

OPERATION OF HYDROLOGIC DATA-COLLECTION STATIONS BY THE U.S. GEOLOGICAL SURVEY IN 1991

By Alberto Condes de la Torre



**U.S. Geological Survey
Open-File Report 92-172**

DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

Chief, Branch of Operational Support
U.S. Geological Survey
405 National Center
12201 Sunrise Valley Drive
Reston, Virginia 22092

Copies of this report can be purchased
from:

Books and Open-File Reports Section
U.S. Geological Survey
Federal Center, Box 25425
Denver, Colorado 80225

CONTENTS

PAGE

ABSTRACT	1
INTRODUCTION	1
HYDROLOGIC DATA COLLECTION STATIONS	3
Surface Water Data.....	3
Ground Water Data.....	5
Sediment Data.....	6
Precipitation Data.....	7
SATELLITE TELEMETRY OF HYDROLOGIC DATA.....	7
SUMMARY	7
REFERENCES CITED	8

FIGURES

Figure 1. Map showing number of stations, by State, at which surface-water discharge data were collected in fiscal year 1991.....	9
2. Diagram showing number of continuous surface-water discharge stations, and sources of funding support, fiscal year 1991.....	10
3. Diagram showing number of partial-record surface-water discharge stations, and sources of funding support, fiscal year 1991.....	11
4. Graph showing number of stations, by year, at which surface-water discharge data were collected from fiscal year 1983 to fiscal year 1991.....	12
5. Map showing change in number of stations, by State, at which continuous surface-water discharge data were collected from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.....	13

6. Map showing number of stations, by State, at which stage-only data were collected on streams in fiscal year 1991.....	14
7. Diagram showing number of continuous surface-water stage-only stations on streams, and sources of funding support, fiscal year 1991.....	15
8. Diagram showing number of partial-record surface-water stage-only stations on streams, and sources of funding support, fiscal year 1991.....	16
9. Graph showing number of stations, by year, at which stage-only data were collected on streams from fiscal year 1983 to 1991.....	17
10. Map showing number of stations, by State, at which stage data were collected on lakes and reservoirs in fiscal year 1991.....	18
11. Diagram showing number of continuous surface-water stage stations on lakes and reservoirs, and sources of funding support, fiscal year 1991.....	19
12. Diagram showing number of partial-record surface-water stage stations on lakes and reservoirs, and sources of funding support, fiscal year 1991.....	20
13. Graph showing number of stations, by year, at which surface-water stage data were collected on lakes and reservoirs from fiscal year 1983 to 1991.....	21
14. Map showing number of stations, by State, at which surface-water quality data were collected in fiscal year 1991.....	22
15. Diagram showing number of continuous surface-water quality stations, and sources of funding support, fiscal year 1991.....	23
16. Diagram showing number of scheduled, long-term operation surface-water quality stations, and sources of funding support, fiscal year 1991.....	24
17. Diagram showing number of short term or project surface-water quality stations, and sources of funding support, fiscal year 1991.....	25

18.	Graph showing number of stations, by year, at which surface-water quality data were collected from fiscal year 1983 to fiscal year 1991.....	26
19.	Map showing change in the number of stations, by State, at which scheduled, long-term operation surface-water quality data were collected from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.....	27
20.	Map showing change in the number of stations, by State, at which surface-water quality data were collected at short-term or project stations from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.....	28
21.	Map showing number of stations, by State, at which ground-water levels were collected in fiscal year 1991.....	29
22.	Diagram showing number of continuous ground-water level stations, and sources of funding support, fiscal year 1991.....	30
23.	Diagram showing number of scheduled, long-term operation ground-water level stations, and sources of funding support, fiscal year 1991.....	31
24.	Diagram showing number of short-term or project ground-water level stations, and sources of funding support, fiscal year 1991.....	32
25.	Graph showing number of stations, by year, at which ground-water levels were collected from fiscal year 1983 to fiscal year 1991.....	33
26.	Map showing change in the number of stations, by State, at which scheduled, long-term operation ground-water levels were collected from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.....	34
27.	Map showing change in the number of stations, by State, at which ground-water levels were collected at short-term or project stations from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.....	35
28.	Map showing number of stations, by State, at which ground-water quality data were collected in fiscal year 1991.....	36

29.	Diagram showing number of scheduled, long-term operation ground-water quality stations, and sources of funding support, fiscal year 1991.....	37
30.	Diagram showing number of short-term or project ground-water quality stations, and sources of funding support, fiscal year 1991.....	38
31.	Graph showing number of stations, by year, at which ground-water quality data were collected from fiscal year 1983 to fiscal year 1991.....	39
32.	Map showing change in the number of stations, by State, at which ground-water quality data were collected at scheduled long-term stations from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.....	40
33.	Map showing change in the number of stations, by State, at which ground-water quality data were collected at short-term or project stations from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.....	41
34.	Map showing number of stations, by State, at which sediment data were collected in fiscal year 1991.....	42
35.	Graph showing the number of stations, by year, at which sediment data were collected from fiscal year 1985 to fiscal year 1991.....	43
36.	Diagram showing number of daily sampling sediment stations, and sources of funding support, fiscal year 1991.....	44
37.	Diagram showing number of periodic sampling sediment stations, and sources of funding support, fiscal year 1991.....	45
38.	Map showing number of stations, by State, at which precipitation data were collected in fiscal year 1991.....	46
39.	Diagram showing number of precipitation-quantity stations, and sources of funding support, fiscal year 1991....	47
40.	Diagram showing number of precipitation-quality stations, and sources of funding support, fiscal year 1991....	48

41.	Graph showing the number of stations, by year, at which precipitation data were collected from fiscal year 1983 to fiscal year 1991.....	49
42.	Map showing number of U.S. Geological Survey stations, by State, at which data-collection platforms for satellite telemetry were operated in fiscal year 1991.....	50
43.	Diagram showing number of stations at which data-collection platforms for satellite telemetry were operated by the U.S. Geological Survey, and sources of funding support, fiscal year 1991.....	51
44.	Graph showing the Number of U.S. Geological Survey Stations, by year, at which data-collection platforms for satellite telemetry were operated from fiscal year 1985 to fiscal year 1991.....	52

TABLE

TABLE 1.	Types and number of hydrologic data-collection stations operated by the U.S. Geological Survey during the 1991 fiscal year, and the sources of funding support.....	2
----------	---	---

OPERATION OF HYDROLOGIC DATA COLLECTION STATIONS BY THE U.S. GEOLOGICAL SURVEY IN 1991

By Alberto Condes de la Torre

ABSTRACT

The U.S. Geological Survey operates hydrologic data-collection stations nationwide to serve the needs of all levels of government, the private sector, and the general public for water-resources information. During fiscal year 1991, surface-water discharge was determined at 10,473 stations; stage data on streams, reservoirs, and lakes were recorded at 2,126 stations; and various surface-water quality characteristics were determined at 3,265 stations. In addition, ground-water levels were measured at 33,386 sites, and the quality of ground water was determined at 8,615 sites. Data on sediment were collected daily at 168 stations and on a periodic basis at 865 stations. Information on precipitation quantity was collected at 1,484 stations and the quality of precipitation was analyzed for 65 stations. Data-collection platforms for satellite telemetry of hydrologic information were used at 3,210 Geological Survey stations. Funding for the hydrologic data-collection stations was derived, either solely or in combination, from three major sources--the Geological Survey's Federal Program appropriation, the Federal-State Cooperative Program, and reimbursements from other Federal agencies.

The number of hydrologic data-collection stations operated by the Geological Survey declined in some types and increased in others from fiscal year 1983 to 1991. Although the number of continuous-record surface-water discharge stations increased by 194, the total number of surface-water discharge stations, both continuous and partial record, was reduced by 603; surface-water quality stations declined by 561; ground-water level stations decreased by 253; and ground-water quality stations increased by 967.

INTRODUCTION

The U.S. Geological Survey operates hydrologic data-collection stations throughout the United States, Puerto Rico, and several Trust Territories. These stations are used to monitor the quantity and quality of the water in the Nation's streams, lakes, and reservoirs; changes in ground-water levels; and the quality of ground water.

The purpose of this report is to describe the number, distribution, and source of funding of hydrologic data-collection stations operated during fiscal year (FY) 1991. Similar reports have been prepared previously for fiscal years 1983, 1985, 1987, and 1989 (Condes de la Torre, 1983, 1985, 1987, and 1989). A summary and analysis is provided of the number of hydrologic stations operated from FY 1983 to FY 1991. The sources of funding support for the stations are the Geological Survey's Federal Program appropriation, the Federal-State Cooperative Program, and reimbursements from other Federal agencies, or a combination of these (table 1).

TABLE 1 -- Types and number of hydrologic data collection stations operated by the U.S. Geological Survey during the 1991 fiscal year and the sources of funding support.

Type of station	Number of Stations by Source of Funding						
	Single Program Support			Combined Support			
	Federal Program (Federal)	State Cooperative Program (COOP)	Reimbursement from other Federal Agencies (OFA)	Federal, COOP, OFA	Federal, COOP, OFA	Federal, COOP, OFA	Total Stations
SURFACE WATER							
<u>Discharge</u>							
Continuous Record	517	4,057	1,866	257	150	462	7,346
Partial Record	47	2,670	324	47	17	14	3,127
<u>Stage Only - Streams</u>							
Continuous Record	12	251	277	5	5	36	586
Partial Record	10	241	47	1	1	110	410
<u>Stage Only - Lakes & Reservoirs</u>							
Continuous Record	15	398	372	14	1	8	808
Partial Record	9	225	85	1	1	1	322
<u>Quality</u>							
Continuous Record	28	378	174	22	8	41	653
Scheduled, Long-term Operation	486	1,462	238	76	15	44	2,322
Short-term or Project Stations	125	544	196	73	0	5	943
GROUND WATER							
<u>Water Levels</u>							
Continuous Record	137	2,005	131	93	0	10	2,376
Scheduled, Long-term Operation	1,334	22,085	1,035	268	0	28	24,750
Short-term or Project Stations	1,102	5,292	1,910	332	0	0	8,636
<u>Quality</u>							
Scheduled, Long-term Operation	261	3,608	380	167	0	0	4,416
Short-term or Project Stations	647	2,273	933	317	0	0	4,199
SEDIMENT							
Daily Sampling	21	63	72	1	8	1	168
Periodic Sampling	420	228	187	27	2	0	865
PRECIPITATION							
Quantity	109	734	612	18	8	2	1,484
Quality	34	25	5	0	0	0	65

In 1983, the Geological Survey established a standard system for counting hydrologic stations so that the type of stations being counted and compared would be consistent from year to year. In 1985, the number of items to be counted was increased to include daily and periodic sediment sampling data and information on data-collection platforms. For this reason, the hydrologic information presented in this report begins in either 1983 or 1985.

For the purpose of this report, "project" refers to a hydrologic investigation conducted by the Geological Survey, and a "scheduled, long-term operation" station is one at which measurements are made or samples are taken on a fixed-time interval over an indefinite period. Also, "continuous" and "continuous record" are used interchangeably.

HYDROLOGIC DATA COLLECTION STATIONS

Surface Water Data

Surface-water discharge (flow) was determined by the U.S. Geological Survey at 10,473 stations in FY 1991. At 7,346 of these stations, continuous-discharge records were computed. That is, records were kept such that the flow can be determined for any moment during any day. At 3,127 other streamflow stations, partial records were collected. For example, at a station where the sole interest is in peak flows, data are collected and recorded only at stages greater than some pre-determined level. The number of stations in each State where continuous surface-water discharge data were collected ranged from 768 in California to 14 in Delaware (figure 1). The Federal-State Cooperative Program funded operation of the largest number of continuous streamflow-discharge stations; it provided sole support for 4,057 stations (figure 2), and in combination with other sources, provided support for 756 more (table 1). The Federal-State Cooperative Program also funded the largest number of partial-record discharge stations; it provided sole support of 2,670 stations (figure 3), and in combination with other sources, 69 more.

The number of continuous-record surface-water discharge stations increased from 7,152 stations in FY 1983 to 7,346 stations in FY 1991 (figure 4). During the same period, the total number of surface-water discharge stations decreased by 603, to 10,473 stations in FY 1991. The change reflects decreases in some States and increases in others (figure 5). In Virginia, for example, 215 partial-record stations were discontinued between FY 1985 and FY 1987 when a multi-year program to develop state-wide low flow regression equations reached the end of the data-collection phase. In Louisiana, 102 partial-record stations were discontinued in 1987 after an analysis showed that, with the data presently available, regression equations could define flood flows well enough to meet existing needs. In California, the increased number of continuous-record discharge stations from FY 1983 to FY 1989 reflects an increase in the monitoring of hydropower development.

Stage-only data were collected by the Geological Survey at 996 stream stations. The number of stage-only data stations on streams ranged from 167 in Florida to none in several states (figure 6). The reimbursement from other Federal agencies supported the largest number of continuous stage-only stations--277 (figure 7)--while the Federal-State Cooperative Program supported the most partial-record stage-only stations--241 (figure 8). The number of continuous-record stations collecting stage-only data on streams increased from 1983 to 1991 (figure 9) whereas the number of partial-record stations decreased.

Stage data were also collected at 1,130 stations on lakes and reservoirs by the Geological Survey. Continuous records of stage were collected at 808 lake and reservoir stations, ranging from 150 in California to none in several states (figure 10). The Federal-State Cooperative Program supported the largest number of continuous-record stations (figure 11) and the largest number of partial-record (figure 12) stage stations on lakes and reservoirs. The number of stage stations on lakes and reservoirs decreased from 1,246 in FY 1983 to 1,130 in FY 1990 (figure 13).

Stream samples were collected and analyzed for water-quality characteristics at 3,265 stations across the nation (figure 14). The types of water-quality parameters measured vary from site to site. Field determinations could include those for temperature, specific conductance, pH, dissolved oxygen, fecal coliform, and fecal streptococci. Laboratory determinations could include those for common constituents such as calcium, magnesium, fluoride, sodium, potassium, dissolved solids, silica, chloride, sulfate, hardness, bicarbonate, carbonate, and turbidity; for major nutrients such as phosphorus, ammonia, nitrite, and nitrate; trace metals such as arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, selenium, and zinc; and for selected radiochemical parameters. A continuous record was maintained at 653 of these sites (figure 15), mainly for water temperature and conductance, but other properties, such as dissolved oxygen concentrations and pH, were also recorded continuously at times. The surface-water quality stations at which a continuous record is maintained are also counted as either (a) scheduled, long-term operation stations, or (b) short-term project stations; therefore, the sum of (a) and (b) represents the total stations of this type.

Water-quality data were collected at 2,322 stream sites as part of a scheduled, long-term operation (figure 16). These include 411 stations, supported in the Survey's Federal Program, which make up the National Stream Quality Accounting Network (NASQAN). NASQAN was established by the U.S. Geological Survey to provide a uniform basis for continually assessing the quality of water in the United States streams. An identical suite of water-quality characteristics is measured at each NASQAN station using the same set of procedures concerning sample-collection techniques, frequency of sampling, and analytical methods (Briggs and Ficke, 1977). There were 943 stations which were sampled as short-term or project stations (figure 17). The collection of surface-water quality data received its largest funding support from the Federal-State Cooperative Program for all types of stations.

The number of stations at which surface-water quality data were collected on a scheduled, long-term basis increased in some states, but the overall total declined from 2,906 in 1983 to 2,322 in 1991 (figure 18). In Wyoming, for example, the number of scheduled, long-term sampling stations was reduced from 1983 to 1991 when the State's emphasis changed from analyses for major dissolved constituents to more expensive analyses for pesticides and herbicides. Thus, in order to accommodate to a static level of available funds, the number of sampling stations had to be decreased (figure 19). The number of short-term or project stations increased slightly during the same period. (figure 20).

Ground Water Data

Ground water is one of the most widely available of the Nation's natural resources. It is estimated that 74 billion gallons per day of ground water are withdrawn in the United States for public supply domestic, commercial, irrigation, livestock, industrial, mining, and thermo-electric uses (Solley and others, 1988). Water-level fluctuations are indicators of the stresses (both natural and man-induced) placed on aquifers, their ability to yield water, and the quantity of water in storage beneath the earth's surface. The U.S. Geological Survey collected information on ground-water levels at 33,386 sites in 1991 (figure 21). Data on water levels were collected continuously at 2,376 sites, of which 2,005 were funded in total by the Federal-State Cooperative Program (figure 22). The stations at which a continuous record of ground-water levels is maintained are also counted as either (a) scheduled, long-term operation stations, or (b) short-term project stations; therefore, the sum of (a) and (b) represents the total stations of this type.

Ground-water levels were collected at 24,750 stations as part of a scheduled, long-term operation to assess long-term trends (figure 23). When special area studies were conducted, water levels were at times collected at short-term or project stations to supplement the information available in the area from the long-term stations. In 1991, water-level data were collected at 8,636 stations for these investigations (figure 24). The Federal-State Cooperative Program provided total funding support for 61 percent of these stations.

From FY 1983 to 1991, the number of scheduled, long-term operation ground-water level stations increased from 24,047 in 1983 to 24,750 in 1991 (figure 25). The number of stations at which data on ground-water levels were collected continuously also increased from 1,982 in 1983 to 2,376 in 1991. Meanwhile, the short-term or project stations increased from 9,592 in 1983 to 11,994 in 1985, and then decreased to 8,636 in 1991.

The change in number of stations at which scheduled, long-term operation ground-water levels were collected from 1983 to 1991 varied from an increase of 1,854 stations in New Mexico to a decrease of 751 stations in Louisiana (figure 26). The change in the number of short-term or project stations at which ground-water levels were collected during the same period also varied from state to state (figure 27).

In 1991, samples of ground water from 8,615 stations were analyzed (figure 28). To maintain information on the changes in quality of critical ground-water bodies, samples were collected at 4,416 stations as part of a scheduled long-term operation (figure 29). Of these, sampling at 3,608 stations was funded in total by the Federal-State Cooperative Program. Ground-water quality data were also collected at 4,199 stations to provide information needed for short-term, generally site-specific studies (figure 30).

Across the country, the number of stations at which ground-water quality samples were collected increased from 7,648 in 1983 to 9,756 in 1986 and then decreased to 8,615 in 1991 (figure 31). There were increases in some states and decreases in others. In Iowa, for example, a major ground-water investigation underway in cooperation with two Iowa state agencies, called for an increased number of scheduled, long-term ground-water quality stations (figure 32). In New Jersey, studies of ground-water quality, in cooperation with the State of New Jersey, required additional short-term or project stations (figure 33).

Sediment Data

Data are needed to evaluate the effect of sediment deposition on reservoir storage; the influence of infrequent large storms on erosion and transport of sediment; and the effects of urban and rural non-point contributions of sediment and the associated transport and fate of nutrients, toxic metals, and organic substances. Burkham (1985) states: "The U.S. Geological Survey (USGS) and other Federal, State, and local agencies obtain records of suspended-sediment discharge at many sites throughout the United States. The use of these records has greatly increased in recent years. Uses involve the evaluation of sediment transport to the oceans, geomorphological studies of denudation and rates of erosion, assessment of soil erosion and soil loss, reservoir sedimentation, general environmental impact assessment, water treatment problems of sediment-associated nutrients and pollutants, and evaluation of the precise impacts of humans."

New field techniques to collect suspended sediment samples are being tested to determine whether or not they produce a representative sample of sediment for chemical analysis. These techniques will be of use in determining the fate of toxic substances in river systems. The movement of sediment into reservoirs and estuaries, and the associated chemical processes, must be understood because sediment can provide a potential source of toxic substances that could have a serious impact on the local biota and the food chain, as well as directly on water supplies.

To help address the problems and issues of sediment in rivers, the Geological Survey collected daily sediment data at 168 stations, and periodic data at 865 other stations (figure 34). This represents a reduction of 44 and 162 stations, respectively, from 1985 to 1991 (figure 35). Reimbursements from other Federal agencies provided support for 43 percent of the daily sampling stations (figure 36), and the Federal program provided support for 49 percent of the periodic sampling stations (figure 37).

Precipitation Data

Collection of precipitation data by the Geological Survey is undertaken only as part of an investigation of a specific hydrologic system. Most of the time, precipitation data from the National Weather Service are used in Geological Survey investigations. Precipitation data were collected at 1,484 sites nationwide (figure 38). At 65 of these sites, quality of precipitation was determined. The largest support for the collection of precipitation quantity (figure 39) and quality (figure 40) data came from the Federal-State Cooperative Program and the Federal Program, respectively. The number of sites at which precipitation data were collected increased from 800 in 1983 to 1,484 in 1991 (figure 41).

