OPERATION OF HYDROLOGIC DATA-COLLECTION STATIONS BY THE U.S. GEOLOGICAL SURVEY IN 1993

By Alberto Condes de la Torre

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BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY

Gordon P. Eaton, 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

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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 1993, surface-water discharge was determined at 10,187 stations; stage data on streams, reservoirs, and lakes were recorded at 2,116 stations; and various surface-water quality characteristics were determined at 3,224 stations. In addition, ground-water levels were measured at 32,476 sites, and the quality of ground water was determined at 6,457 sites. Data on sediment were collected daily at 161 stations and on a periodic basis at 988 stations. Information on precipitation quantity was collected at 1,432 stations and the quality of precipitation was analyzed at 48 stations. Data-collection platforms for satellite telemetry of hydrologic information were used at 3,560 U.S. Geological Survey stations. Funding for the hydrologic stations was derived, either solely or in combination, from three major sources--the U.S. Geological Survey's Federal Program appropriation, the Federal-State Cooperative Program, and reimbursements from other Federal agencies.

The number of hydrologic stations operated by the U.S. Geological Survey declined in some types and increased in others from fiscal year 1983 to 1993. Although the number of continuous-record surface-water discharge stations increased by 120, the total number of surface-water discharge stations, both continuous and partial record, was reduced by 889; surface-water quality stations declined by 602; ground-water level stations decreased by 1,163; and ground-water quality stations decreased by 1,191.

INTRODUCTION

The U.S. Geological Survey operates hydrologic data-collection stations throughout the United States, Puerto Rico, and several Trust Territories. These hydrologic data-collection 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) 1993. Similar reports have been prepared previously for fiscal years 1983, 1985, 1987, 1989 and 1991 (Condes de la Torre, 1983, 1985, 1987, 1989 and 1991). A summary and analysis is provided of the number of hydrologic stations operated from FY 1983 to FY 1993. The sources of funding support for the stations are the U.S. Geological Survey's Federal Program appropriation, the Federal-State Cooperative Program (Gilbert and Mann, 1993), 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 1993 fiscal year and the sources of funding support.

Type of station	Number of Stations by Source of Funding							Total Stations
	Single Program Support			Combined Support				
	Federal Program (Federal)	Federal-State Cooperative Program (COOP)	Reimbursement from other Federal Agencies (OFA)	Federal, COOP	Federal, OFA	COOP, OFA	Federal, COOP, OFA	
SURFACE WATER								
Discharge								
Continuous Record	571	4,110	1,902	106	141	403	39	7,272
Partial Record	135	2,240	379	138	13	10	0	2,915
Stage Only - Streams								
Continuous Record	13	139	347	6	8	33	1	547
Partial Record	9	323	18	0	1	109	0	460
Stage Only - Lakes & Reservoirs								
Continuous Record	22	380	381	6	0	8	0	797
Partial Record	11	196	99	0	1	5	0	312
Quality								
*Continuous Record	62	428	193	13	7	3	3	709
Scheduled, Long-term Operation	443	1,230	345	51	21	19	5	2,114
Short-term or Project Stations	94	809	166	6	27	8	0	1,110
GROUND WATER								
Water Levels								
*Continuous Record	167	1,825	100	101	0	11	0	2,204
Scheduled, Long-term Operation	2,251	22,285	1,225	335	0	28	0	26,124
Short-term or Project Stations	686	3,895	1,545	69	37	120	0	6,352
Quality								
Scheduled, Long-term Operation	59	2,214	359	15	0	12	0	2,659
Short-term or Project Stations	810	1,815	939	38	37	130	29	3,798
SEDIMENT								
Daily Sampling	24	62	63	1	8	1	2	161
Periodic Sampling	455	361	147	11	13	0	1	988
PRECIPITATION								
Quantity	76	724	606	8	16	2	0	1,432
Quality	34	11	3	0	0	0	0	48

* The stations at which a continuous record is maintained in this type 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.

In 1983, the U.S. 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 items to be counted were increased to include stations operated to collect daily and periodic sediment sampling data and information on the number of data-collection platforms. For this reason, the 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 U.S. 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 10,187 stations in FY 1993. At 7,272 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 2,915 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 17 in Delaware to 763 in California (figure 1). The Federal-State Cooperative Program funded operation of the largest number of continuous surface water discharge stations; it provided sole support for 4,110 stations (figure 2), and in combination with other sources, provided support for 548 more (table 1). The Federal-State Cooperative Program also funded the largest number of partial-record discharge stations; it provided sole support of 2,240 stations (figure 3), and in combination with other sources, 148 more.

The number of continuous-record surface-water discharge stations increased from 7,152 stations in FY 1983 to 7,272 stations in FY 1993 (figure 4), with a low of 7,000 in FY 1987 and a high of 7,363 in FY 1990. During the same period, the total number of surface-water discharge stations decreased by 889, to 10,187 stations in FY 1993. The change reflects decreases in some States and increases in others (figure 5). In Oregon, the number of discharge stations decreased by 52 from 1991 to 1992 when a State cooperator terminated funding stations in the Federal-State Cooperative Program (Table 2).

Stage-only data were collected by the U.S. Geological Survey at 1,007 stream stations. The number of stage-only data stations on streams ranged from none in several States to 133 in South Carolina (figure 6). The reimbursement from other Federal agencies supported the largest number of continuous stage-only stream stations--347 (figure 7)--while the Federal-State Cooperative Program supported the most partial-record stage-only stations--323 (figure 8). The number of continuous-

record stations collecting stage-only data on streams increased by 128 from 1983 to 1993 (figure 9), whereas the number of partial-record stations decreased by 11.

Stage data were also collected at 1,109 stations on lakes and reservoirs by the U.S. Geological Survey. Continuous records of stage were collected at 797 lake and reservoir stations, ranging from 147 in California to none in several States (figure 10). Reimbursements from other Federal agencies supported the largest number of continuous-record stations (figure 11), and the Federal-State Cooperative Program supported 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 1,109 in FY 1993 (figure 13).

Stream samples were collected and analyzed for water-quality characteristics at 3,224 stations across the Nation (figure 14). The types of chemical constituents and physical properties 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 709 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 2,114 stream sites as part of a scheduled, long-term operation (figure 16). These include 386 stations, supported in the U.S. Geological 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 1,110 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 2,114 in 1993 (figure 18). In Wyoming, for example, the number of scheduled, long-term sampling stations was reduced from 1983 to 1993 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 during the same period. (figure 20). In North Dakota, the number of short-term or project surface-water quality stations increased as a result of increased interest in the quality of water in the Souris River and Red River of the North.

Ground Water Data

Ground water is one of the most widely available of the Nation's natural resources. It is estimated that 79 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, 1993). 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 32,476 sites in 1993 (figure 21). Water levels were recorded continuously at 2,204 sites, of which 1,825 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 measured at 26,124 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 measured at short-term or project stations to supplement the information available in the area from the long-term stations. In 1993, water-level data were collected at 6,352 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 1993, the number of scheduled, long-term operation ground-water level stations increased from 24,047 in 1983 to 26,124 in 1993 (figure 25). The number of stations at which ground-water levels were measured continuously also increased from 1,982 in 1983 to 2,204 in 1993. Meanwhile, the short-term or project stations increased from 9,592 in 1983 to 11,994 in 1985, and then decreased to 6,352 in 1993.

The change in number of scheduled, long-term operation ground-water level stations varied between 1983 to 1993 from an increase of 3,440 in Nebraska 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 measured during the same period also varied from state to state (figure 27).

In 1993, samples of ground water from 6,457 stations were analyzed (figure 28). To maintain information on the changes in quality of critical ground-water bodies, samples were collected at 2,659 stations as part of a scheduled long-term operation (figure 29). Of these, sampling at 2,214 stations was funded in total by the Federal-State Cooperative Program. Ground-water quality data were also collected at 3,798 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 6,457 in 1993 (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, which called for an increased number of scheduled, long-term ground-water quality stations was discontinued in 1993 (figure 32). In Mississippi, a study of chloride monitoring for salt water intrusion 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 environment impact assessment, water treatment problems of sediment-associated nutrients and pollutants, and evaluation of the precise impacts of humans."

Field techniques to collect suspended sediment samples were tested to determine whether or not they produce a representative sample of sediment for chemical analysis. The collection methods were found to produce representative sediment samples for chemical analyses; however, new protocols are needed for equipment cleaning and identifying noncontaminated equipment. These new protocols are being written. 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 U.S. Geological Survey collected daily sediment data at 161 stations, and periodic data at 988 other stations (figure 34). This represents a reduction of 51 and 39 stations, respectively, from 1985 to 1993 (figure 35). Reimbursements from other Federal agencies provided support for 39 percent of the daily sampling stations (figure 36), and the Federal program provided support for 46 percent of the periodic sampling stations (figure 37).

