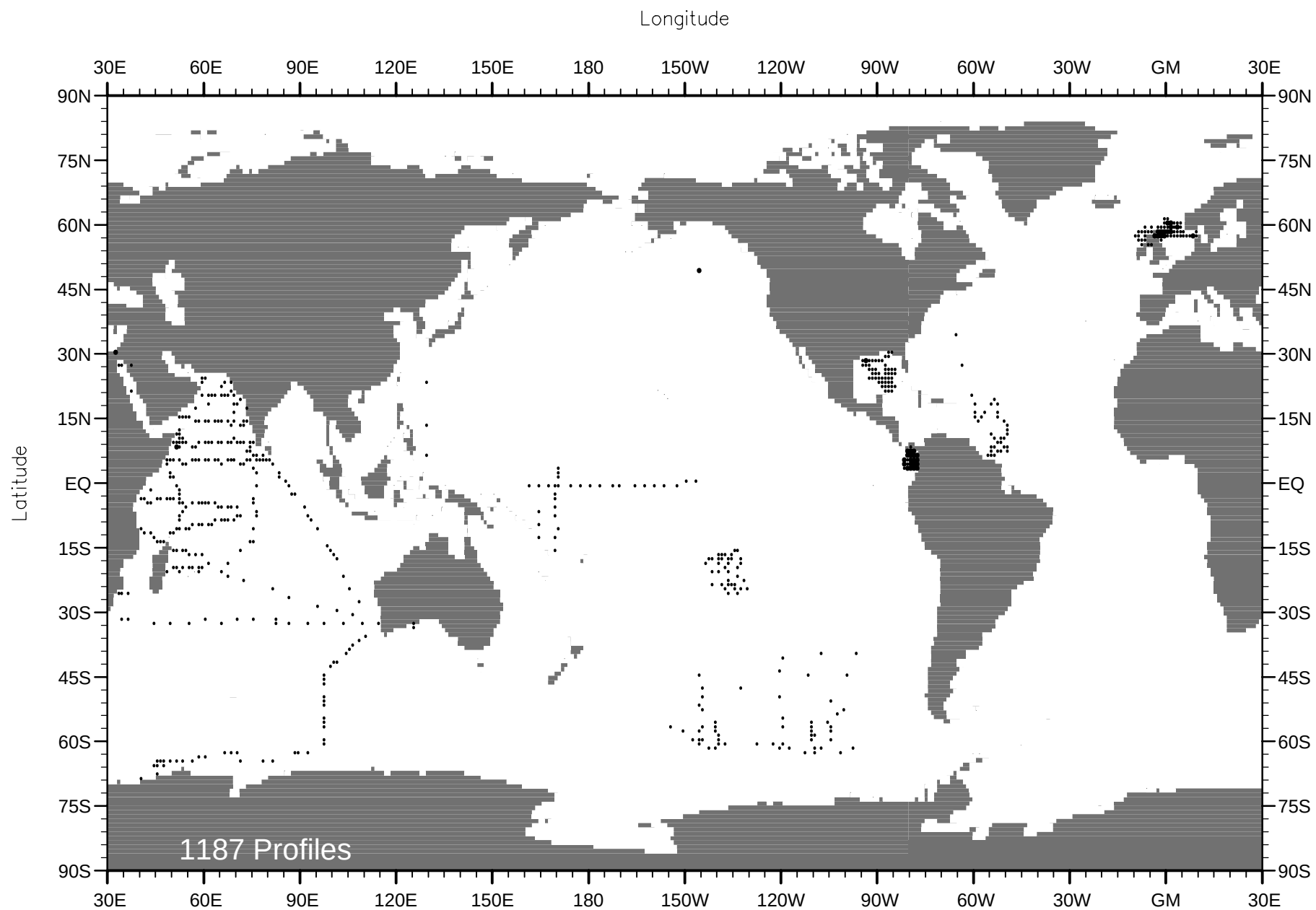


Fig. A12 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1965 .

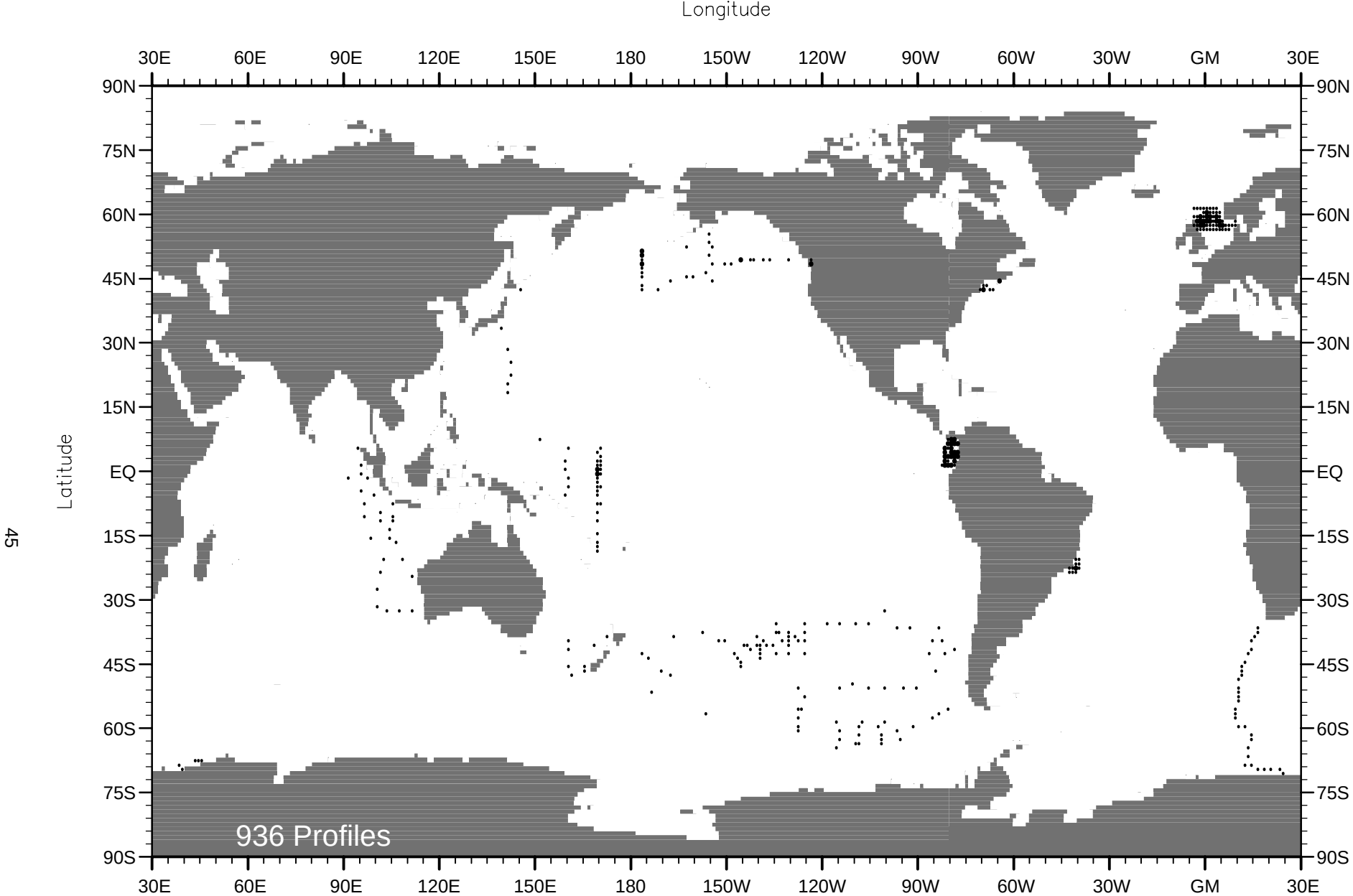


Fig. A13 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1966 .



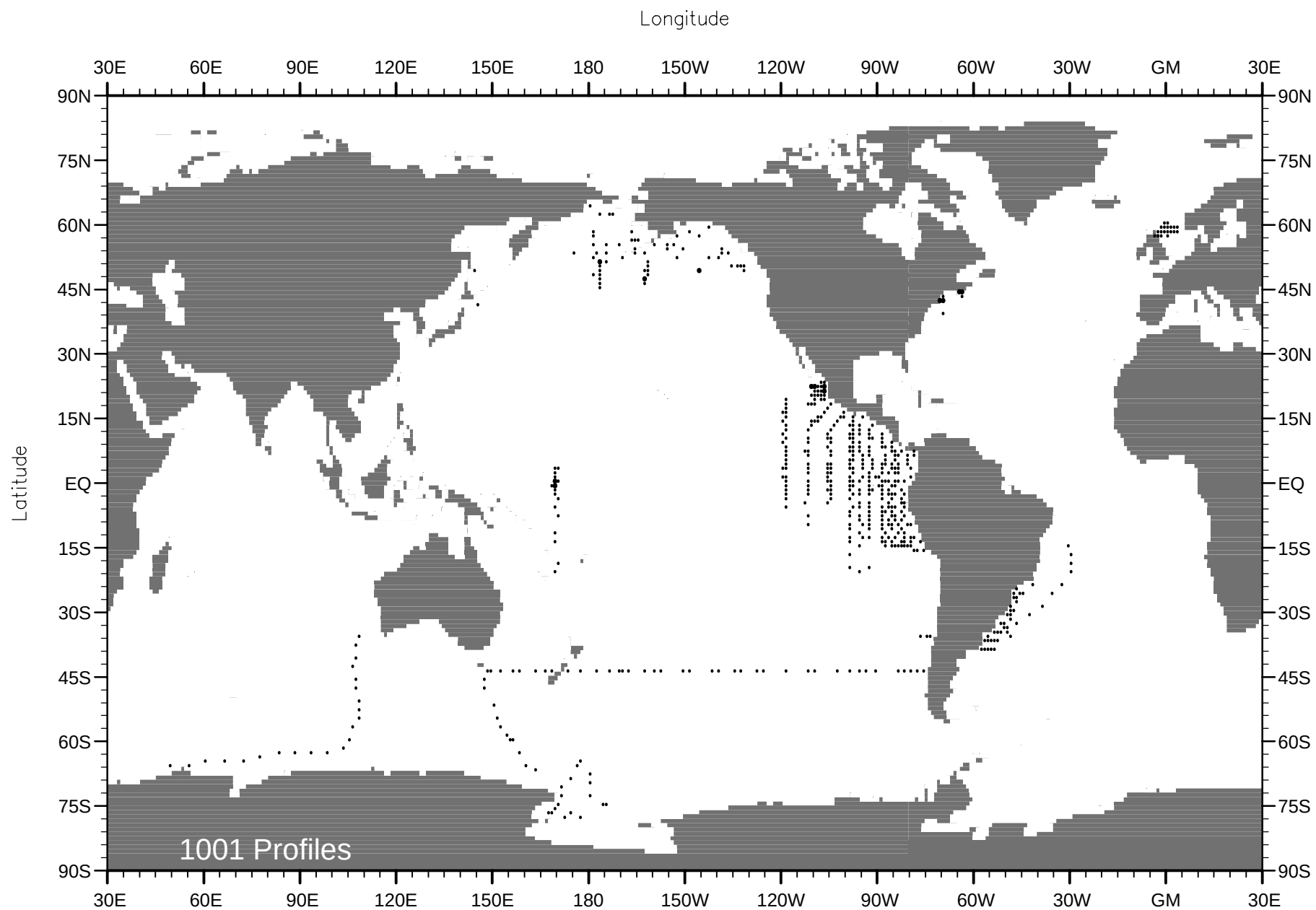


Fig. A14 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1967 .

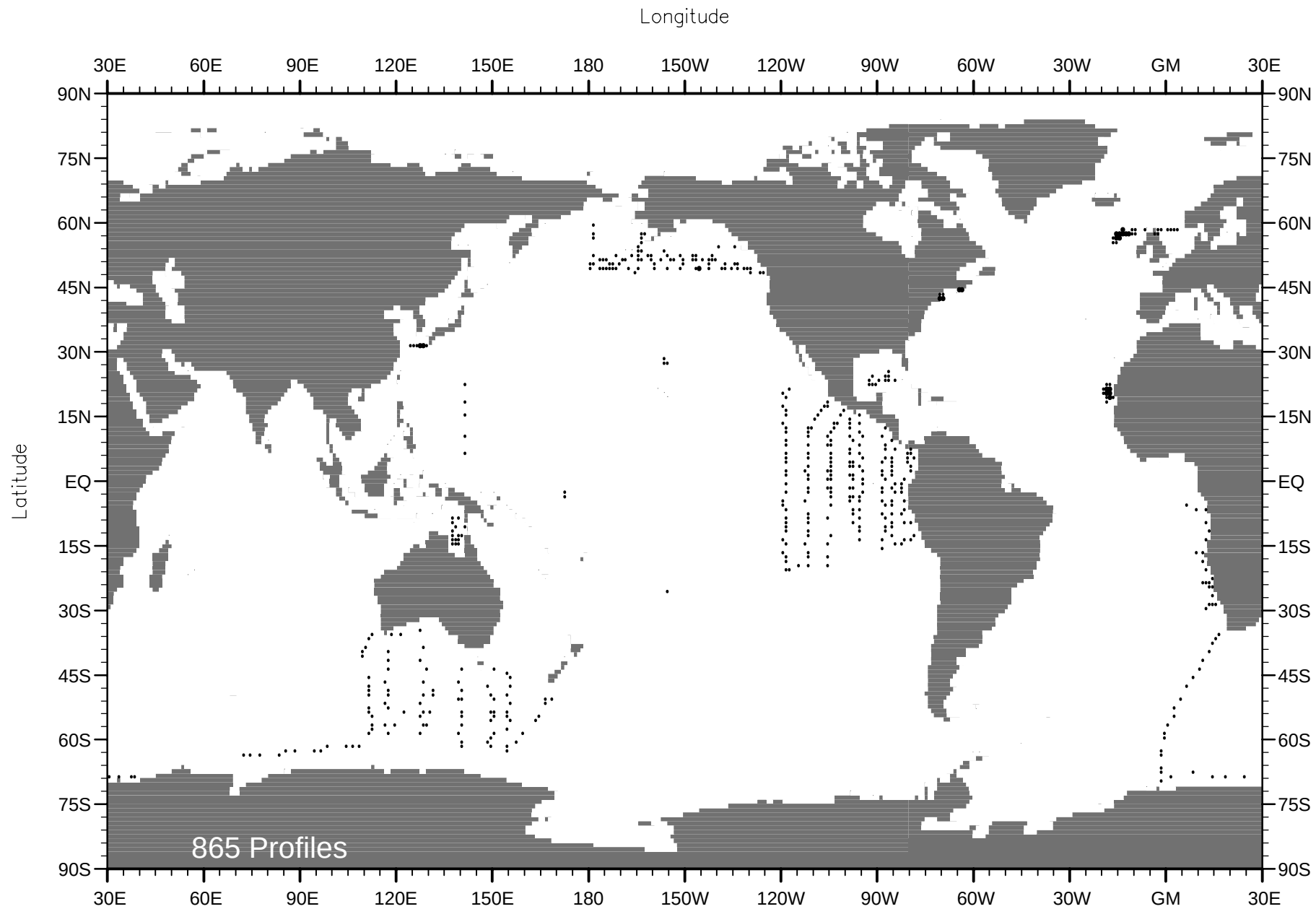


Fig. A15 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1968 .

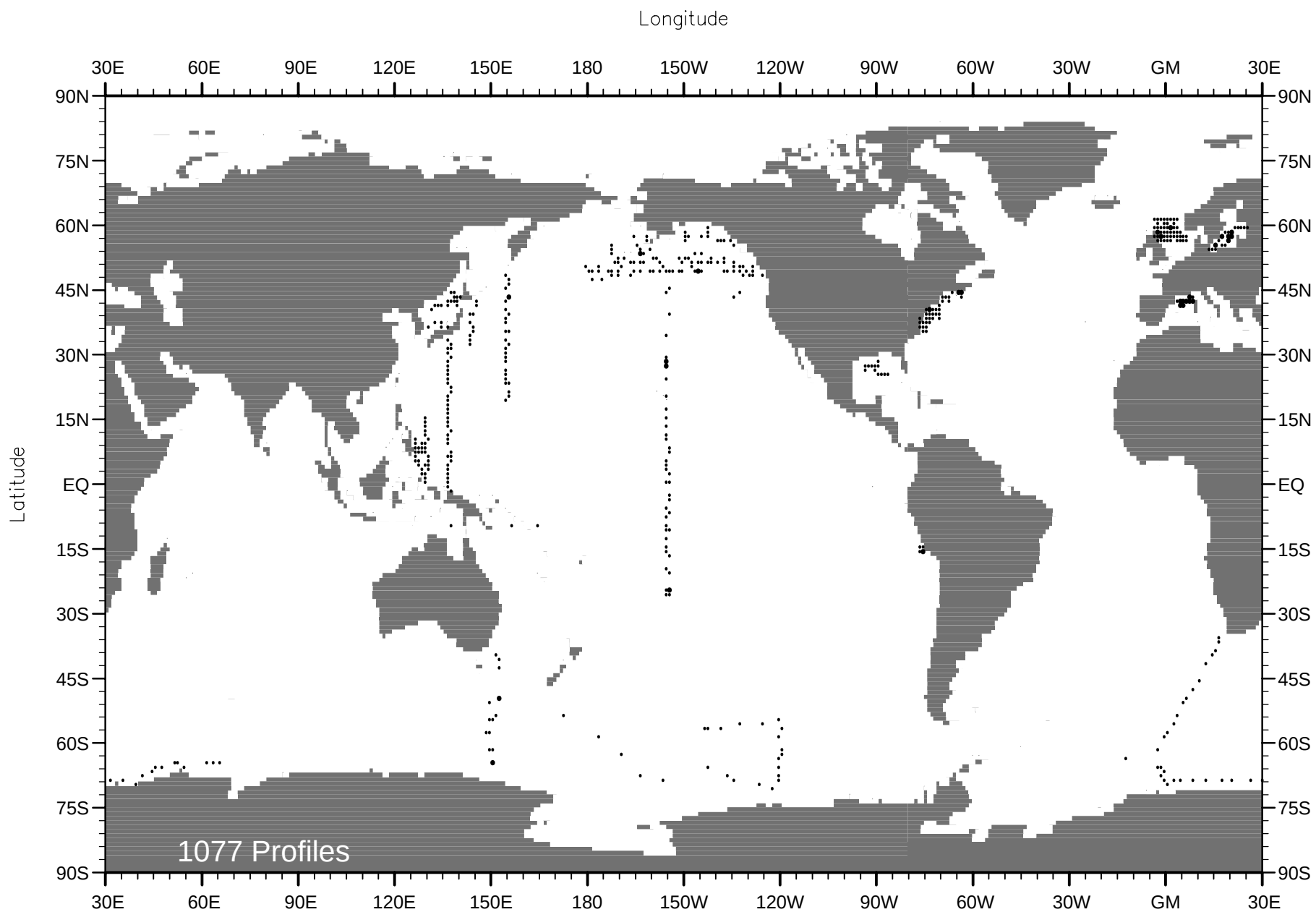


Fig. A16 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1969 .

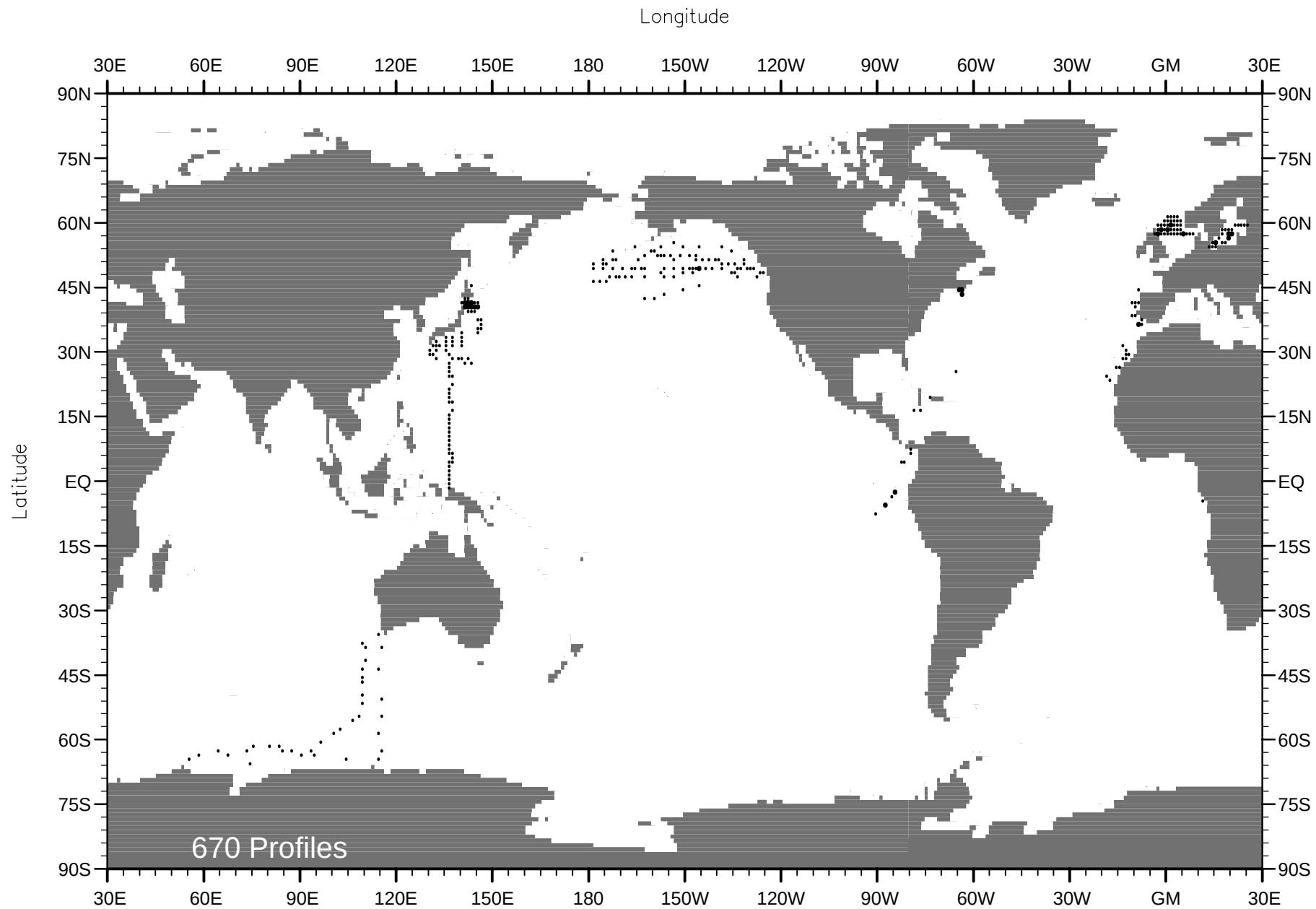


Fig. A17 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1970 .

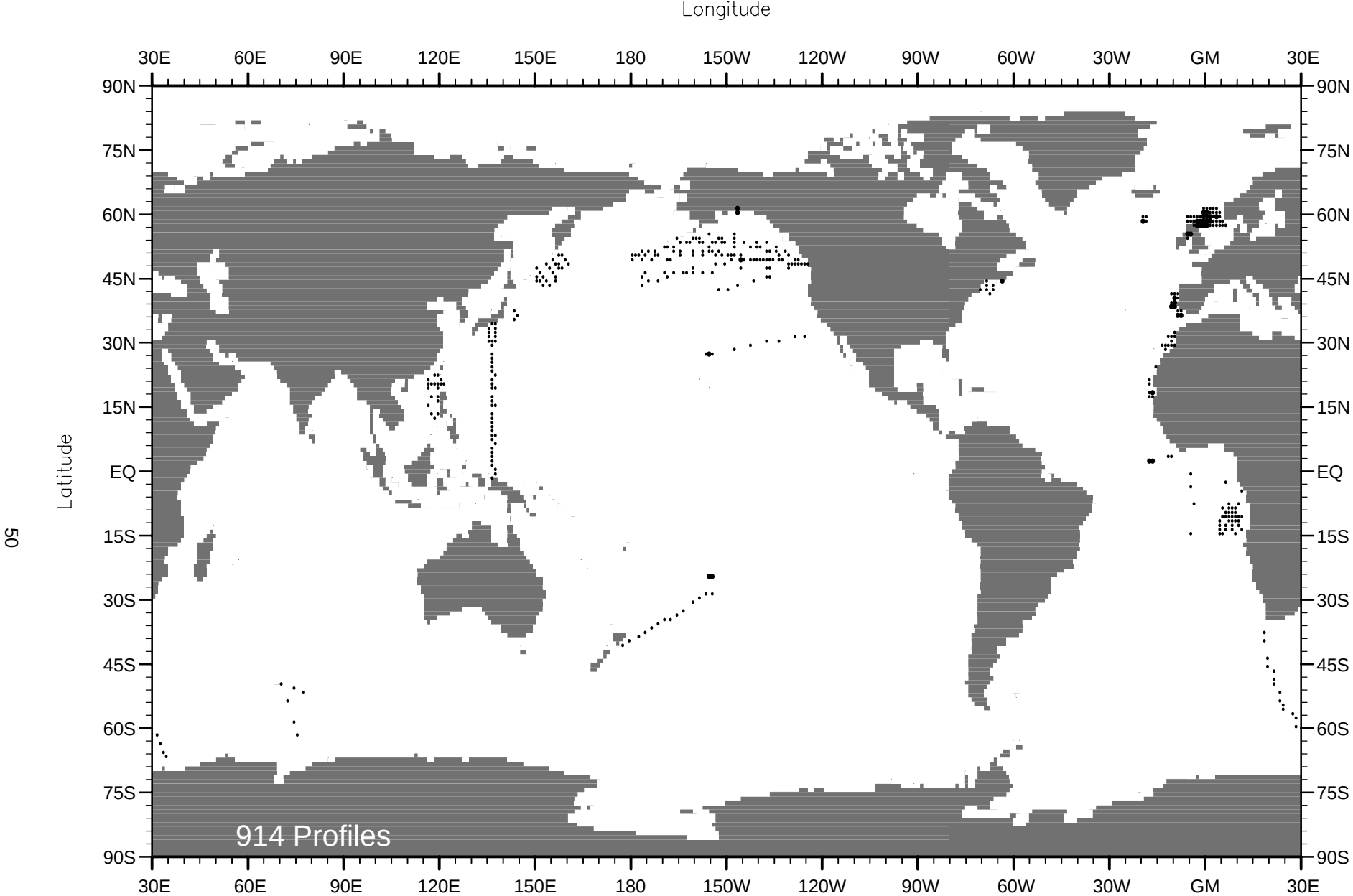
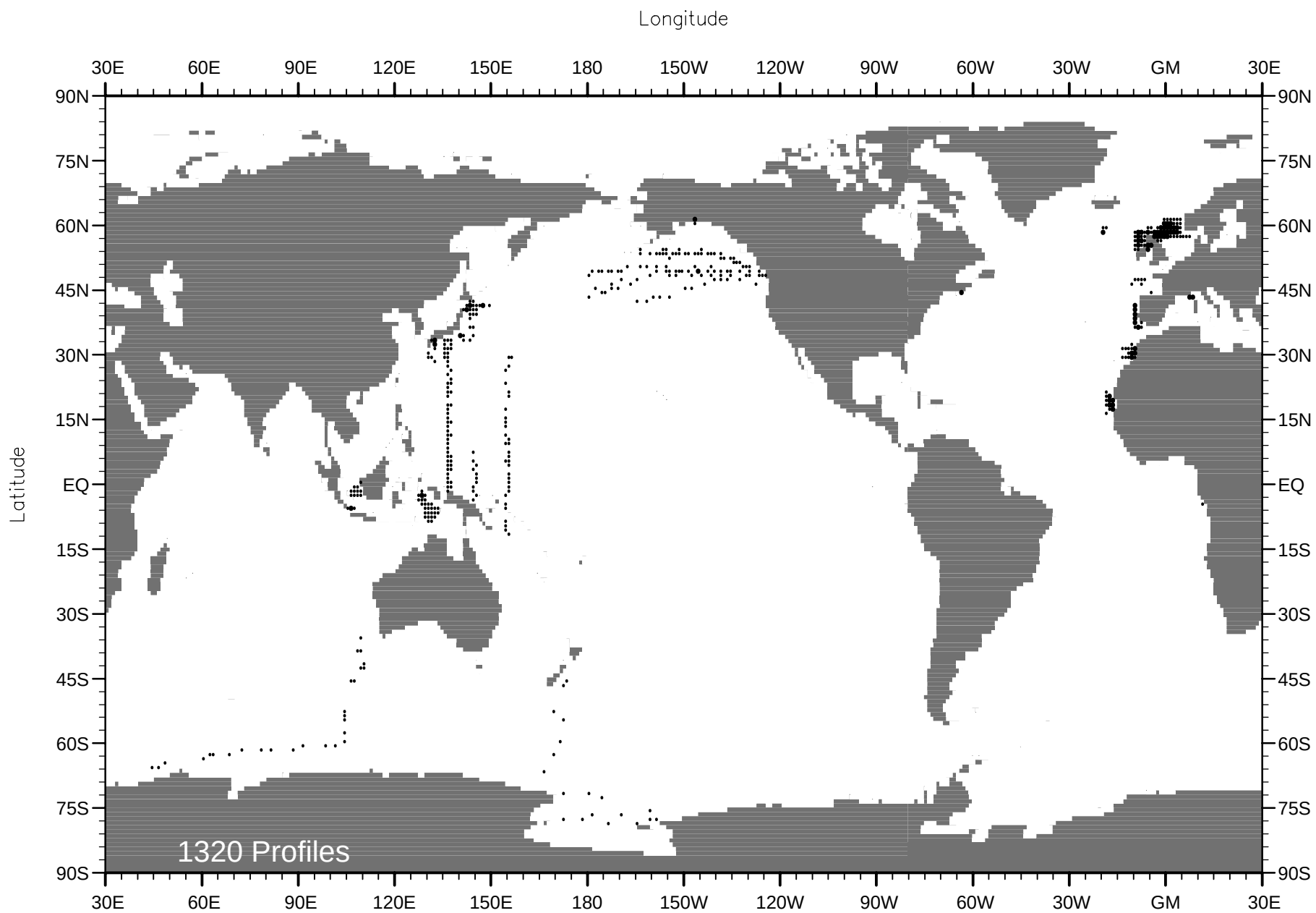


Fig. A18 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1971 .



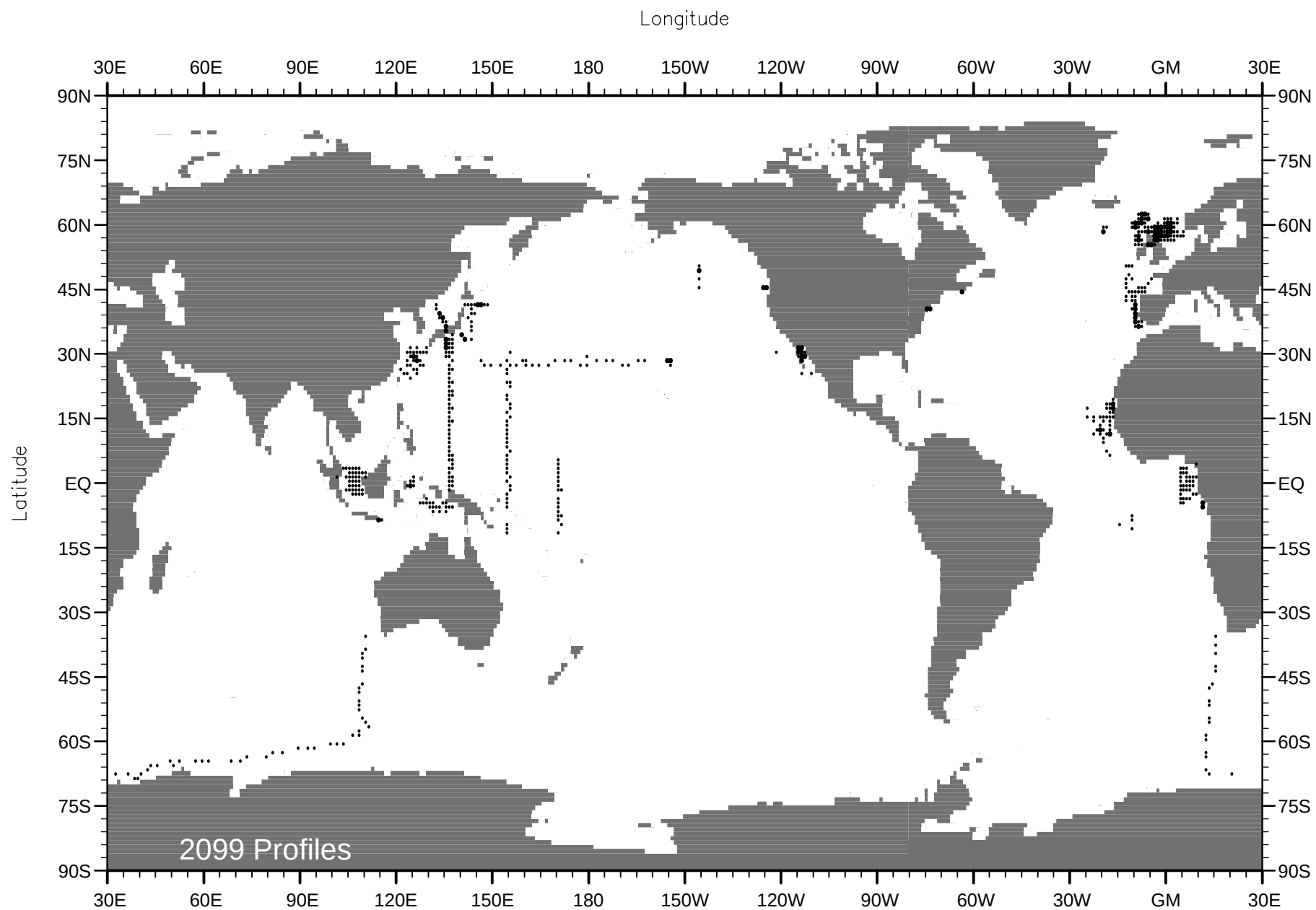


Fig. A20 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1973 .

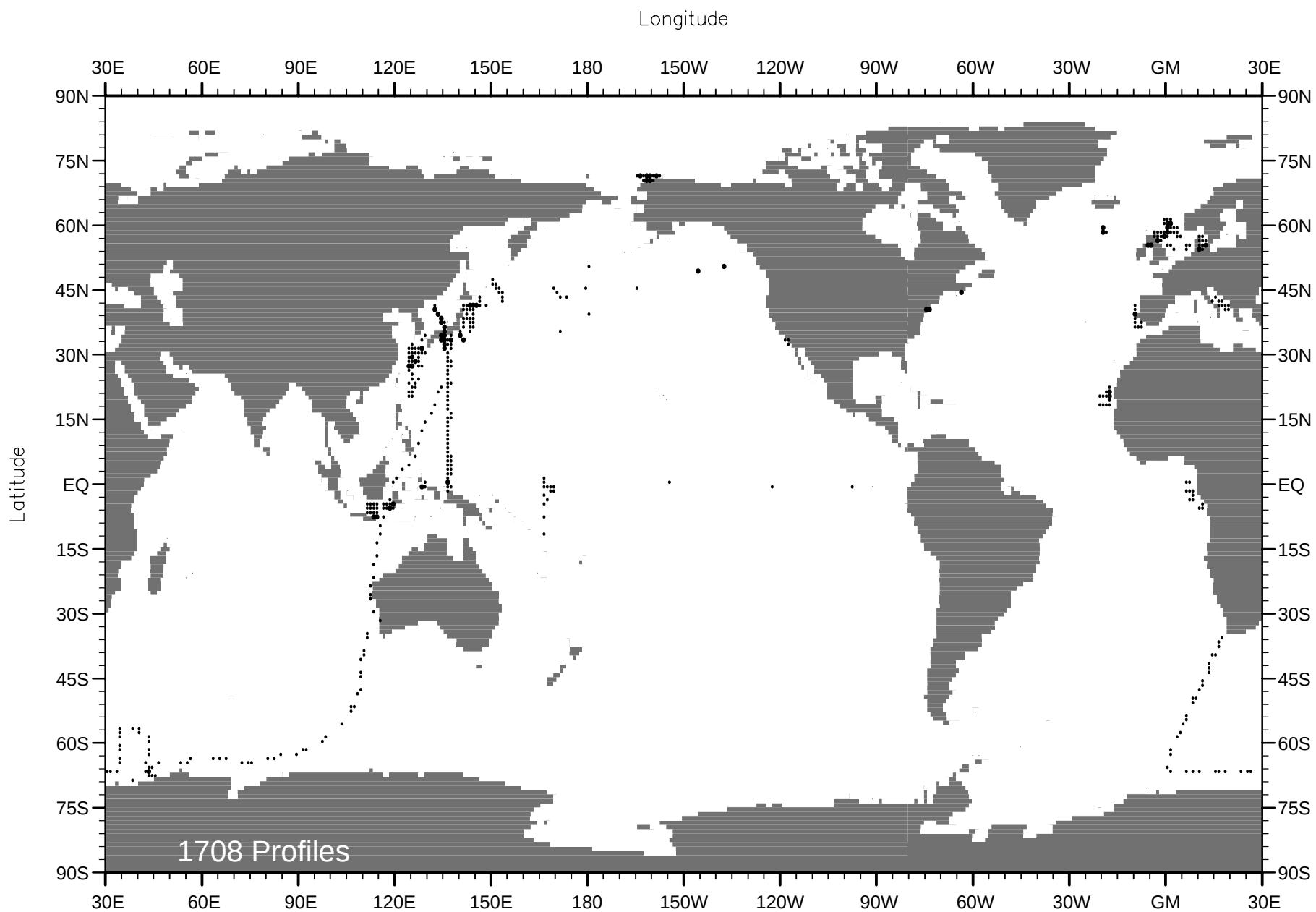


Fig. A21 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1974 .



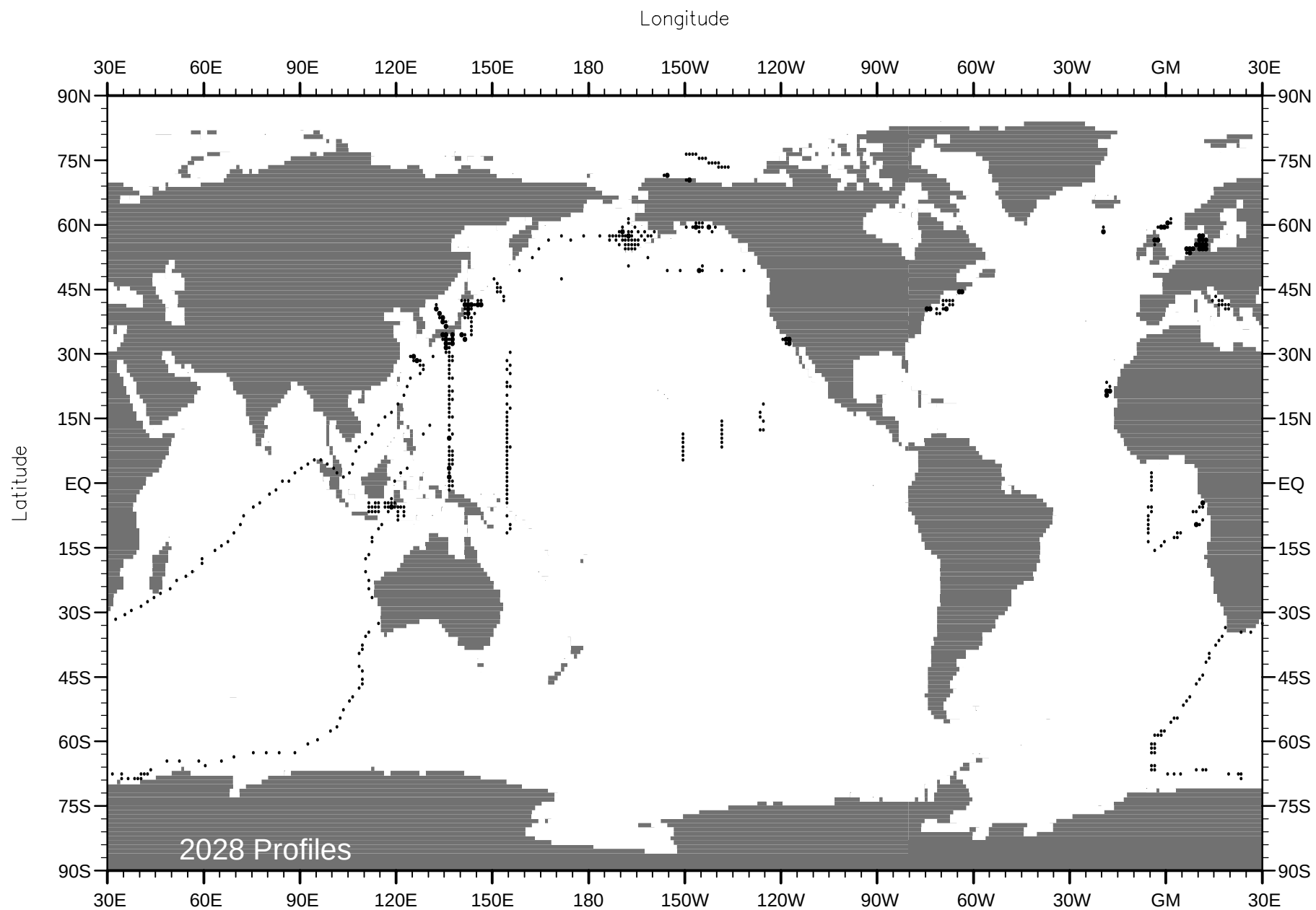


Fig. A22 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1975 .

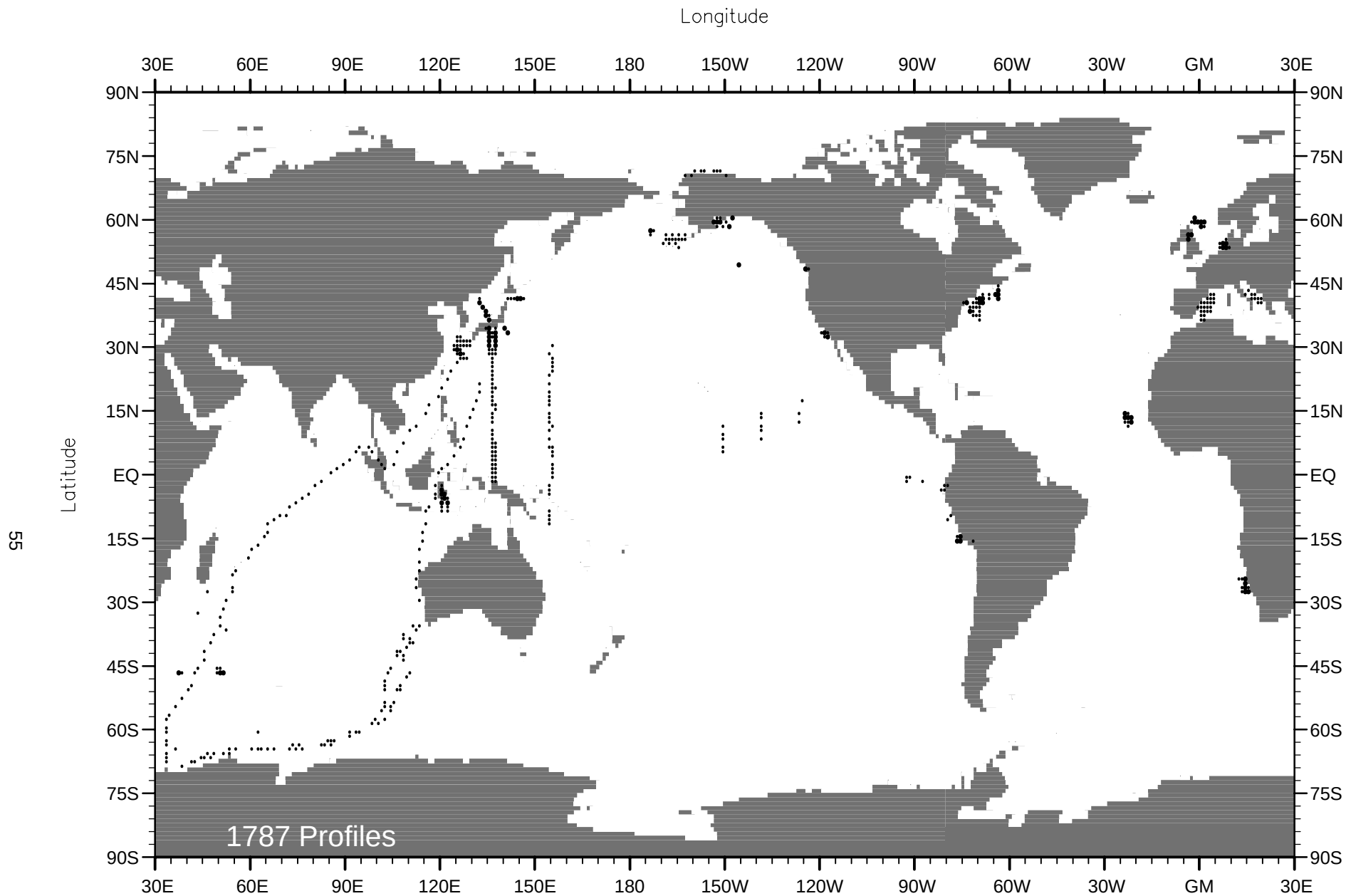


Fig. A23 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1976 .

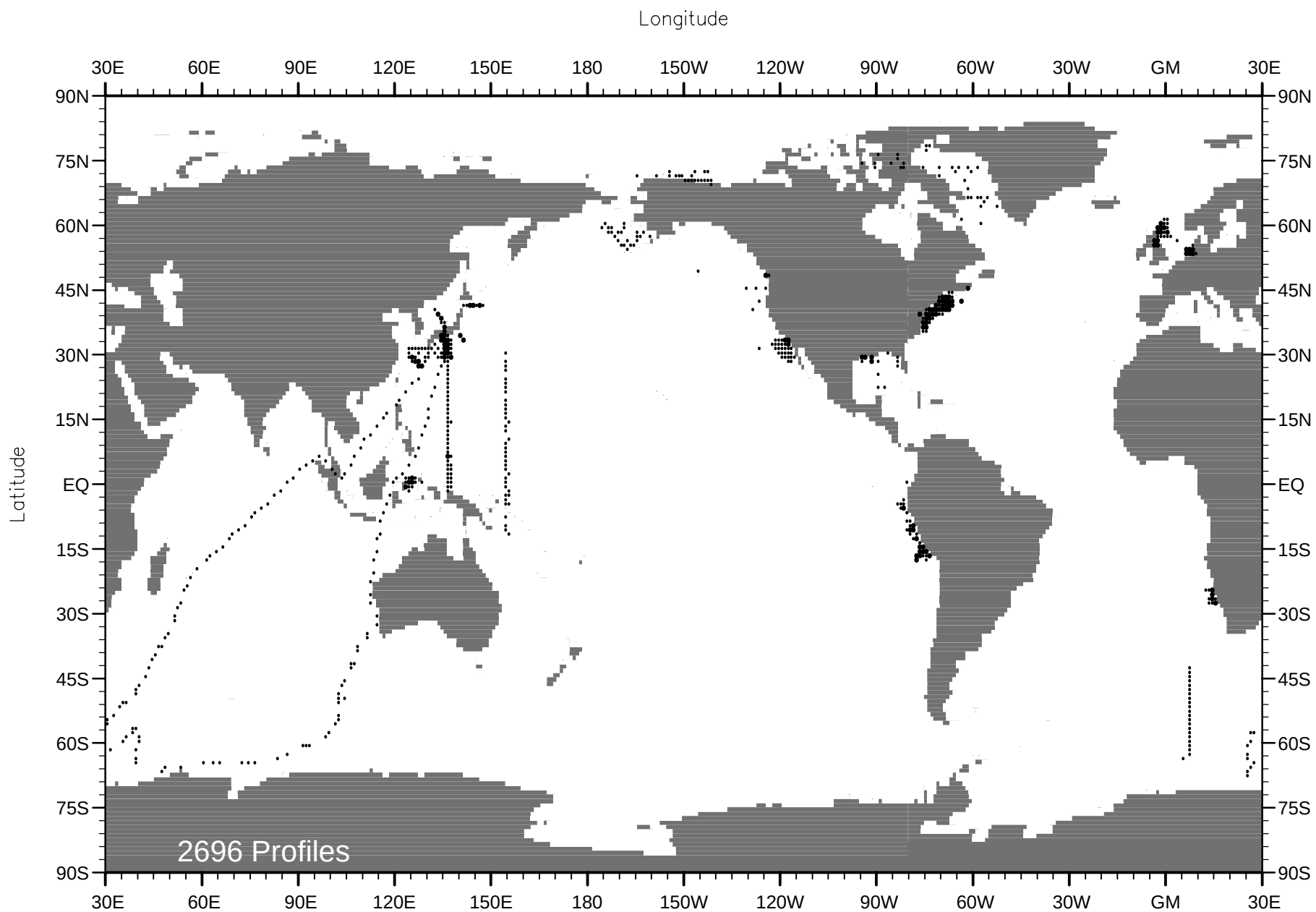


Fig. A24 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1977 .

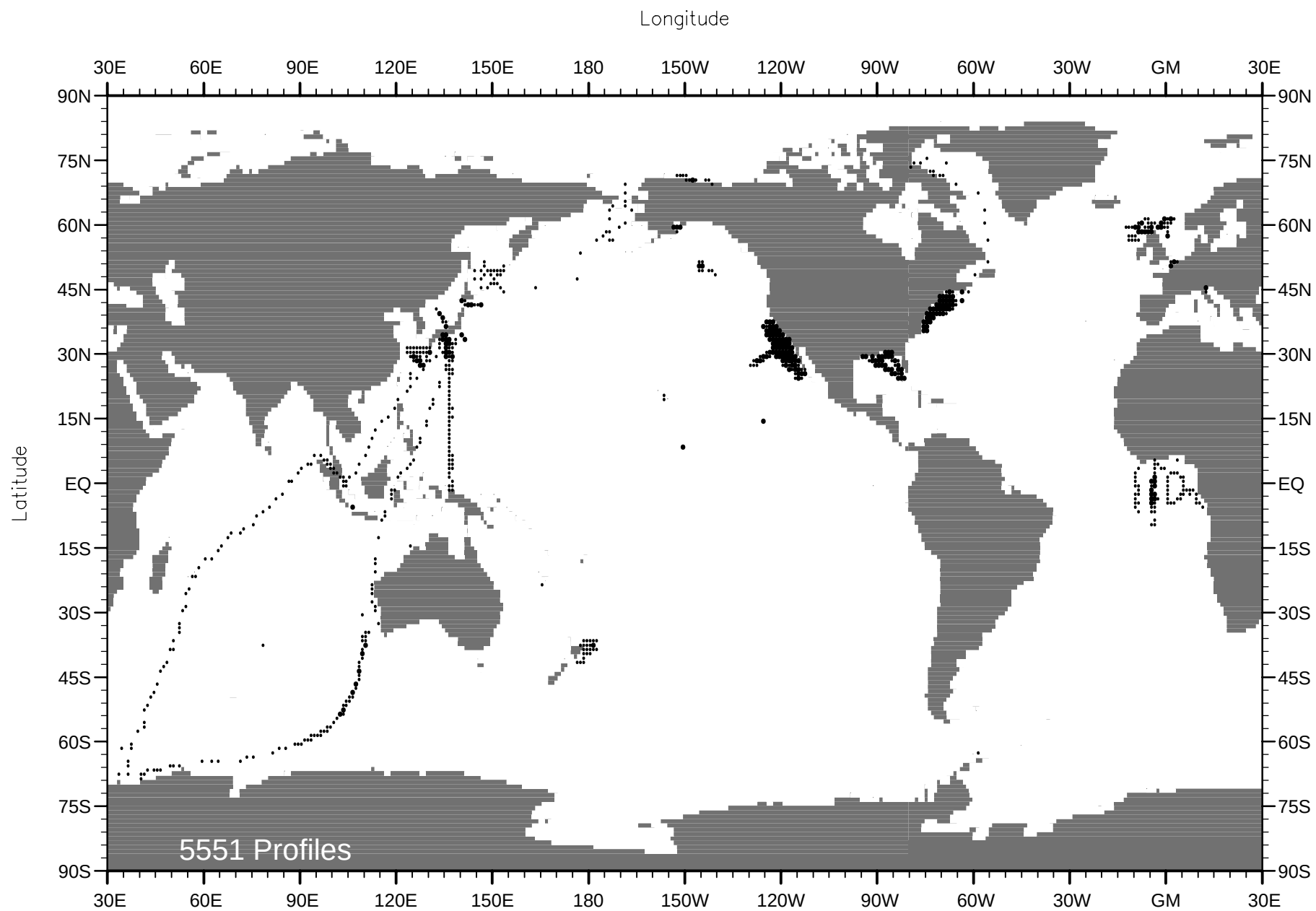


Fig. A25 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1978 .

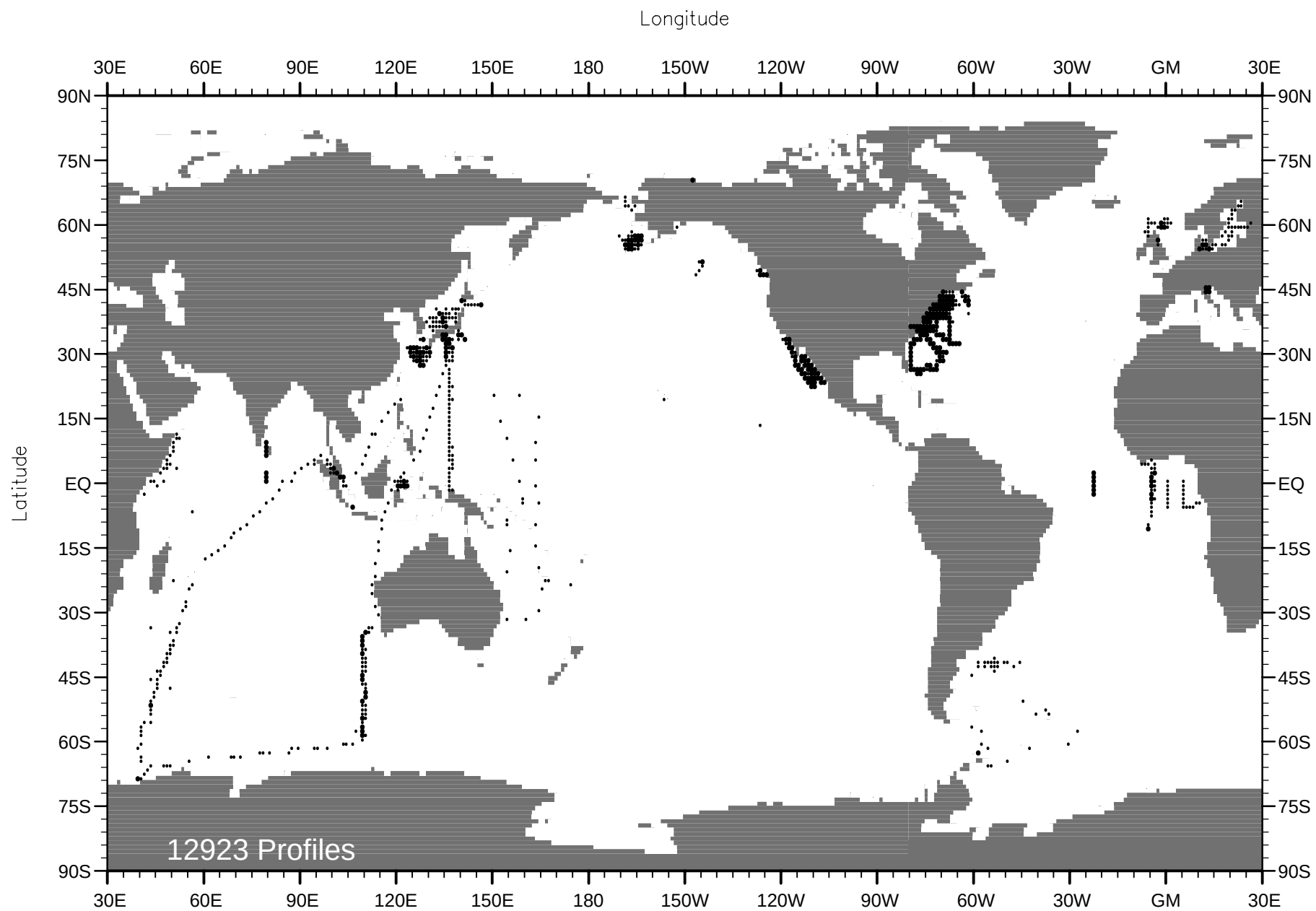


Fig. A26 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1979 .

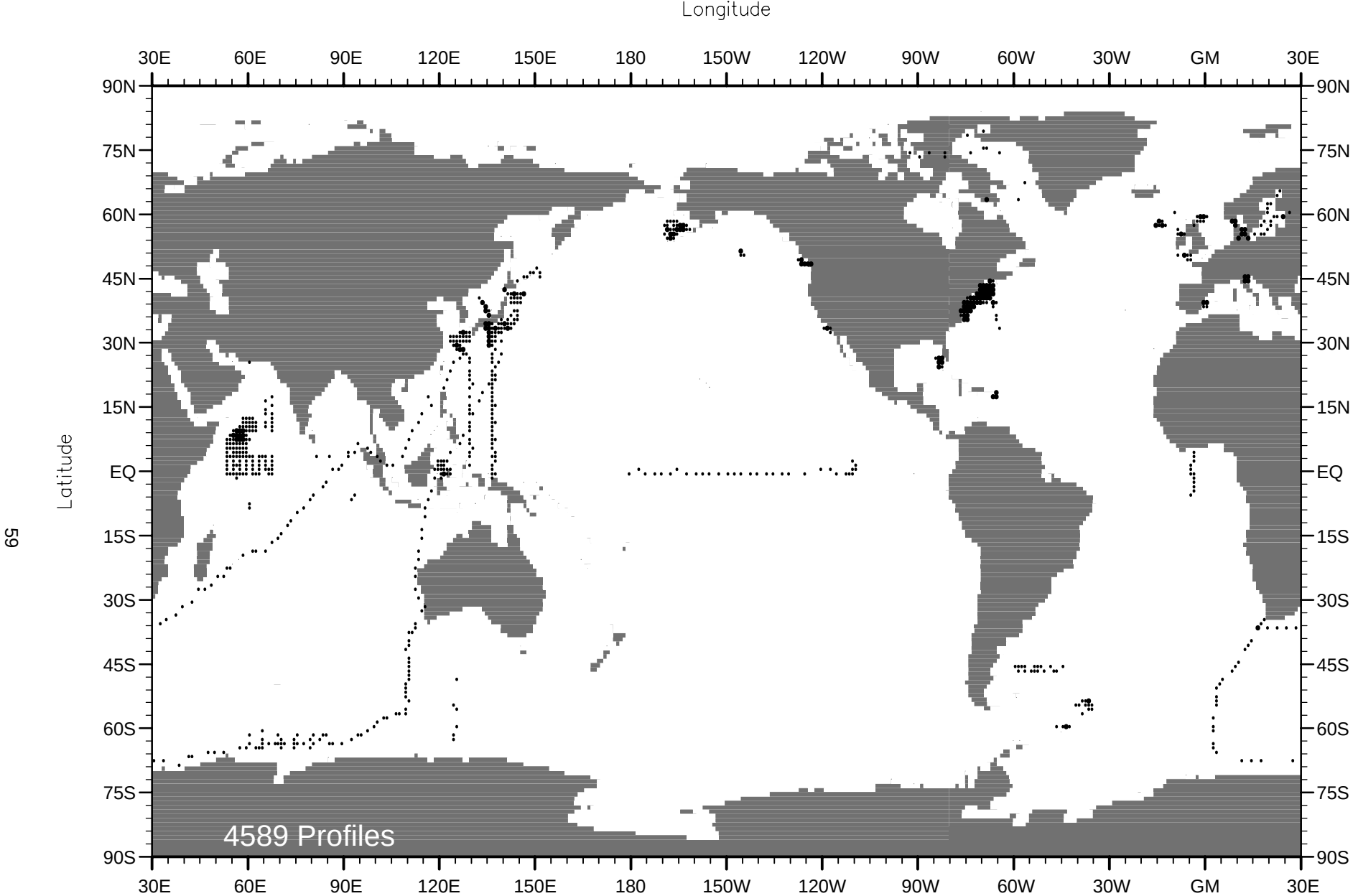


Fig. A27 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1980 .

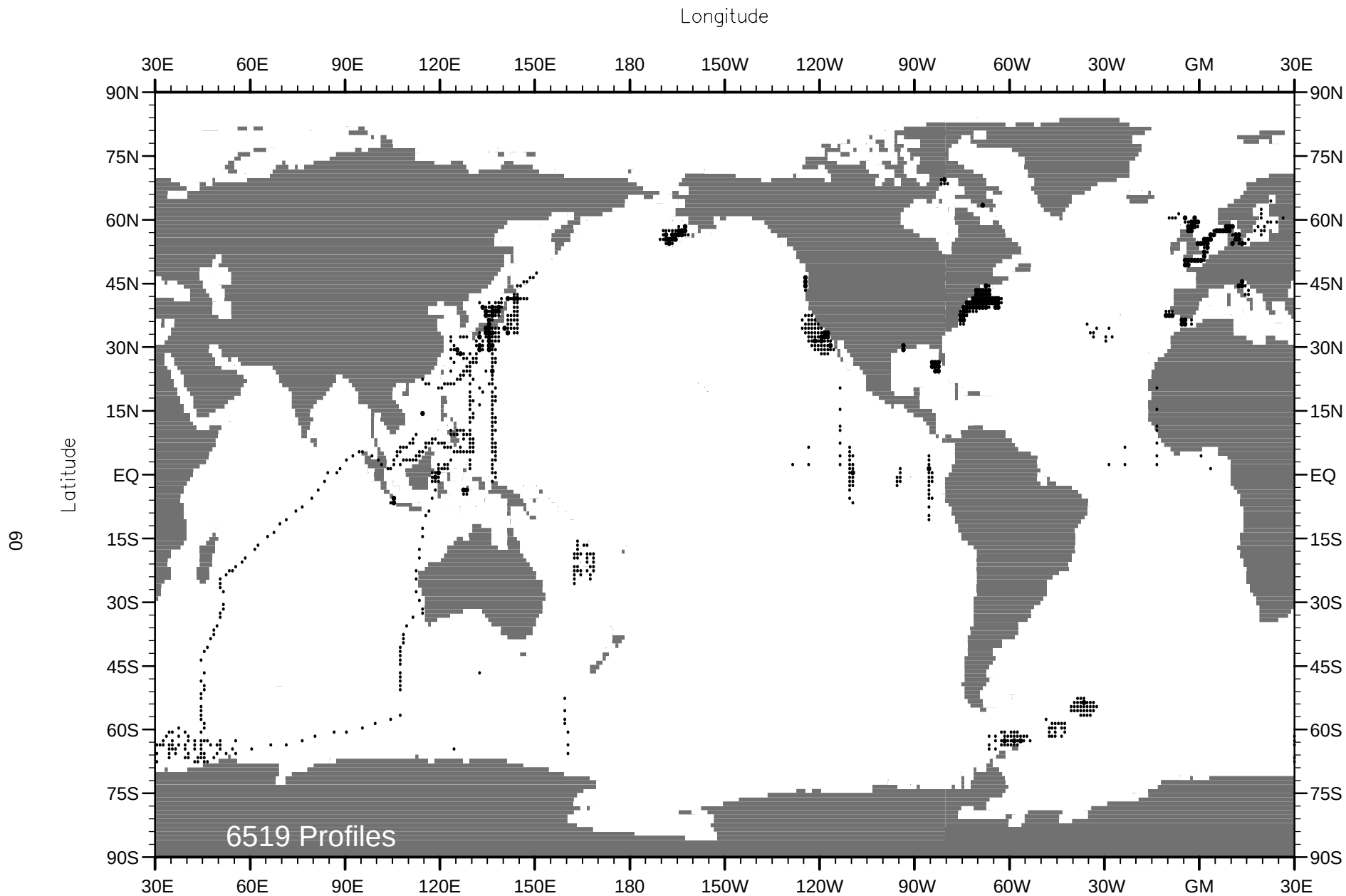


Fig. A28 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1981 .

Latitude

Longitude

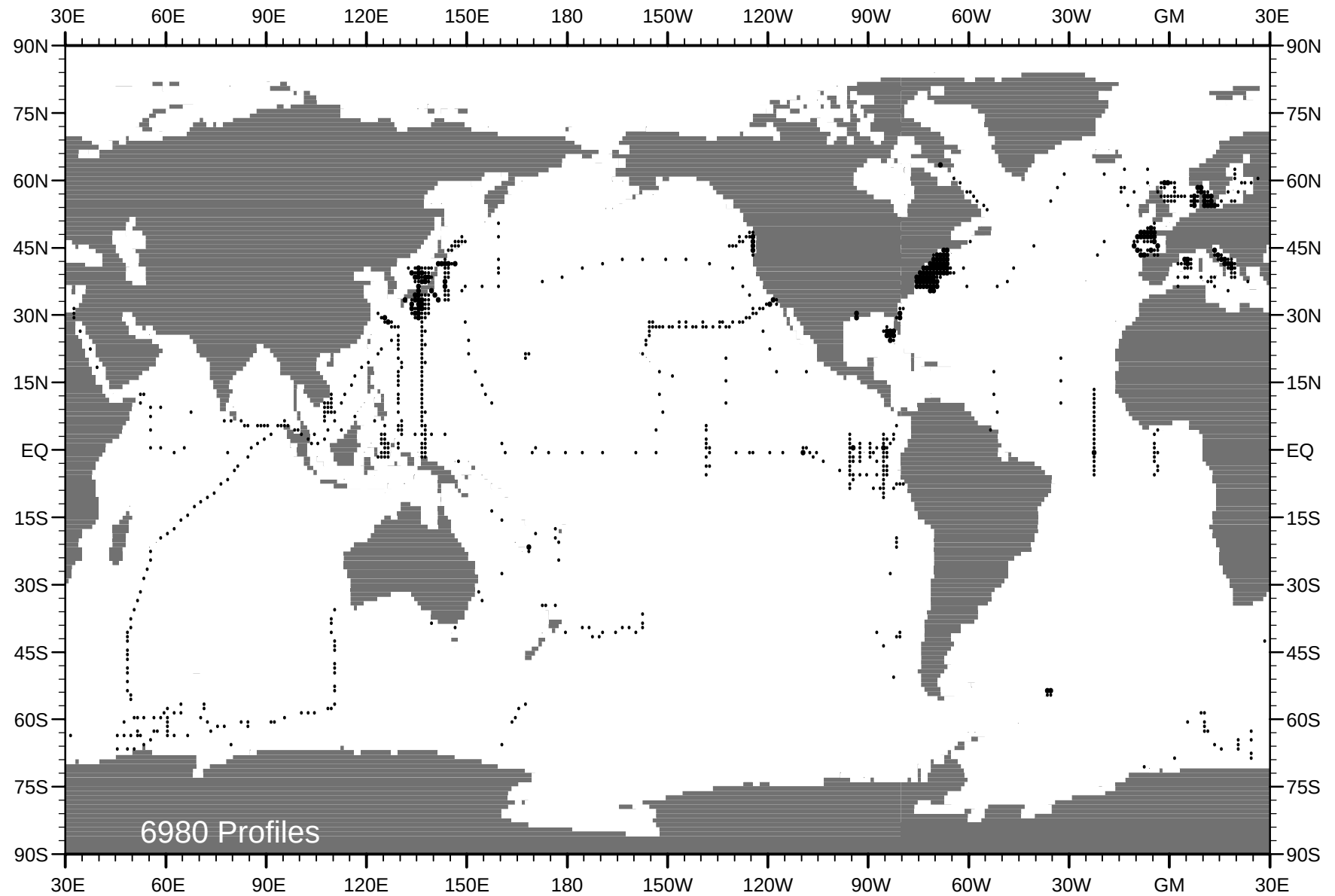


Fig. A29 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1982 .



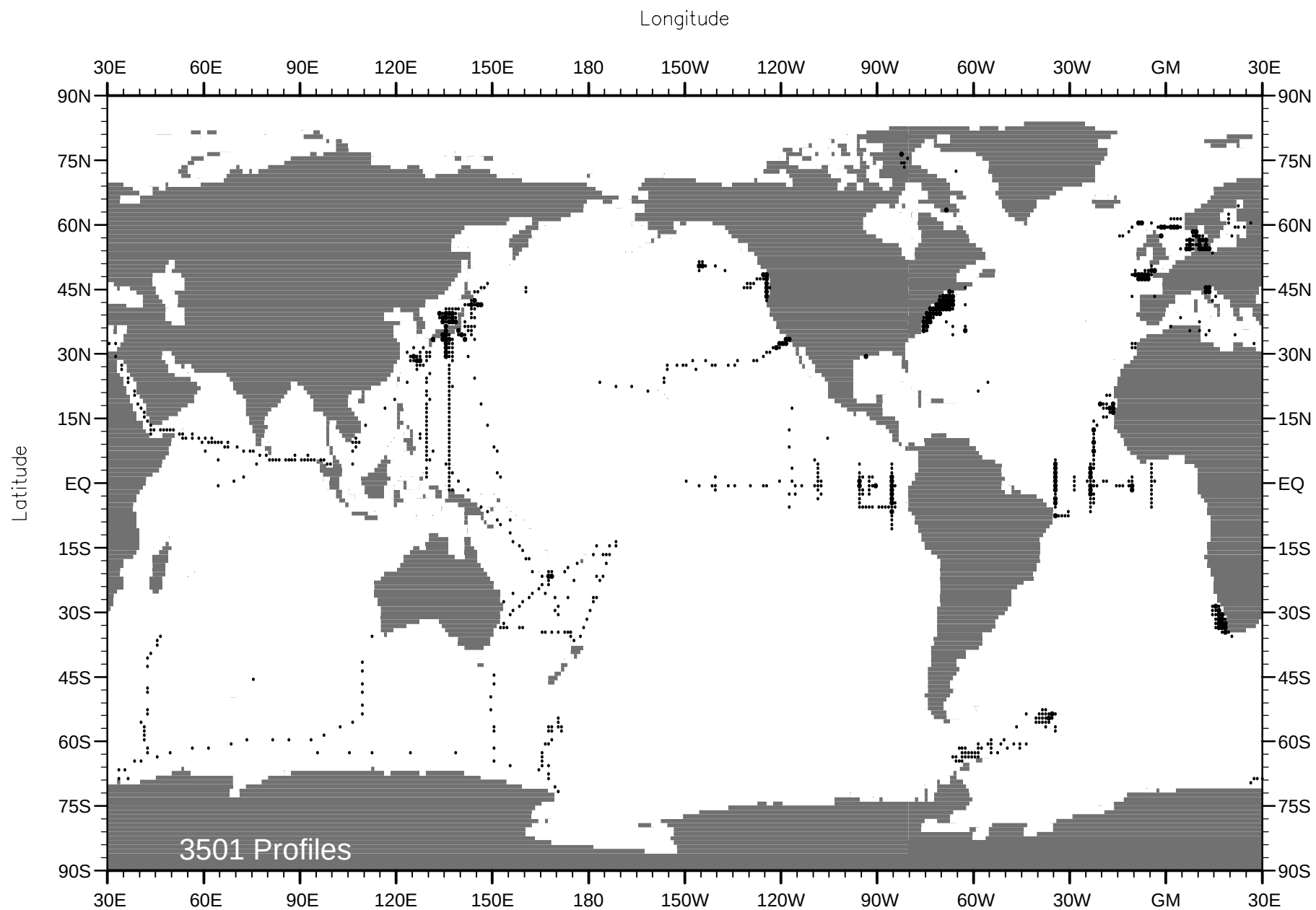


Fig. A30 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1983 .

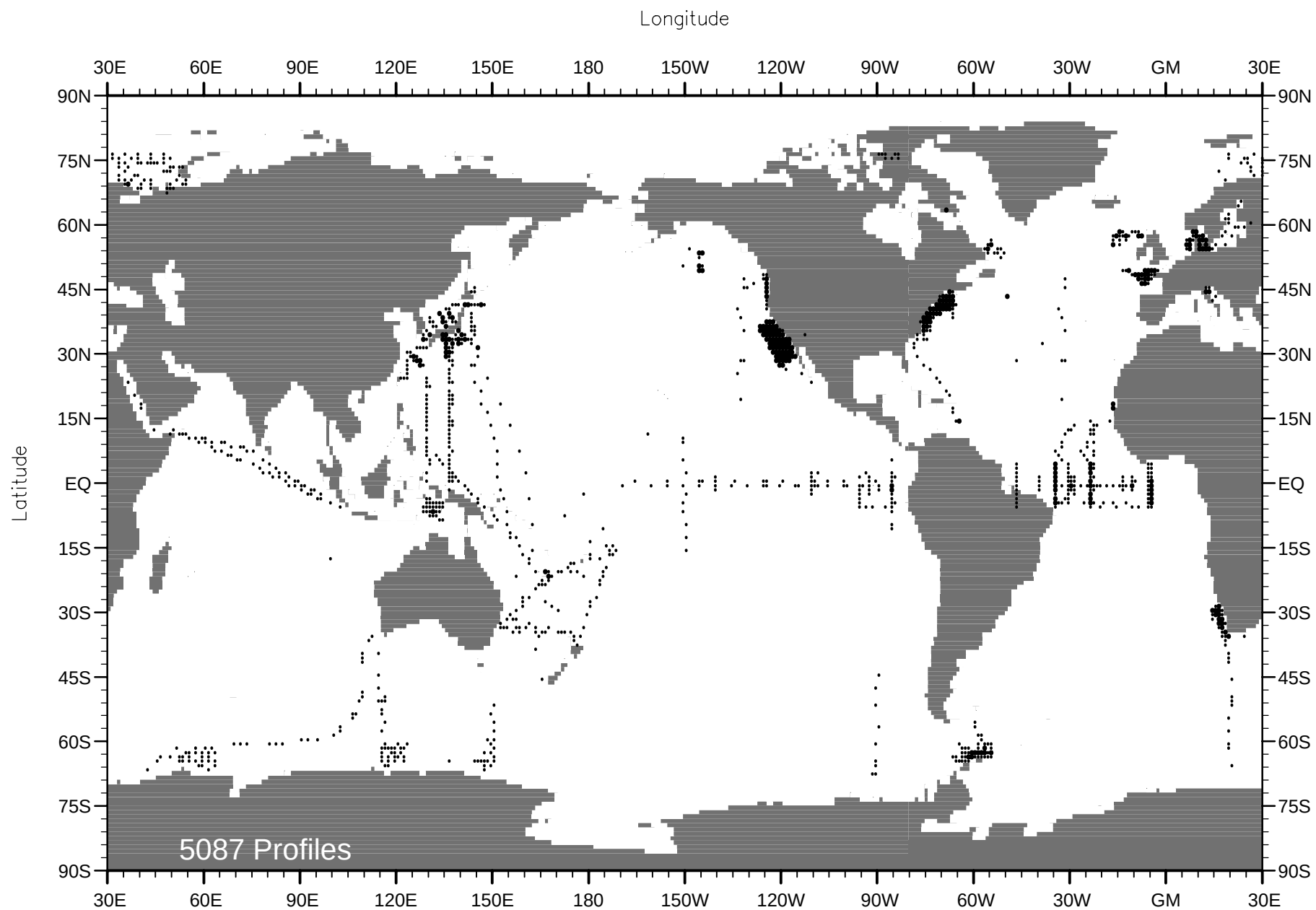


Fig. A31 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1984 .

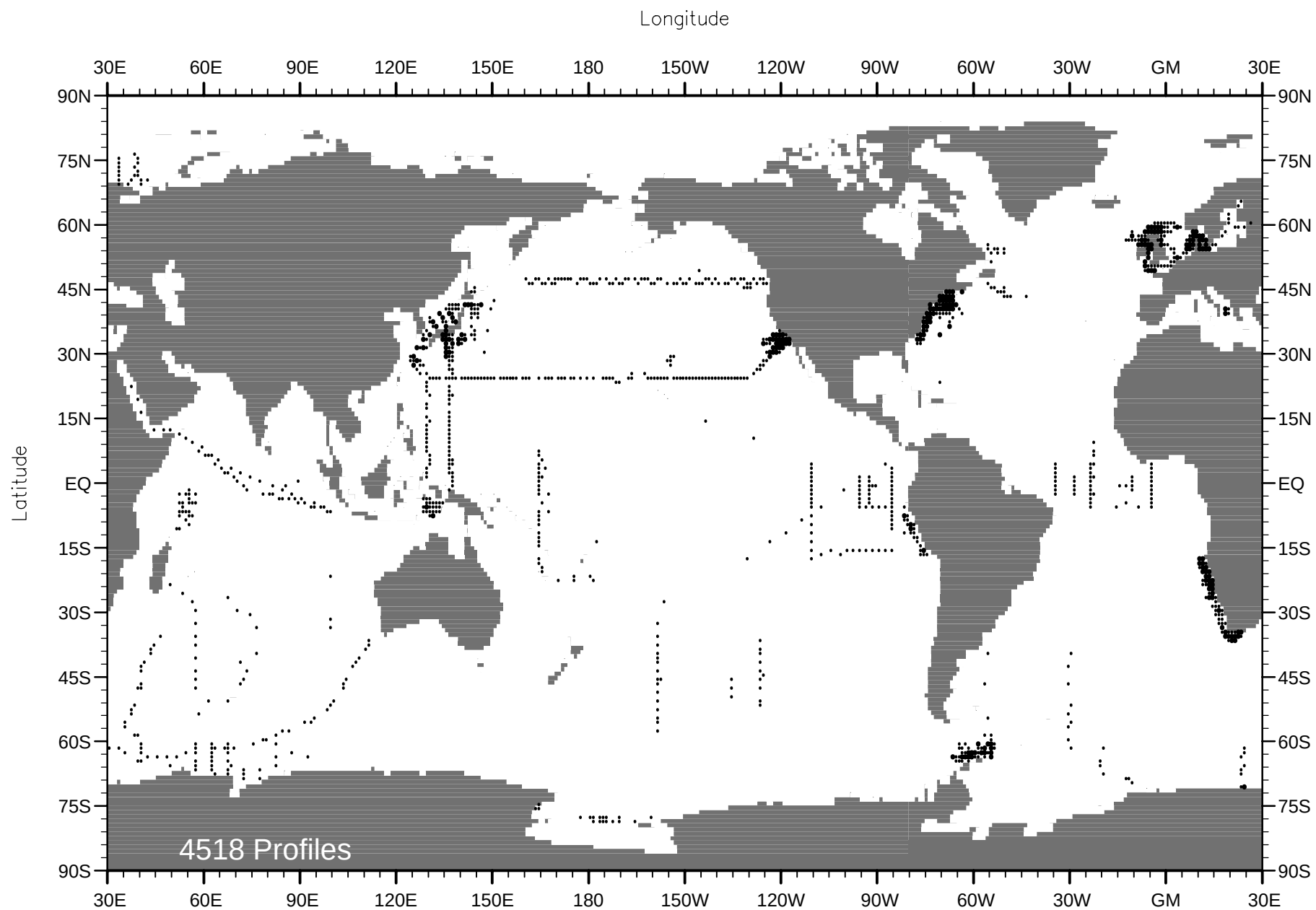


Fig. A32 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1985 .