SATELLITE TELEMETRY OF HYDROLOGIC DATA

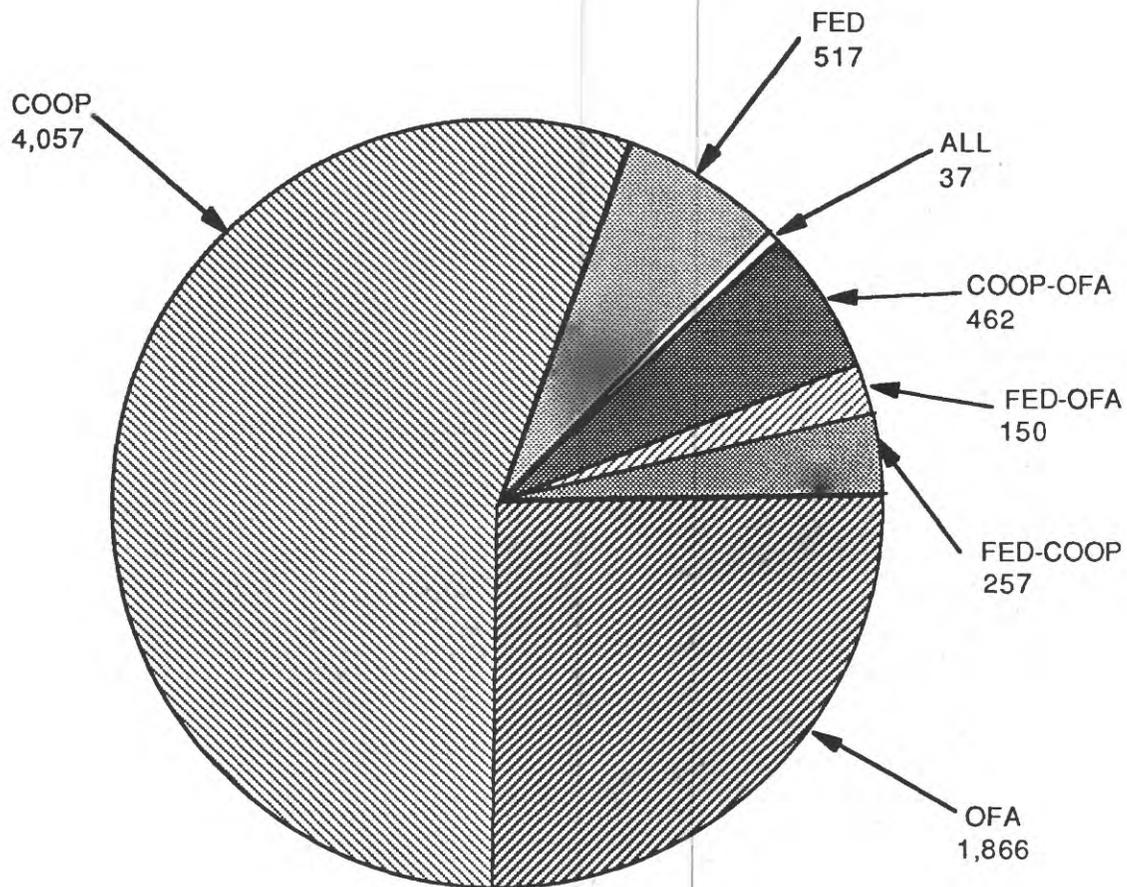
Satellite telemetry is playing an increasing role in the collection of hydrologic data in real time. A satellite data-collection system consists of a data-collection platform (which is a small battery-operated radio), an earth-orbiting satellite, and an earth receive and data-processing station. The demand for a cost-effective means of collecting hydrologic data in real time for hazard-warning systems and water management has increased rapidly (Paulson and Shope, 1984). In 1991, data-collection platforms were located in 3,210 U.S. Geological Survey hydrologic data-collection stations and were transmitting data on one, or a combination, of the following parameters: stream stage or discharge, reservoir stage, water quality, and precipitation (figure 42). There were 2,492 stations at which data-collection platforms were operated by the U.S. Geological Survey and 718 U.S. Geological Survey stations at which the data-collection platforms were operated by others. About two-thirds of the funding for the operation of the data-collection platforms is provided by other Federal agencies (figure 43). The number of data-collection platforms located in U.S. Geological Survey hydrologic stations increased from 1,520 in 1985 to 3,210 in 1991 (figure 44).

SUMMARY

The U.S. Geological Survey operates an extensive, nationwide network for the collection of hydrologic data. The surface-water data include information on discharge and stage of streams, stages of lakes and reservoirs, and surface-water quality. Data are also collected on ground-water levels and the quality of ground water. Data on sediment are collected on a daily and periodic basis. Data on the quantity and quality of precipitation are usually collected only in selected study areas. Satellite telemetry is being used to collect hydrologic data in real time. From FY 1983 to FY 1991 the total number of surface-water discharge stations declined. The number of continuous-record discharge stations increased, surface-water quality stations declined, ground-water level stations declined slightly, and ground-water quality stations increased.

REFERENCES CITED

- Briggs, J.D., and Ficke, J.F., 1977, Quality of rivers of the United States, 1975 water year--based on the National Stream Quality Accounting Network (NASQAN): U.S. Geological Survey Open-File Report 78-200, 436 p.
- Burkham, D.C., 1985, An approach for appraising the accuracy of suspended-sediment data: U.S. Geological Survey Professional Paper 1333, 18 p.
- Condes de la Torre, A., 1983, Operation of hydrologic data-collection stations by the U.S. Geological Survey in 1983: U.S. Geological Survey Open-File Report 83-862, 29 p.
- _____, 1985, Operation of hydrologic data-collection stations by the U.S. Geological Survey in 1985: U.S. Geological Survey Open-File Report 85-640, 37 p.
- _____, 1987, Operation of hydrologic data-collection stations by the U.S. Geological Survey in 1987: U.S. Geological Survey Open-File Report 87-563, 42 p.
- _____, 1989, Operation of hydrologic data-collection stations by the U.S. Geological Survey in 1989: U.S. Geological Survey Open-File Report 90-171, 52 p.
- Paulson, R.W., and Shope, W.G., Jr., 1984, Development of earth satellite technology for the telemetry of hydrologic data: Water Resources Bulletin, v. 20, no. 4, p. 611-618.
- Solley, W.B., Merk, C.F. and Pierce, R.R., 1988, Estimated Use of Water in the United States in 1985: U.S. Geological Survey, Circular 1004, 82 p.



TOTAL STATIONS = 7,346

EXPLANATION

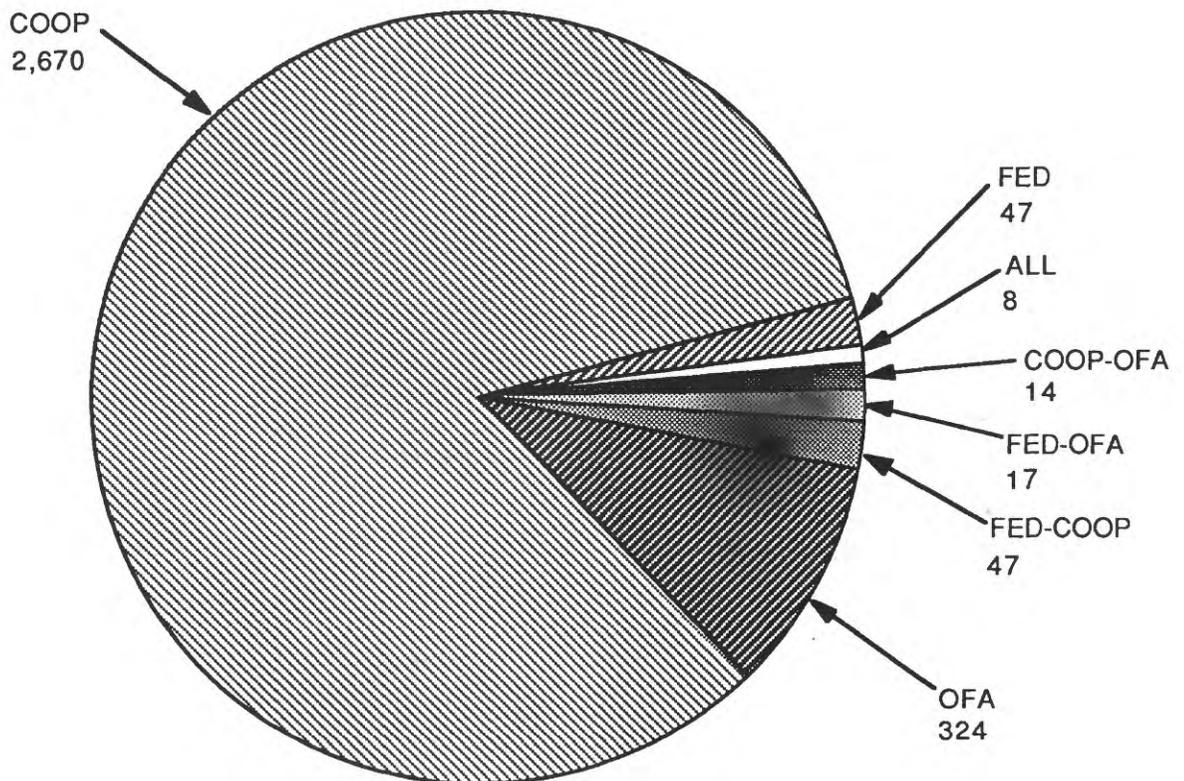
SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies
- FED-OFA = Federal and Other Federal Agencies
- ALL = FED and OFA and COOP

Figure 2.--Number of continuous surface-water discharge stations, and sources of funding support, fiscal year 1991.



TOTAL STATIONS = 3,127

EXPLANATION

SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies
- FED-OFA = Federal and Other Federal Agencies
- ALL = FED and OFA and COOP

Figure 3.--Number of partial record surface-water discharge stations, and sources of funding support, fiscal year 1991.

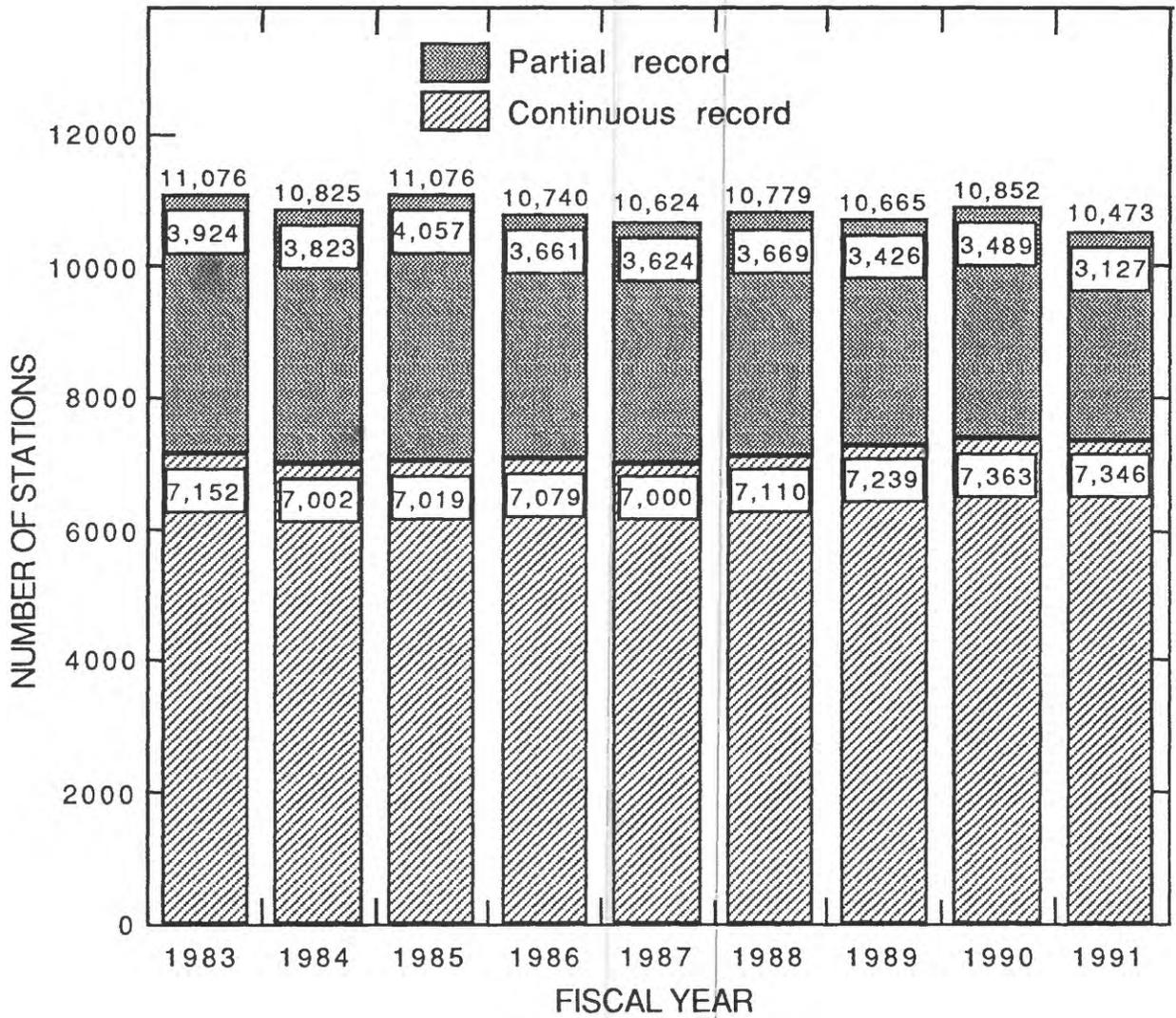


Figure 4.--Number of stations, by year, at which surface-water discharge data were collected from fiscal year 1983 to 1991.

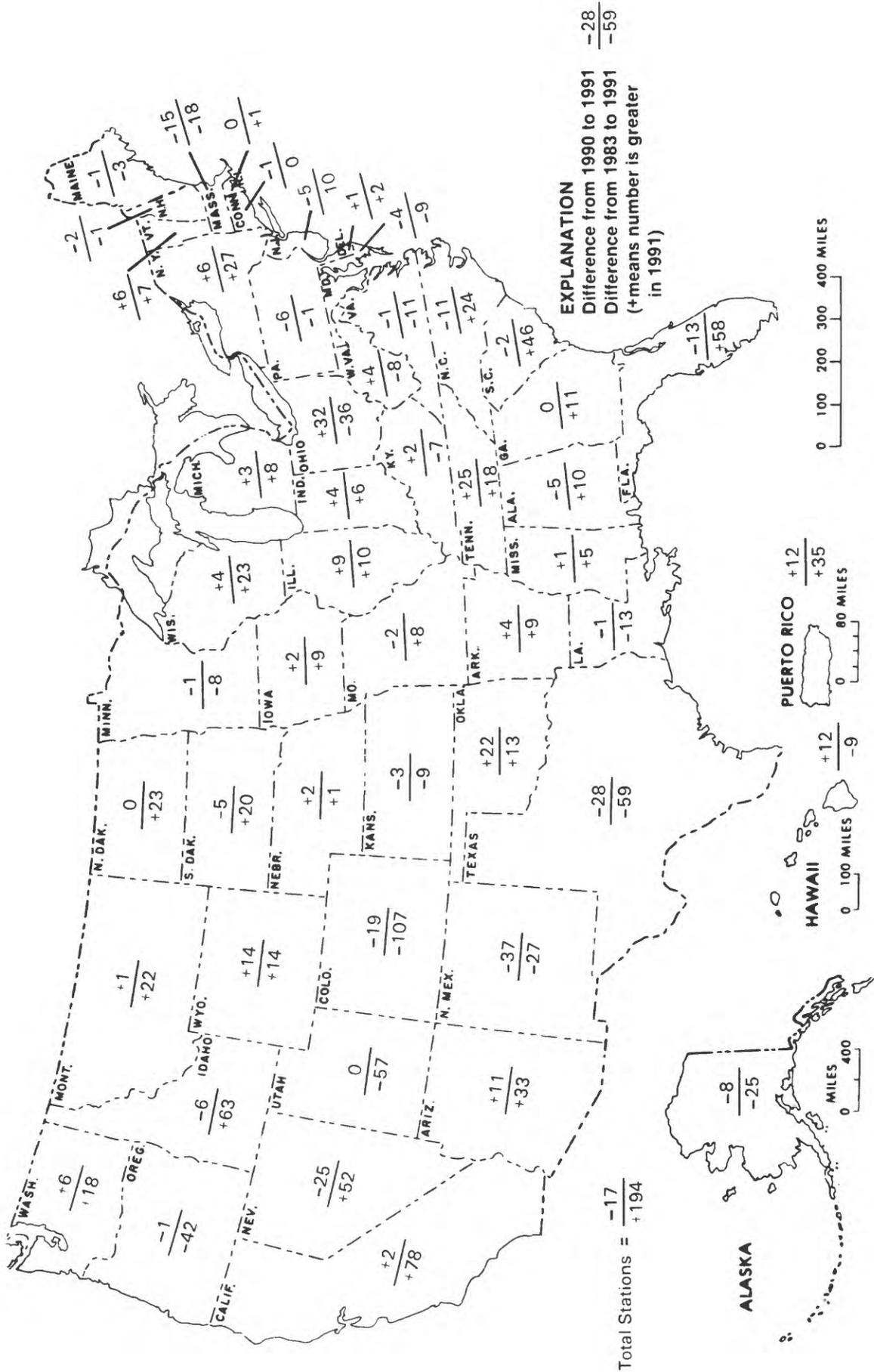


Figure 5.--Change in number of stations, by State, at which continuous surface-water discharge data were collected from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.