Precipitation Data

Precipitation data are collected by the U.S. Geological Survey 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 U.S. Geological Survey investigations.

Precipitation data were collected at 1,432 sites nationwide (figure 38). At 48 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 1,432 in 1993 (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 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 1993, data-collection platforms were located in 3,560 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 2,963 stations at which data-collection platforms were operated by the U.S. Geological Survey and 597 U.S. Geological Survey stations at which the data-collection platforms were operated by others. Over half 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 3,560 in 1993 (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 1993 the total number of surface-water discharge stations declined. The number of continuous-record discharge stations increased, surface-water quality stations declined, and ground-water level and ground-water quality stations both decreased.

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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., Pierce, R.R., and Perlman, H.A., 1993, Estimated Use of Water in the United States in 1990: U.S. Geological Survey, Circular 1081, 76 p.

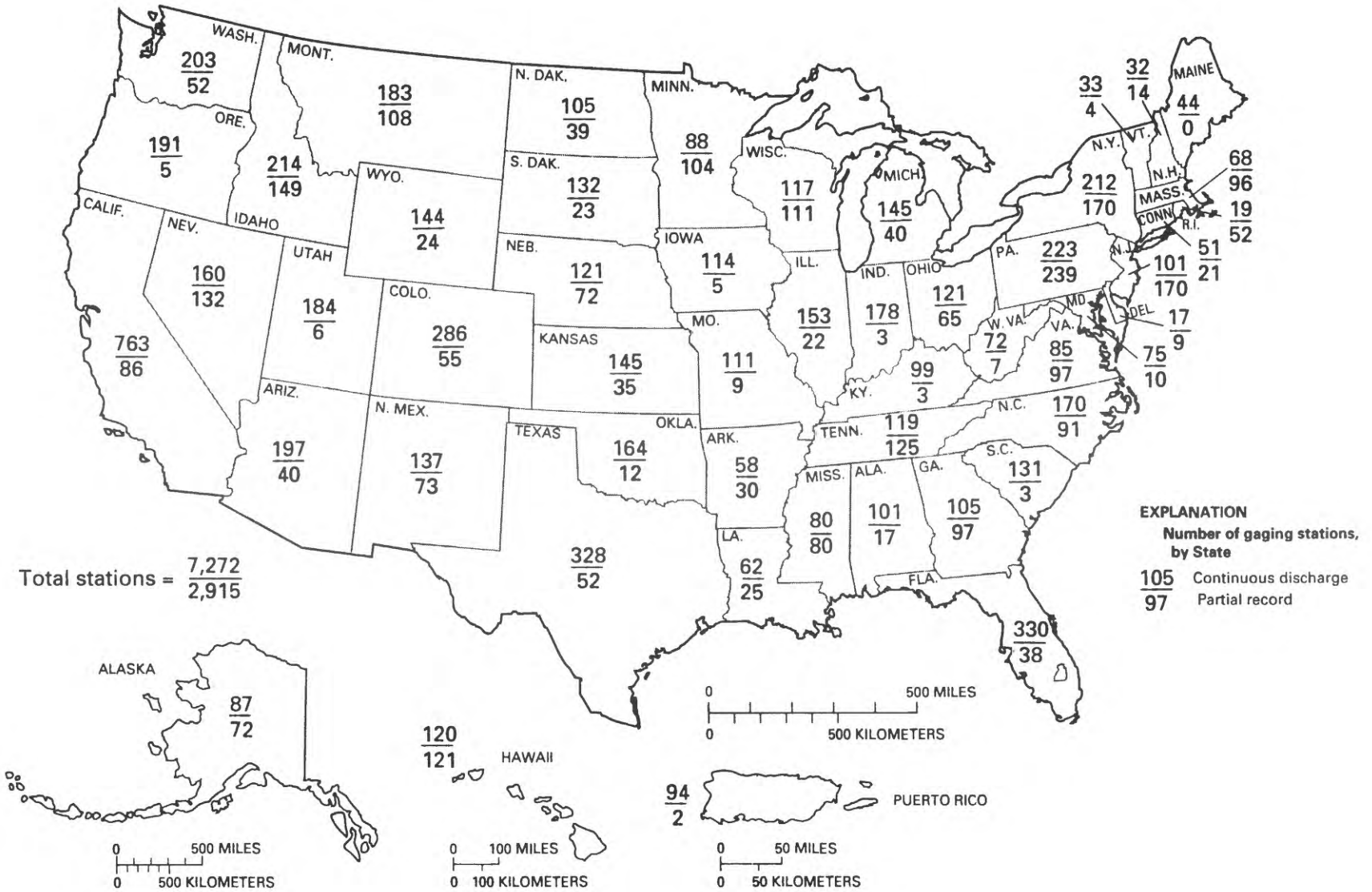
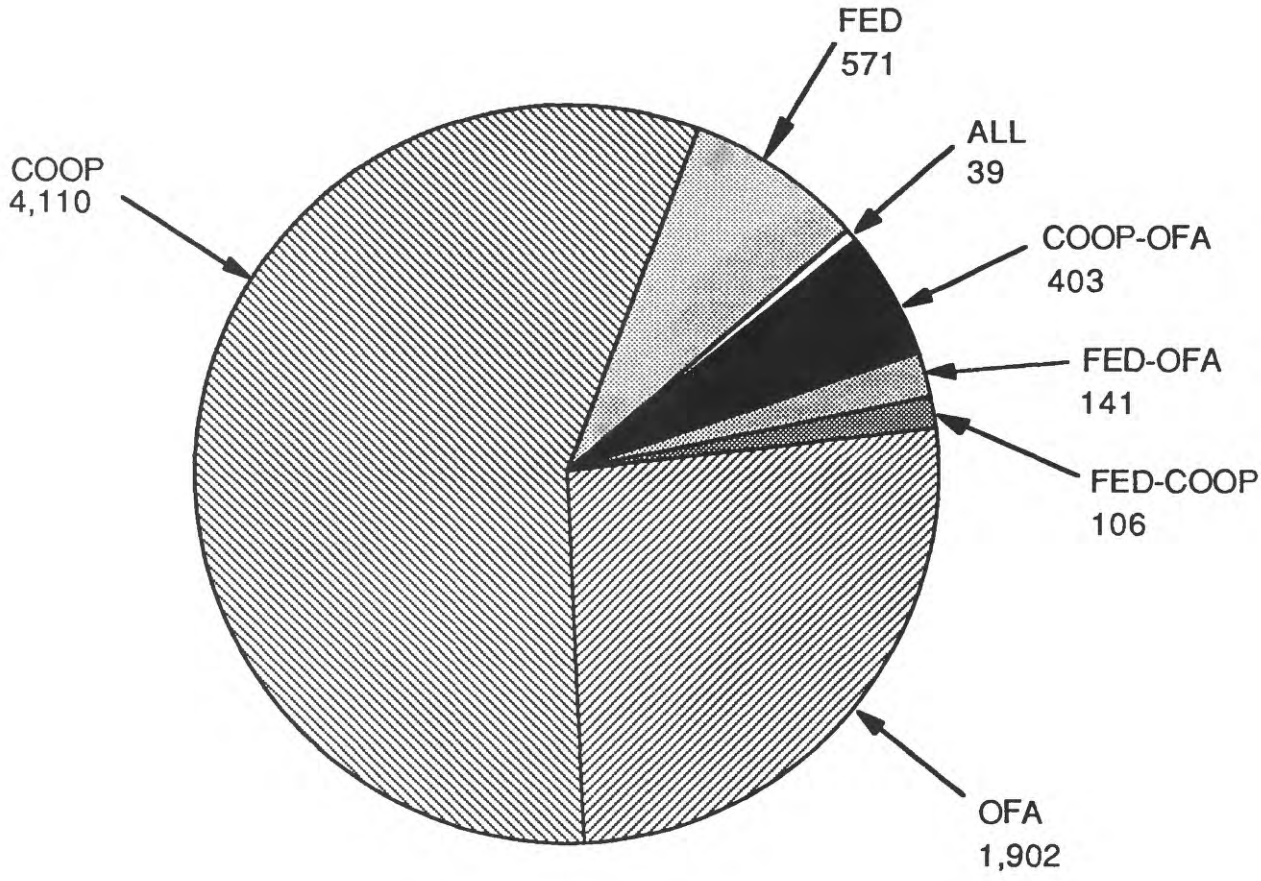


Figure 1.--Number of stations, by State, at which surface-water discharge data were collected in fiscal year 1993.