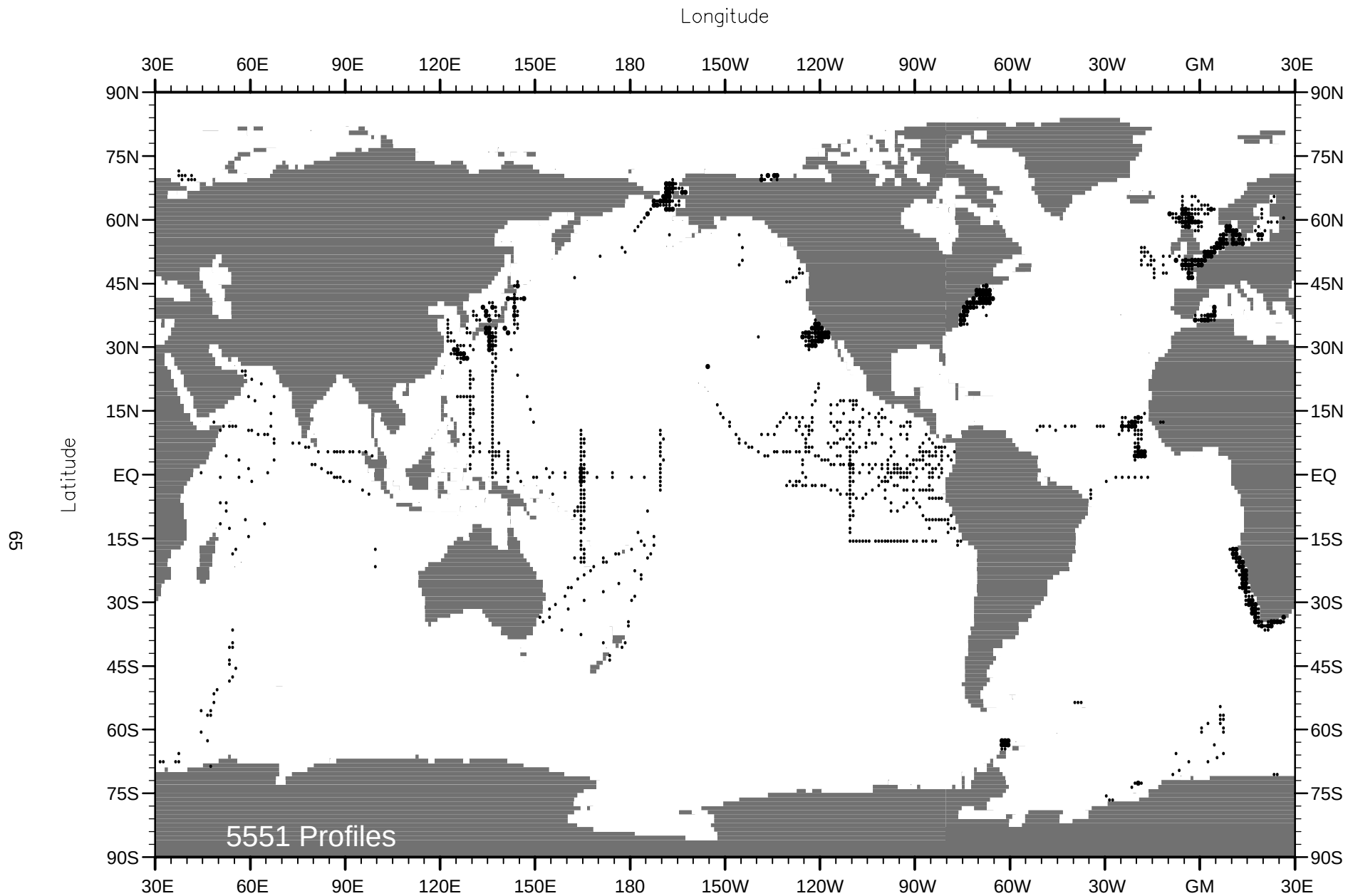


Fig. A33 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1986 .

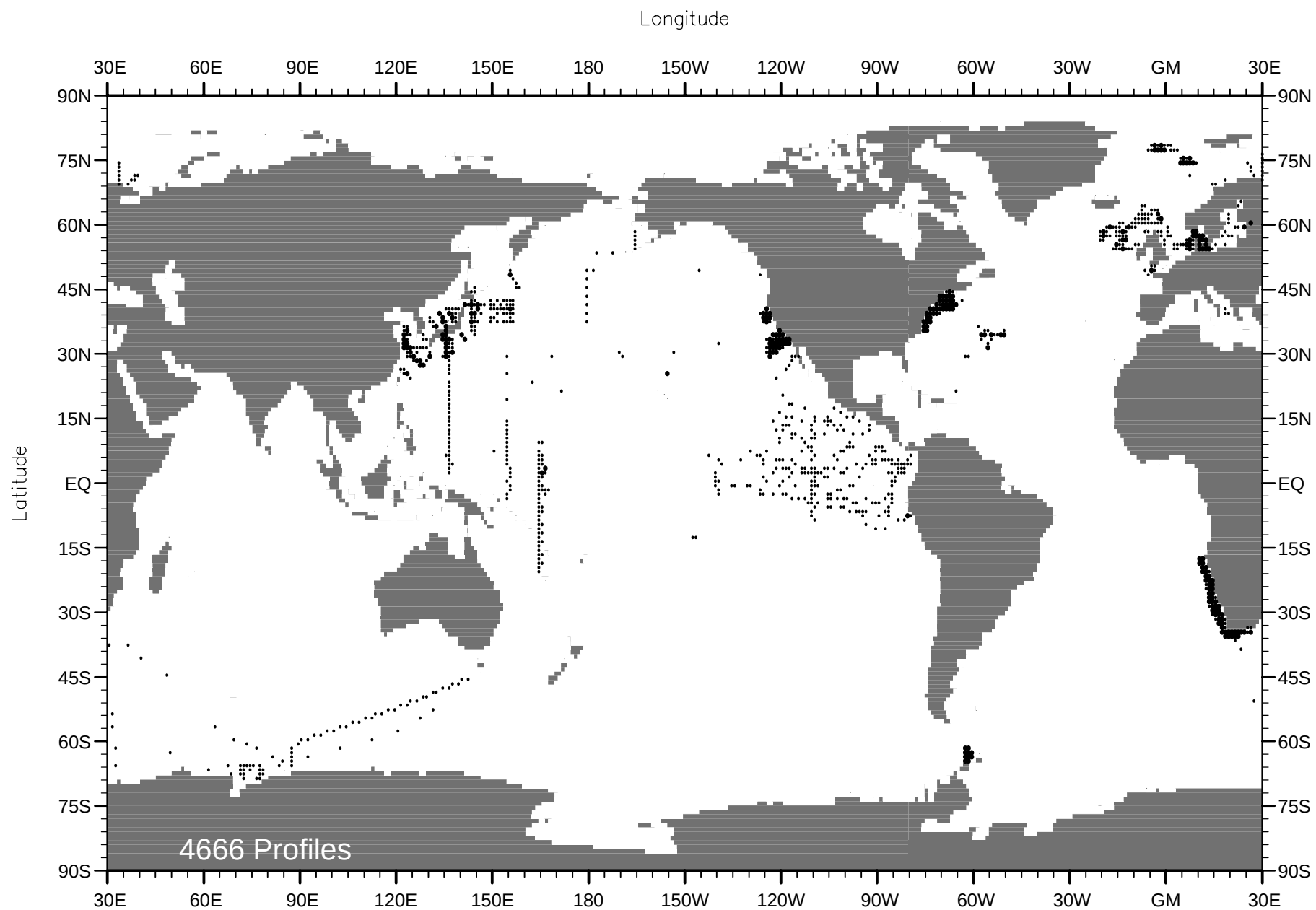


Fig. A34 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1987 .

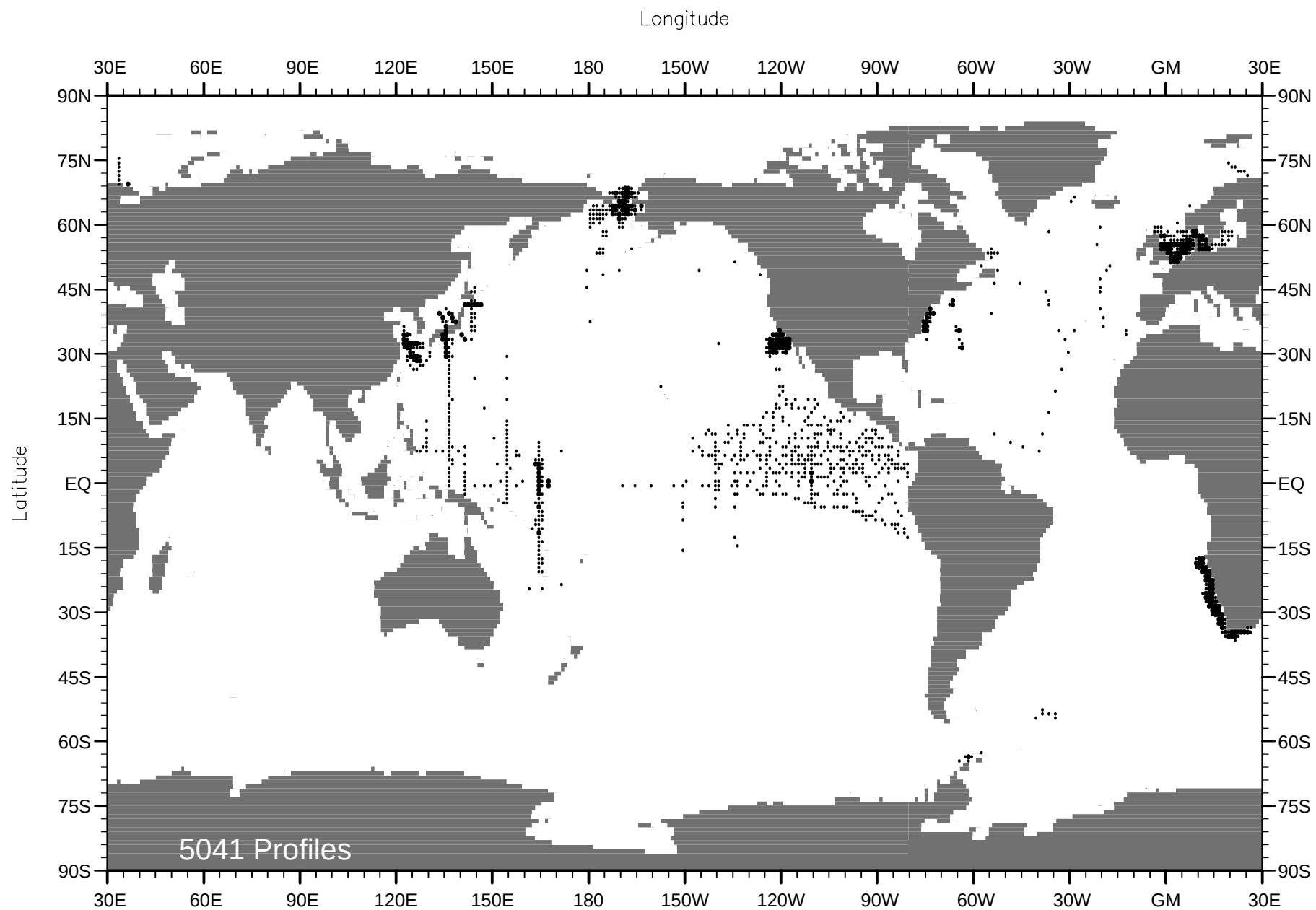


Fig. A35 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1988 .

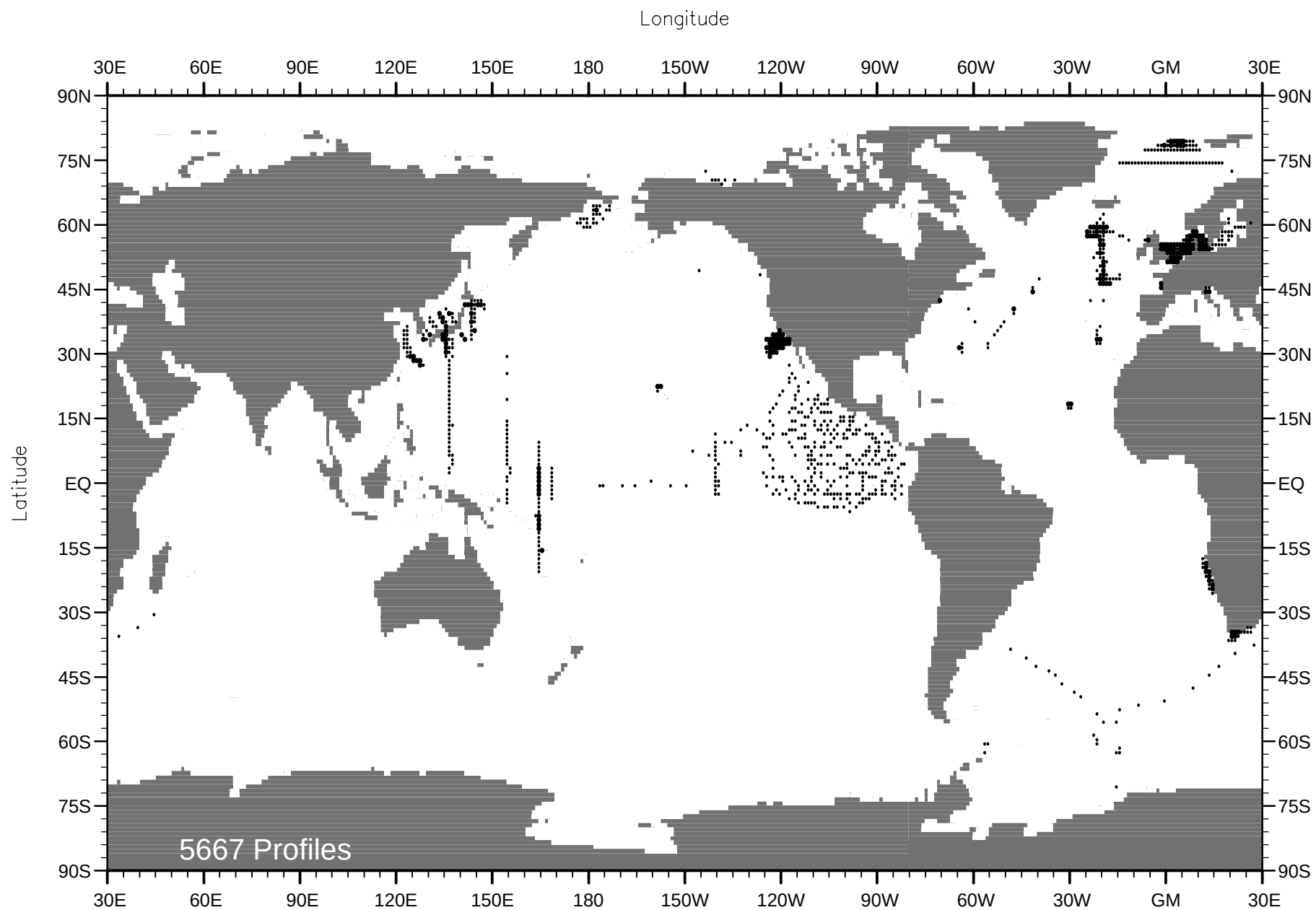


Fig. A36 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1989 .

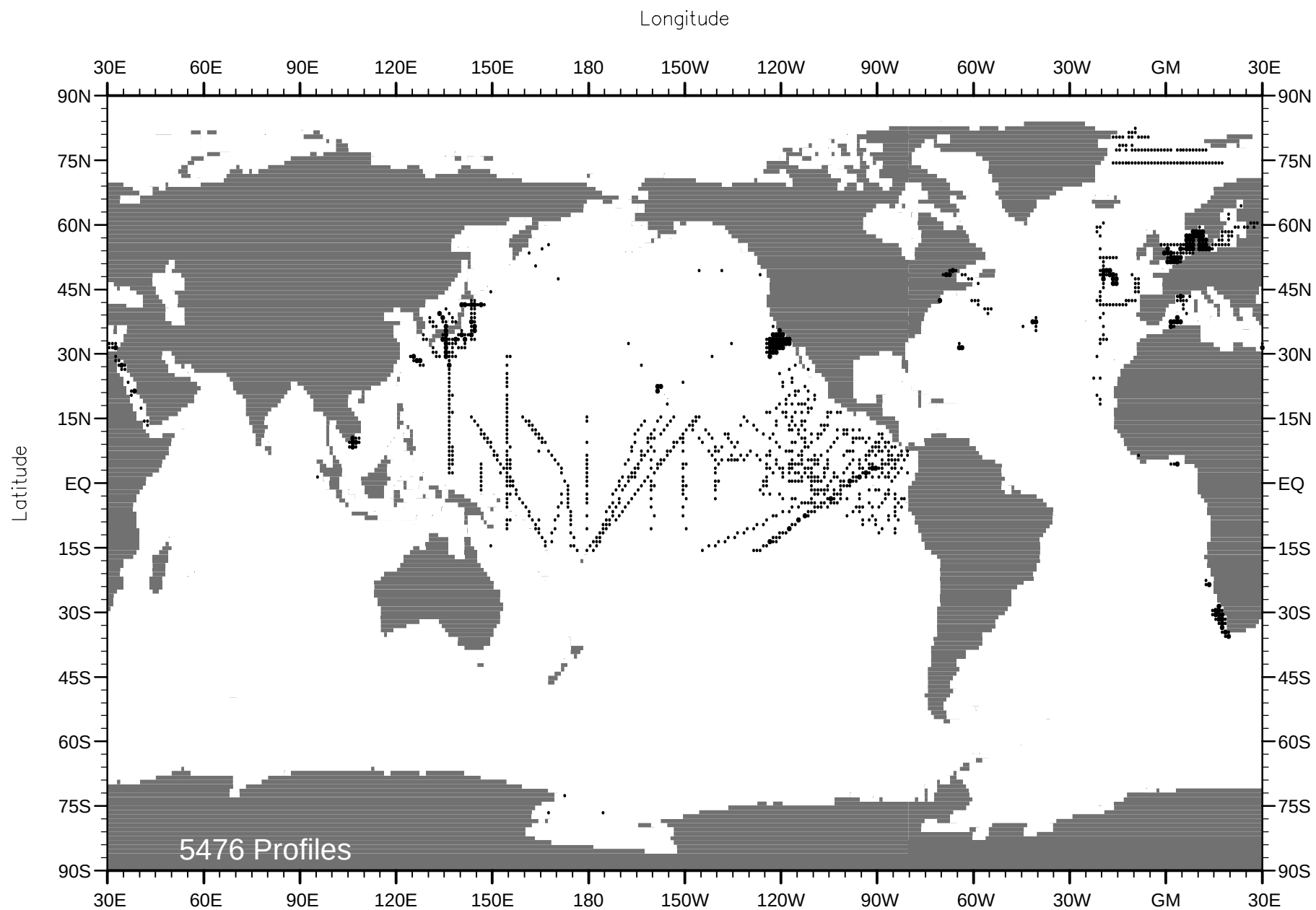


Fig. A37 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1990 .



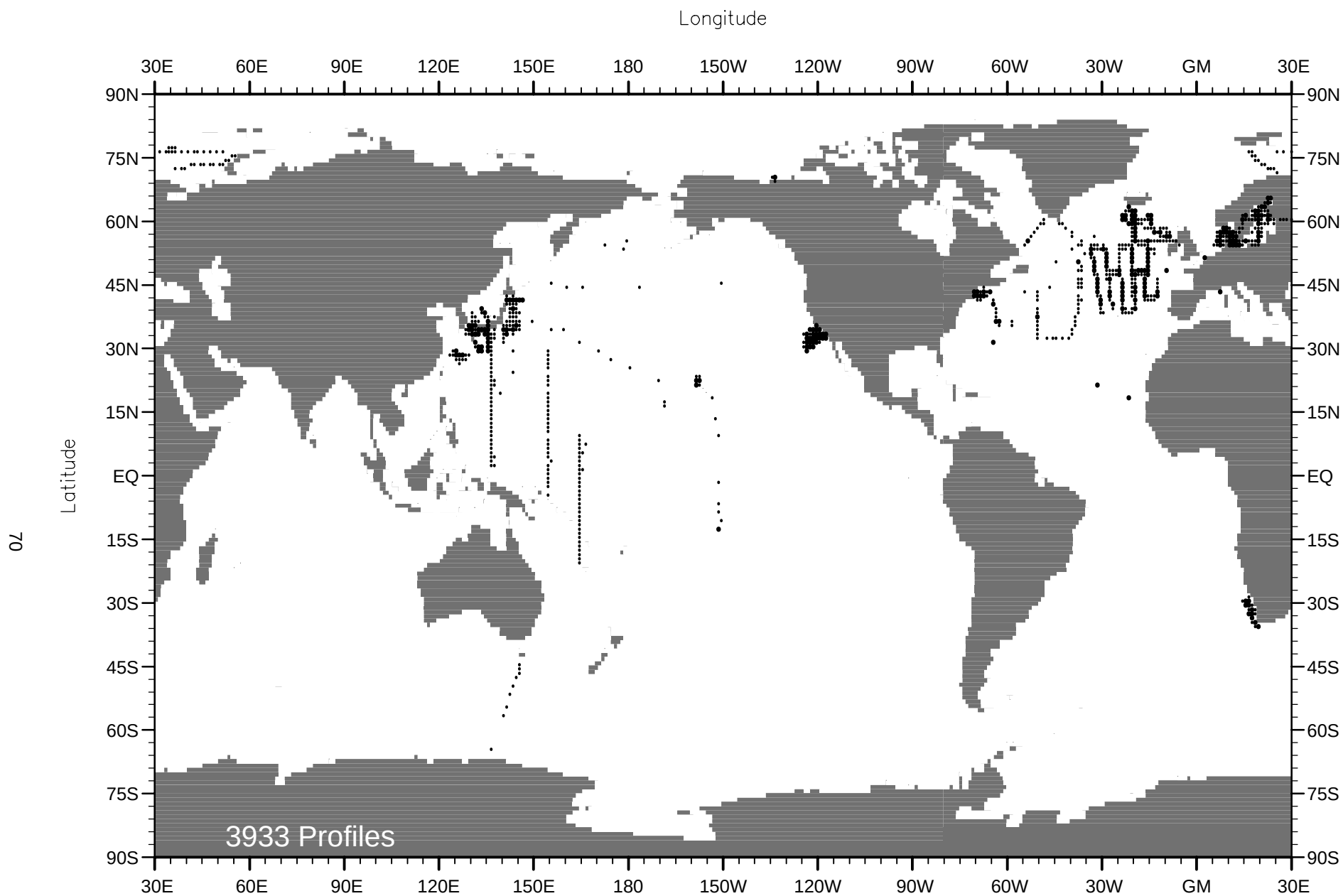


Fig. A38 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1991 .

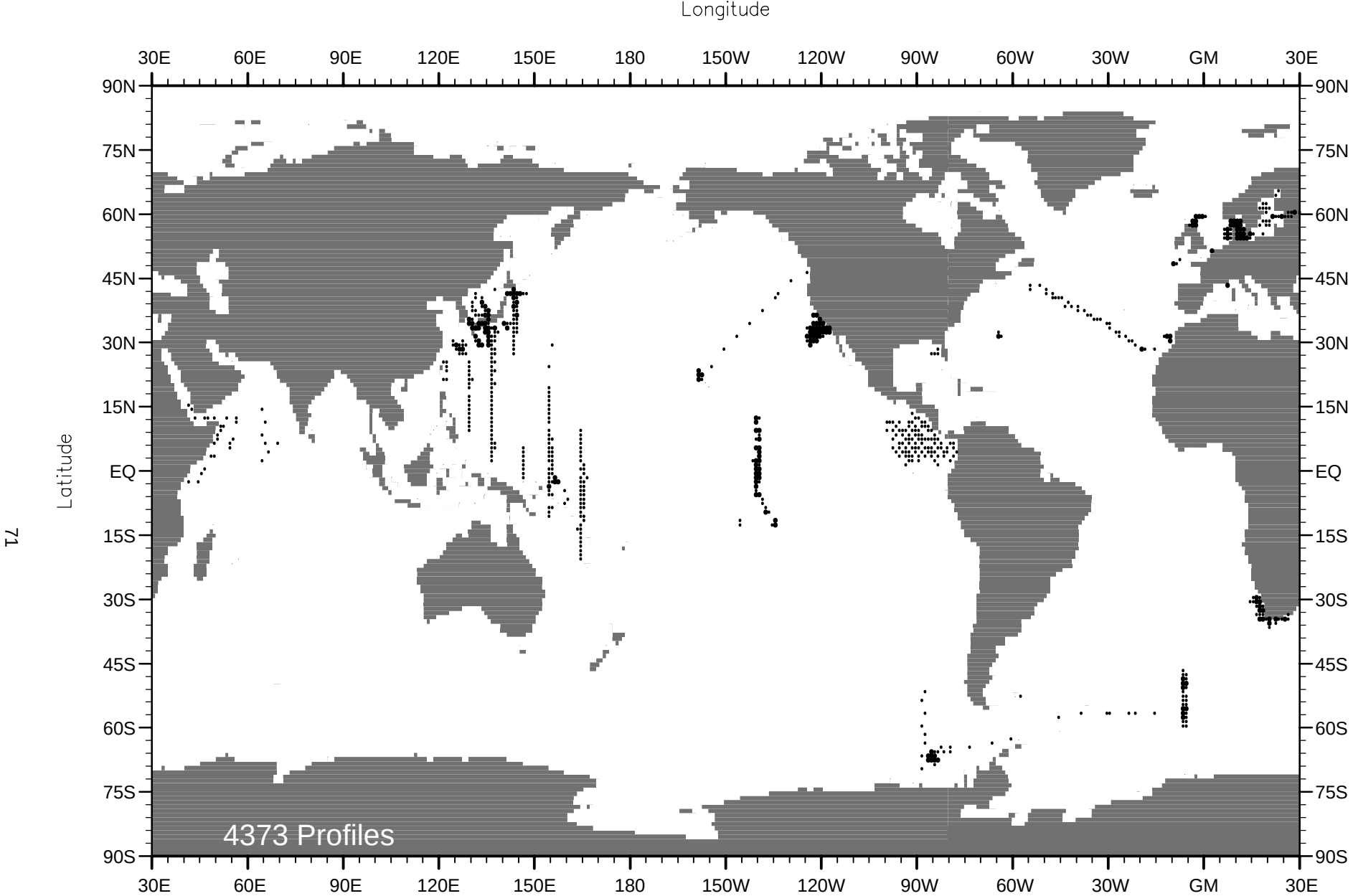


Fig. A39 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1992 .

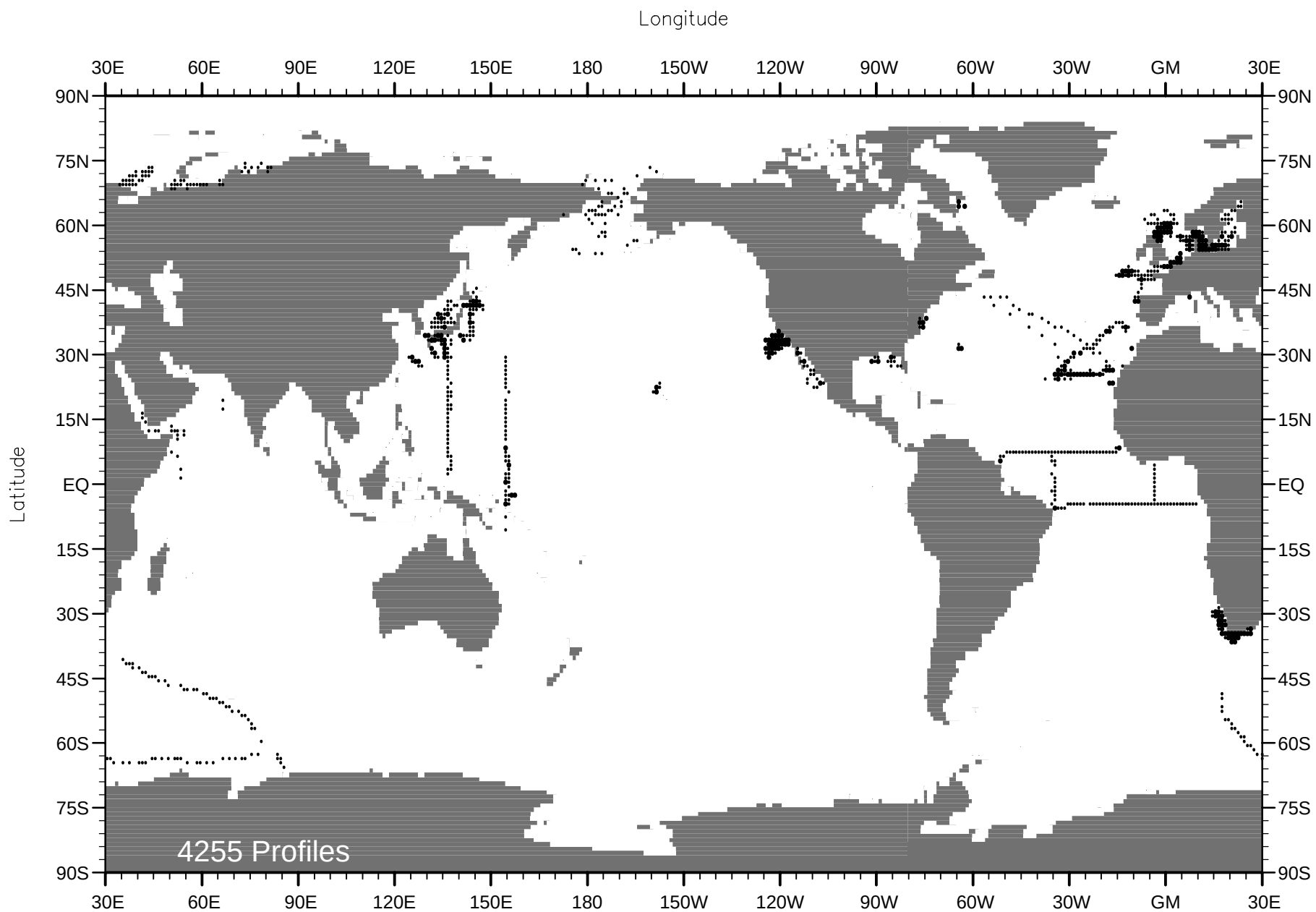


Fig. A40 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1993 .

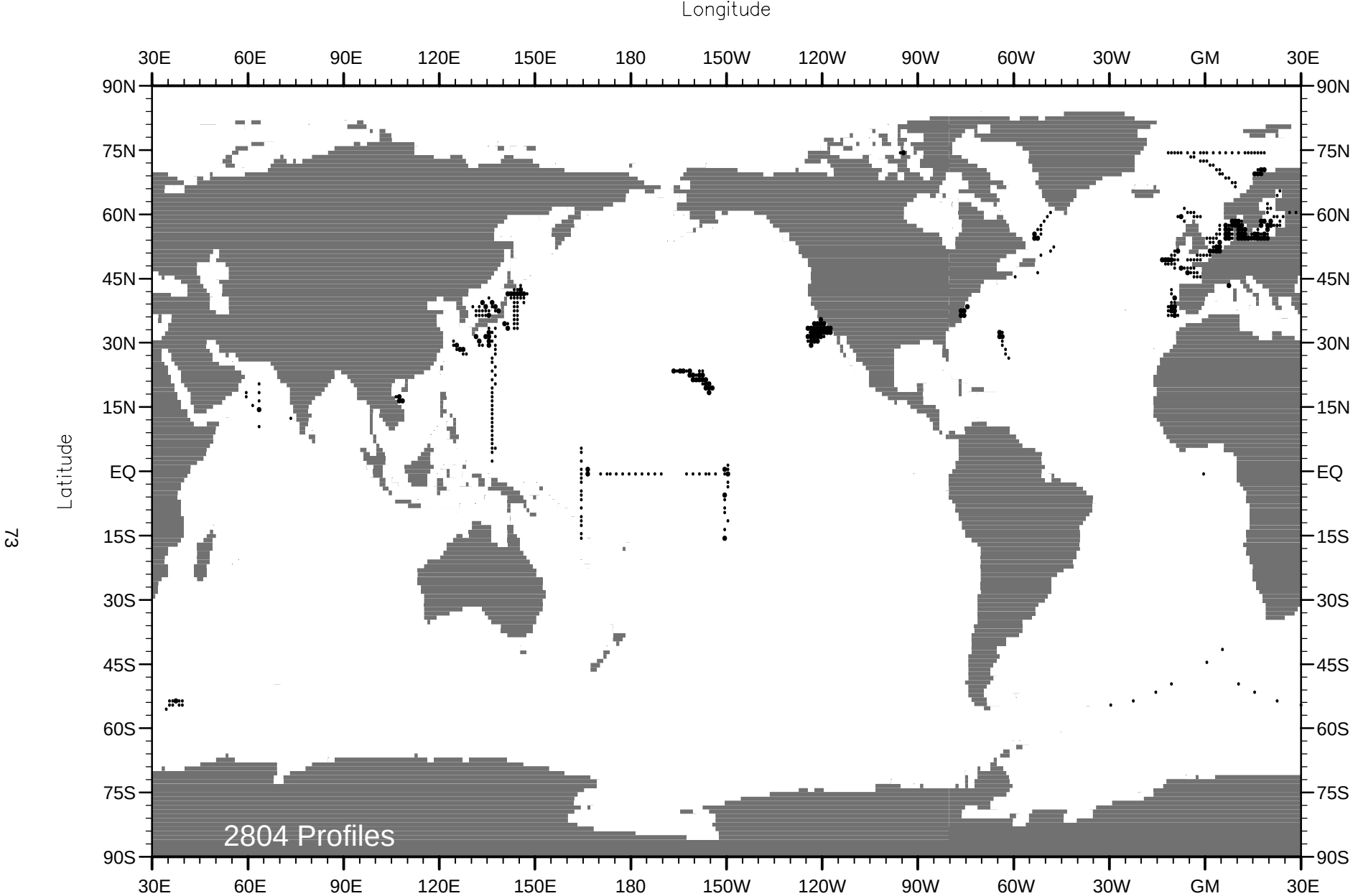


Fig. A41 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1994 .

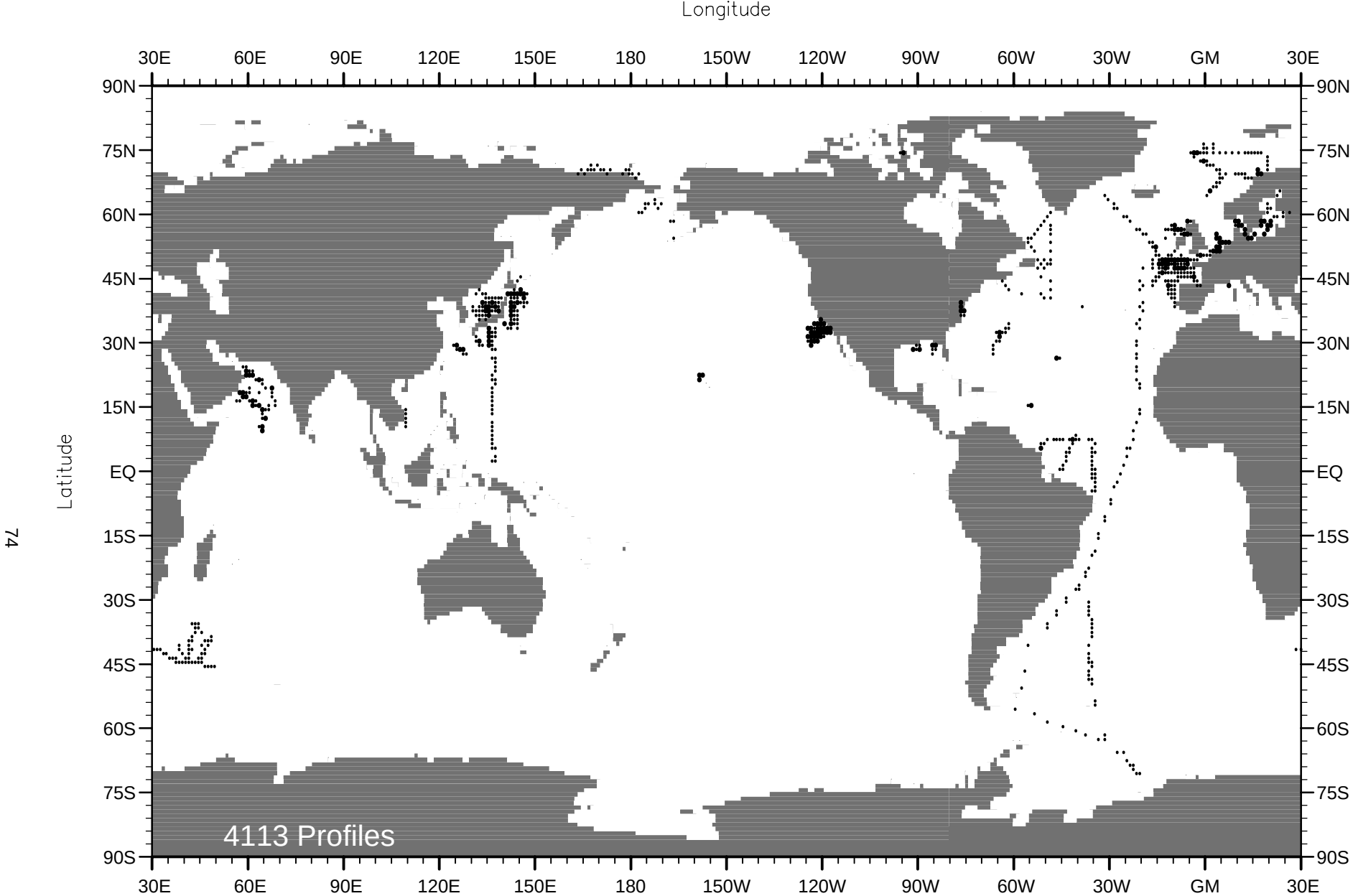


Fig. A42 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1995 .

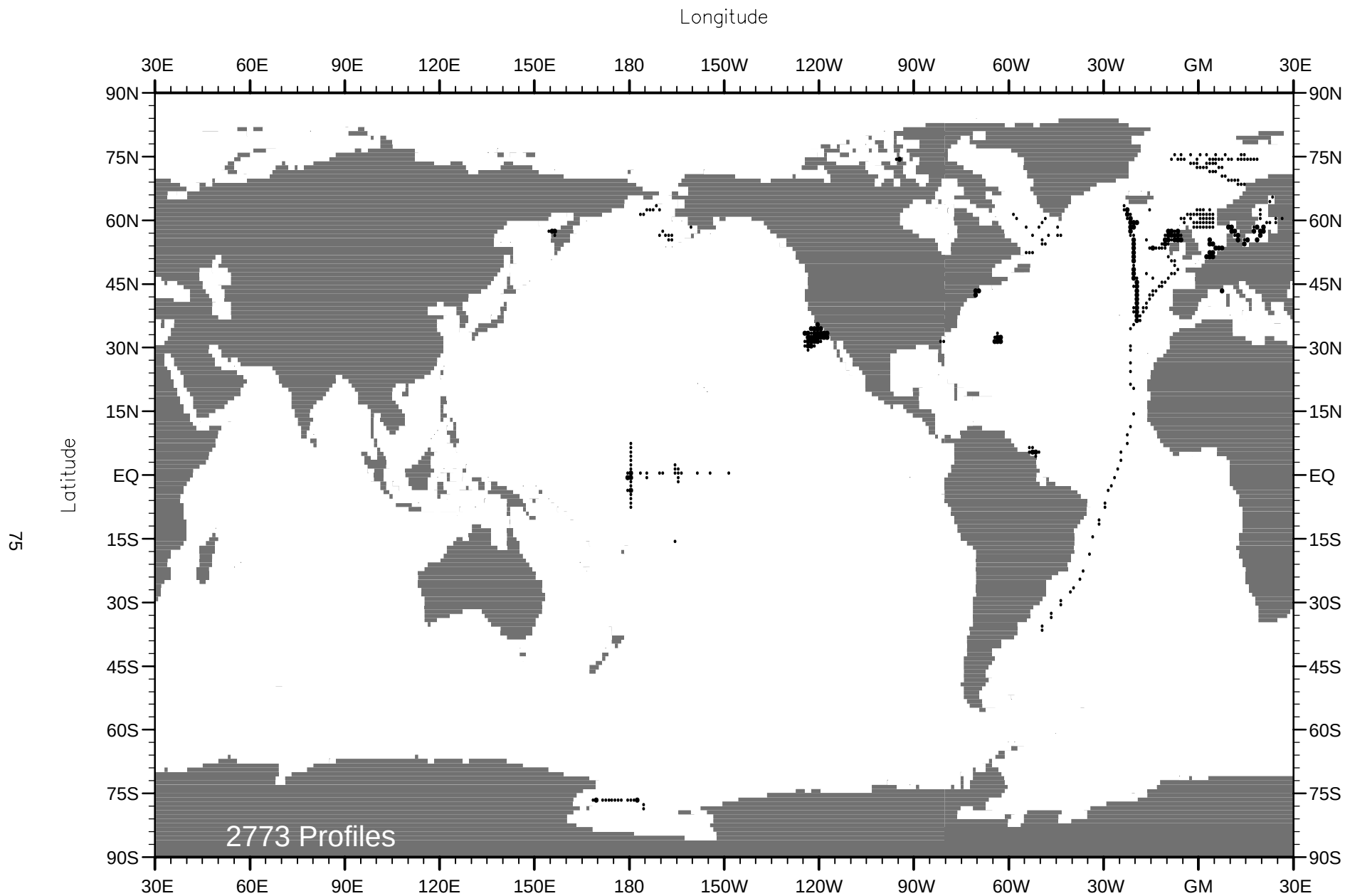


Fig. A43 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1996 .

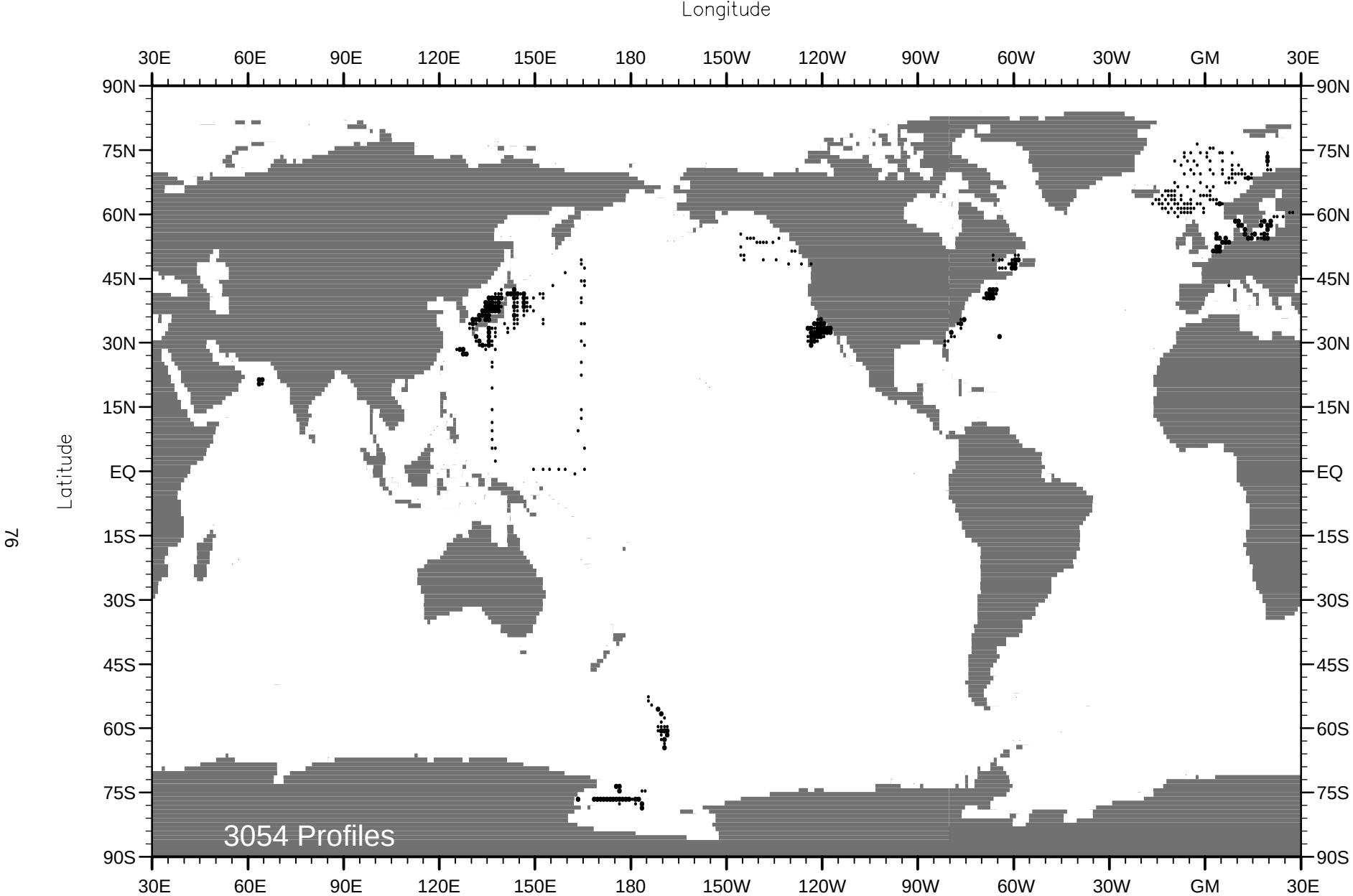


Fig. A44 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1997 .

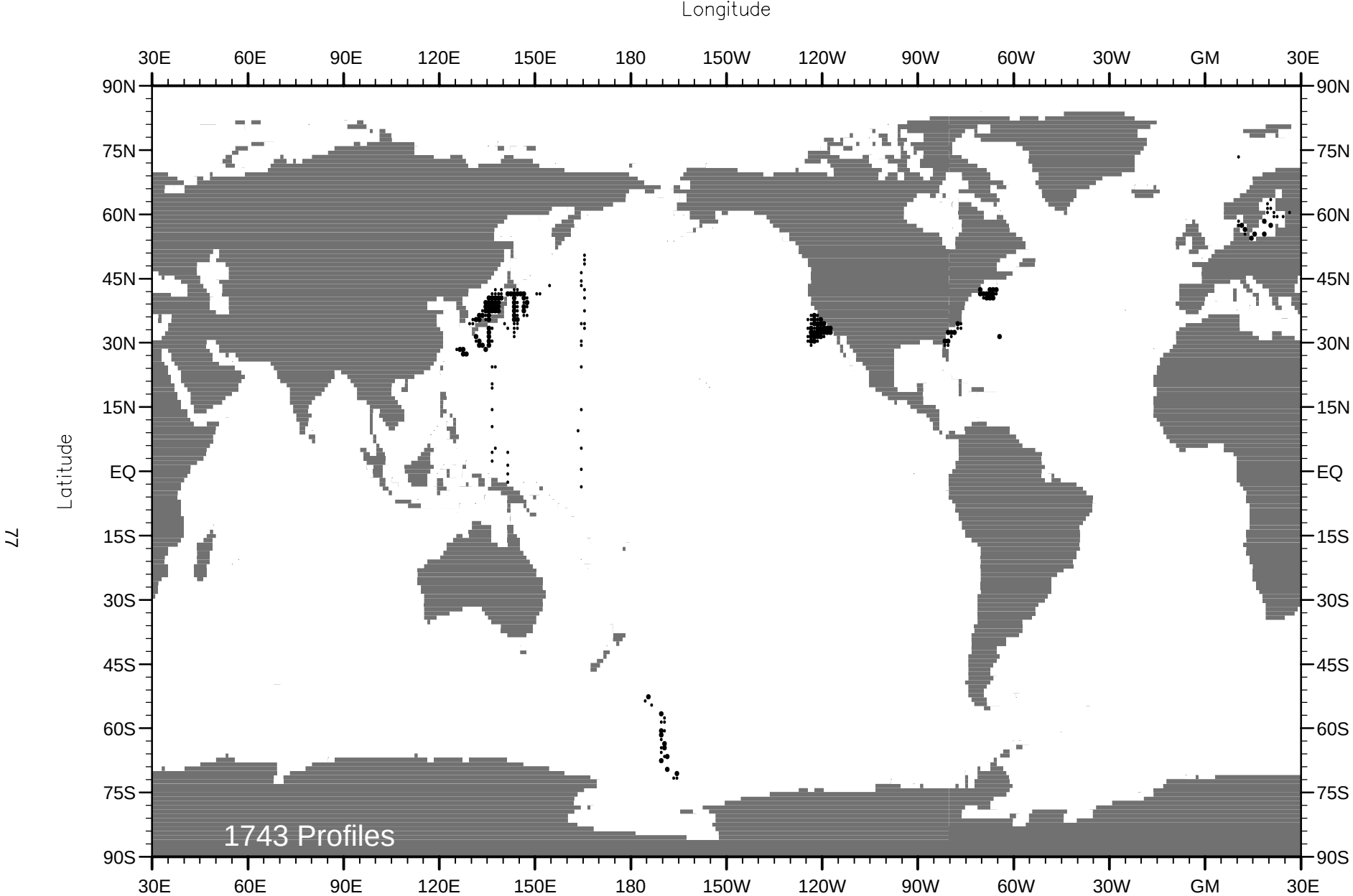


Fig. A45 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1998 .



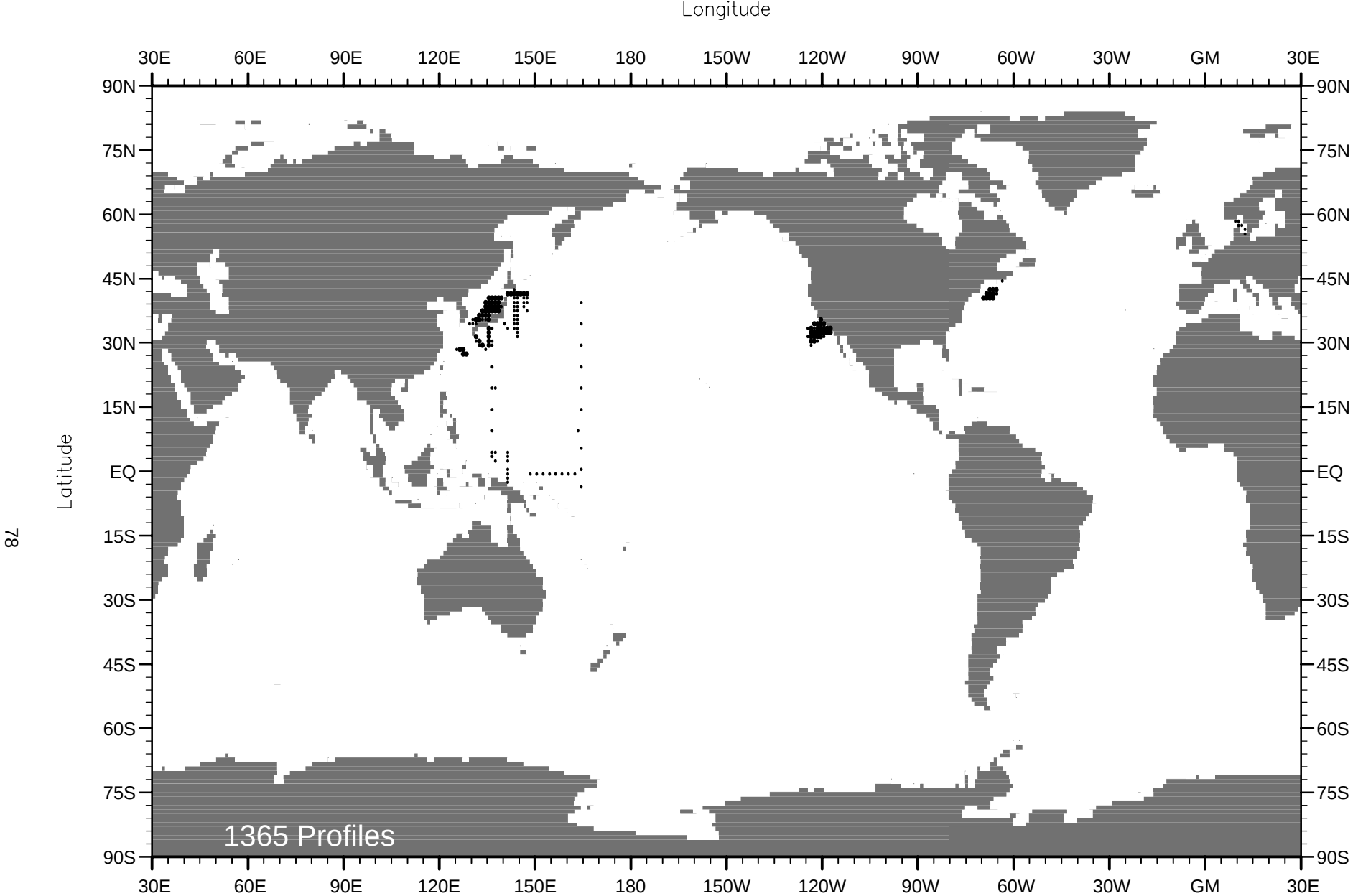


Fig. A46 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 1999 .

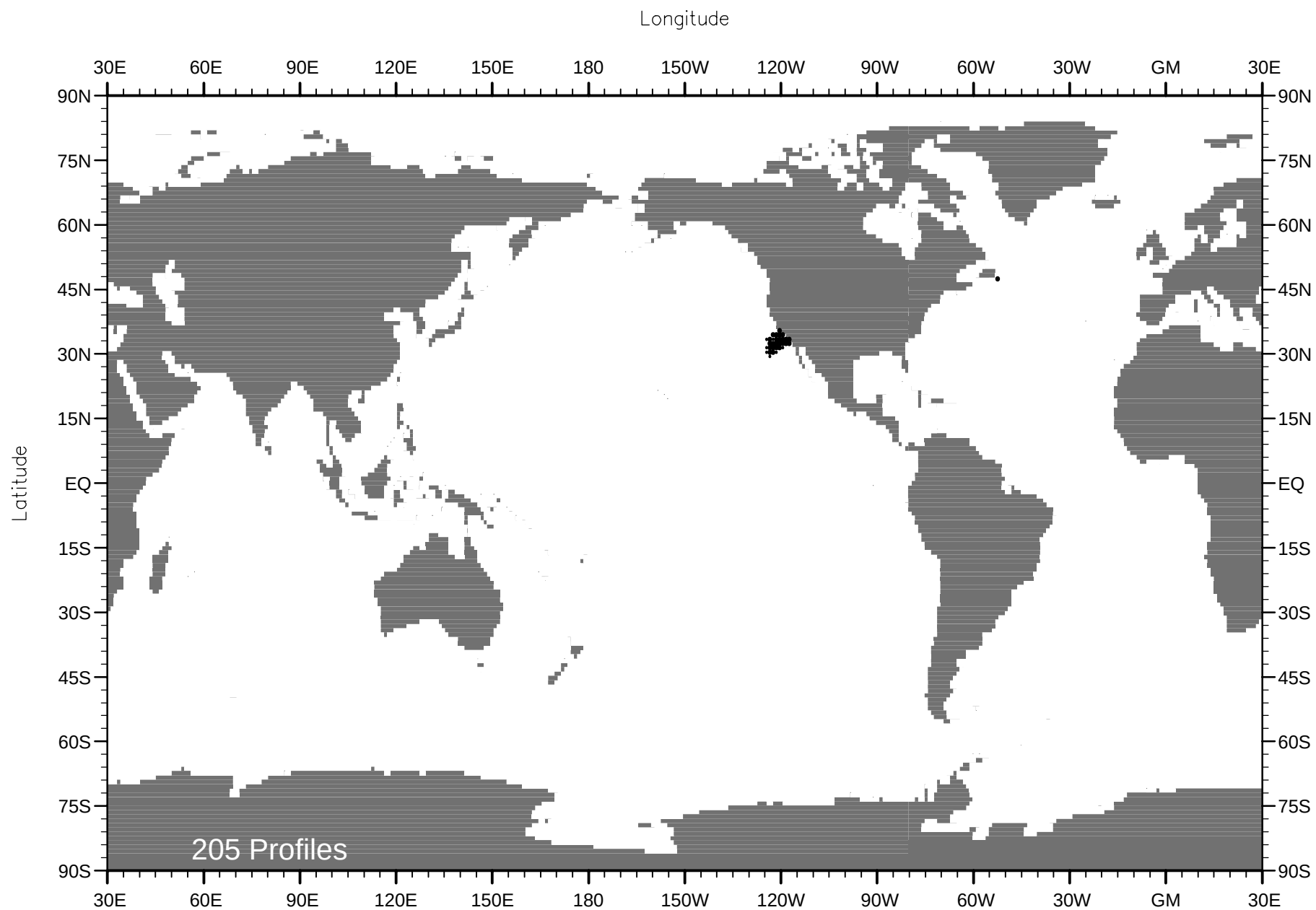


Fig. A47 Distribution of all Ocean Station Data (OSD) chlorophyll profiles in WOD01 for year 2000 .

## **5. APPENDIX B: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL SURFACE-ONLY CHLOROPHYLL DATA IN WOD01**

This appendix contains yearly distributions of all Surface-only chlorophyll data contained in WOD01. 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 WOD01 Surface-only chlorophyll data are plotted including stations that may be erroneously located over land. However, WOD01 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.

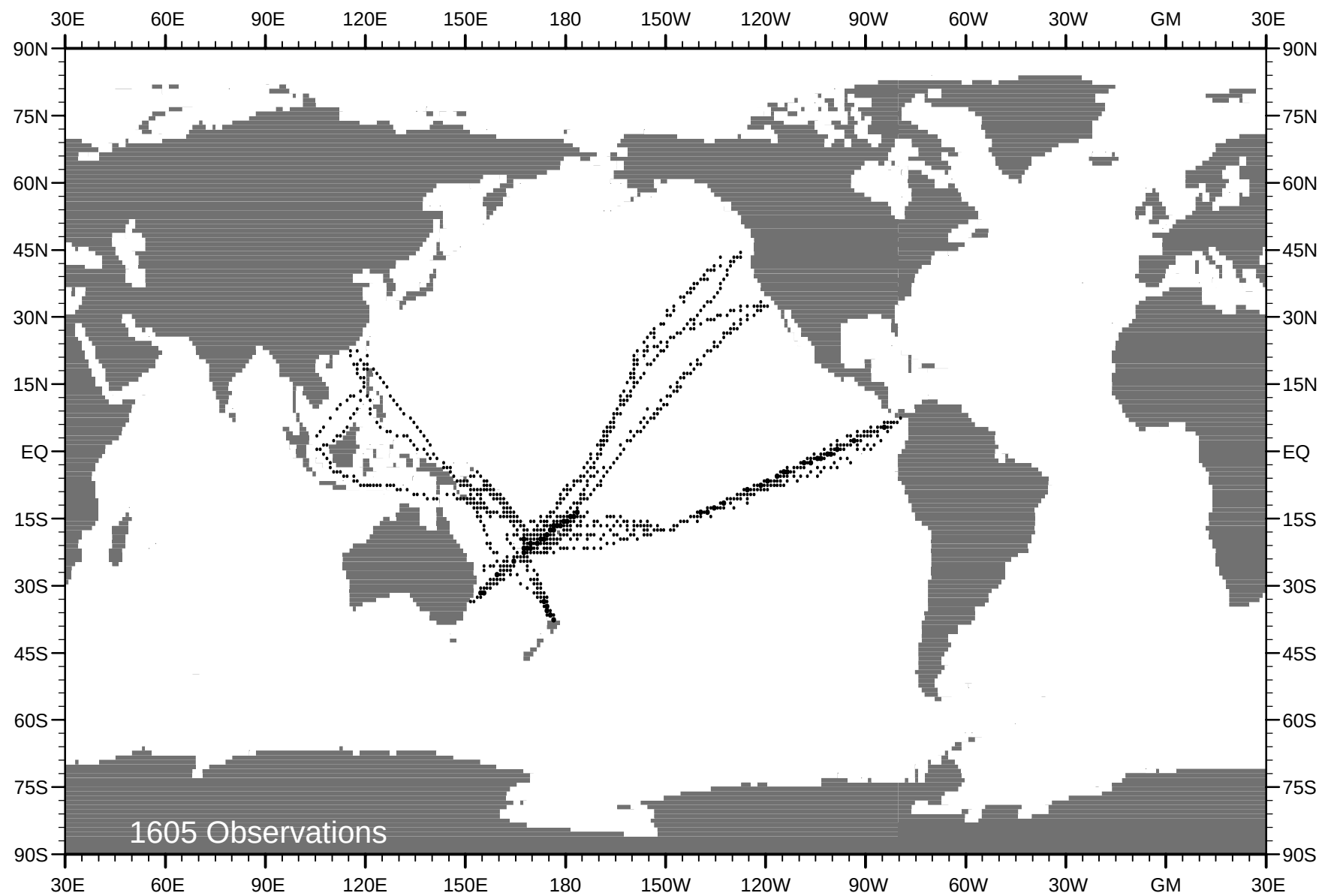


Fig. B1 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1978 .

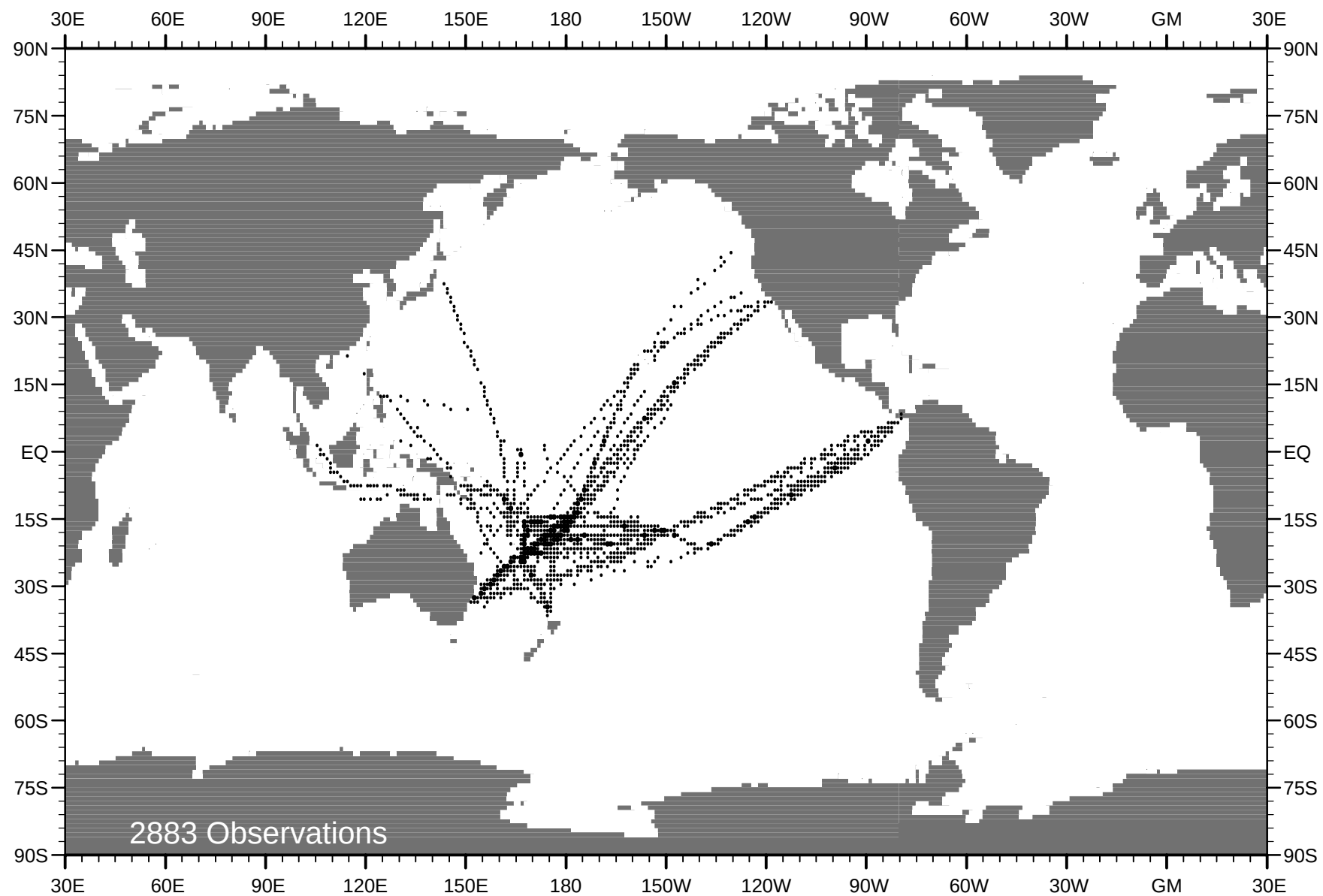


Fig. B2 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1979 .

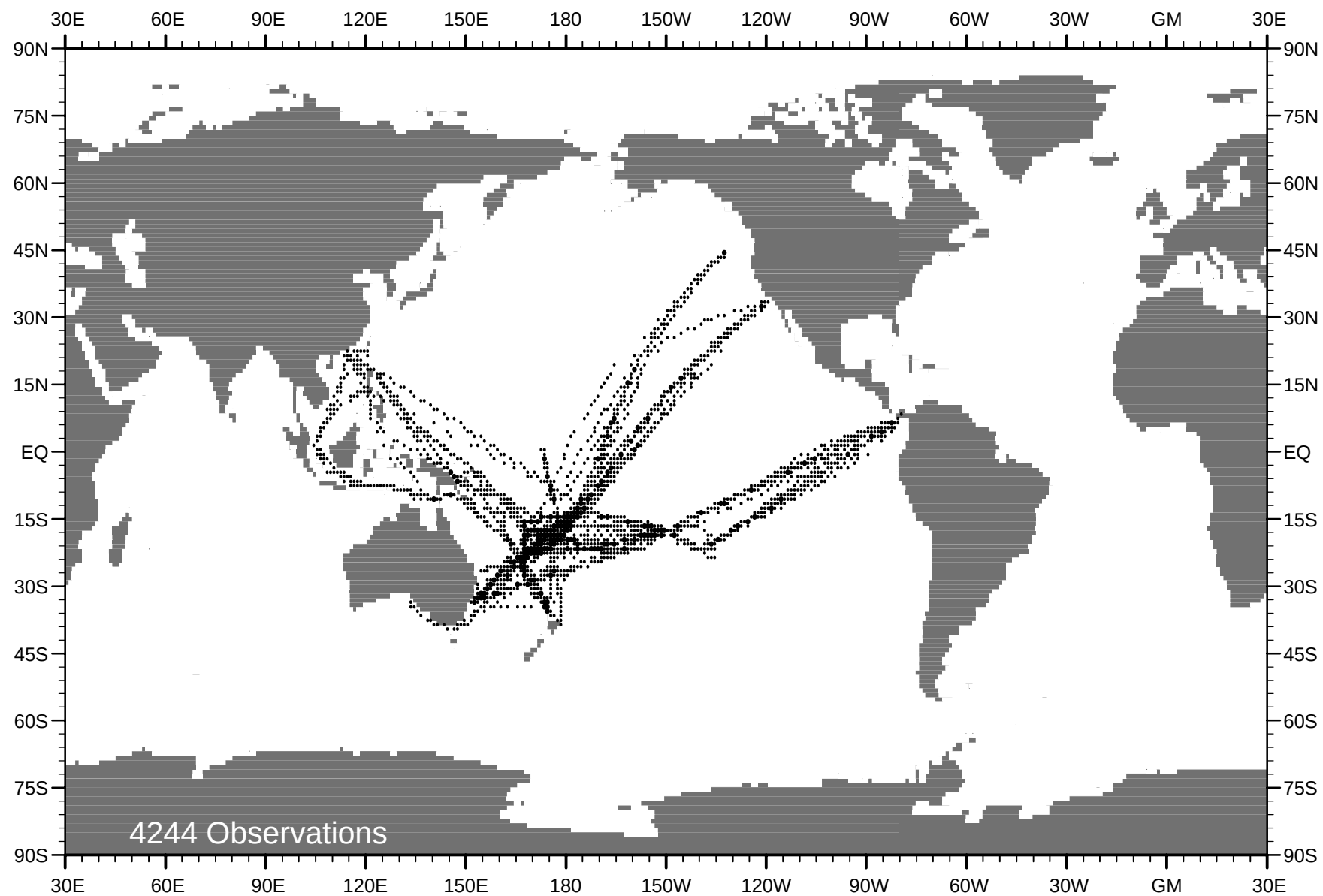


Fig. B3 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1980 .

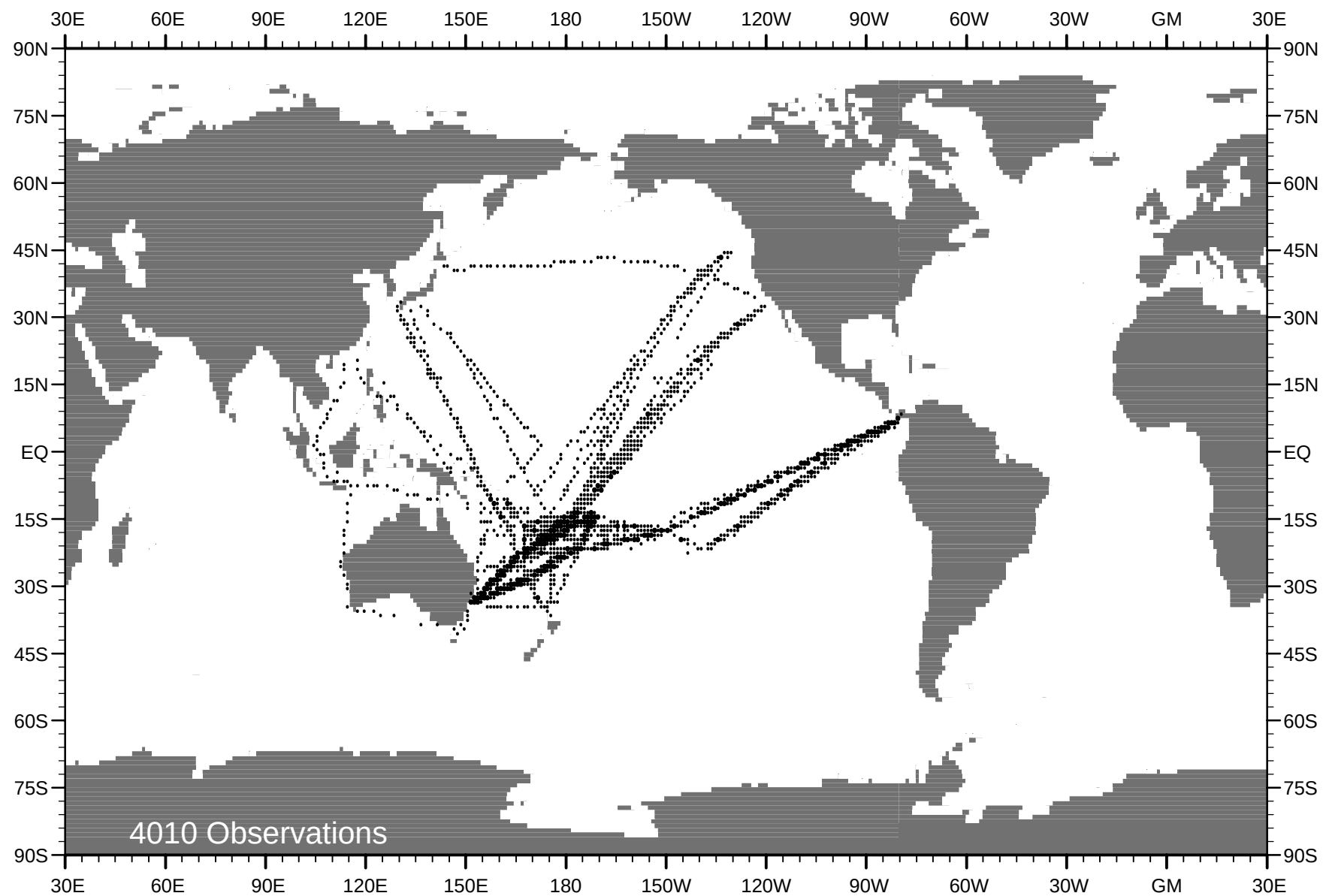


Fig. B4 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1981 .

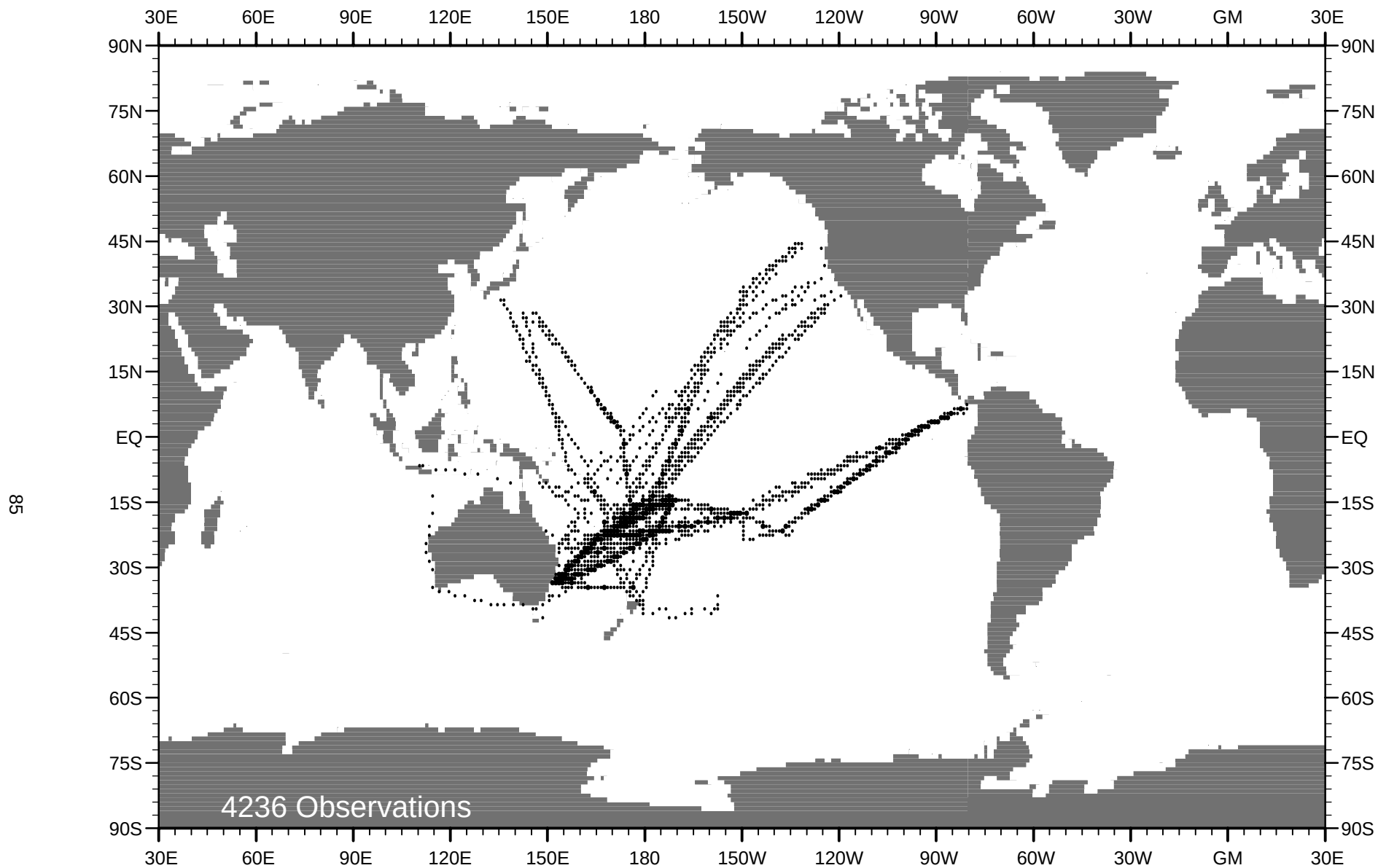


Fig. B5 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1982 .



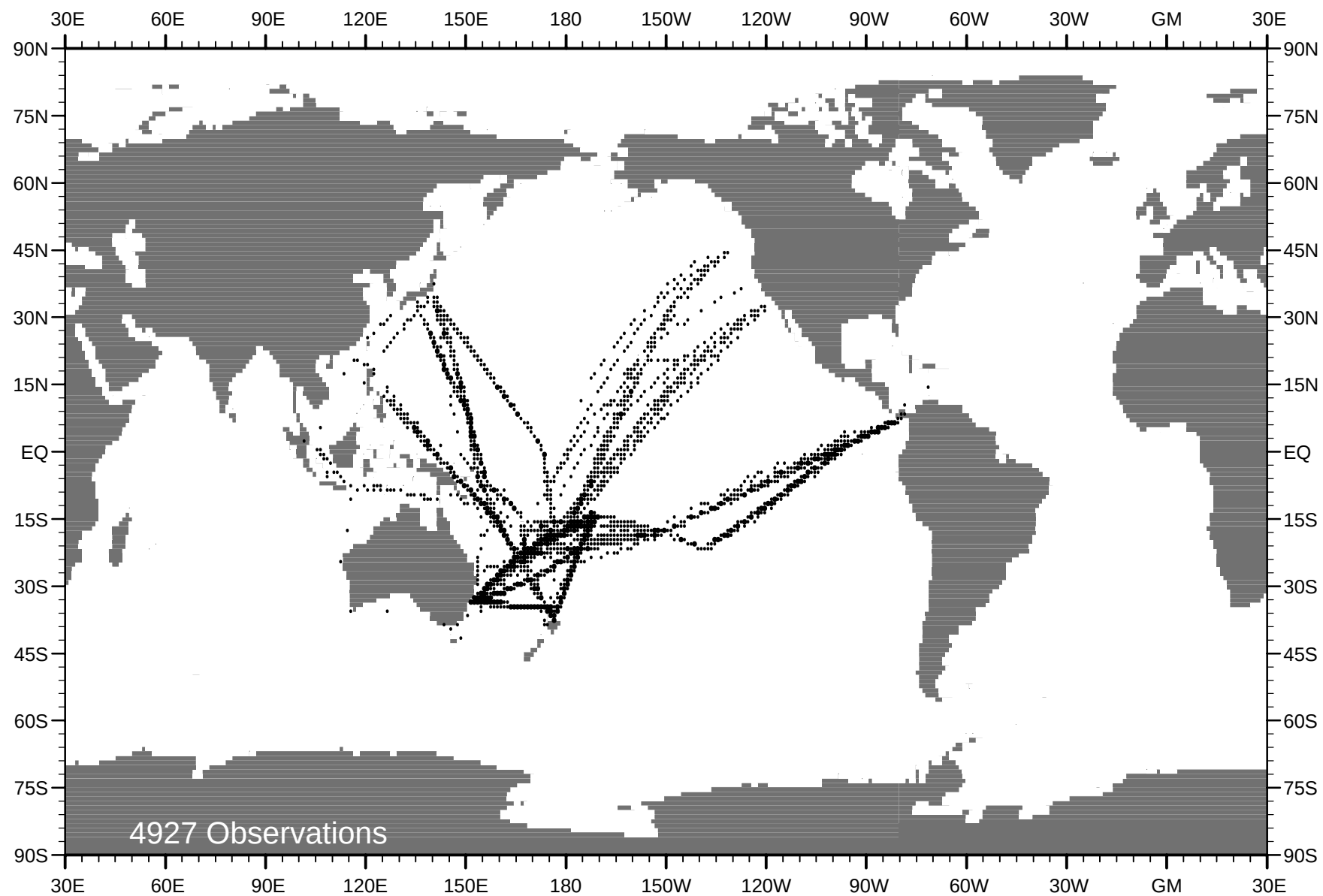


Fig. B6 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1983 .

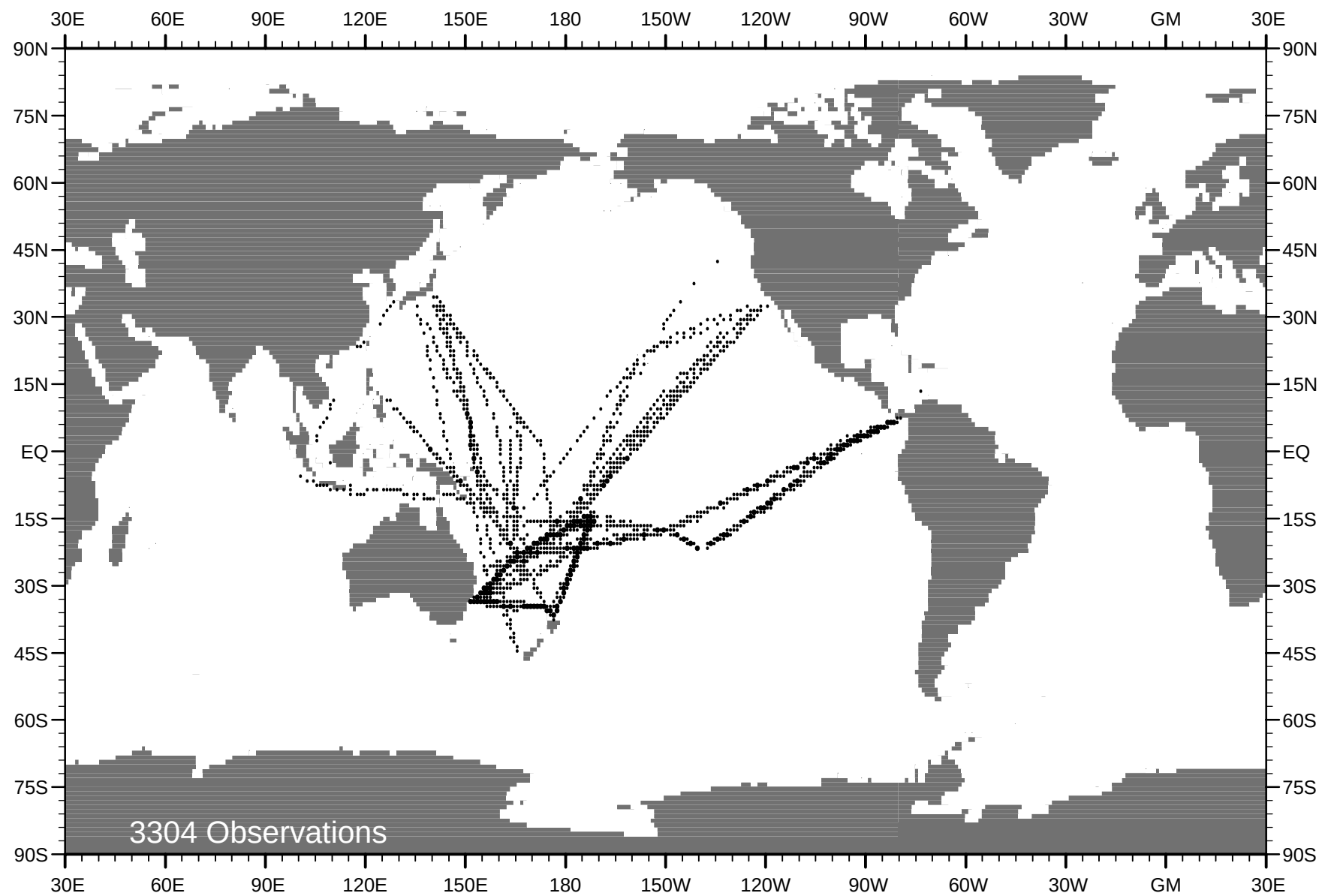


Fig. B7 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1984 .