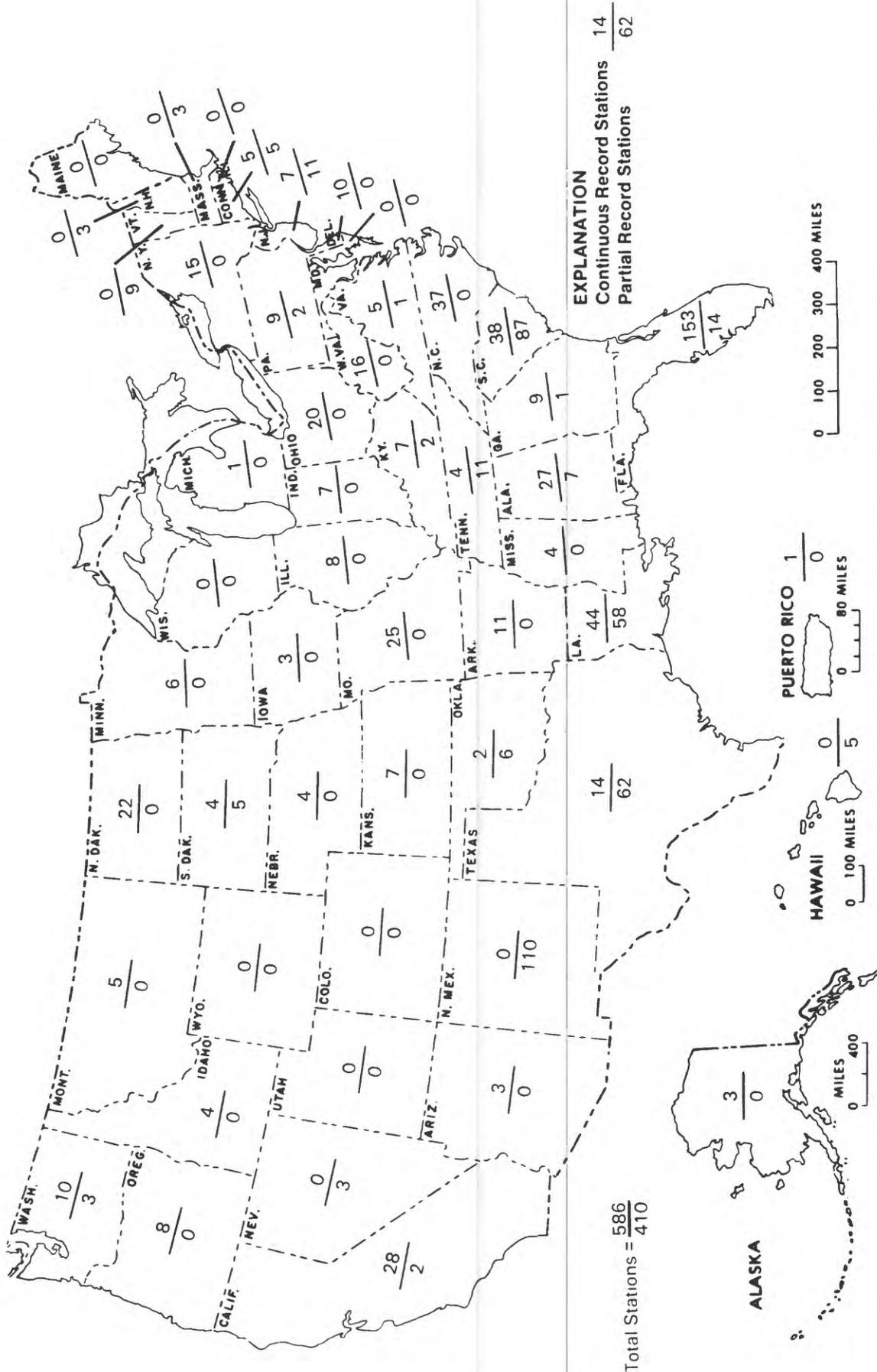
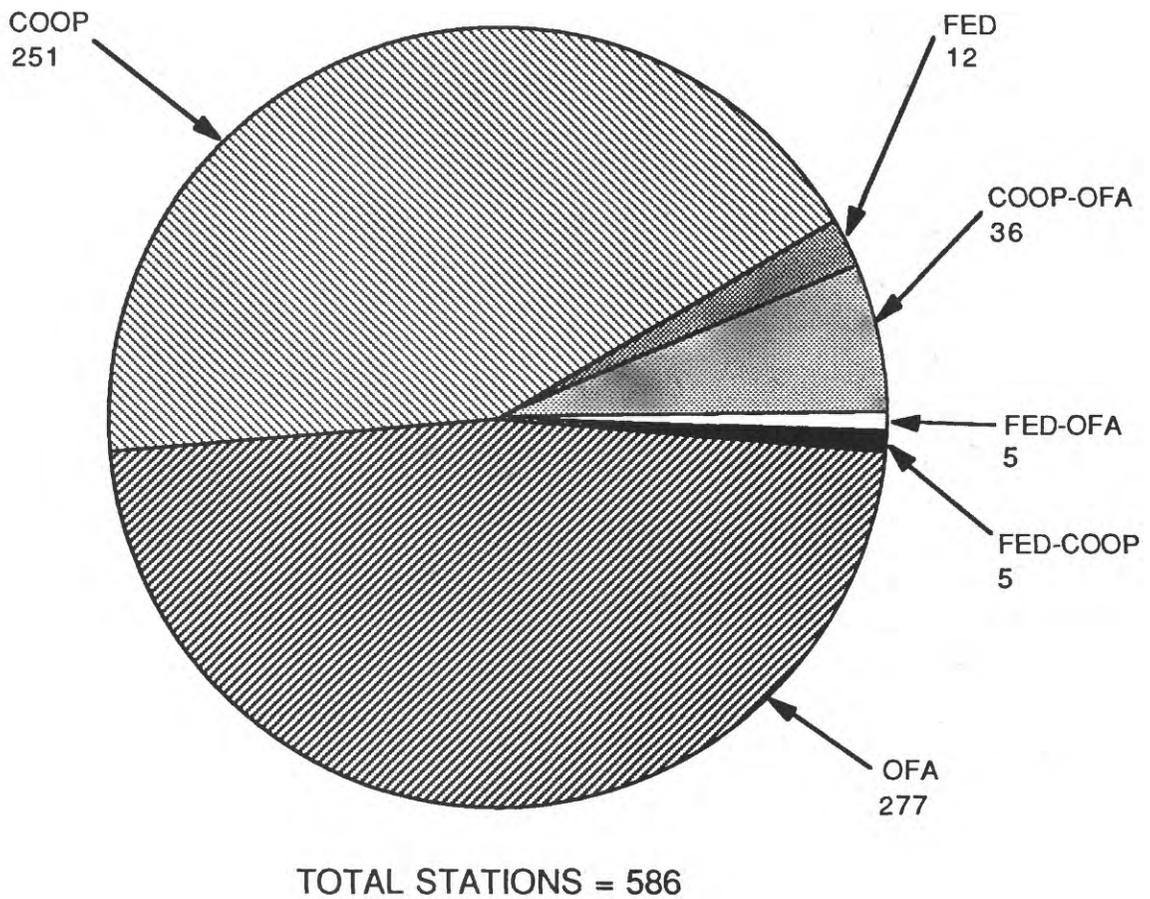


Figure 6.--Number of stations, by State, at which stage-only data were collected on streams in fiscal year 1991.



EXPLANATION

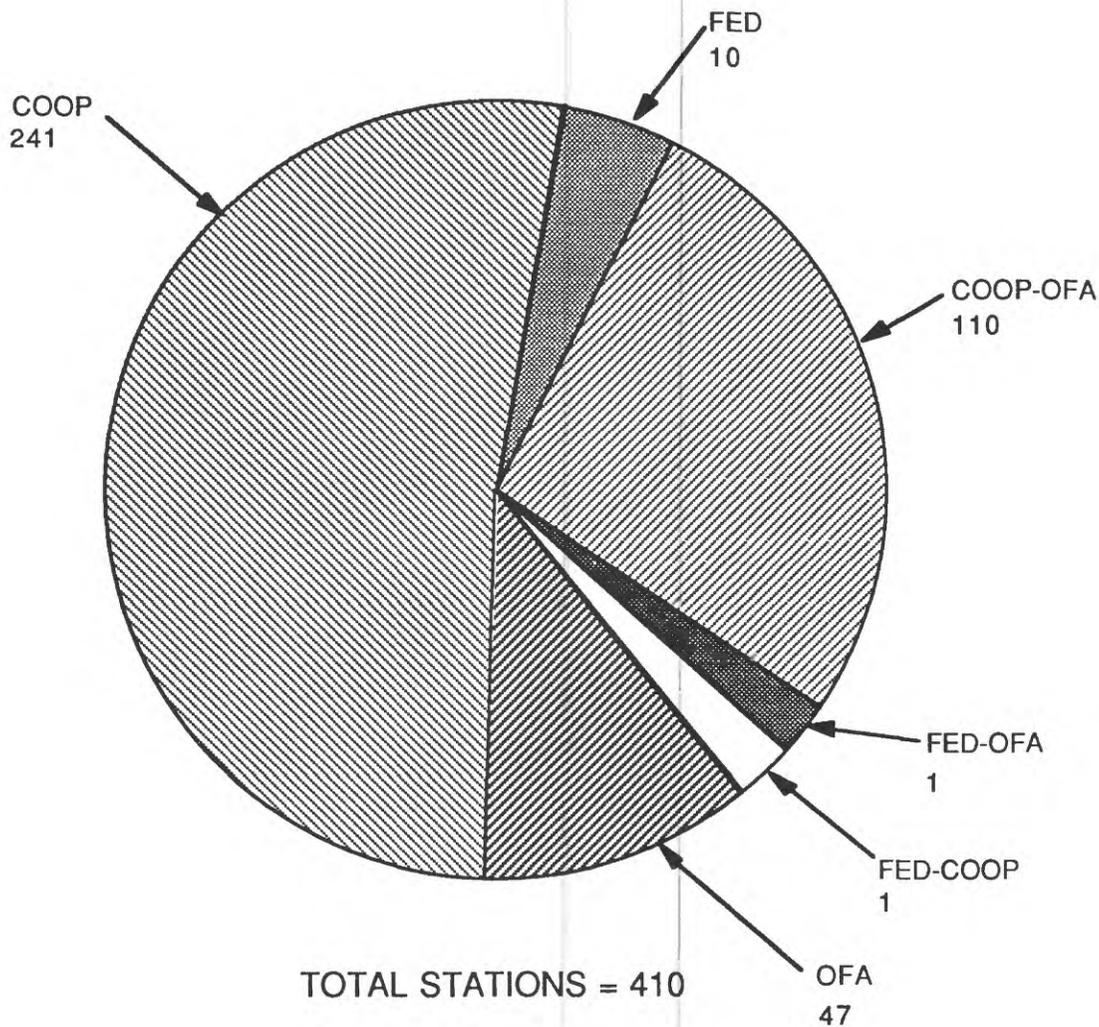
SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies
- FED-OFA = Federal and Other Federal Agencies

Figure 7.--Number of continuous surface-water stage-only stations on streams, and sources of funding support, fiscal year 1991.



EXPLANATION

SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies
- FED-OFA = Federal and Other Federal Agencies

Figure 8.--Number of partial record surface-water stage-only stations on streams, and sources of funding support, fiscal year 1991.

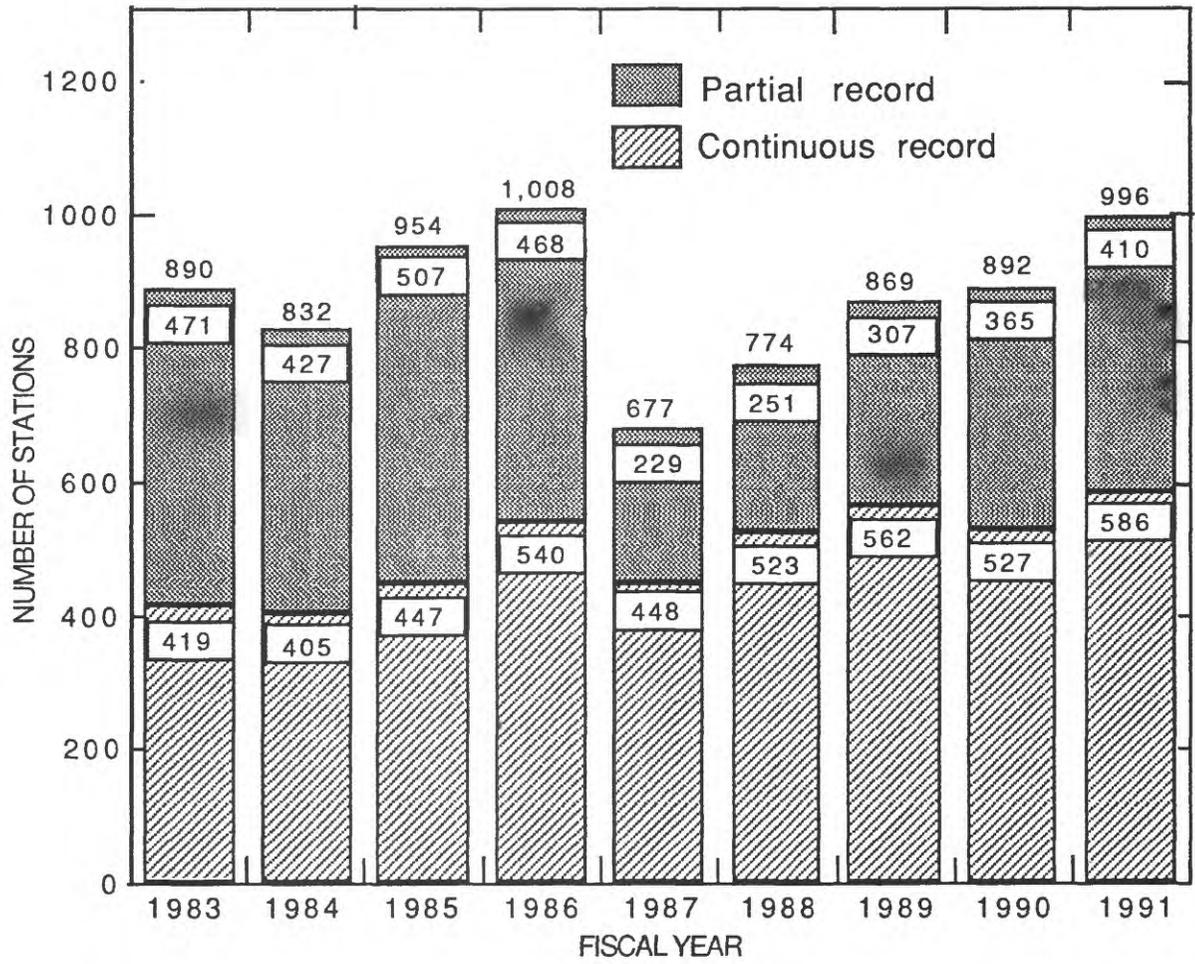
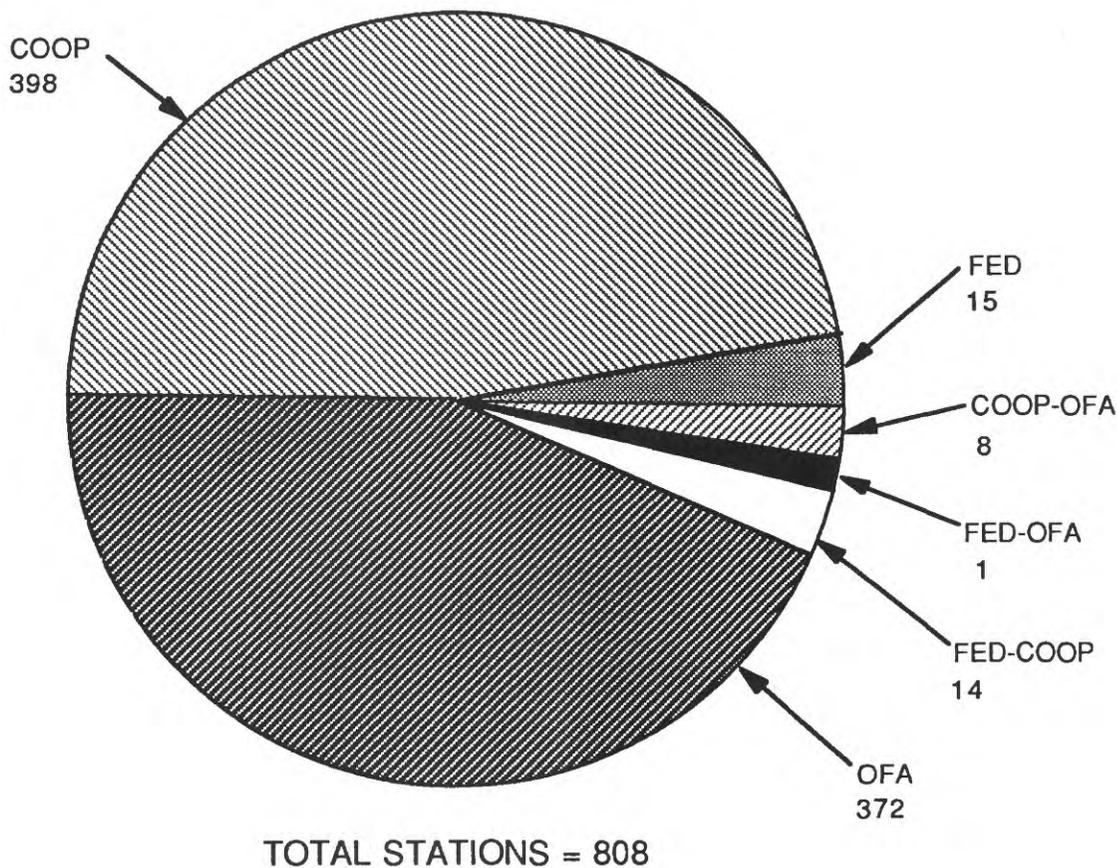


Figure 9.--Number of stations, by year, at which stage-only data were collected on streams from fiscal year 1983 to 1991.



EXPLANATION

SINGLE PROGRAM SUPPORT

FED = Federal

OFA = Other Federal Agencies

COOP = Federal - State Cooperative Program

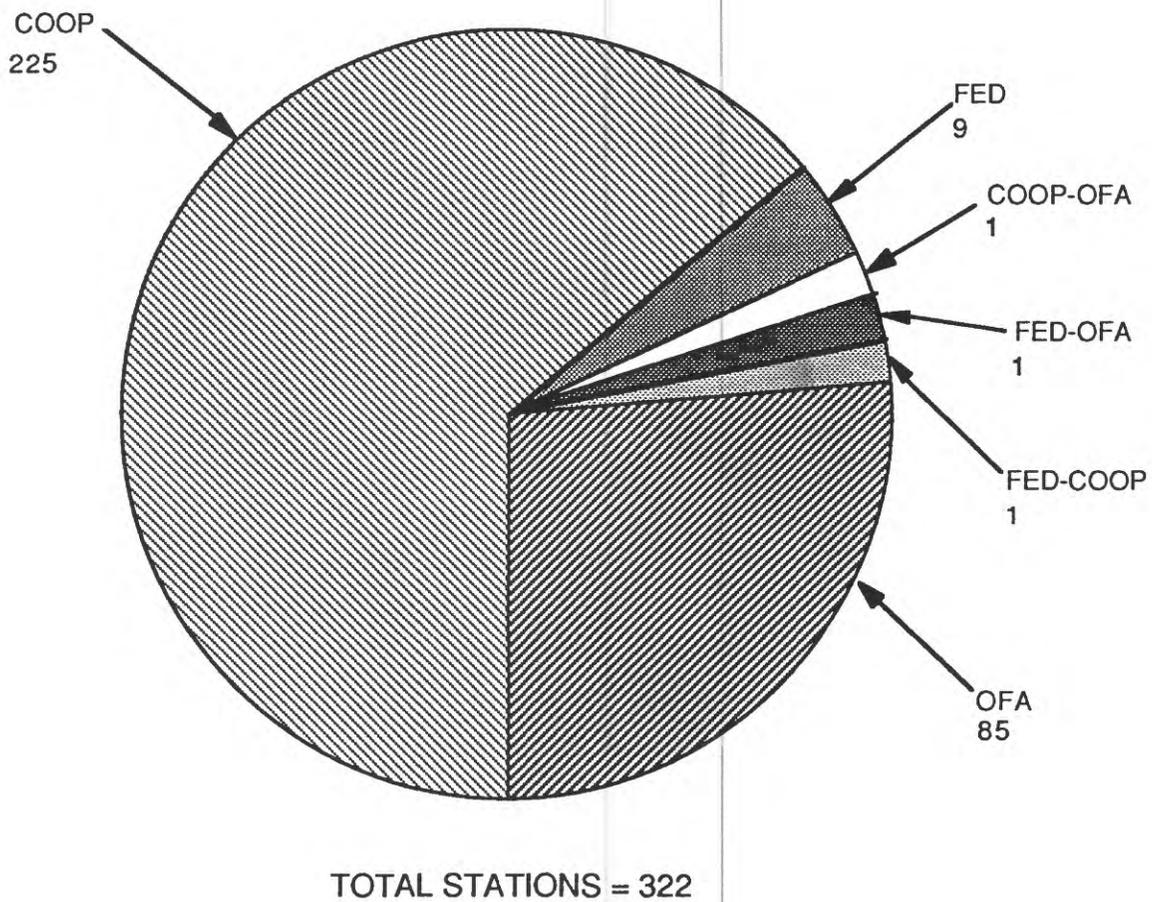
COMBINED PROGRAM SUPPORT

FED - COOP = Federal and Federal - State Cooperative Program

COOP-OFA = Federal - State Cooperative Program and Other
Federal Agencies

FED-OFA = Federal and Other Federal Agencies

Figure 11.--Number of continuous surface-water stage stations on lakes and reservoirs, and sources of funding support, fiscal year 1991.



EXPLANATION

SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies
- FED-OFA = Federal and Other Federal Agencies

Figure 12.--Number of partial record surface-water stage stations on lakes and reservoirs, and sources of funding support, fiscal year 1991.