TOTAL STATIONS = 7,272

EXPLANATION

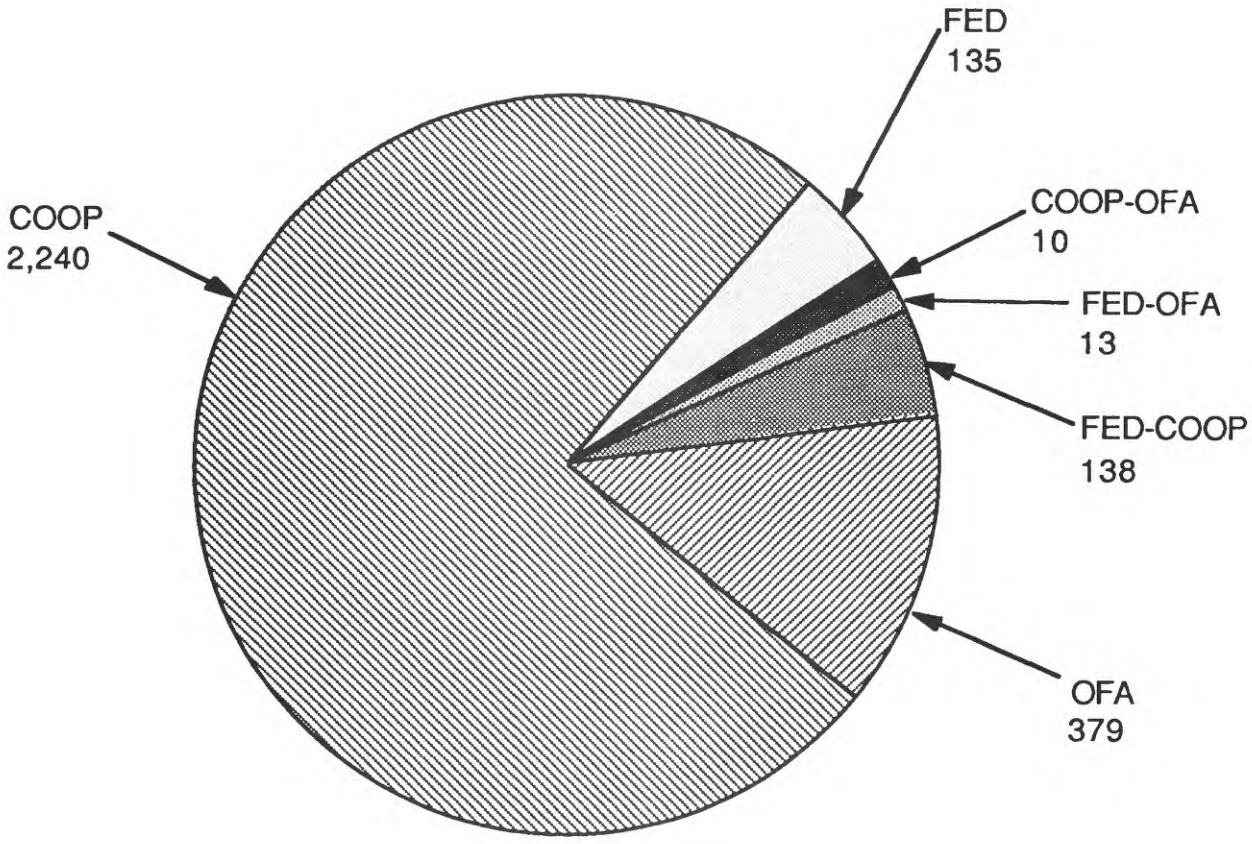
SINGLE PROGRAM SUPPORT

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 1993.



TOTAL STATIONS = 2,915

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 3.--Number of partial record surface-water discharge stations, and sources of funding support, fiscal year 1993.

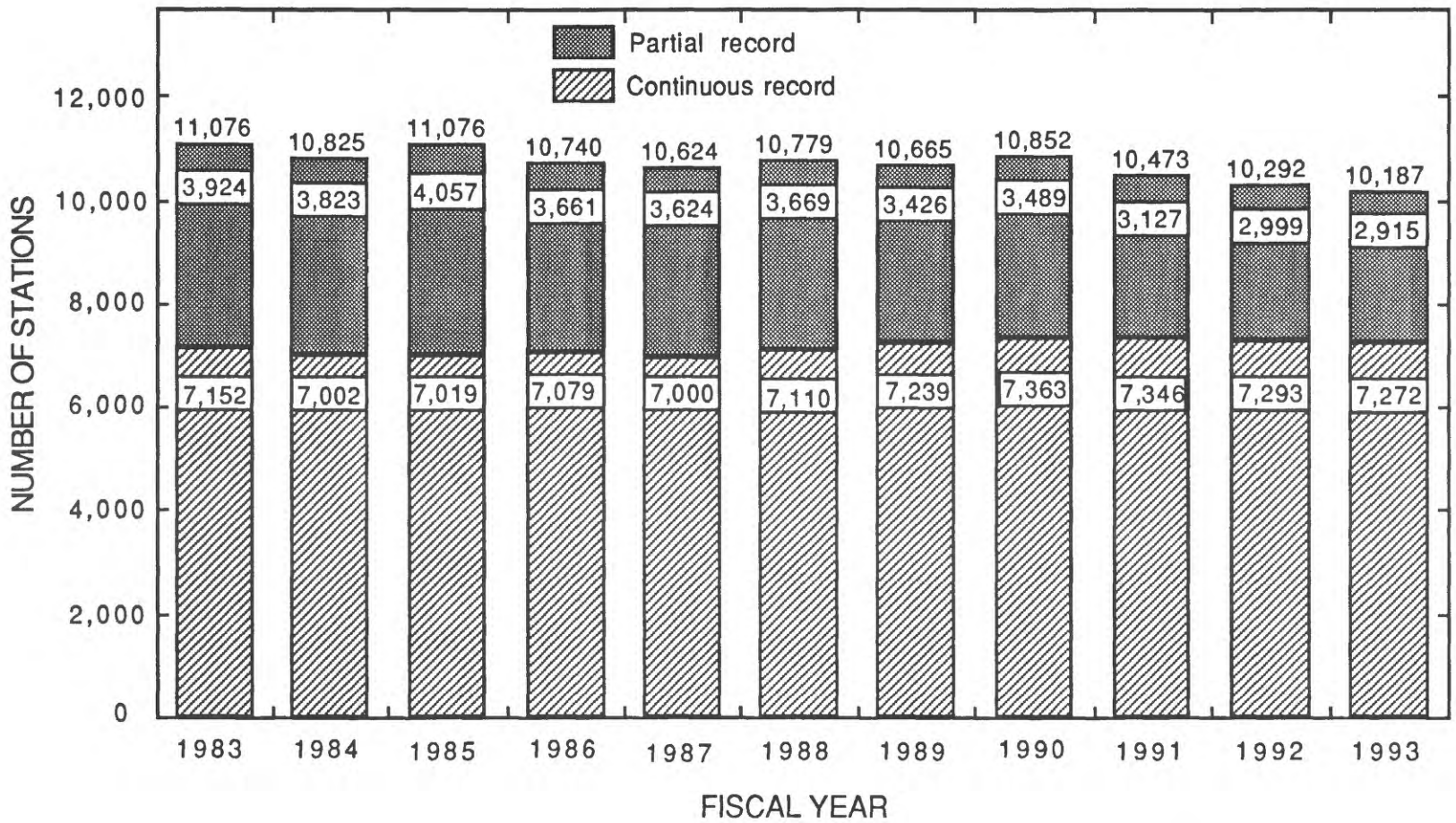


Figure 4.--Number of stations, by year, at which surface-water discharge data were collected from fiscal year 1983 to 1993.