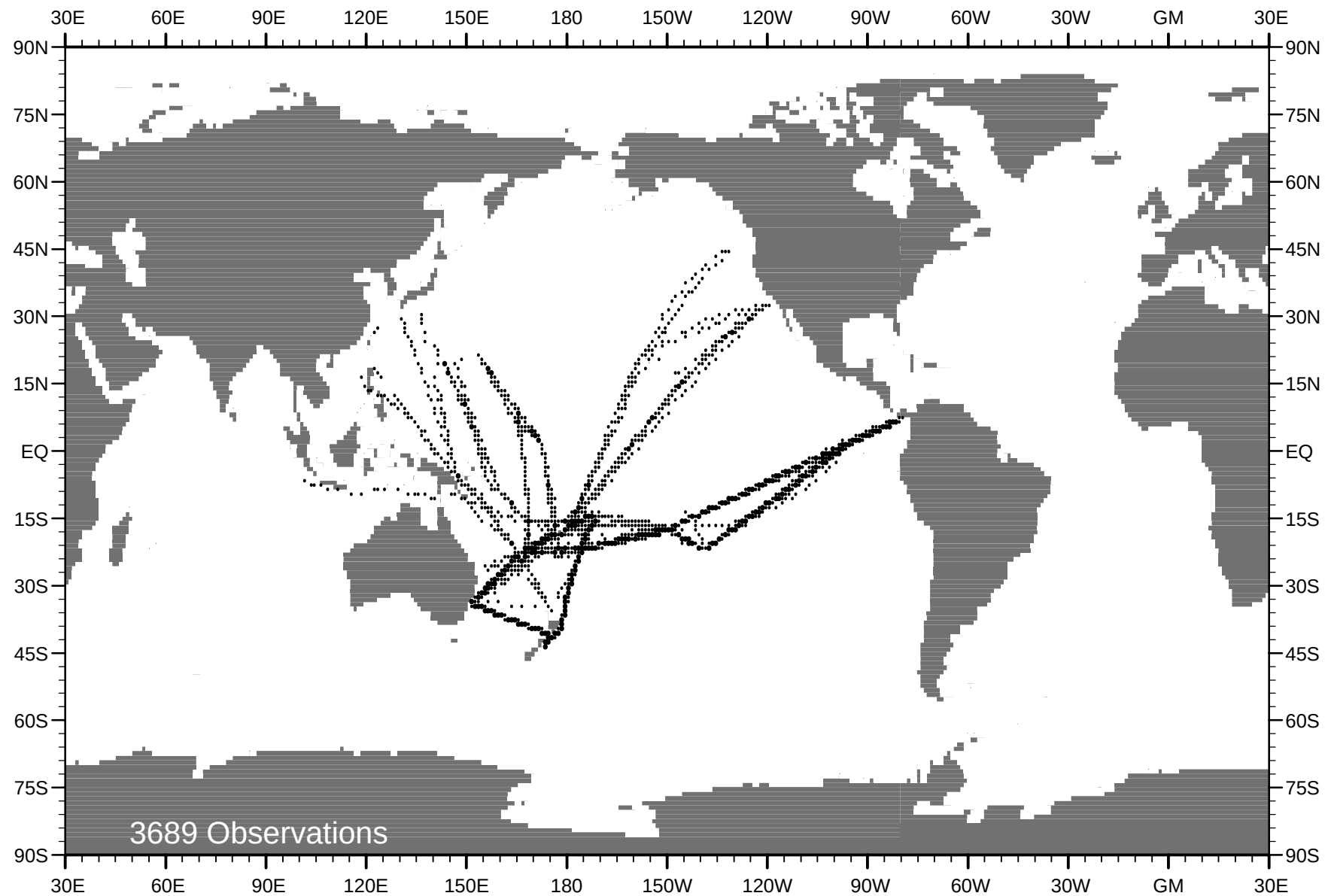


Fig. B8 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1985 .

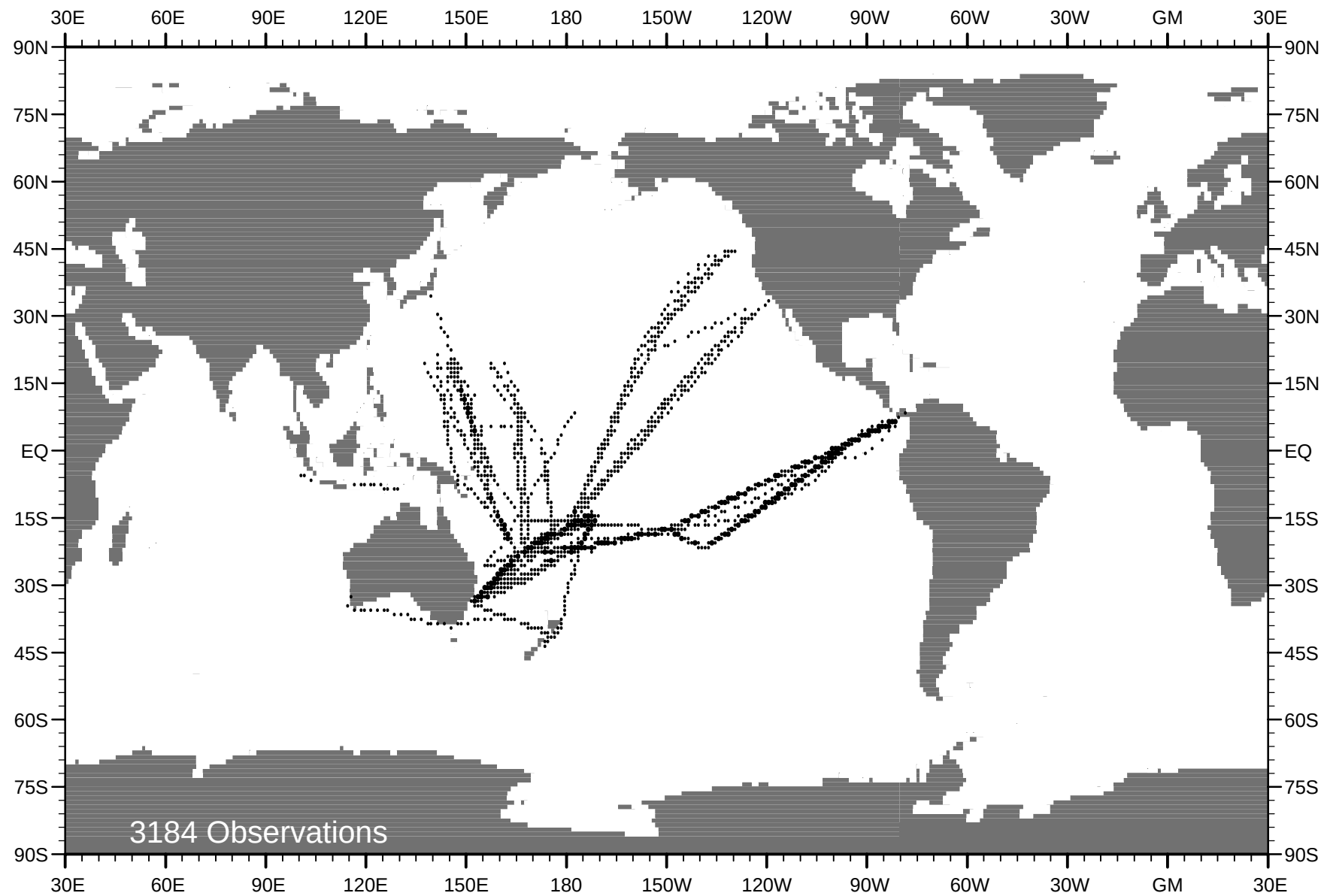


Fig. B9 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1986 .

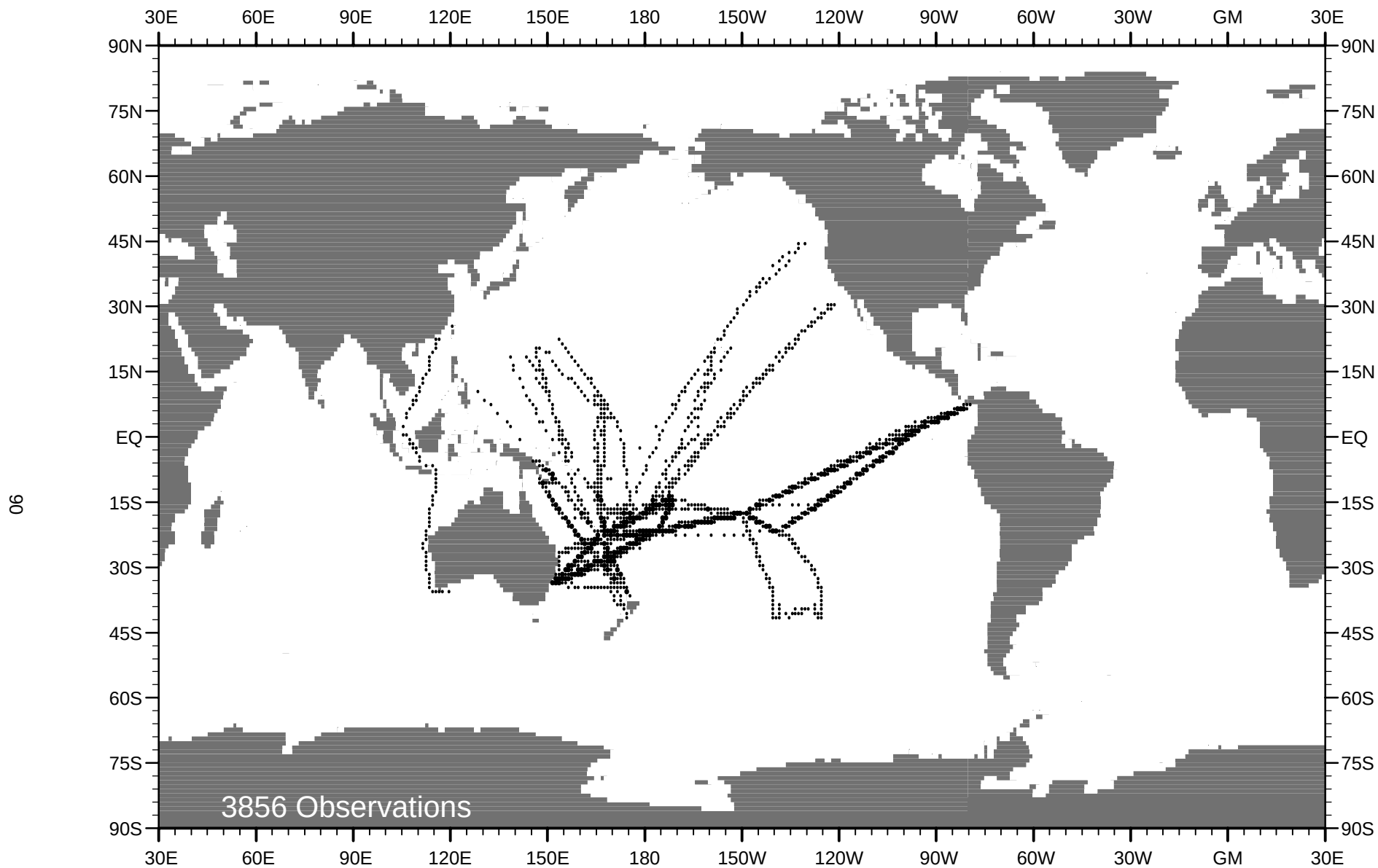


Fig. B10 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1987 .

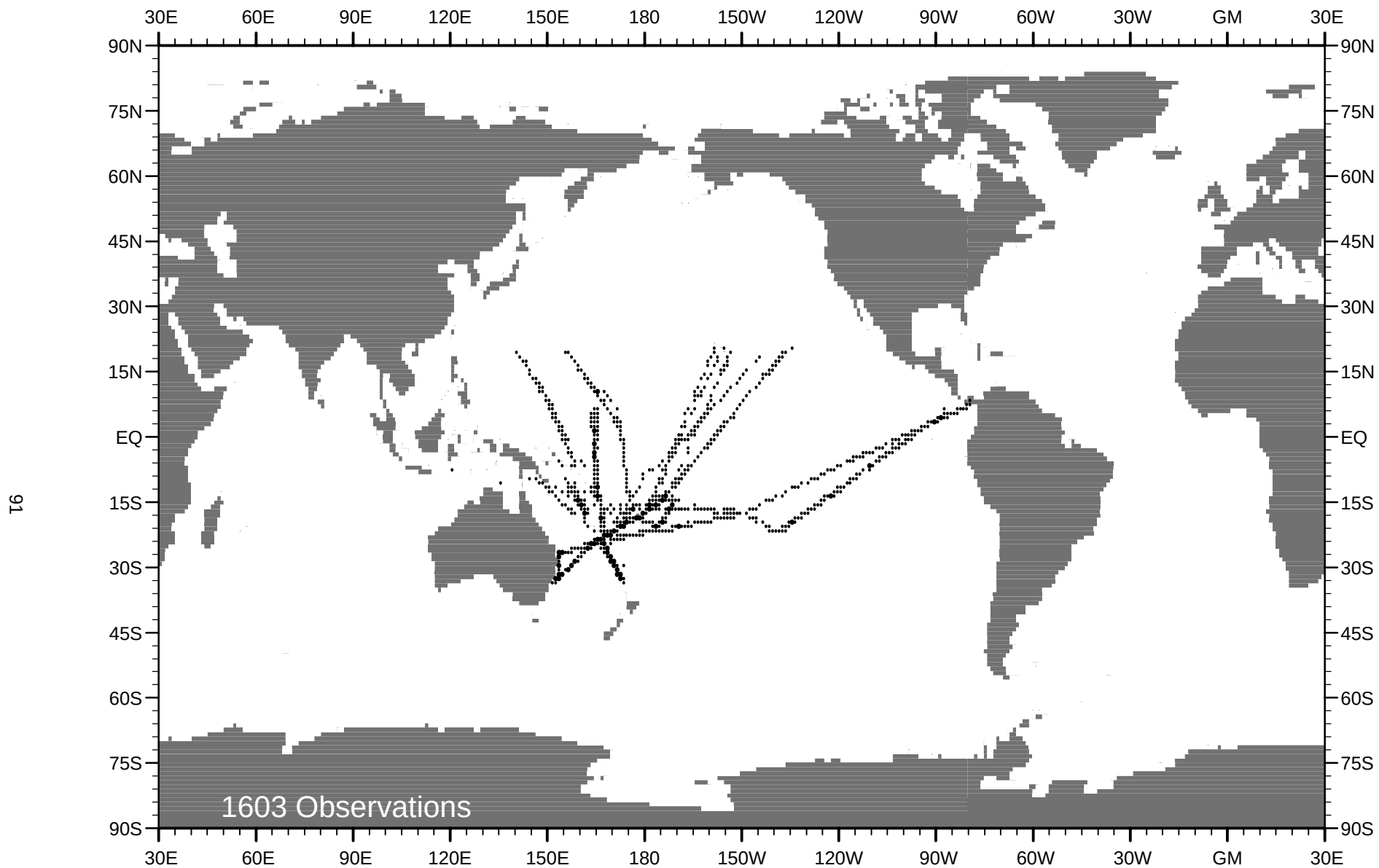


Fig. B11 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1988 .

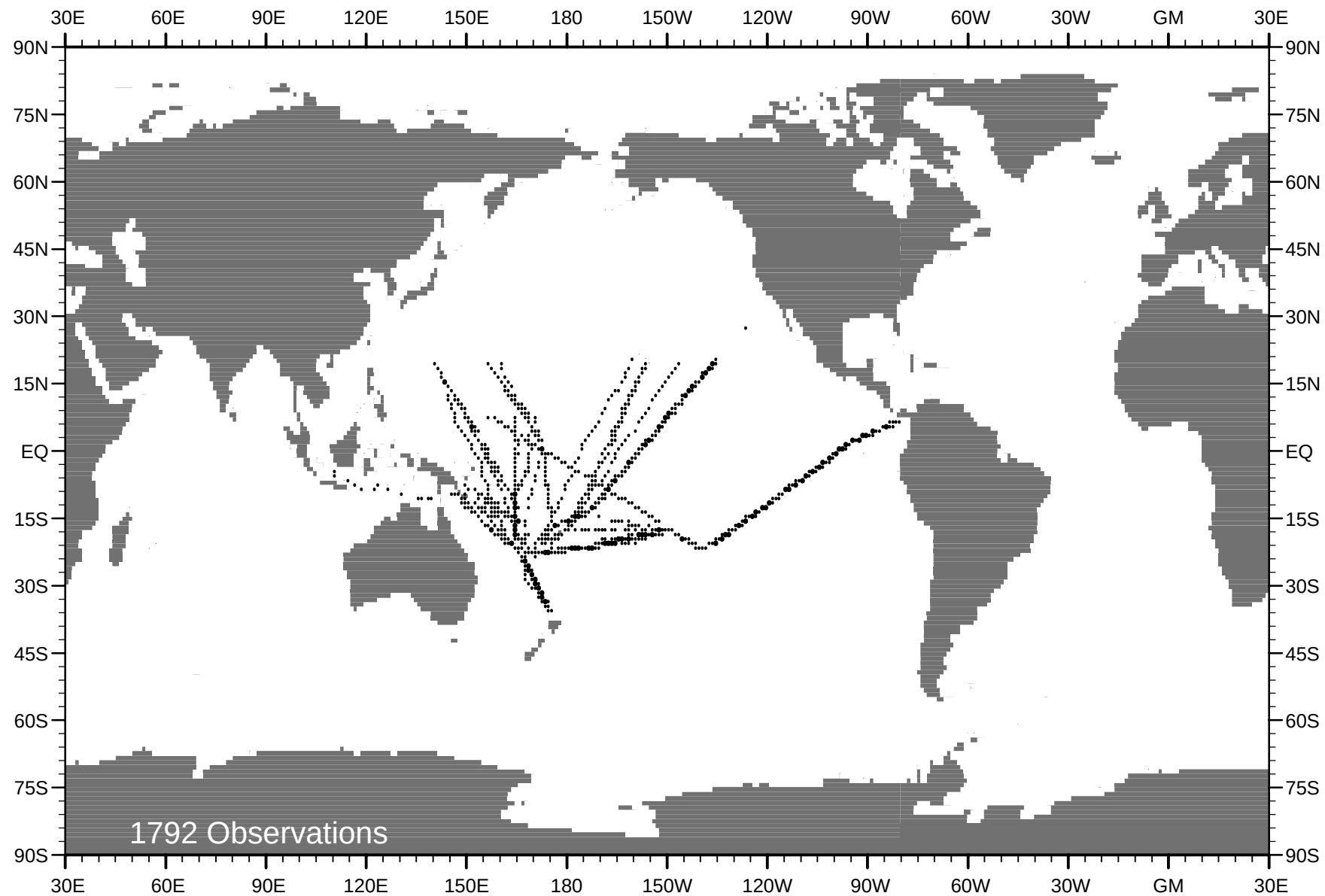


Fig. B12 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1989 .

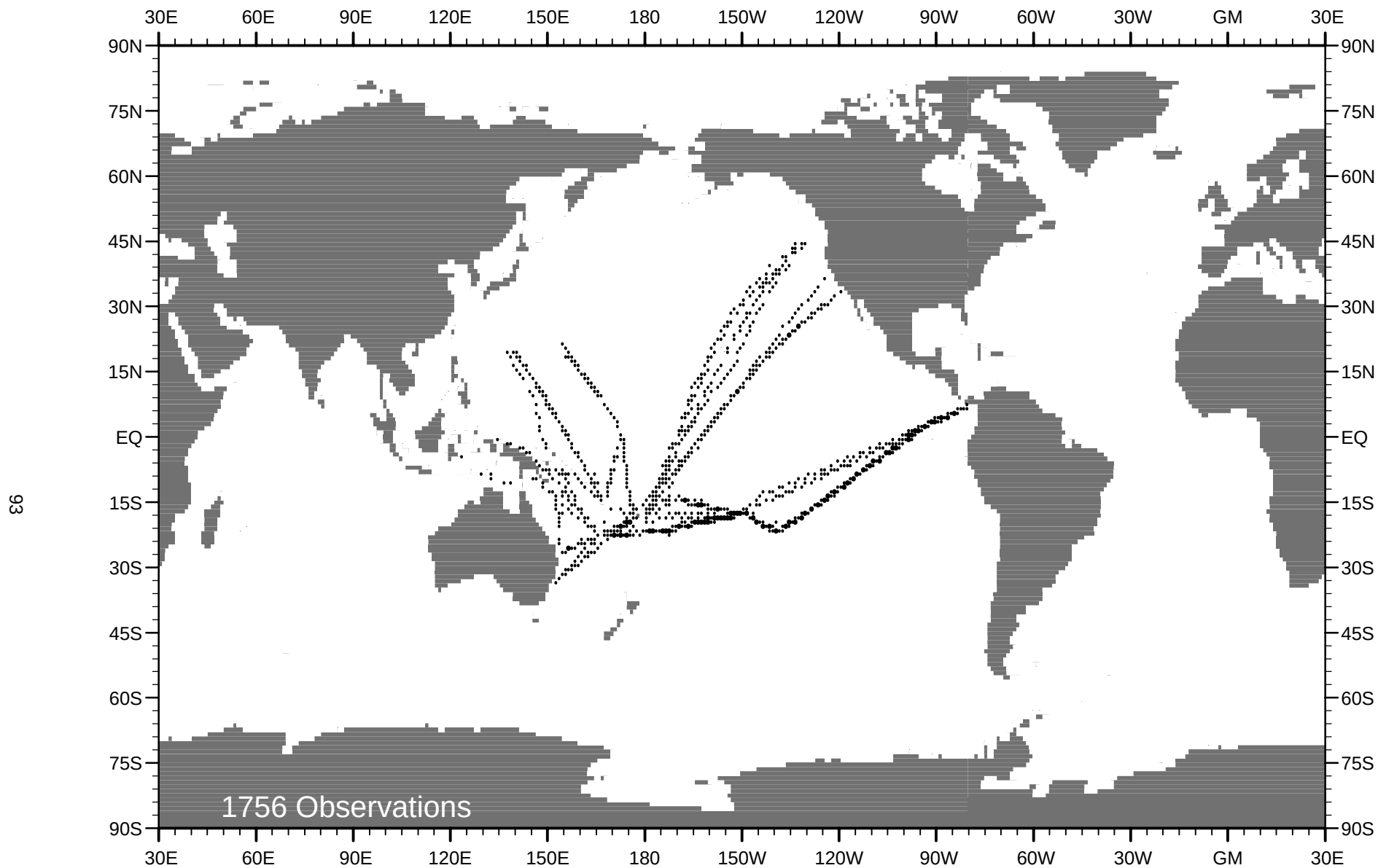


Fig. B13 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1990 .



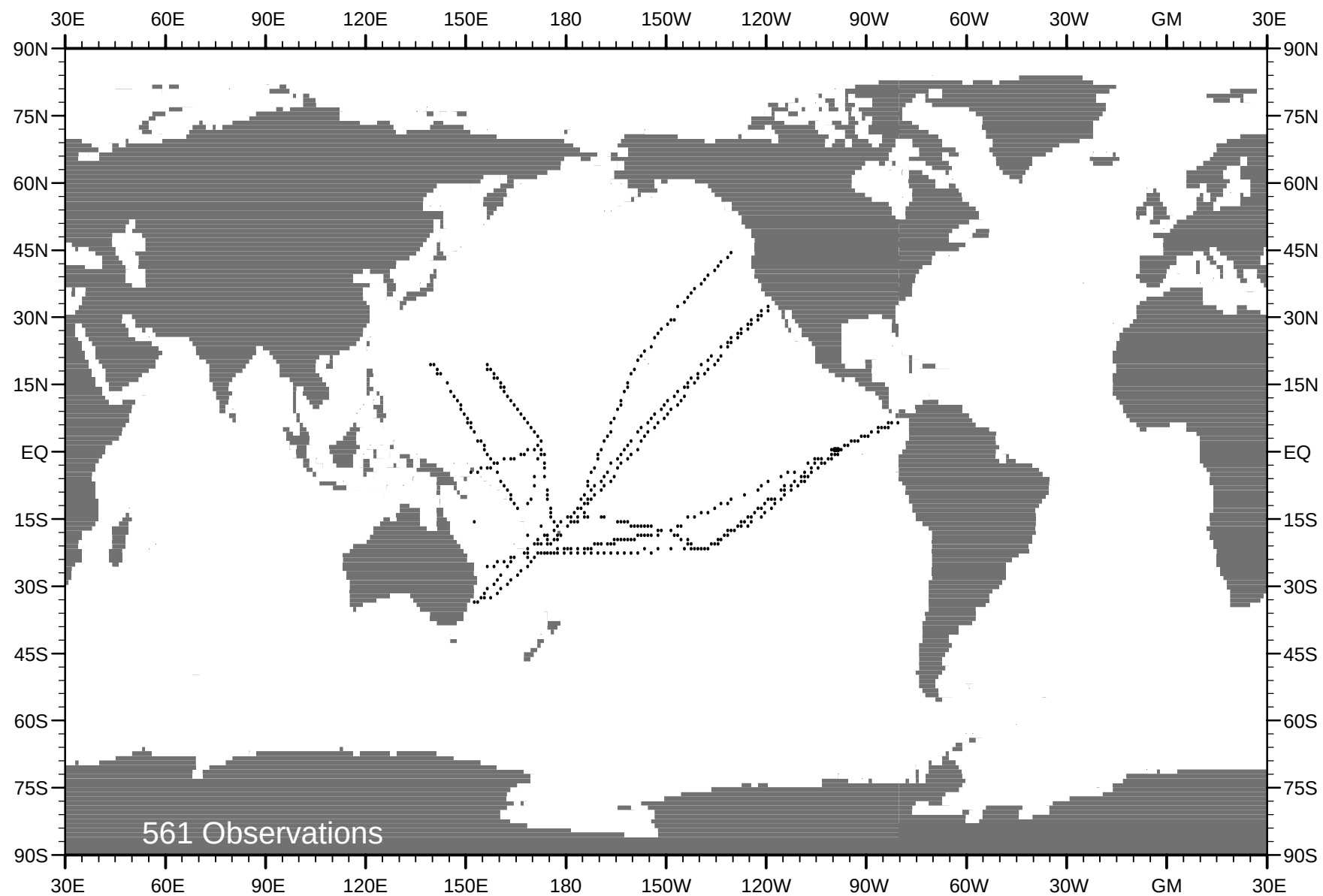


Fig. B14 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1991 .

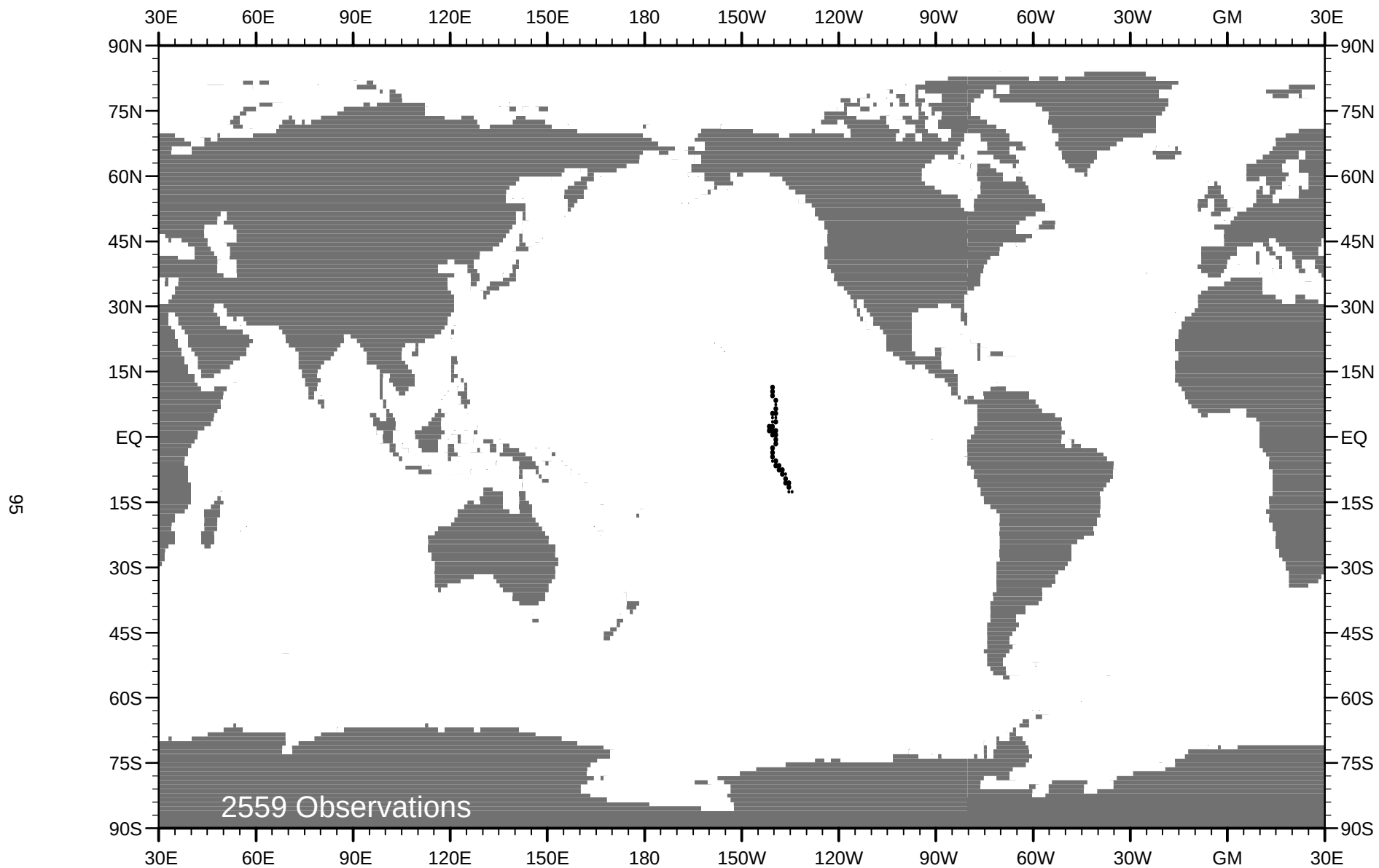


Fig. B15 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1992 .

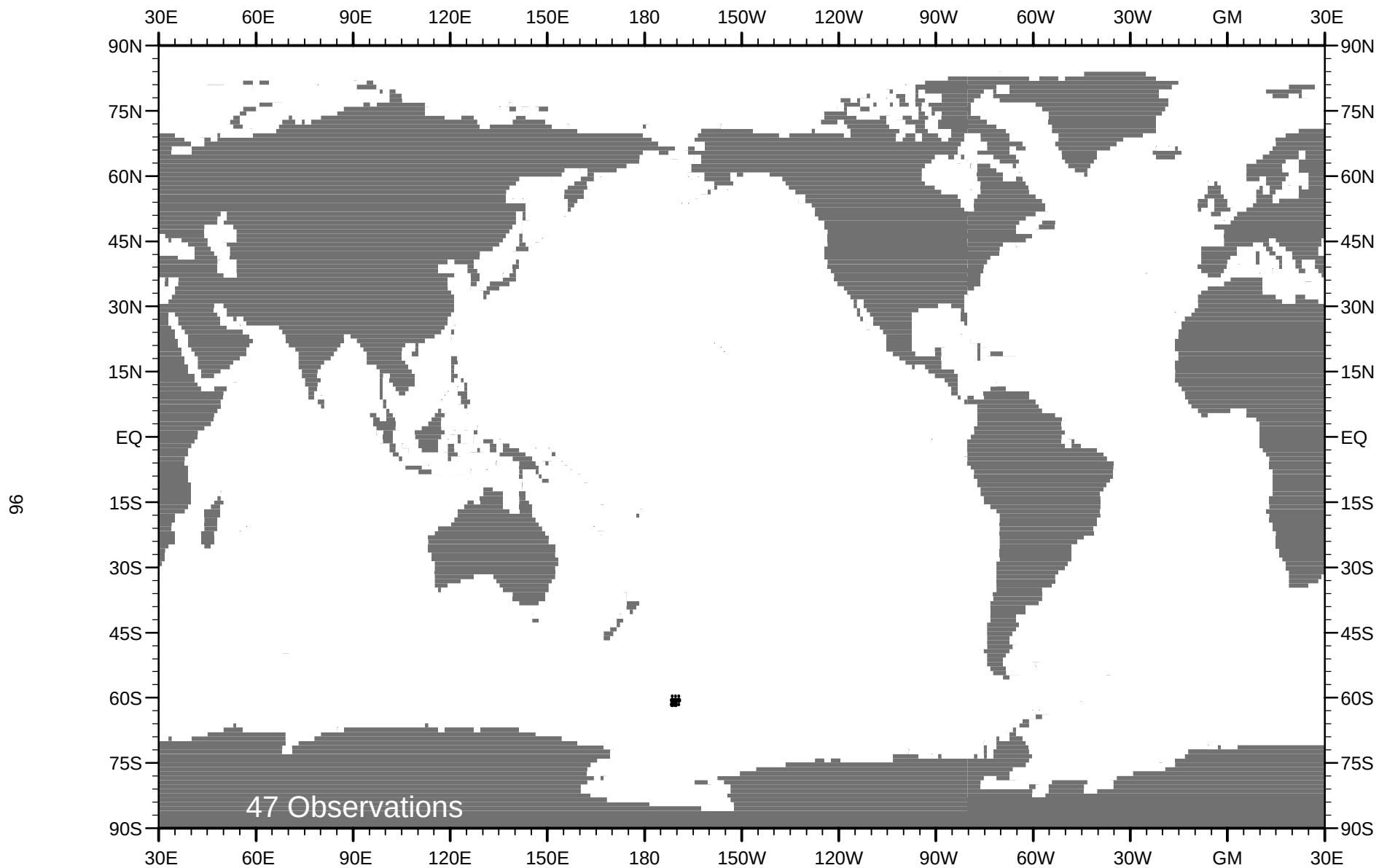


Fig. B16 Distribution of all Surface-only (SURF) chlorophyll data in WOD01 for year 1998 .

**6. APPENDIX C: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL OCEAN STATION DATA (OSD) PLANKTON ABUNDANCE DATA IN WOD01**

This appendix contains yearly distributions of all OSD plankton abundance data contained in WOD01. 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 WOD01 OSD plankton abundance data are plotted including stations that may be erroneously located over land. However, WOD01 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 C, a small dot indicates a one-degree square containing from one to four stations and a large dot indicates five or more stations.

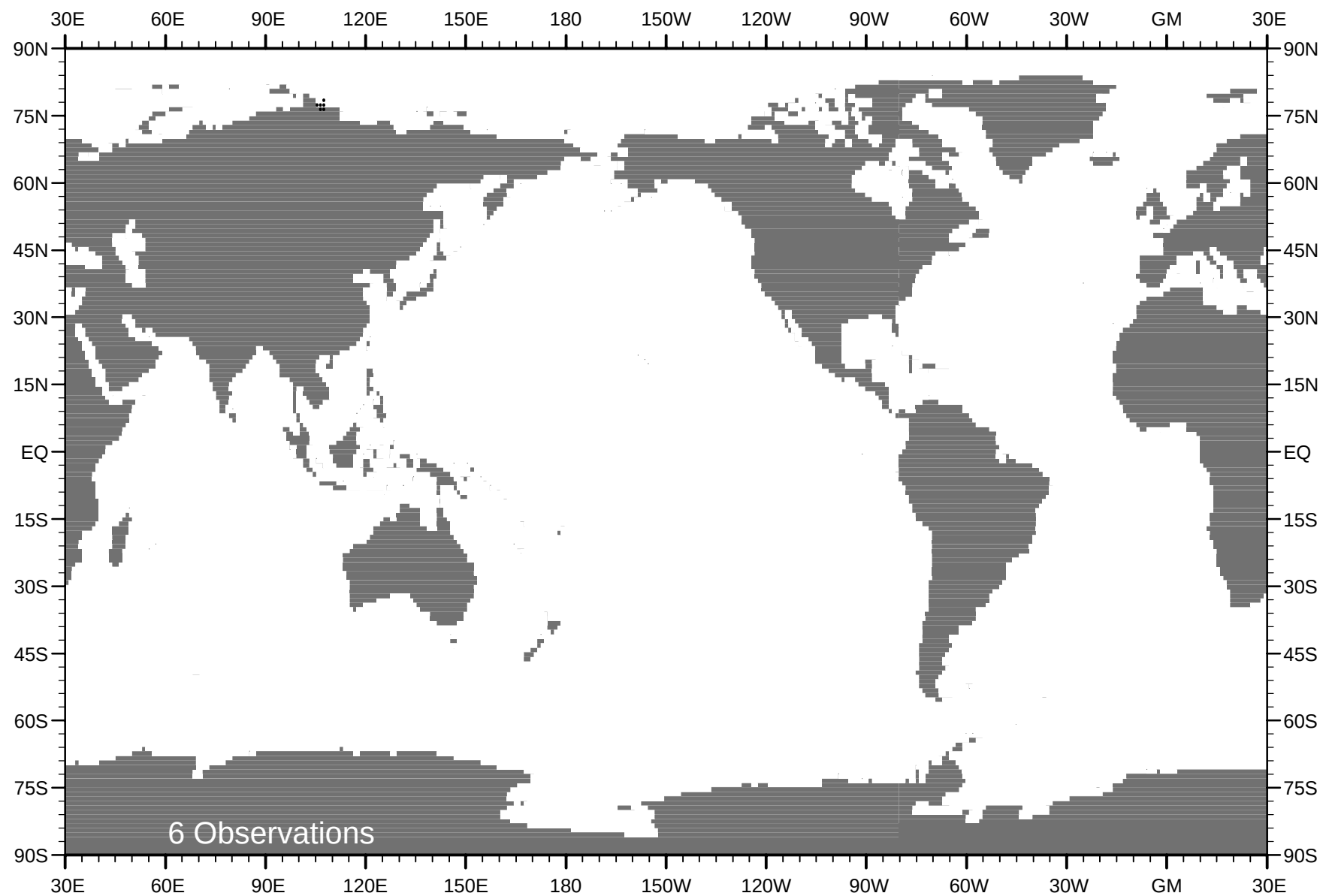


Fig. C1 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1913 .

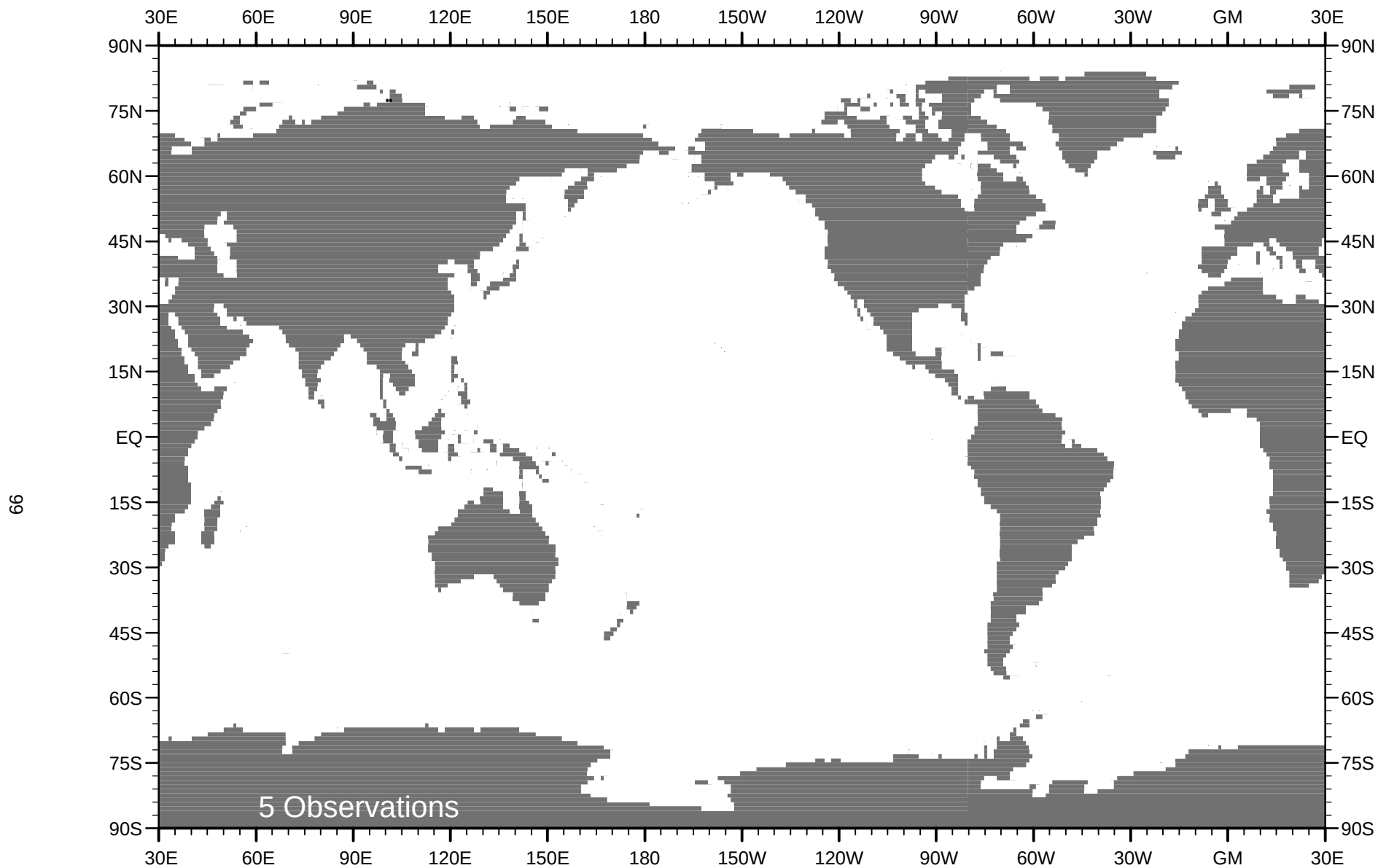


Fig. C2 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1914 .

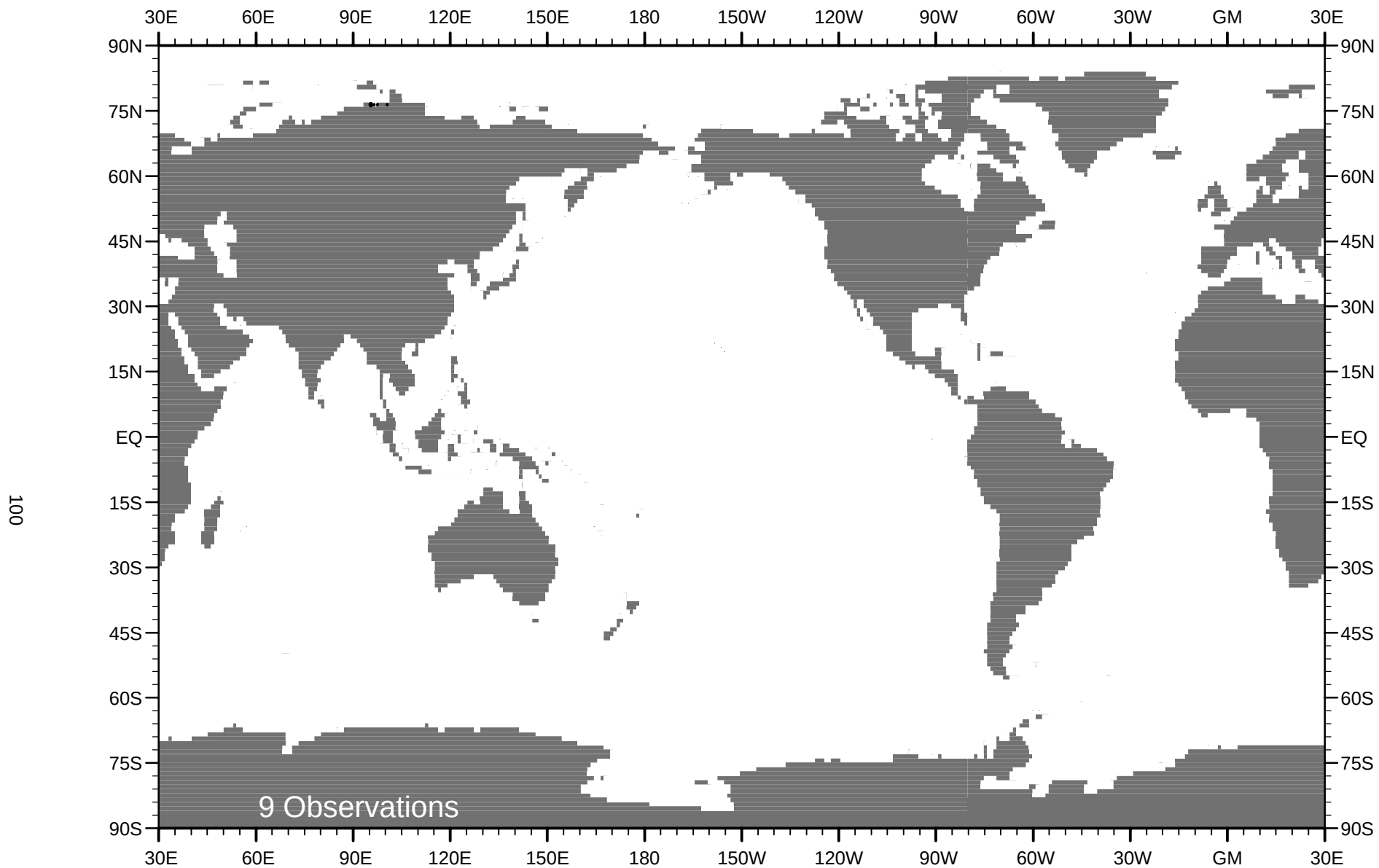


Fig. C3 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1915 .

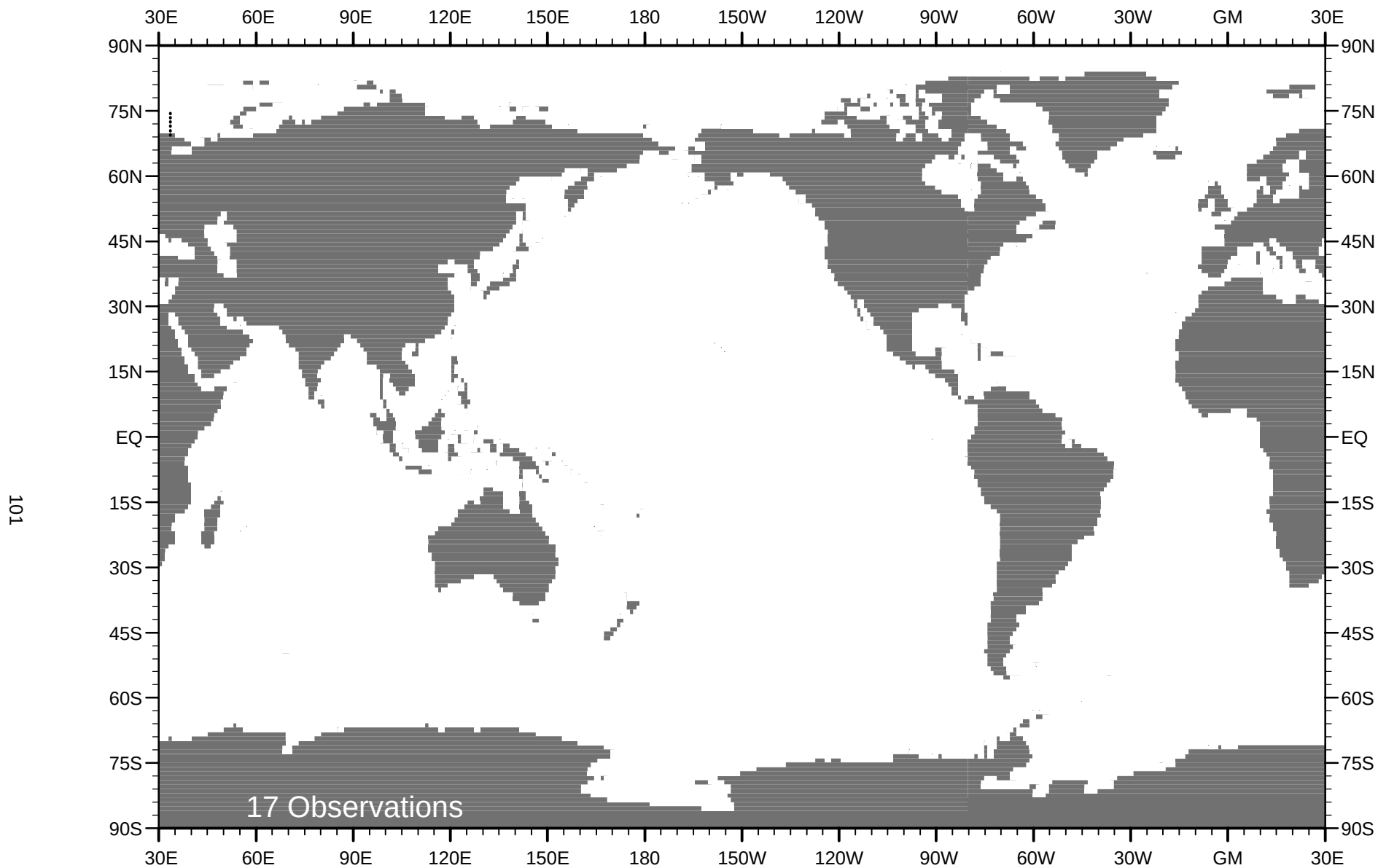


Fig. C4 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1921 .



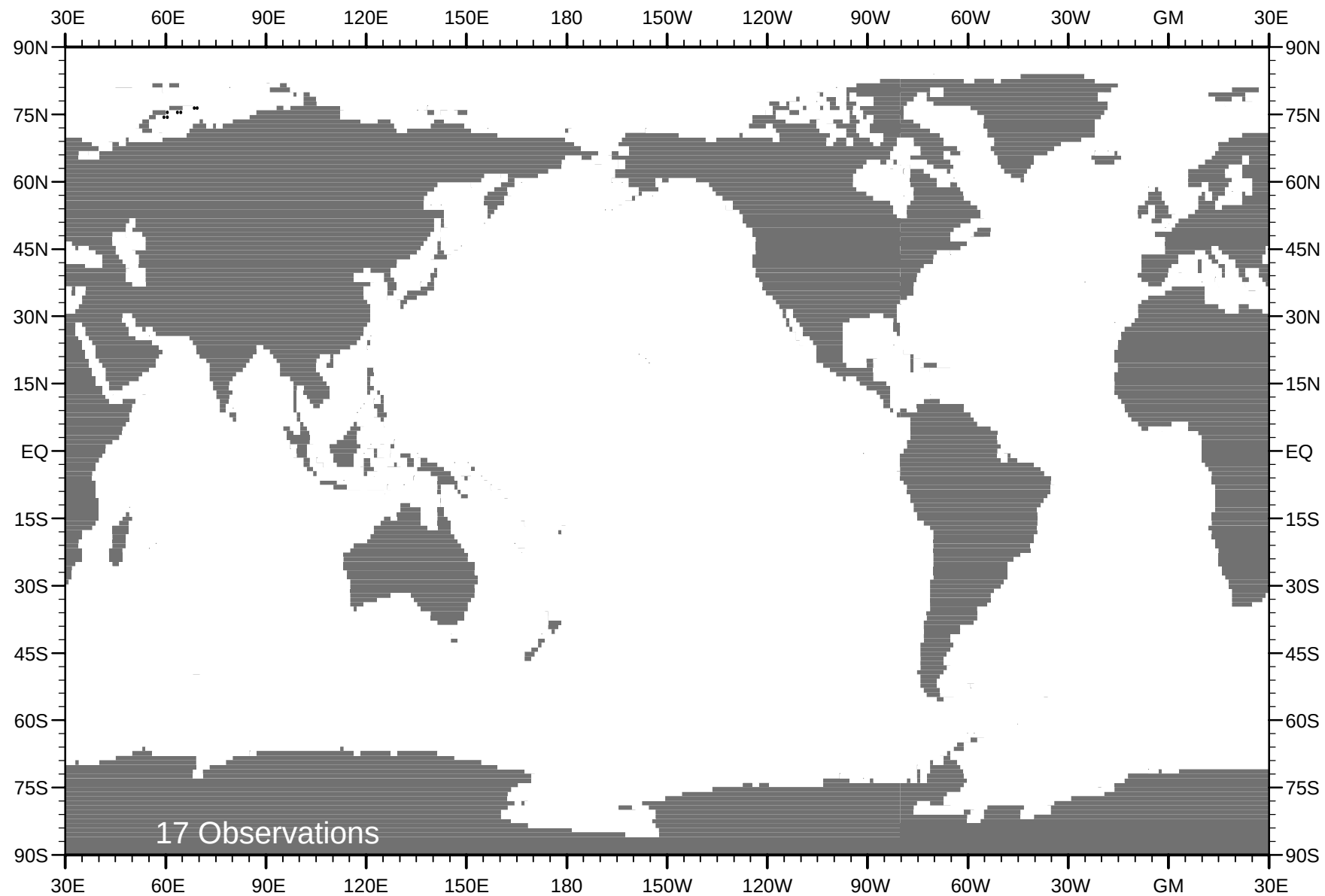


Fig. C5 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1925 .

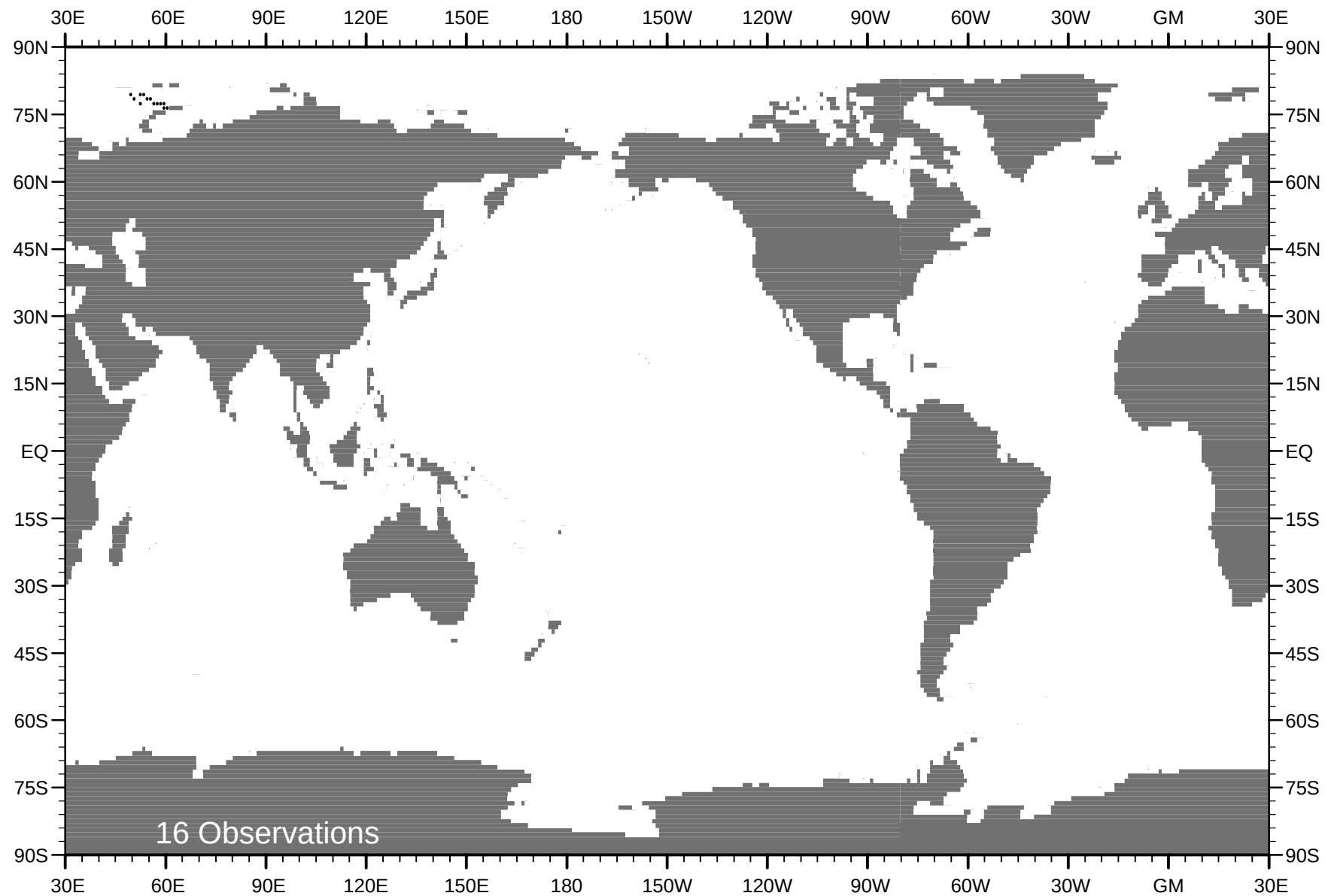


Fig. C6 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1927 .

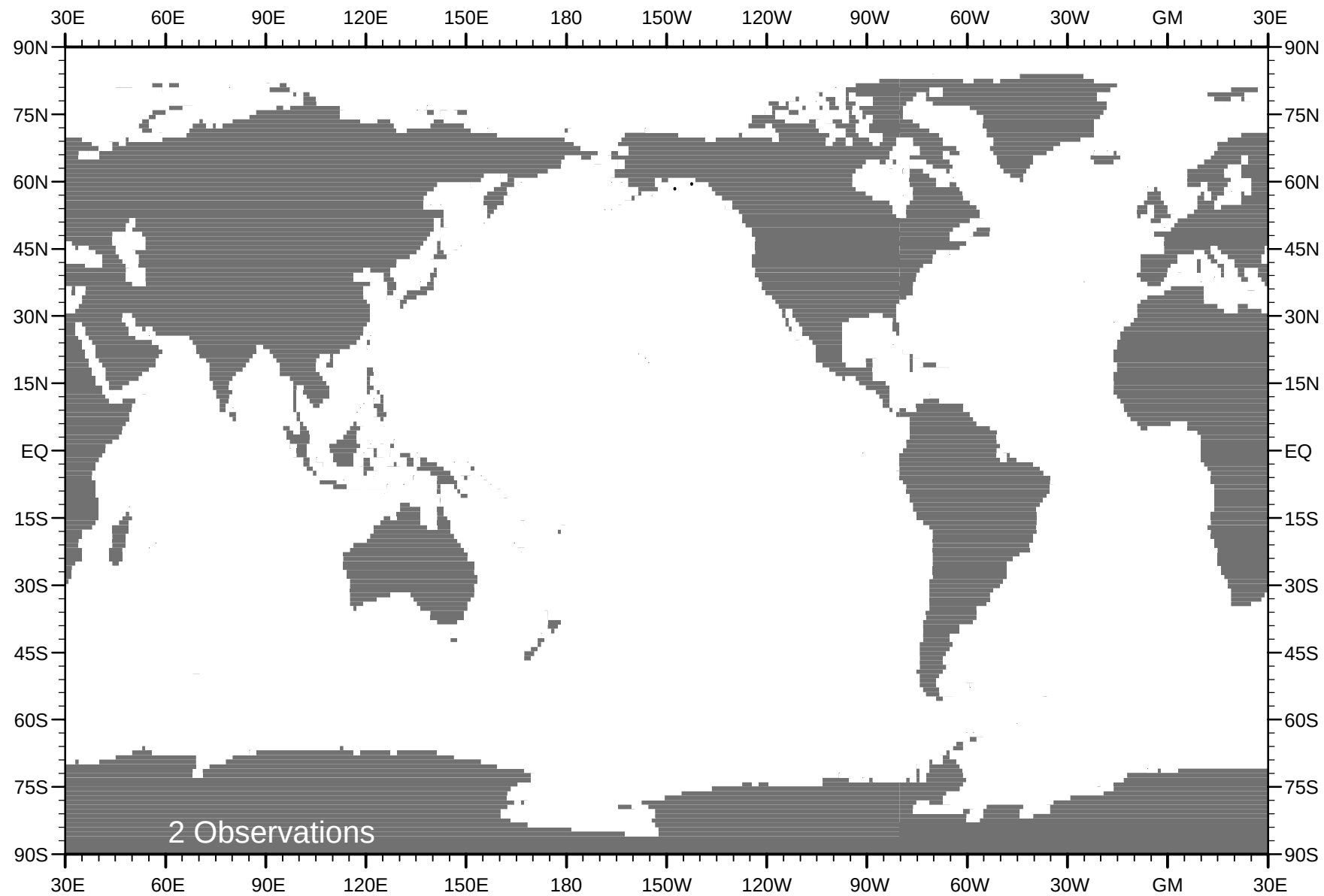


Fig. C7 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1928 .

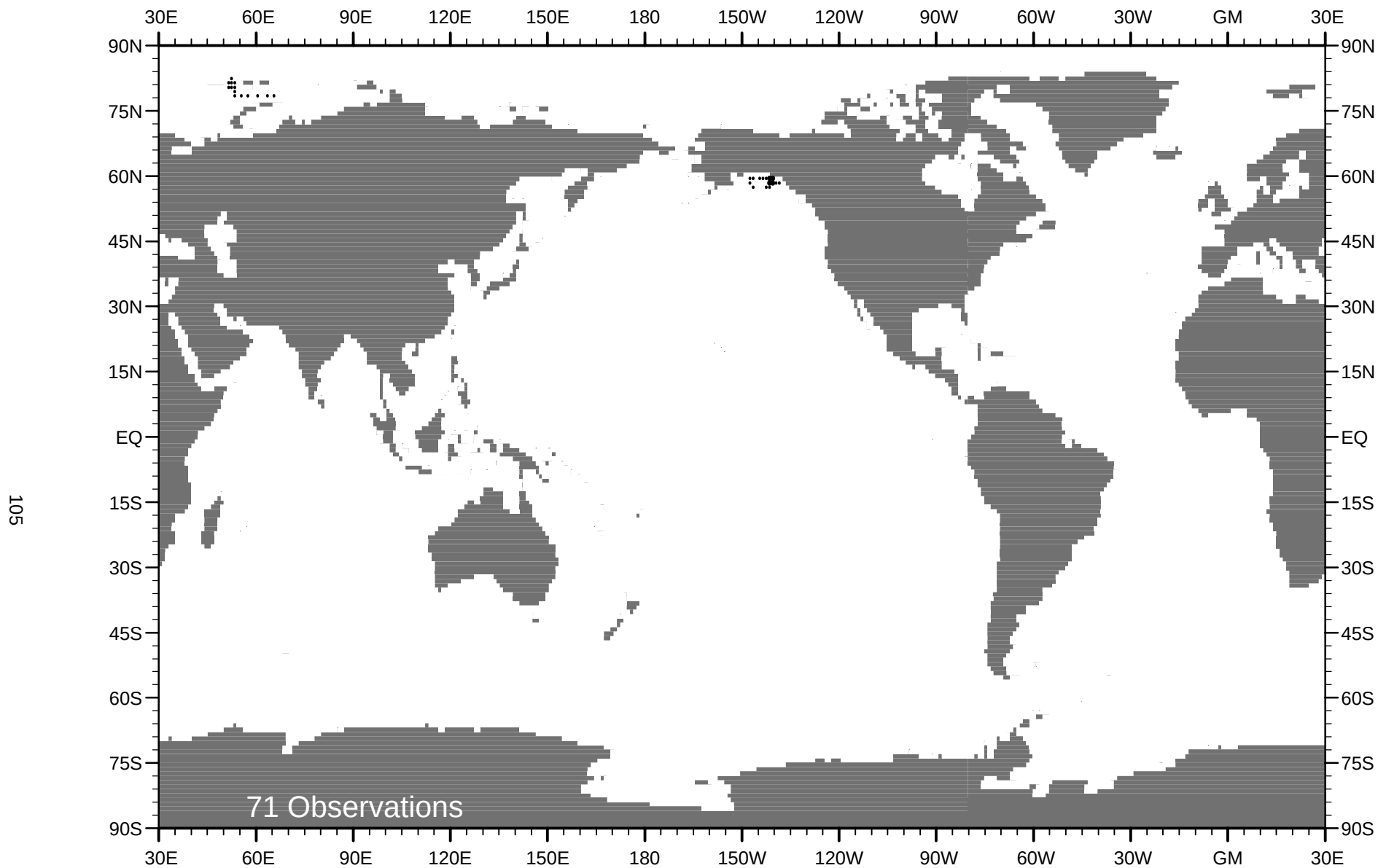


Fig. C8 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1929 .

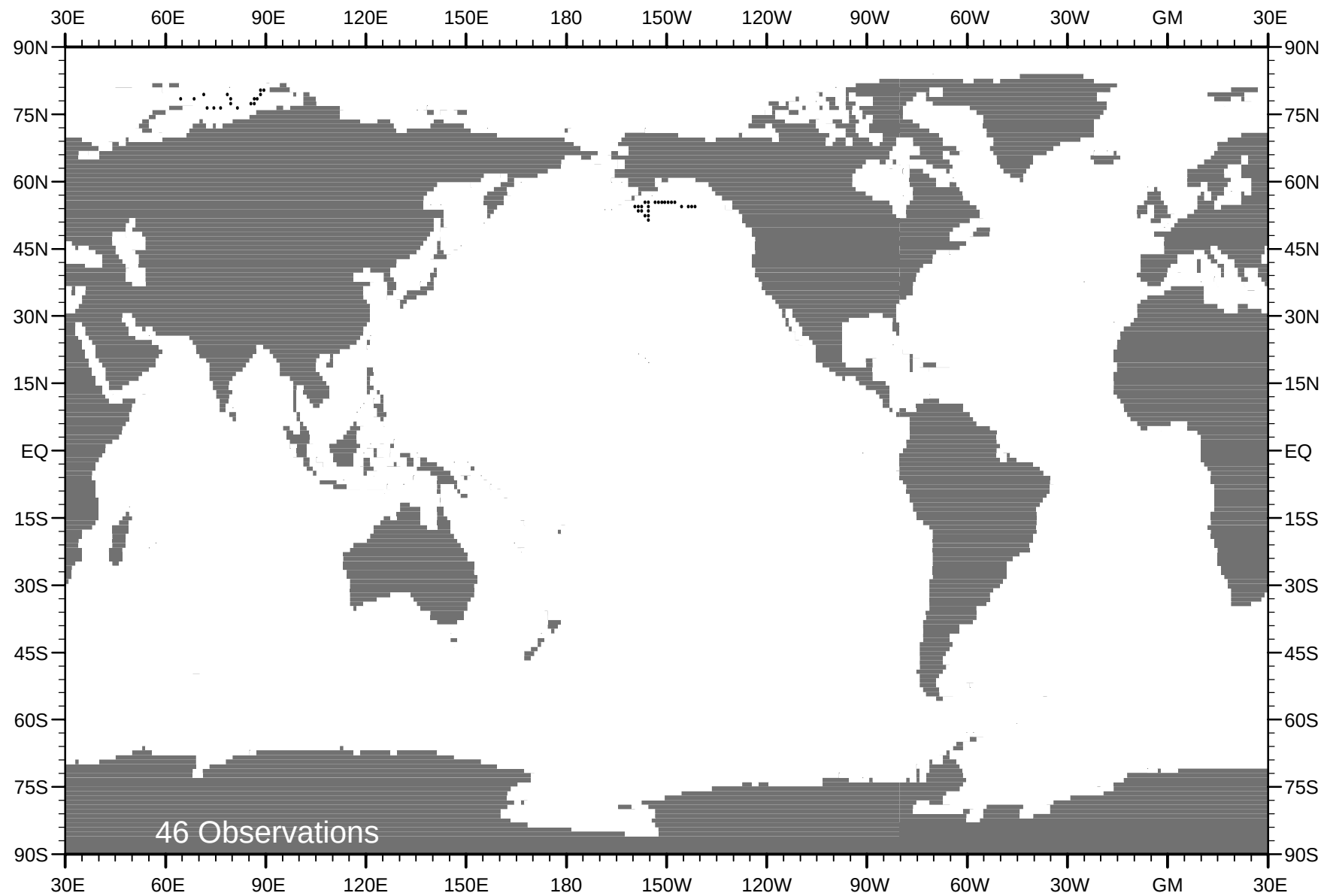


Fig. C9 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1930 .

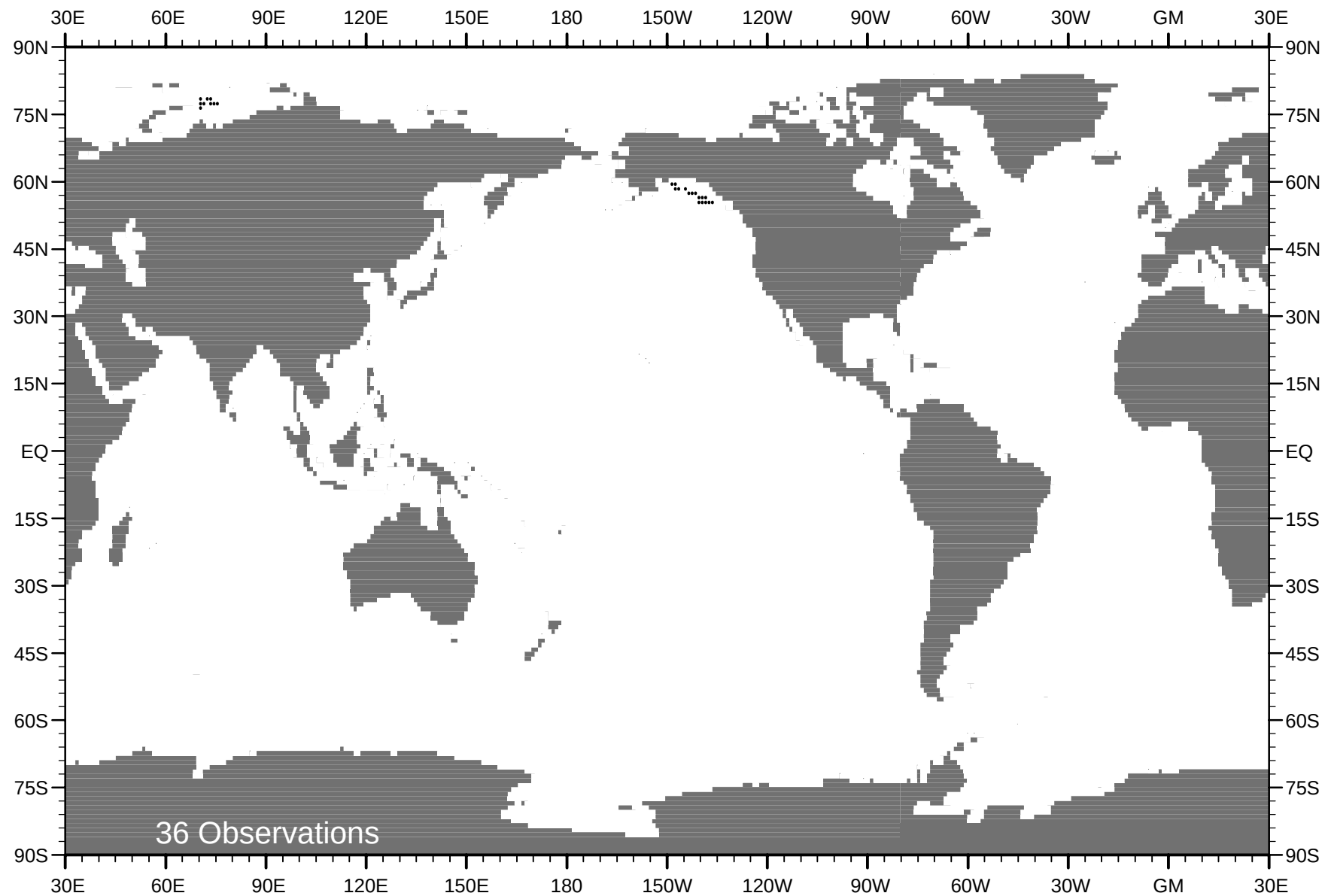


Fig. C10 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1931 .

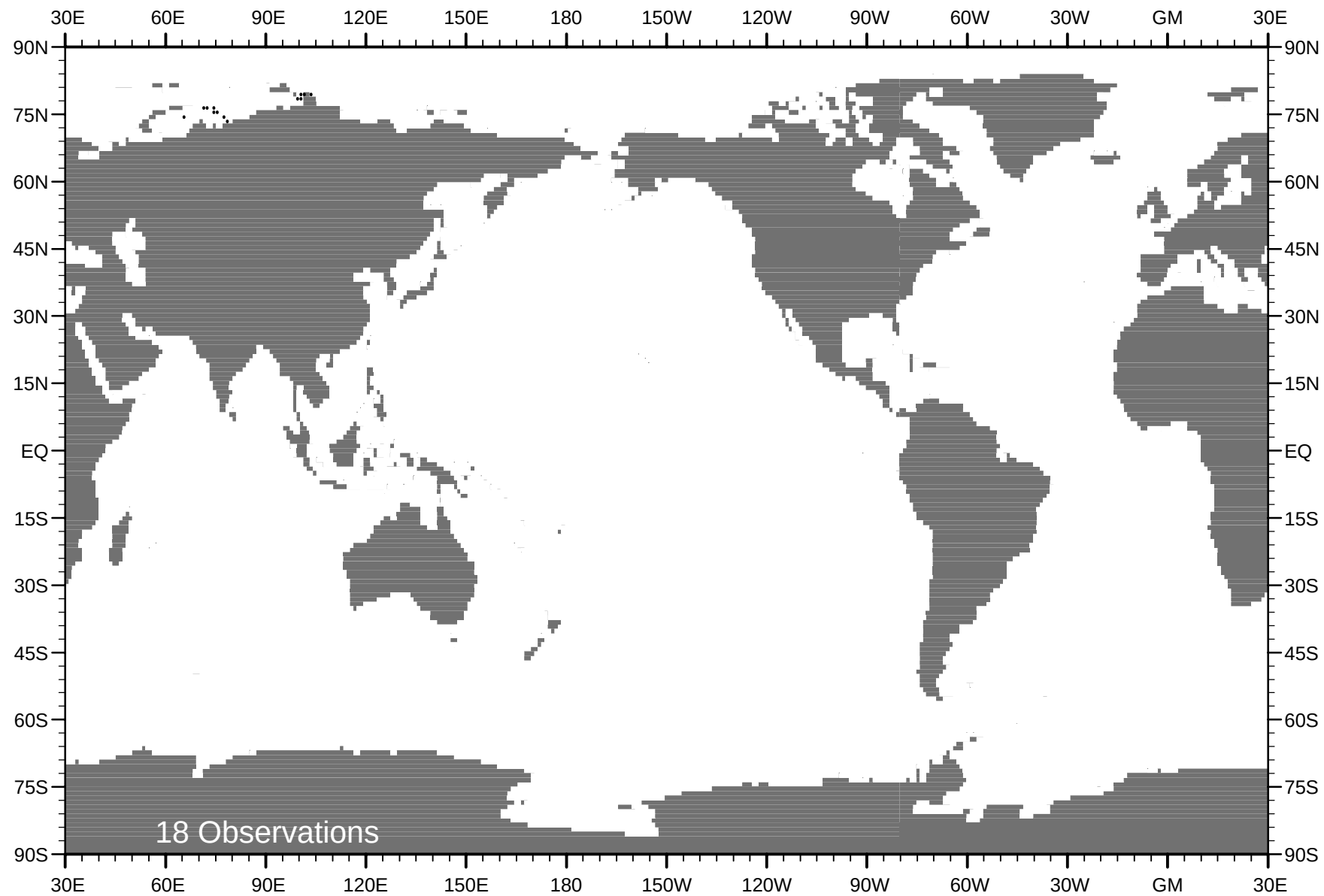


Fig. C11 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1932 .

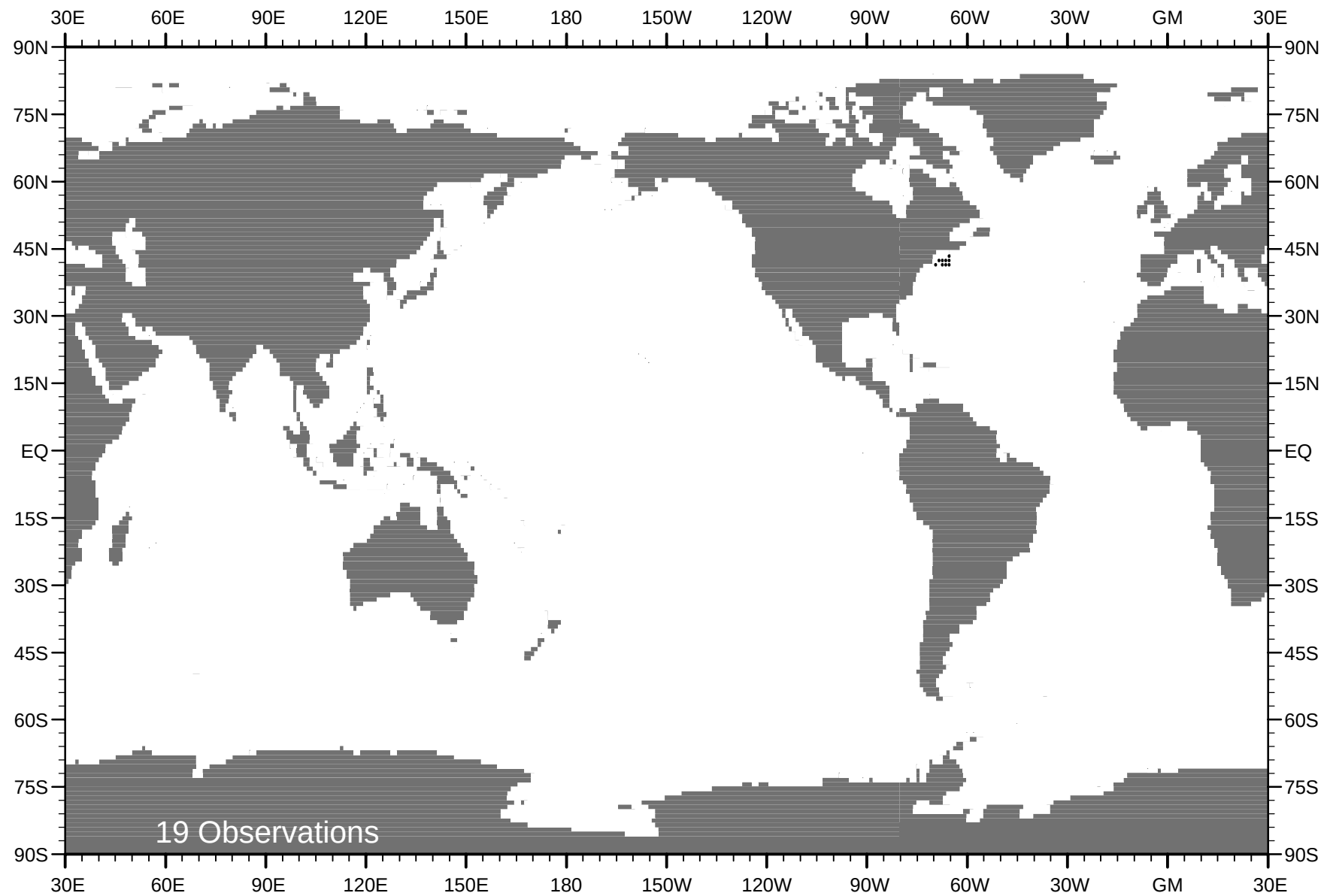


Fig. C12 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1933 .