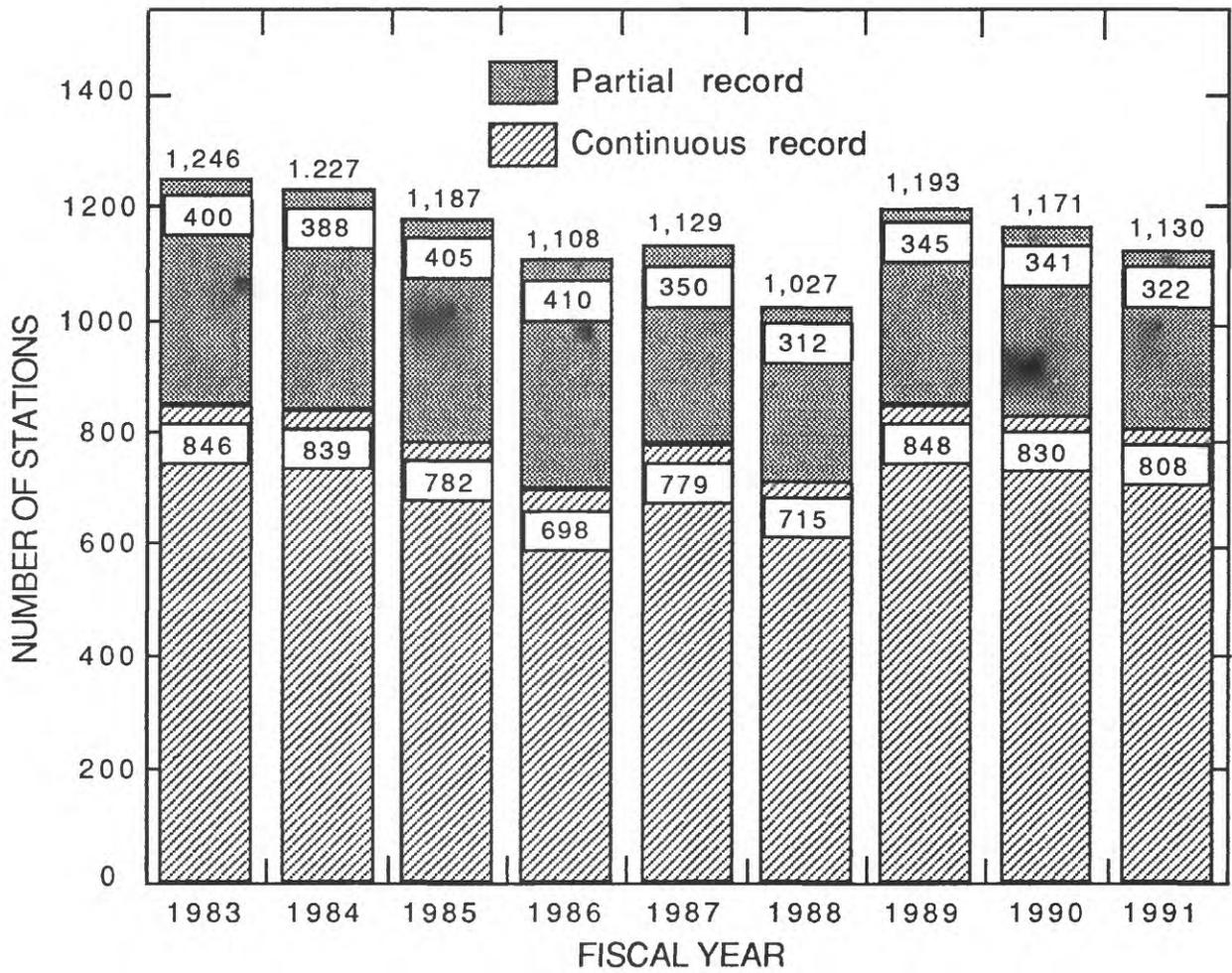
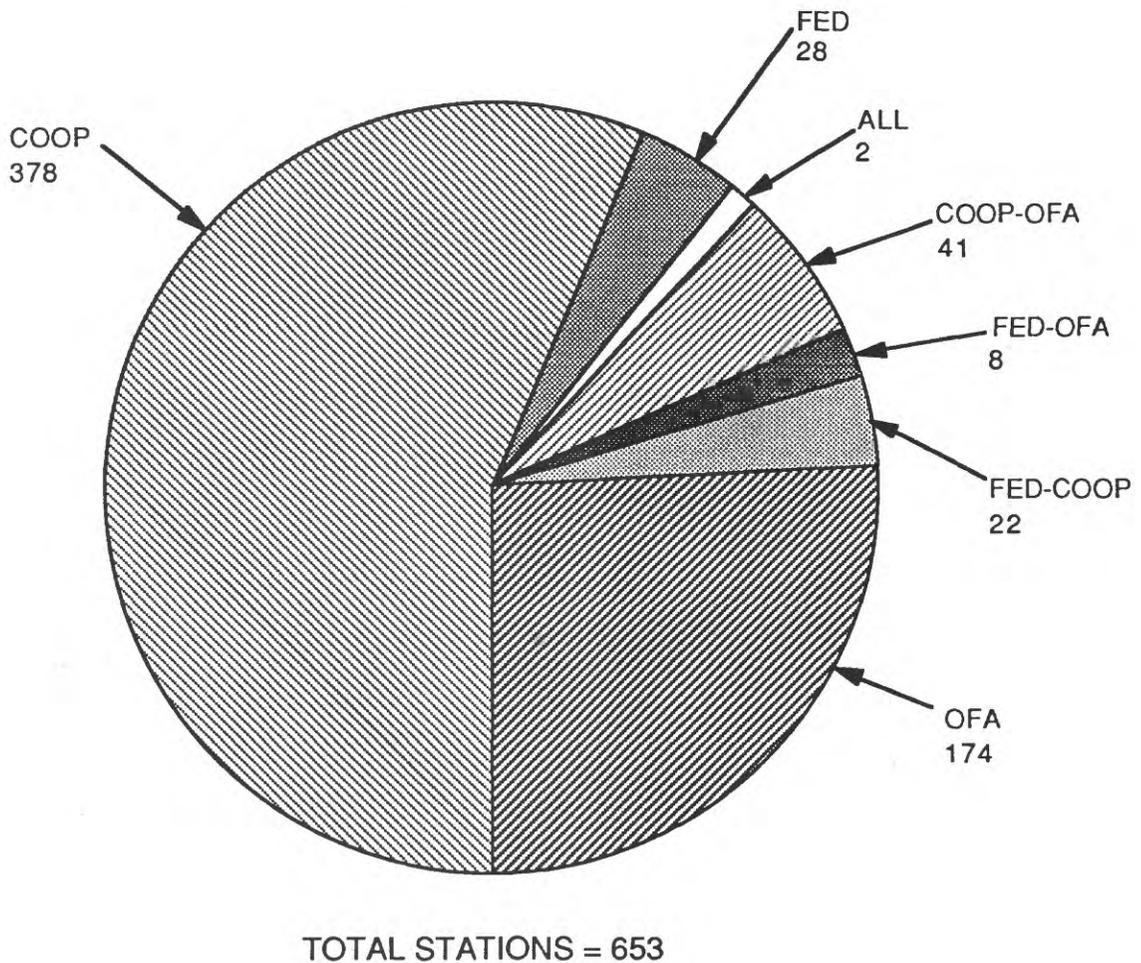


Figure 13.--Number of stations, by year, at which surface-water stage data were collected on lakes and reservoirs from fiscal year 1983 to fiscal year 1991.



EXPLANATION

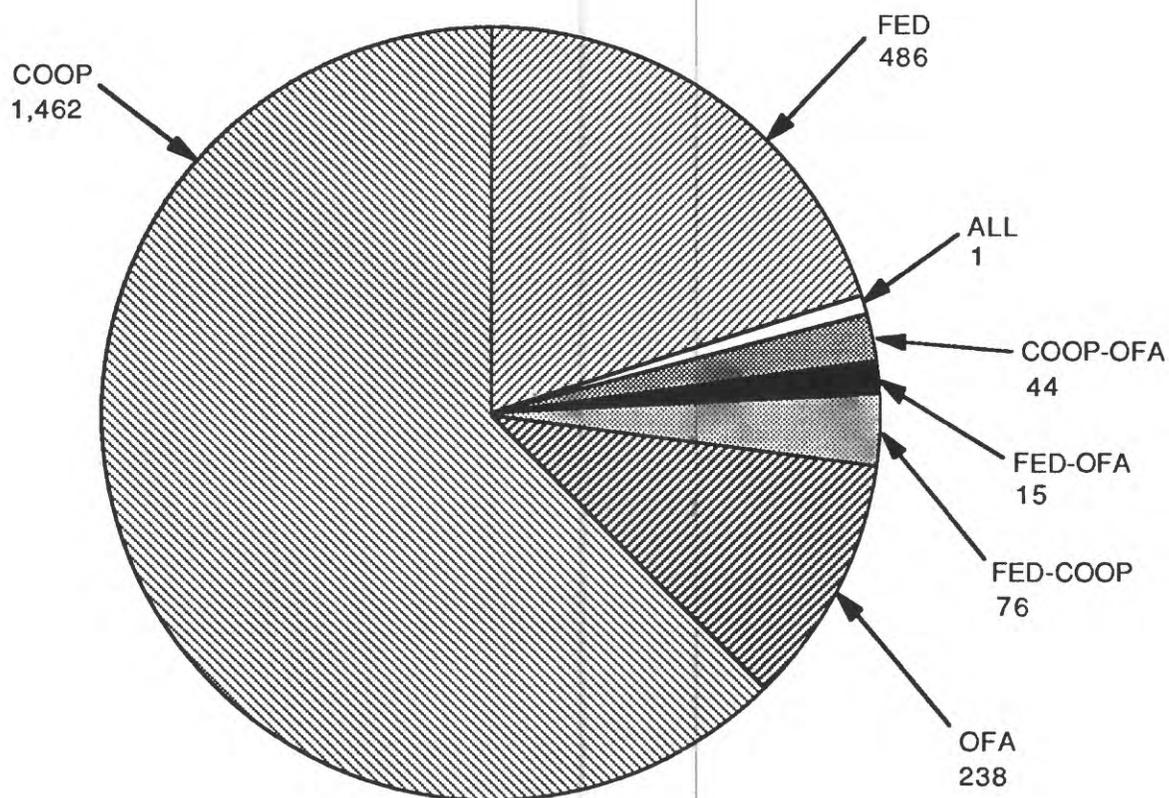
SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies
- FED-OFA = Federal and Other Federal Agencies
- ALL = FED and OFA and COOP

Figure 15.--Number of continuous surface-water quality stations, and sources of funding support, fiscal year 1991.



TOTAL STATIONS = 2,322

EXPLANATION

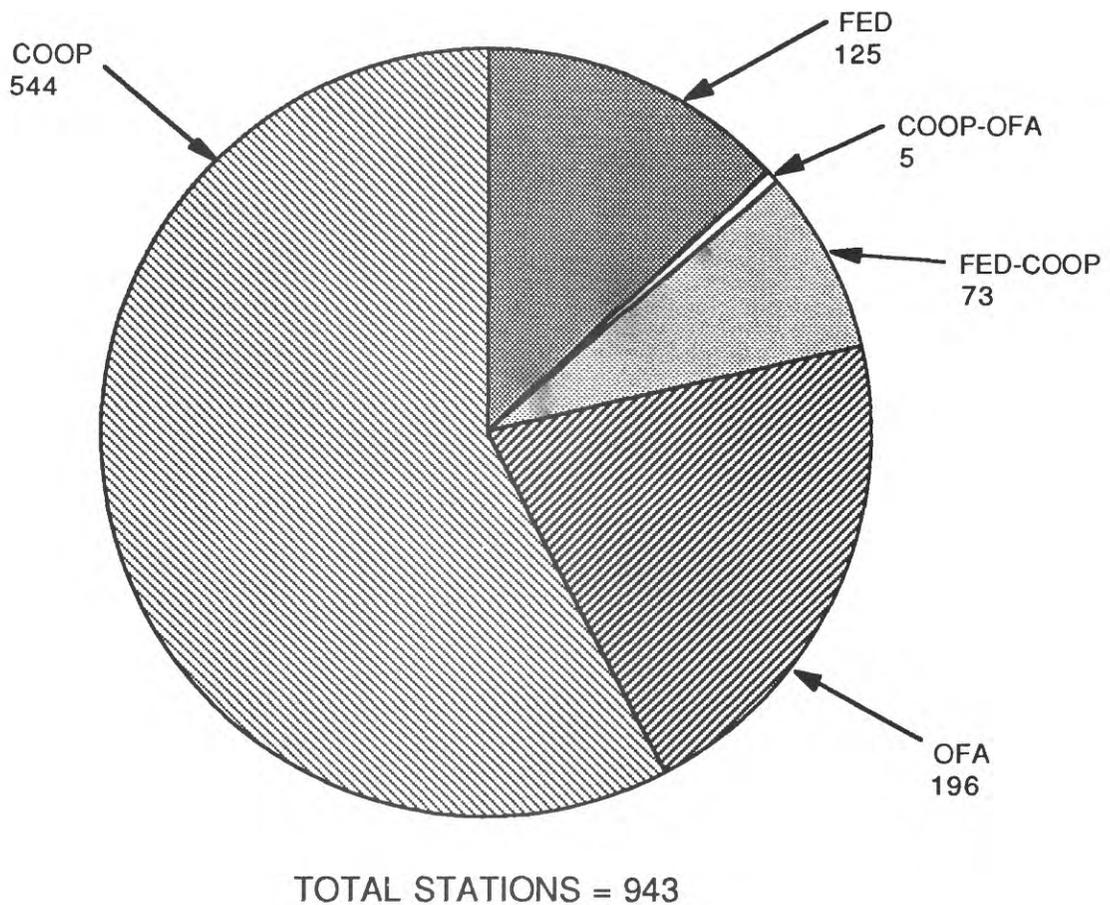
SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies
- FED-OFA = Federal and Other Federal Agencies
- ALL = FED and OFA and COOP

Figure 16.--Number of scheduled, long-term operation surface-water quality stations, and sources of funding support, fiscal year 1991.



EXPLANATION

SINGLE PROGRAM SUPPORT

FED = Federal

OFA = Other Federal Agencies

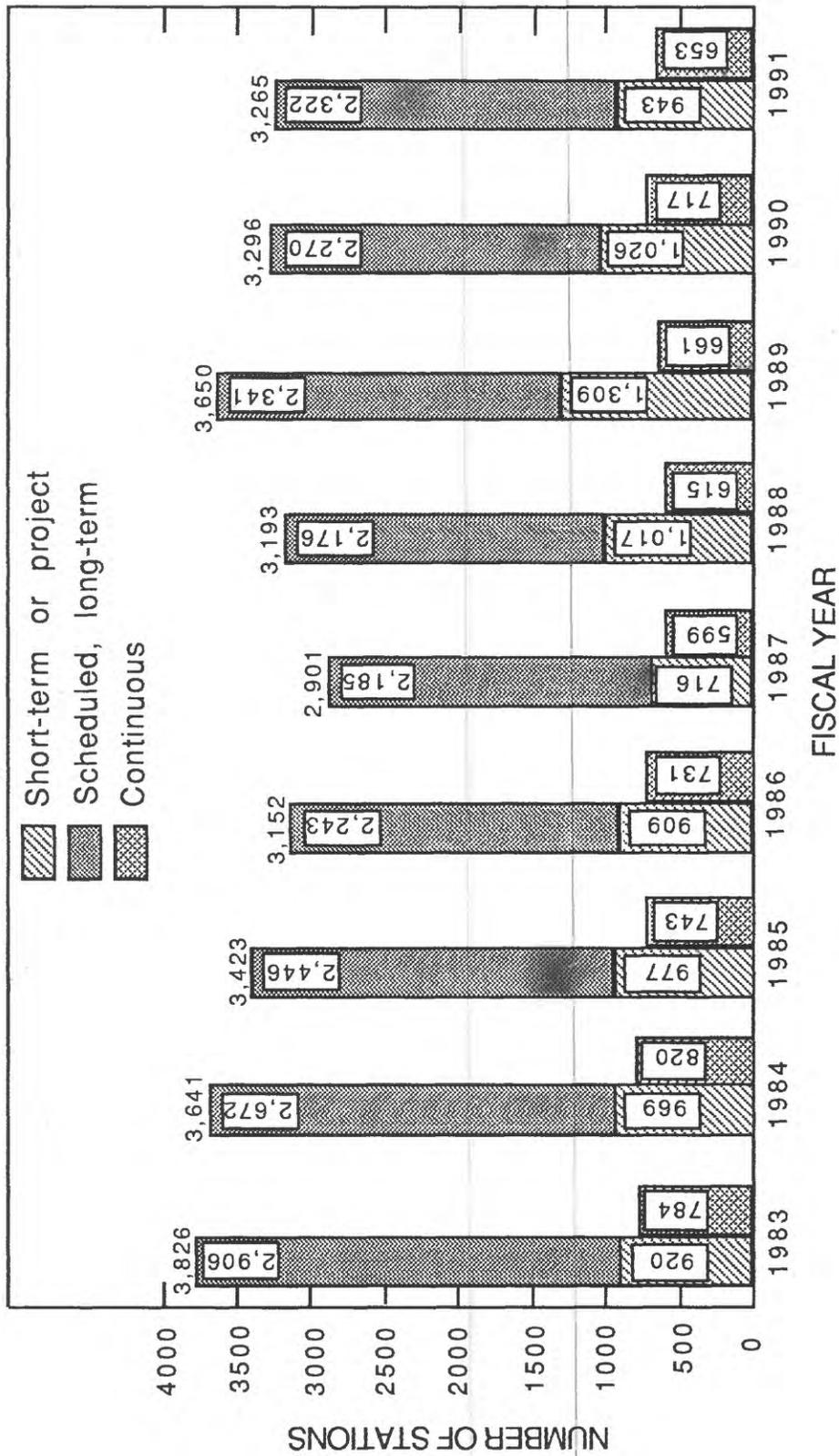
COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

FED - COOP = Federal and Federal - State Cooperative Program

COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies

Figure 17.--Number of short-term or project surface-water quality stations, and sources of funding support, fiscal year 1991.



NOTE: The annual totals shown reflect that the number of stations in the "continuous" category are counted in either the "scheduled, long-term" or the "short-term, or project" categories.

Figure 18. ---Number of stations, by year, at which surface-water quality data were collected from fiscal year 1983 to 1991.

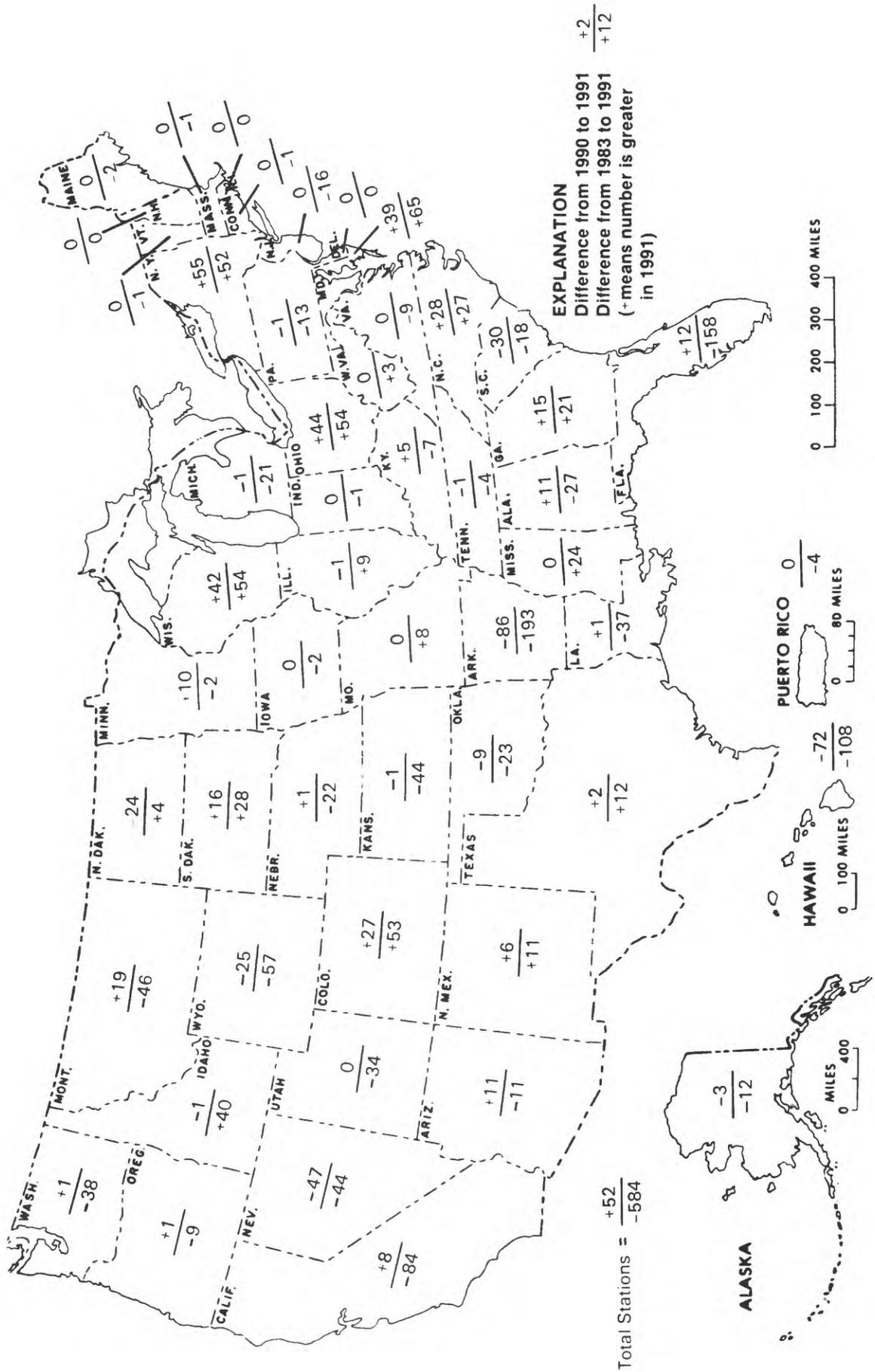


Figure 19.--Change in number of stations, by State, at which scheduled, long-term operation surface-water quality data were collected from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.