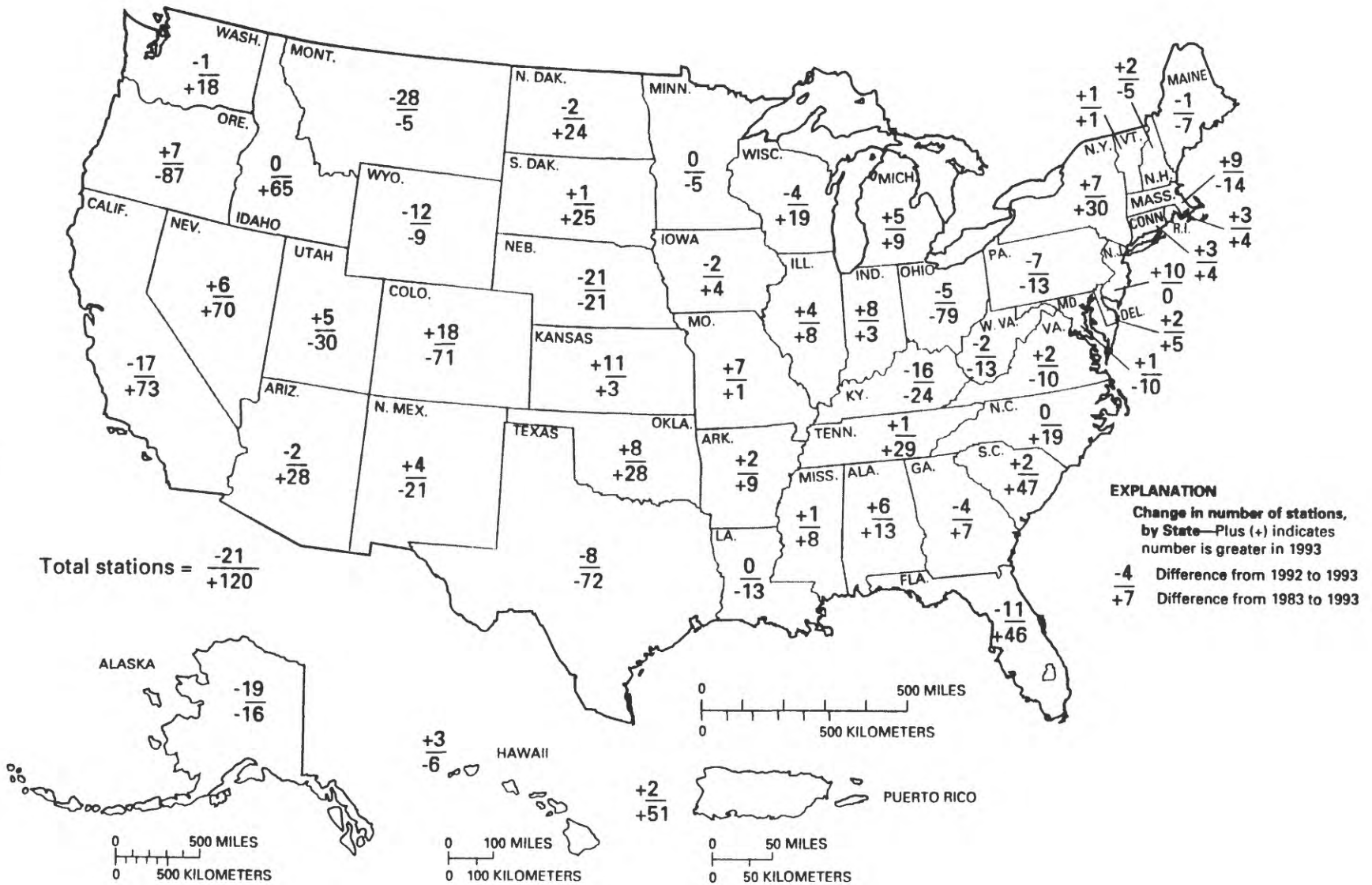


Figure 5.--Change in number of stations, by State, at which continuous surface-water discharge data were collected from fiscal year 1992 to fiscal year 1993, and from fiscal year 1983 to fiscal year 1993.

Table 2. -- Number of continuous surface-water discharge stations, by State and year, from fiscal year 1983 to 1993.

	NUMBER OF STATIONS										
STATE/YEAR	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Alabama	88	86	79	75	75	80	93	103	98	95	101
Alaska	103	101	104	100	83	76	79	86	78	106	87
Arizona	169	199	194	204	182	187	189	191	202	199	197
Arkansas	49	48	45	46	40	48	53	54	58	56	58
California	690	639	641	631	605	619	757	766	768	780	763
Colorado	357	331	342	331	283	281	267	269	250	268	286
Connecticut	47	47	46	48	46	51	50	48	47	48	51
Delaware	12	12	12	12	13	13	13	13	14	15	17
Florida	284	287	282	299	339	342	295	355	342	341	330
Georgia	98	99	107	86	108	108	109	109	109	109	105
Hawaii	126	129	134	113	107	112	112	105	117	117	120
Idaho	149	157	201	214	212	215	224	218	212	214	214
Illinois	145	139	140	160	135	142	136	146	155	149	153
Indiana	175	171	177	181	175	177	178	177	181	170	178
Iowa	110	108	113	116	116	117	117	117	119	116	114
Kansas	142	144	138	140	140	140	141	136	133	134	145
Kentucky	123	114	106	106	108	108	115	114	116	115	99
Louisiana	75	68	80	71	61	63	62	63	62	62	62
Maine	51	49	47	44	44	47	49	49	48	45	44
Maryland	85	89	91	104	104	104	84	80	76	74	75
Massachusetts	82	81	78	76	79	77	84	79	64	59	68
Michigan	136	128	128	129	129	140	140	141	144	140	145
Minnesota	93	85	89	97	98	93	91	86	85	88	88
Mississippi	72	68	67	74	79	78	79	76	77	79	80
Missouri	110	108	104	105	105	105	113	120	118	104	111
Montana	188	184	189	164	206	202	211	209	210	211	183
Nebraska	142	145	145	144	144	141	144	141	143	142	121
Nevada	90	90	94	90	96	111	134	167	142	154	160
New Hampshire	37	38	36	36	36	38	38	38	36	30	32
New Jersey	101	101	95	97	108	101	95	96	91	91	101
New Mexico	158	147	147	160	176	172	172	168	131	133	137
New York	182	185	172	167	186	184	194	203	209	205	212
North Carolina	151	154	154	167	173	205	192	186	175	170	170
North Dakota	81	75	74	103	100	101	98	104	104	107	105
Ohio	200	130	109	127	122	133	136	132	164	126	121
Oklahoma	136	123	123	122	113	123	120	127	149	156	164
Oregon	278	278	277	280	268	246	244	237	236	184	191
Pennsylvania	236	235	251	249	243	250	236	241	235	230	223
Puerto Rico	43	58	58	56	49	60	61	66	78	92	94
Rhode Island	15	15	15	15	16	16	16	16	16	16	19
South Carolina	84	107	104	102	118	114	119	132	130	129	131
South Dakota	107	113	109	105	102	132	137	132	127	131	132
Tennessee	90	105	99	89	97	86	92	83	108	118	119
Texas	400	399	397	384	365	361	368	369	341	336	328
Utah	214	201	194	193	157	176	165	157	157	179	184
Vermont	32	31	31	31	30	33	33	33	39	32	33
Virginia	95	100	85	86	82	84	80	85	84	83	85
Washington	185	182	215	239	240	199	191	197	203	204	203
West Virginia	85	73	64	79	77	72	73	73	77	74	72
Wisconsin	98	97	100	95	93	109	112	117	121	121	117
Wyoming	153	149	137	137	135	138	148	153	167	156	144
Total	7,152	7,002	7,019	7,079	7,000	7,110	7,239	7,363	7,346	7,293	7,272