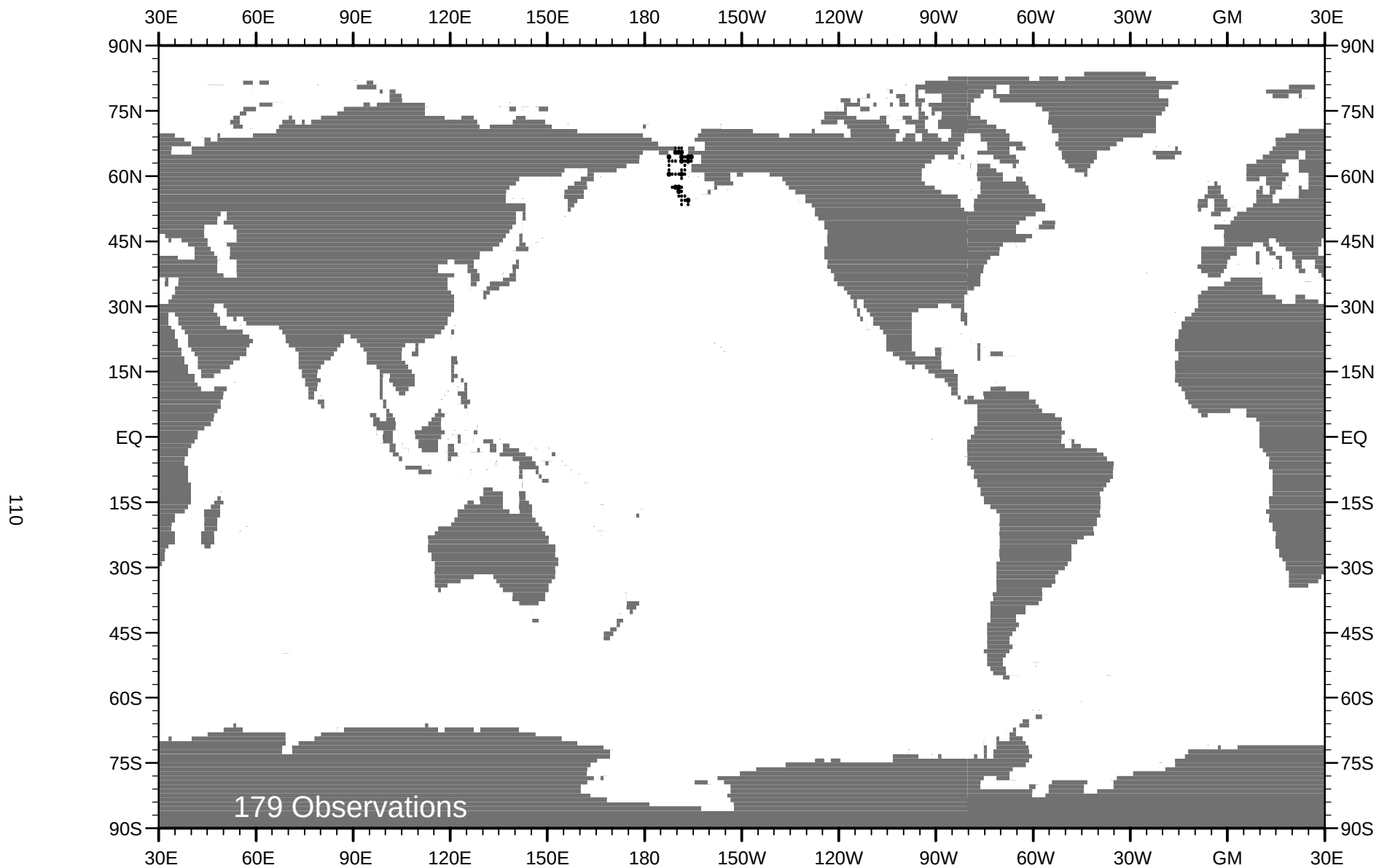


Fig. C13 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1934 .

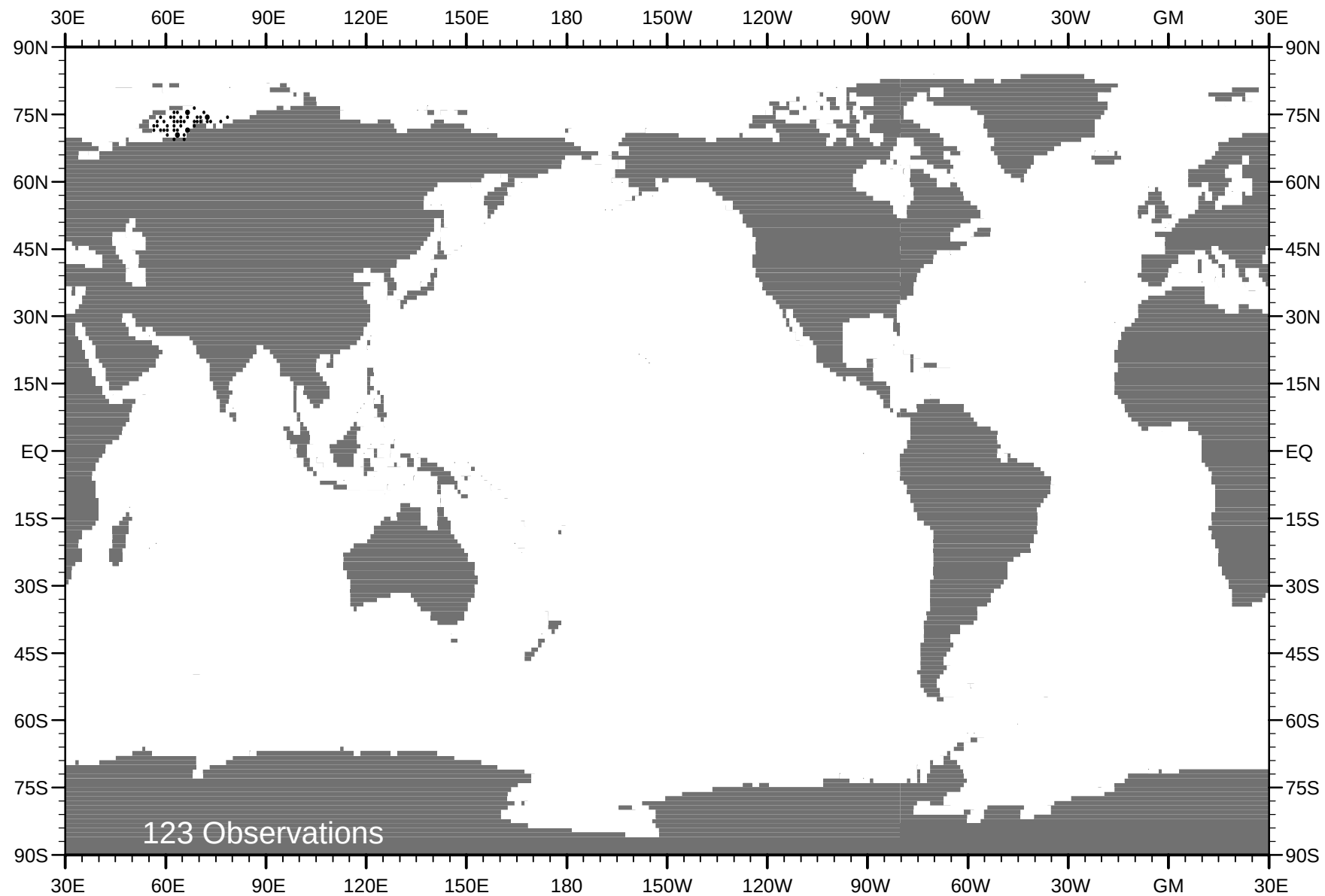


Fig. C14 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1936 .

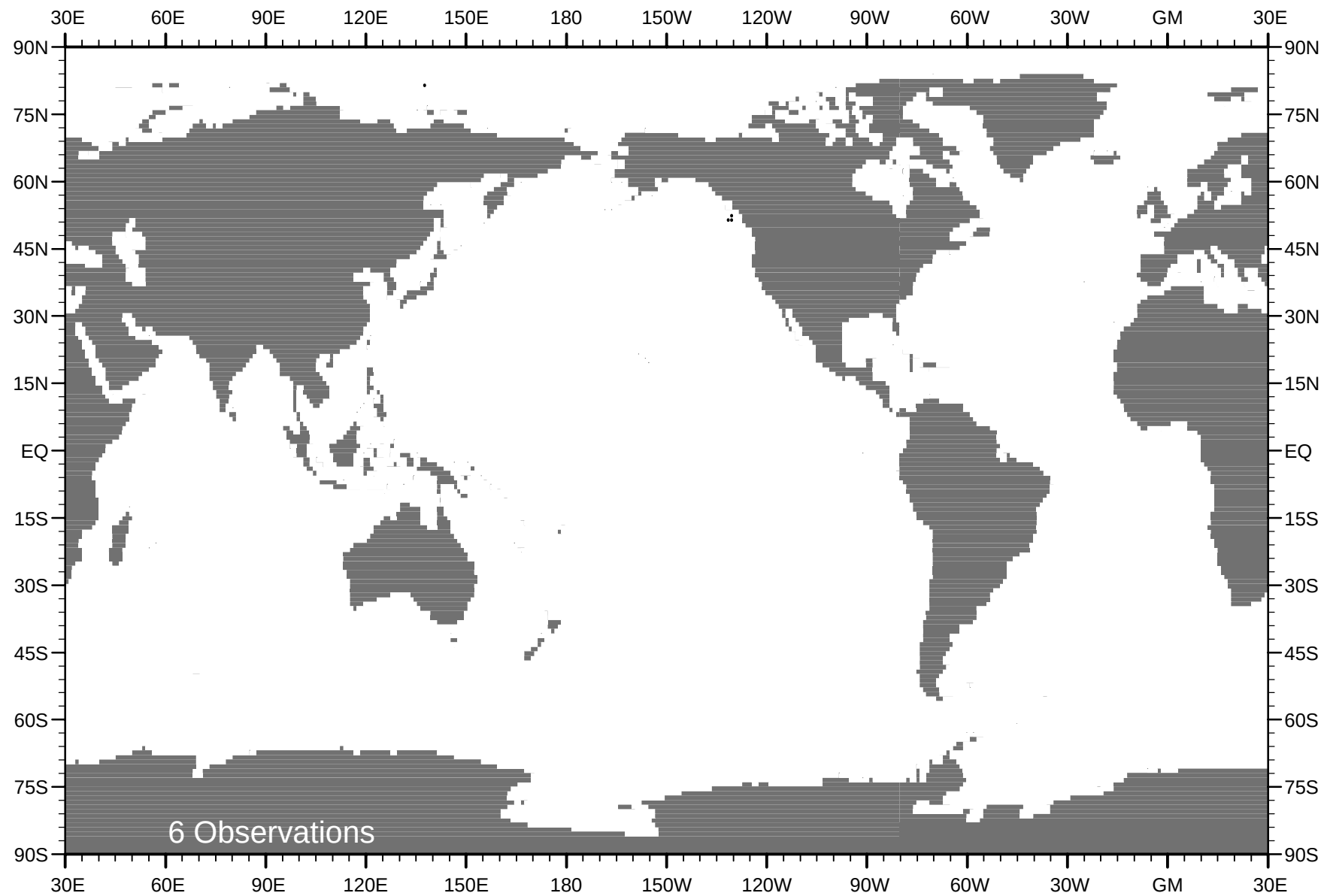


Fig. C15 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1938 .

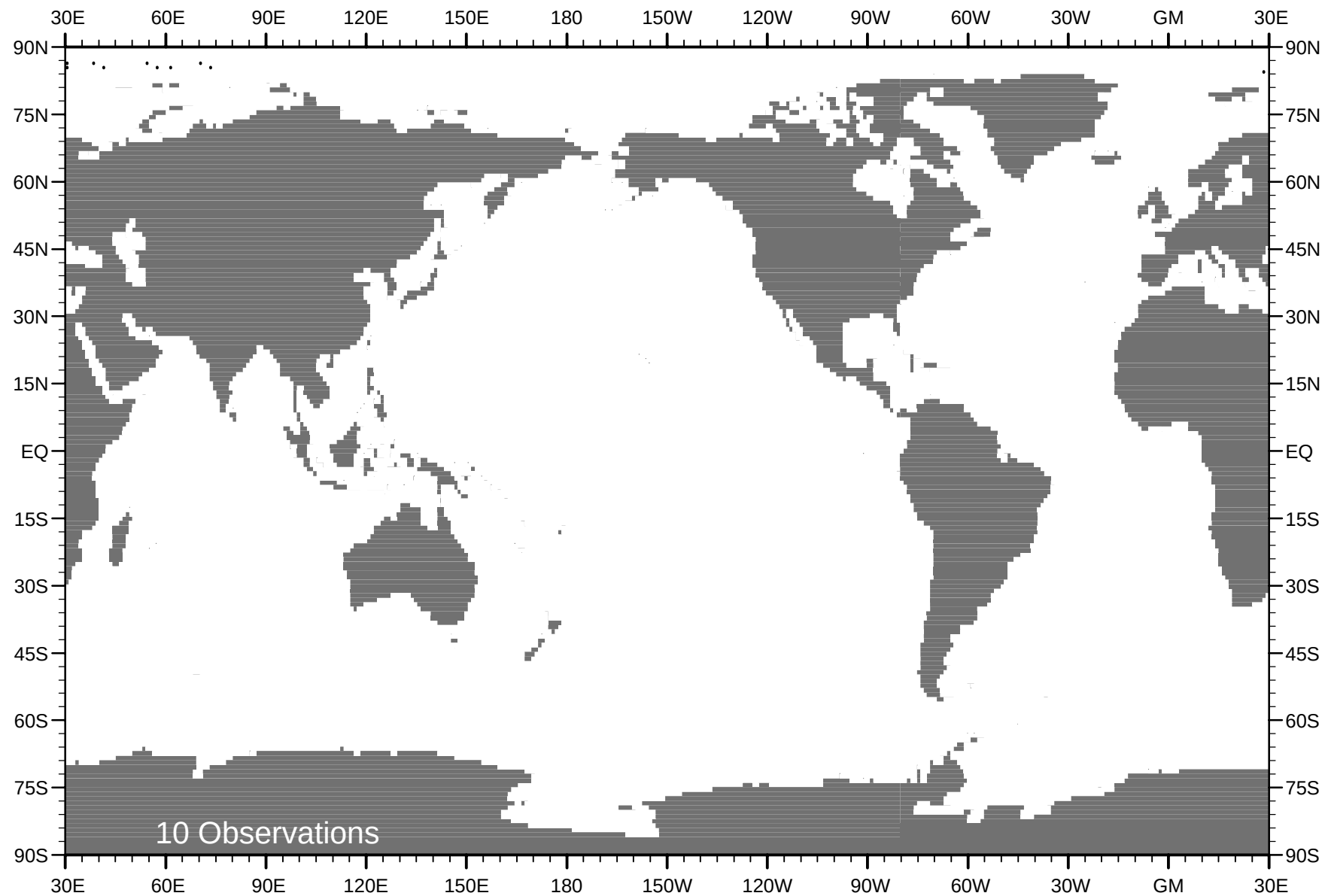


Fig. C16 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1939 .

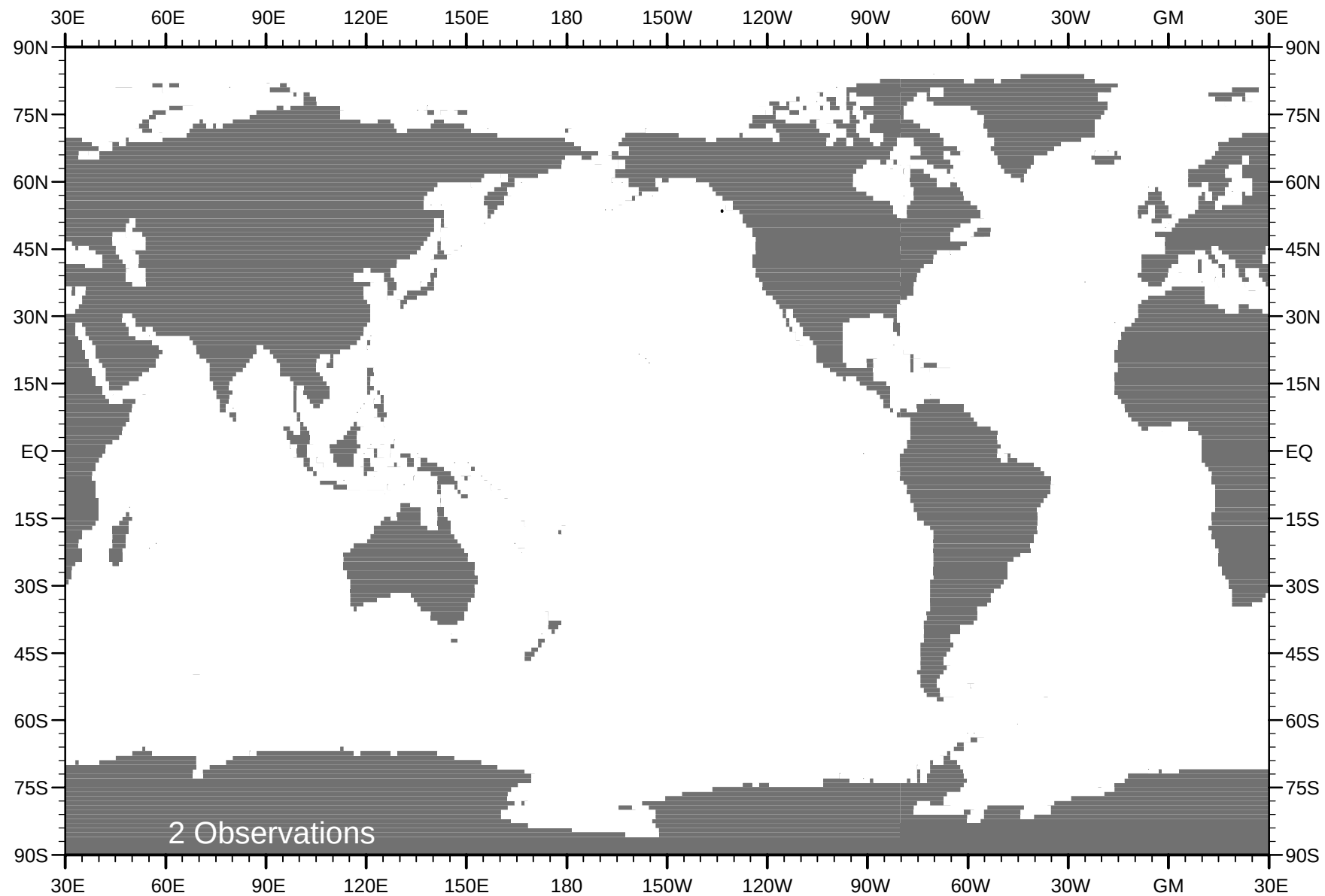


Fig. C17 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1940 .

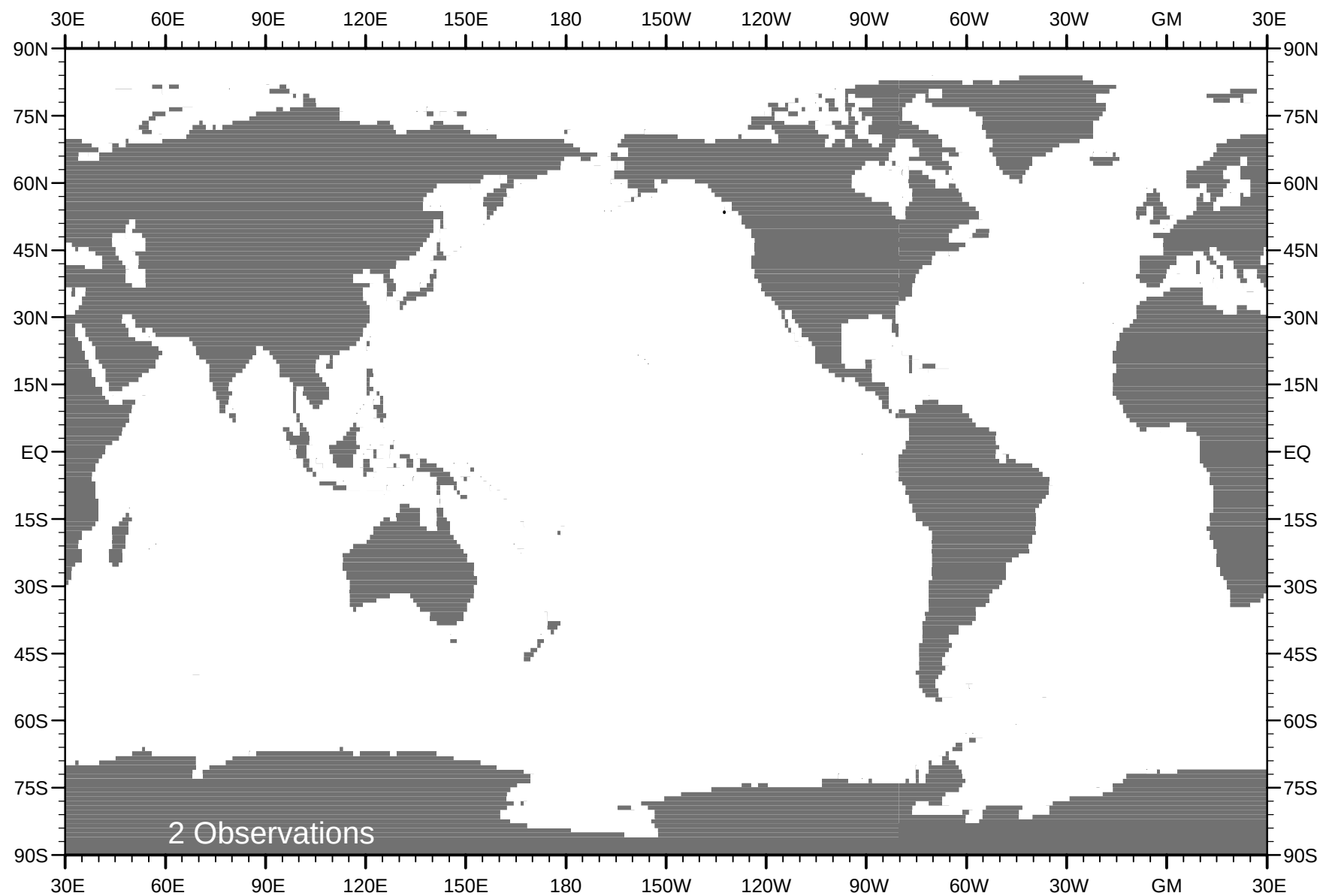


Fig. C18 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1942 .

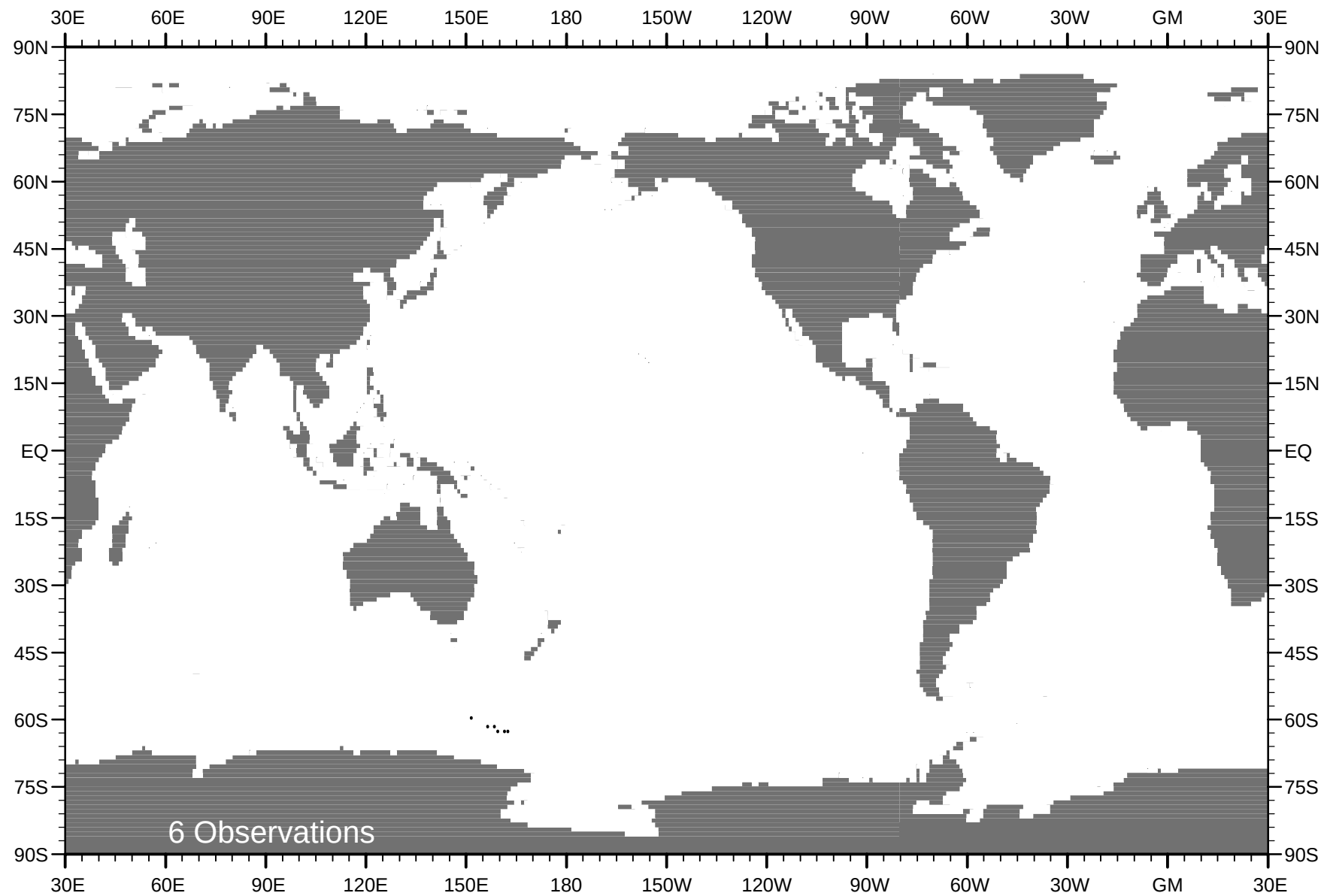


Fig. C19 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1946 .

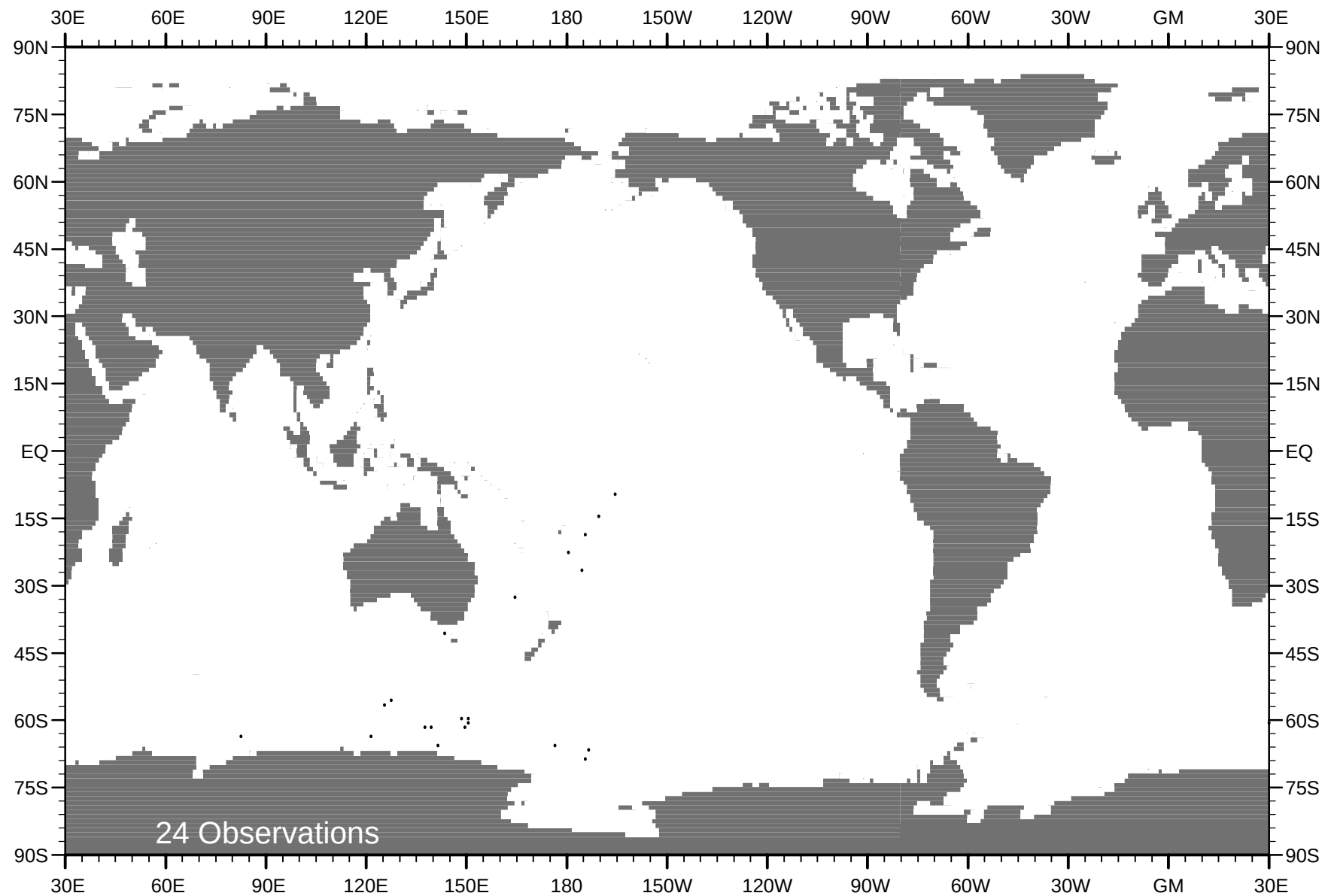


Fig. C20 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1947 .



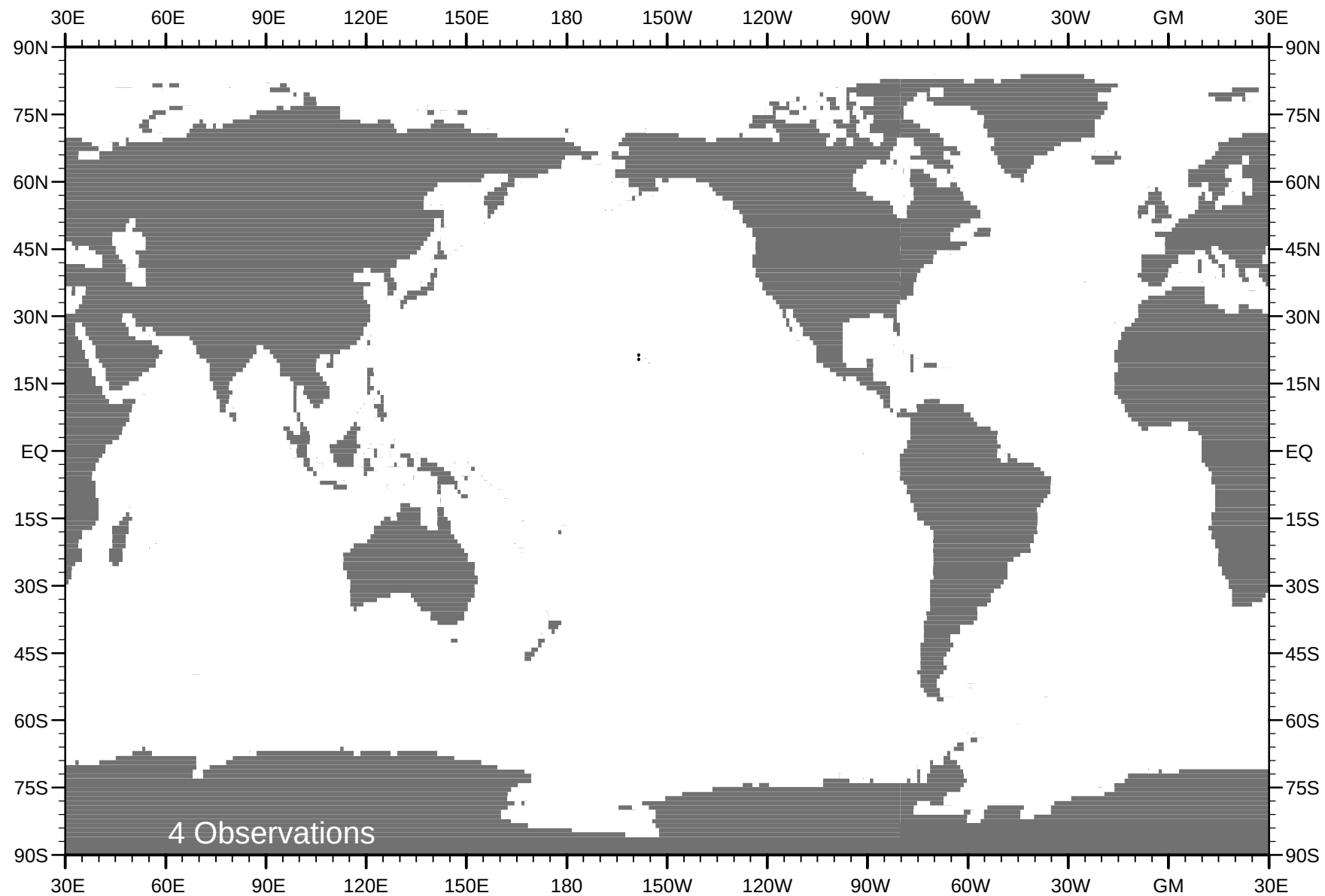


Fig. C21 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1950 .

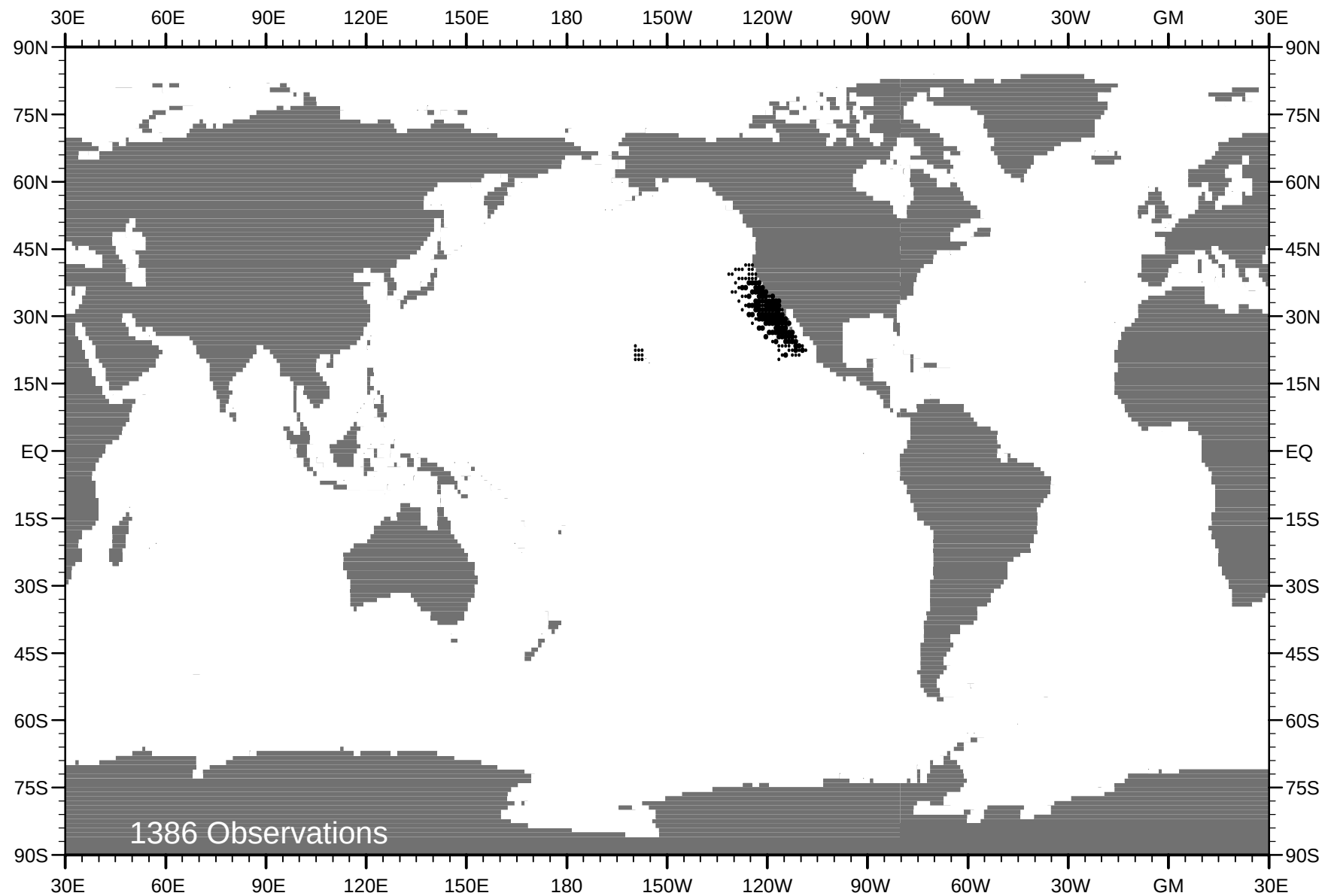


Fig. C22 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1951 .

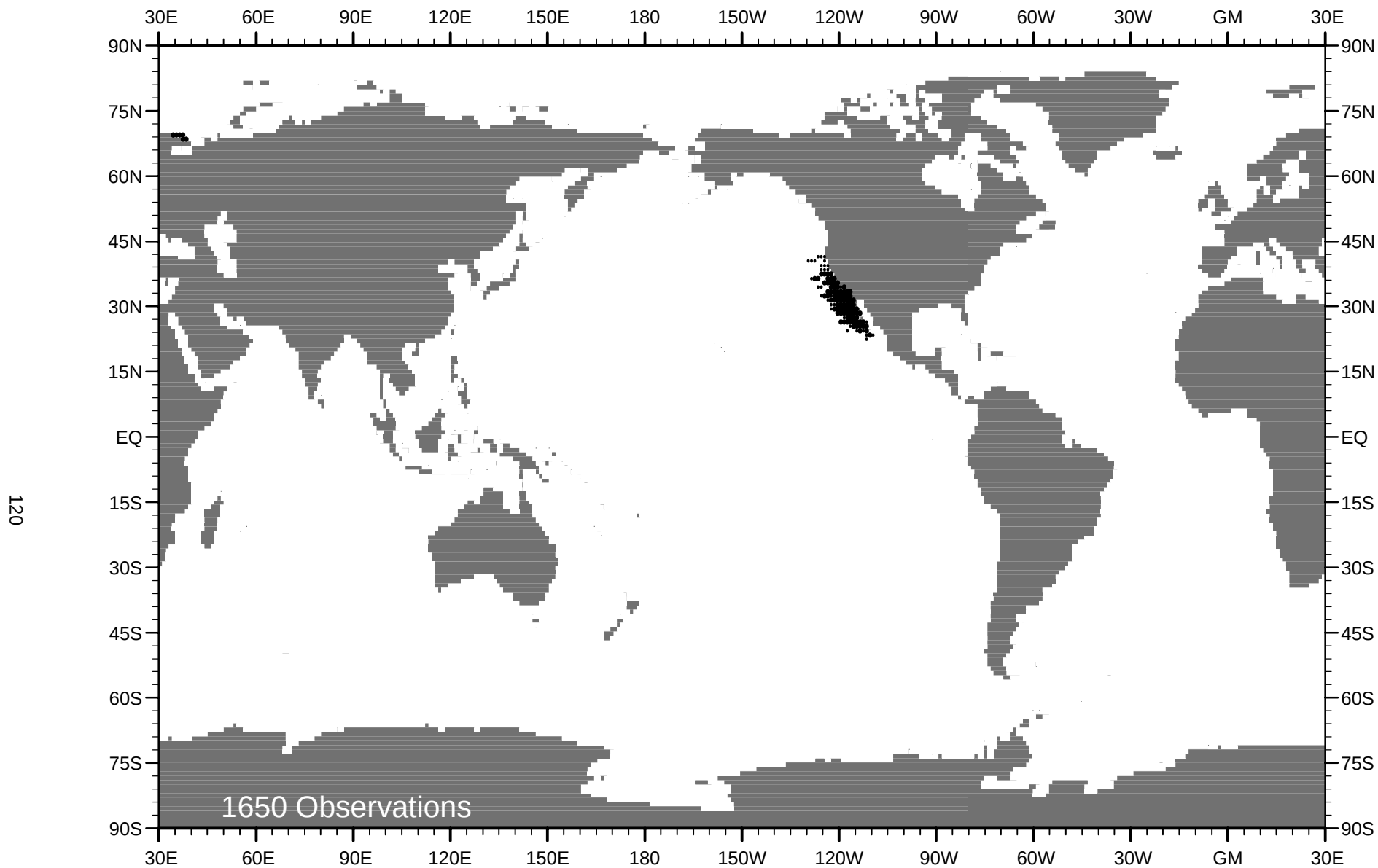


Fig. C23 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1952 .

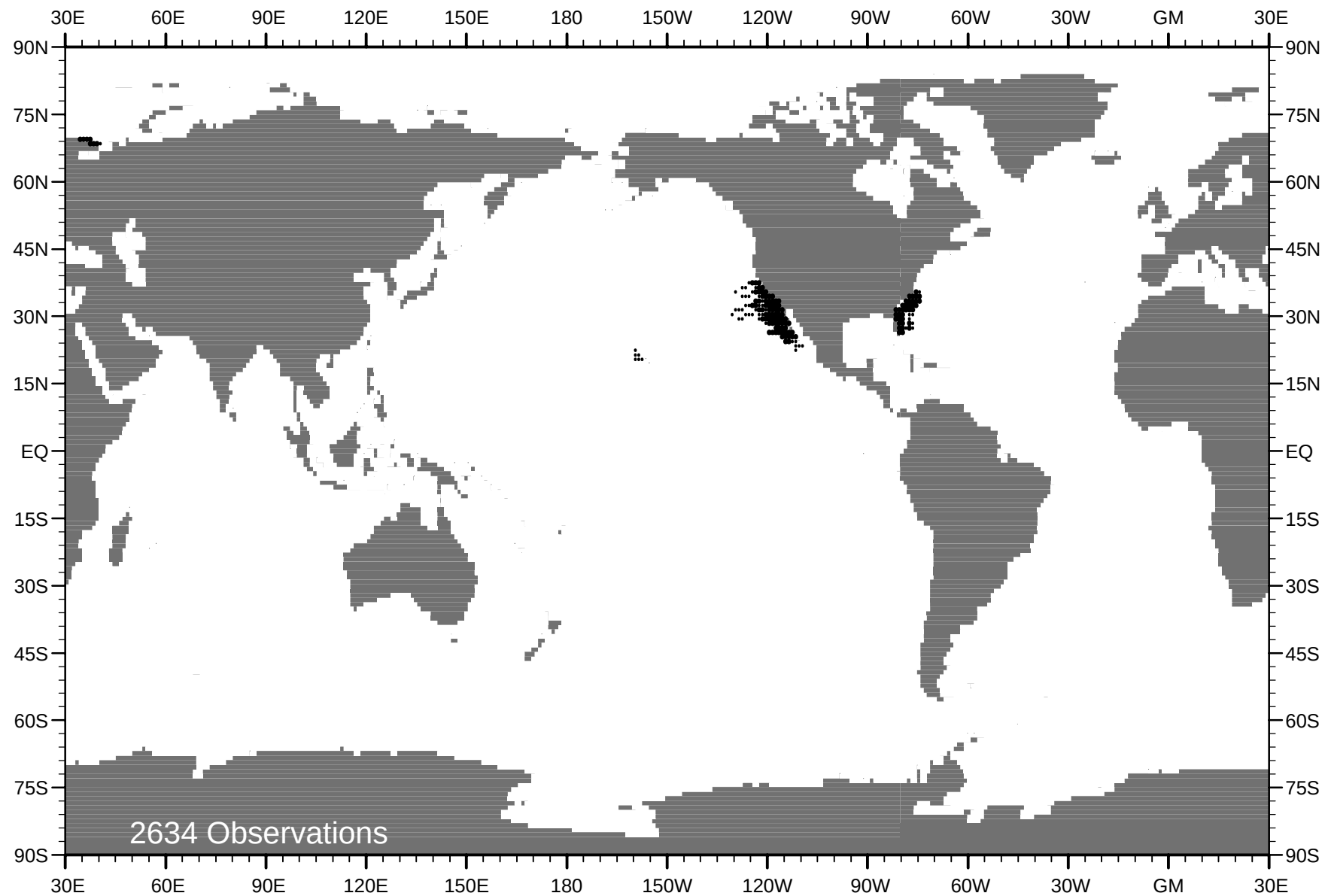


Fig. C24 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1953 .

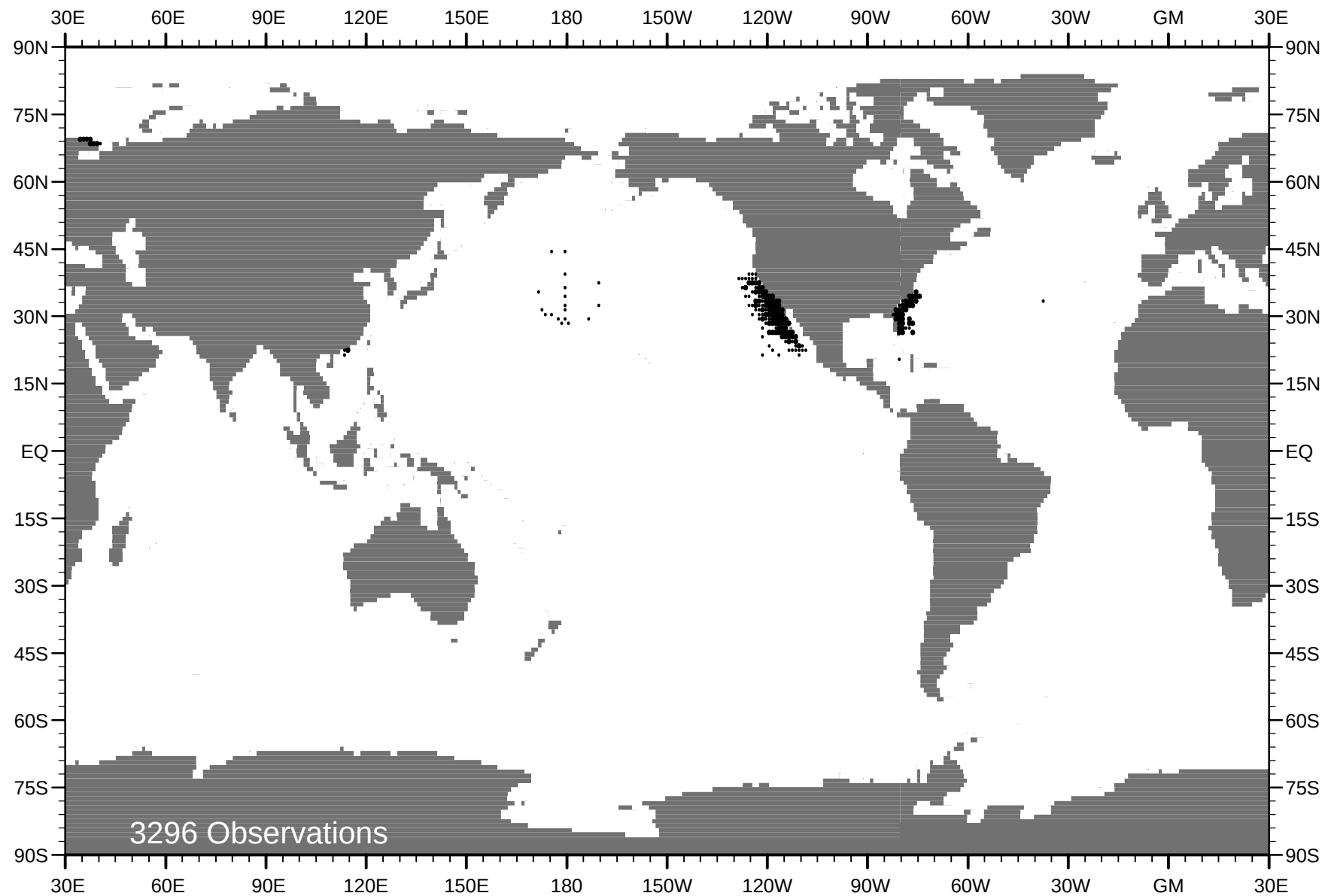


Fig. C25 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1954 .

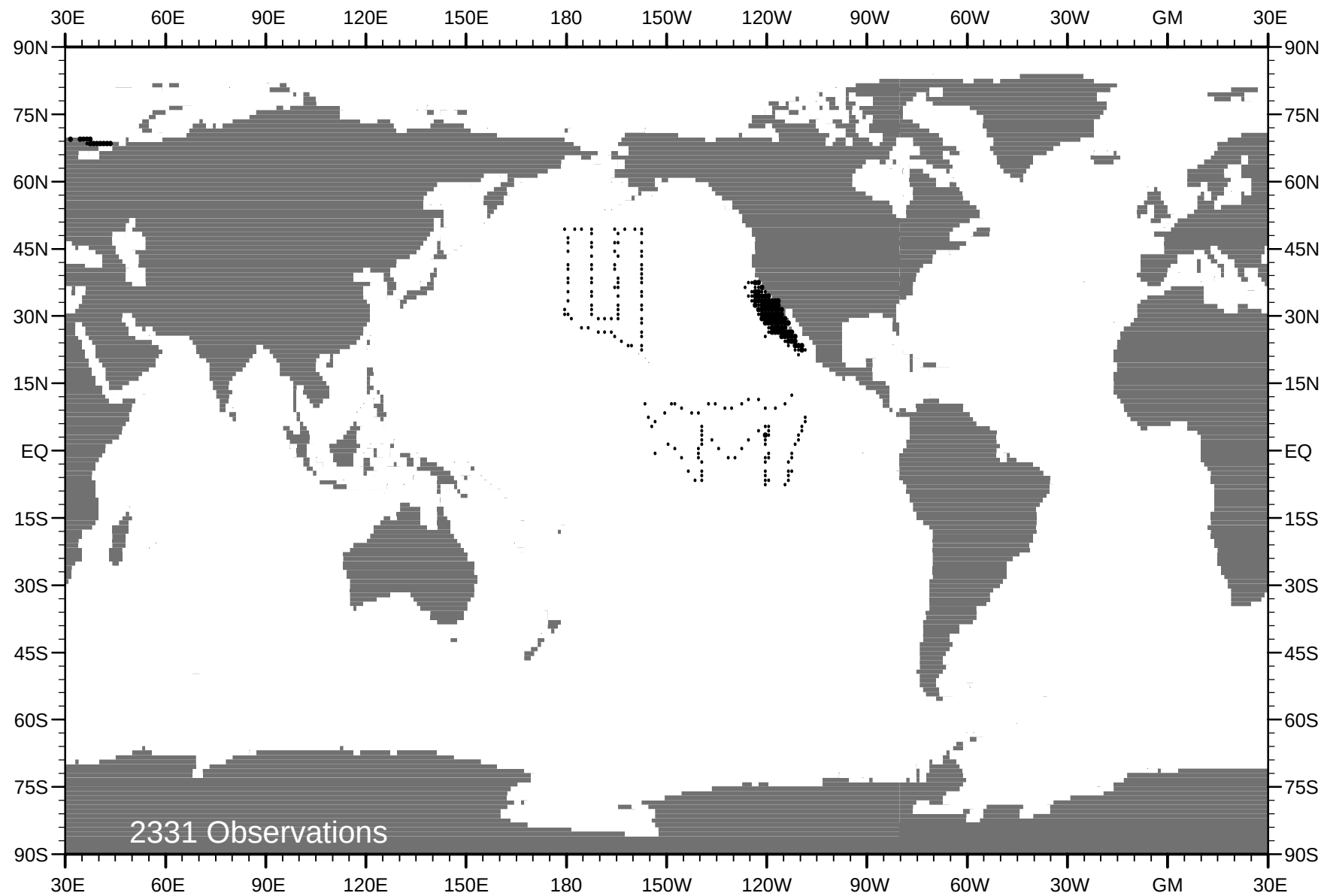


Fig. C26 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1955 .

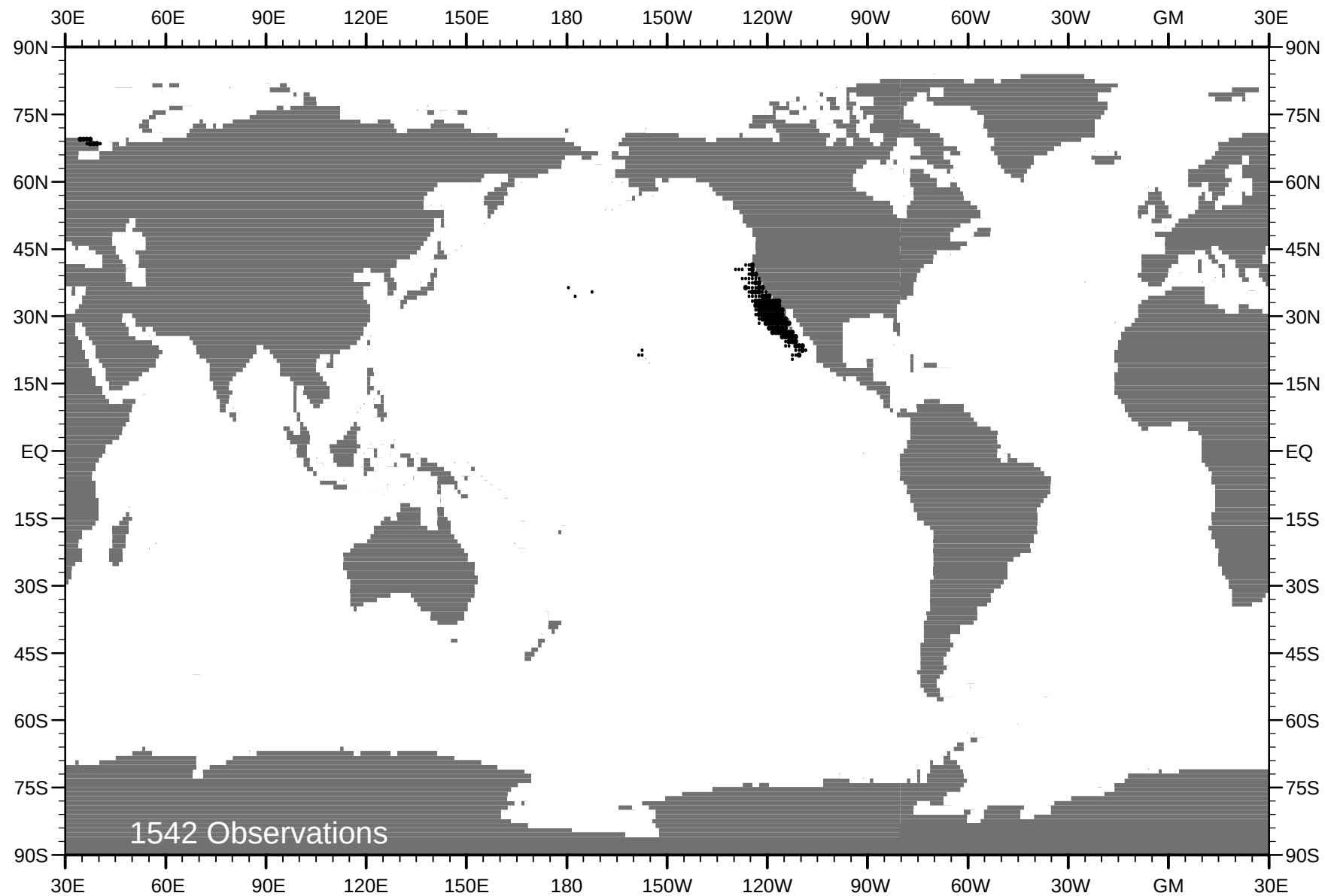


Fig. C27 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1956 .

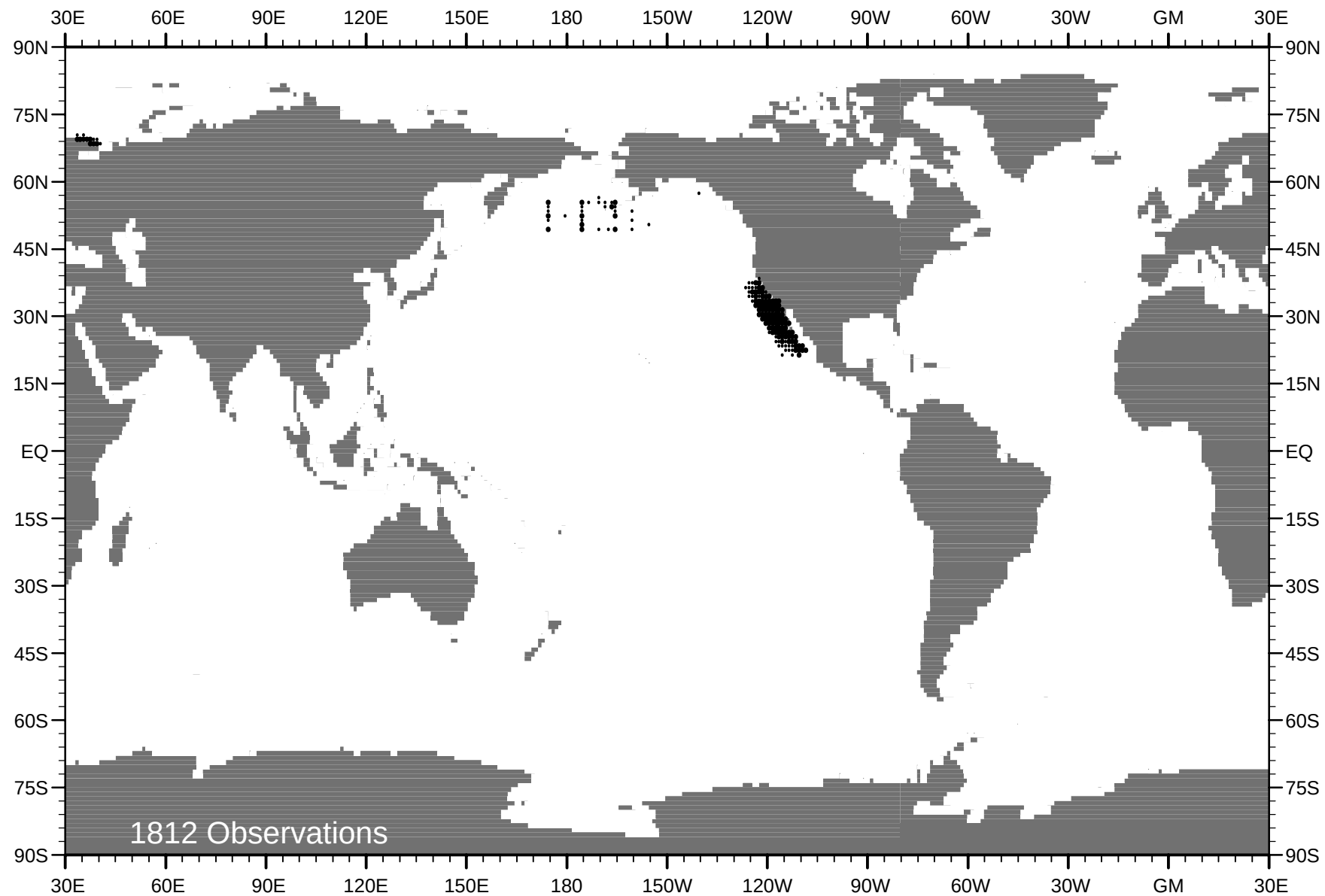


Fig. C28 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1957 .



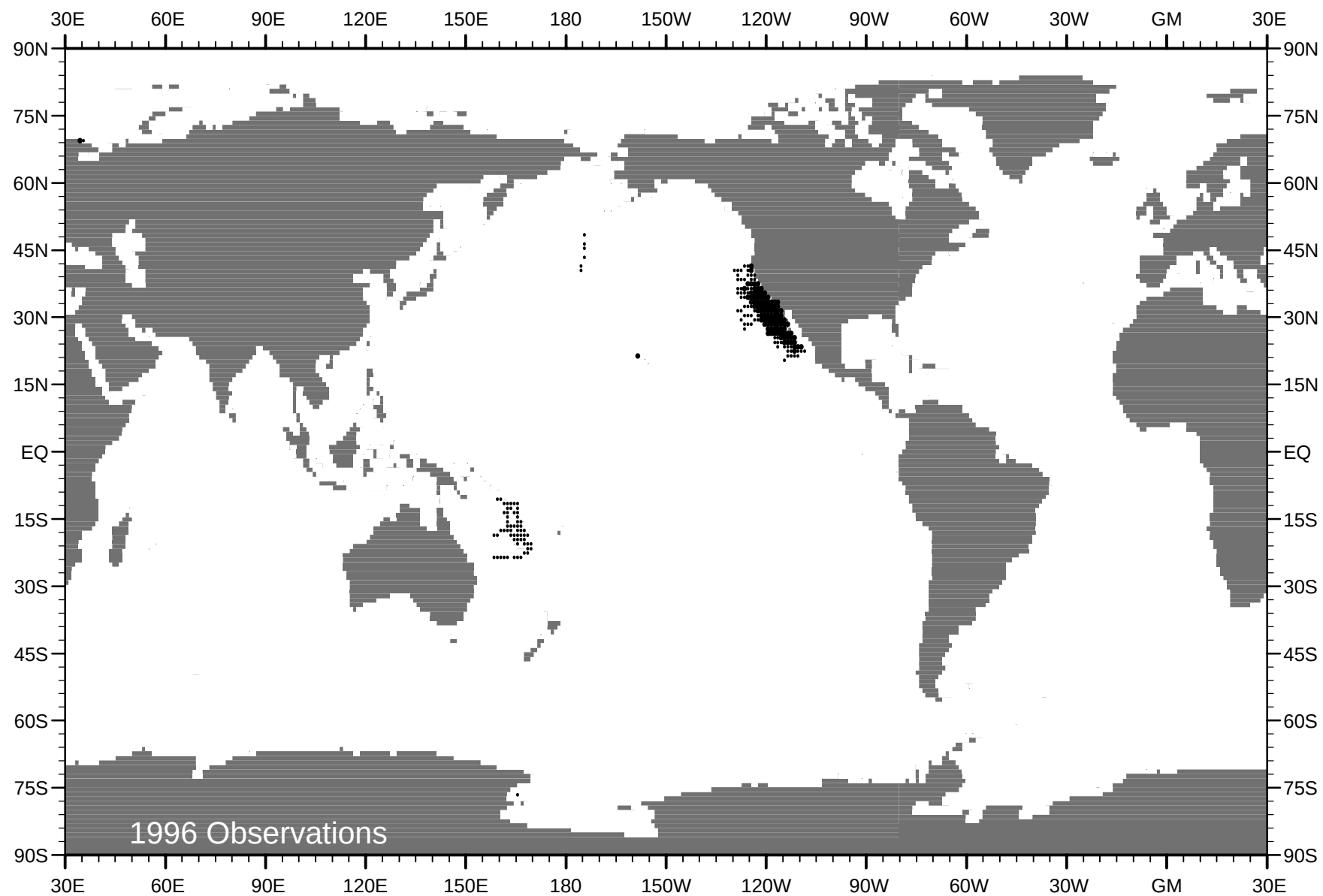


Fig. C29 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1958 .

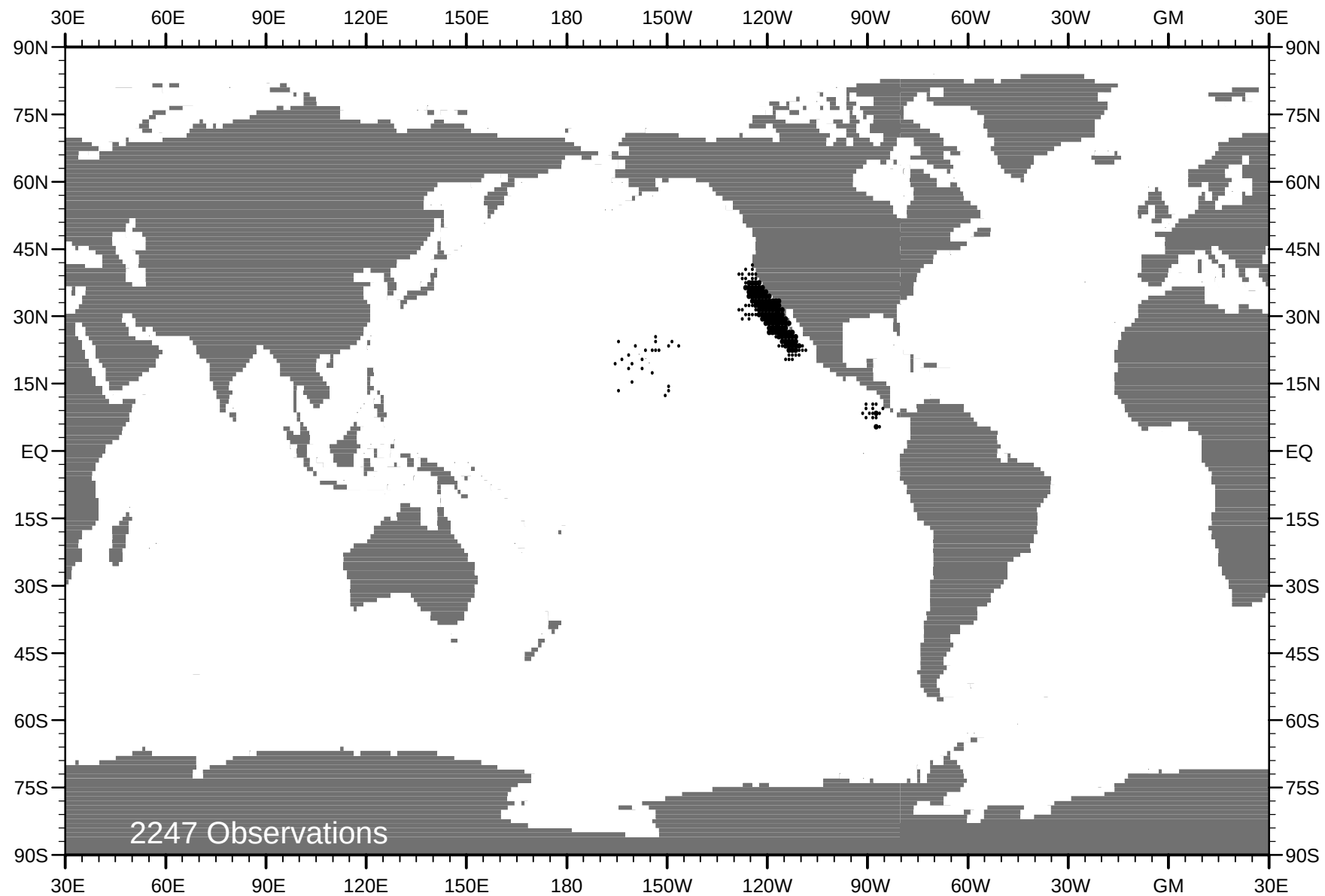


Fig. C30 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1959 .

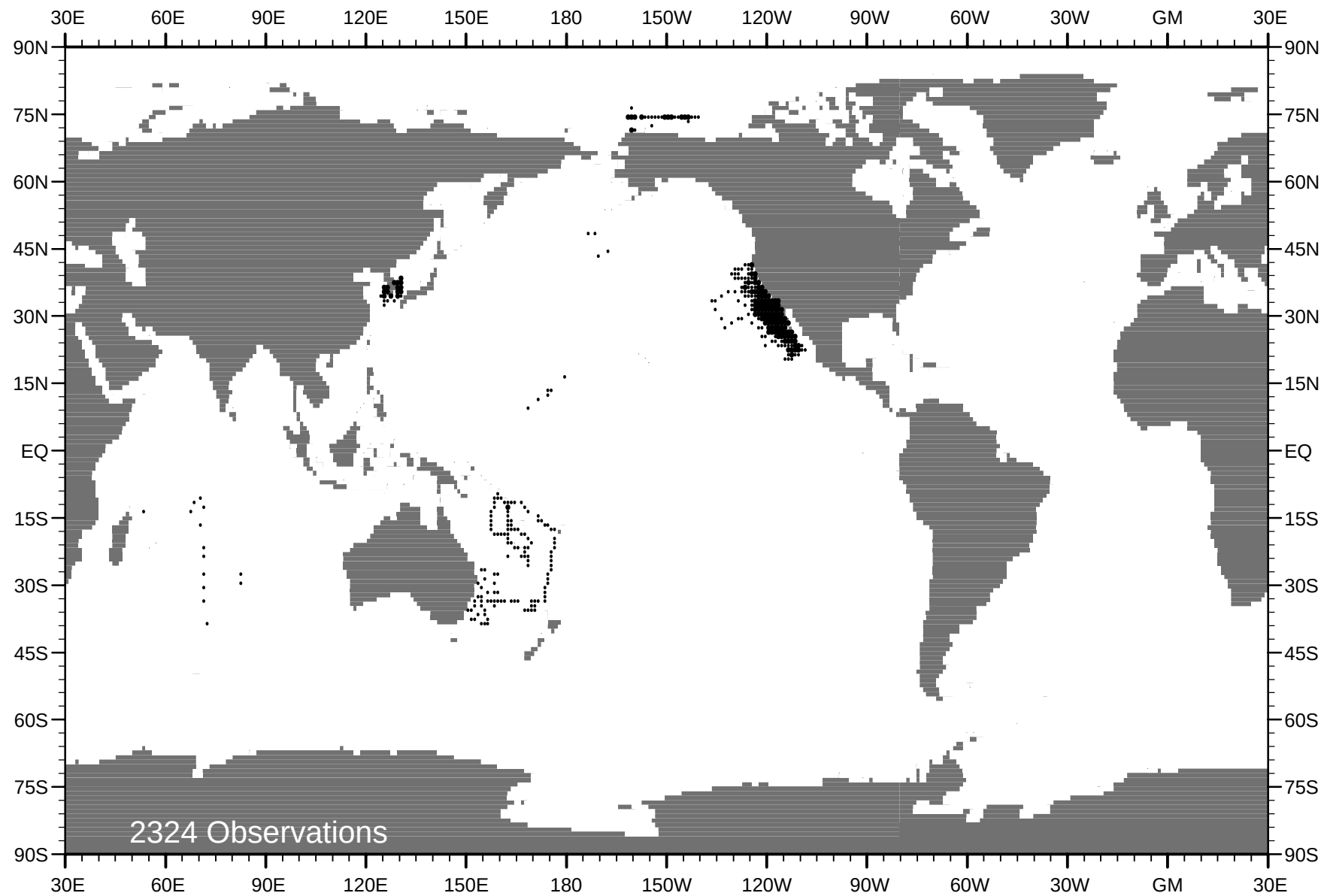


Fig. C31 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1960 .

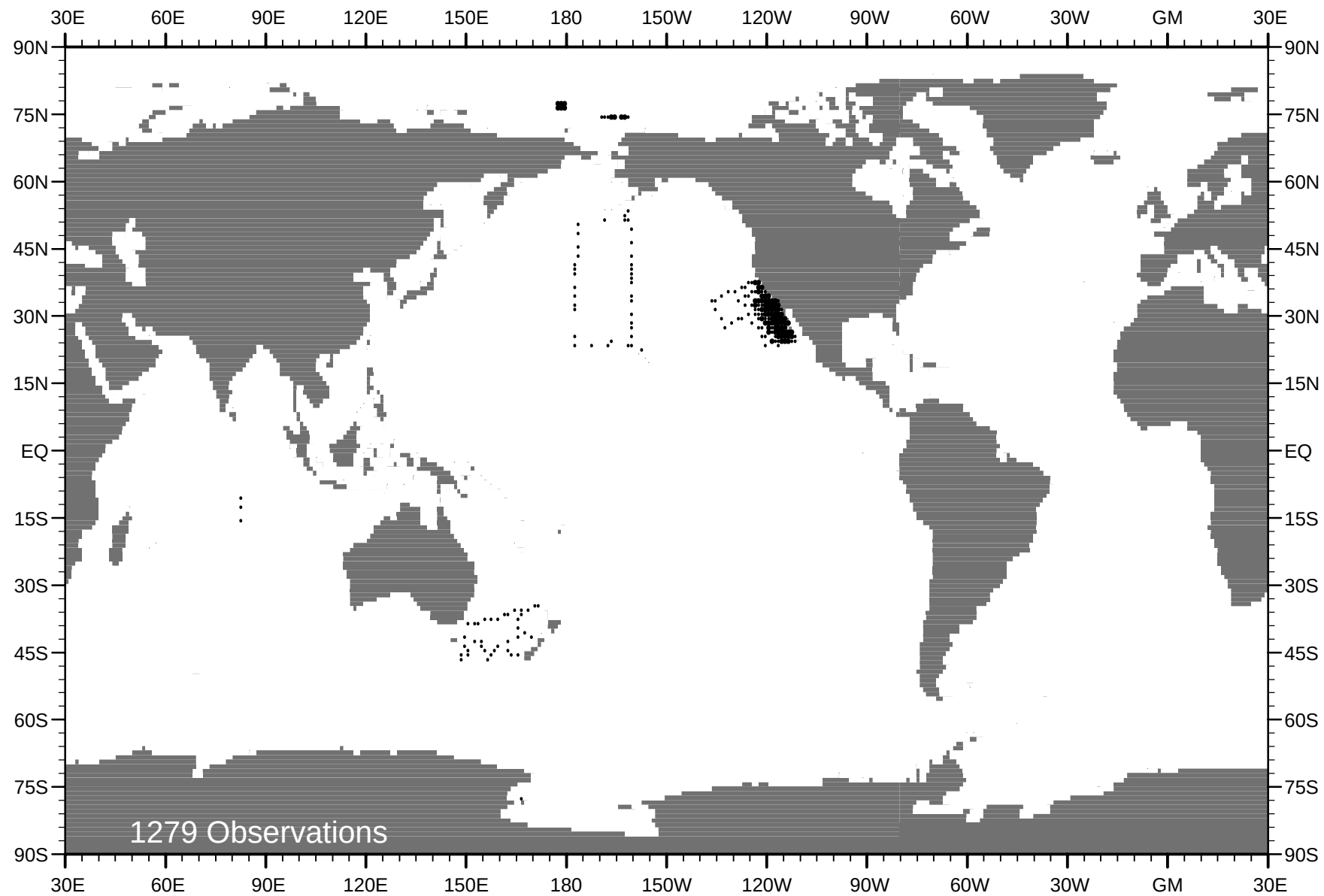


Fig. C32 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1961 .

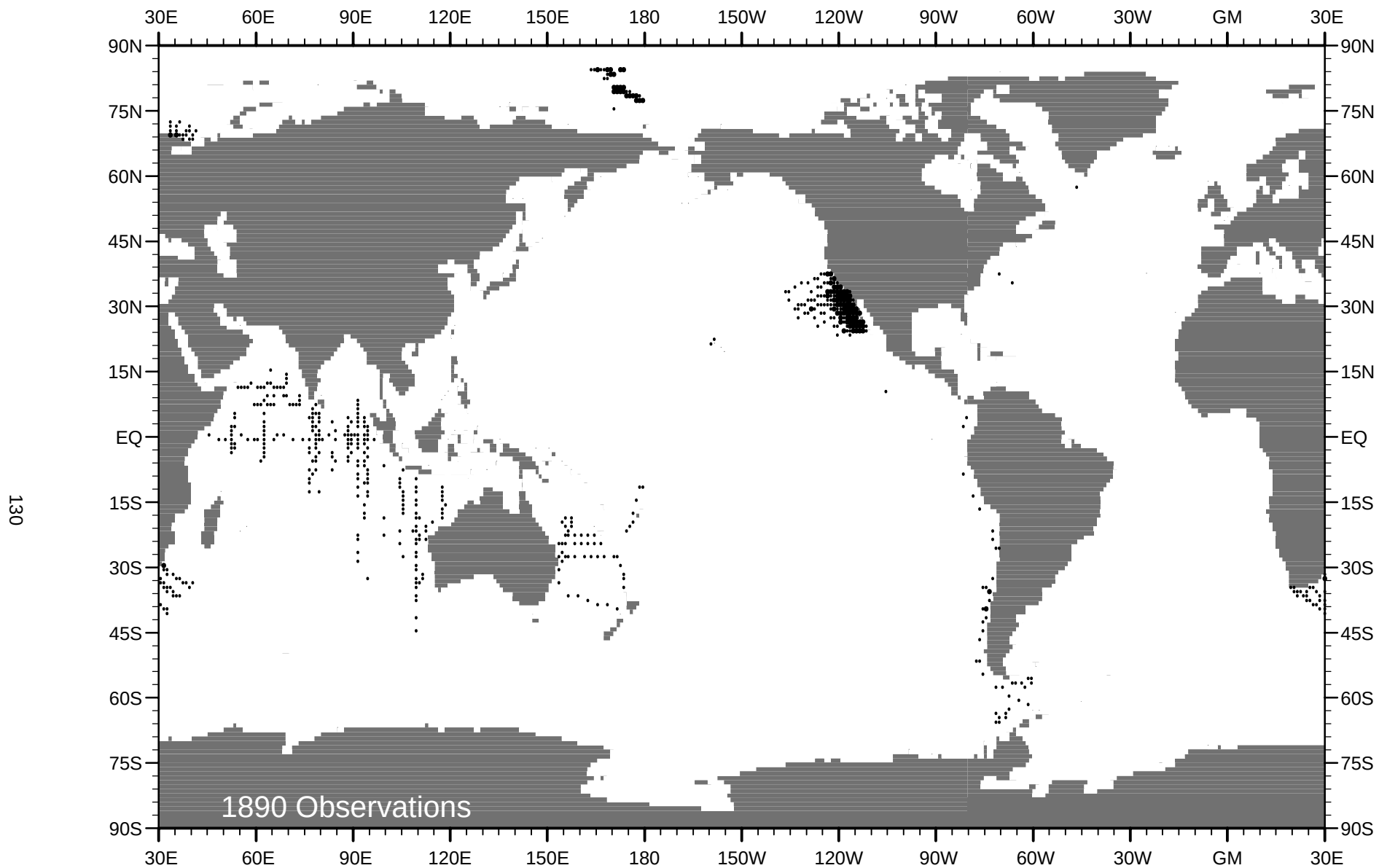


Fig. C33 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1962 .

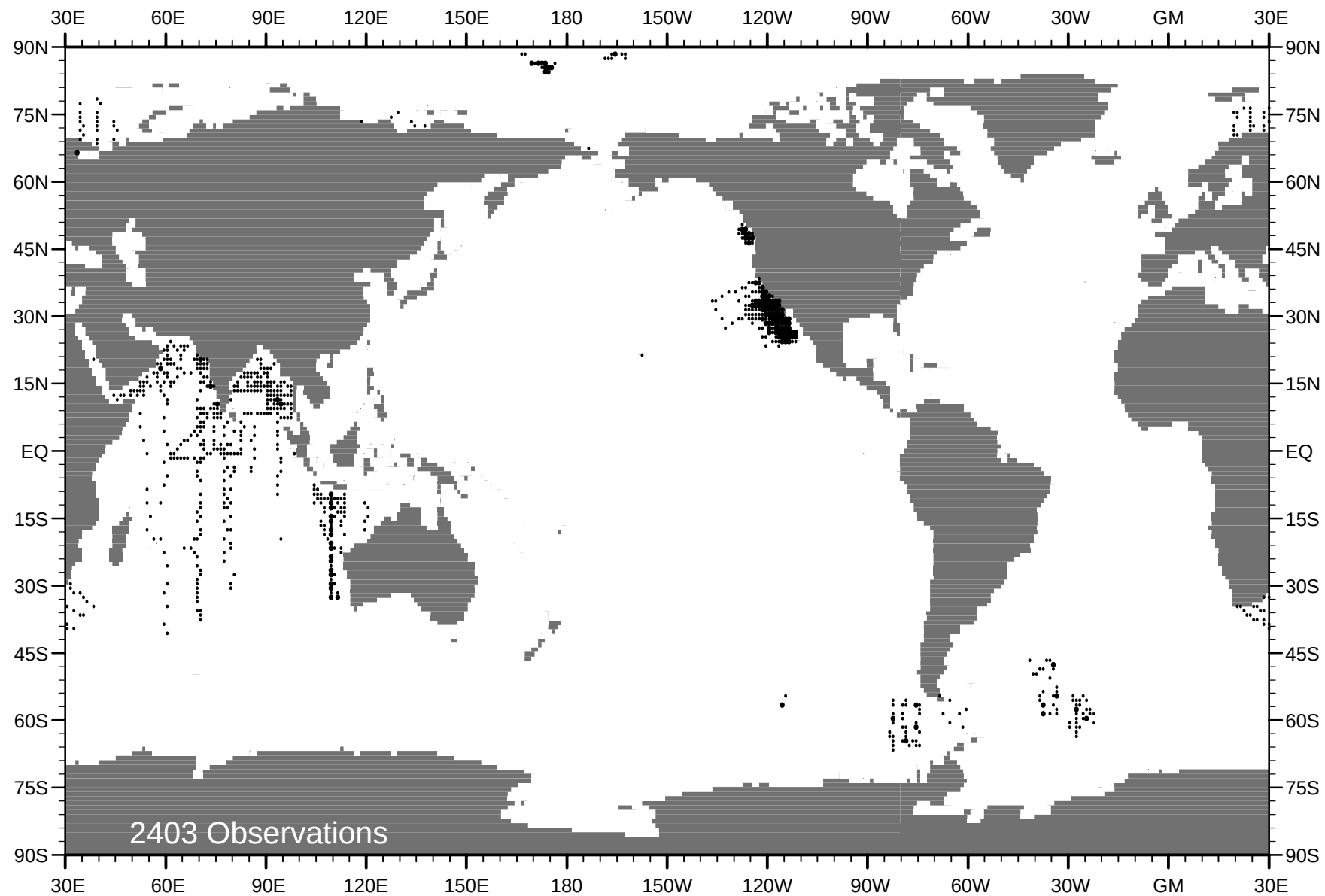


Fig. C34 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1963 .