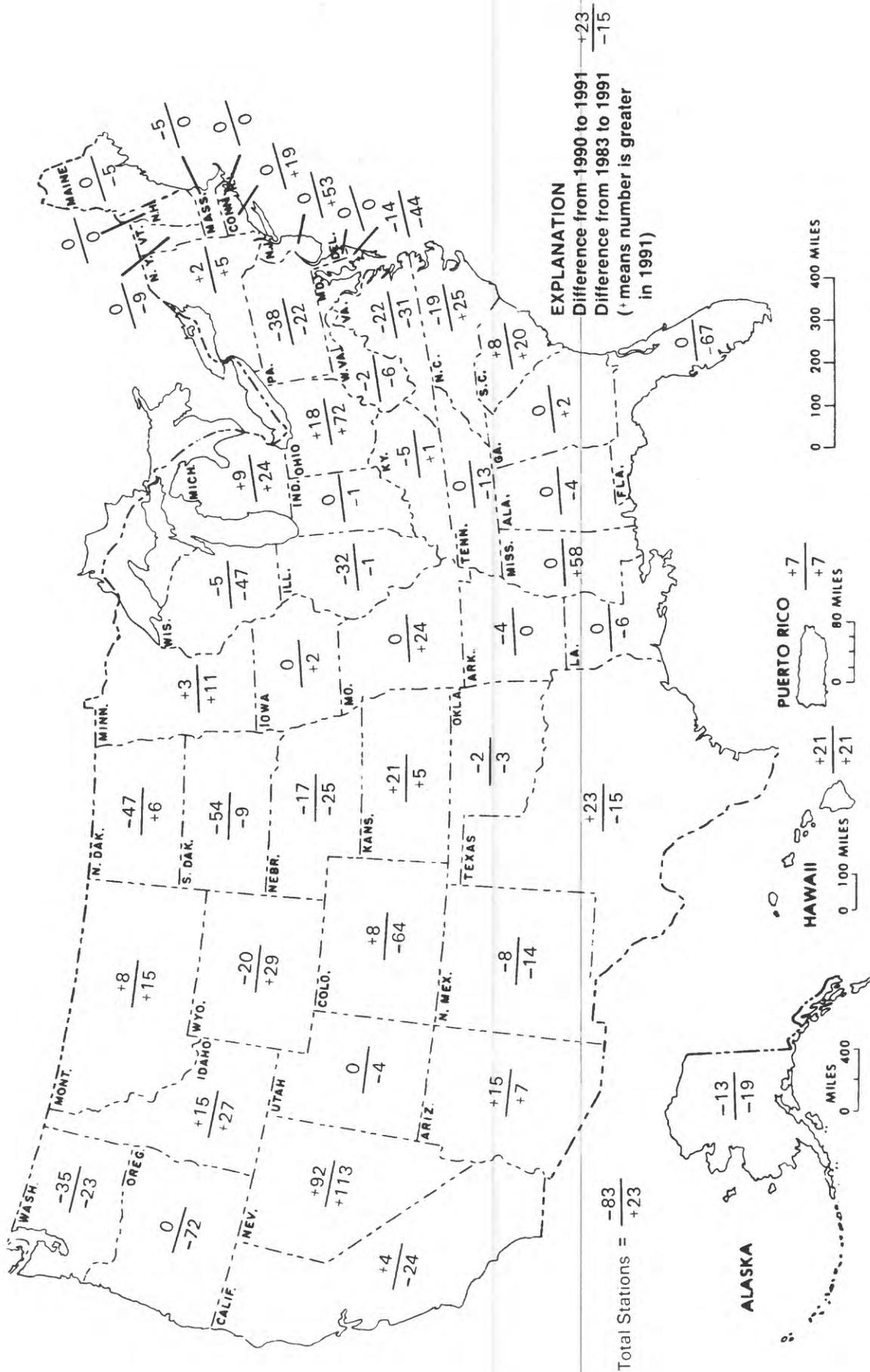
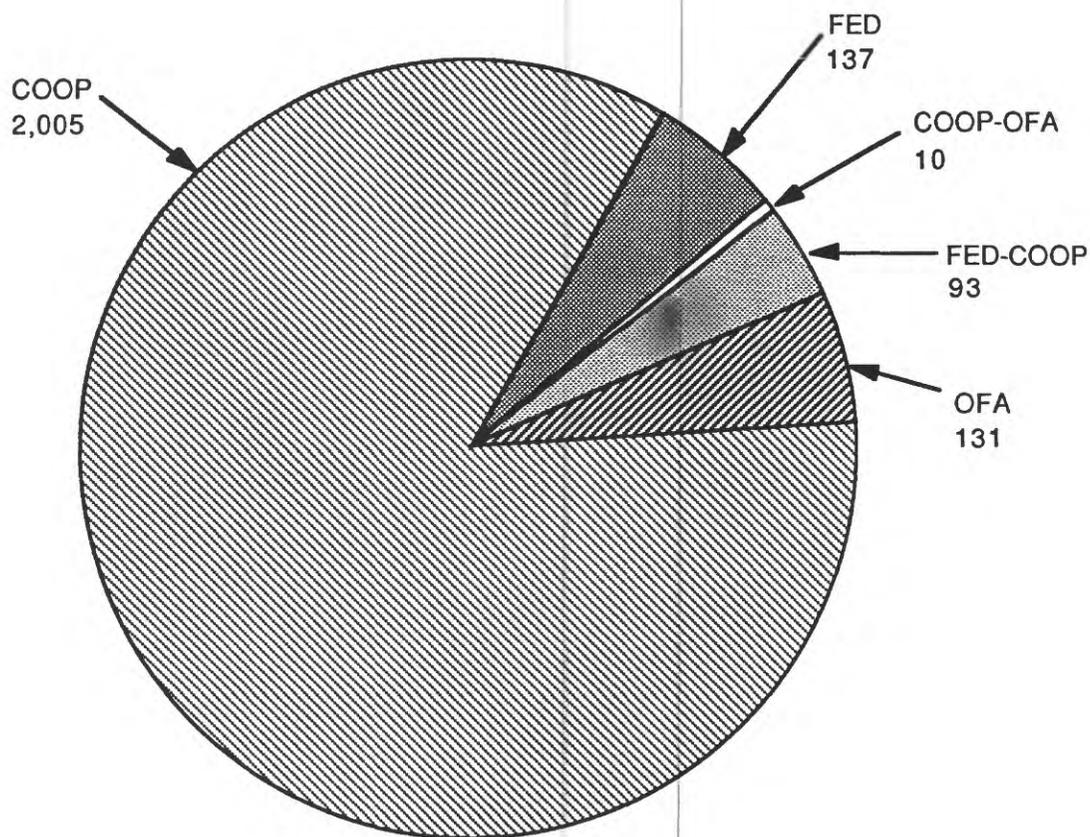


Figure 20. --Change in number of stations, by State, at which surface-water quality data were collected at short-term or project stations from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.



TOTAL STATIONS = 2,376

EXPLANATION

SINGLE PROGRAM SUPPORT

FED = Federal

OFA = Other Federal Agencies

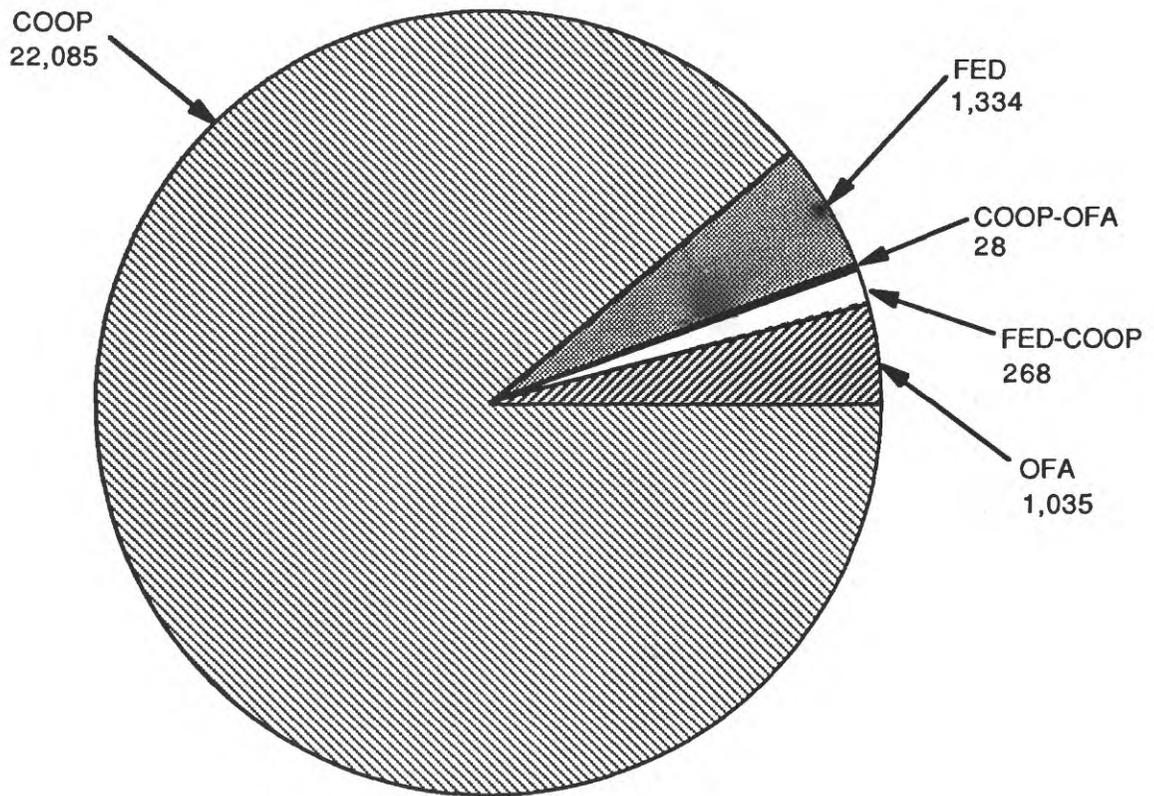
COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

FED - COOP = Federal and Federal - State Cooperative Program

COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies

Figure 22.--Number of continuous ground-water level stations, and sources of funding support, fiscal year 1991.



TOTAL STATIONS - 24,750

EXPLANATION

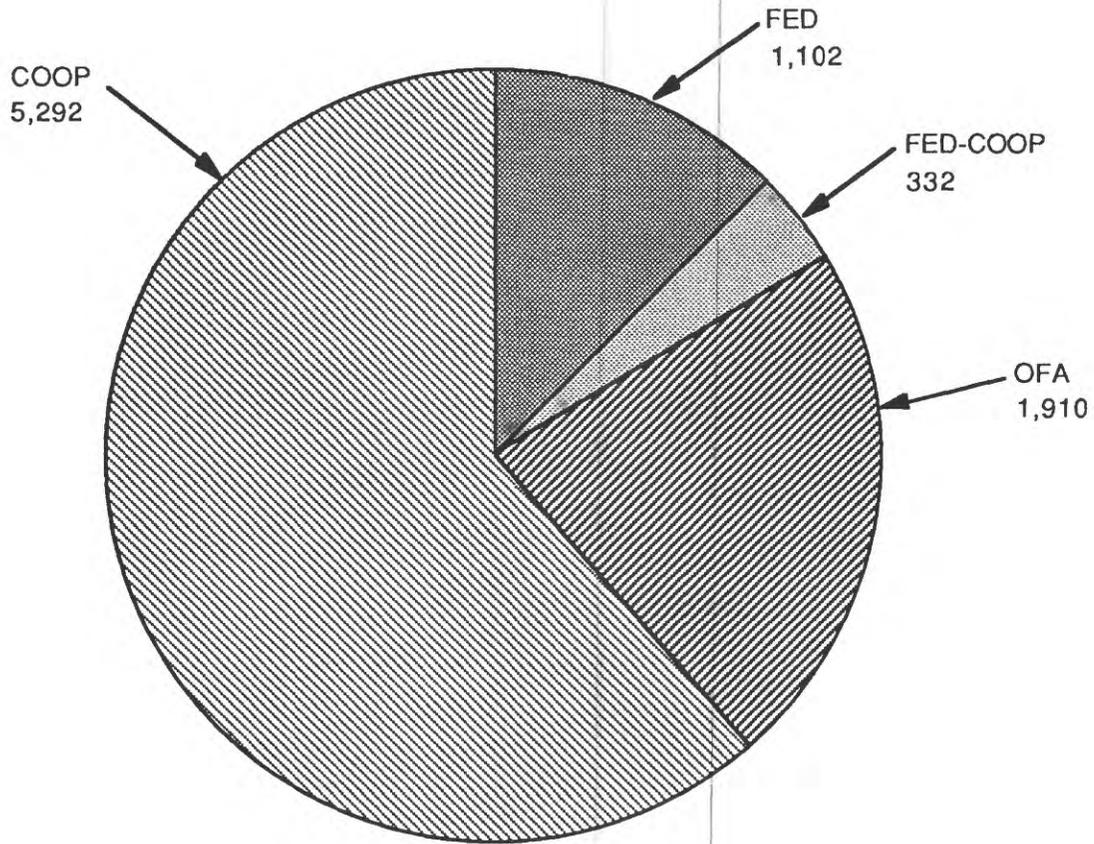
SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies

Figure 23.--Number of scheduled, long-term operation ground-water level stations, and sources of funding support, fiscal year 1991.



TOTAL STATIONS = 8,636

EXPLANATION

SINGLE PROGRAM SUPPORT

FED = Federal

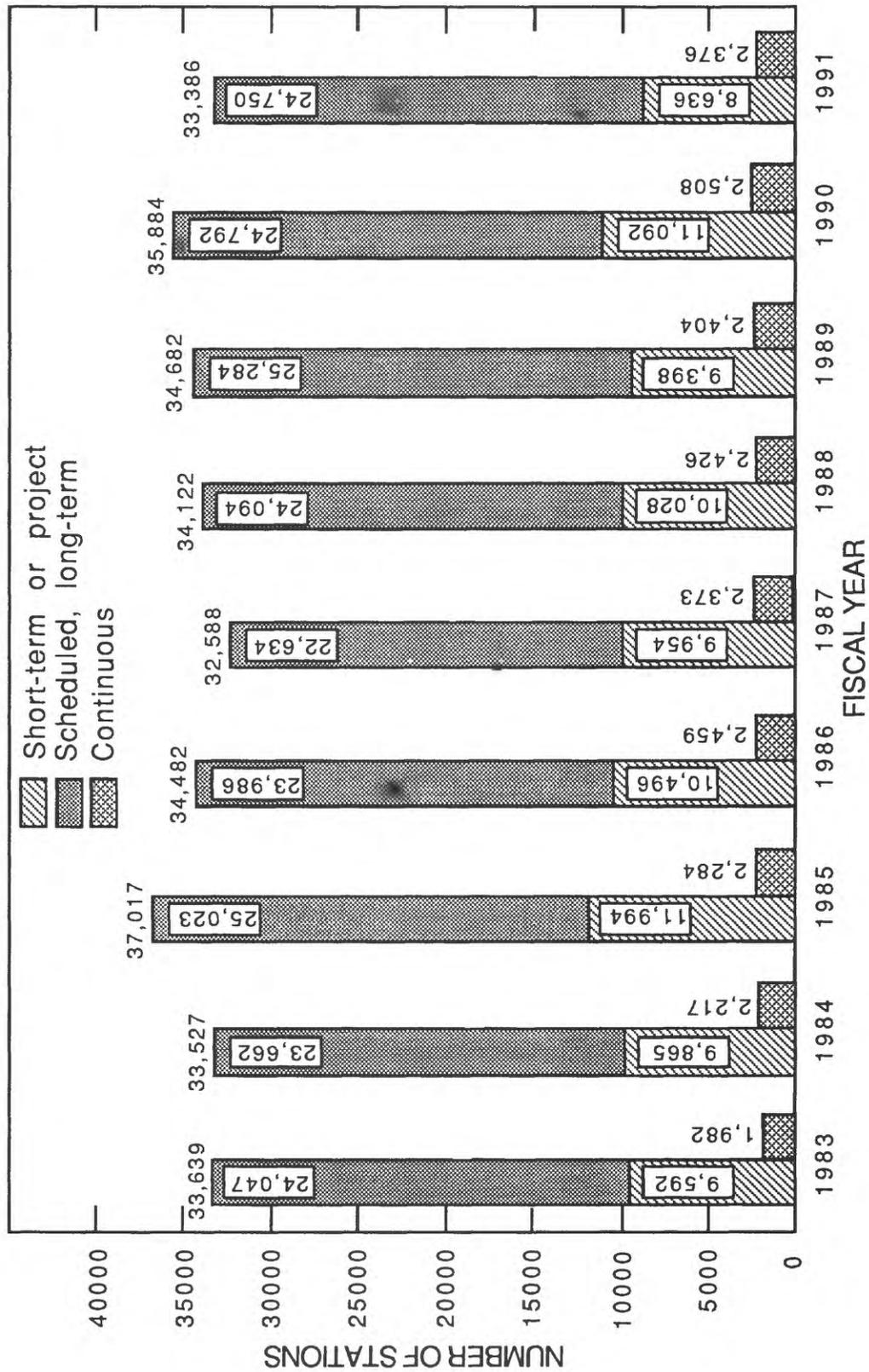
OFA = Other Federal Agencies

COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

FED - COOP = Federal and Federal - State Cooperative Program

Figure 24.--Number of short-term or project ground-water level stations, and sources of funding support, fiscal year 1991.



NOTE: The annual totals shown reflect that the number of stations in the "continuous" category are included in either the "scheduled, long-term" or the "short-term, or project" categories.

Figure 25.--Number of stations, by year, at which ground-water levels were collected from fiscal year 1983 to fiscal year 1991.