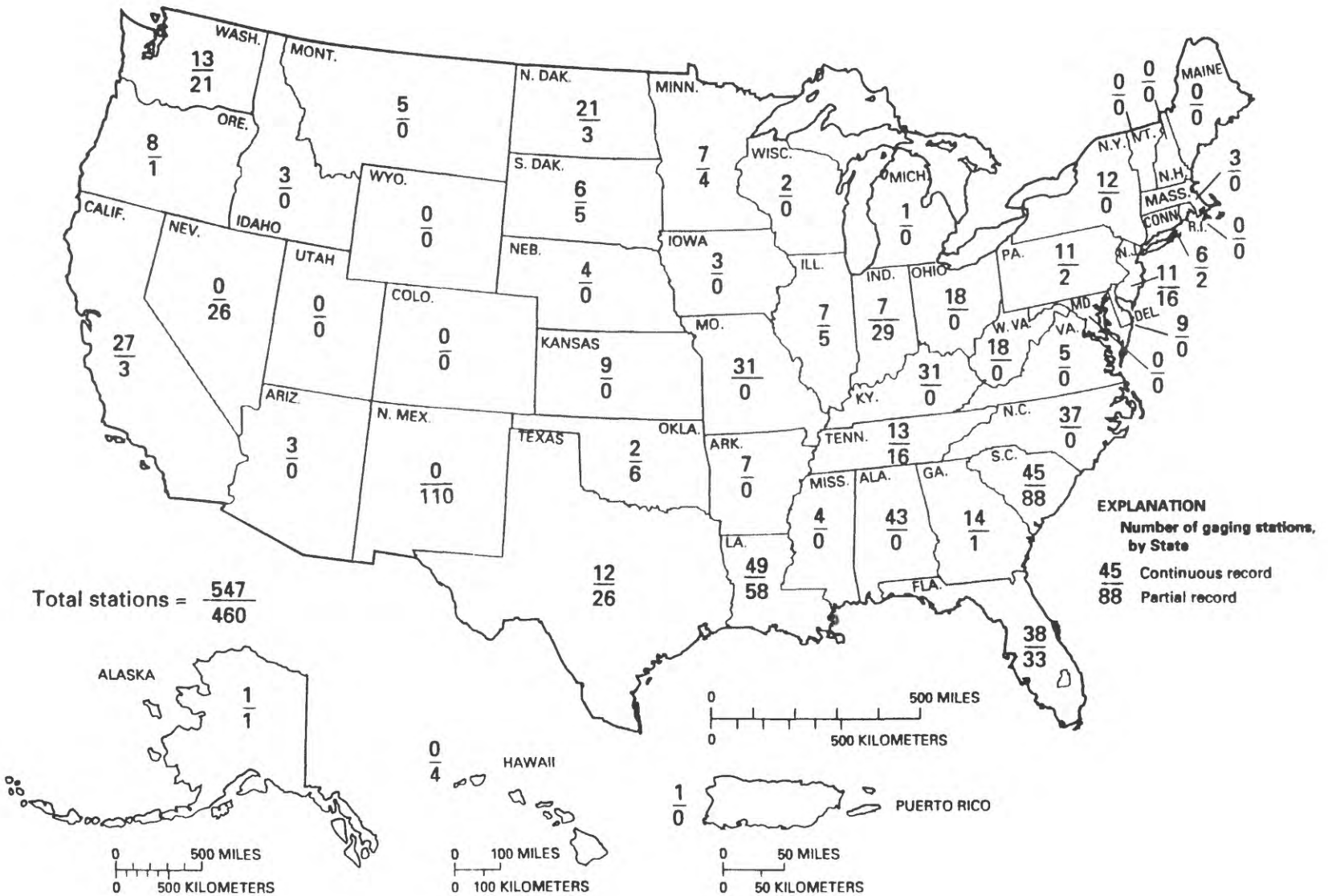
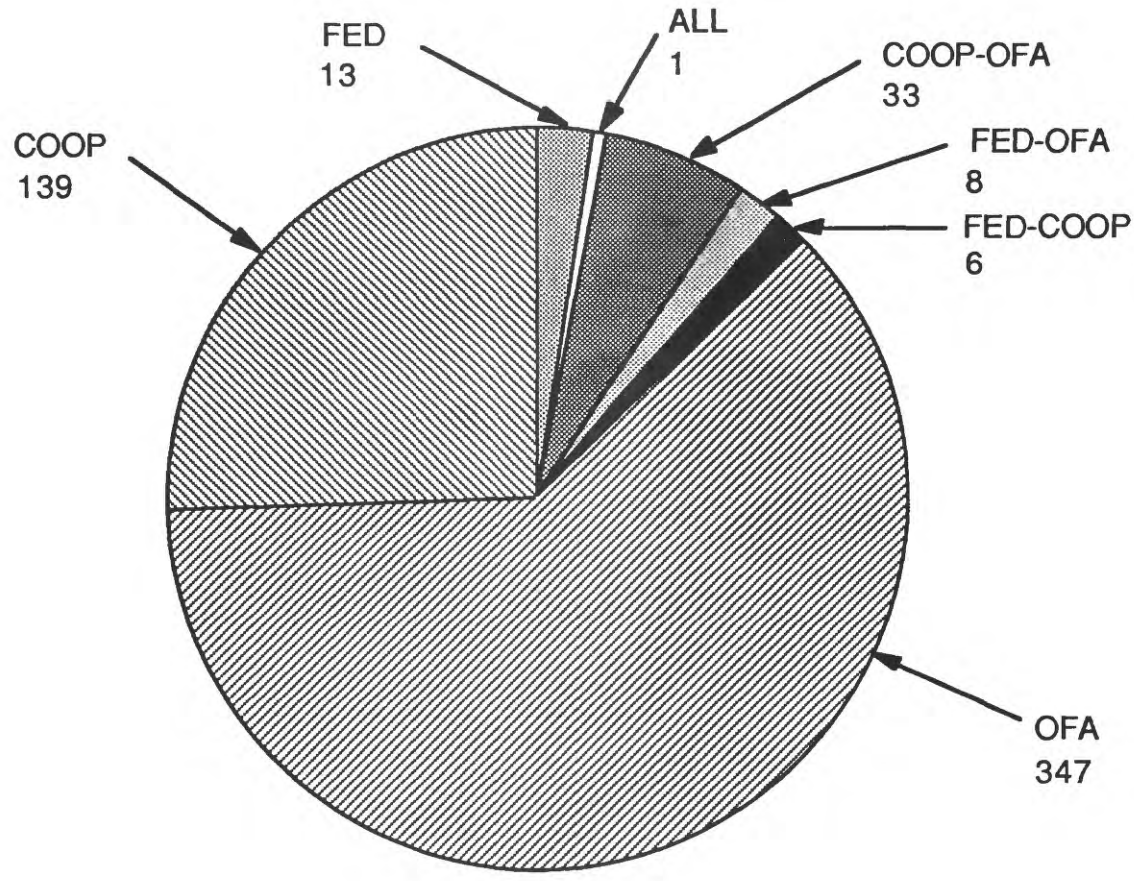


Figure 6.--Number of stations, by State, at which stage-only data were collected on streams in fiscal year 1993.



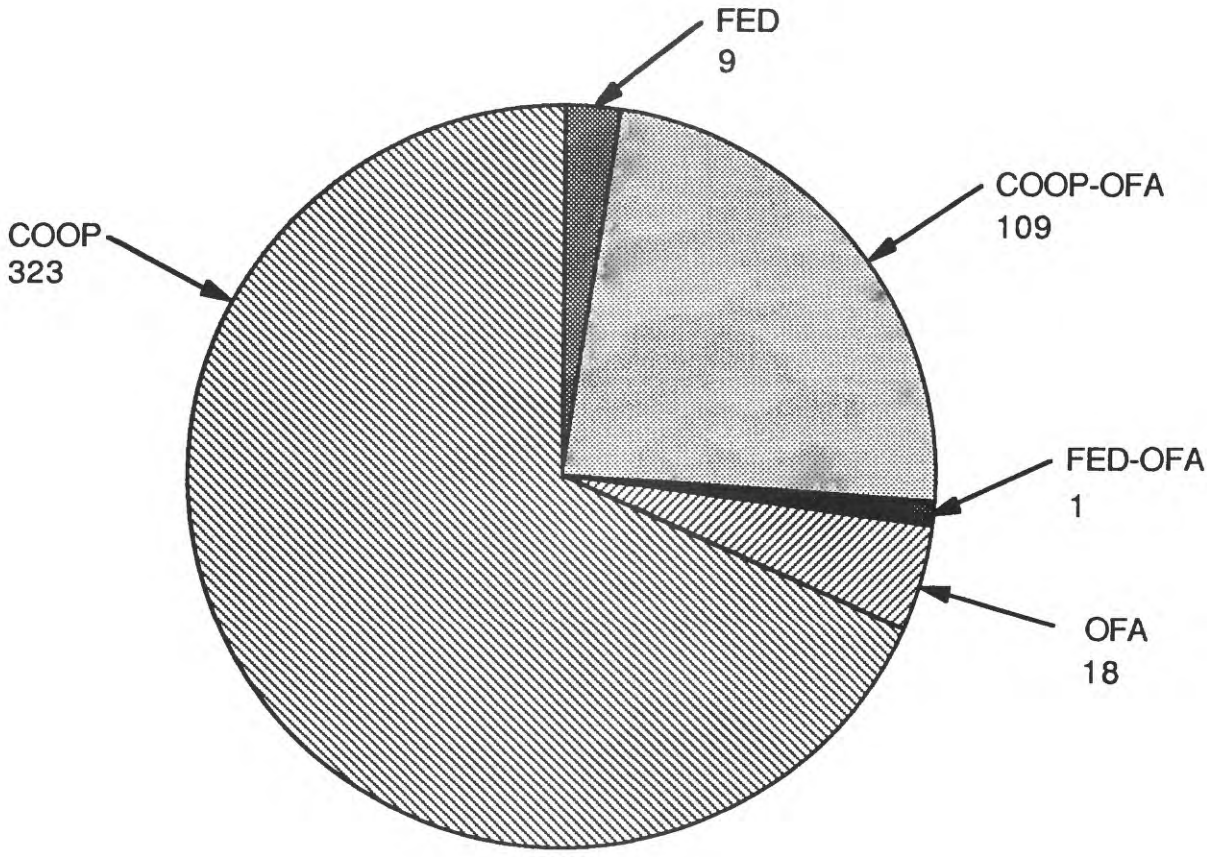
TOTAL STATIONS = 547

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 7.--Number of continuous surface-water stage-only stations on streams, and sources of funding support, fiscal year 1993.



EXPLANATION

SINGLE PROGRAM SUPPORT

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

COMBINED PROGRAM SUPPORT

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 1993.