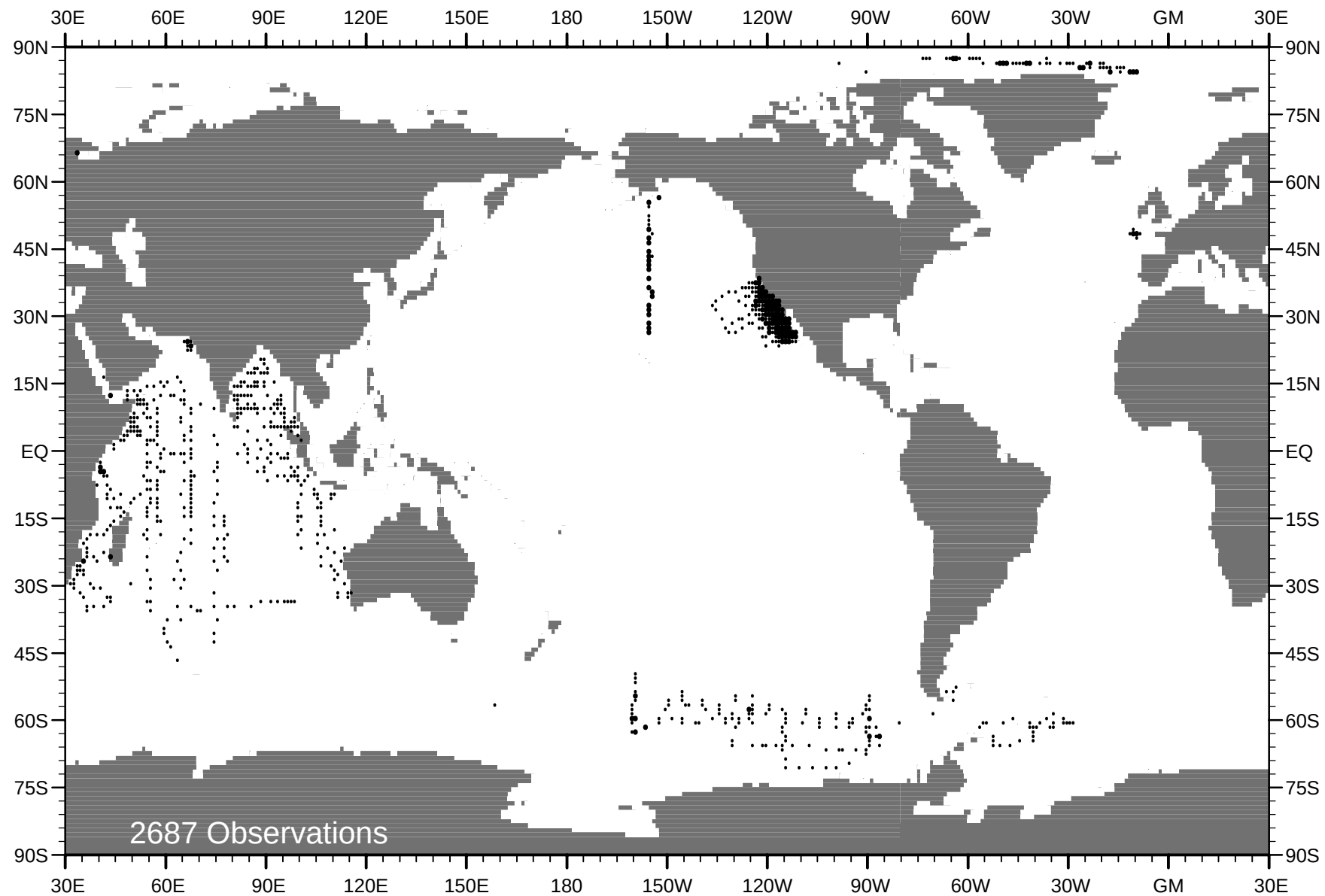


Fig. C35 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1964 .

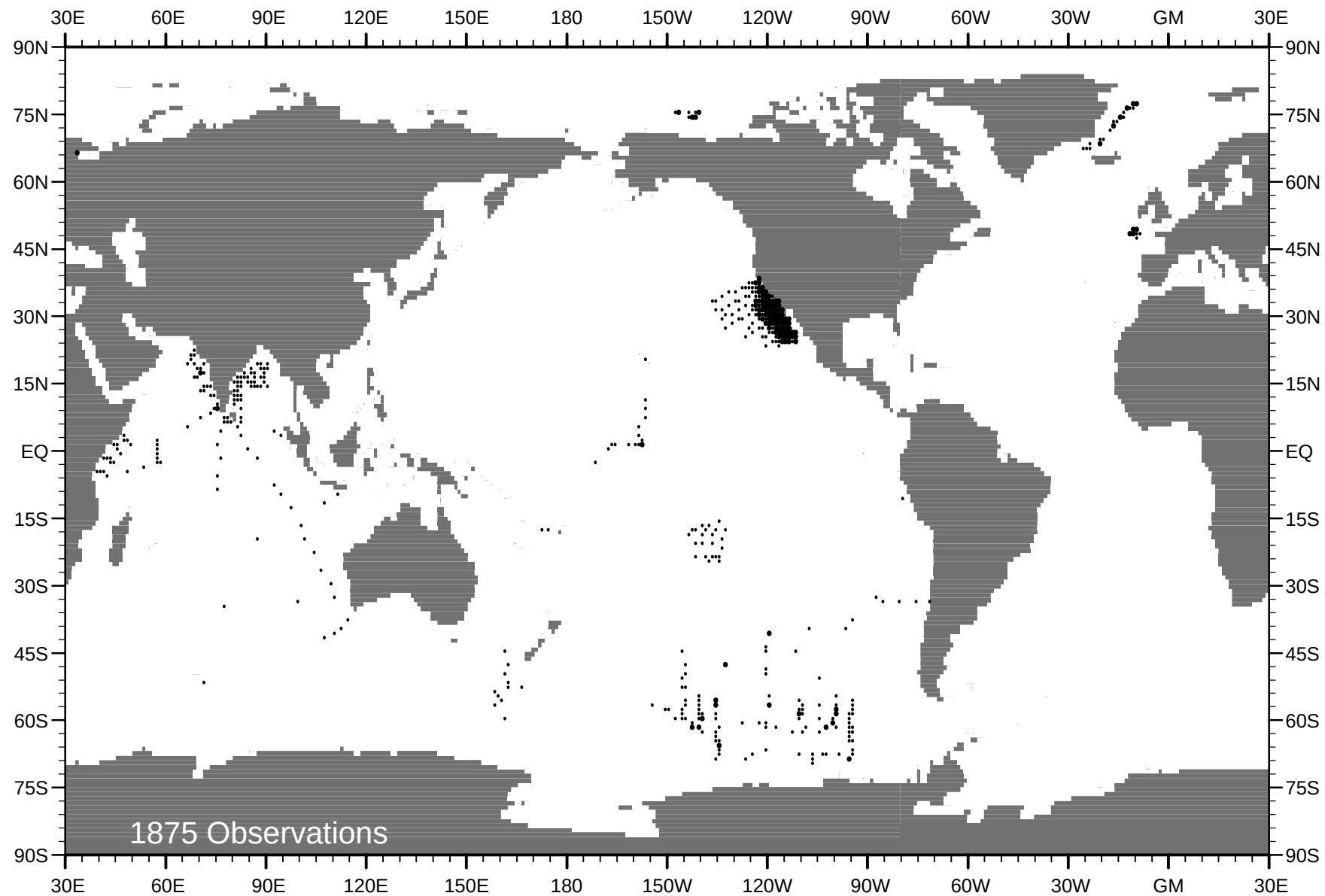


Fig. C36 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1965 .



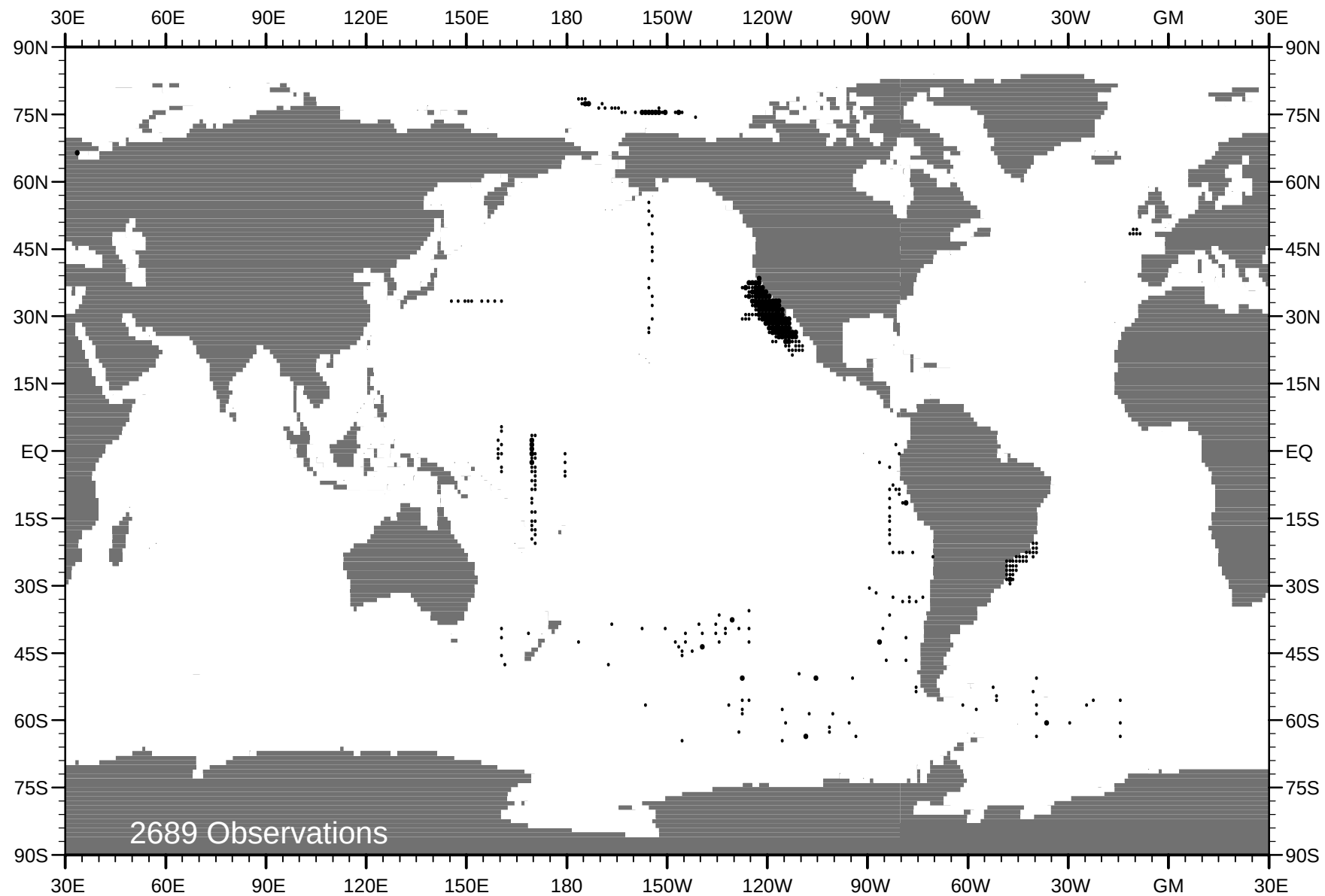


Fig. C37 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1966 .

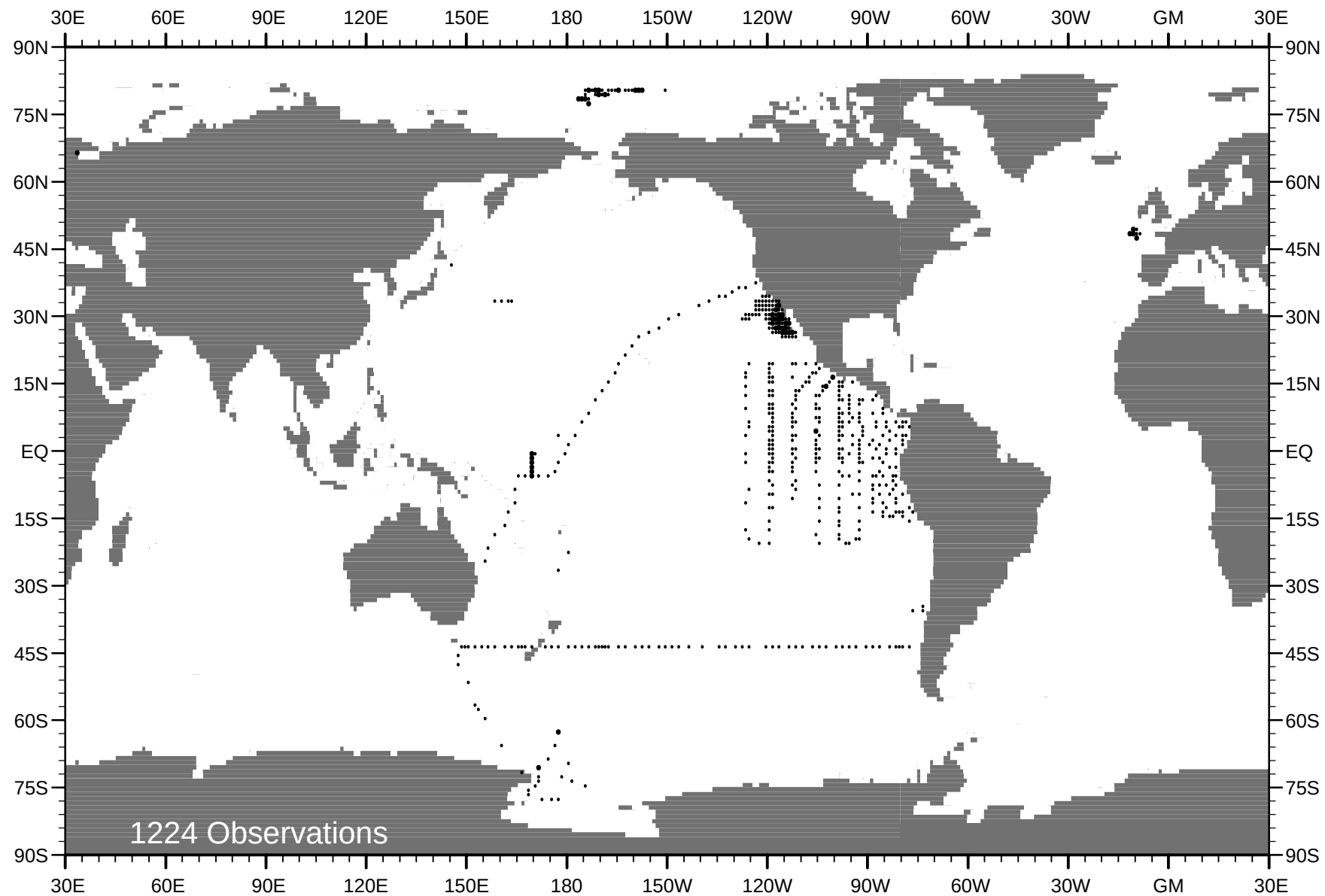


Fig. C38 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1967 .

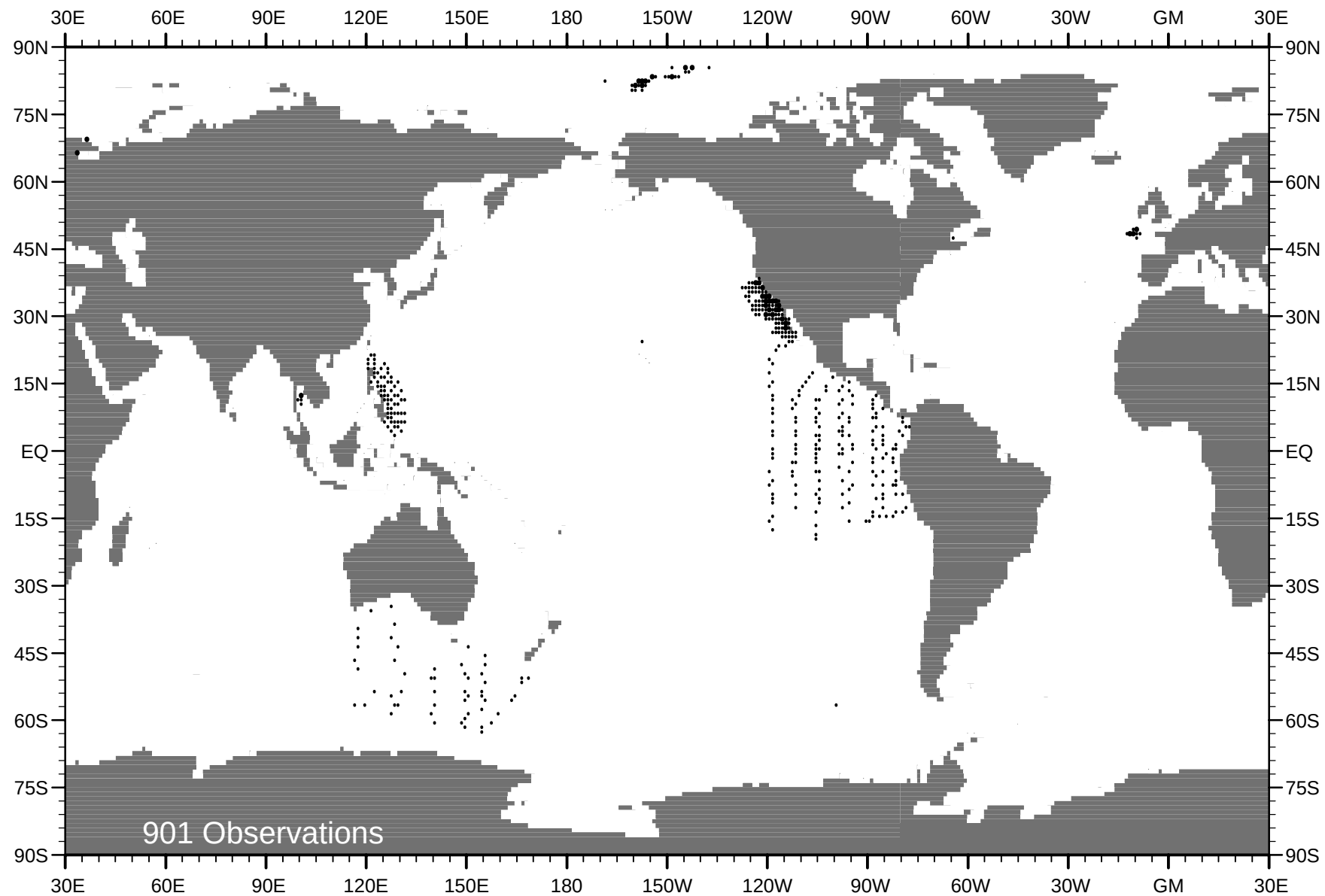


Fig. C39 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1968 .

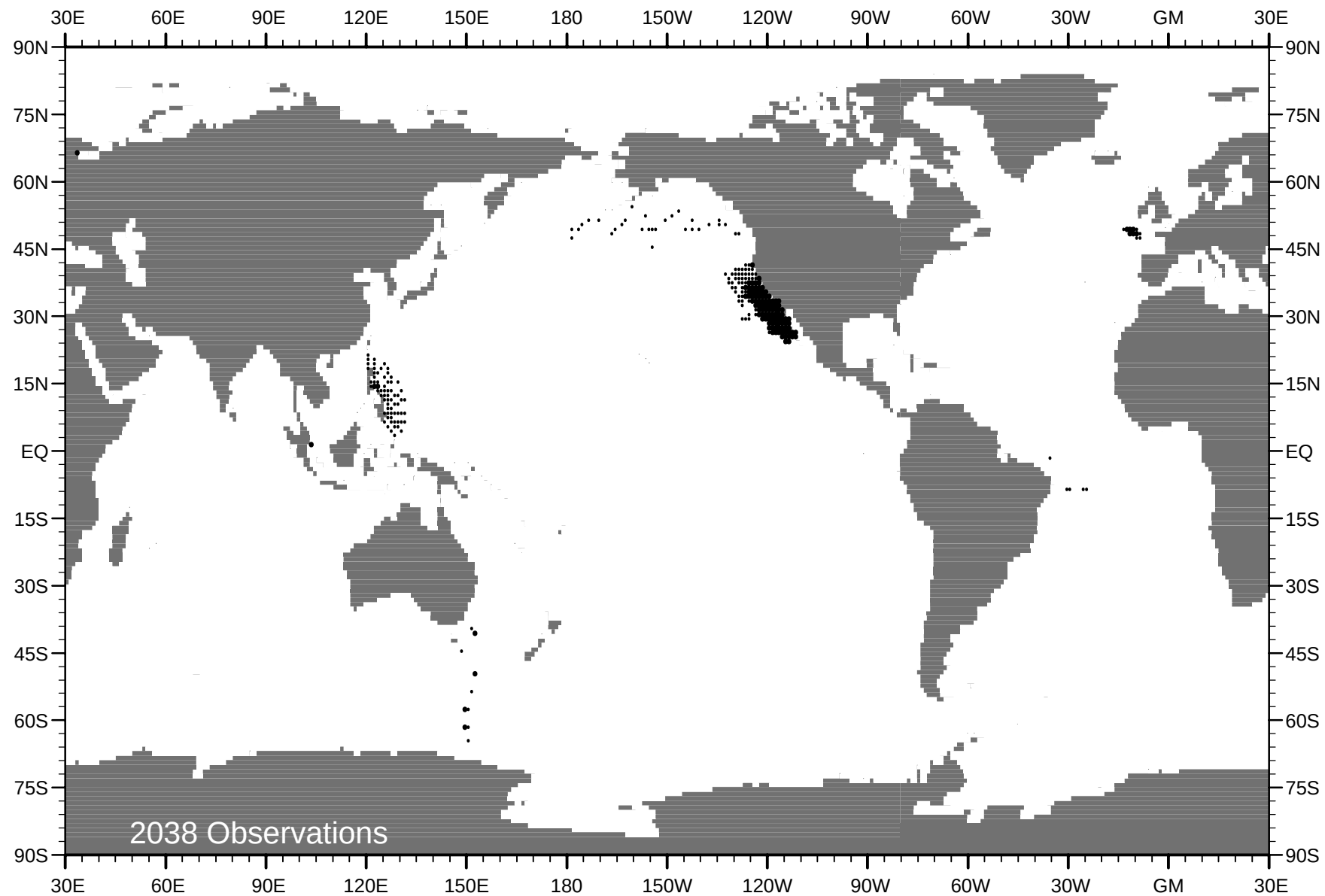


Fig. C40 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1969 .

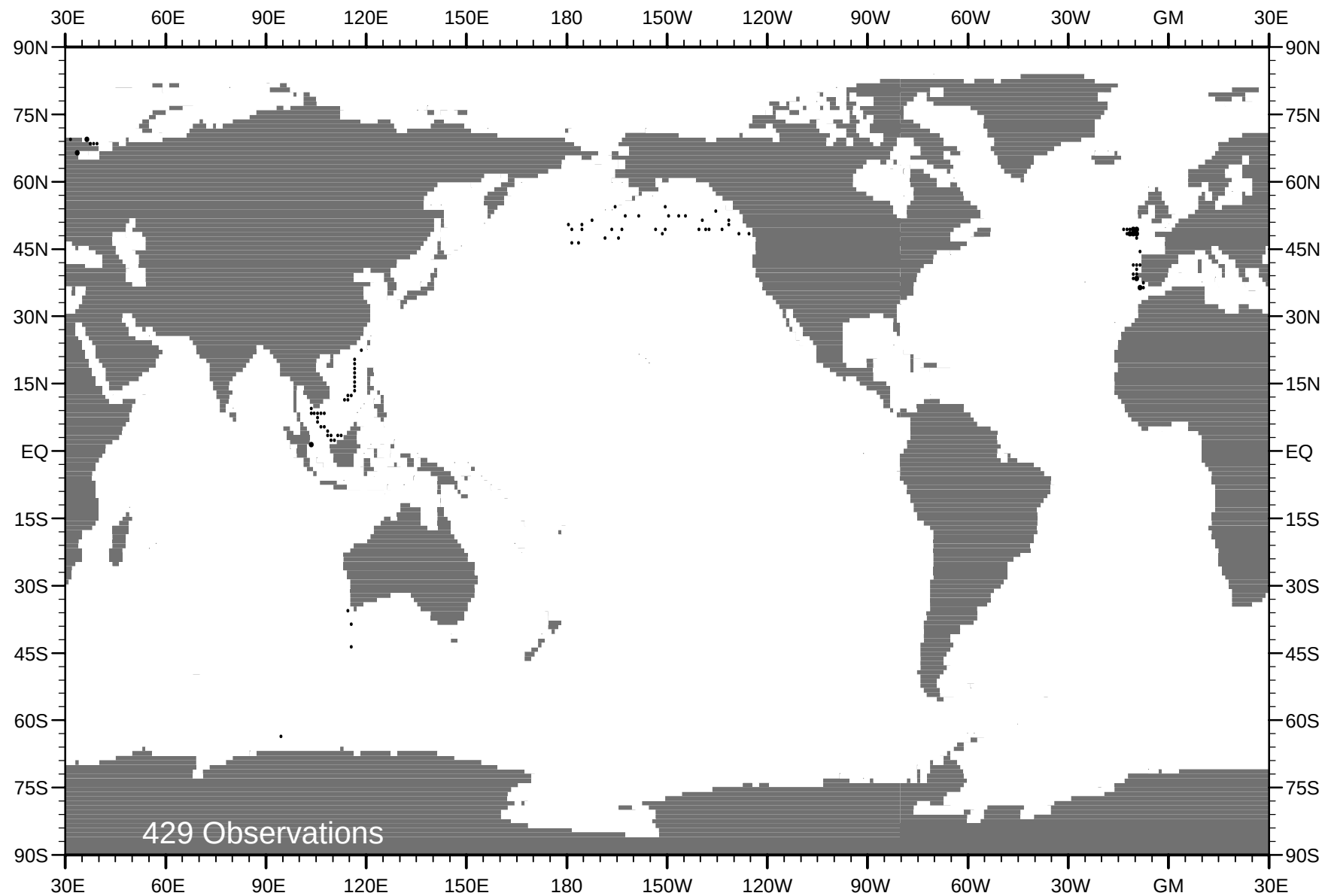


Fig. C41 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1970 .

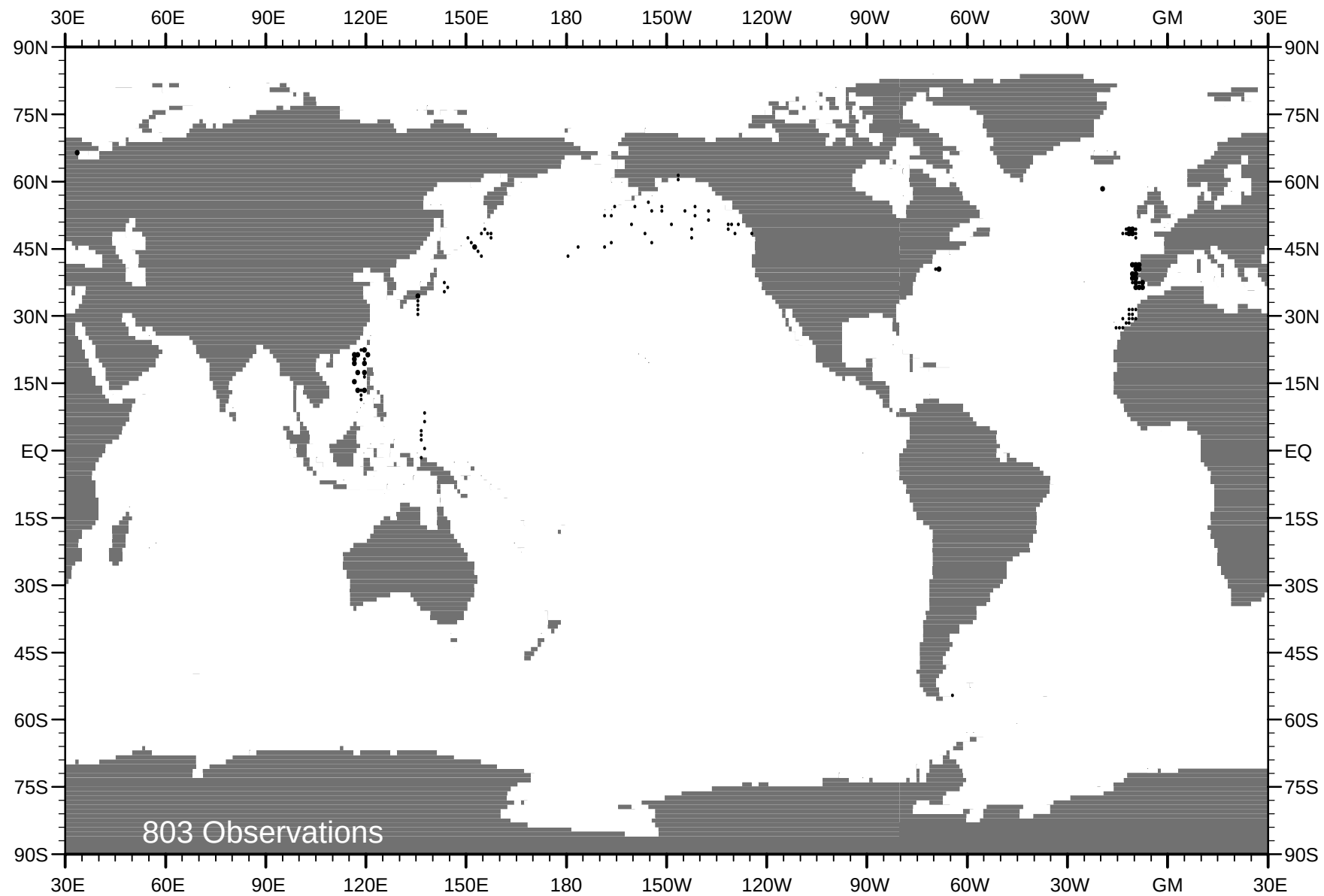


Fig. C42 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1971 .

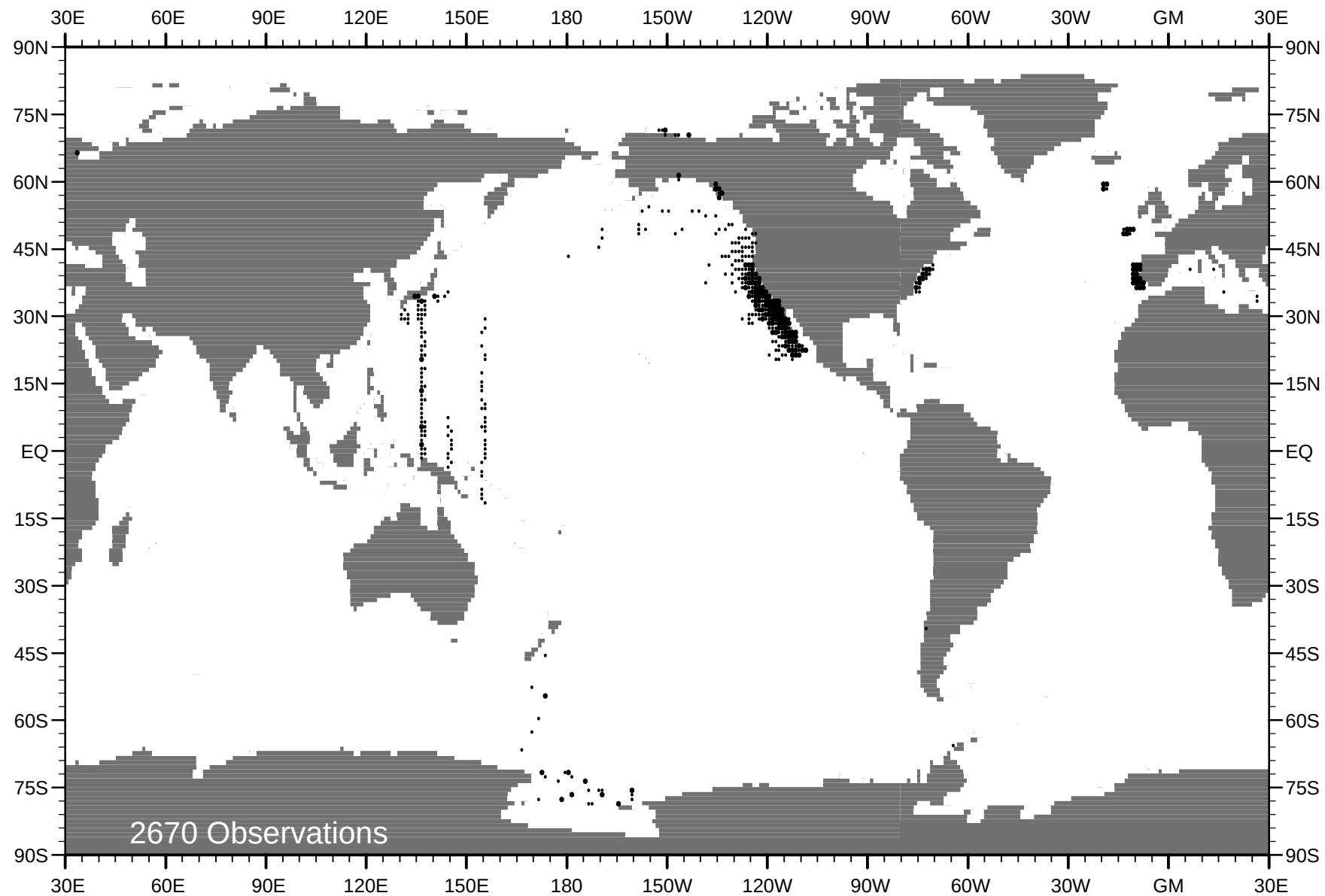


Fig. C43 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1972 .

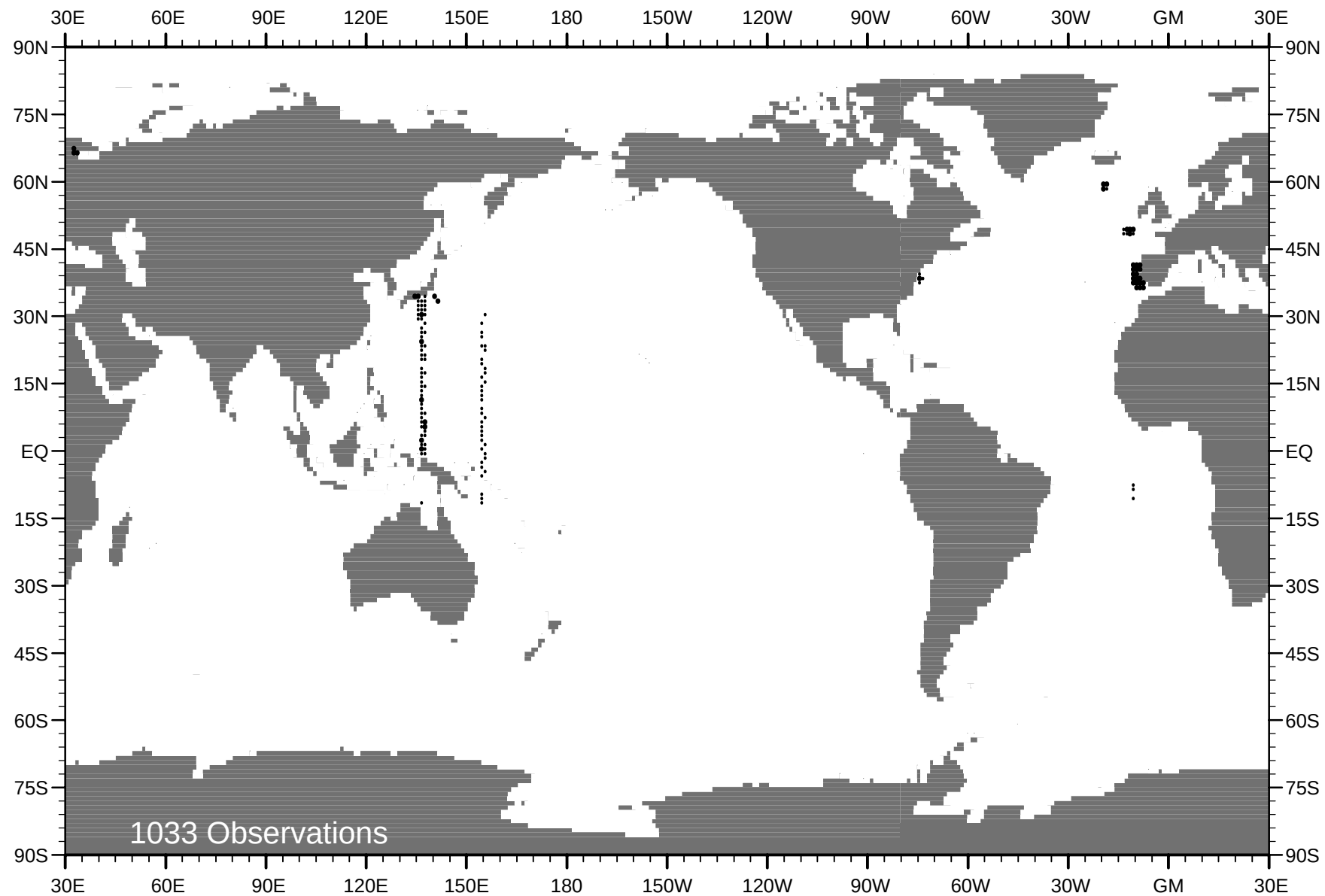


Fig. C44 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1973 .



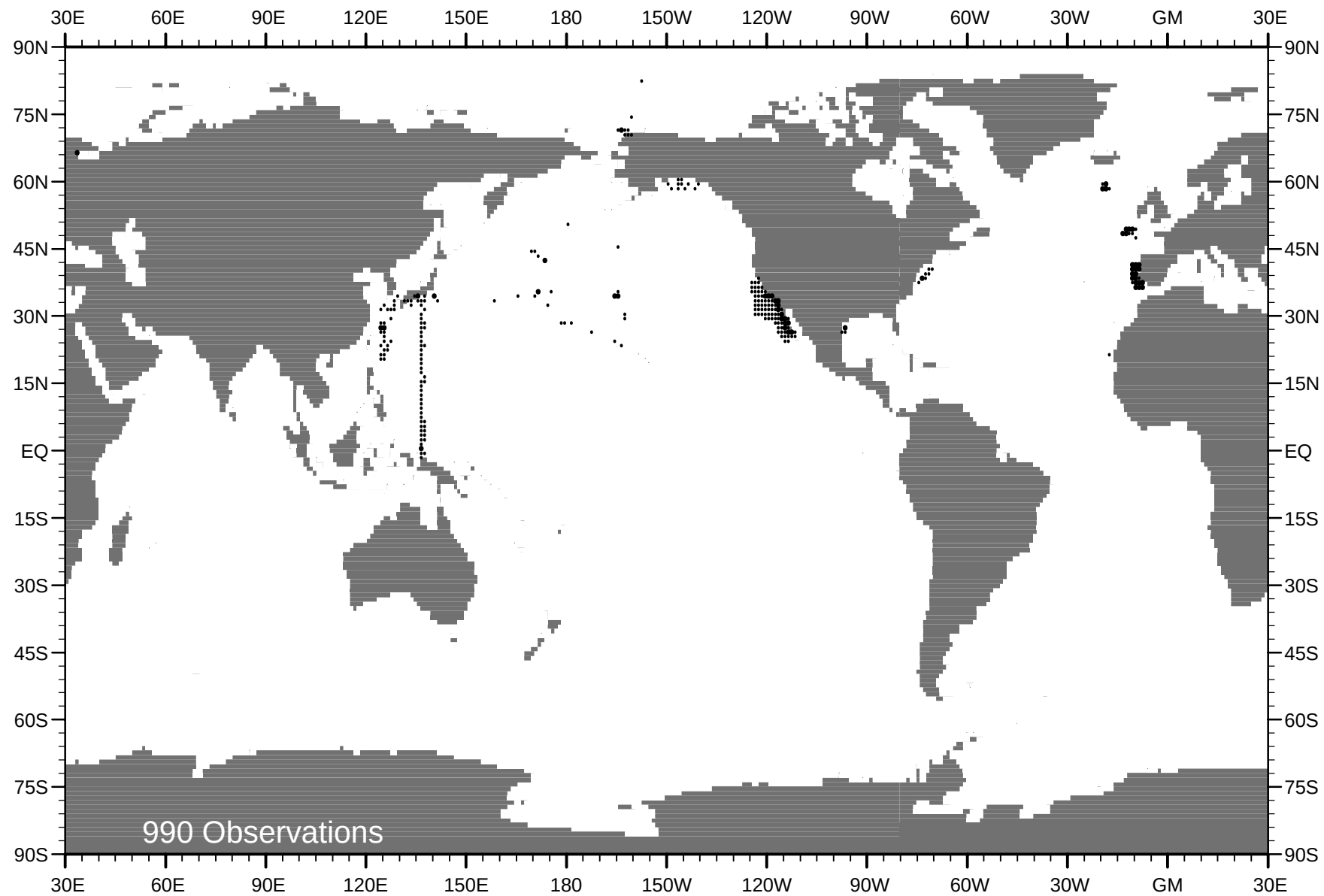


Fig. C45 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1974 .

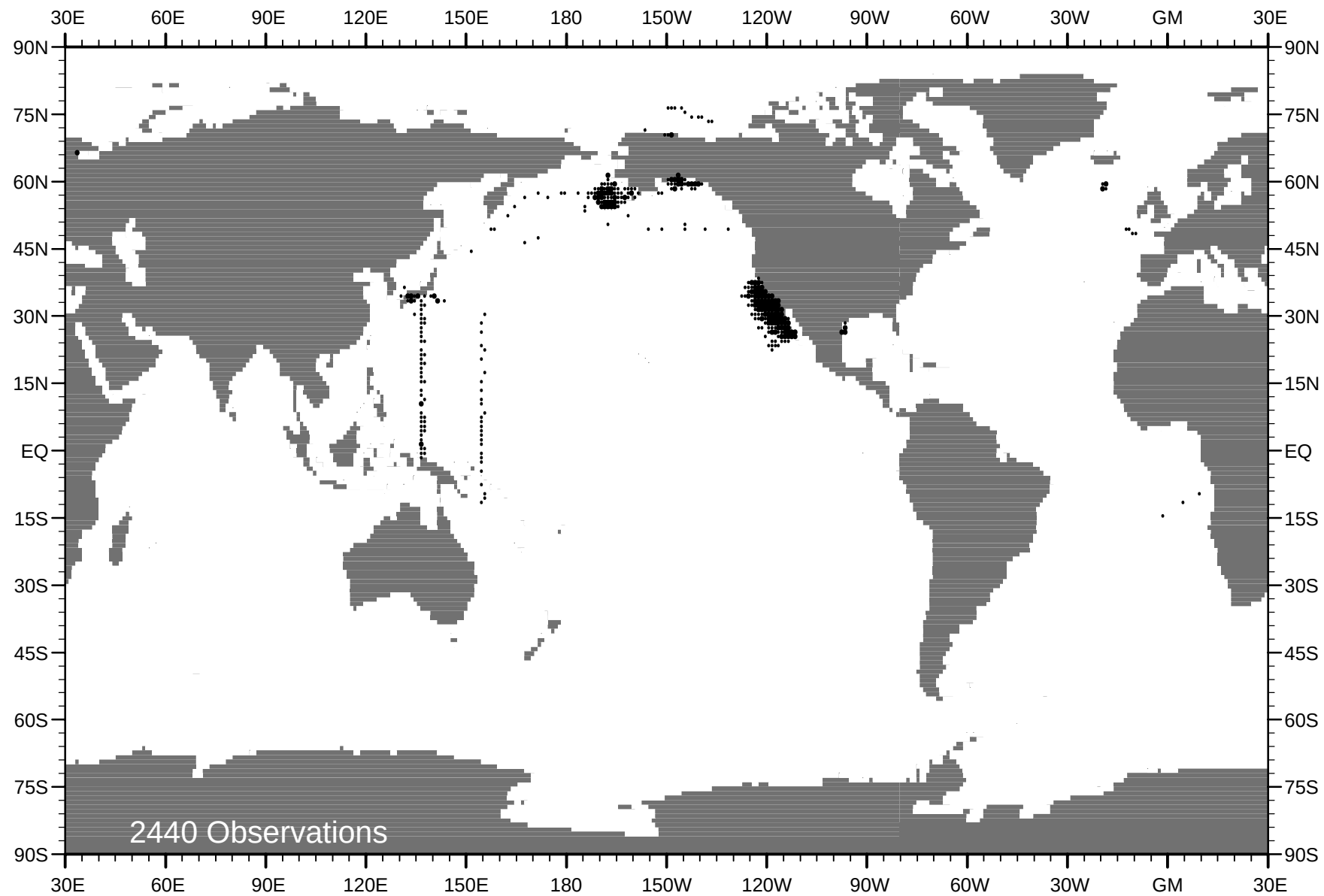


Fig. C46 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1975 .

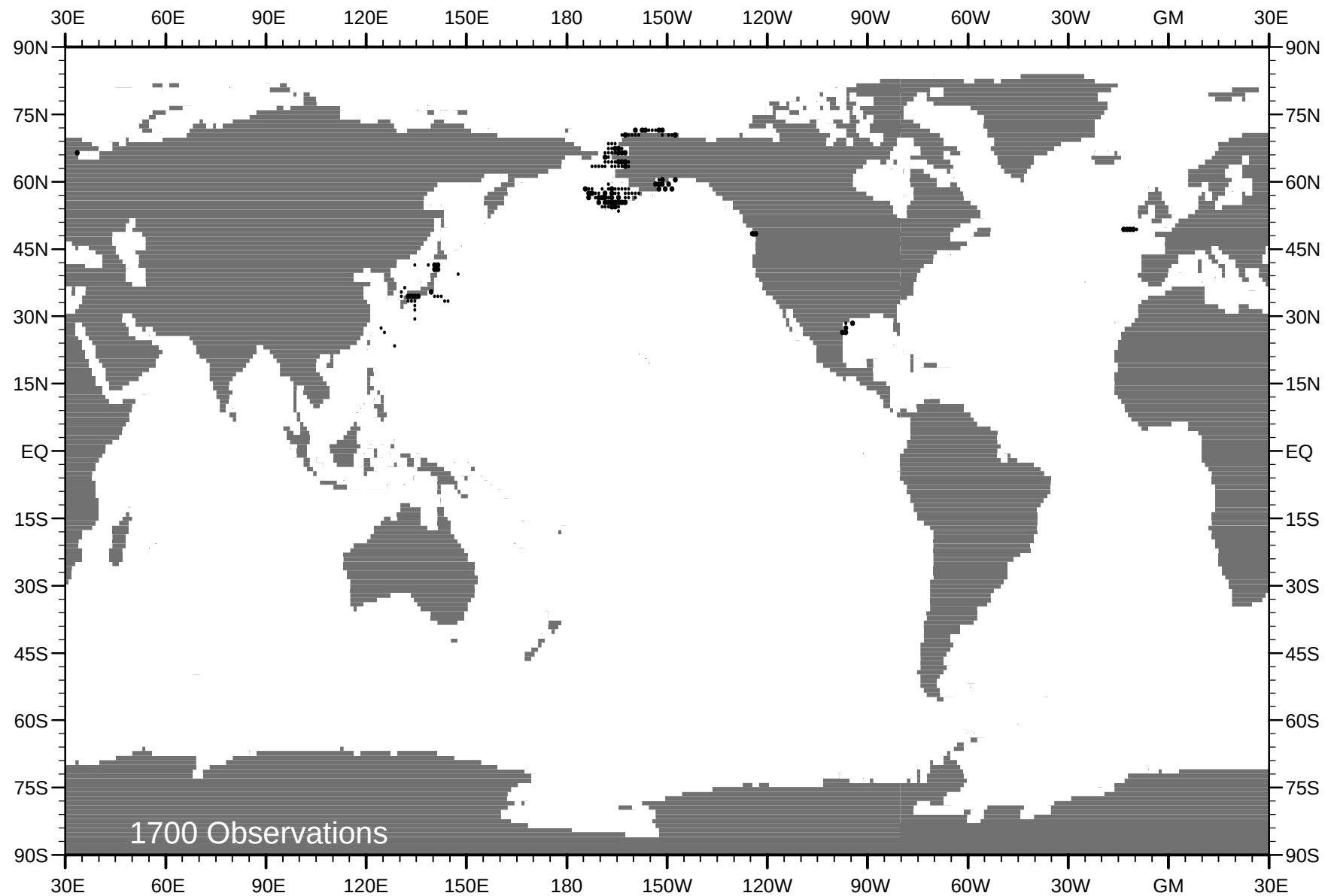


Fig. C47 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1976 .

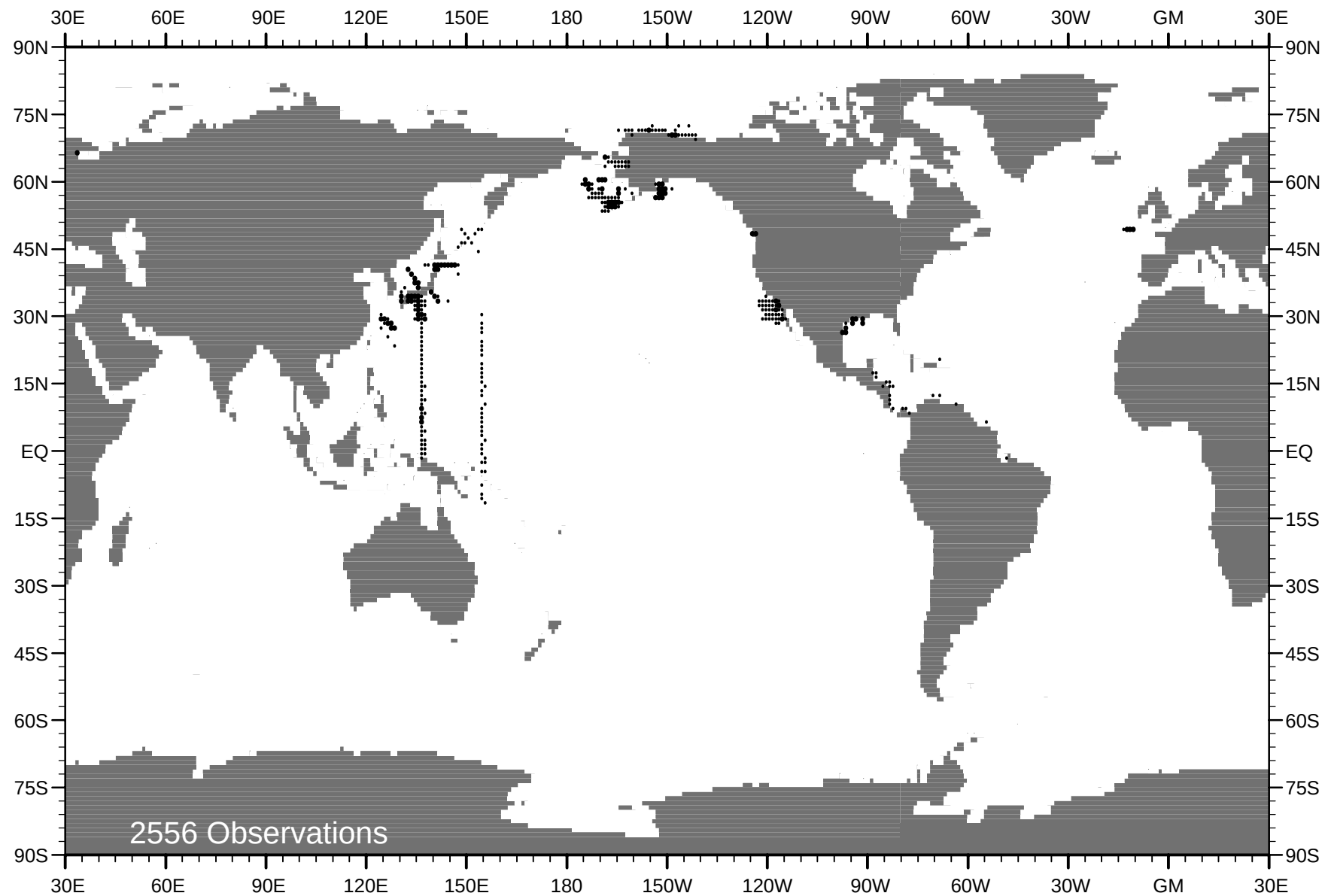


Fig. C48 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1977 .

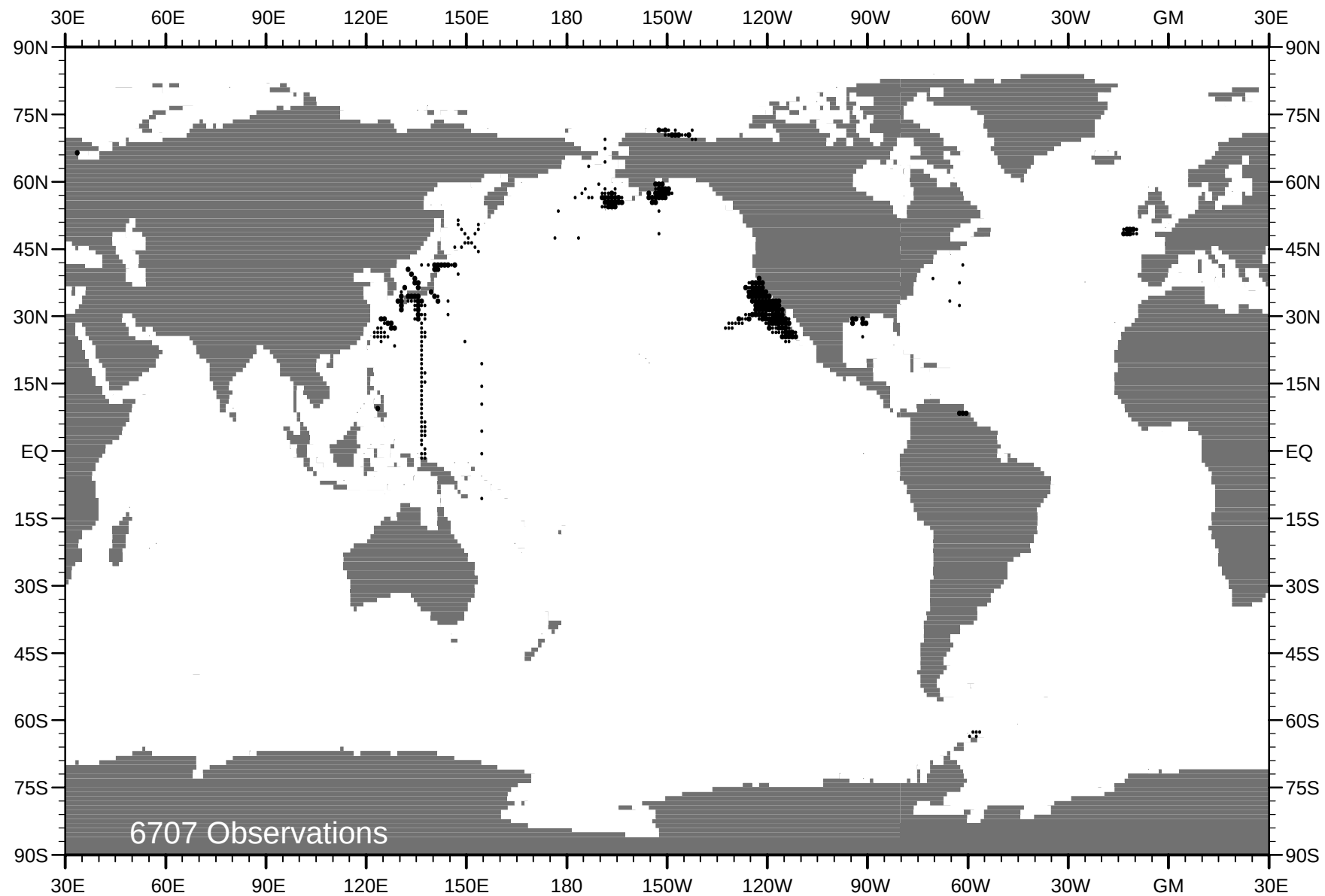


Fig. C49 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1978 .

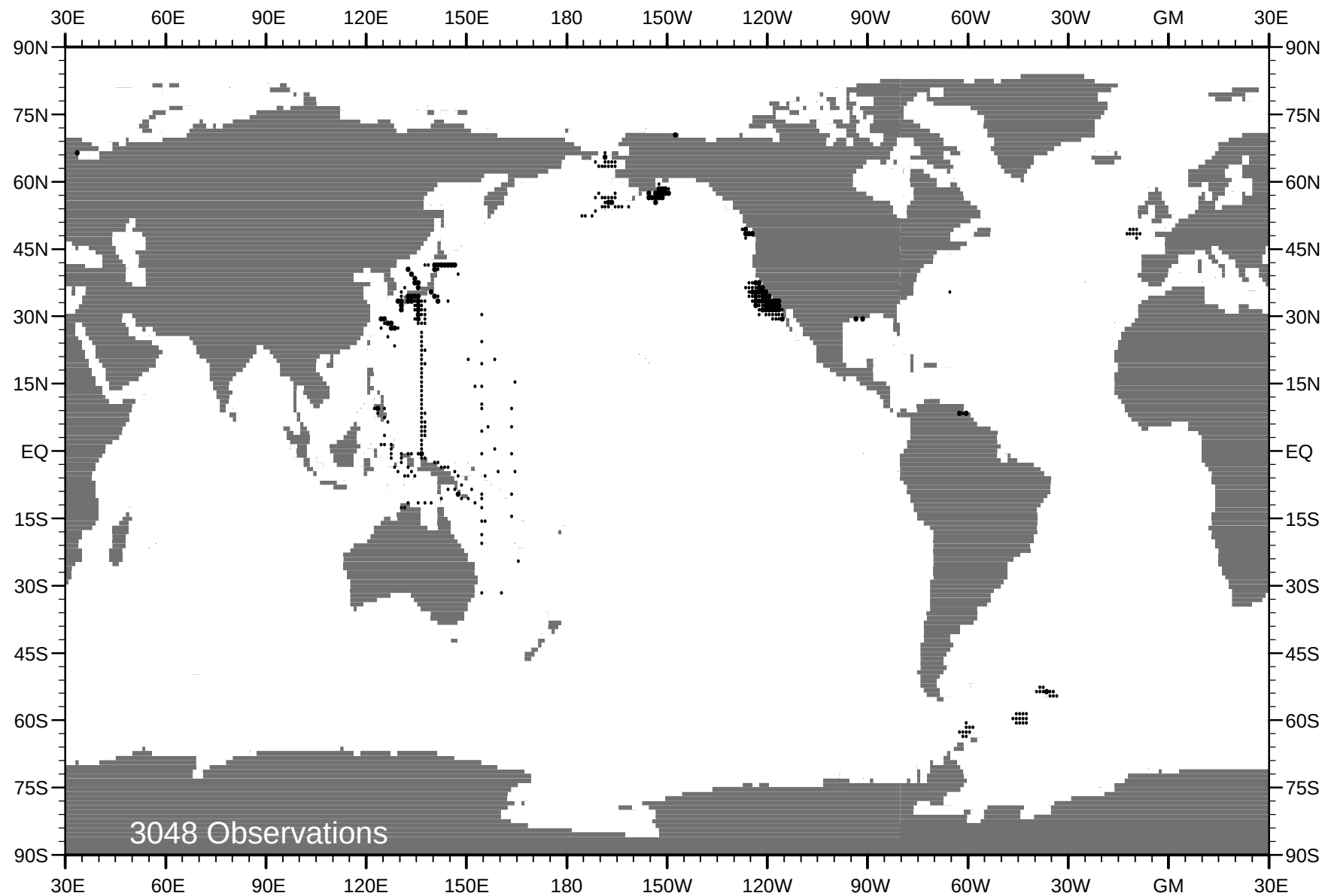


Fig. C50 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1979 .

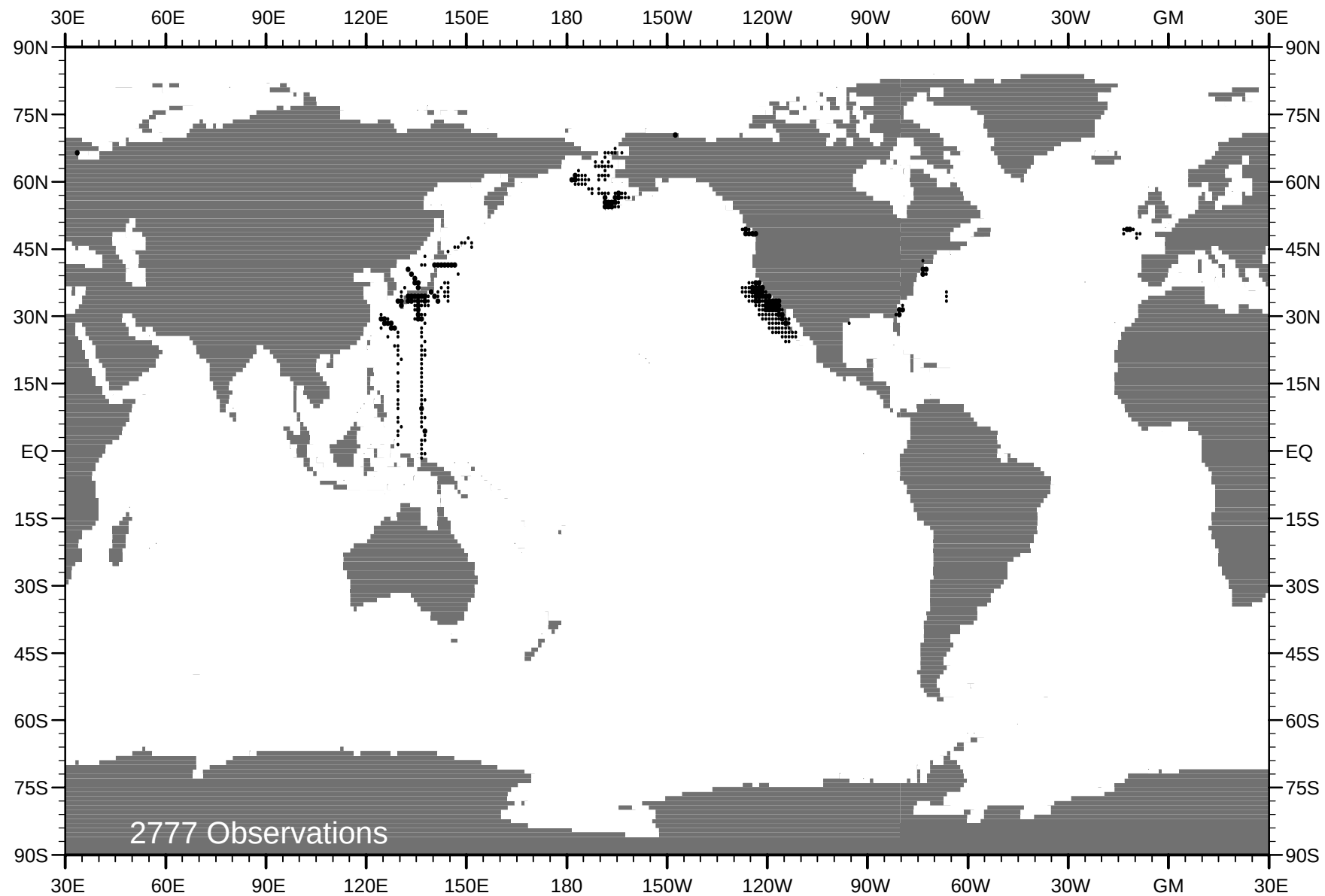


Fig. C51 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1980 .

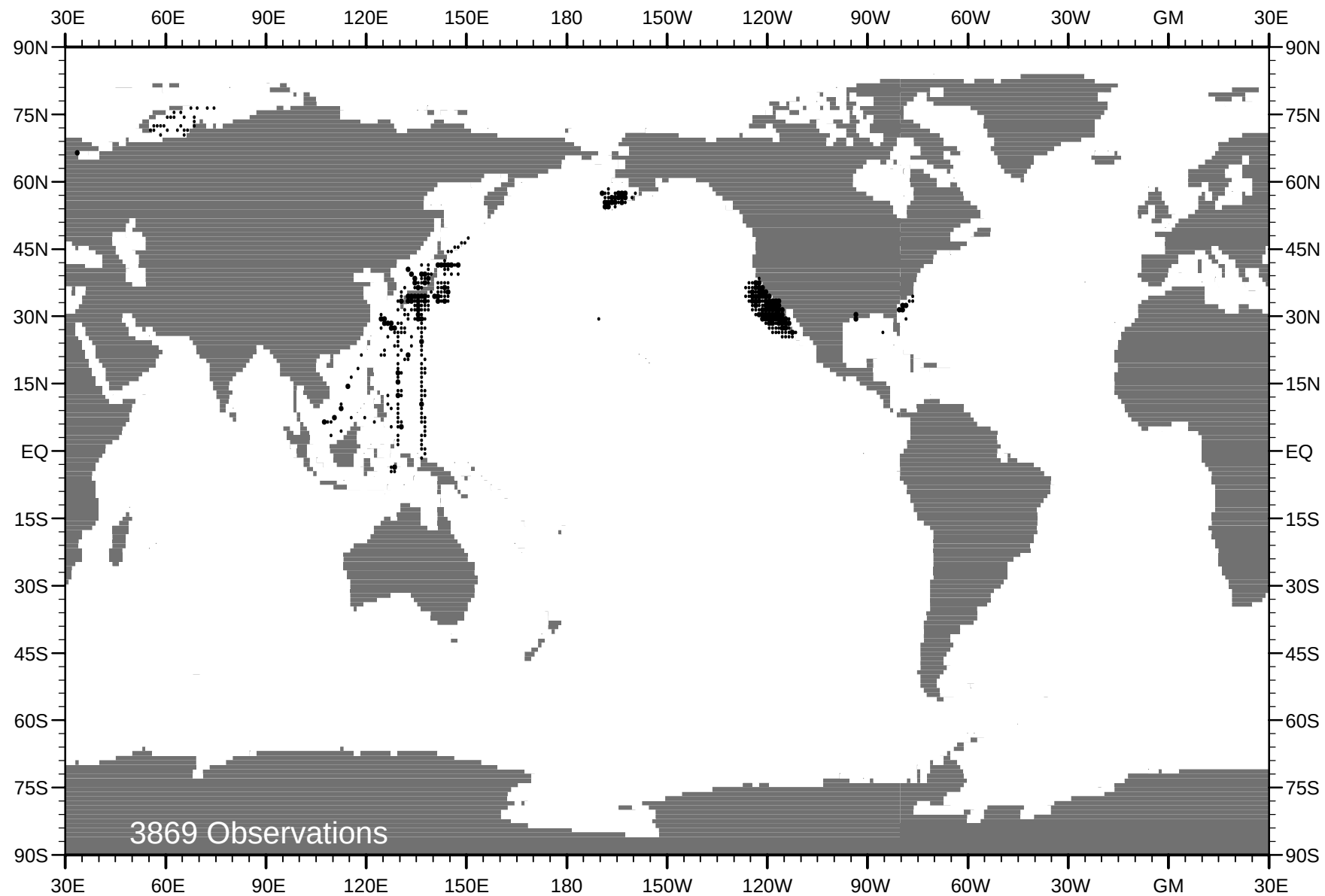


Fig. C52 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1981 .



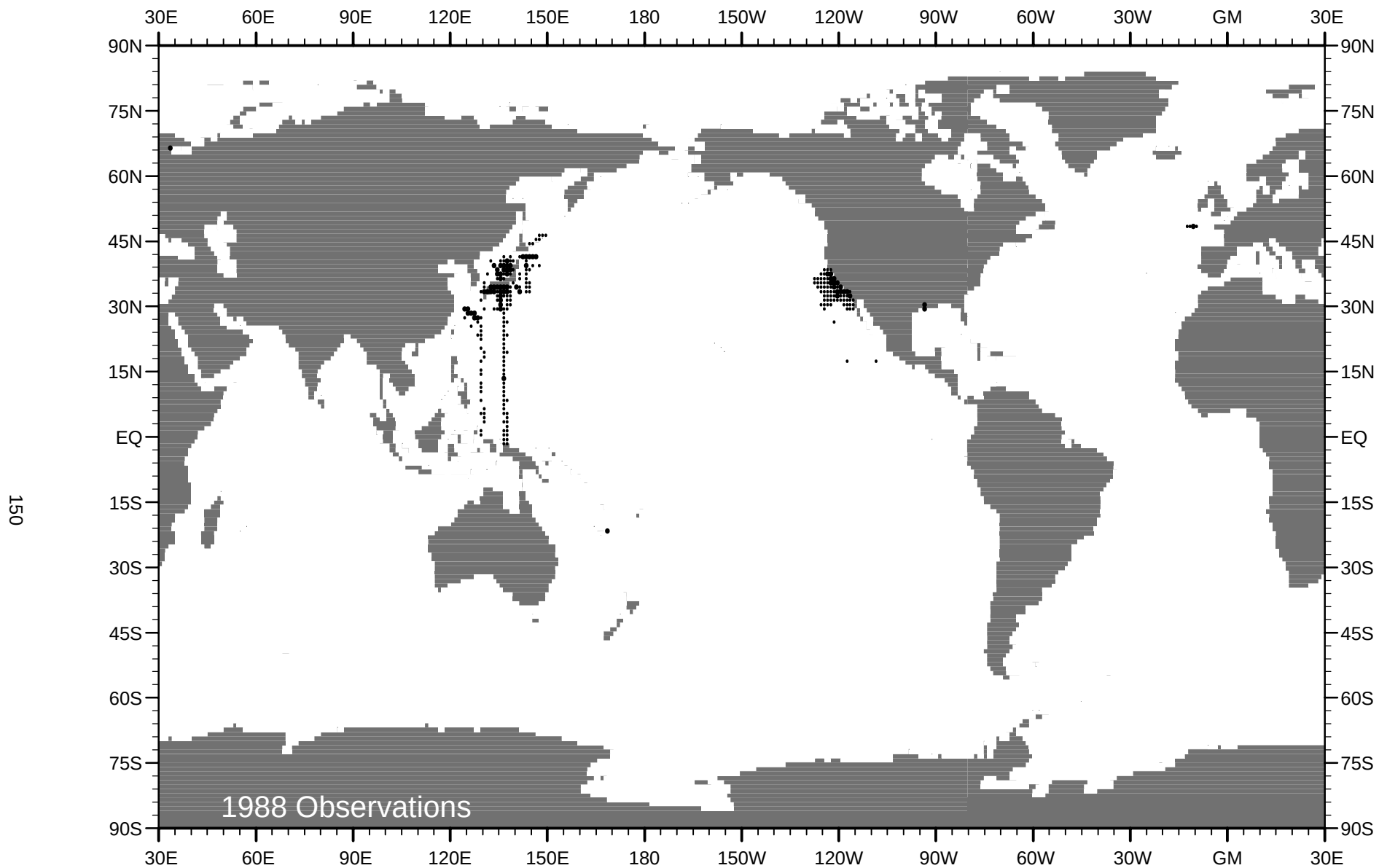


Fig. C53 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1982 .

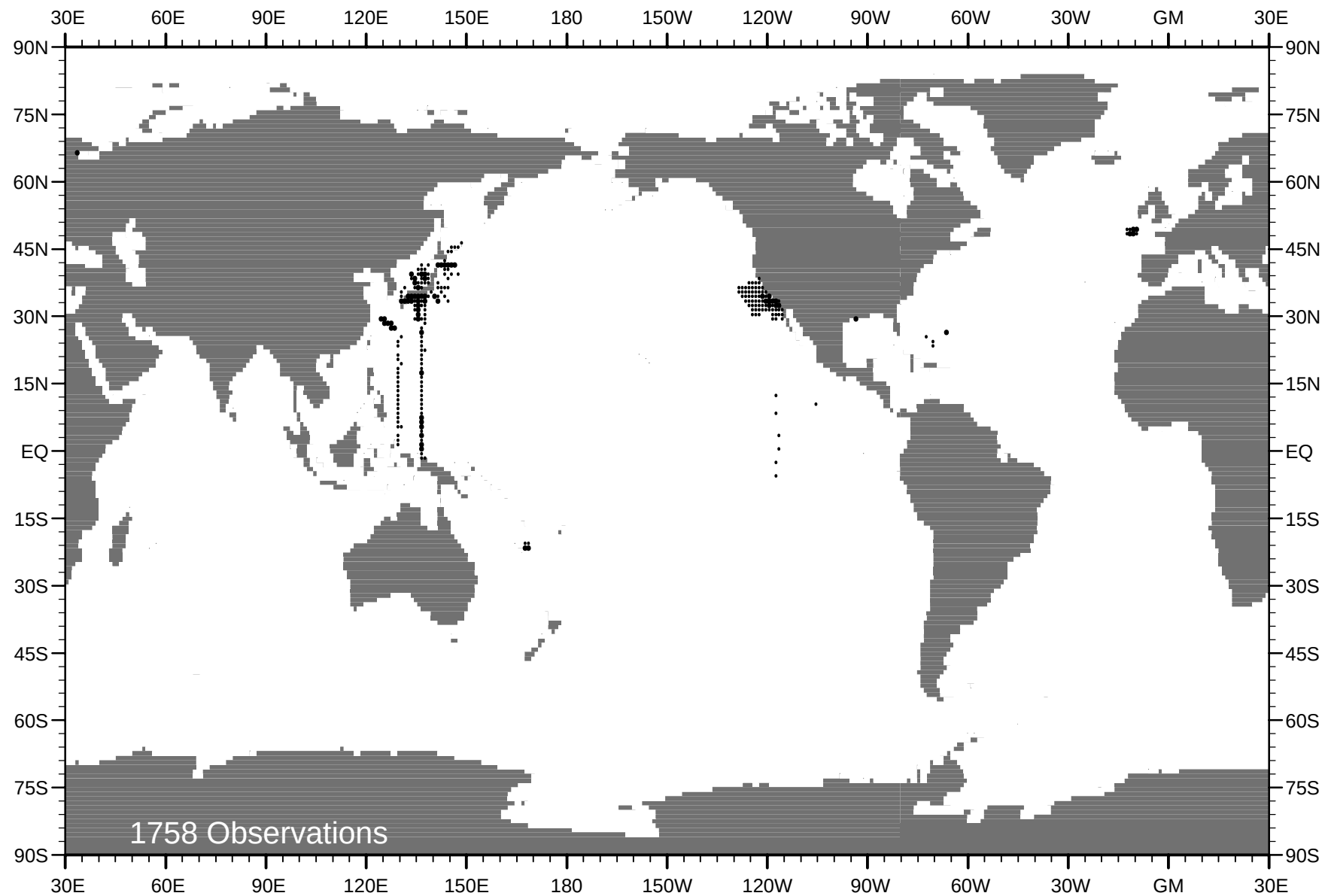


Fig. C54 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1983 .

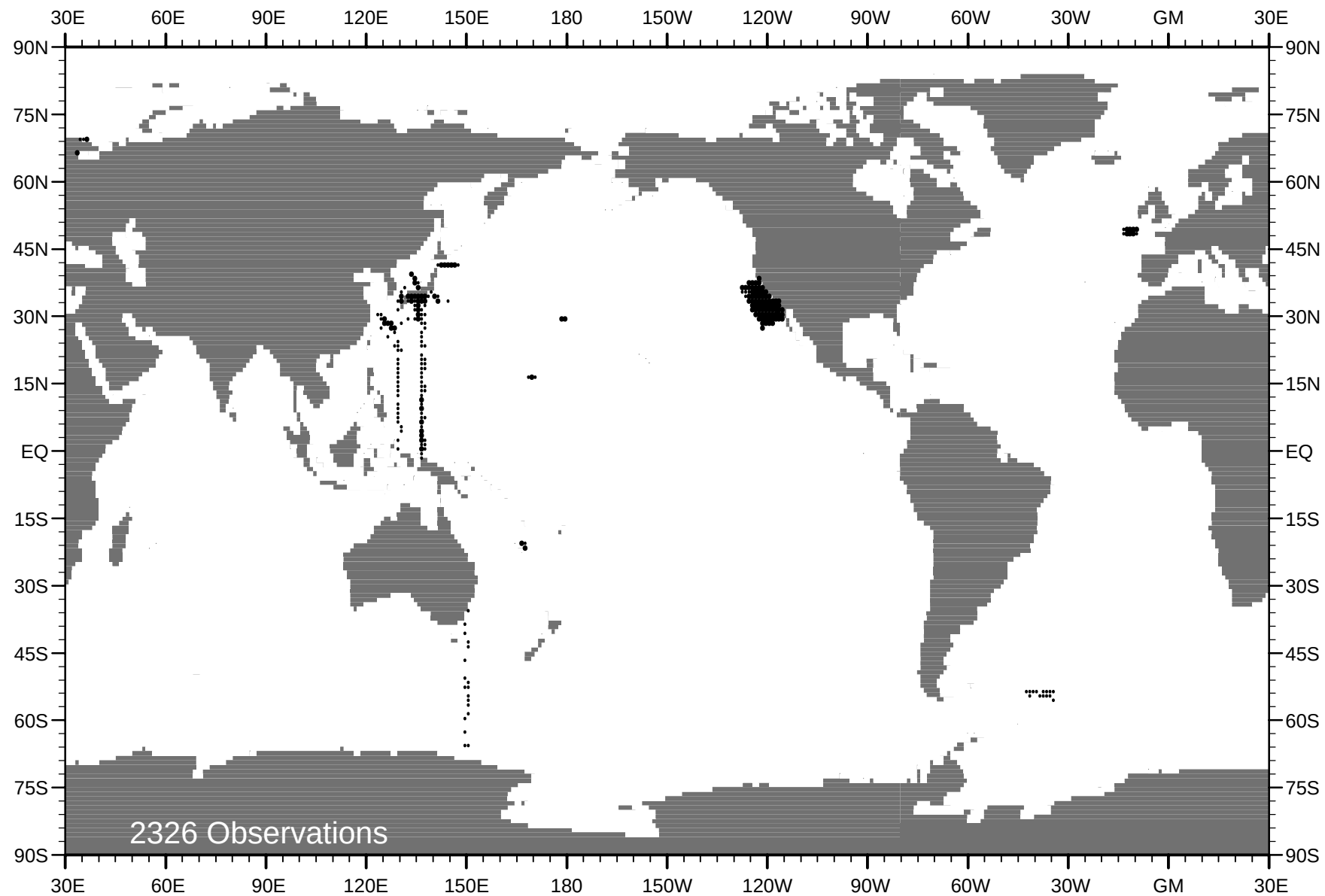


Fig. C55 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1984 .

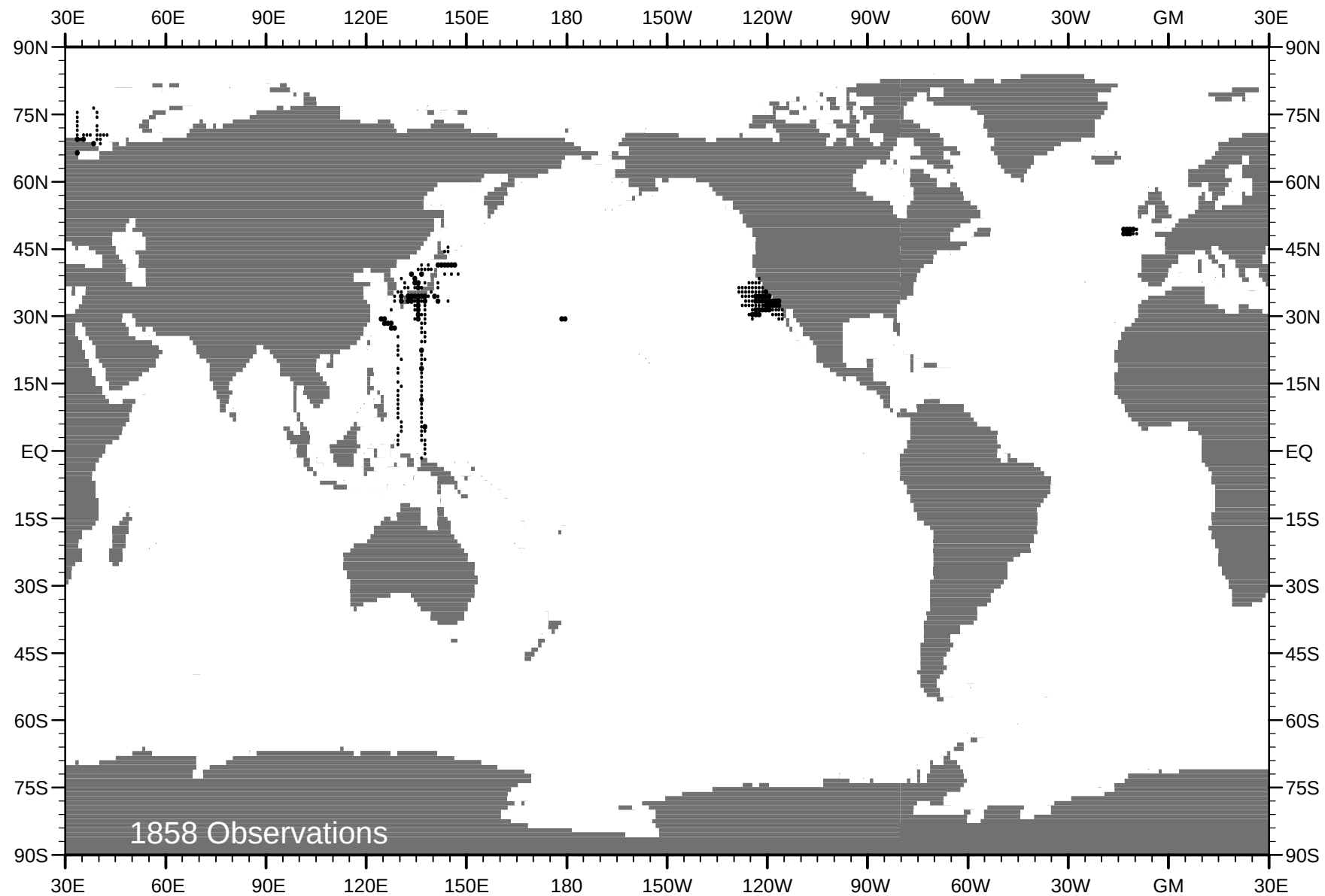


Fig. C56 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1985 .