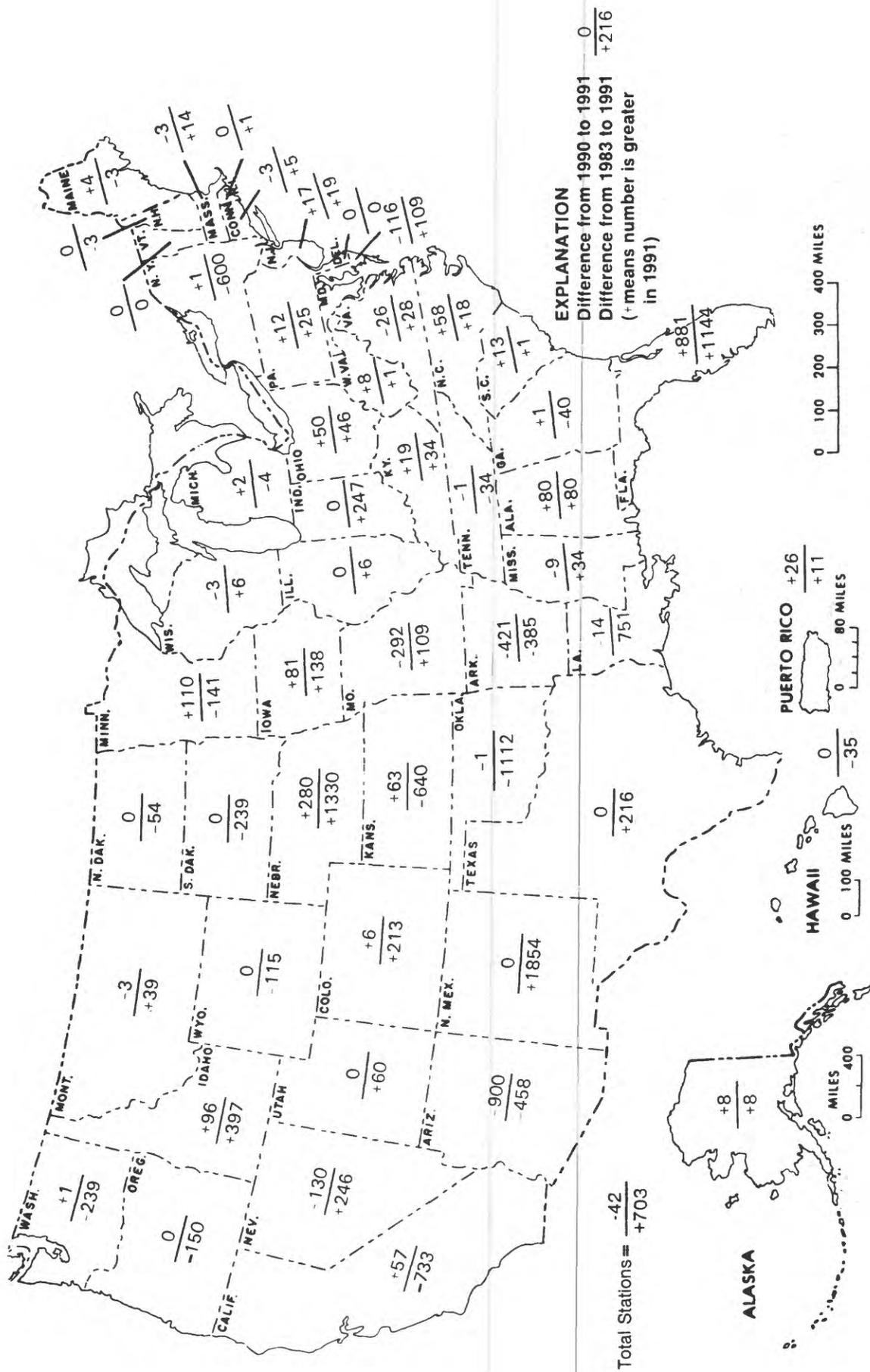


Figure 26.---Change in number of stations, by State, at which scheduled, long-term operation ground-water levels were collected from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.

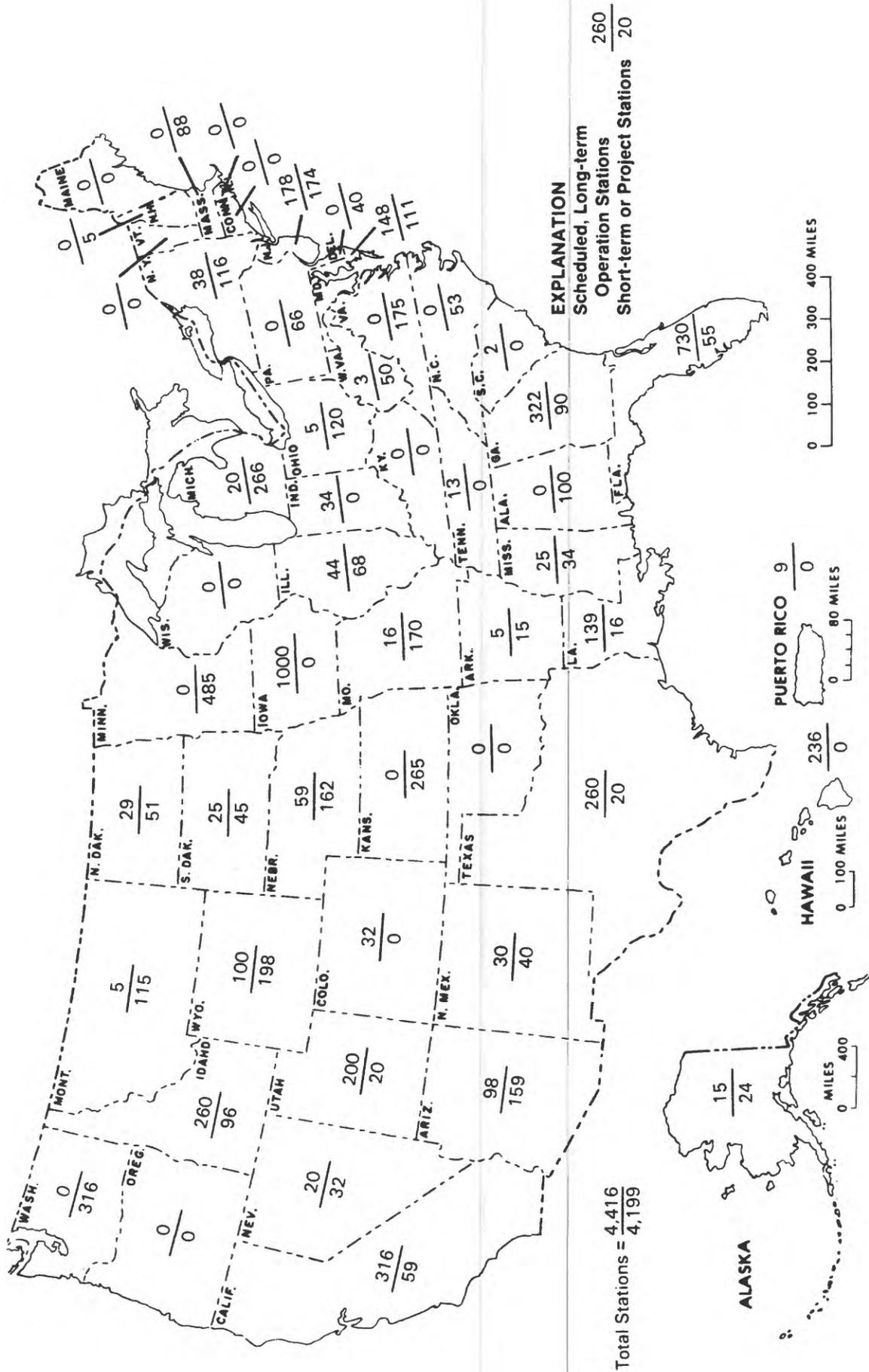
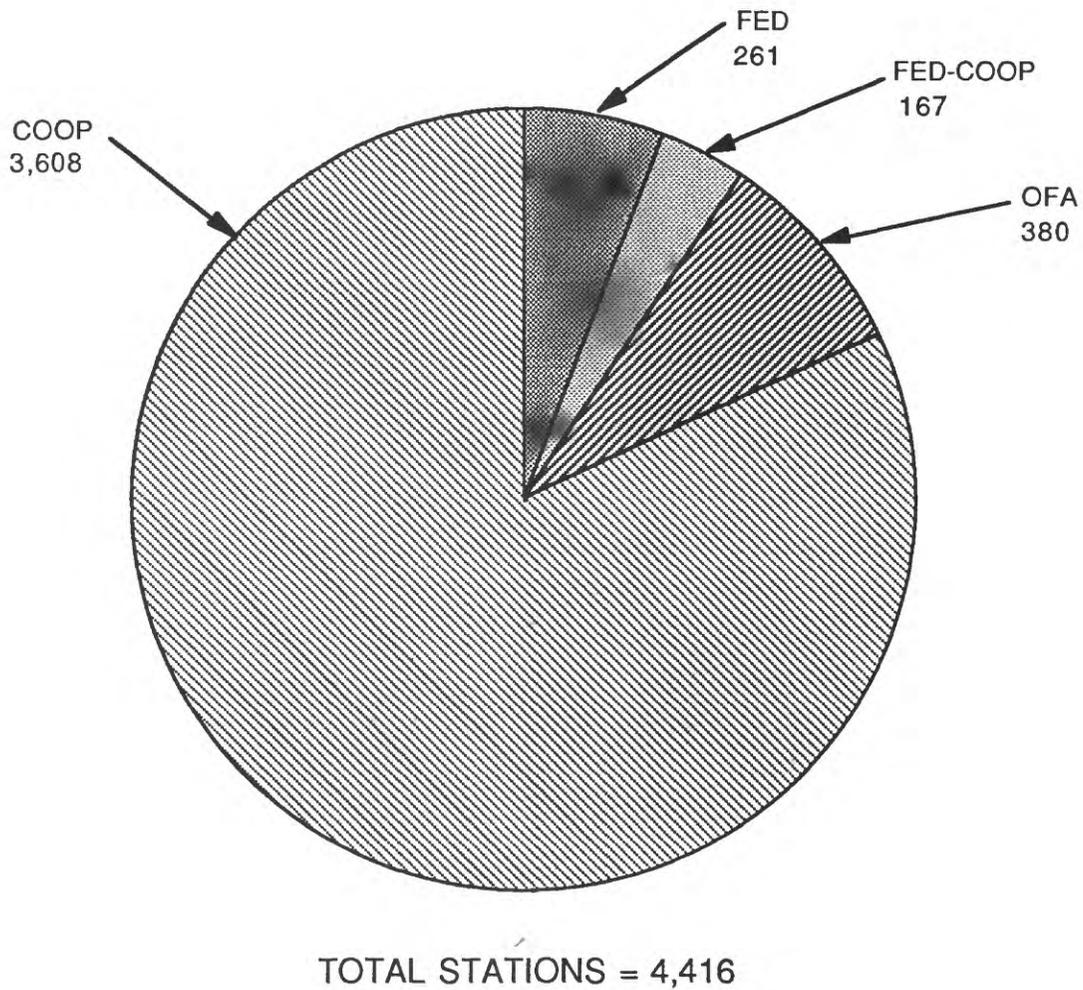


Figure 28.--Number of stations, by State, at which ground-water quality data were collected in fiscal year 1991.



EXPLANATION

SINGLE PROGRAM SUPPORT

FED = Federal

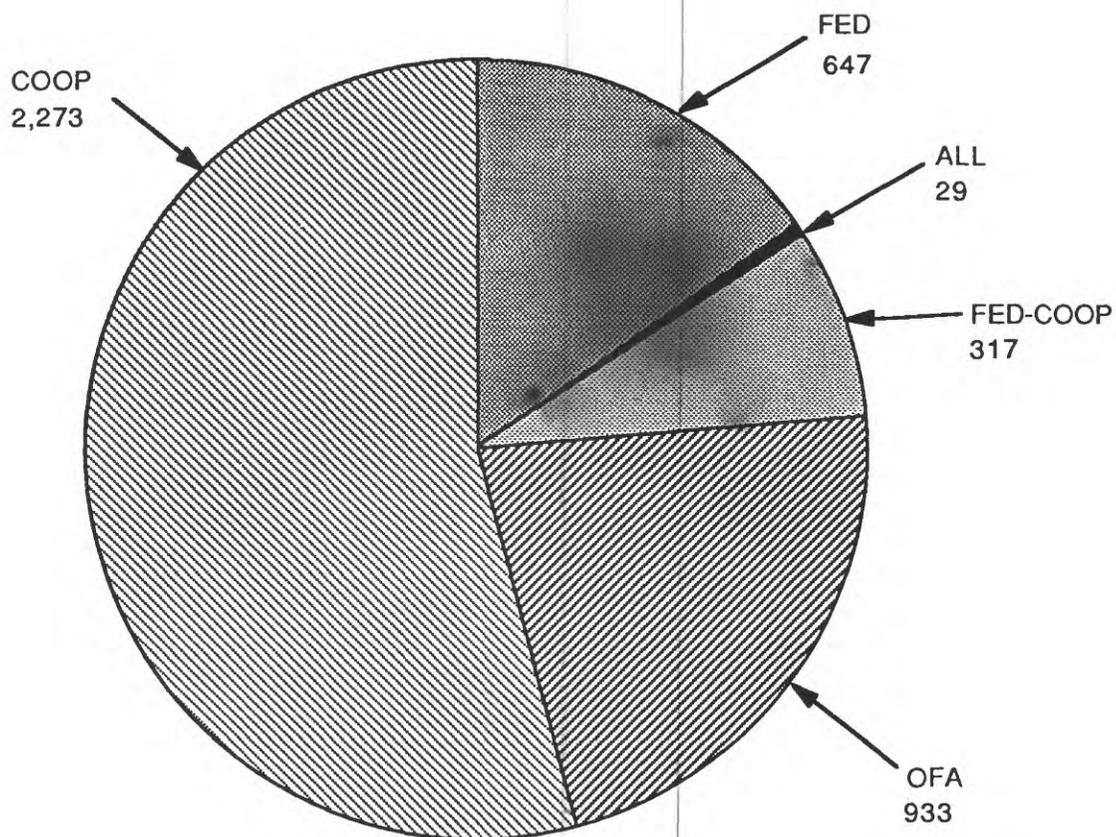
OFA = Other Federal Agencies

COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

FED - COOP = Federal and Federal - State Cooperative Program

Figure 29.--Number of scheduled, long-term operation ground-water quality stations, and sources of funding support, fiscal year 1991.



TOTAL STATIONS = 4,199

EXPLANATION

SINGLE PROGRAM SUPPORT

FED = Federal

OFA = Other Federal Agencies

COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

FED - COOP = Federal and Federal - State Cooperative Program

ALL = FED and OFA and COOP

Figure 30.--Number of short-term or project ground-water quality stations, and sources of funding support, fiscal year 1991.

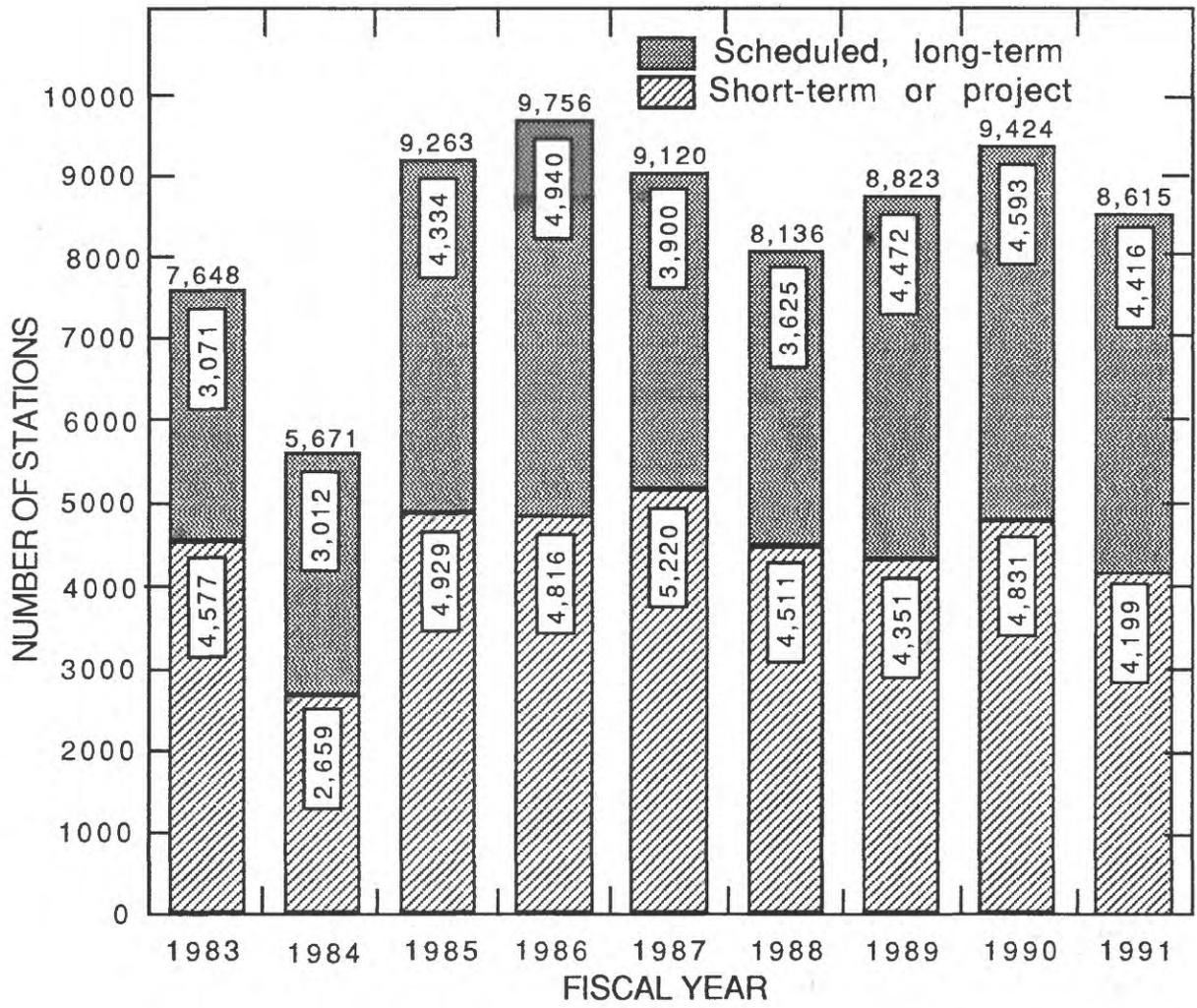


Figure 31.--Number of stations, by year, at which ground-water quality data were collected from fiscal year 1983 to fiscal year 1991.

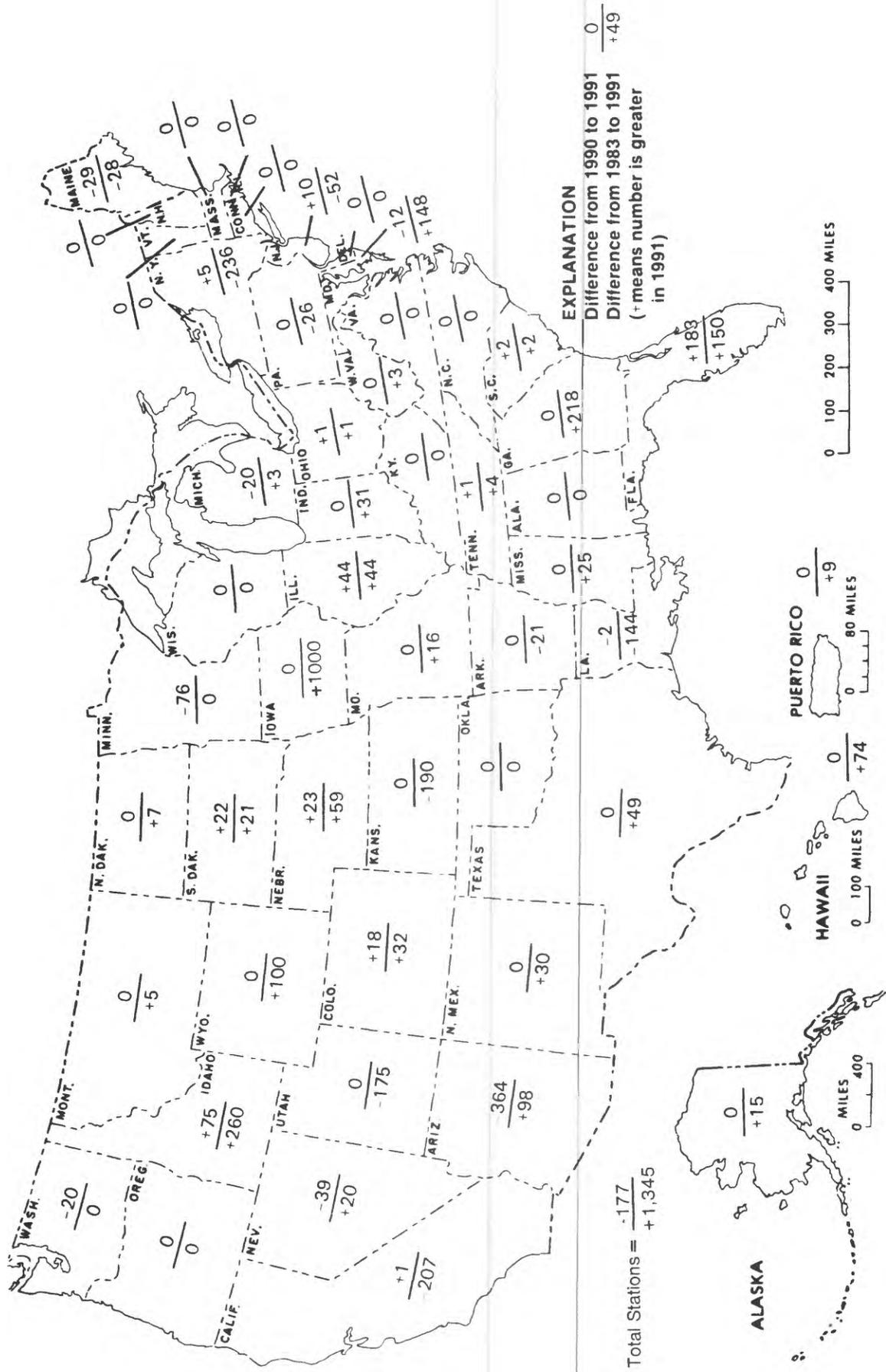


Figure 32.--Change in number of stations, by state, at which ground-water quality data were collected at scheduled, long-term stations from fiscal year 1990 to fiscal year 1991, and from fiscal year 1983 to fiscal year 1991.