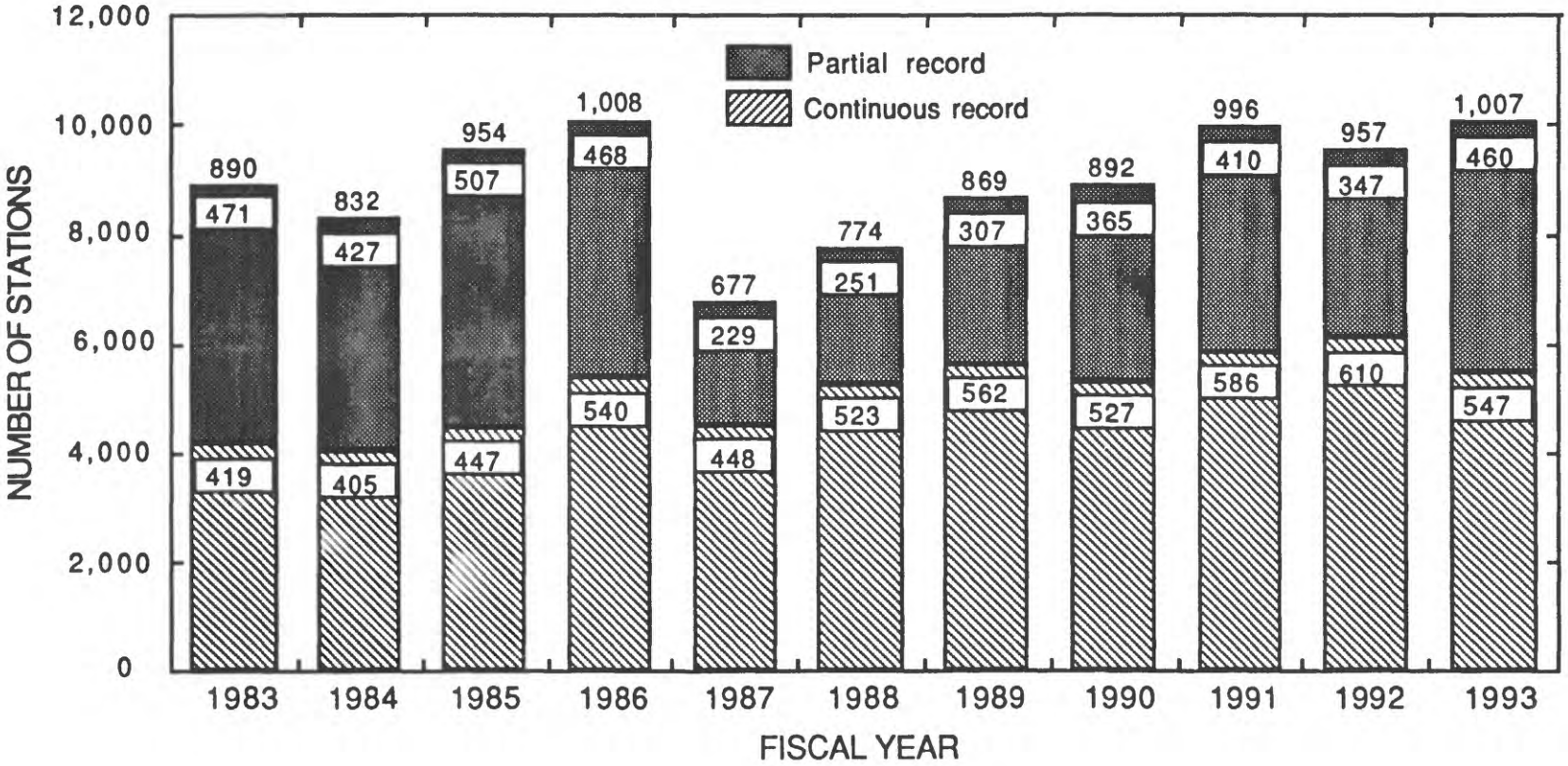


Figure 9.--Number of stations, by year, at which stage-only data were collected on streams from fiscal year 1983 to 1993.

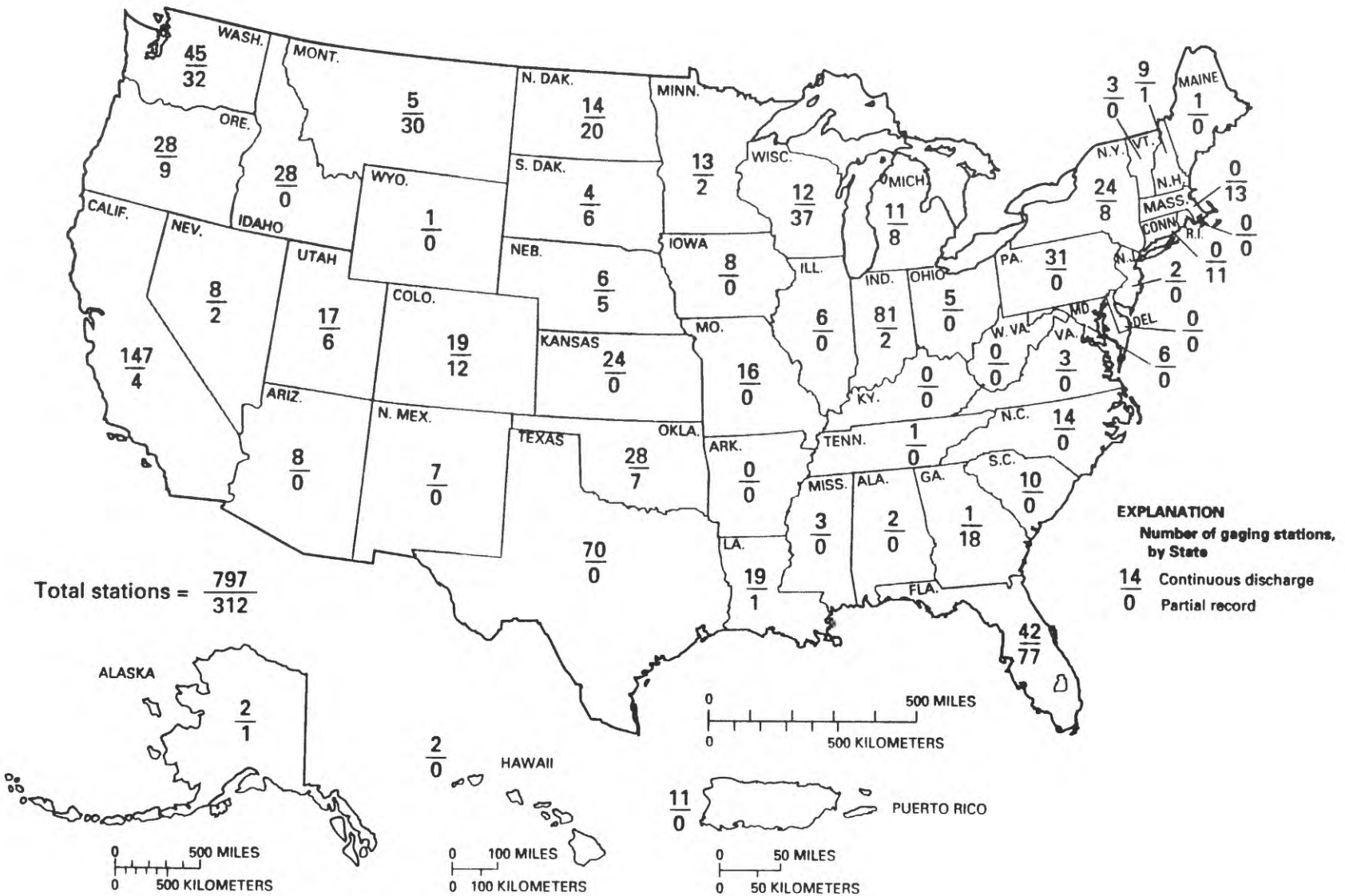
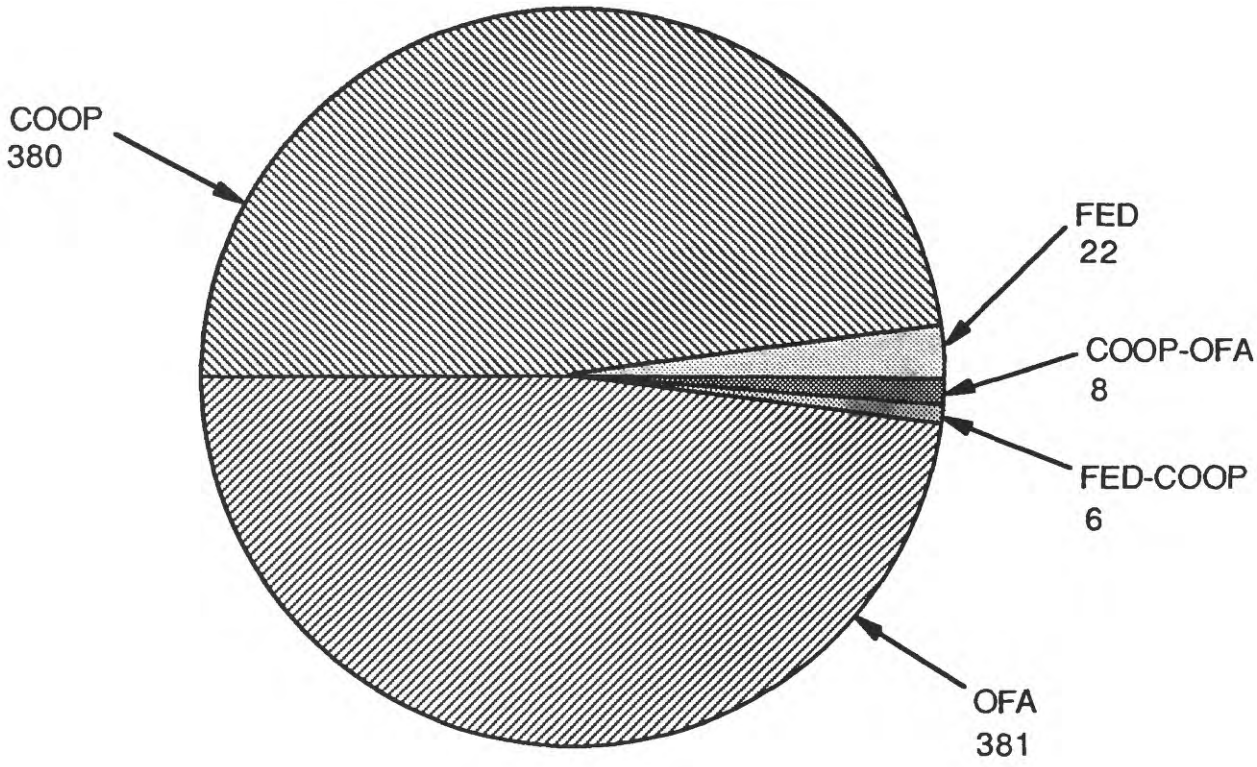