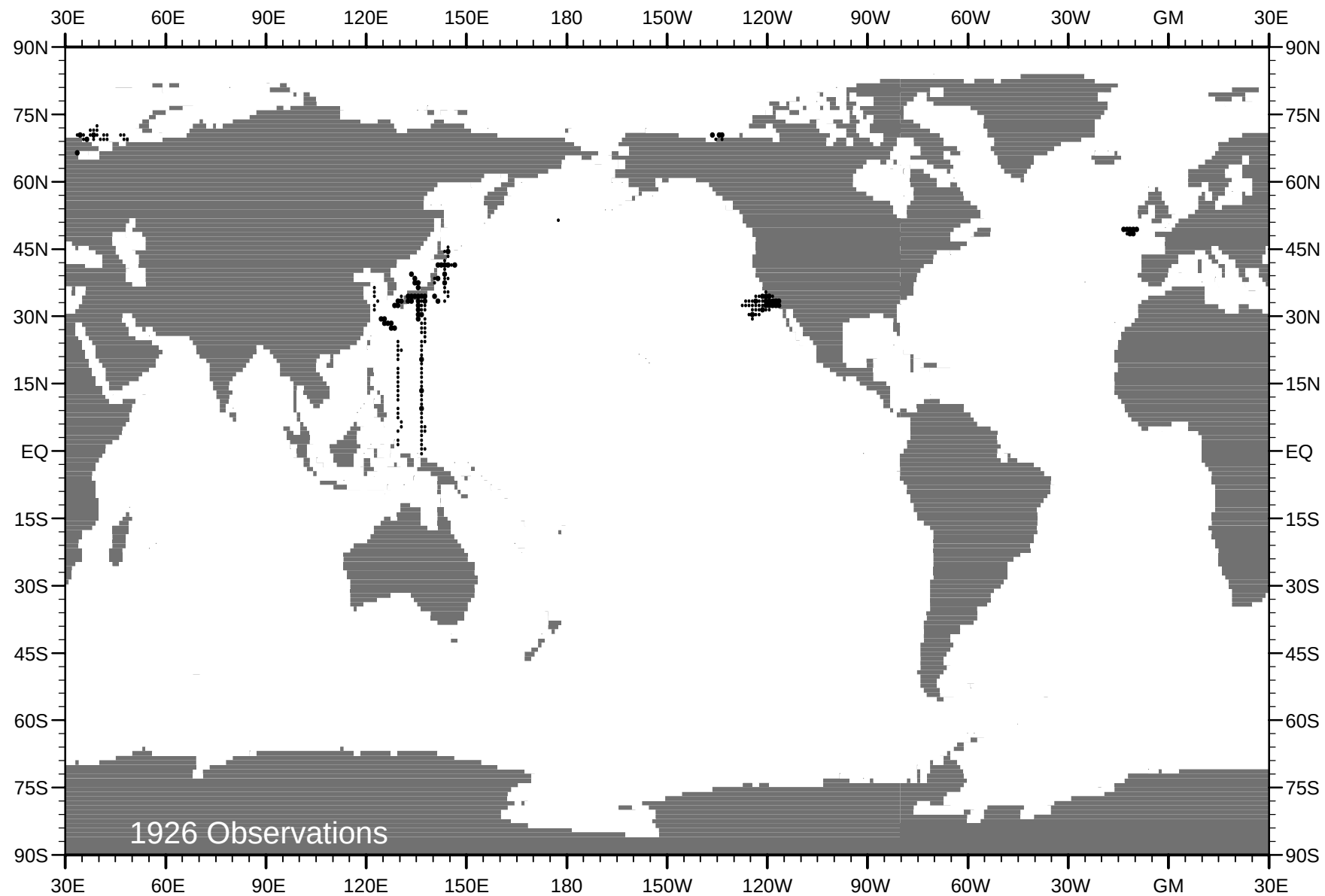


Fig. C57 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1986 .

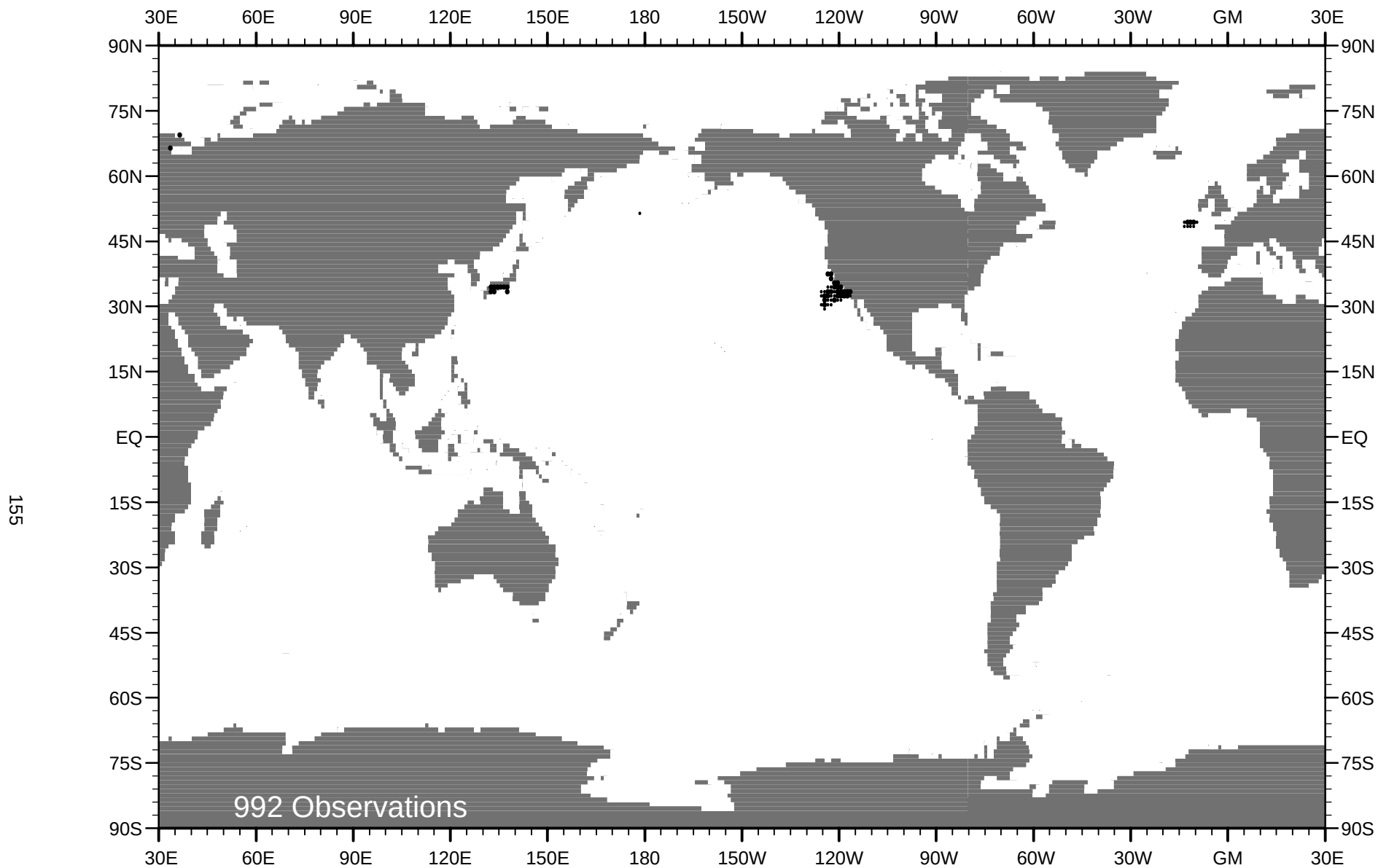


Fig. C58 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1987 .

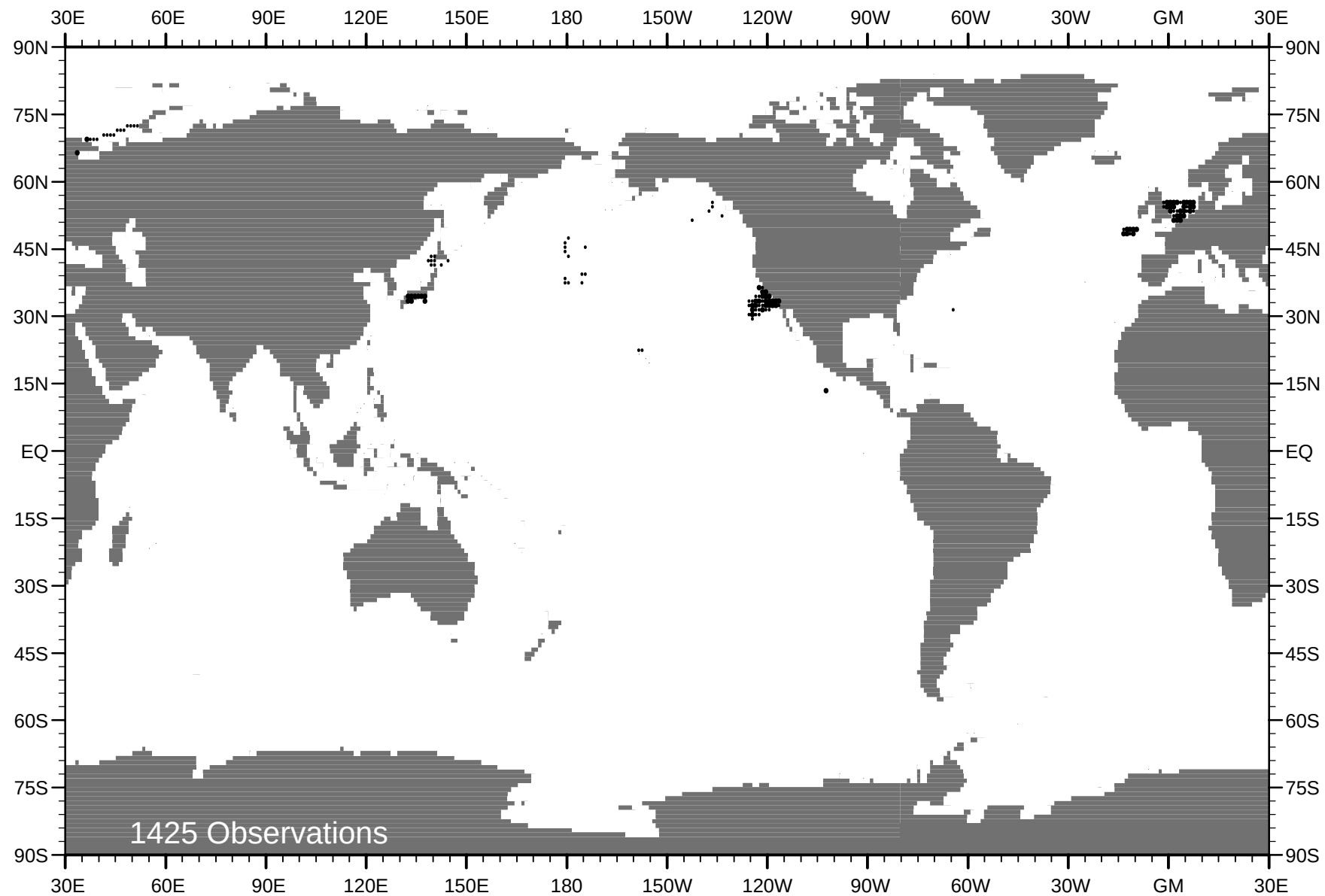


Fig. C59 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1988 .

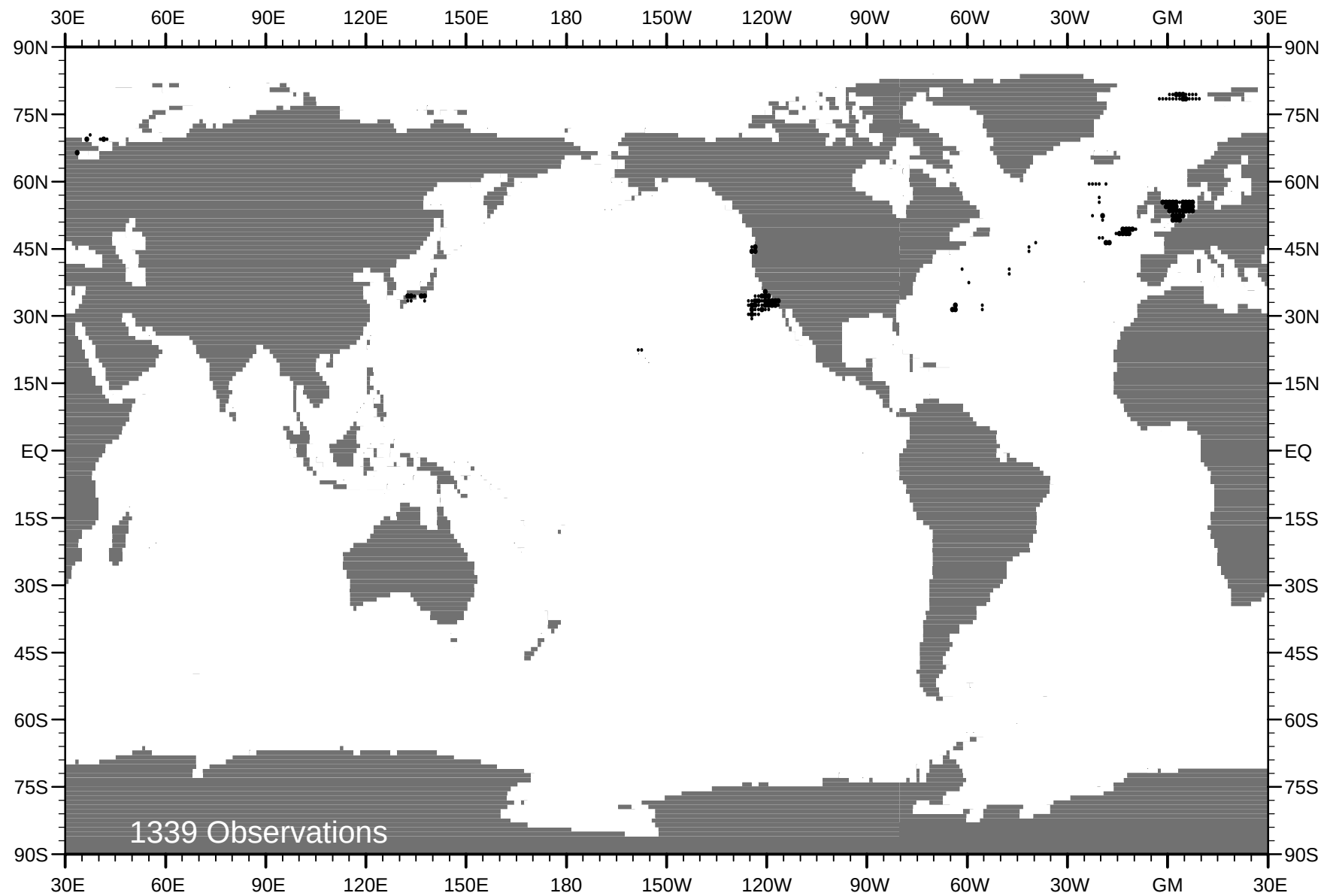


Fig. C60 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1989 .



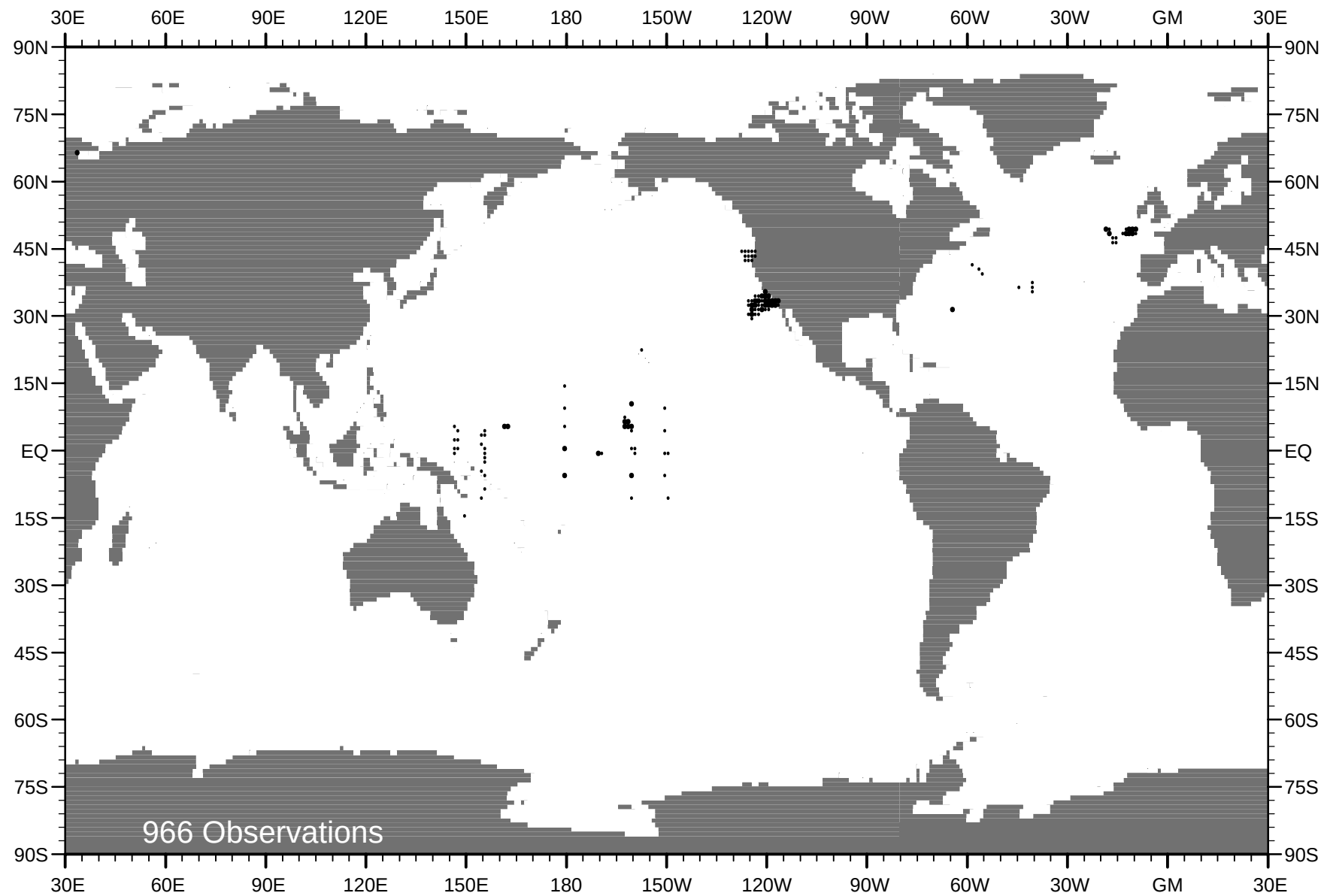


Fig. C61 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1990 .

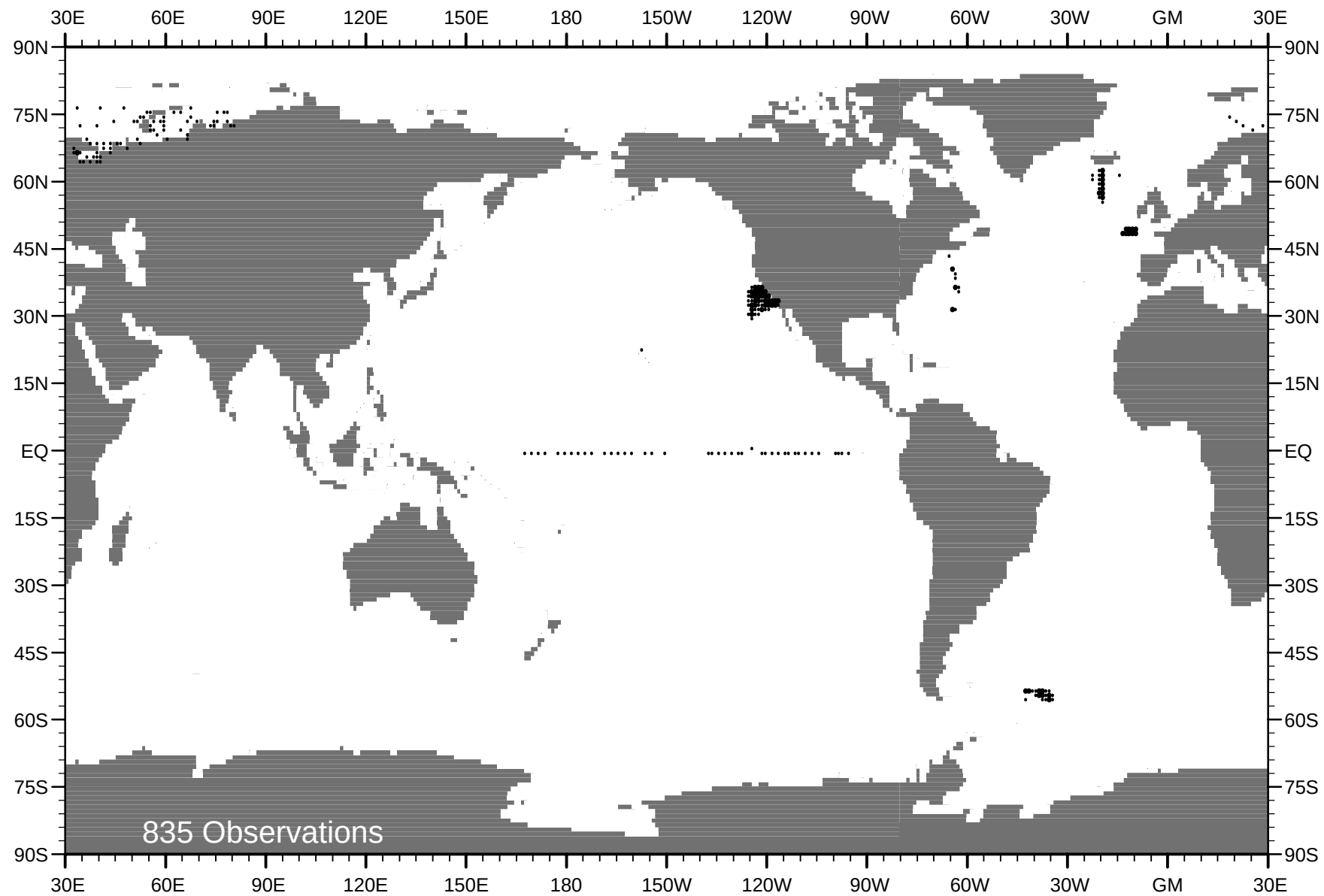


Fig. C62 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1991 .

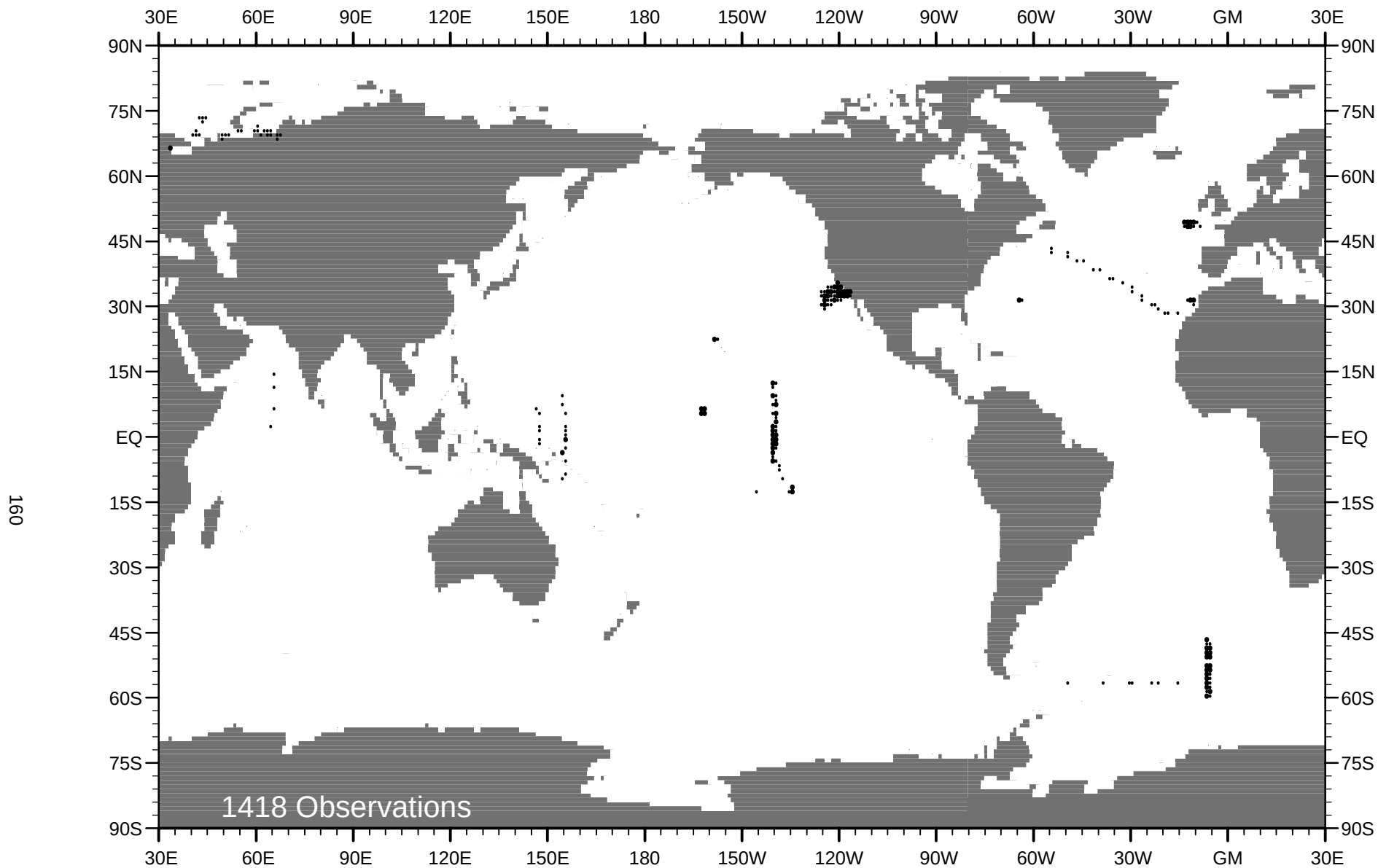


Fig. C63 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1992 .

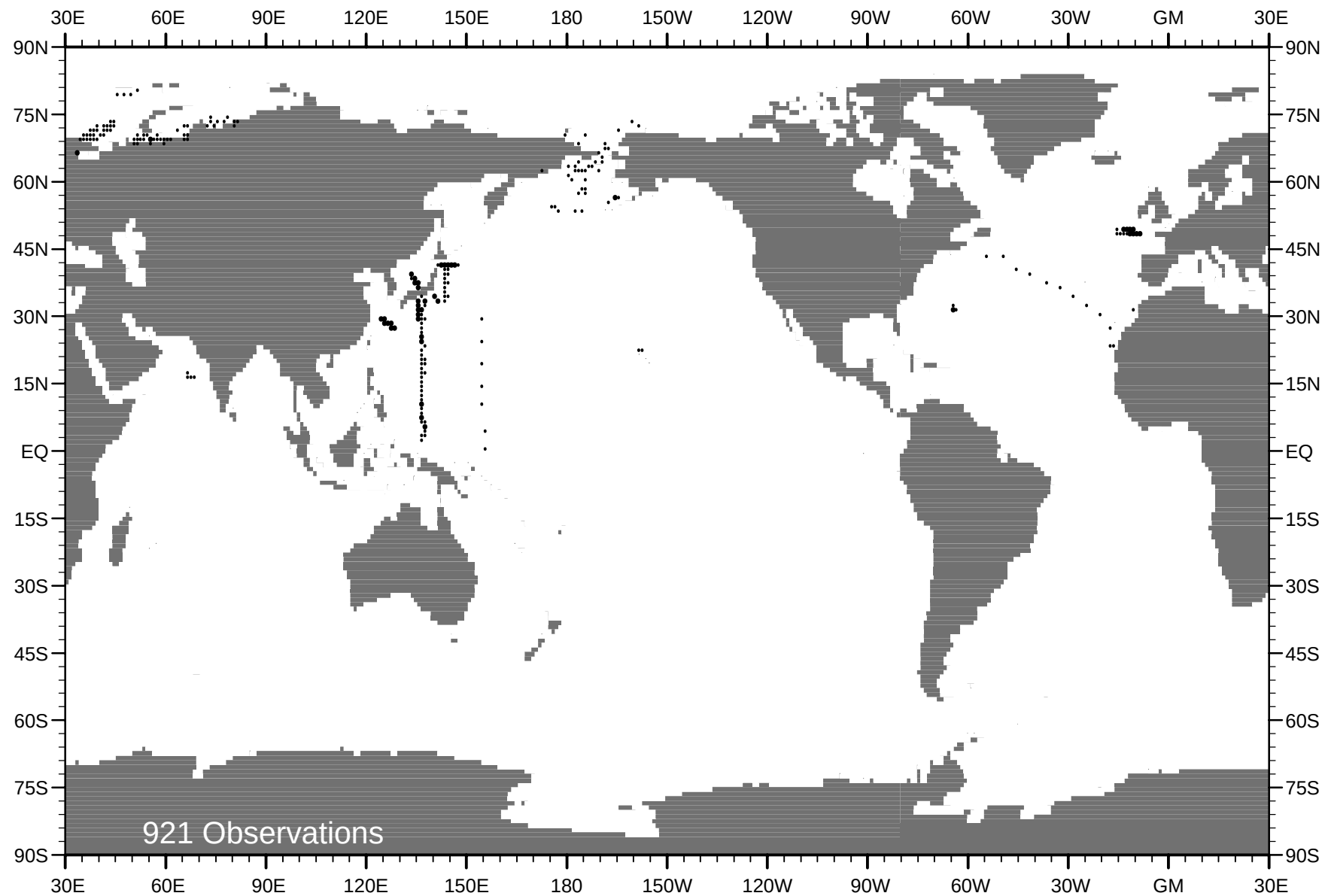


Fig. C64 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1993 .

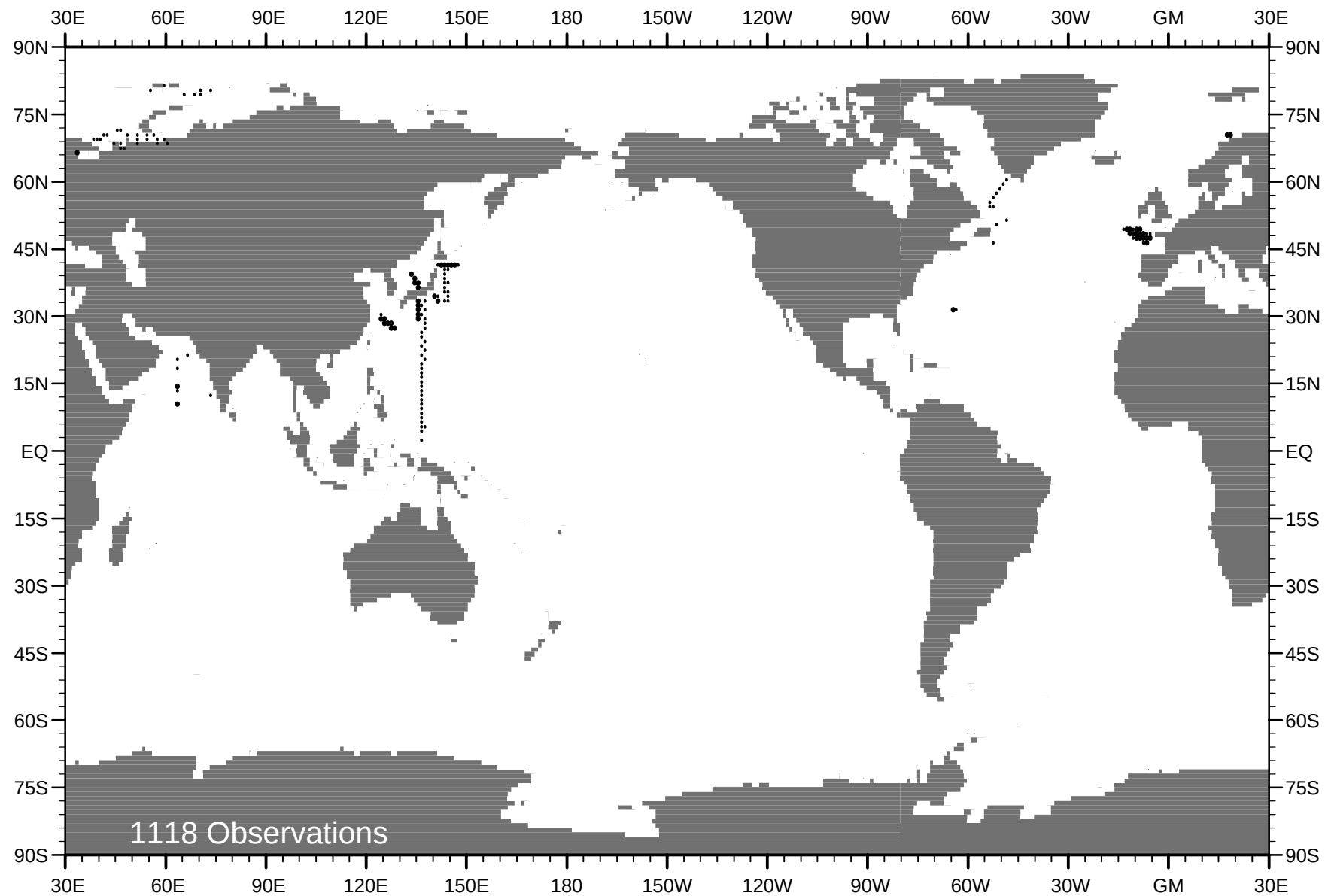


Fig. C65 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1994 .

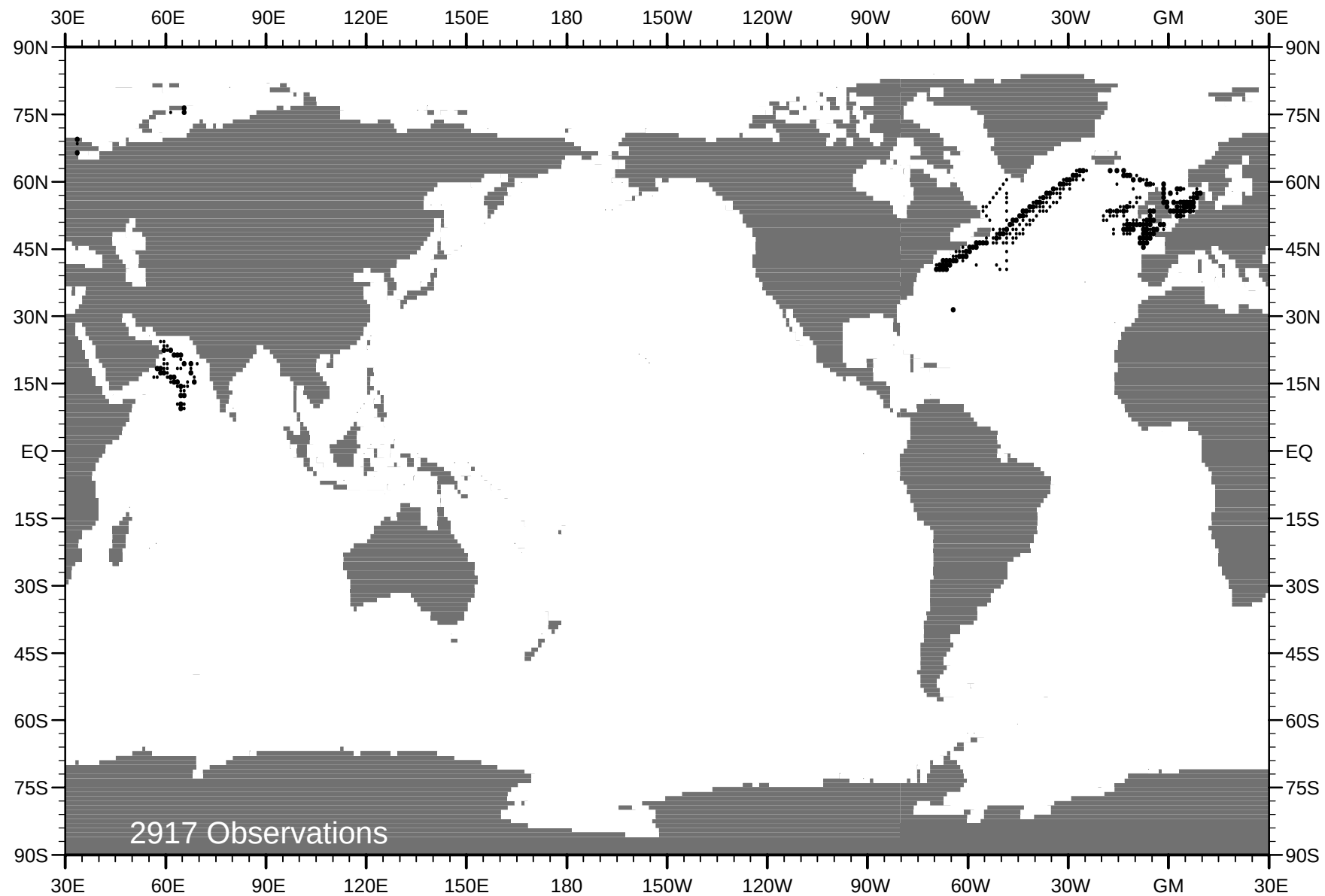


Fig. C66 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1995 .

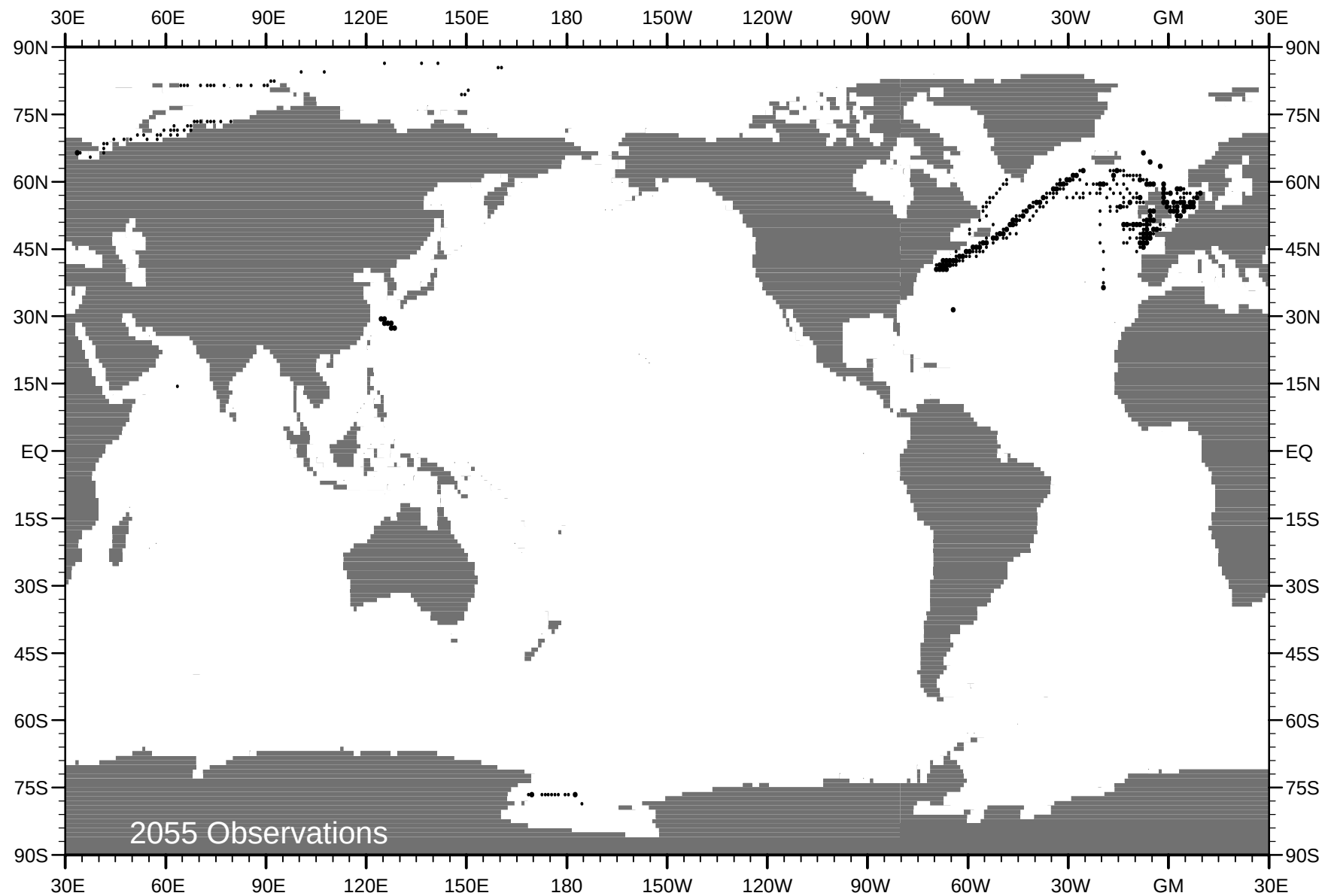


Fig. C67 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1996 .

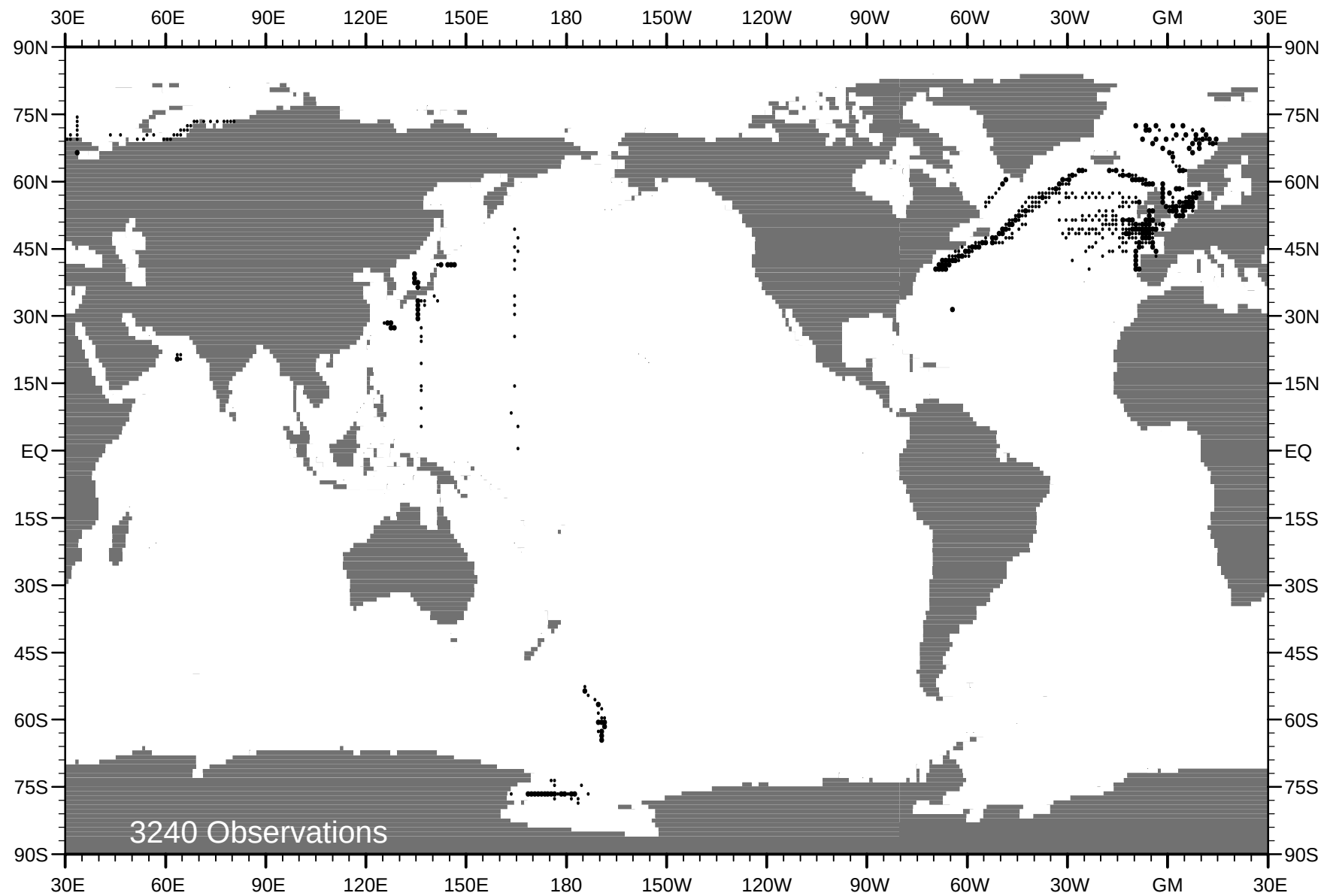


Fig. C68 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1997 .



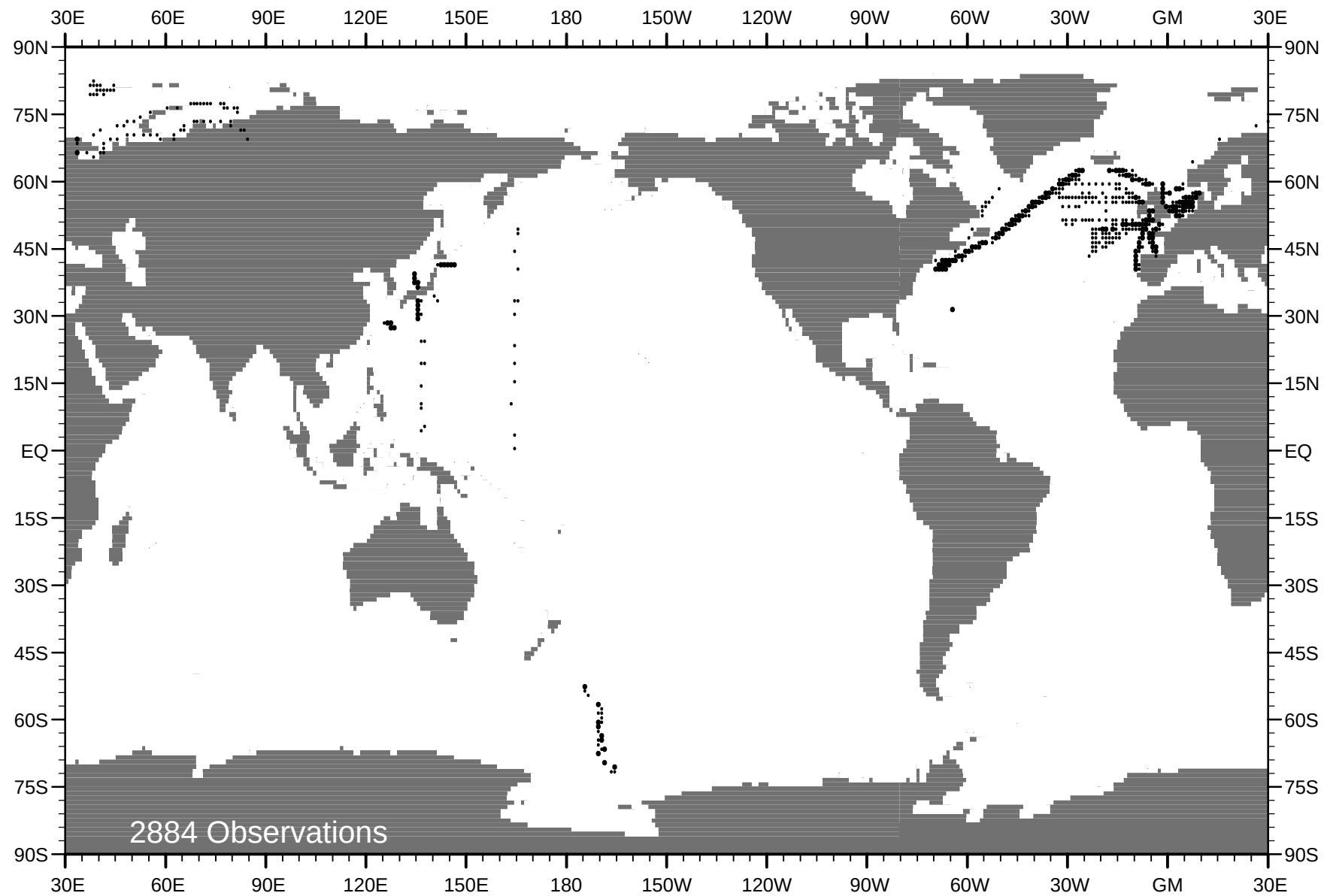


Fig. C69 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1998 .

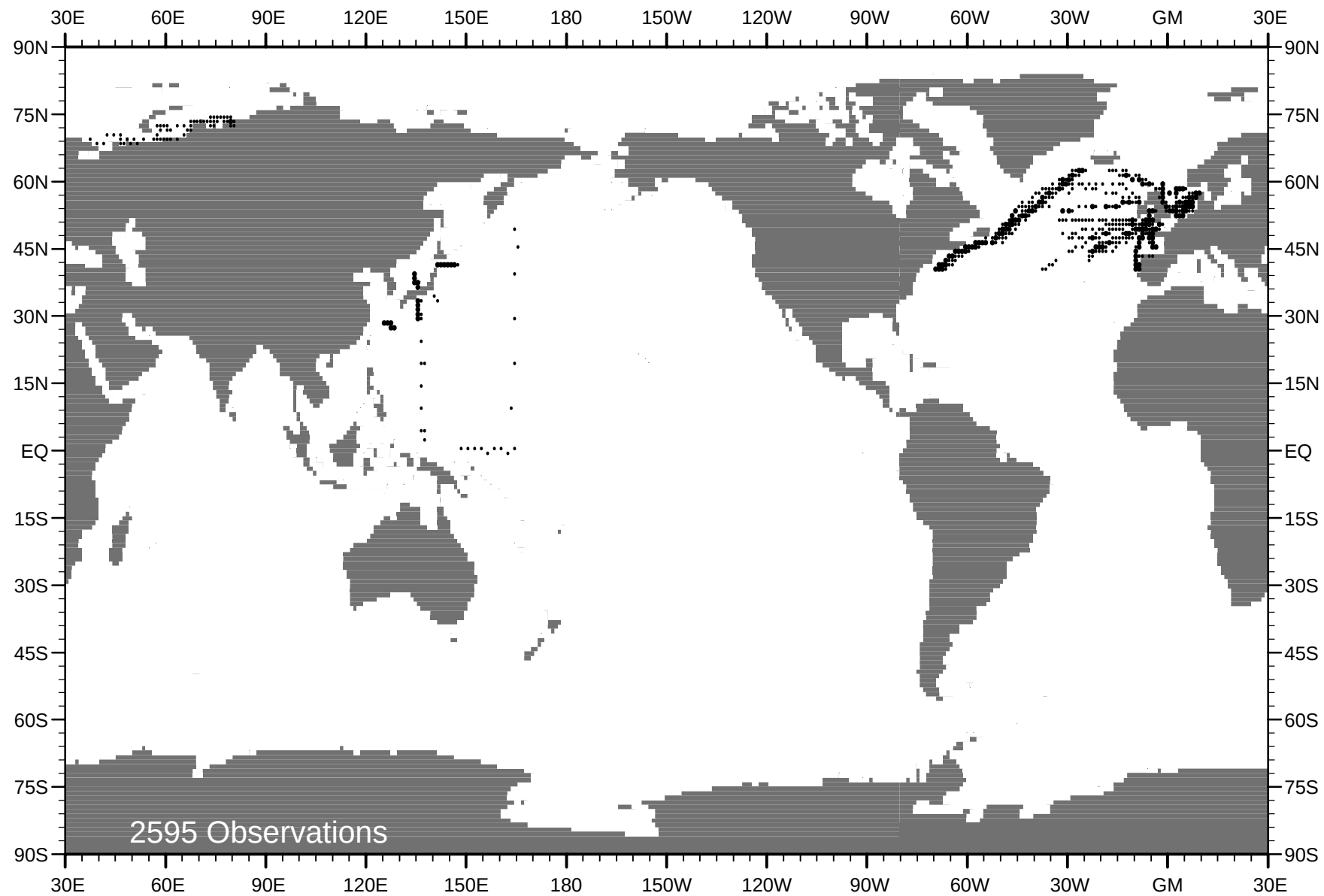


Fig. C70 Distribution of all Ocean Station Data (OSD) plankton abundance data in WOD01 for year 1999 .

## **7. APPENDIX D: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL OCEAN STATION DATA (OSD) PLANKTON BIOMASS DATA IN WOD01**

This appendix contains yearly distributions of all OSD plankton biomass data contained in WOD01. 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 WOD01 OSD plankton biomass data are plotted including stations that may be erroneously located over land. However, WOD01 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 D, a small dot indicates a one-degree square containing from one to four stations and a large dot indicates five or more stations.

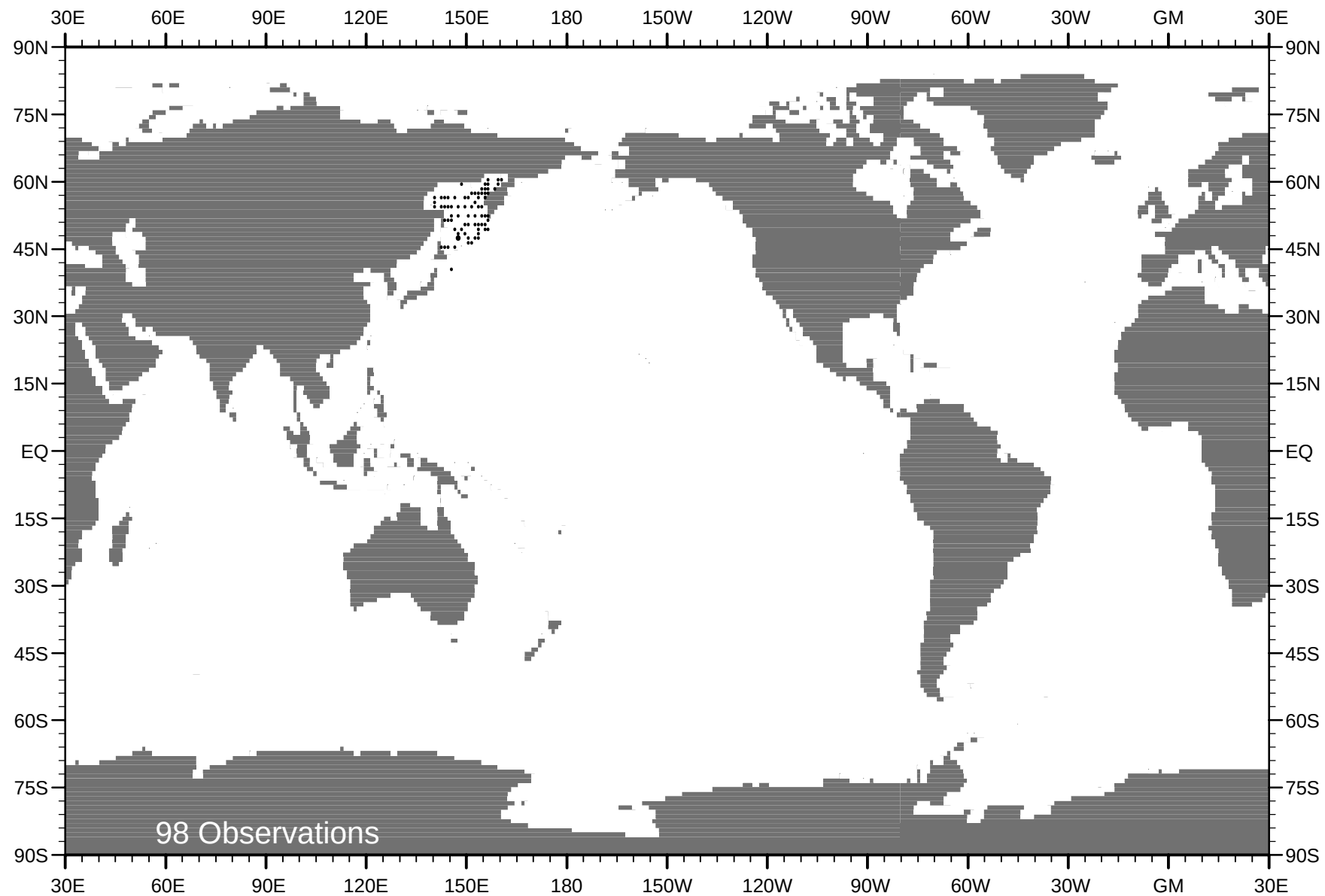


Fig. D1 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1949 .

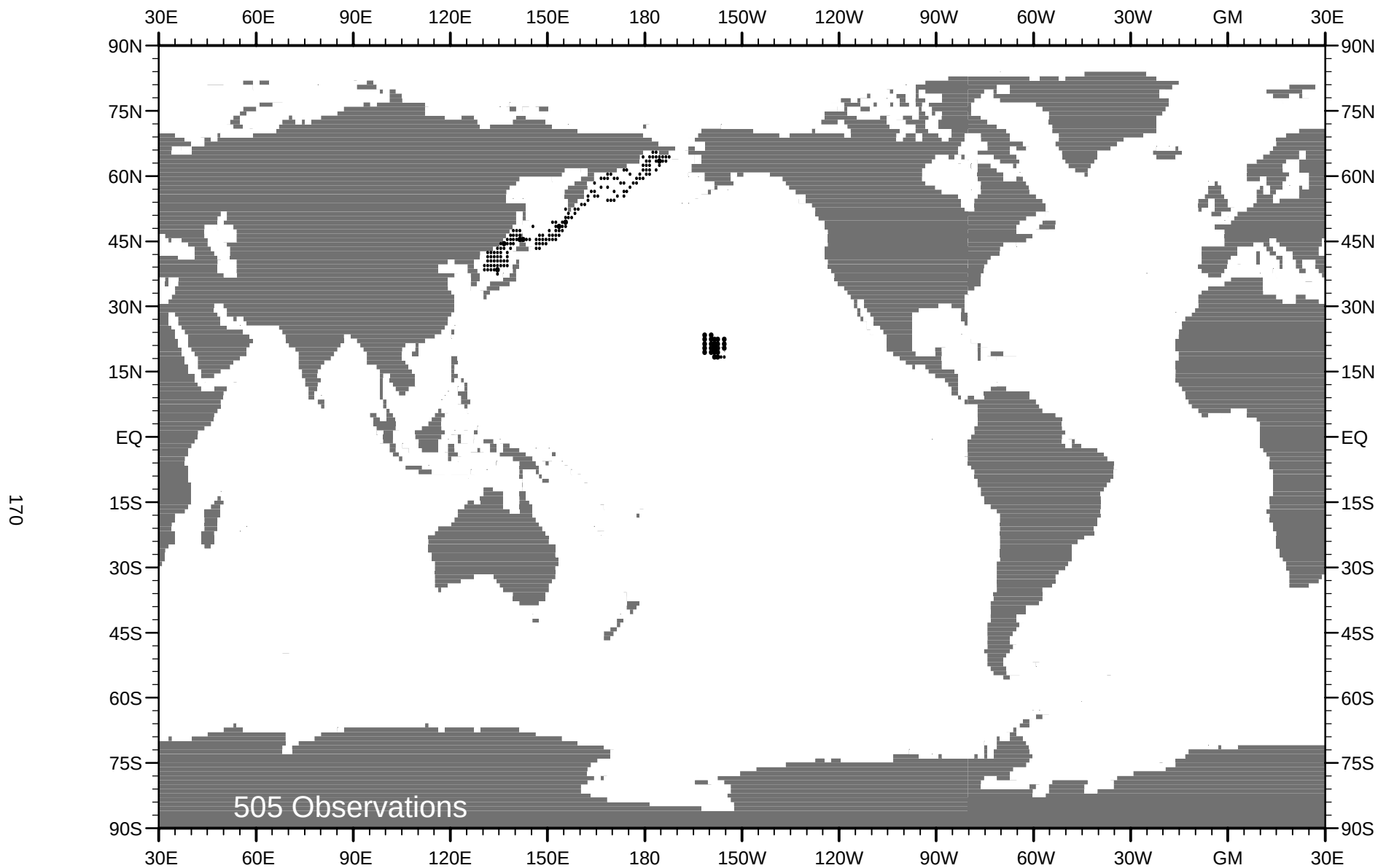


Fig. D2 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1950 .

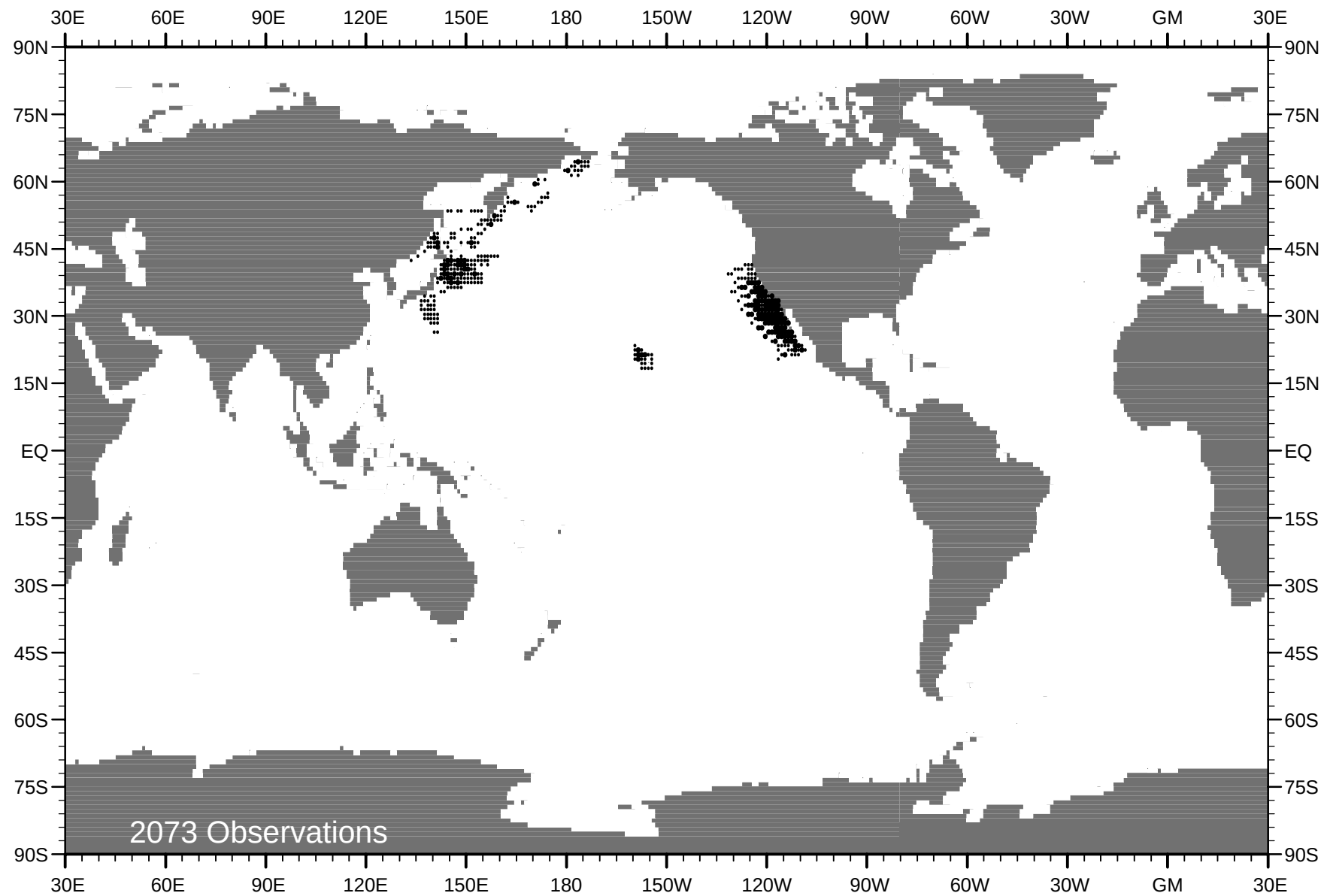


Fig. D3 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1951 .

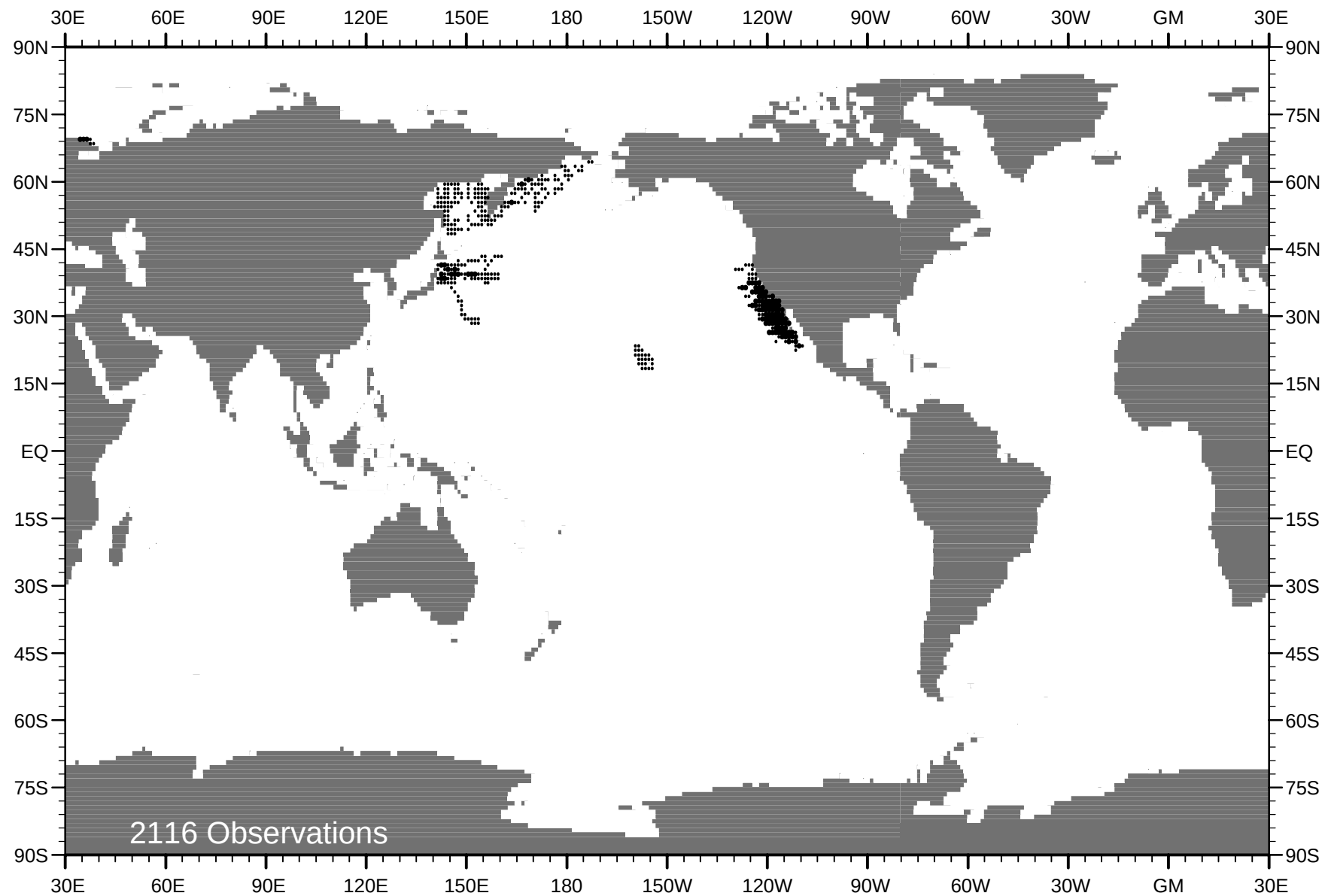


Fig. D4 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1952 .

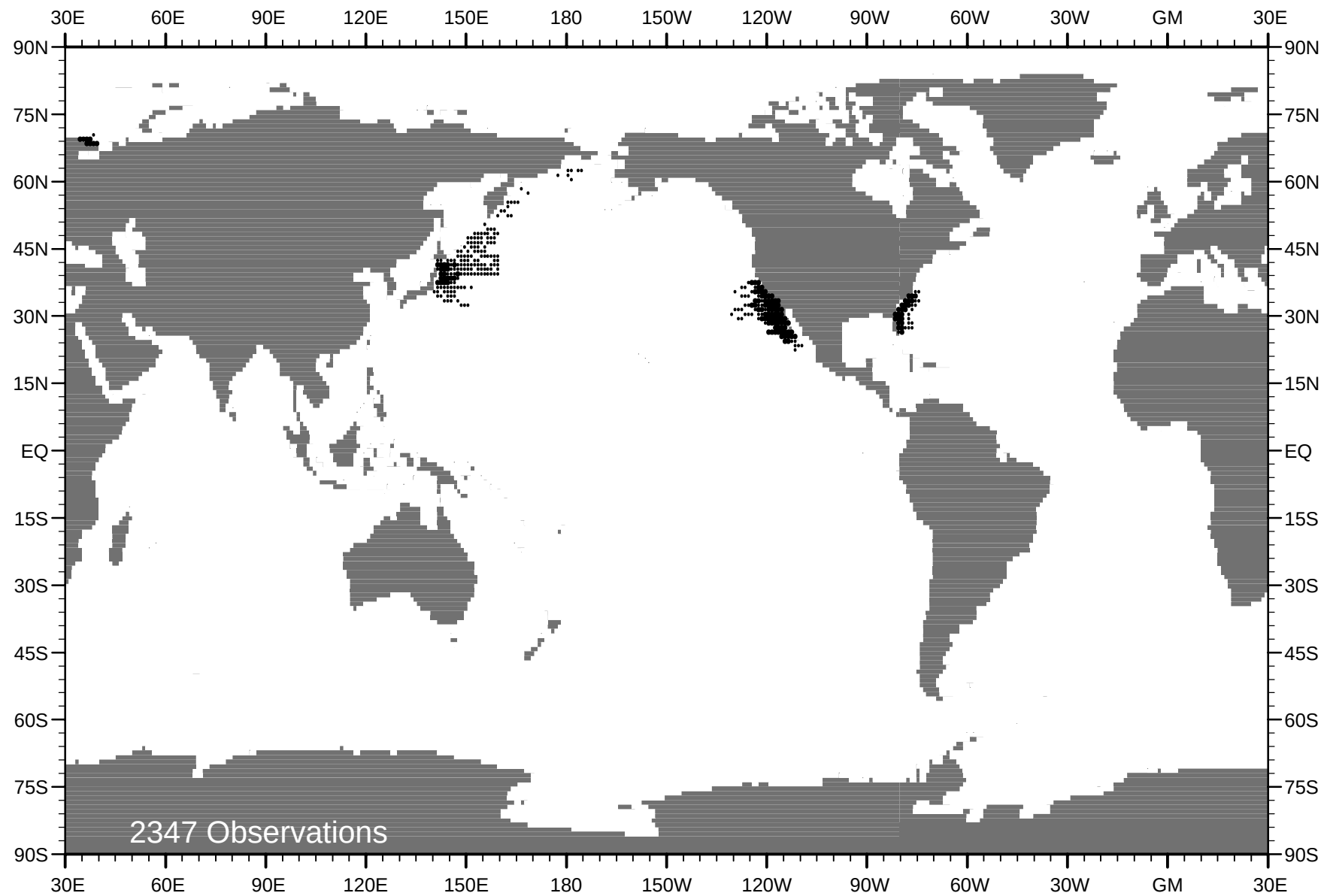


Fig. D5 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1953 .



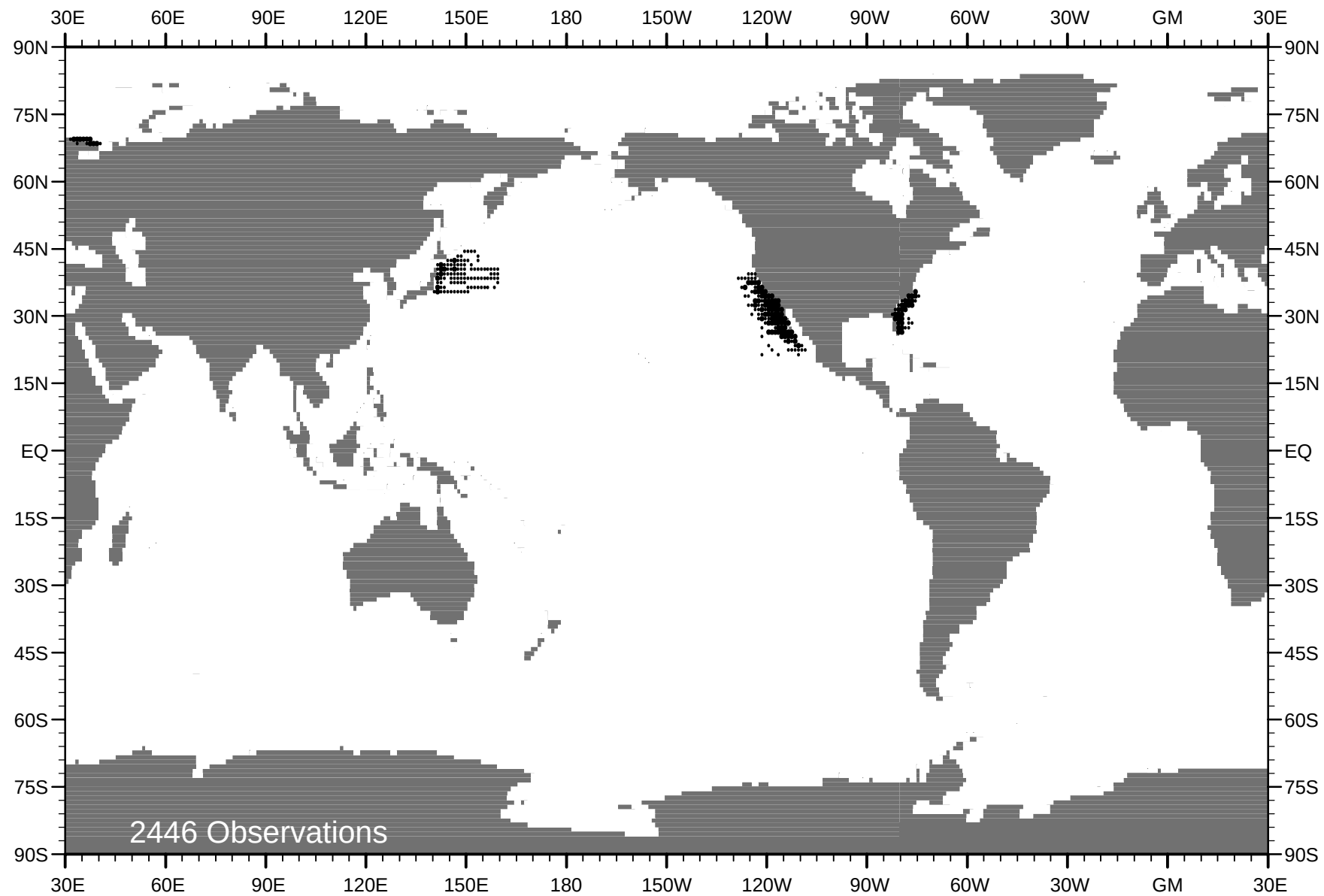


Fig. D6 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1954 .

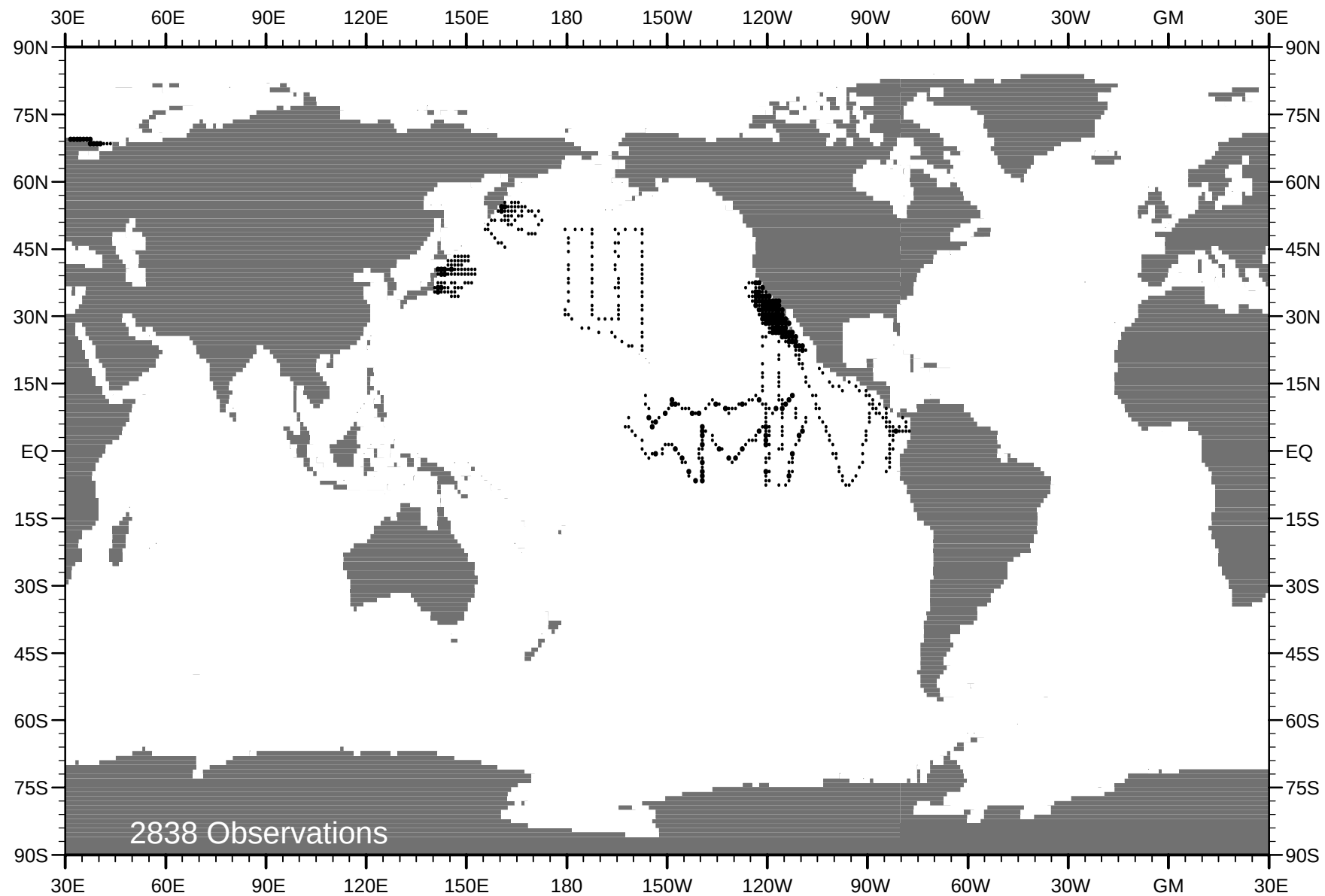


Fig. D7 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1955 .

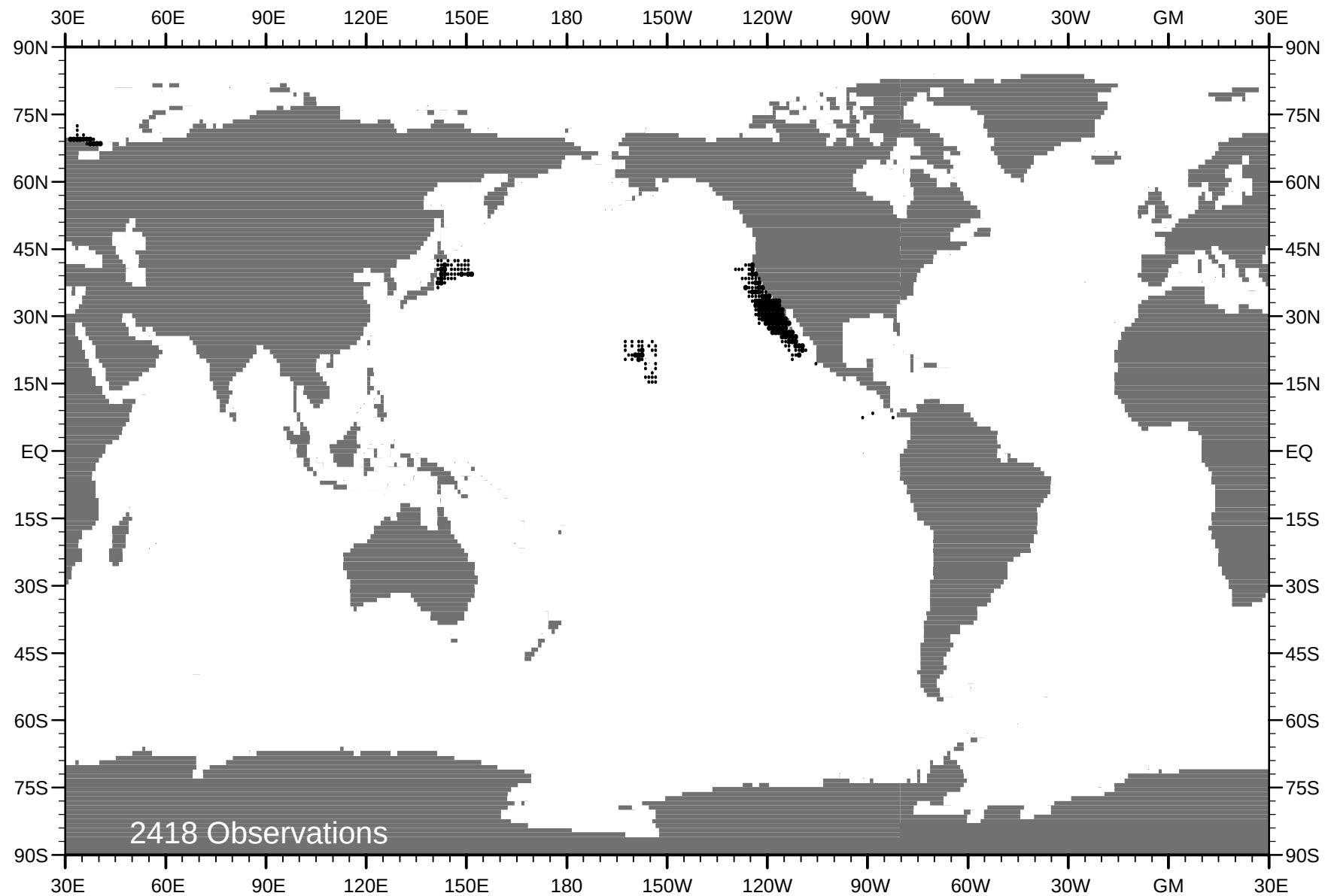


Fig. D8 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1956 .