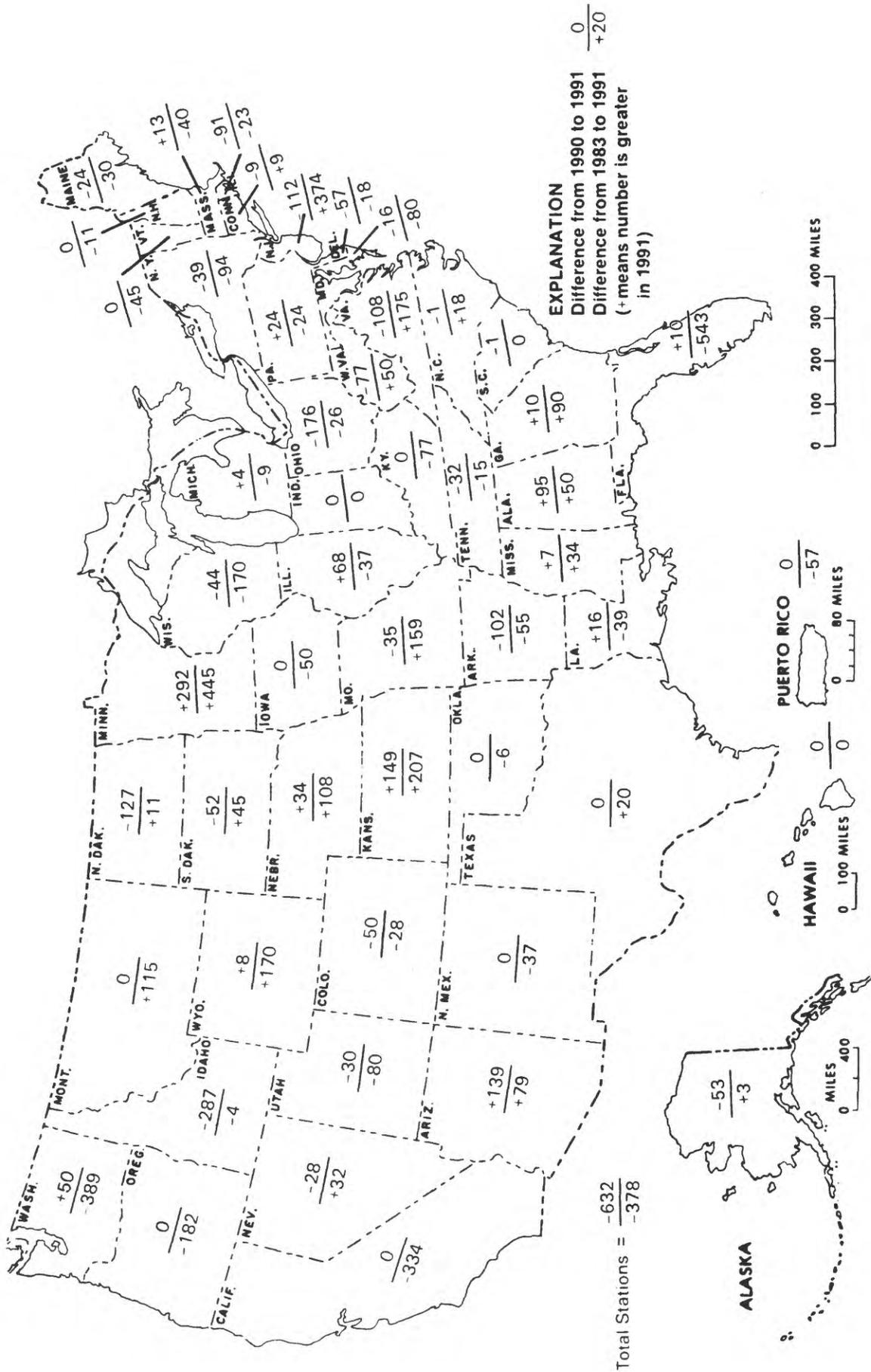


Figure 33.--Change in number of stations, by State, at which ground-water quality data were collected at short-term or project stations from fiscal year 1990 to fiscal year 1991 and from fiscal year 1983 to fiscal year 1991.

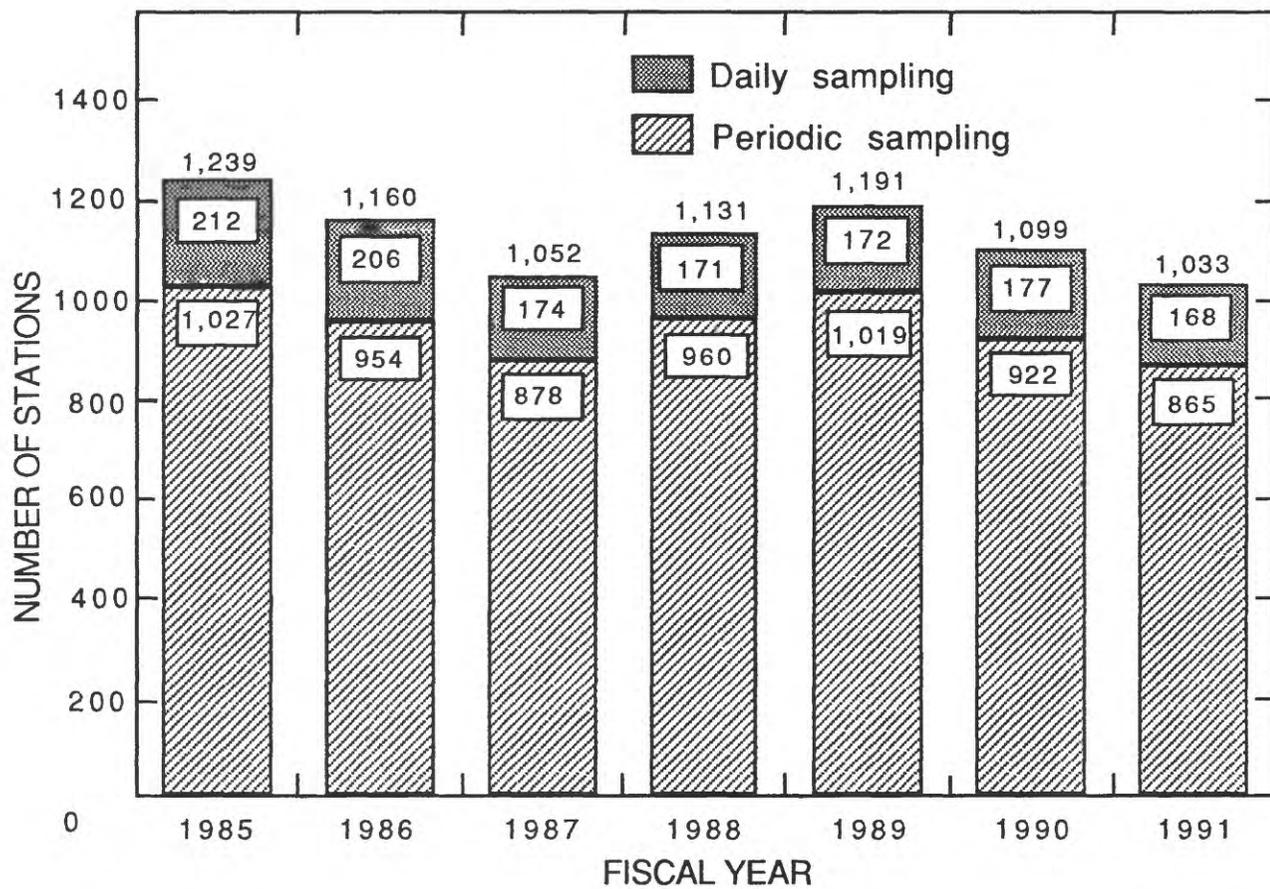
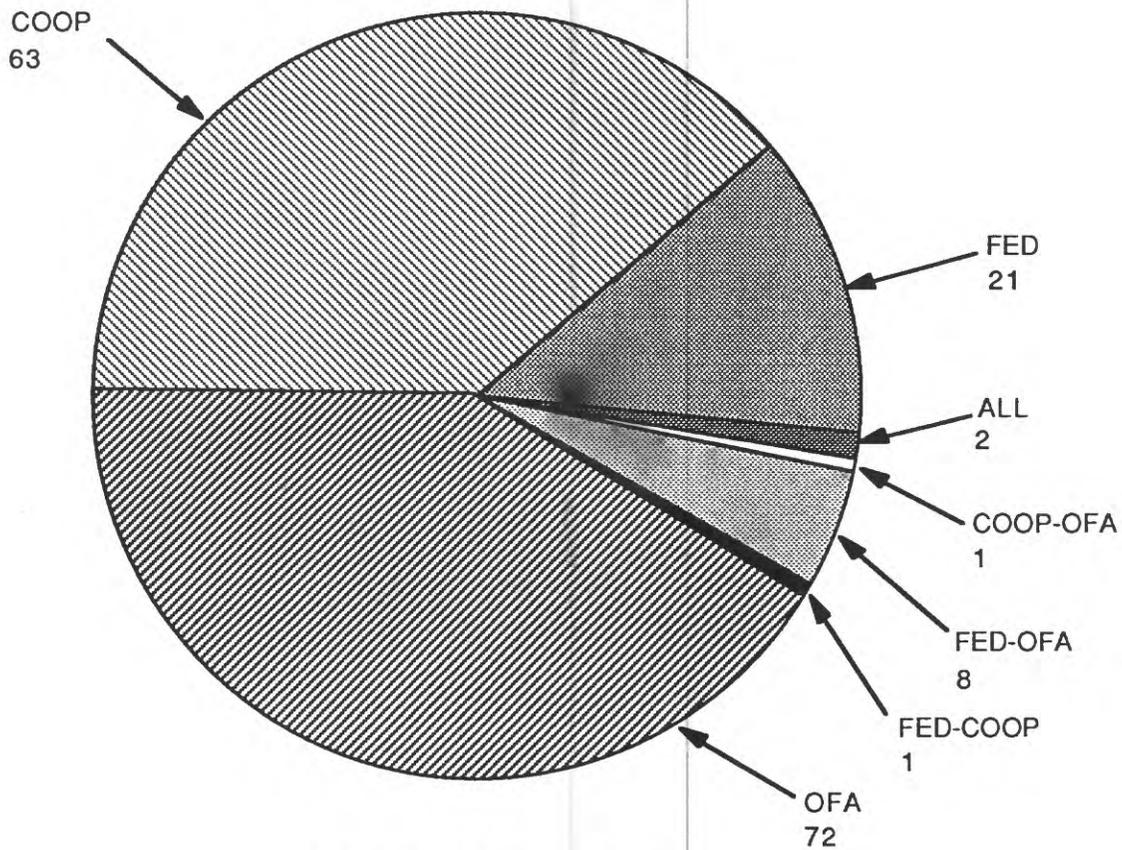


Figure 35.--Number of stations, by year, at which sediment data were collected from fiscal year 1985 to fiscal year 1991.



TOTAL STATION = 168

EXPLANATION

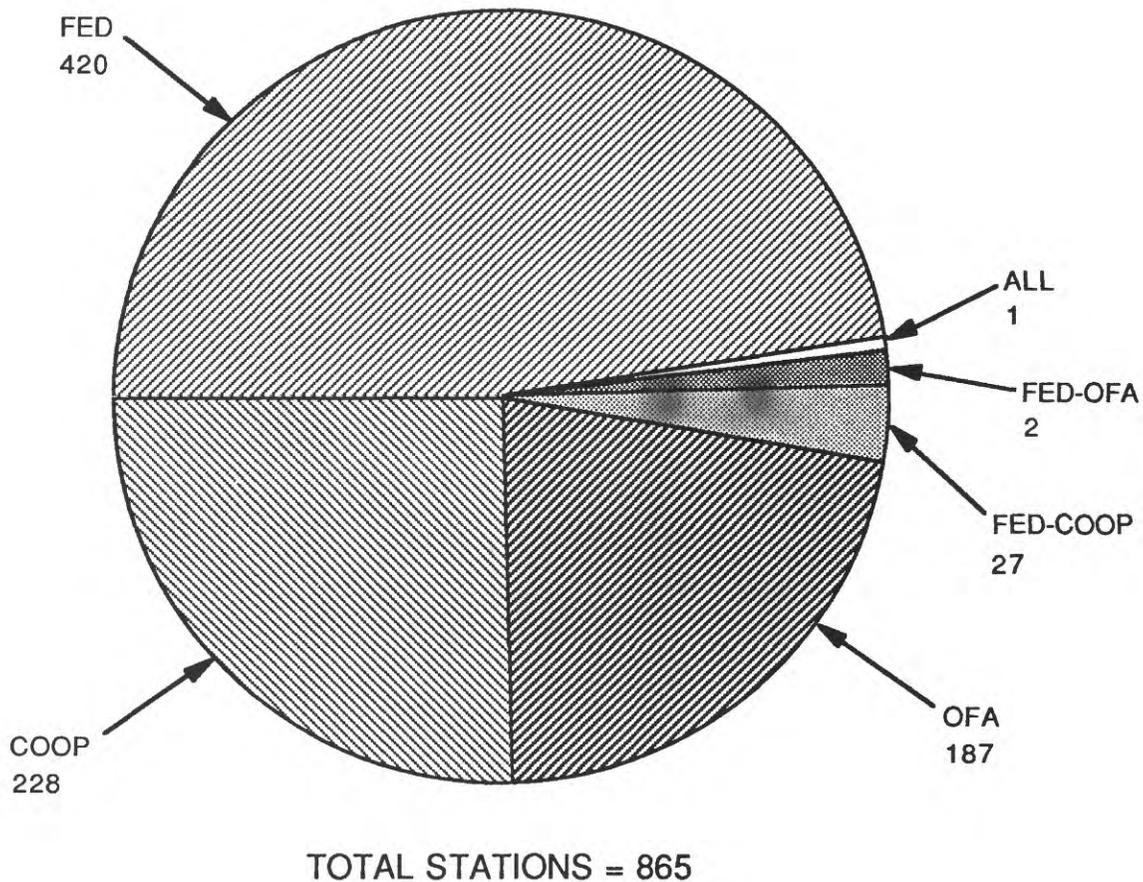
SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies
- FED-OFA = Federal and Other Federal Agencies
- ALL = FED and OFA and COOP

Figure 36.--Number of daily sampling sediment stations, and sources of funding support, fiscal year 1991.



EXPLANATION

SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- FED-OFA = Federal and Other Federal Agencies
- ALL = FED and OFA and COOP (1 station not shown)

Figure 37.--Number of periodic sampling sediment stations, and sources of funding support, fiscal year 1991.

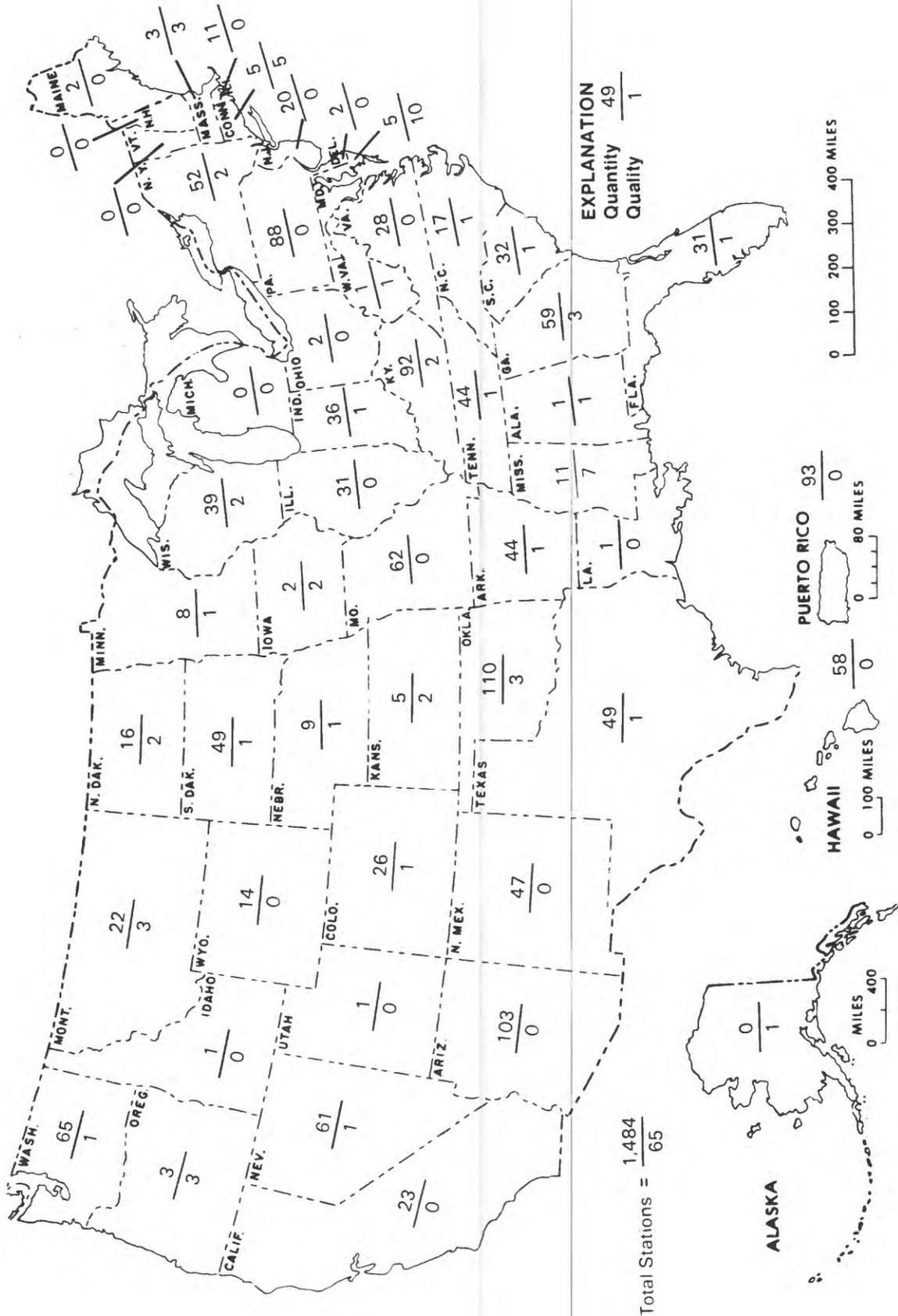
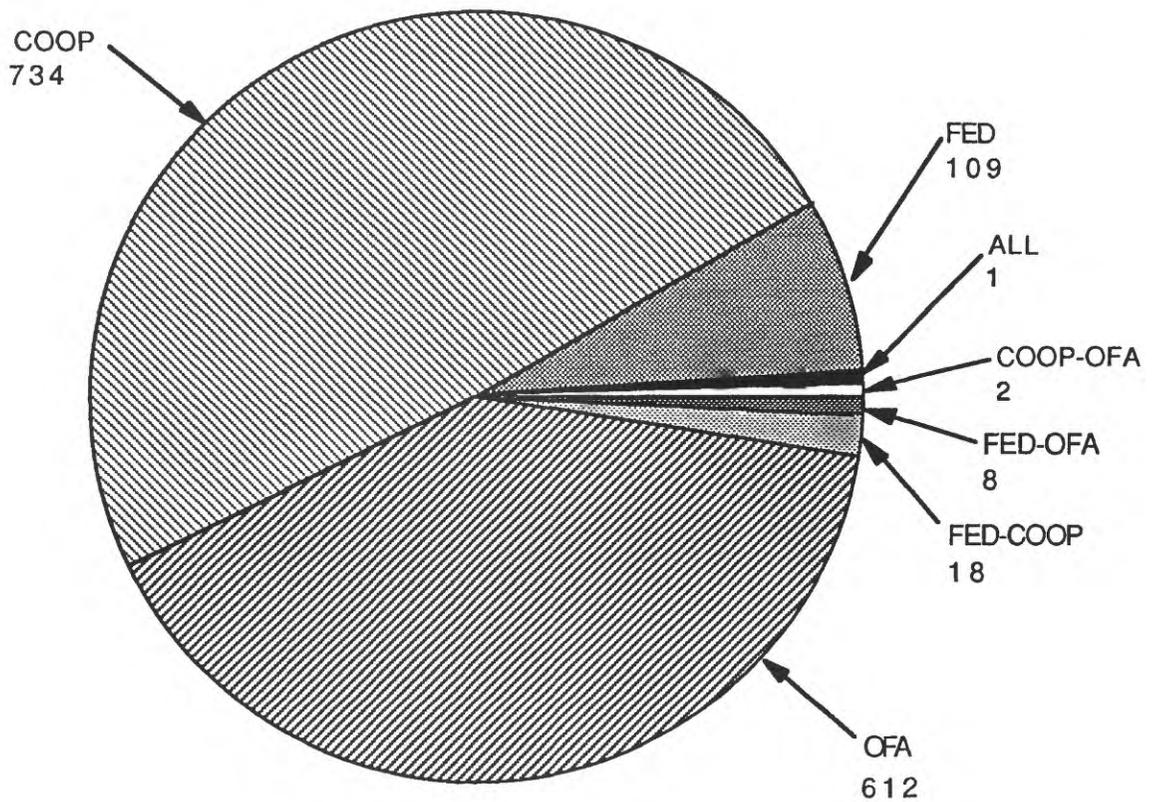


Figure 38.--Number of stations, by State, at which precipitation data were collected in fiscal year 1991.