Figure 10.--Number of stations, by State, at which stage data were collected on lakes and reservoirs in fiscal year 1993.



EXPLANATION

SINGLE PROGRAM SUPPORT

FED = Federal

OFA = Other Federal Agencies

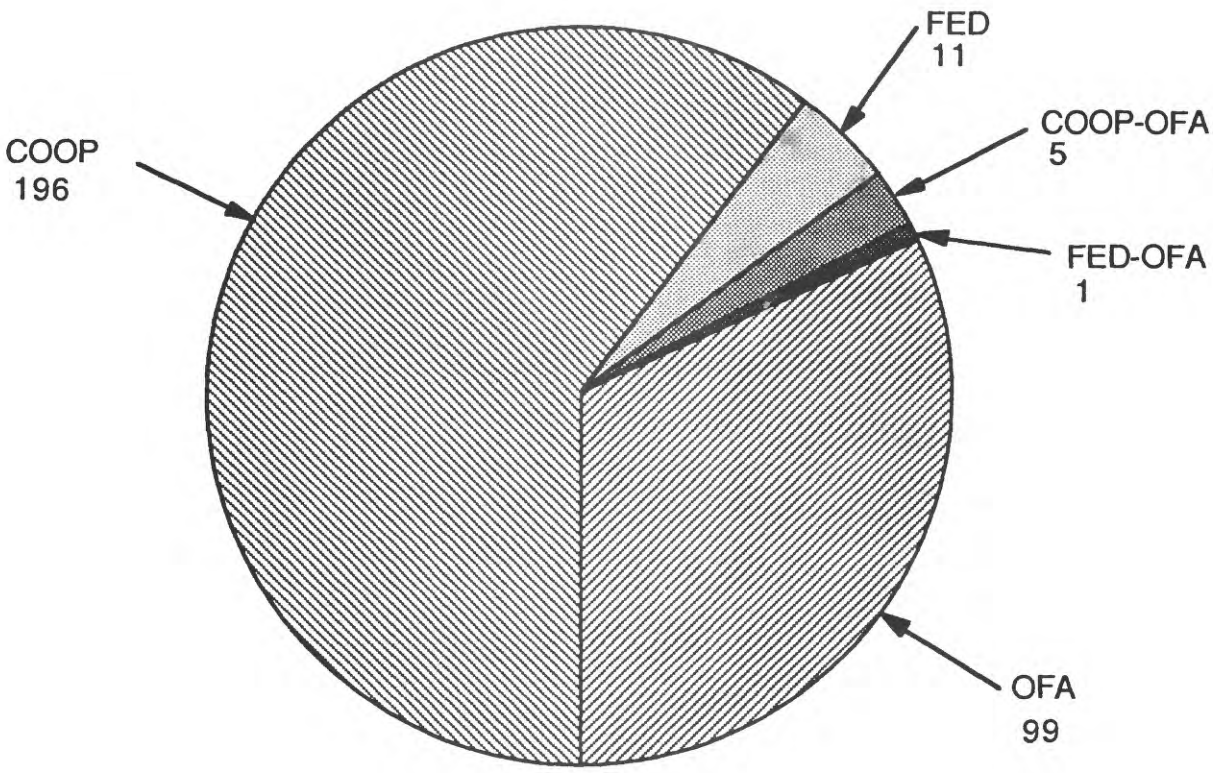
COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

FED - COOP = Federal and Federal - State Cooperative Program

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

Figure 11.--Number of continuous surface-water stage stations on lakes and reservoirs, and sources of funding support, fiscal year 1993.



TOTAL STATIONS = 312

EXPLANATION

SINGLE PROGRAM SUPPORT

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

COMBINED PROGRAM SUPPORT

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 1993.

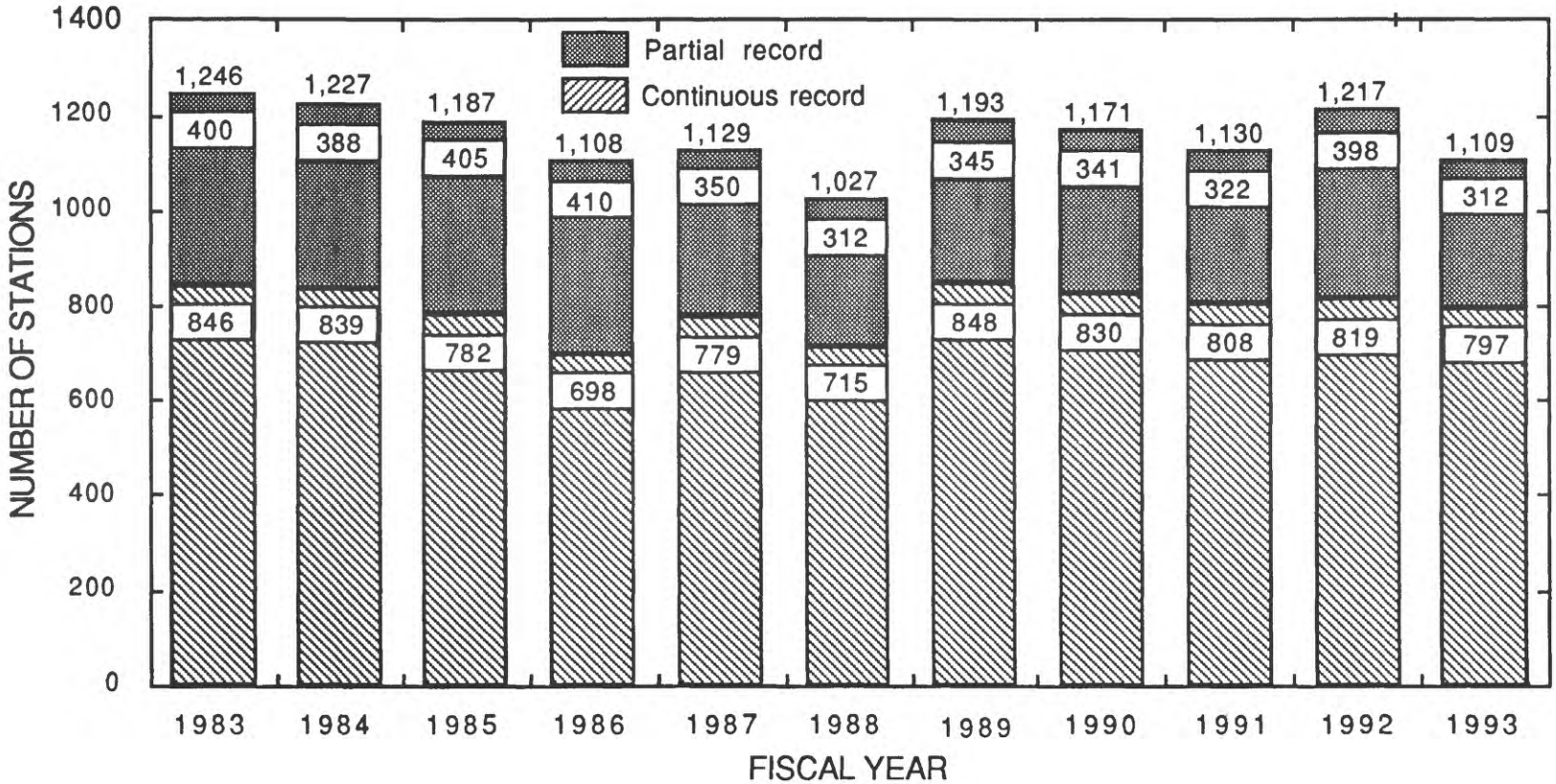


Figure 13.--Number of stations, by year, at which surface-water stage data were collected on lakes and reservoirs from fiscal year 1983 to fiscal year 1993.