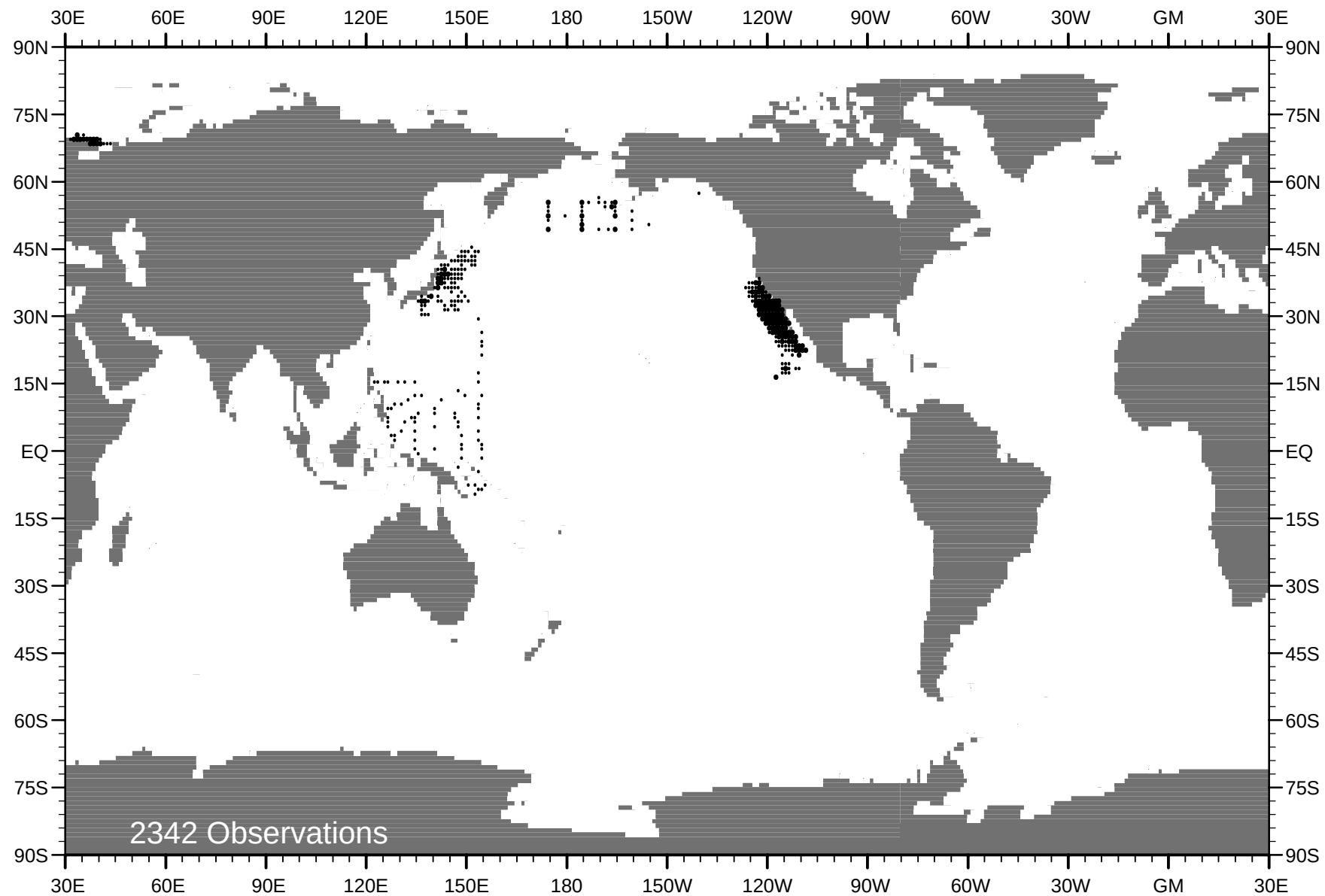


Fig. D9 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1957 .

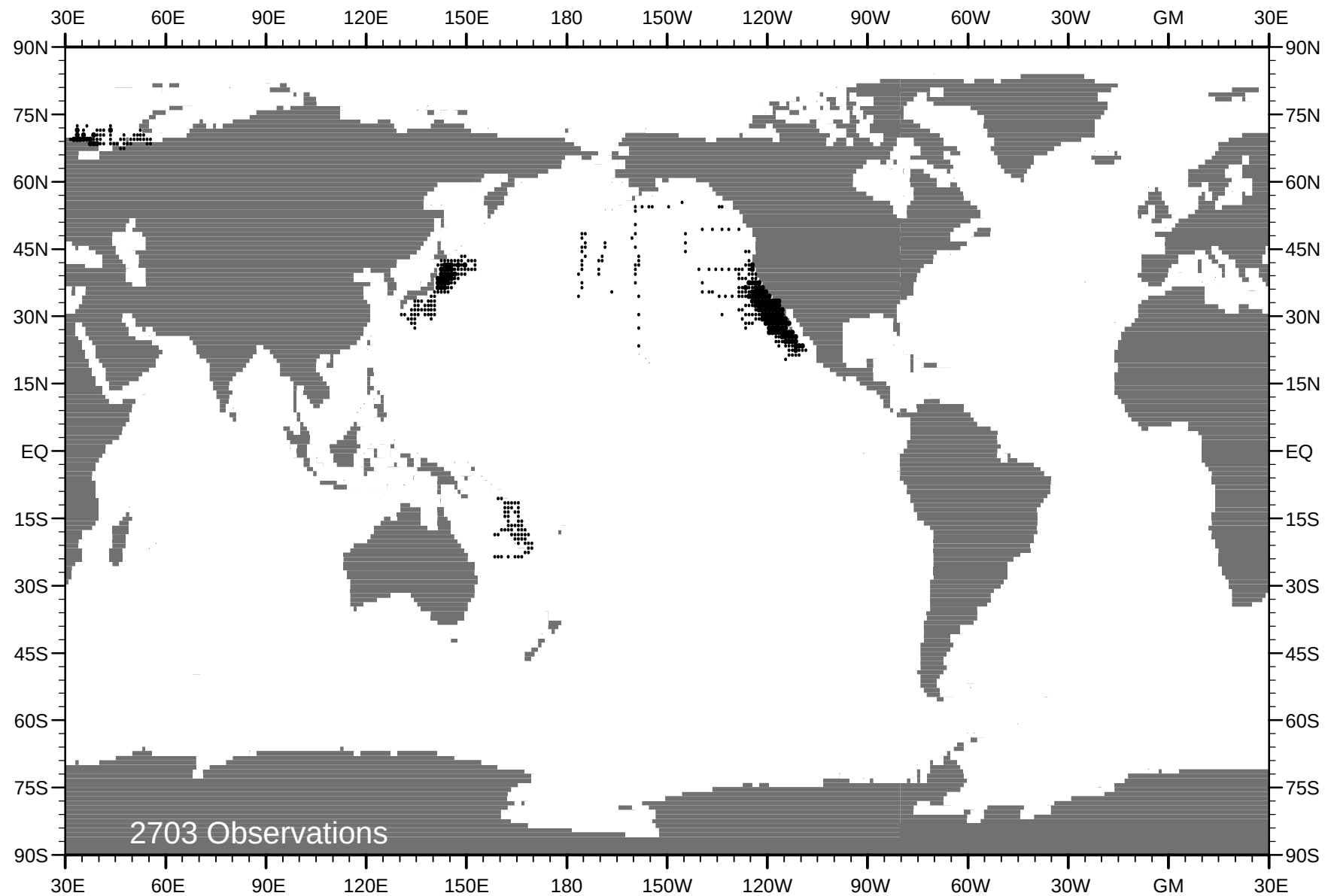


Fig. D10 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1958 .

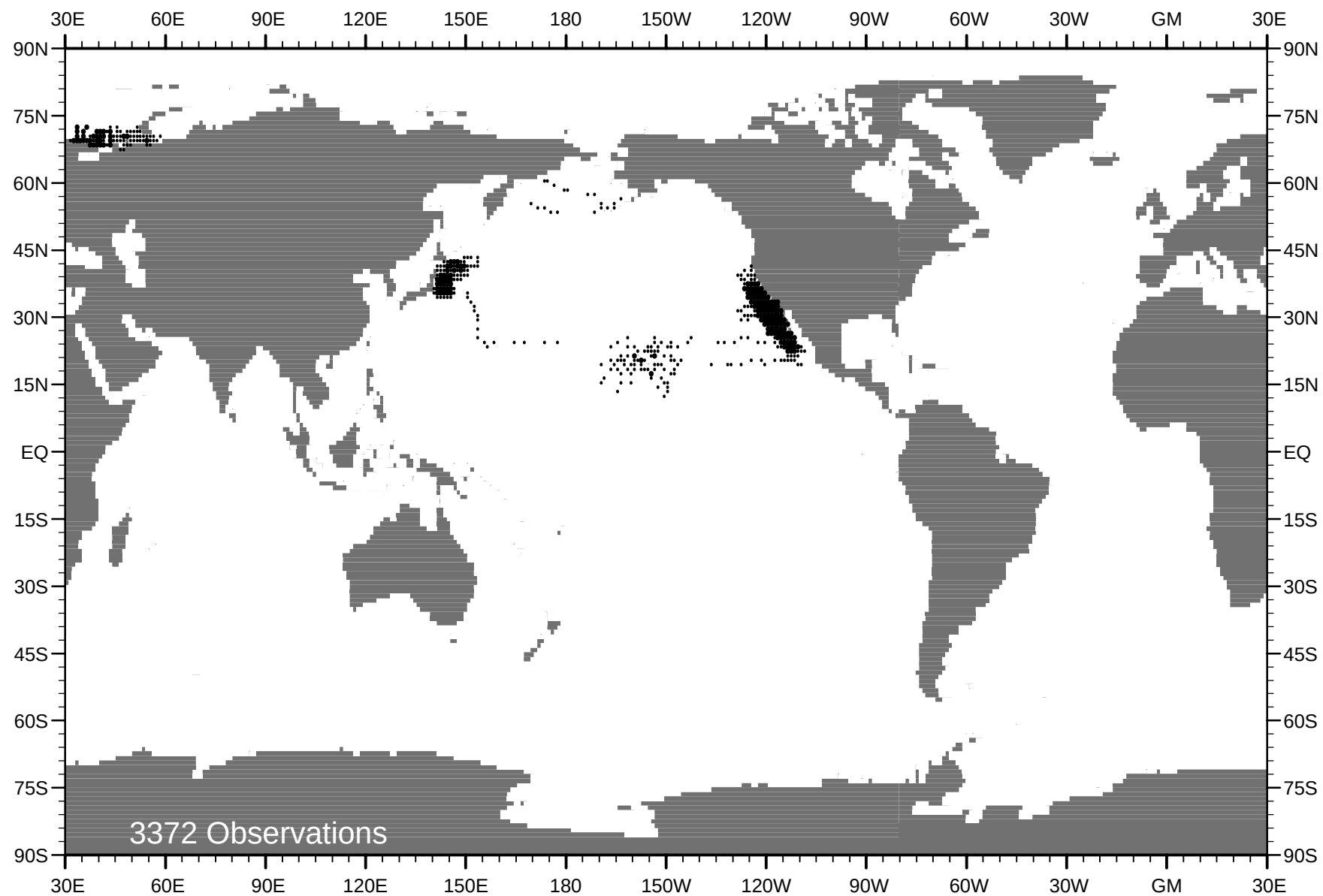


Fig. D11 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1959 .

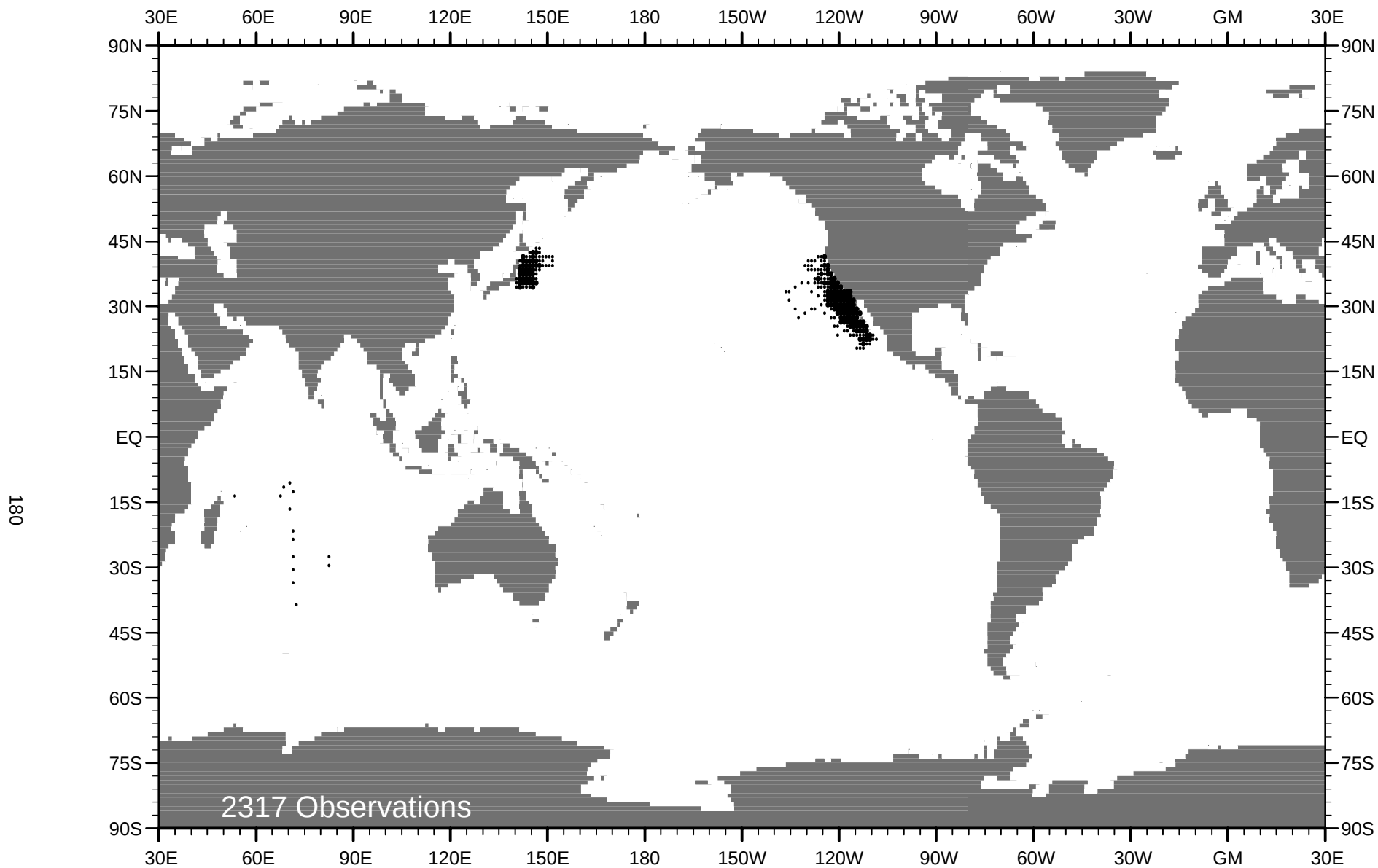


Fig. D12 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1960 .

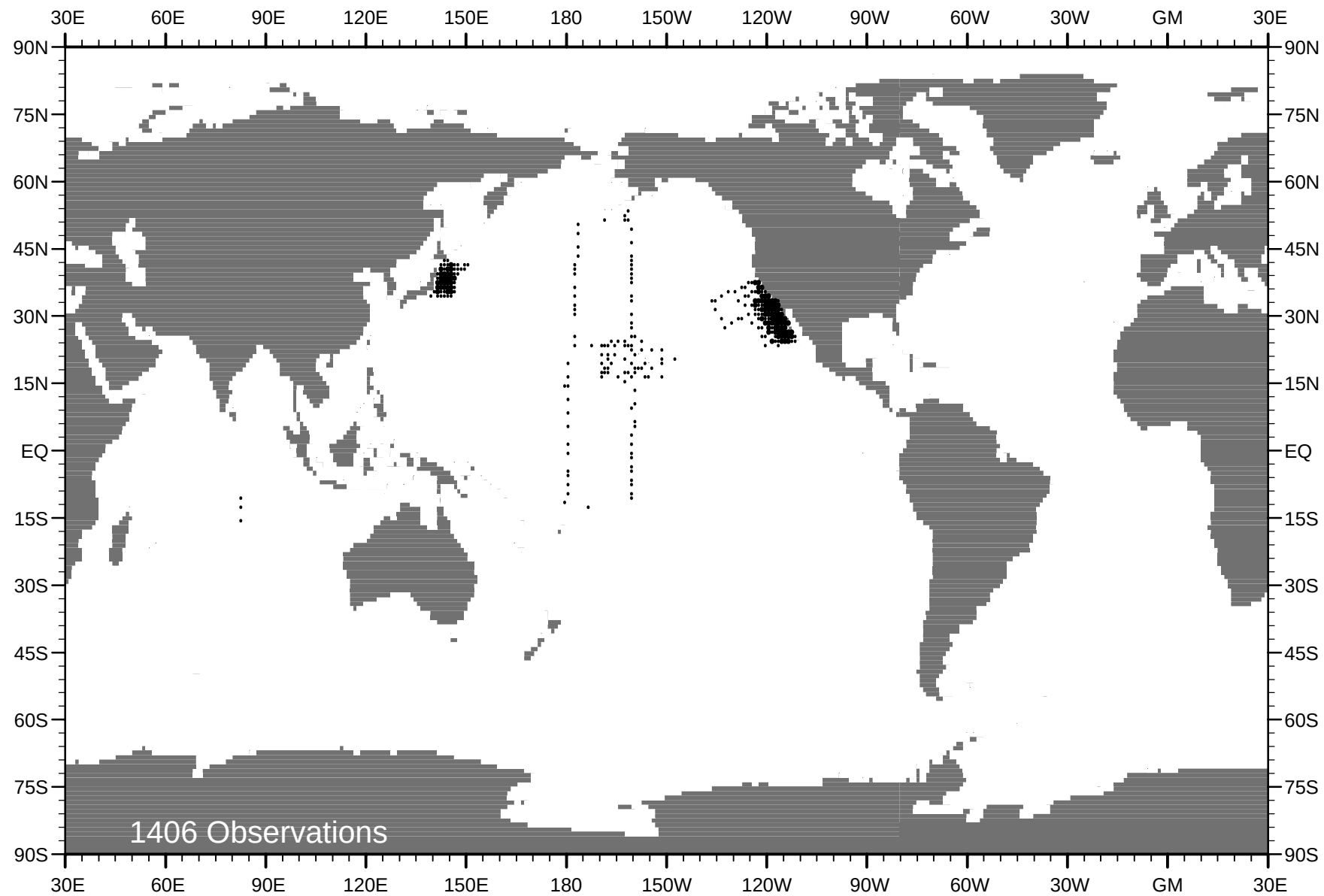


Fig. D13 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1961 .



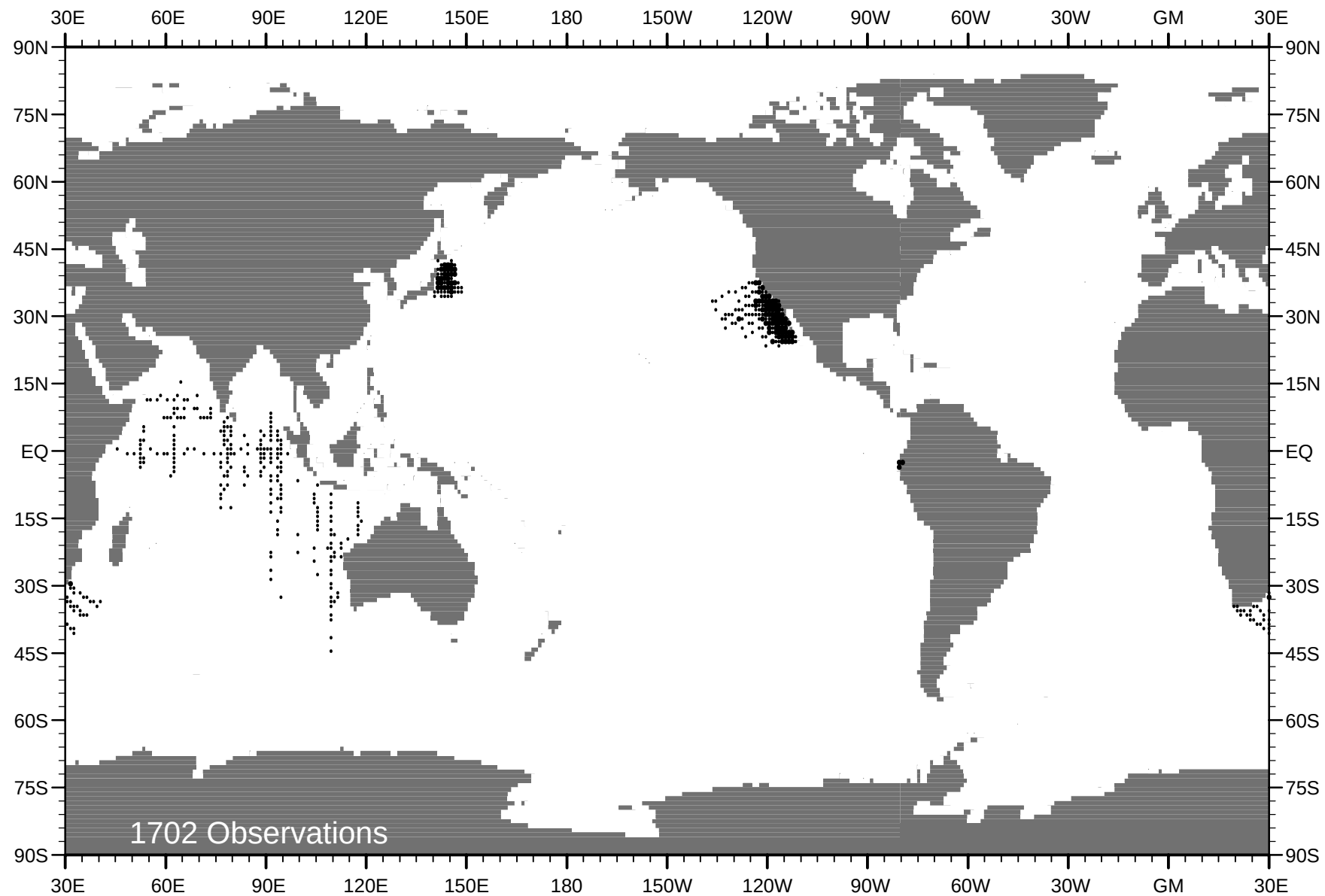


Fig. D14 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1962 .

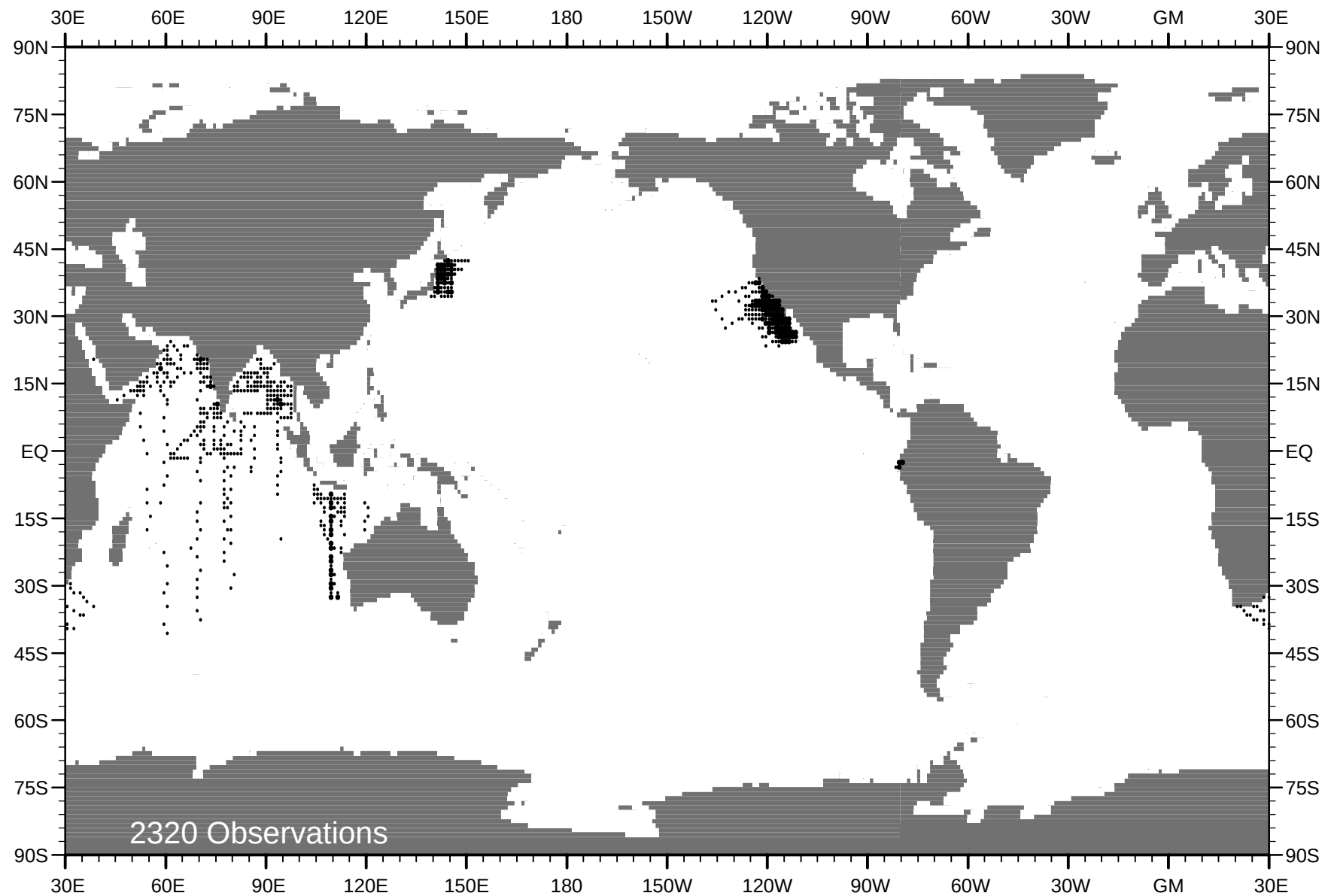


Fig. D15 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1963 .

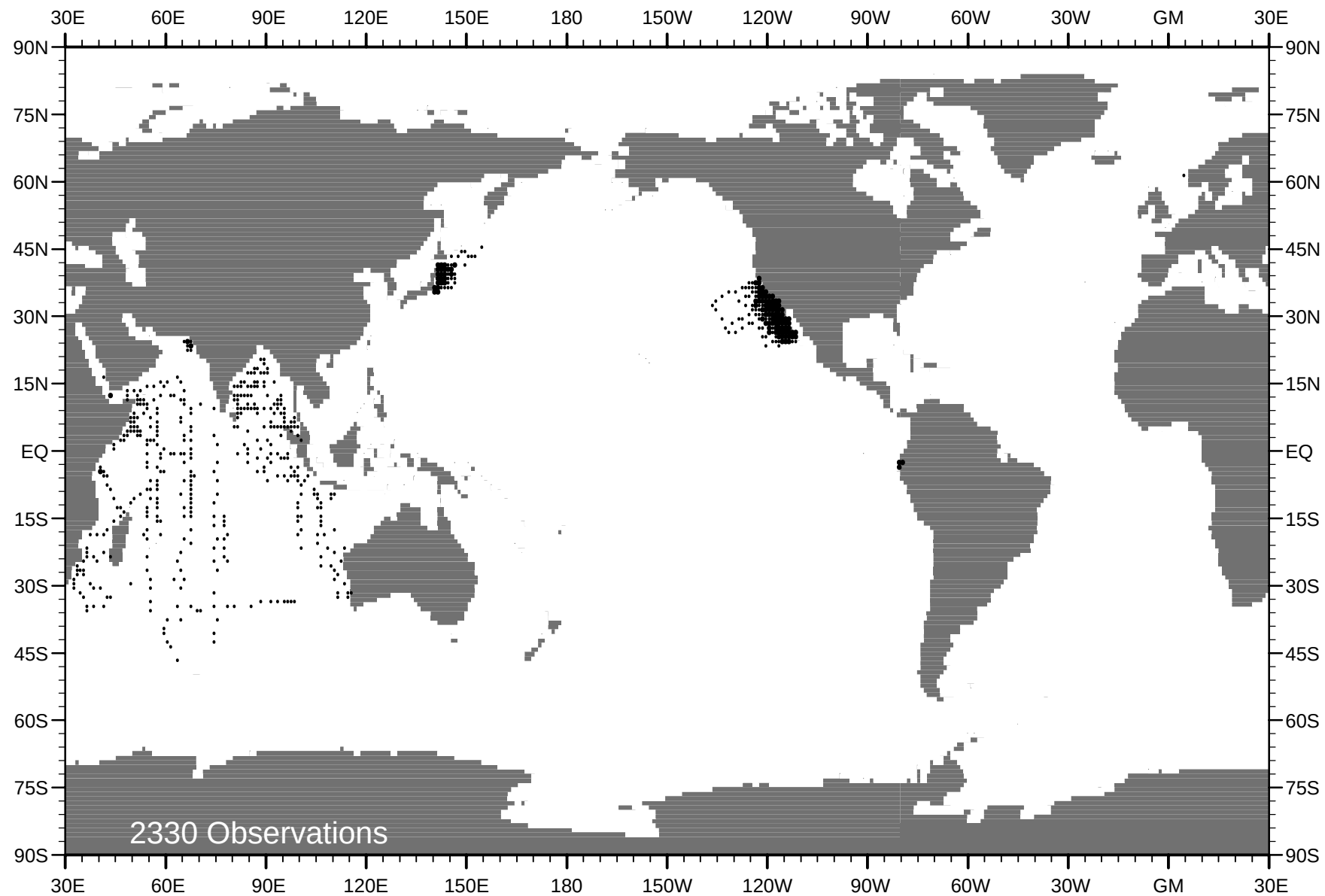


Fig. D16 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1964 .

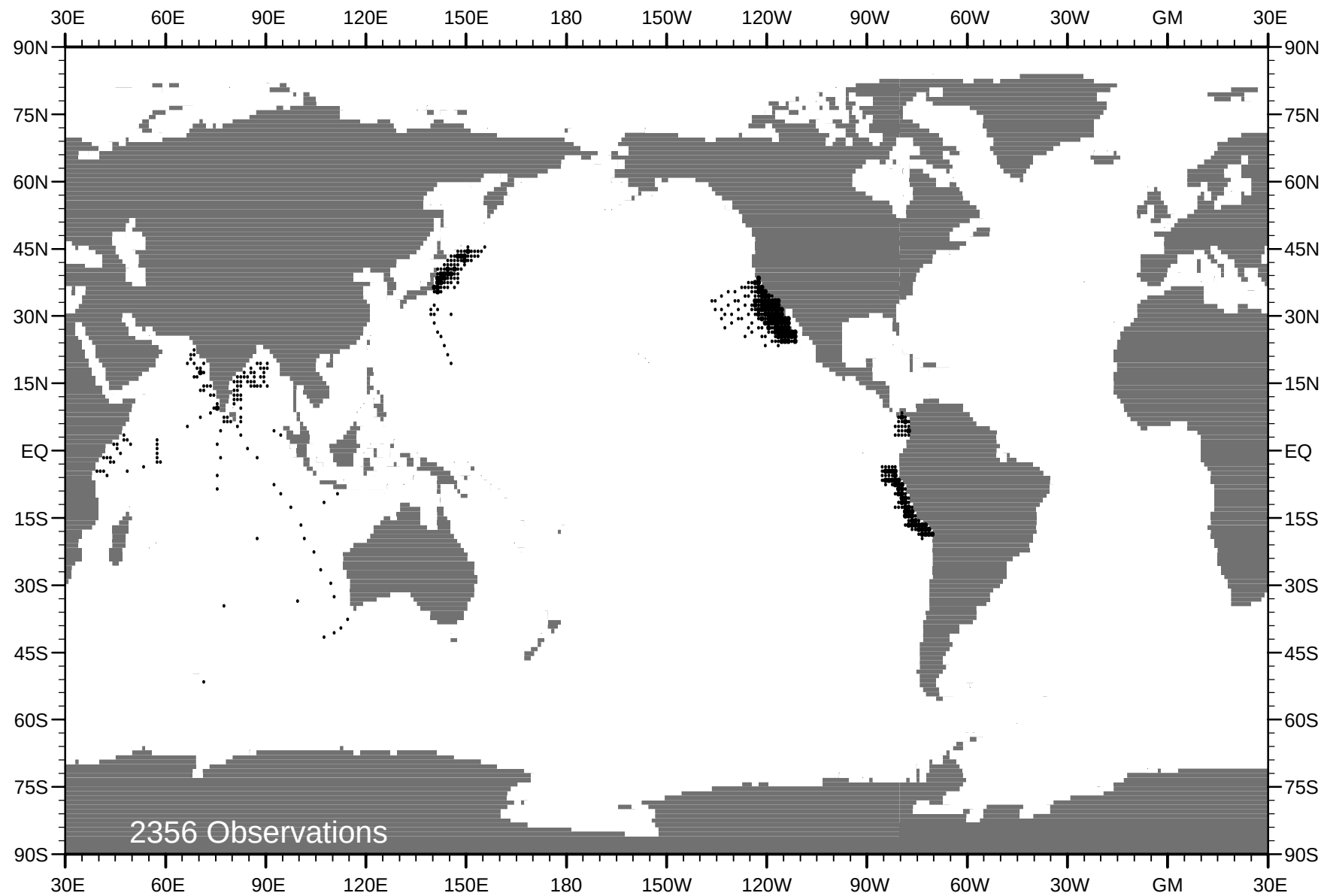


Fig. D17 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1965 .

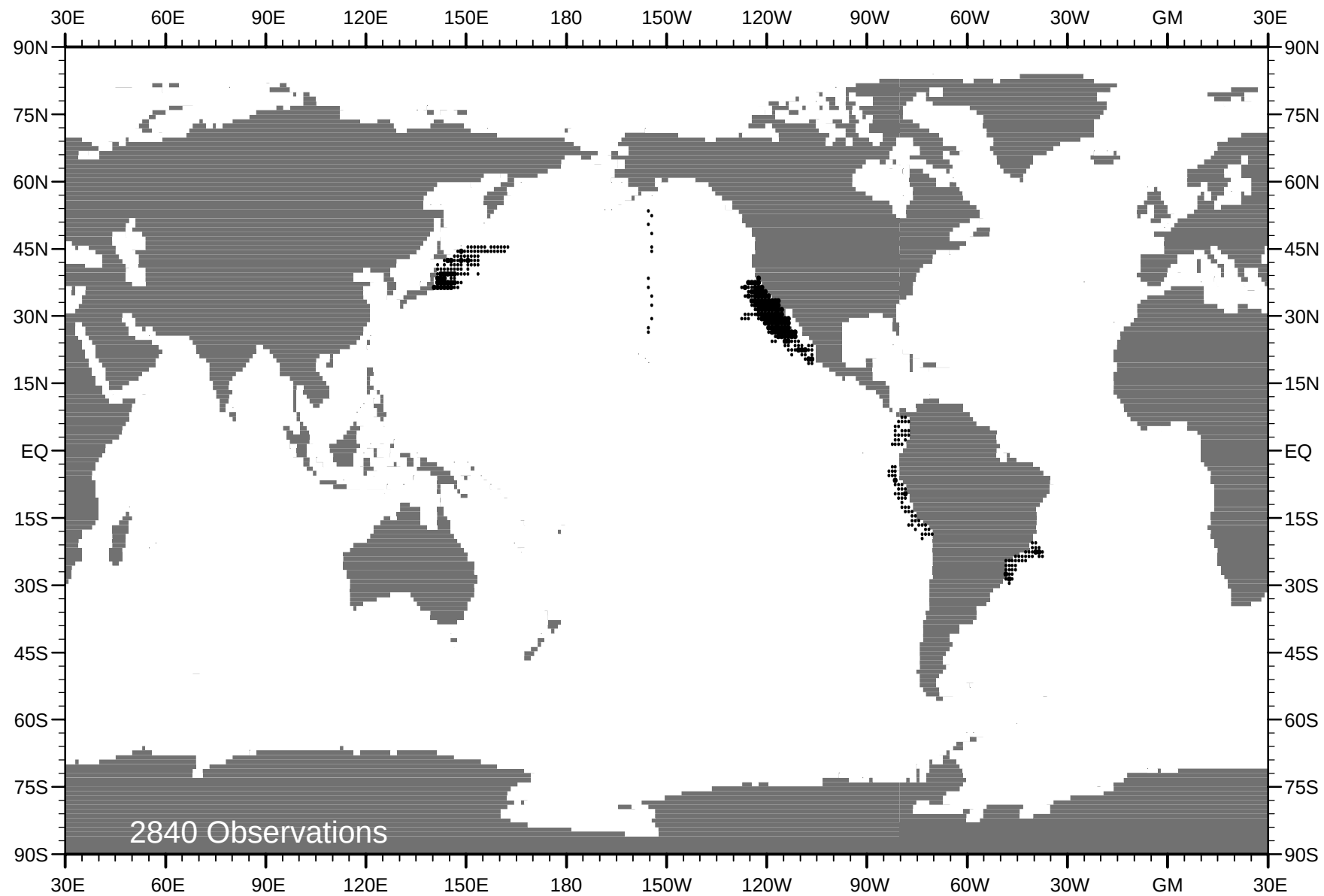


Fig. D18 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1966 .

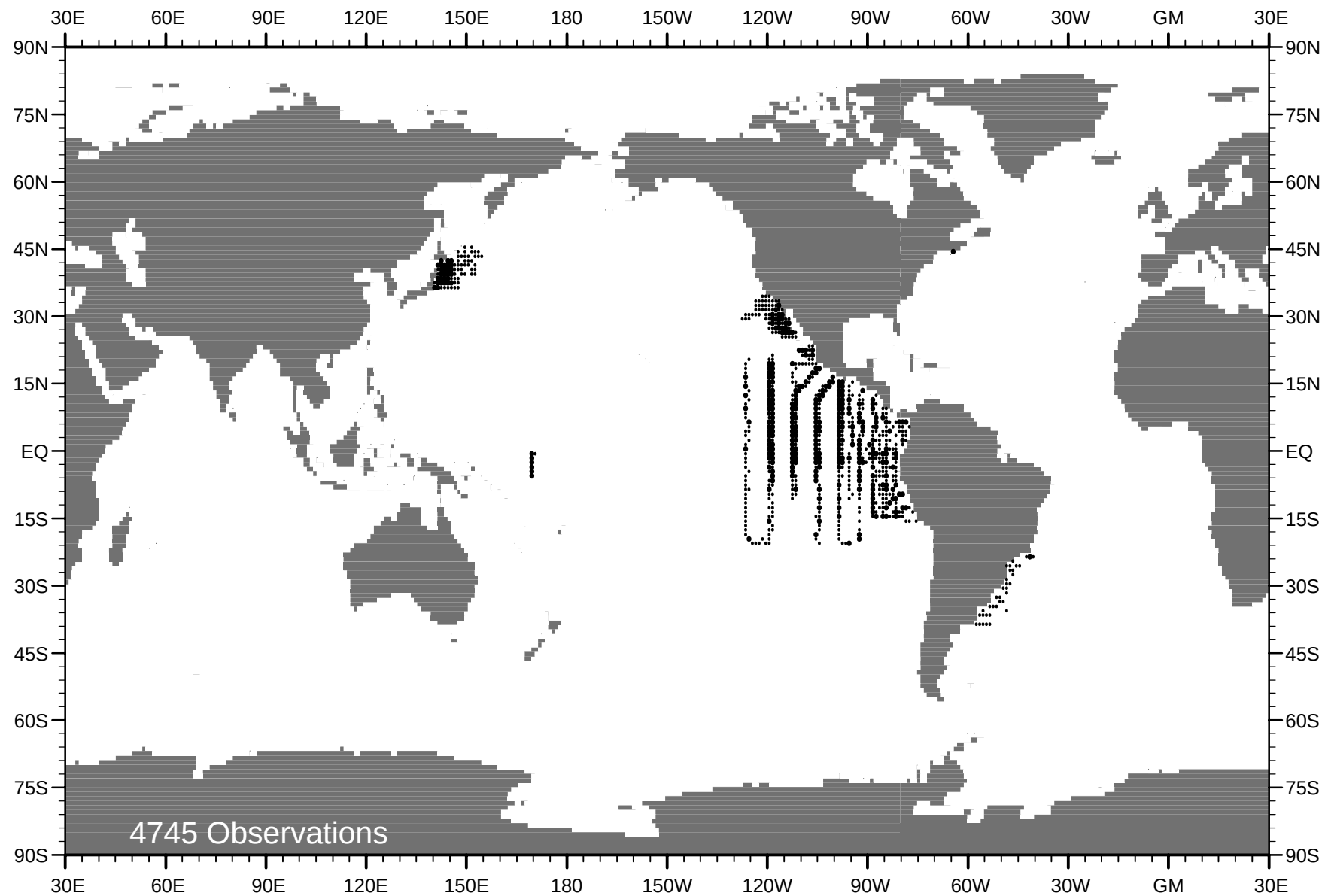


Fig. D19 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1967 .

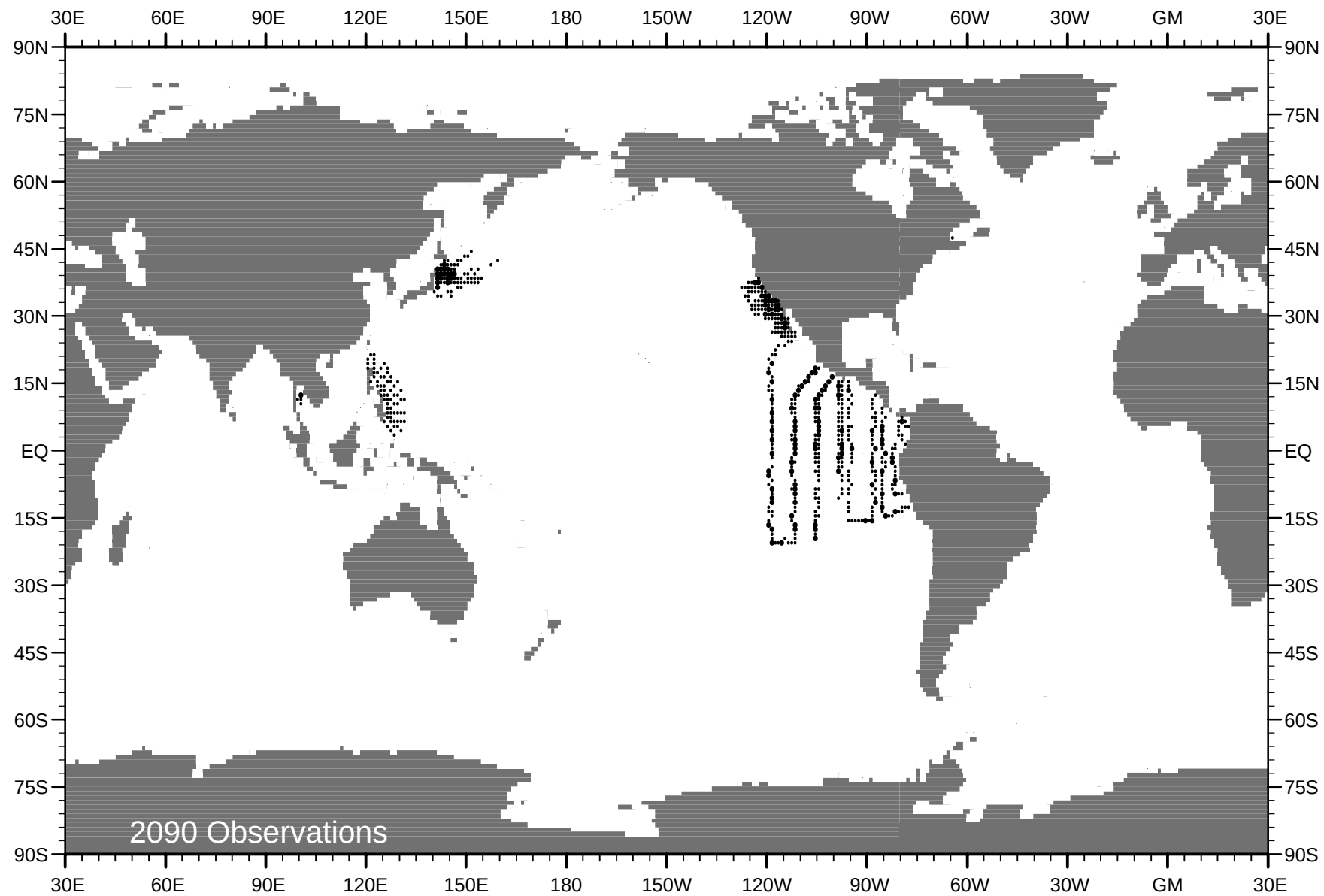


Fig. D20 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1968 .

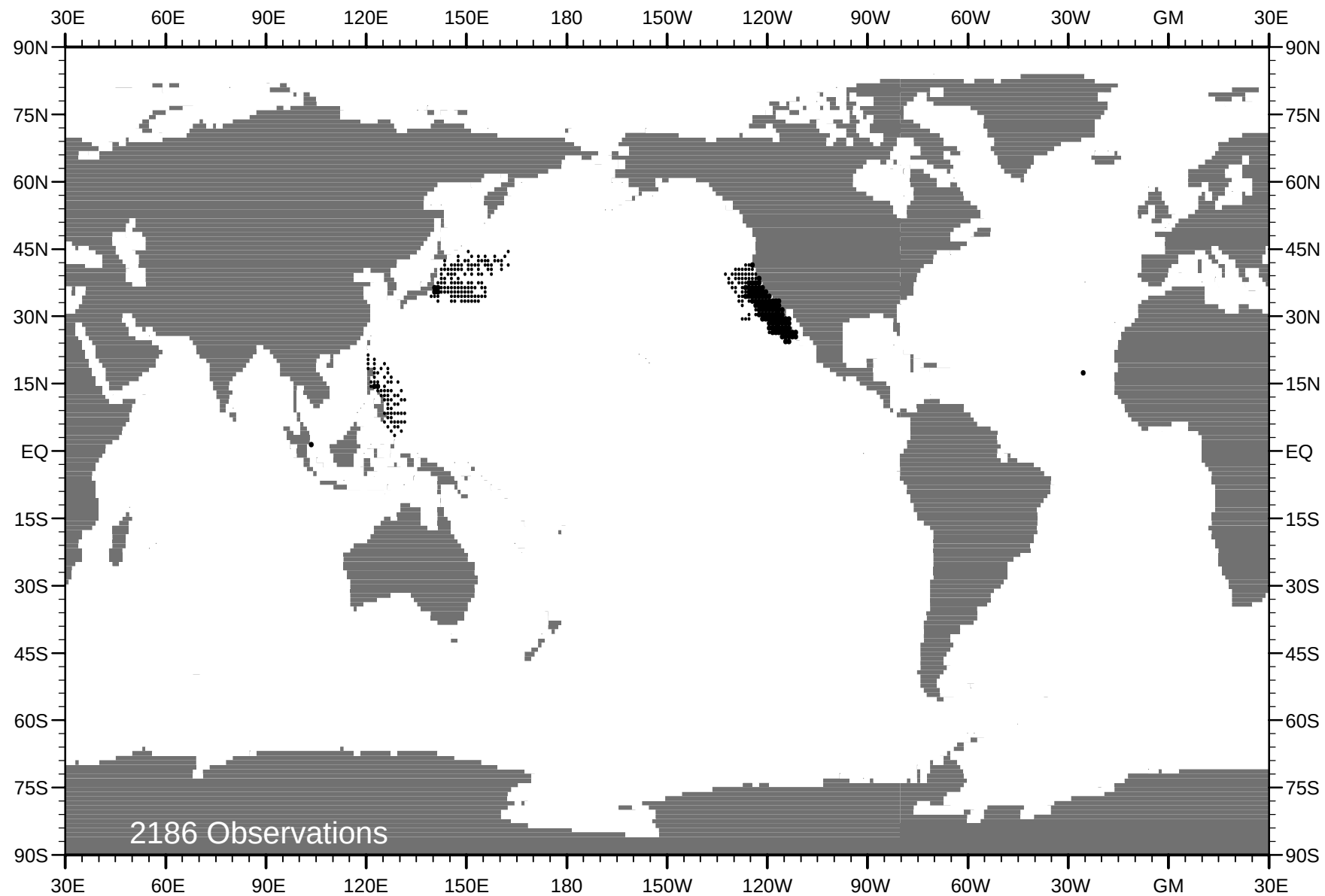


Fig. D21 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1969 .



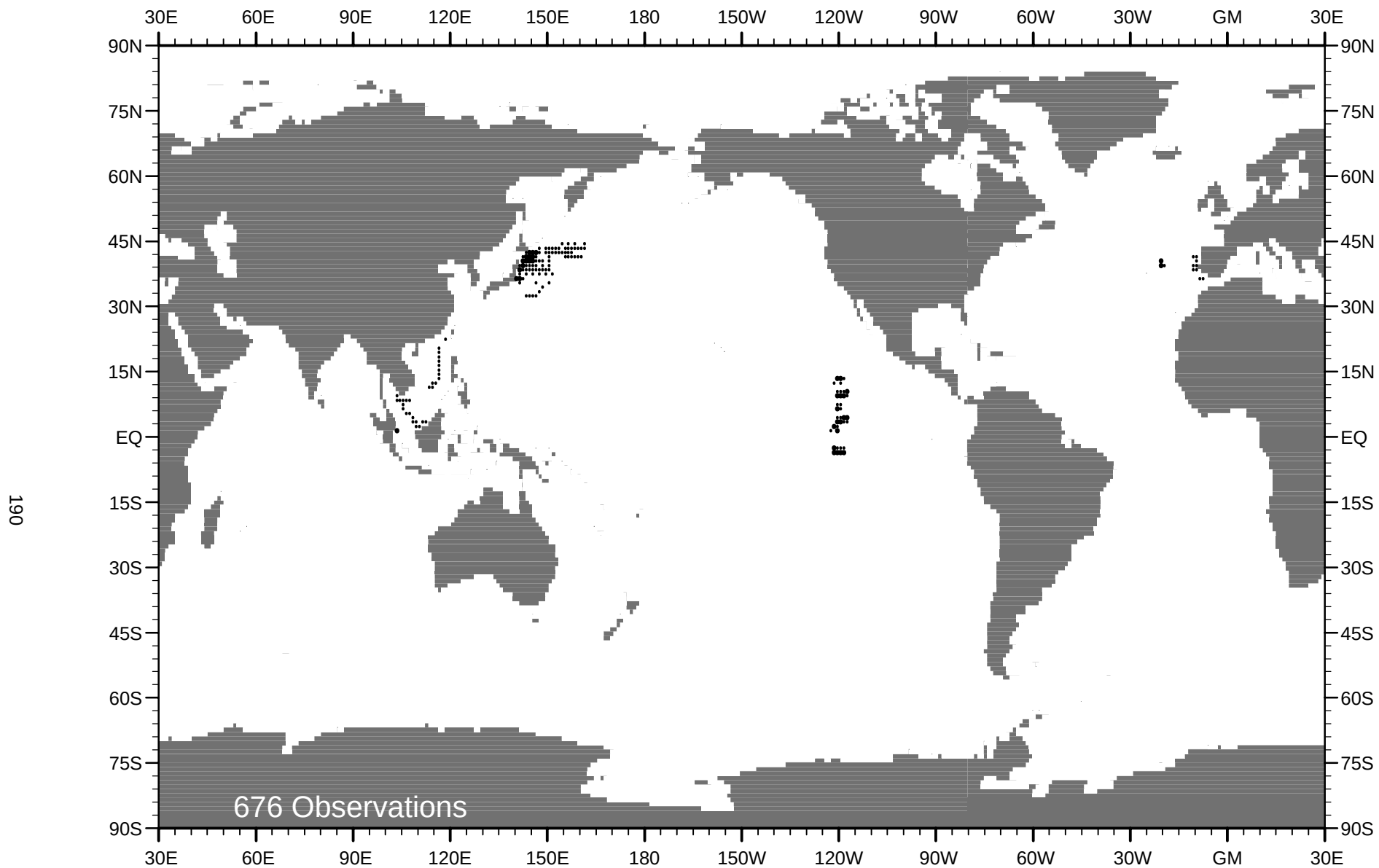


Fig. D22 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1970 .

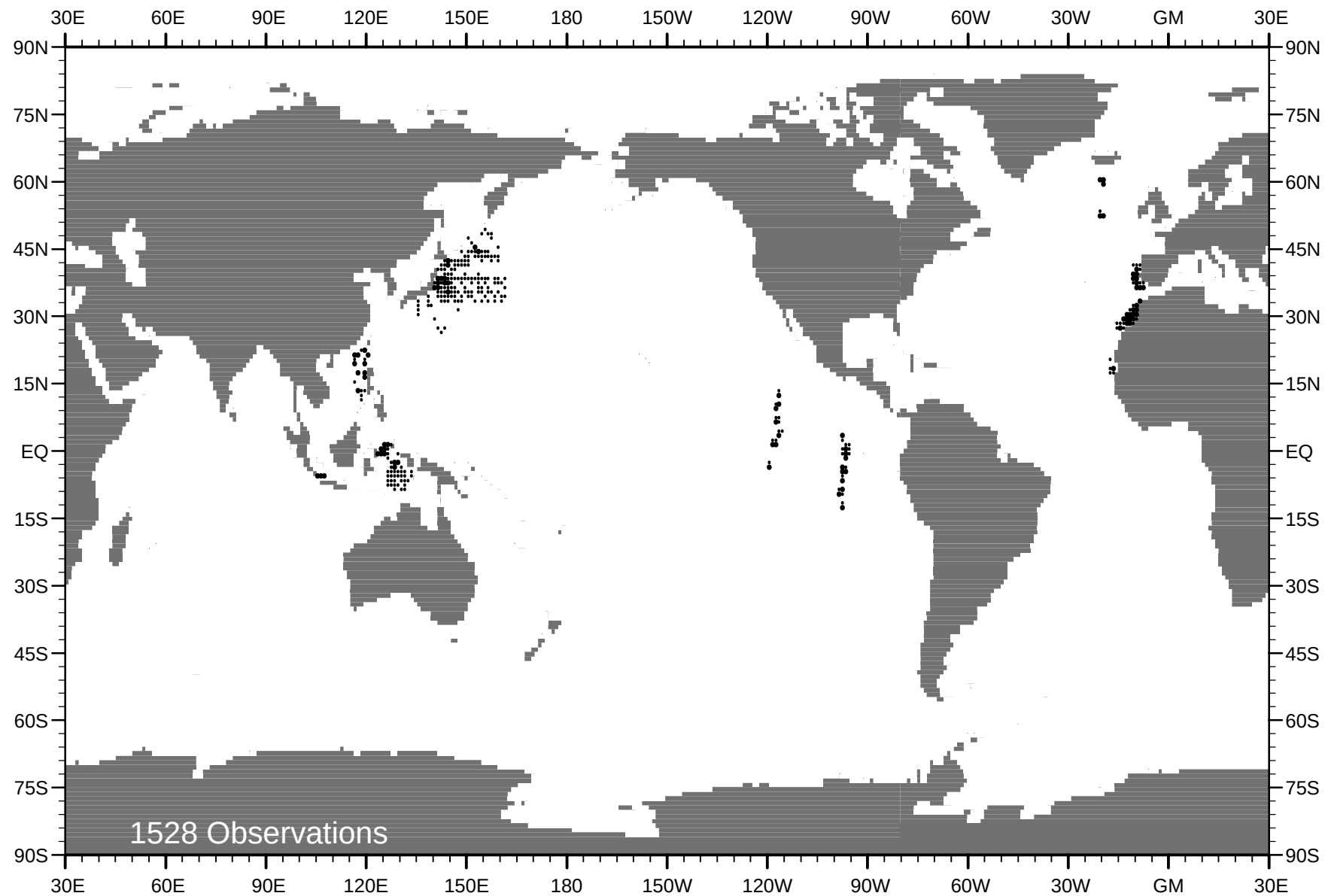


Fig. D23 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1971 .

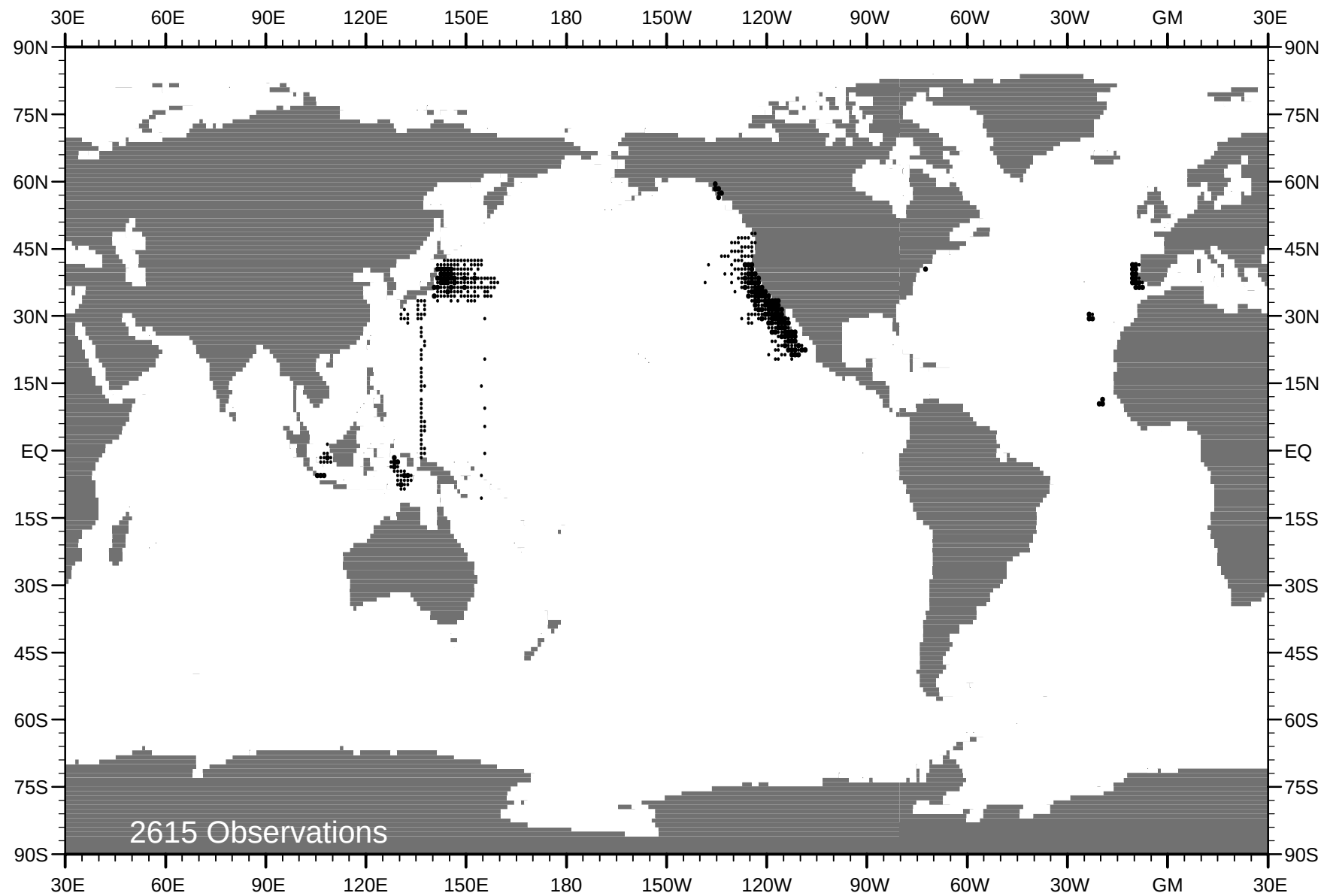


Fig. D24 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1972 .

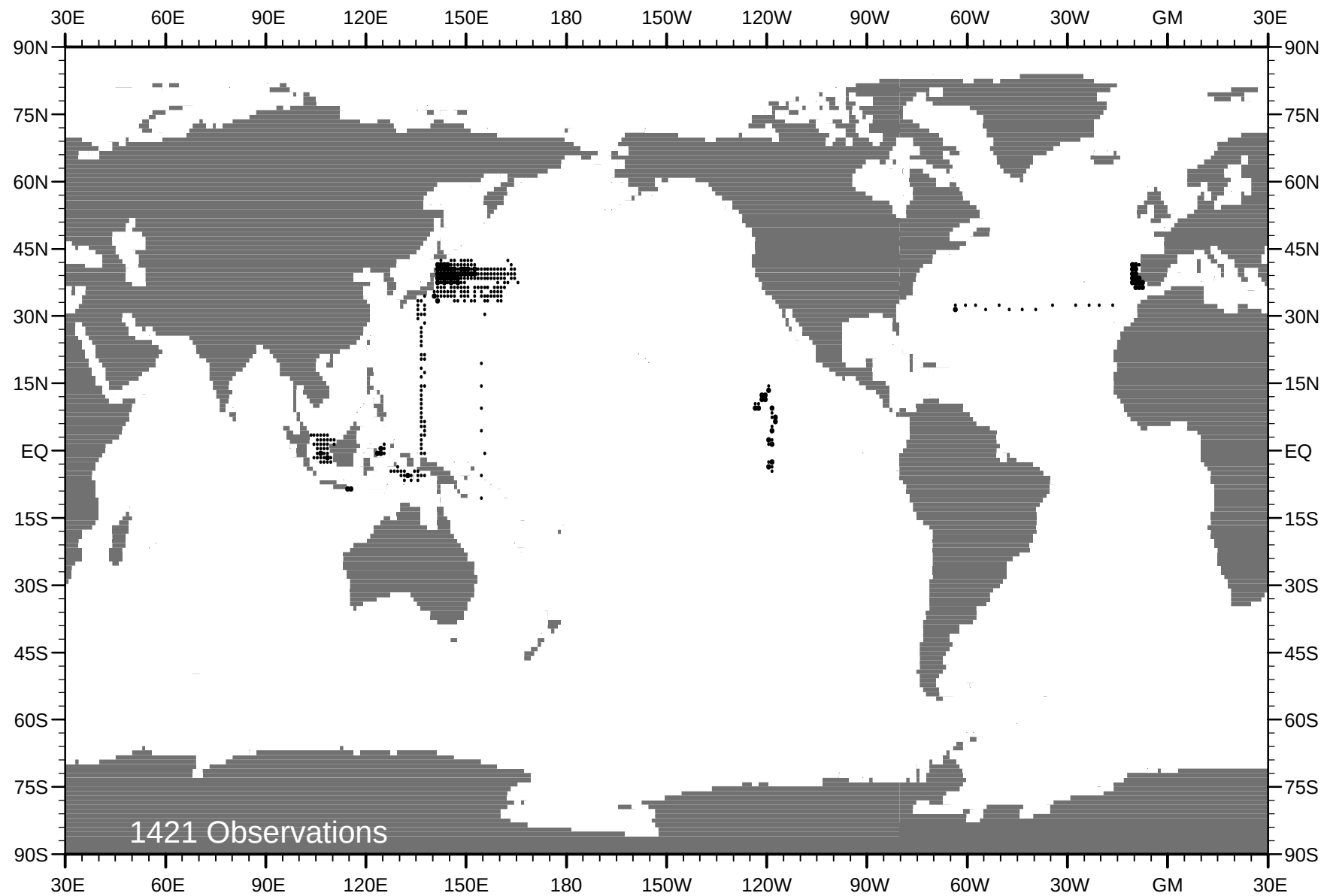


Fig. D25 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1973 .

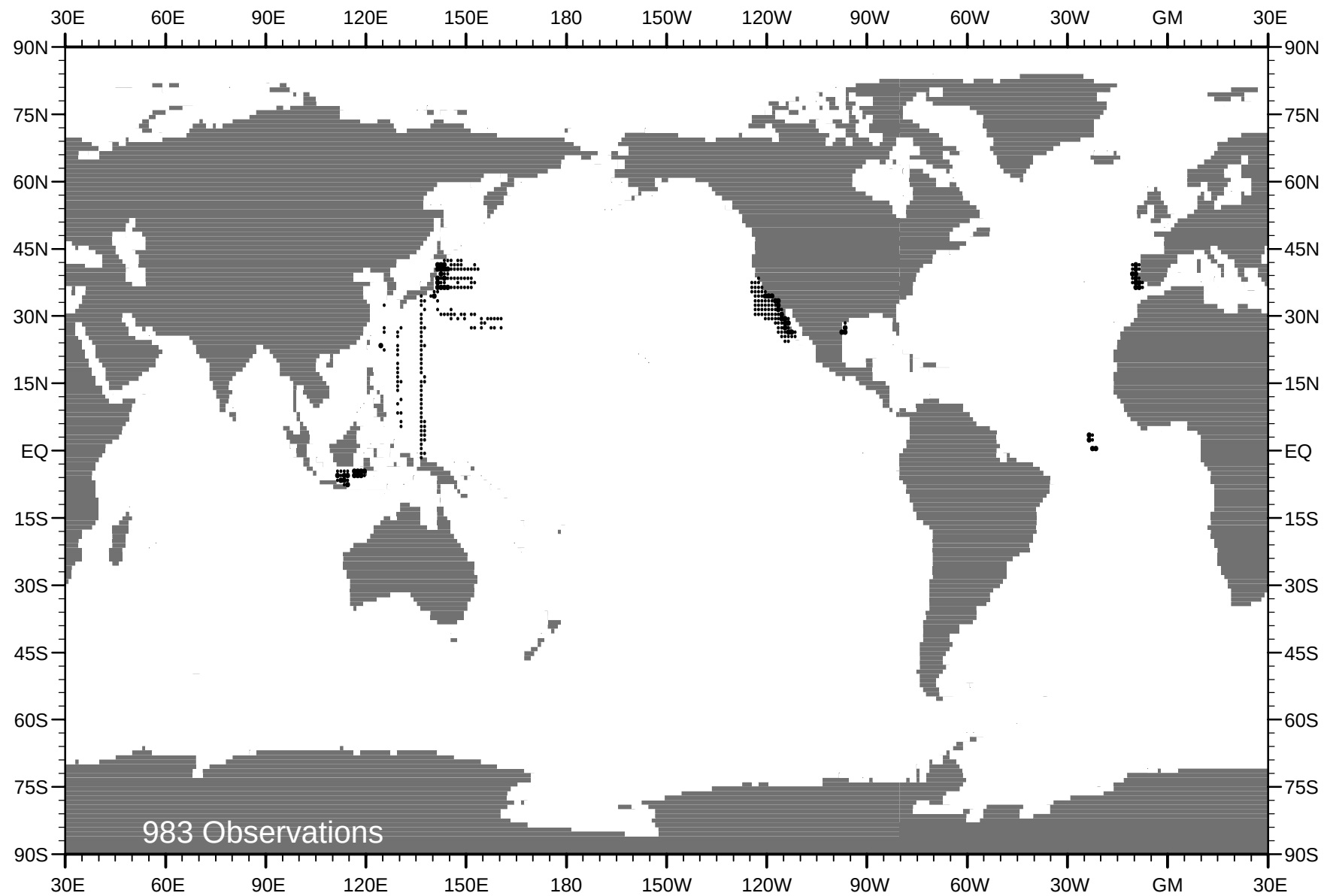


Fig. D26 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1974 .

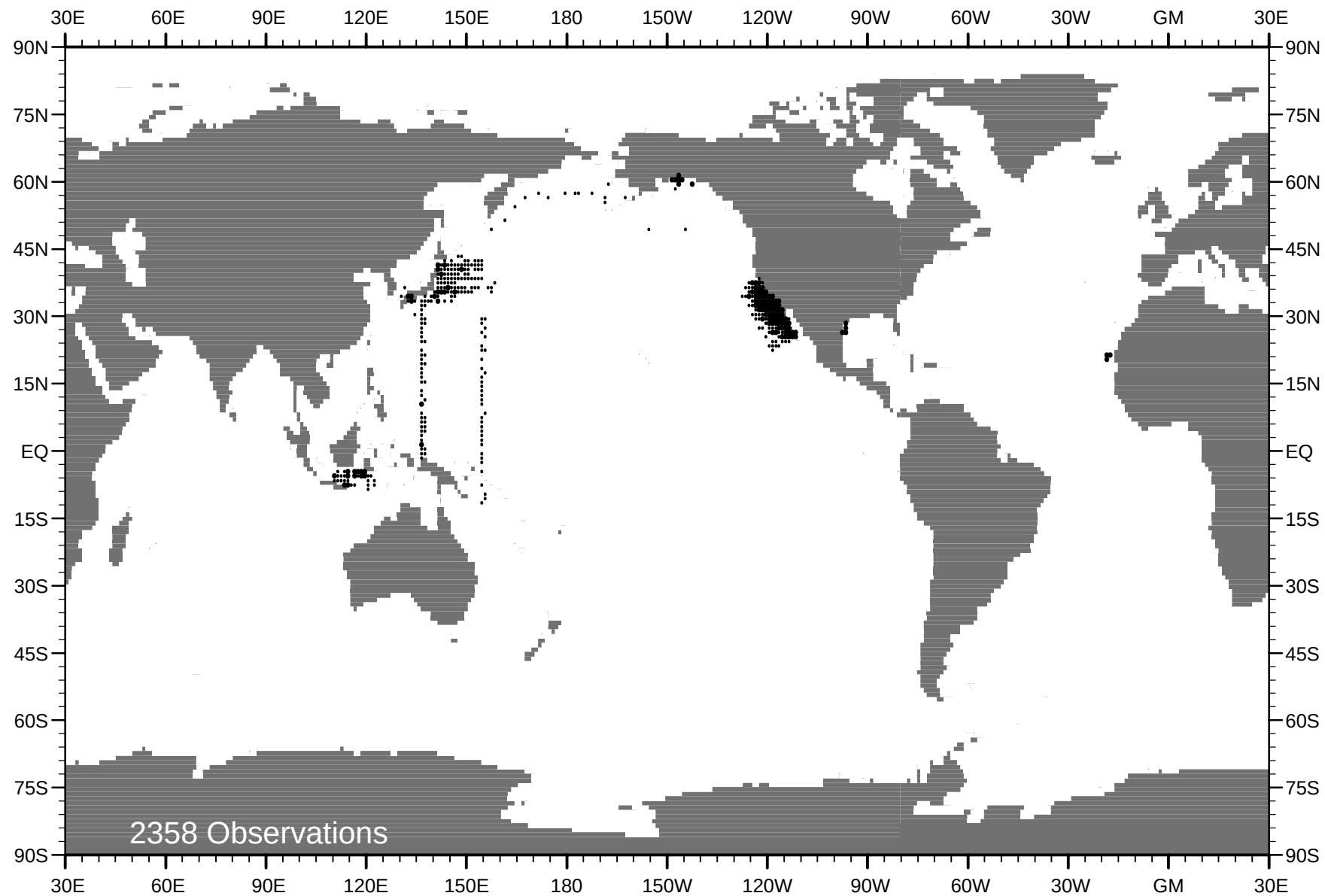


Fig. D27 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1975 .

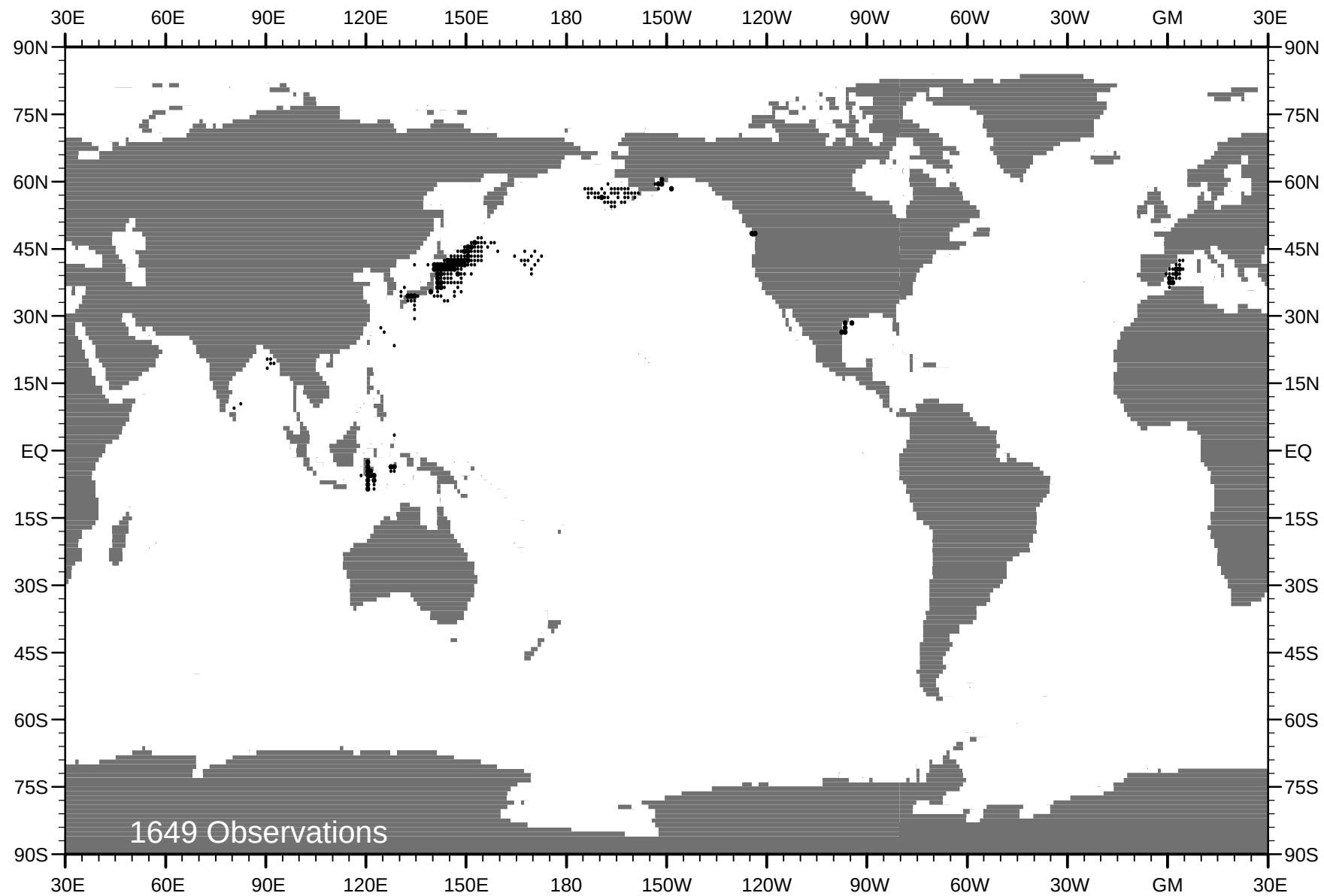


Fig. D28 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1976 .

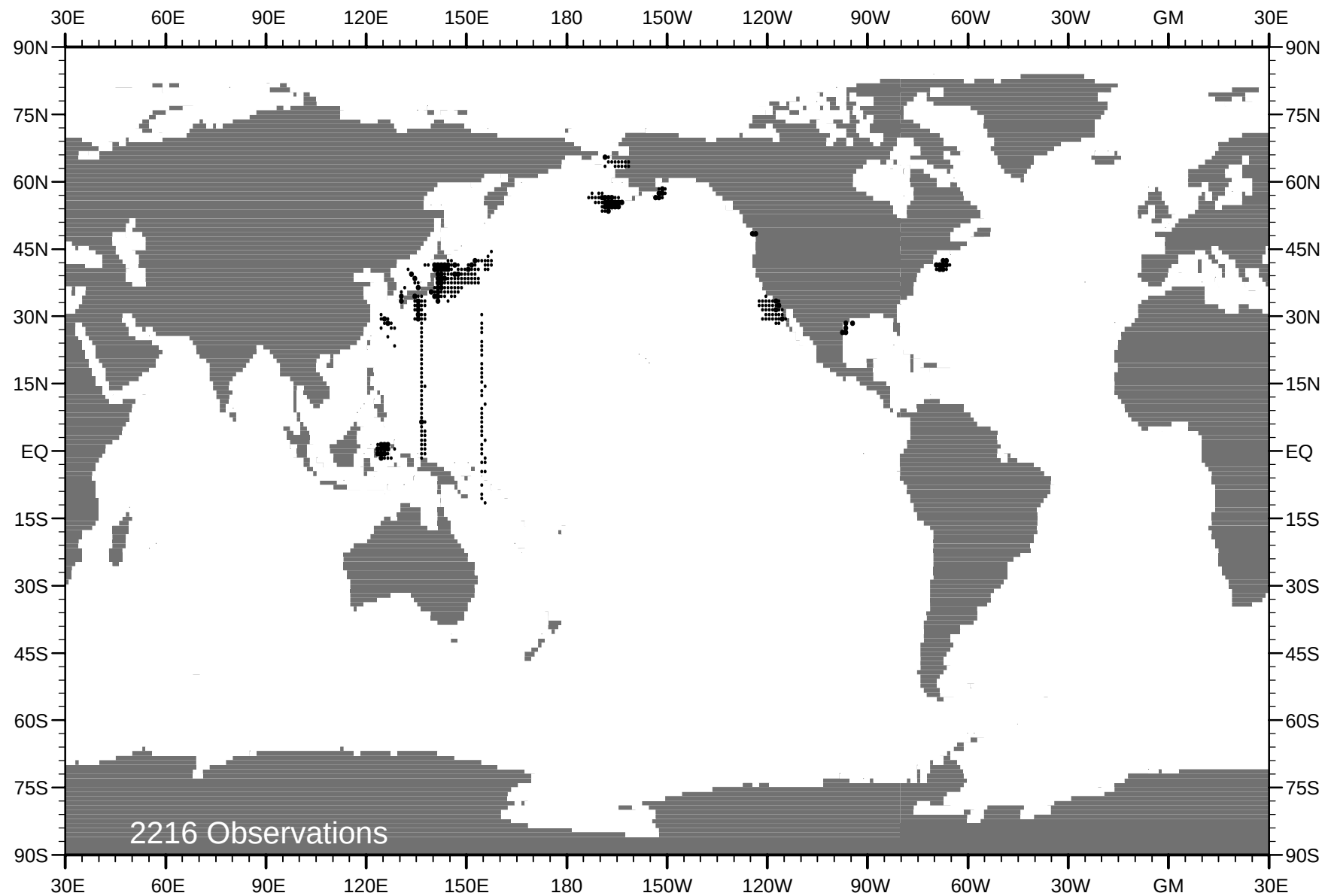


Fig. D29 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1977 .