TOTAL STATIONS = 1,484

EXPLANATION

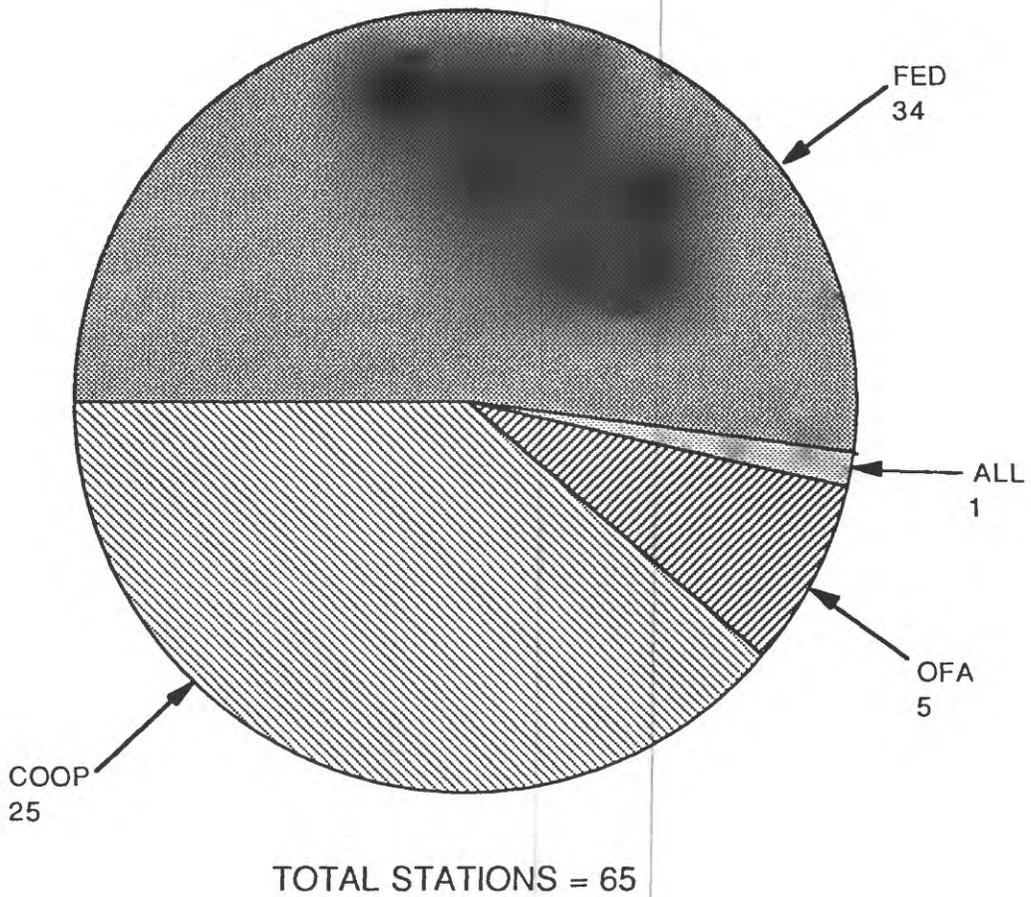
SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies
- FED-OFA = Federal and Other Federal Agencies
- ALL = FED and OFA and COOP

Figure 39.--Number of precipitation-quantity stations, and sources of funding support, fiscal year 1991.



EXPLANATION

SINGLE PROGRAM SUPPORT

FED = Federal

OFA = Other Federal Agencies

COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

ALL = FED and OFA and COOP

Figure 40.--Number of precipitation-quality stations, and sources of funding support, fiscal year 1991.

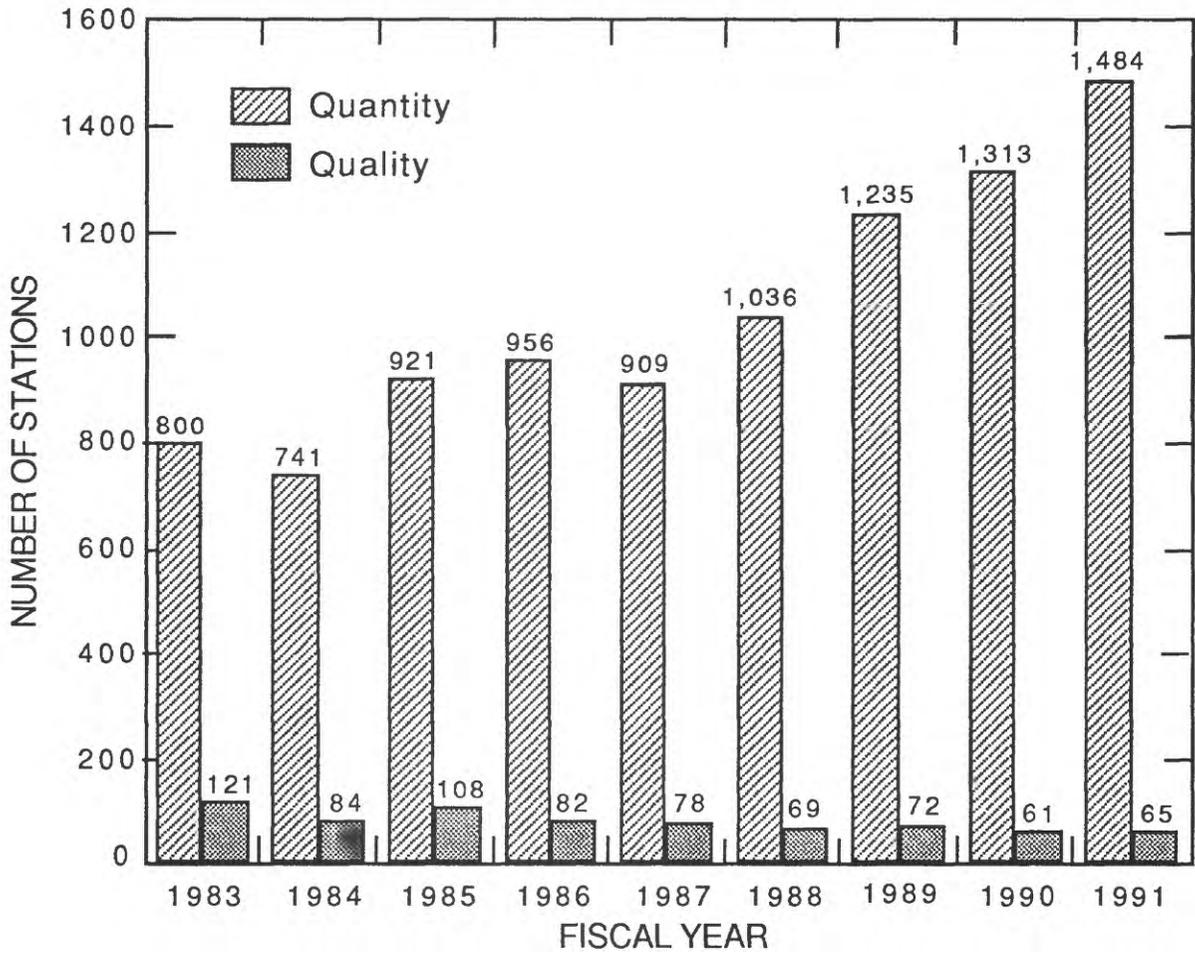


Figure 41.--Number of stations, by year, at which precipitation data were collected from fiscal year 1983 to fiscal year 1991.

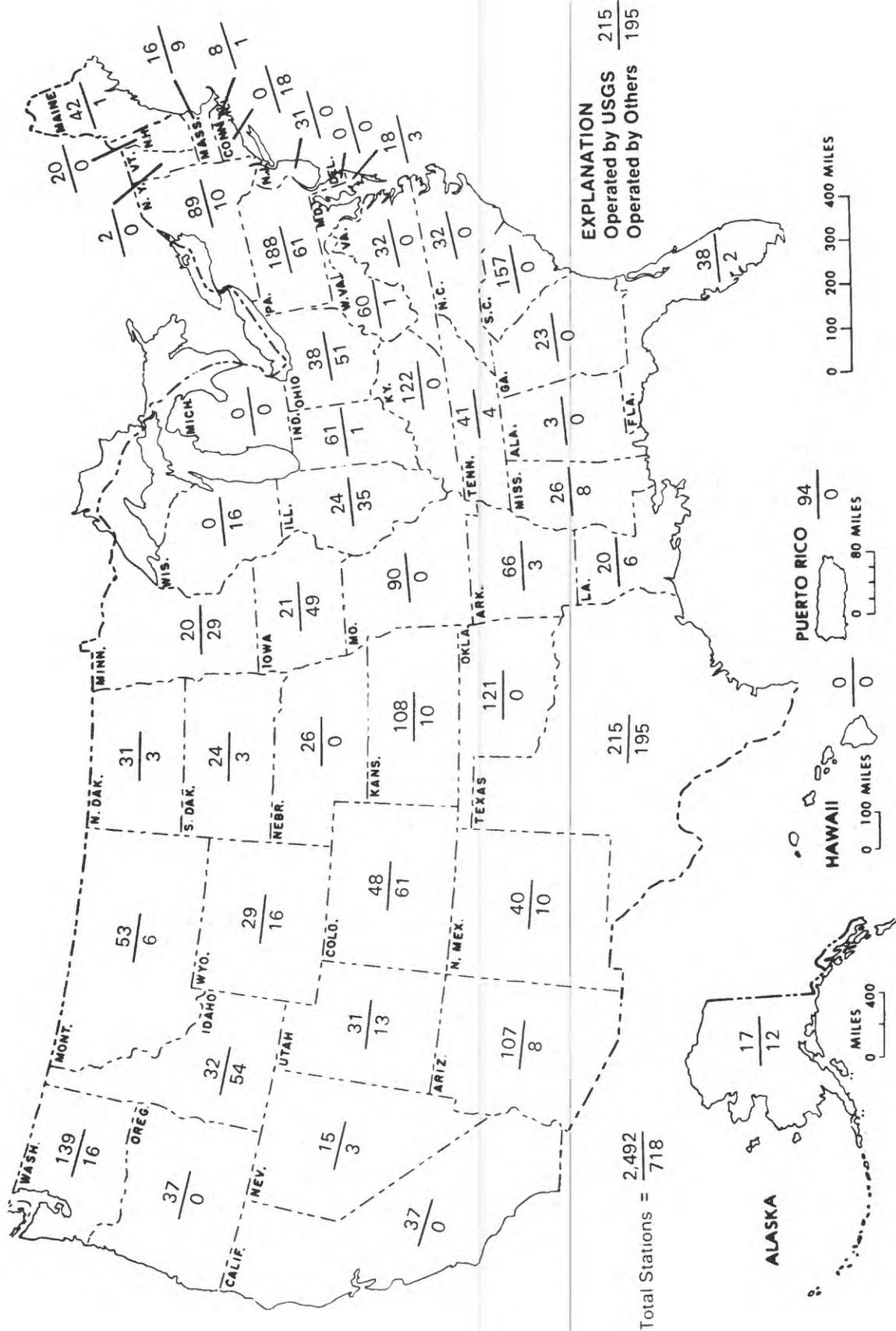
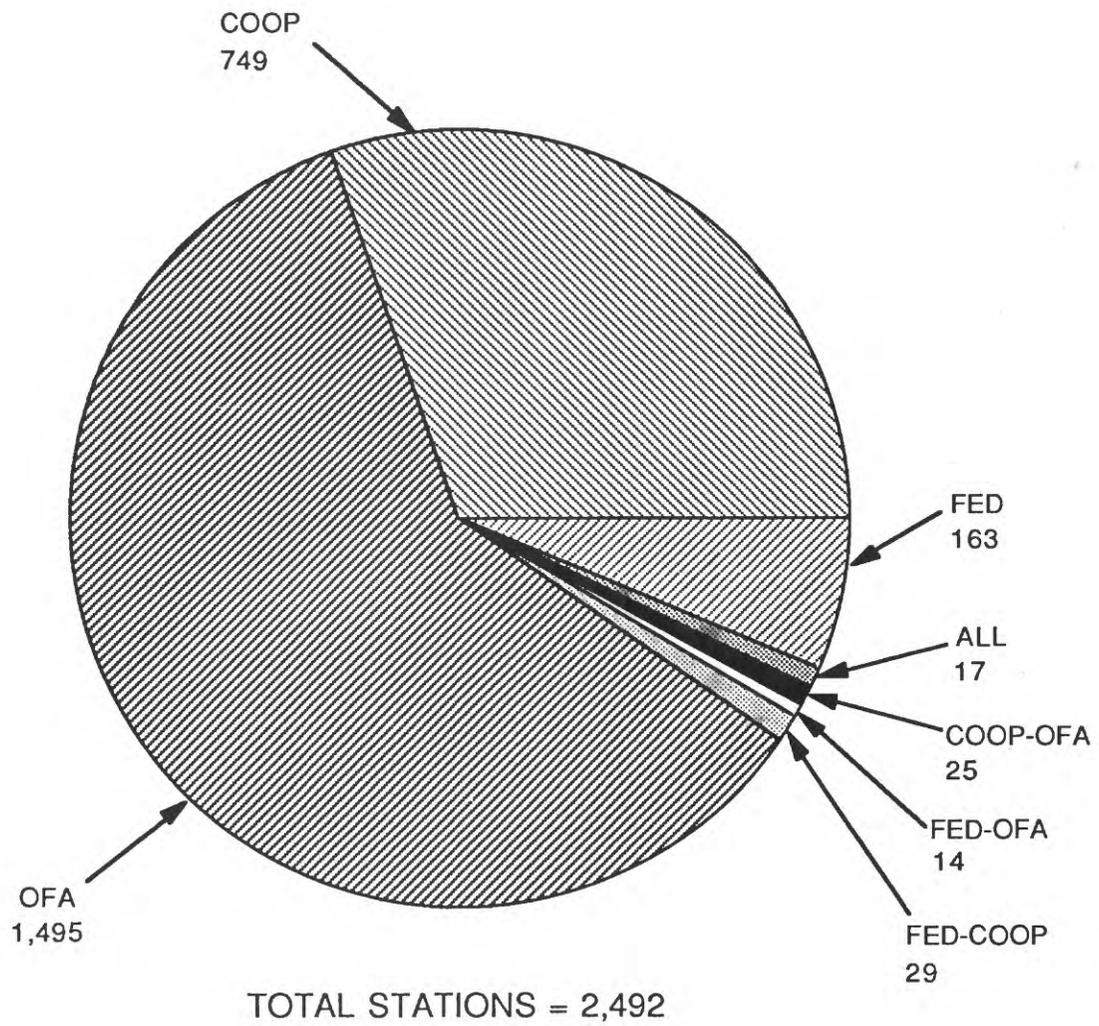


Figure 42.--Number of U.S. Geological Survey stations, by State, at which data-collection platforms for satellite telemetry were operated in fiscal year 1991.



EXPLANATION

SINGLE PROGRAM SUPPORT

- FED = Federal
- OFA = Other Federal Agencies
- COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

- FED - COOP = Federal and Federal - State Cooperative Program
- COOP-OFA = Federal - State Cooperative Program and Other Federal Agencies
- FED-OFA = Federal and Other Federal Agencies
- ALL = FED and OFA and COOP

Figure 43.--Number of stations at which data-collection platforms for satellite telemetry were operated by the U.S. Geological Survey, and sources of funding support, fiscal year 1991.

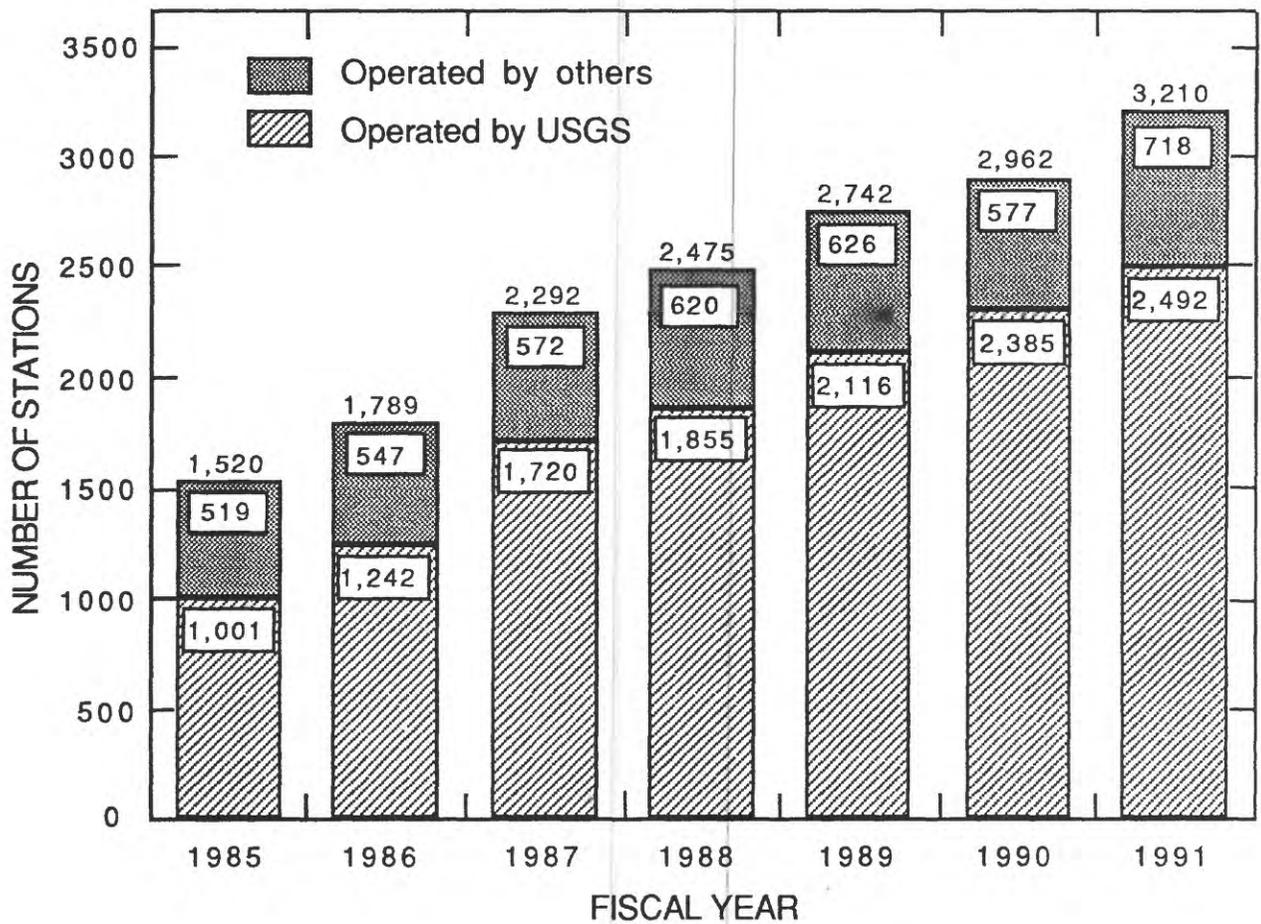


Figure 44.--Number of U.S. Geological Survey stations, by year, at which data-collection platforms for satellite telemetry were operated from fiscal year 1985 to fiscal year 1991.