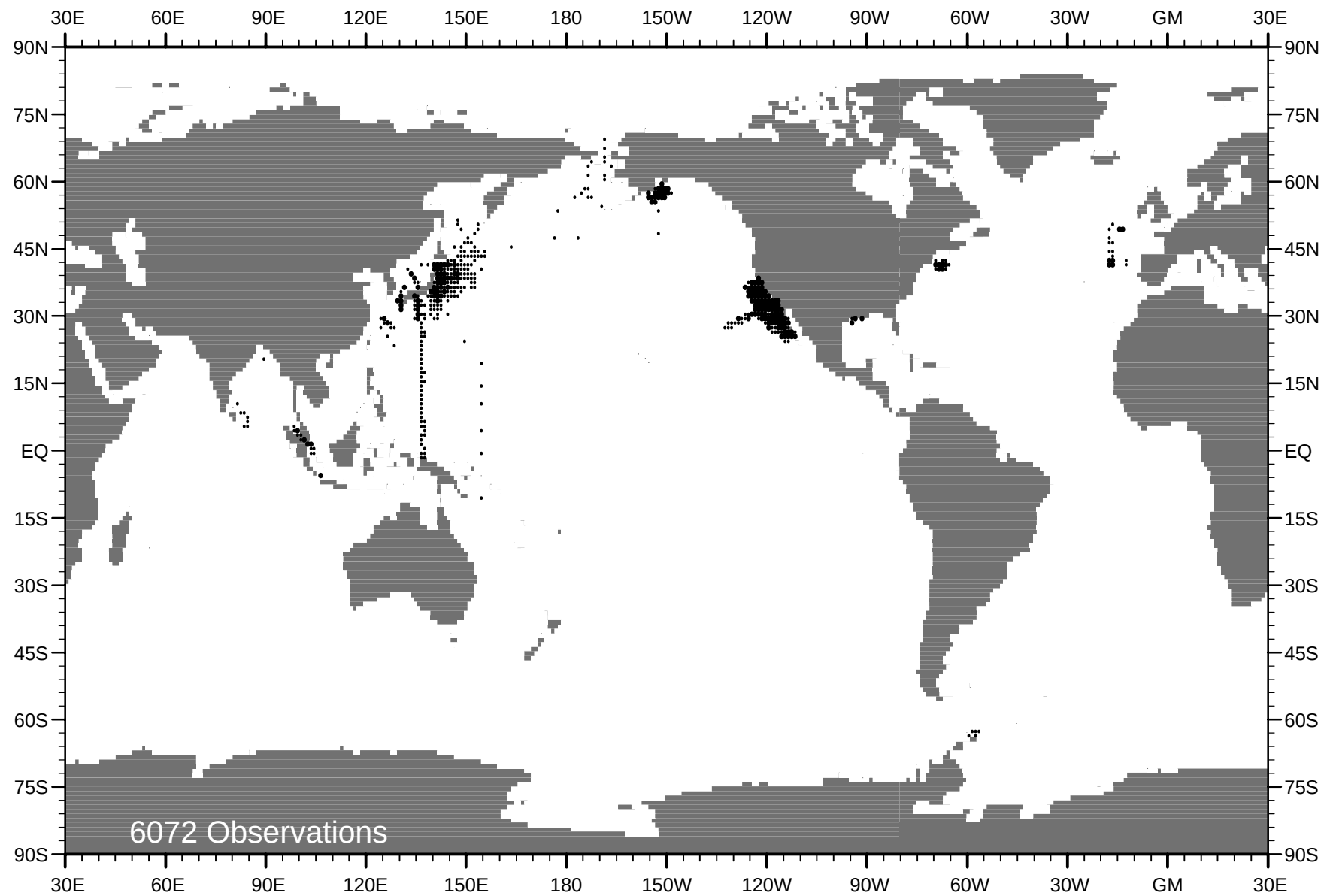


Fig. D30 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1978 .

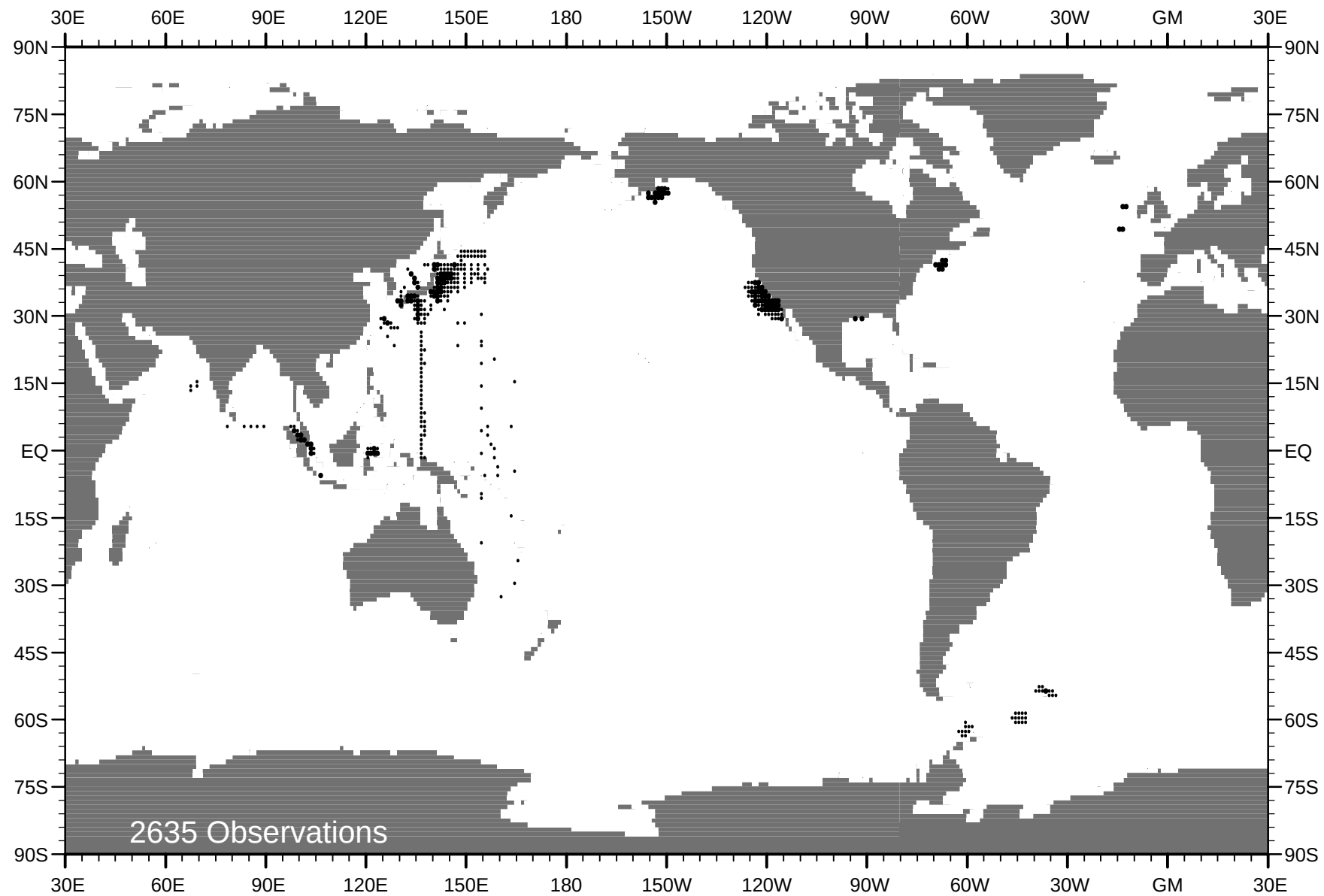


Fig. D31 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1979 .

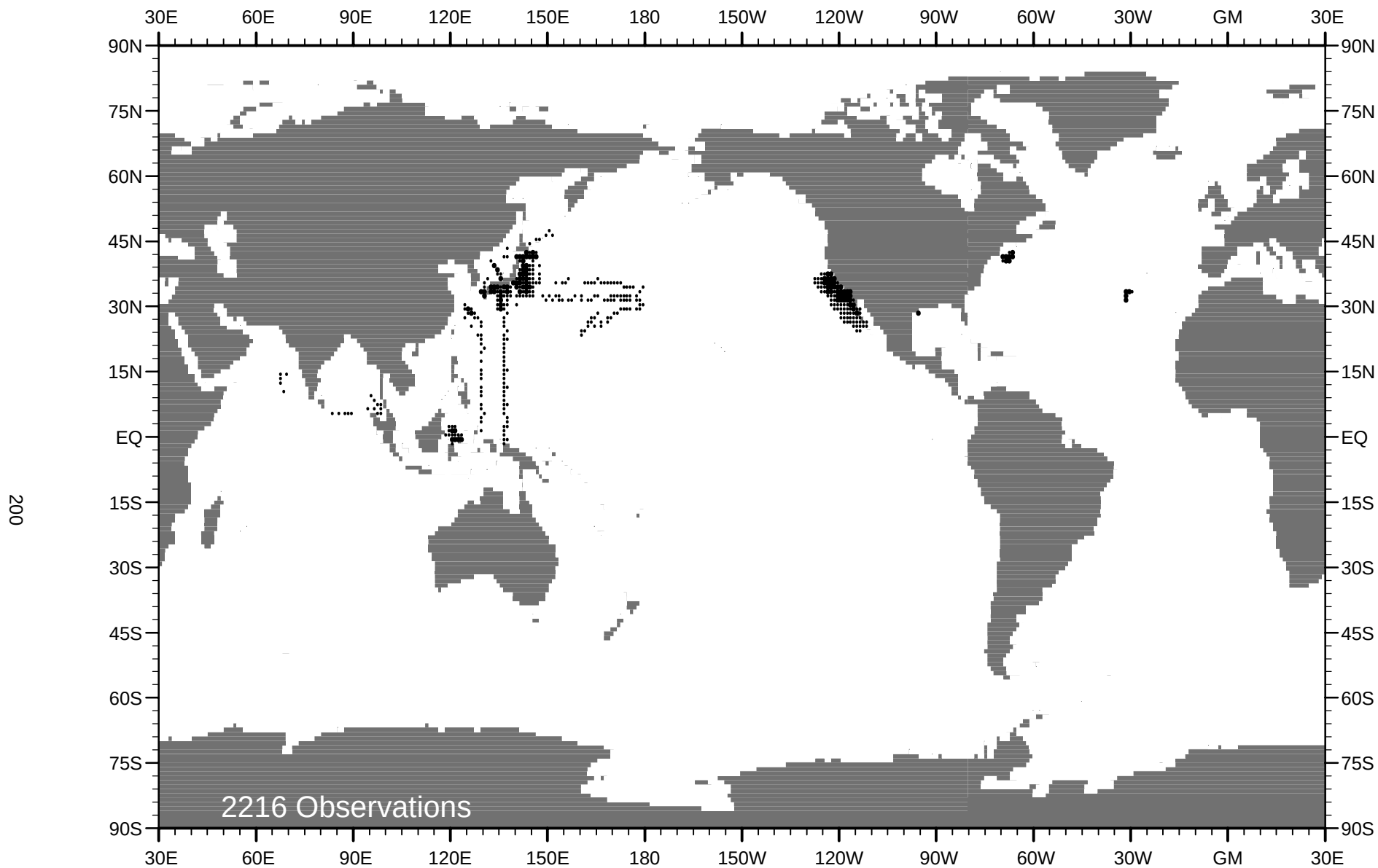


Fig. D32 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1980 .

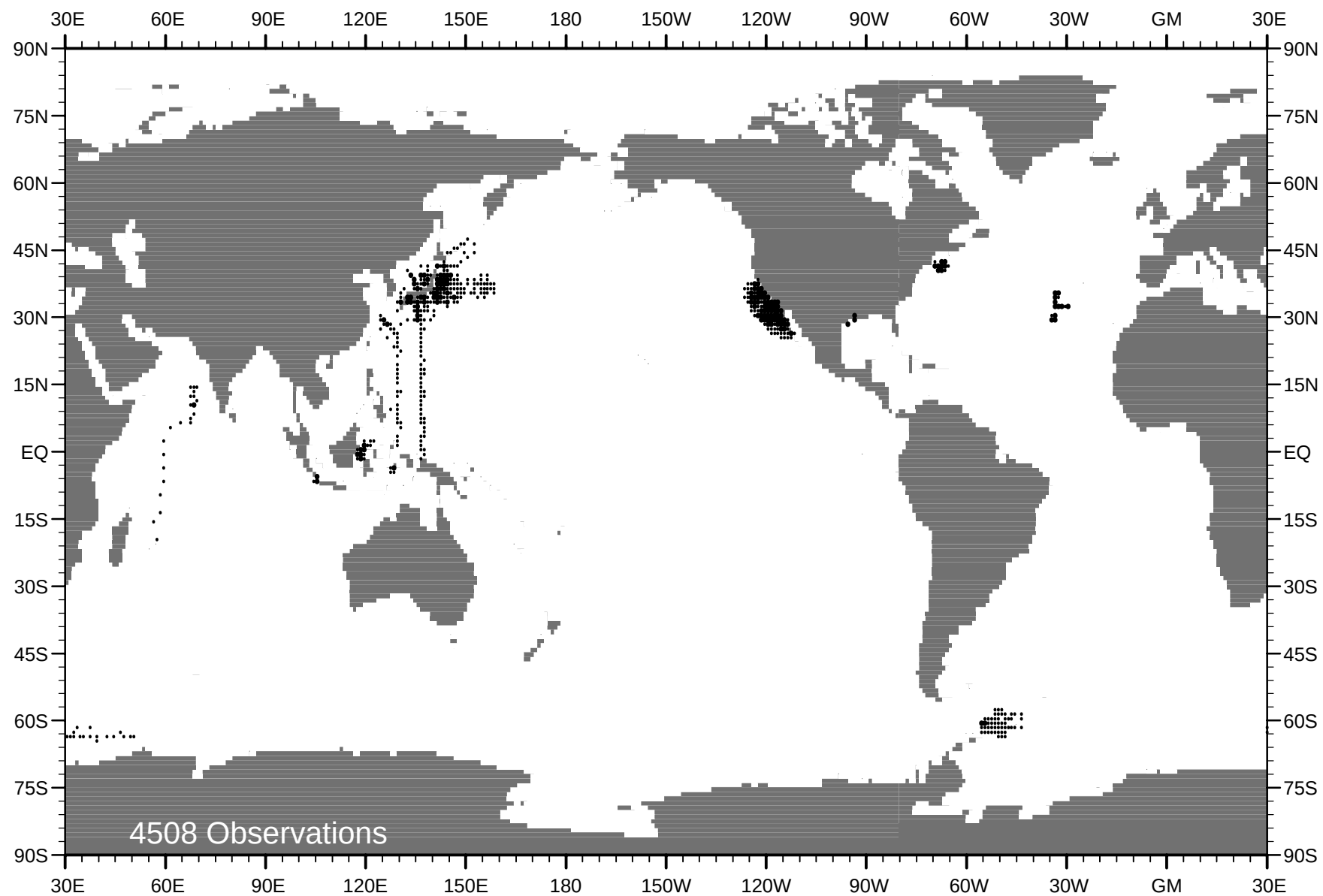


Fig. D33 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1981 .

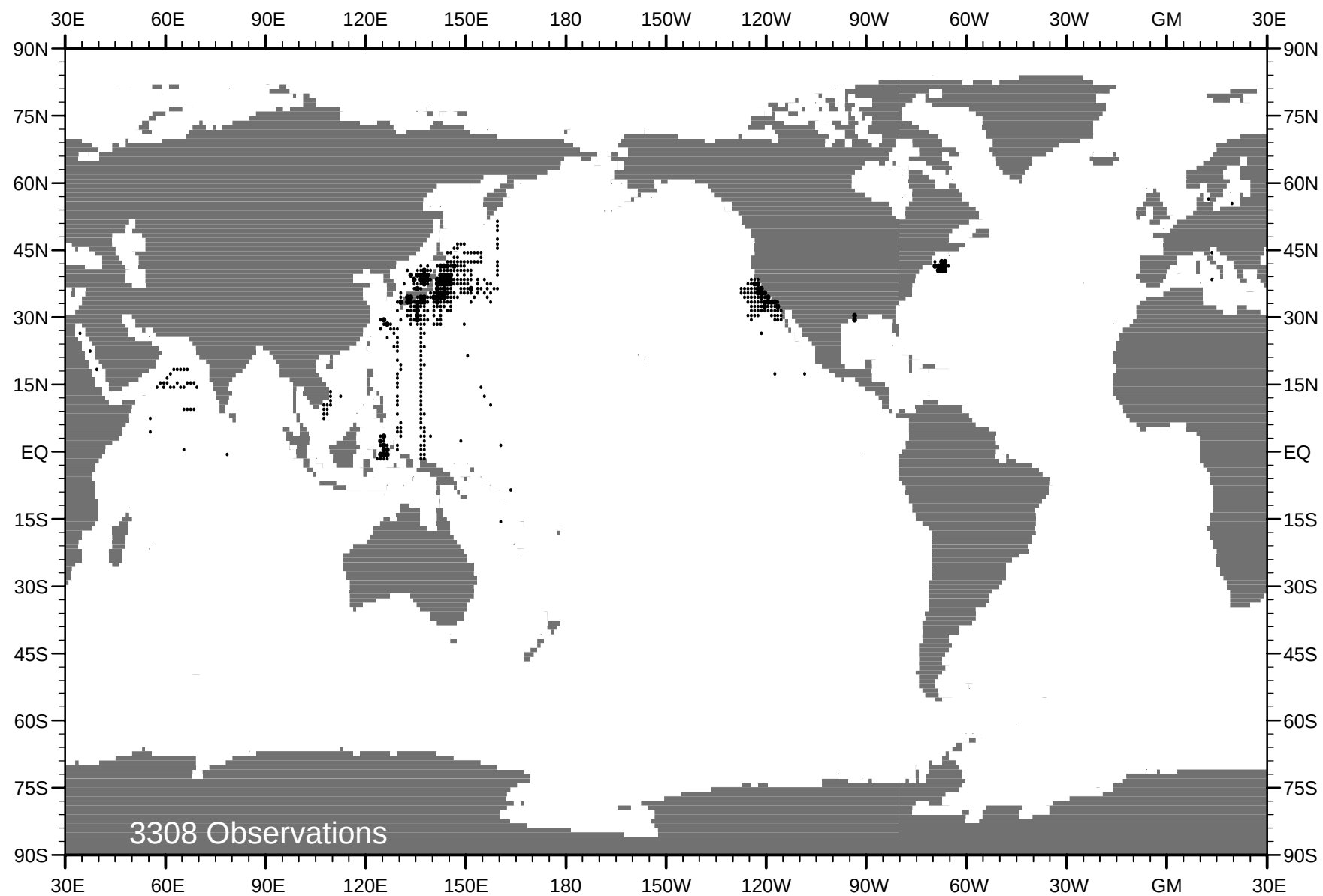


Fig. D34 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1982 .

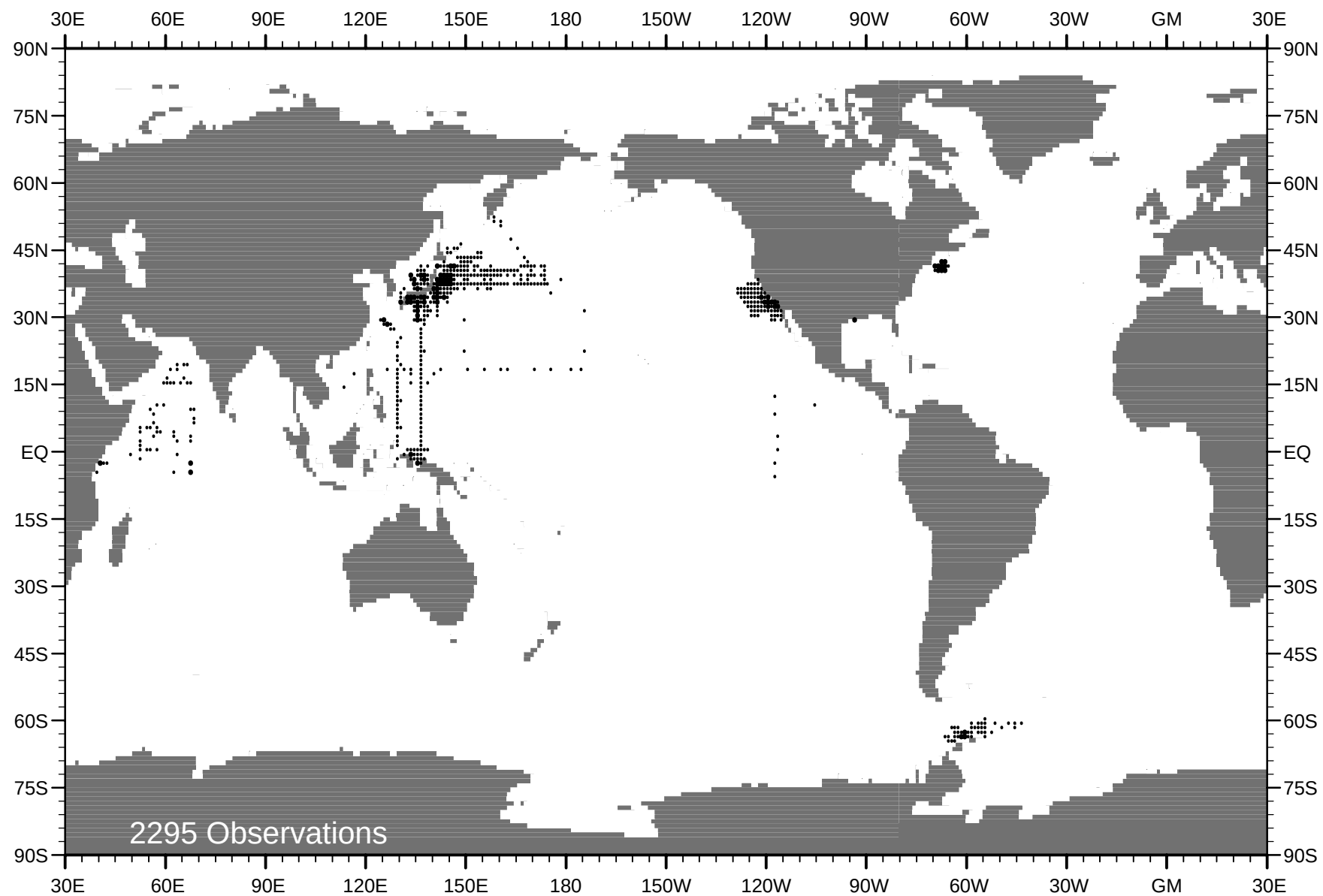


Fig. D35 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1983 .

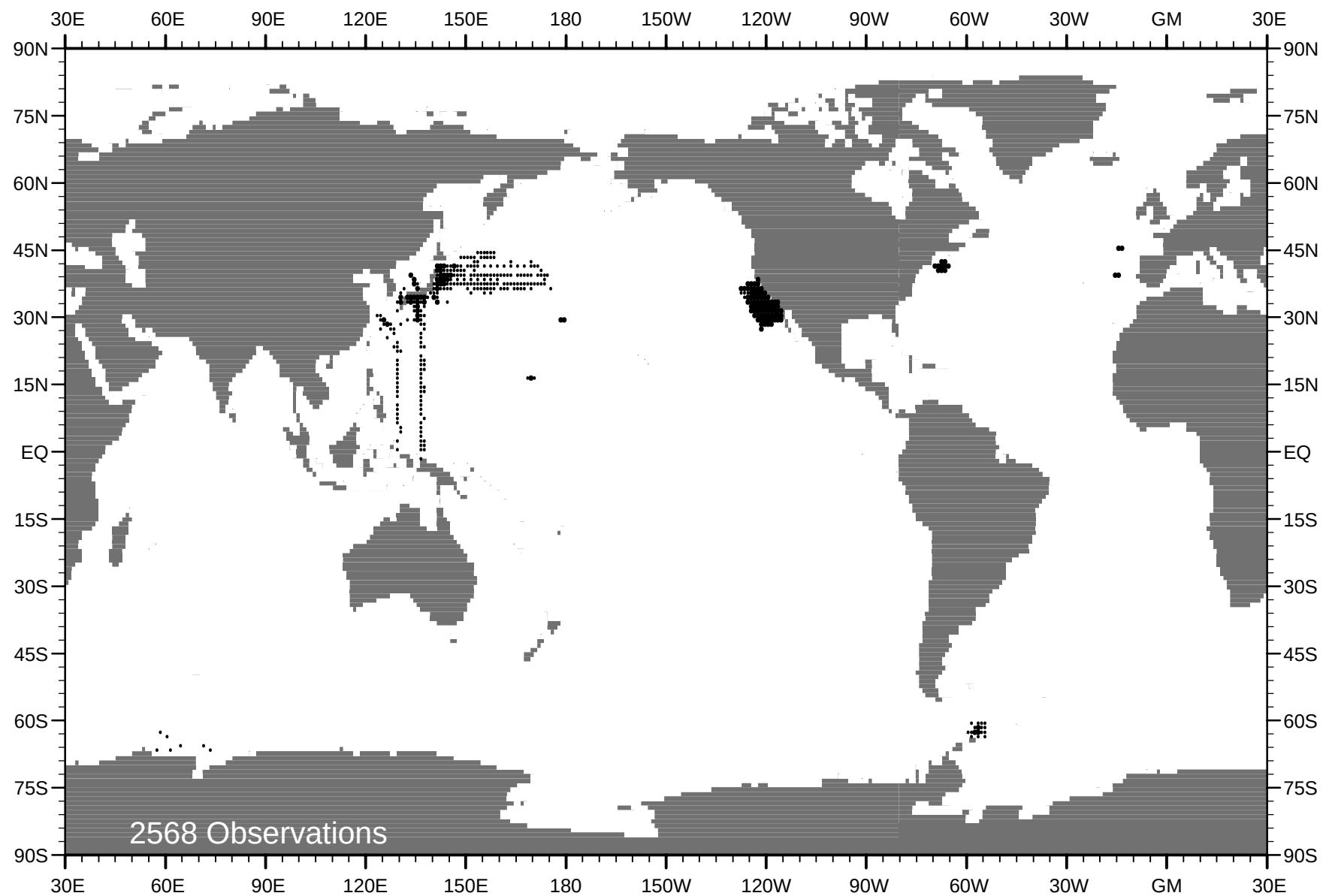


Fig. D36 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1984 .

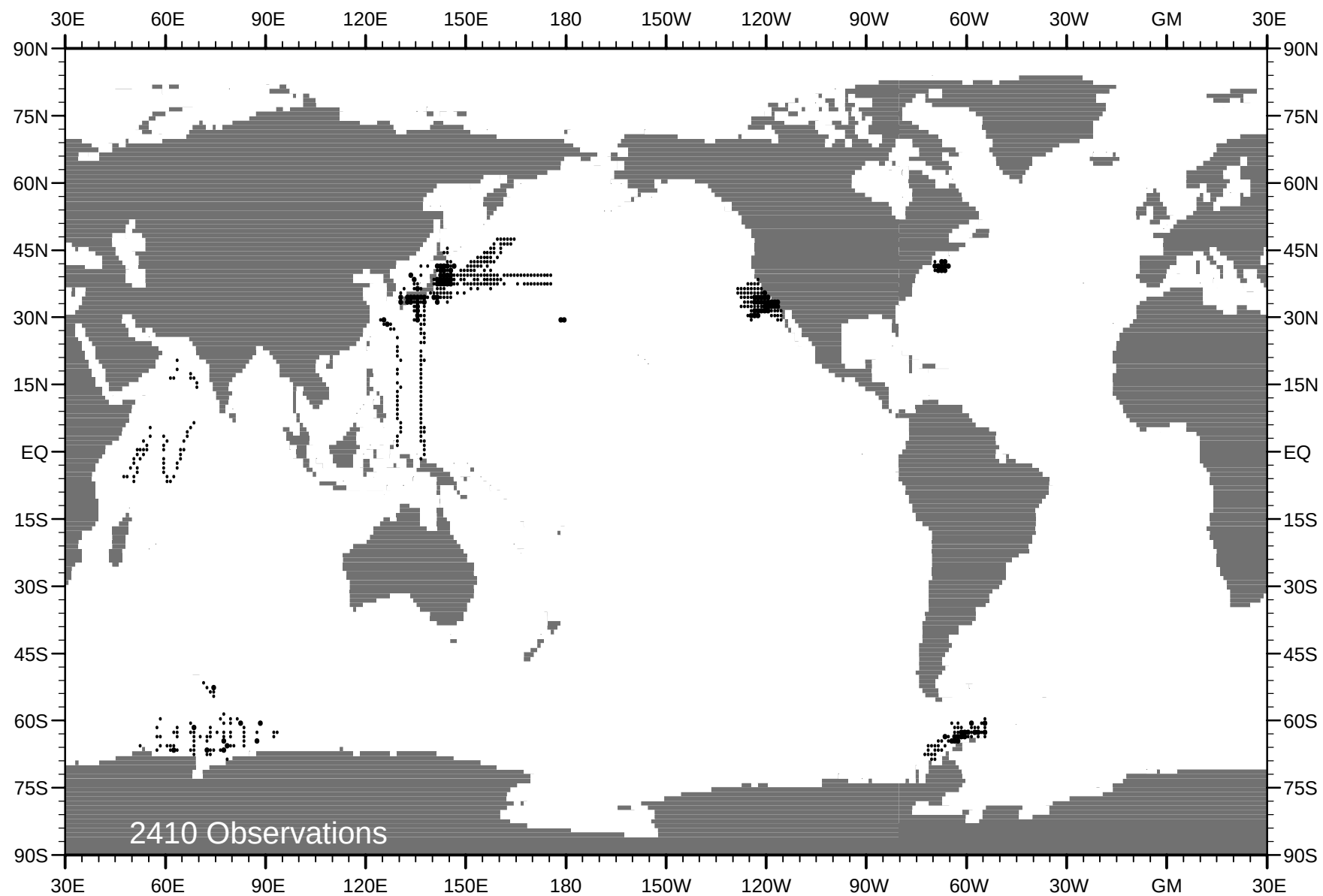


Fig. D37 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1985 .



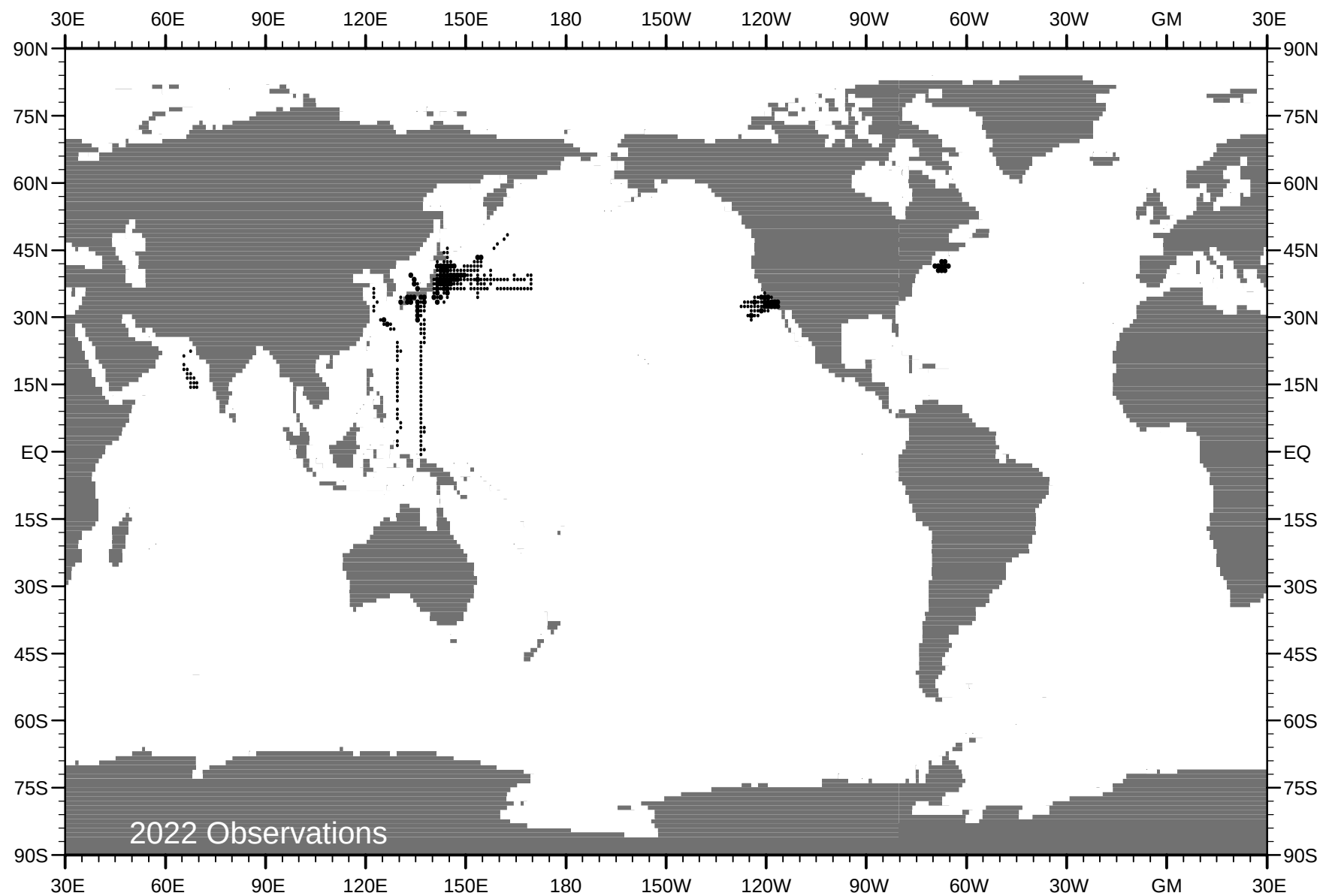


Fig. D38 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1986 .

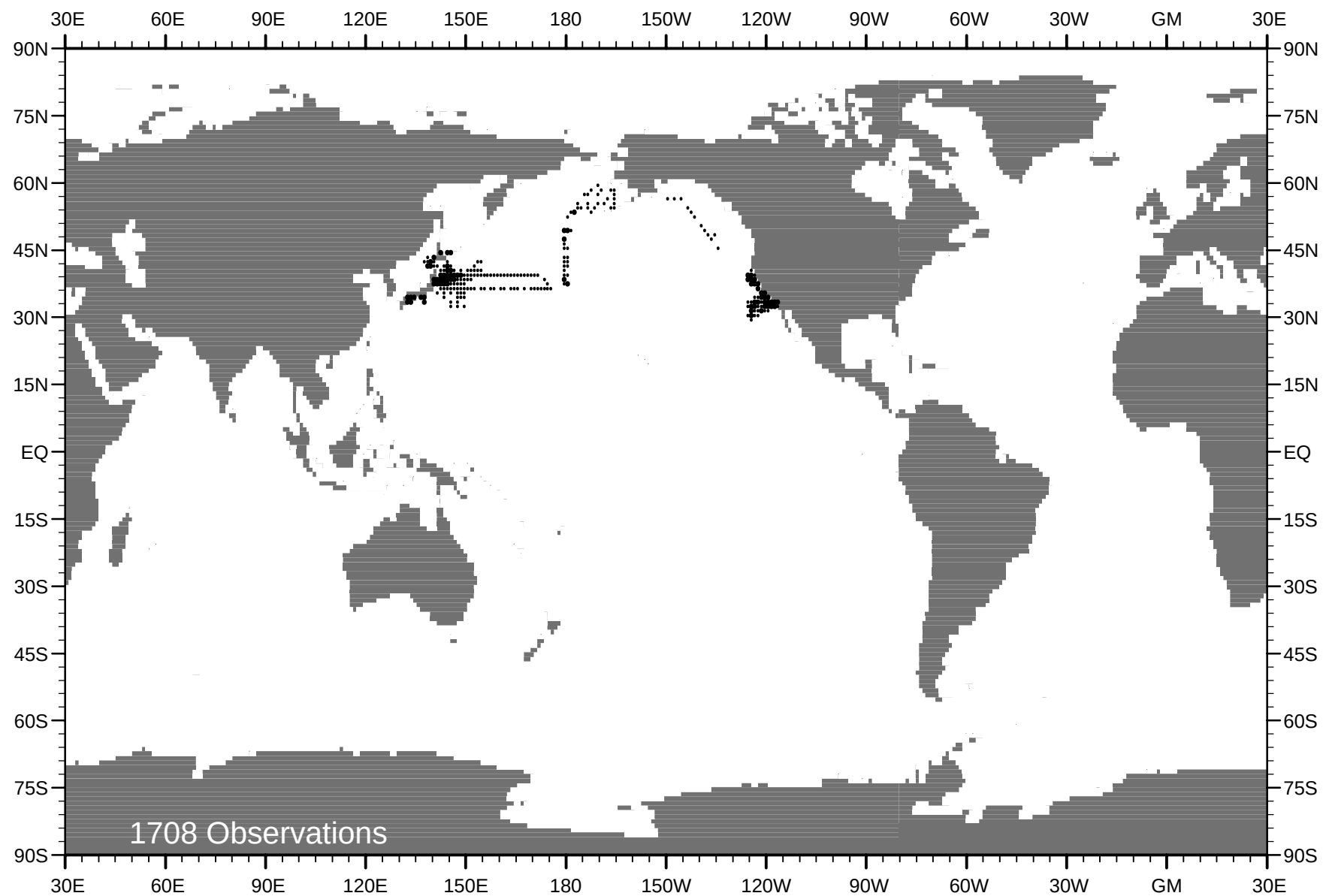


Fig. D39 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1987 .

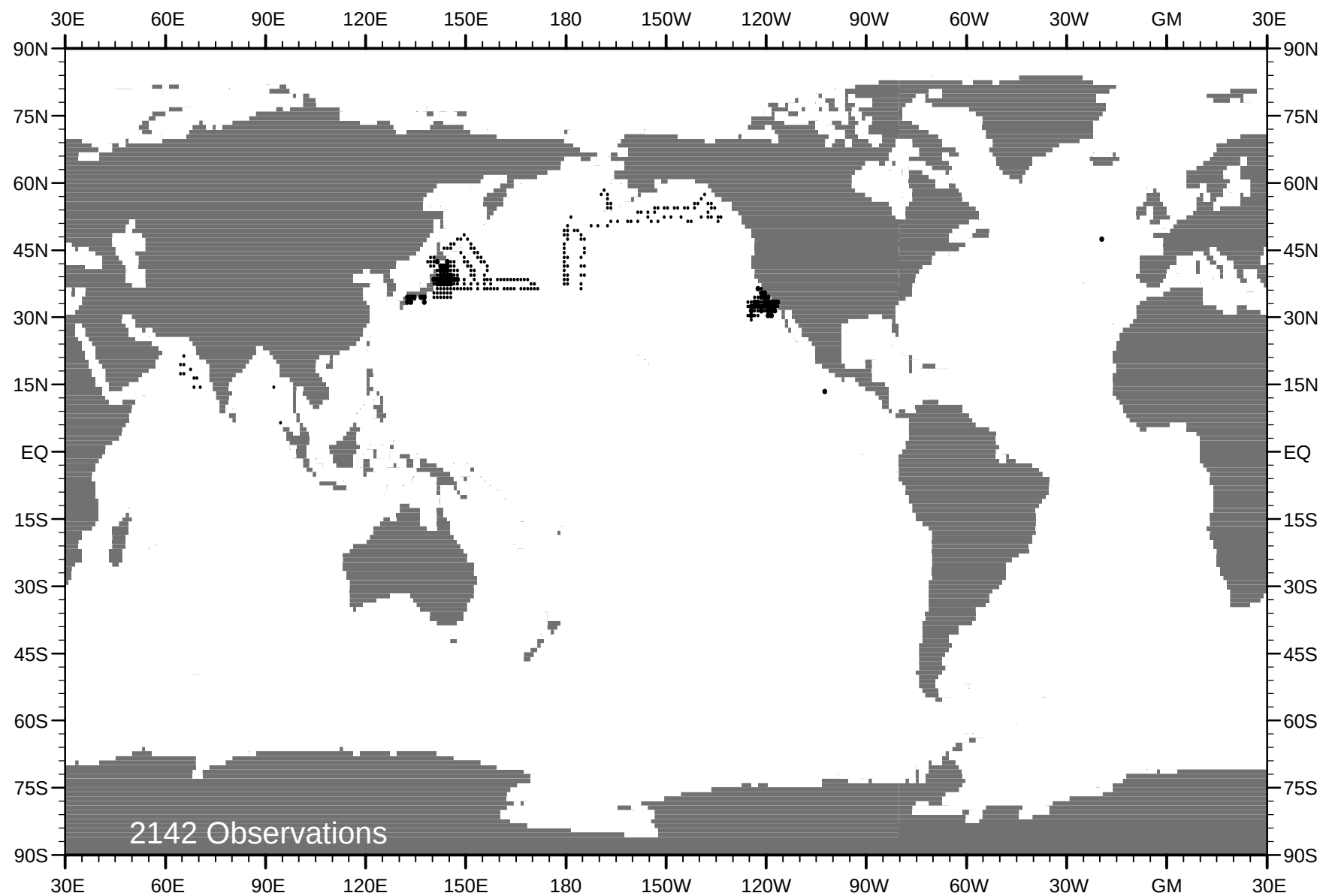


Fig. D40 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1988 .

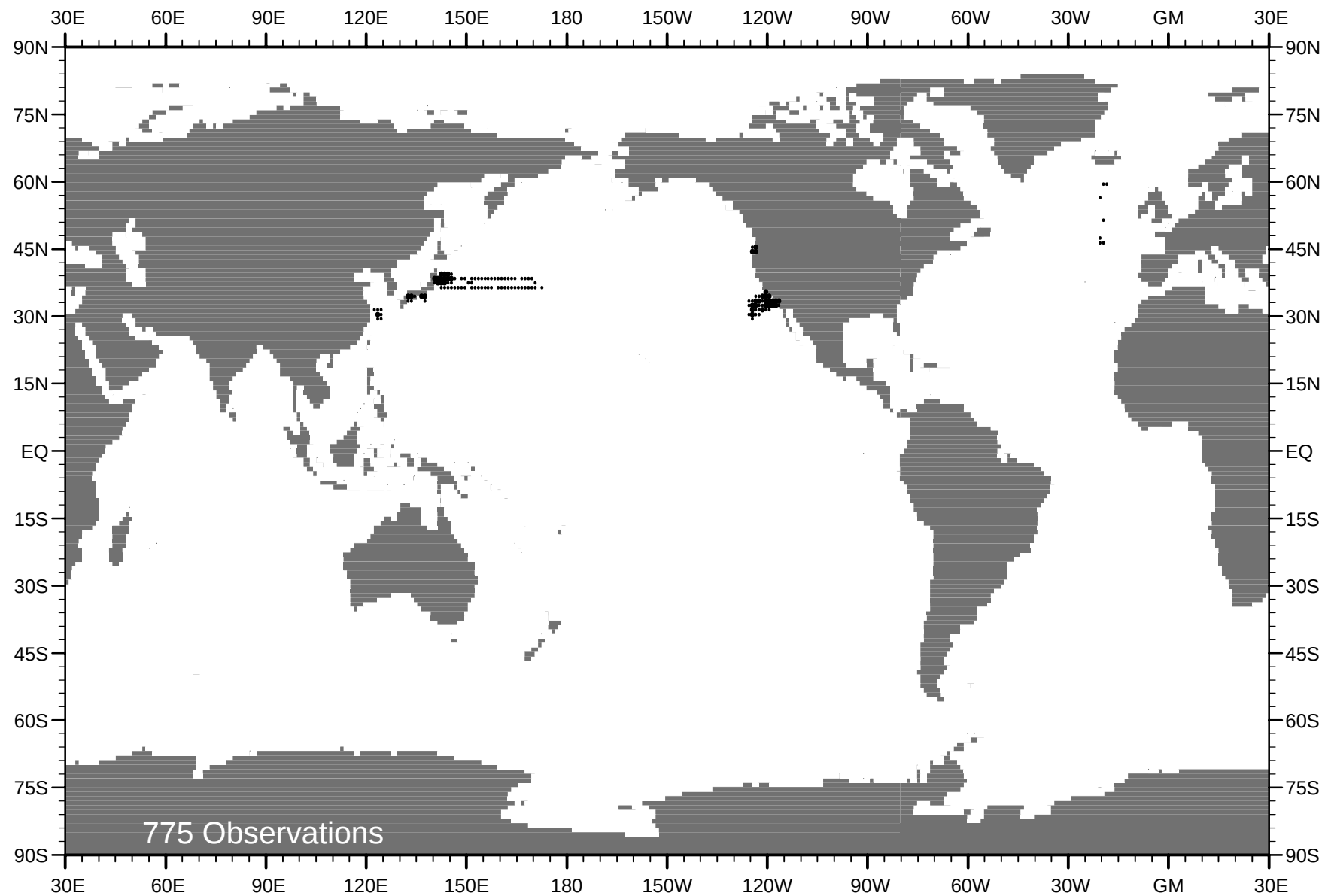


Fig. D41 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1989 .

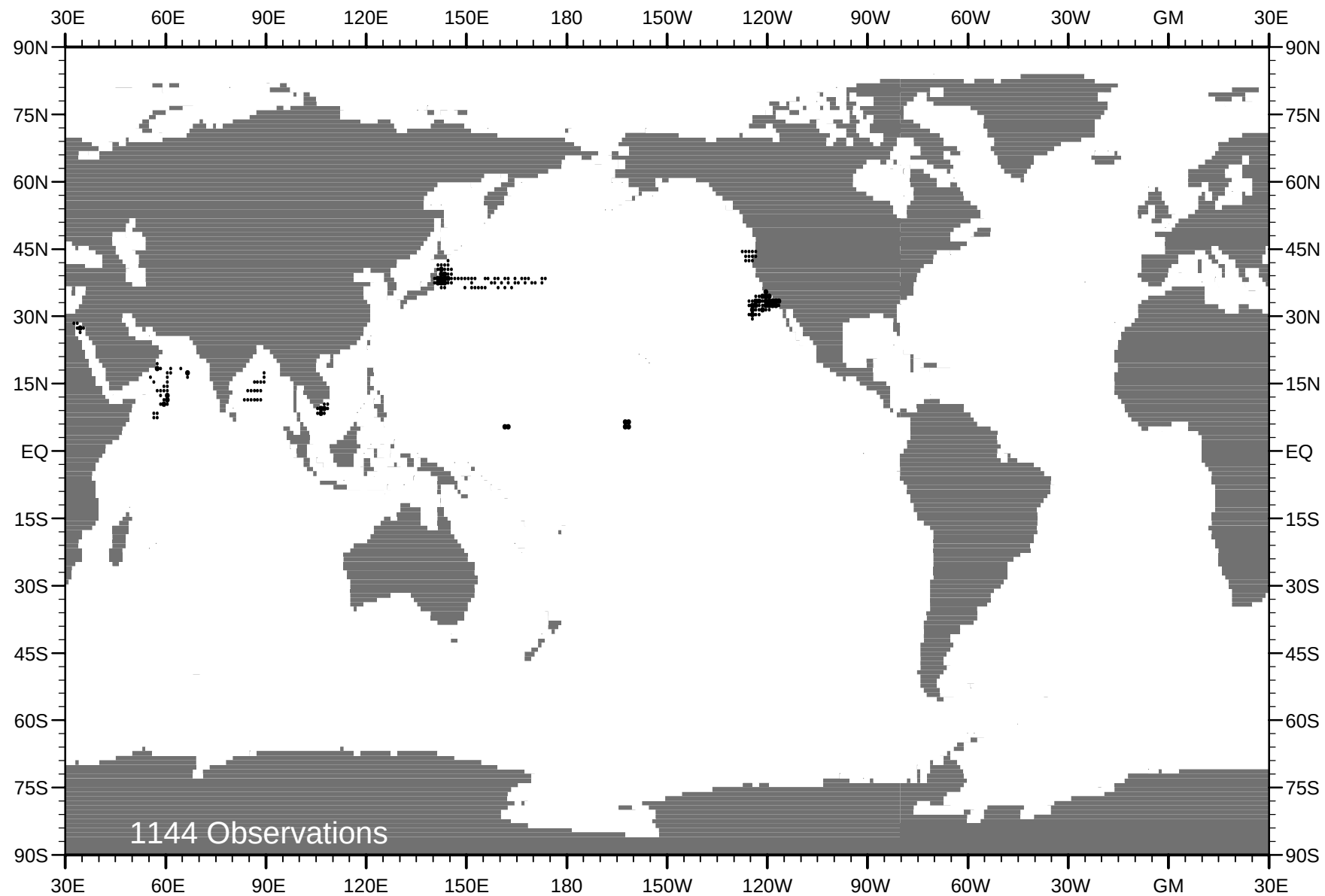


Fig. D42 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1990 .

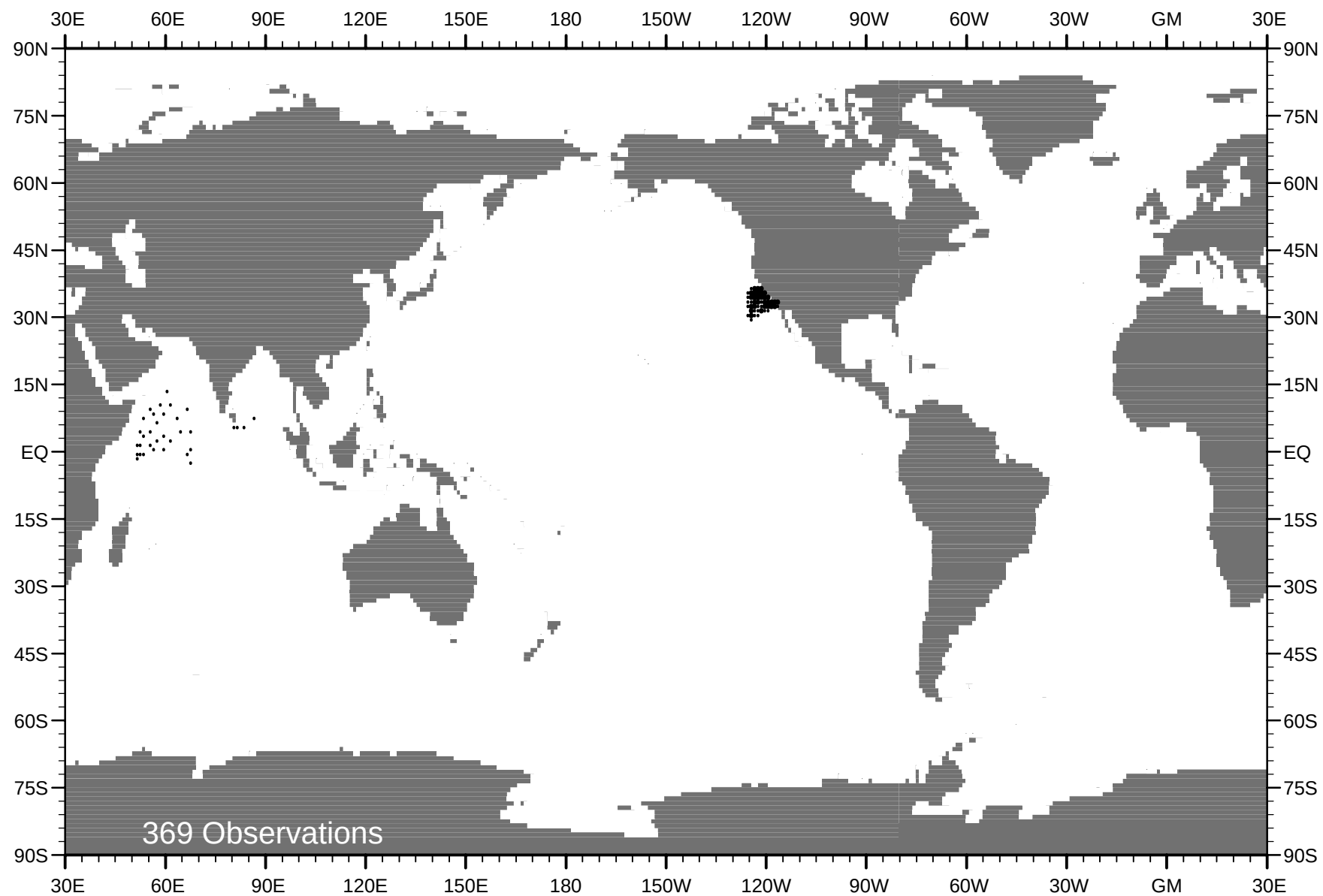


Fig. D43 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1991 .

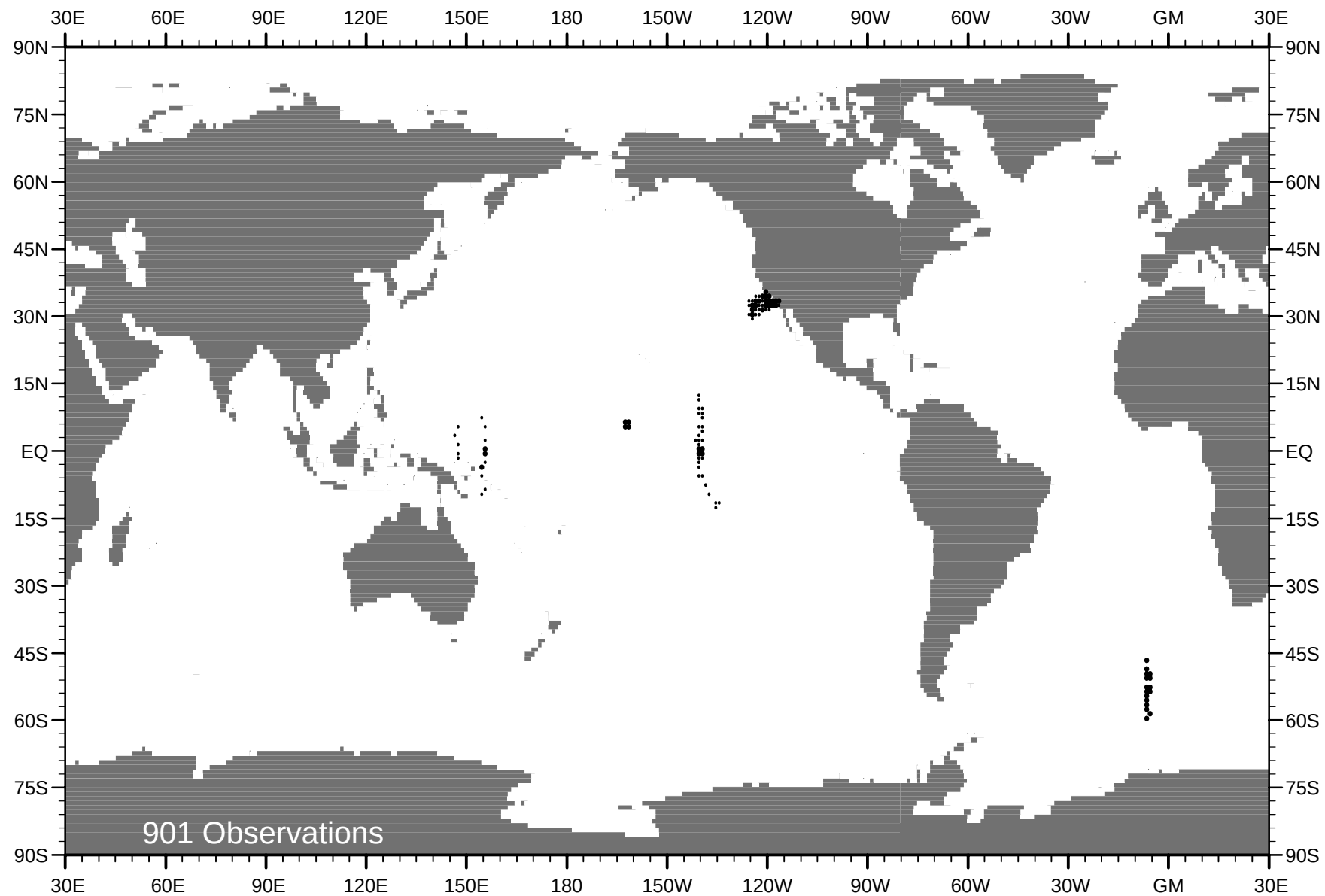


Fig. D44 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1992 .

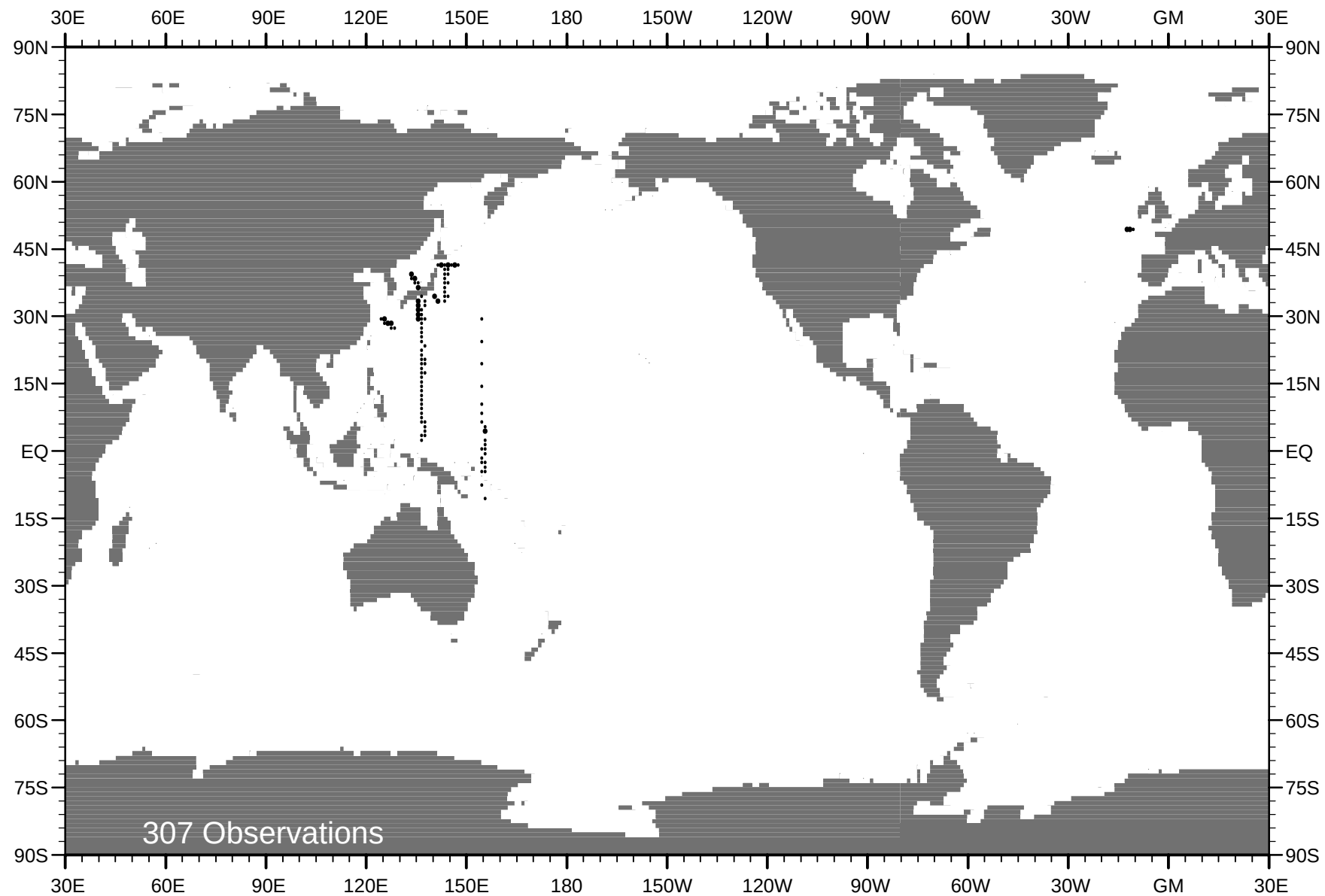


Fig. D45 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1993 .



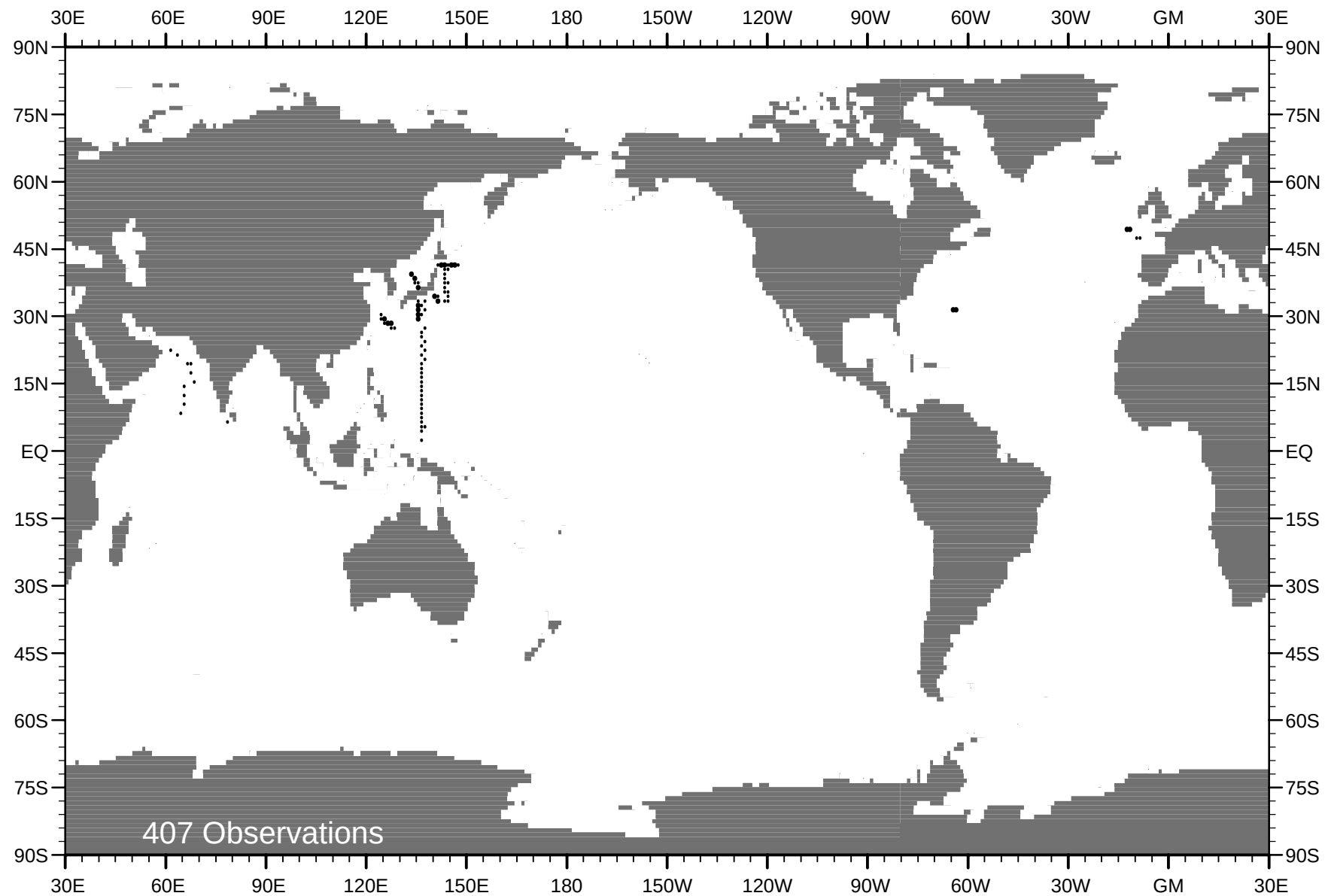


Fig. D46 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1994 .

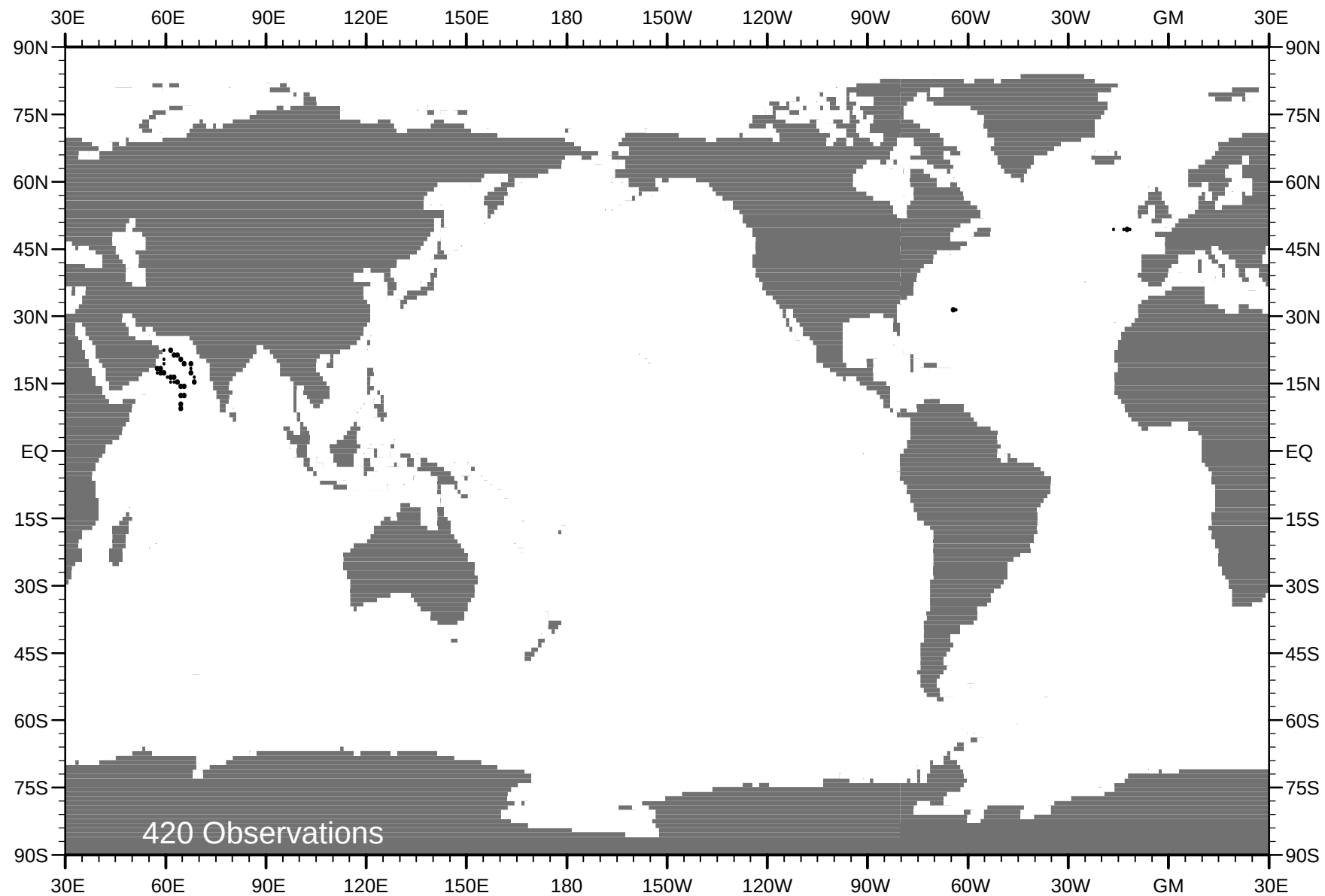


Fig. D47 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1995 .

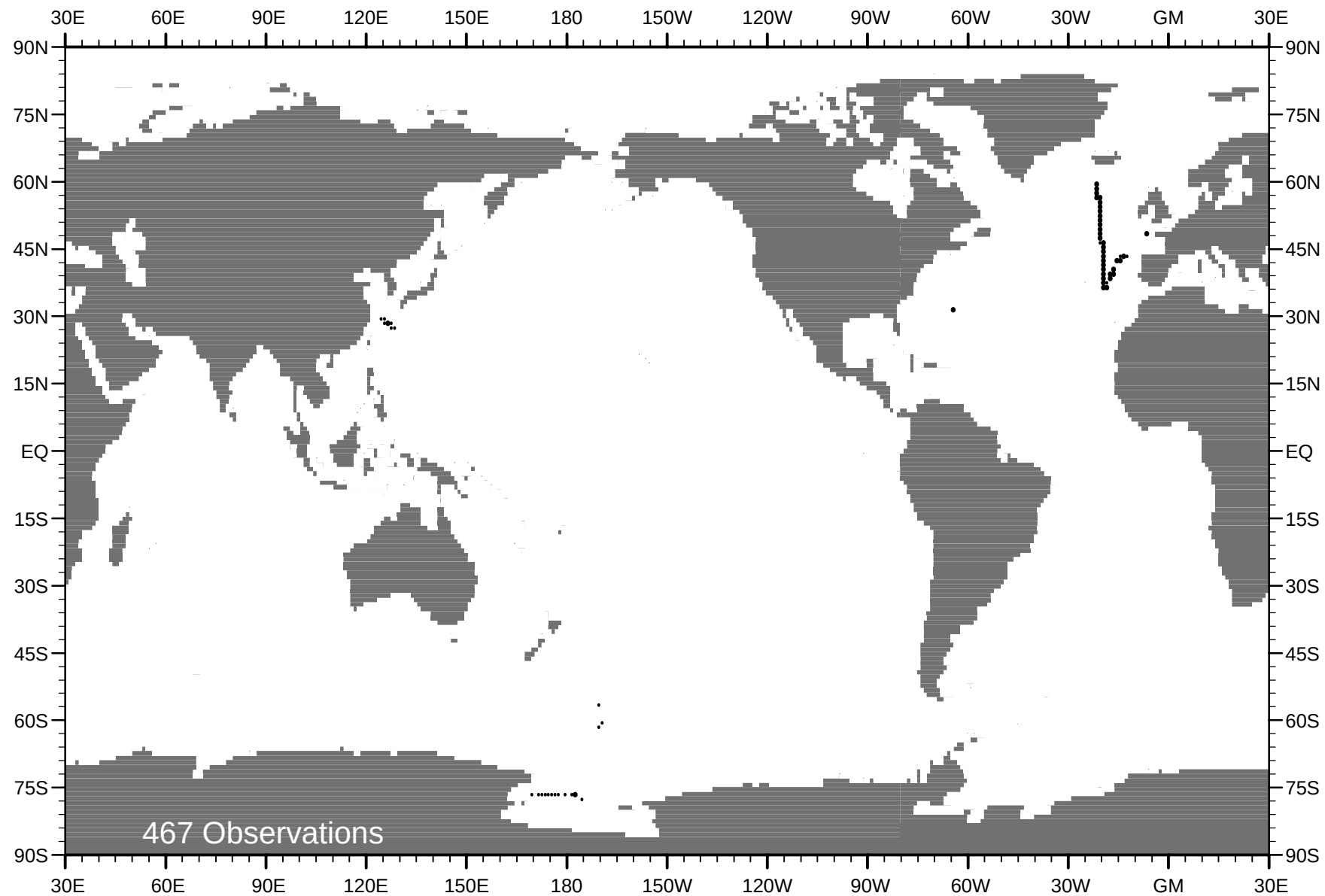


Fig. D48 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1996 .

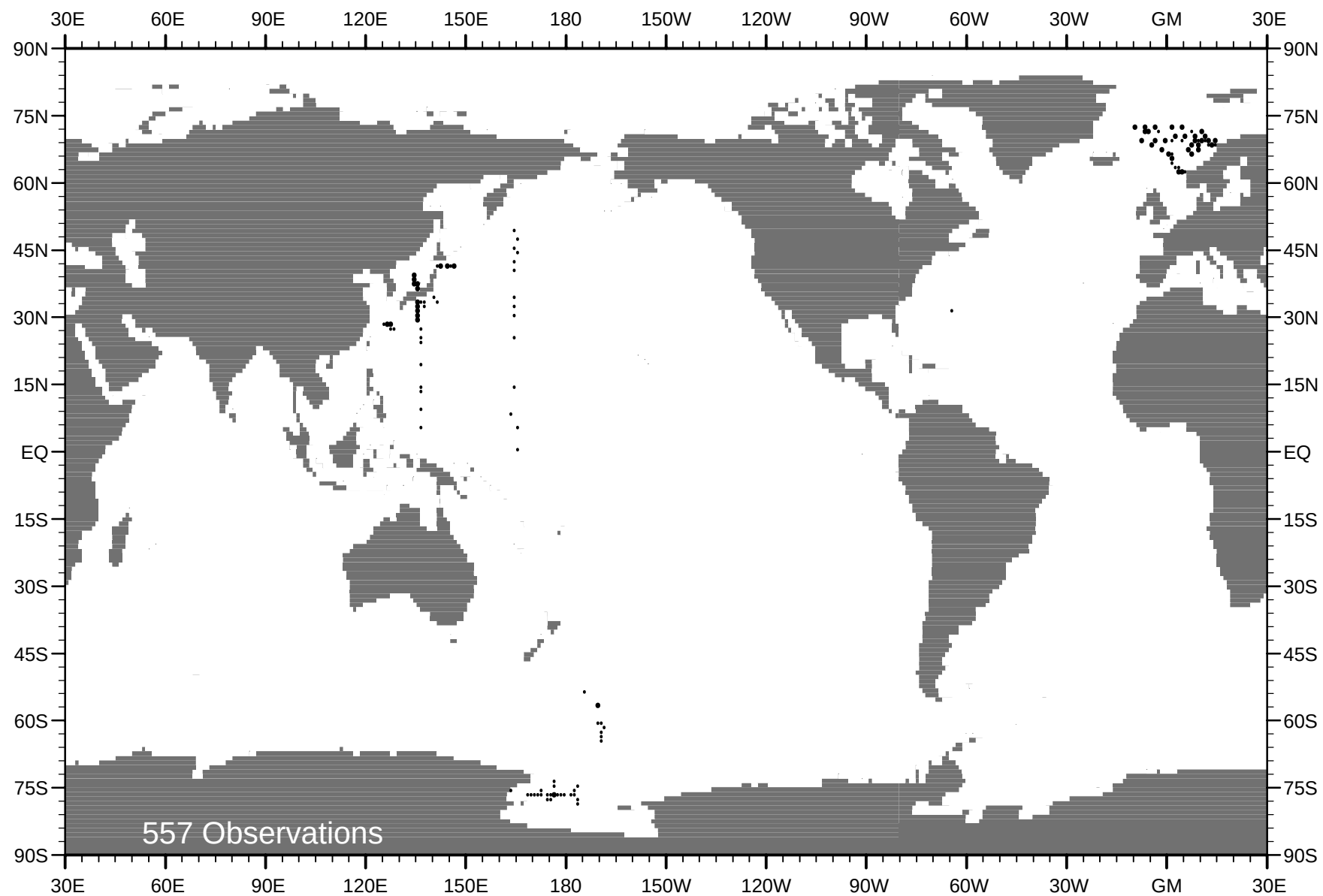


Fig. D49 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1997 .

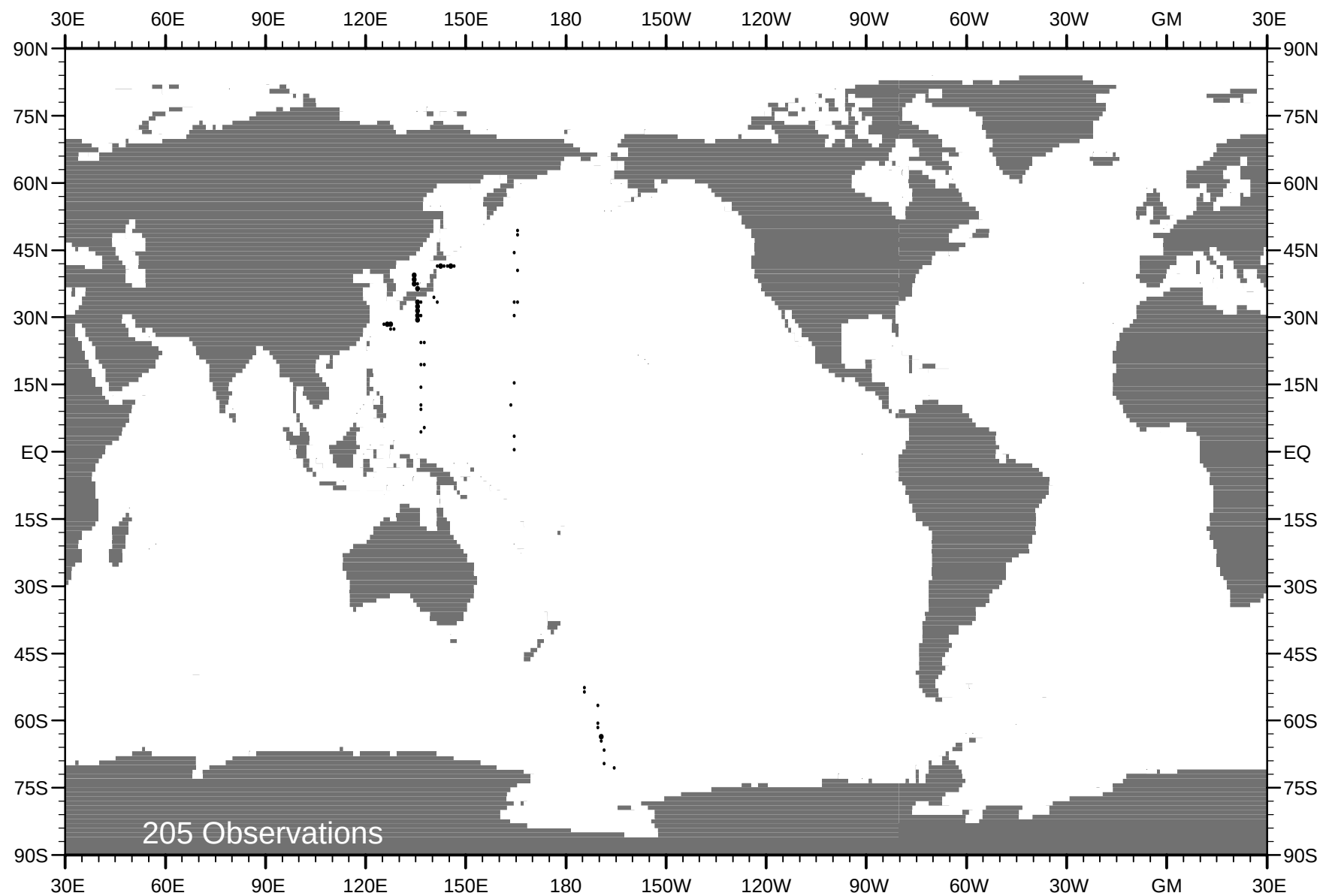


Fig. D50 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1998 .

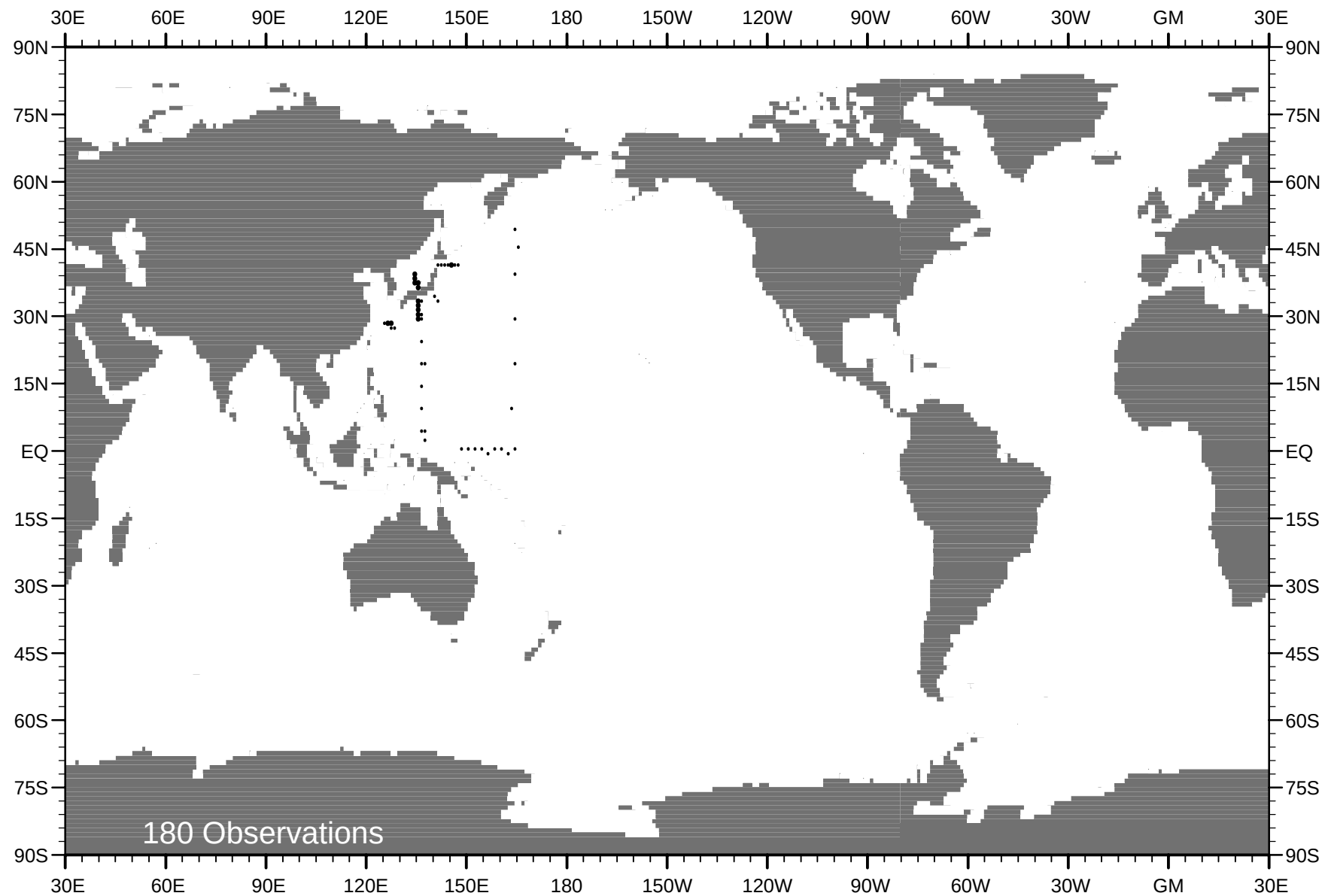


Fig. D51 Distribution of all Ocean Station Data (OSD) plankton biomass data in WOD01 for year 1999 .