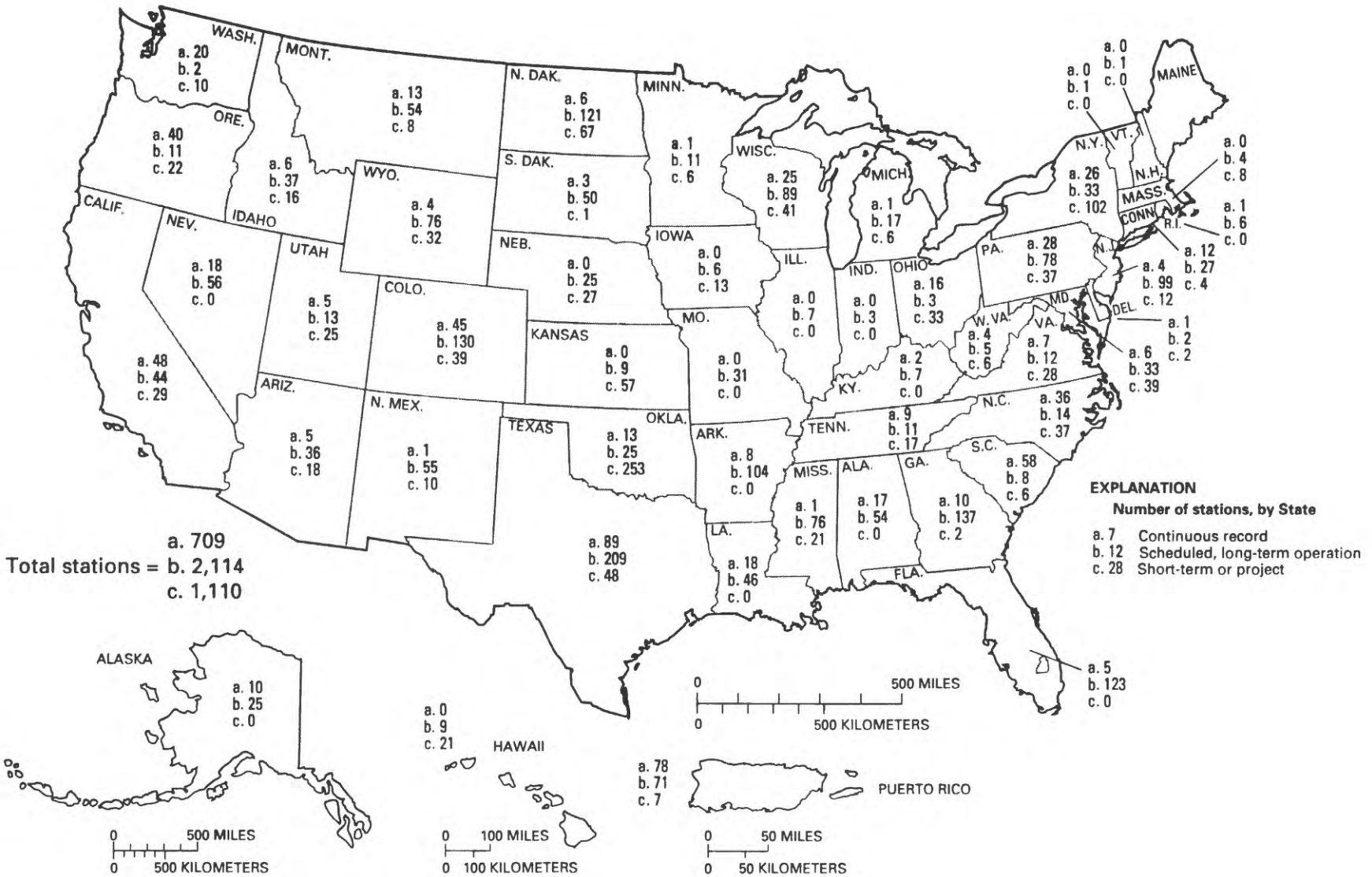
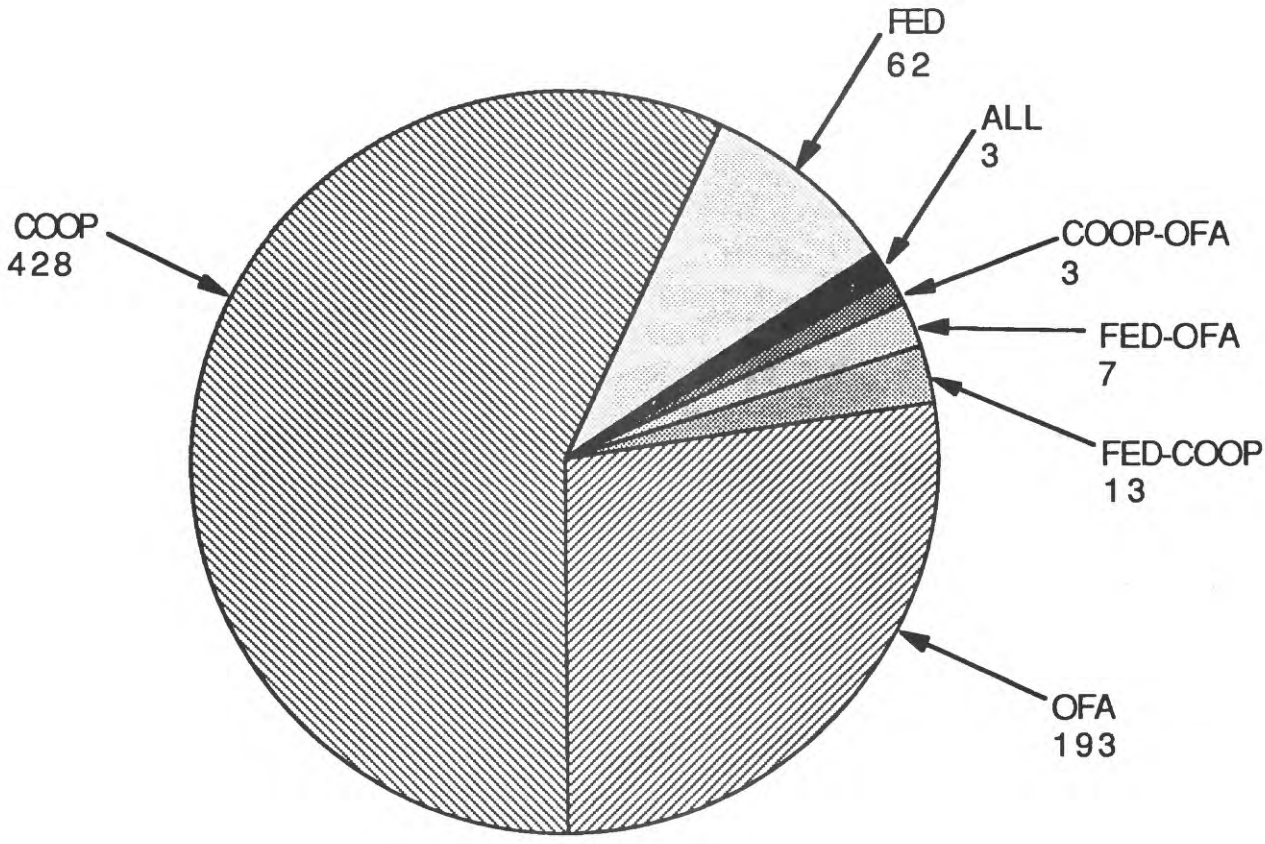


Figure 14.--Number of stations, by State, at which surface-water quality data were collected in fiscal year 1993.



TOTAL STATIONS - 709

EXPLANATION

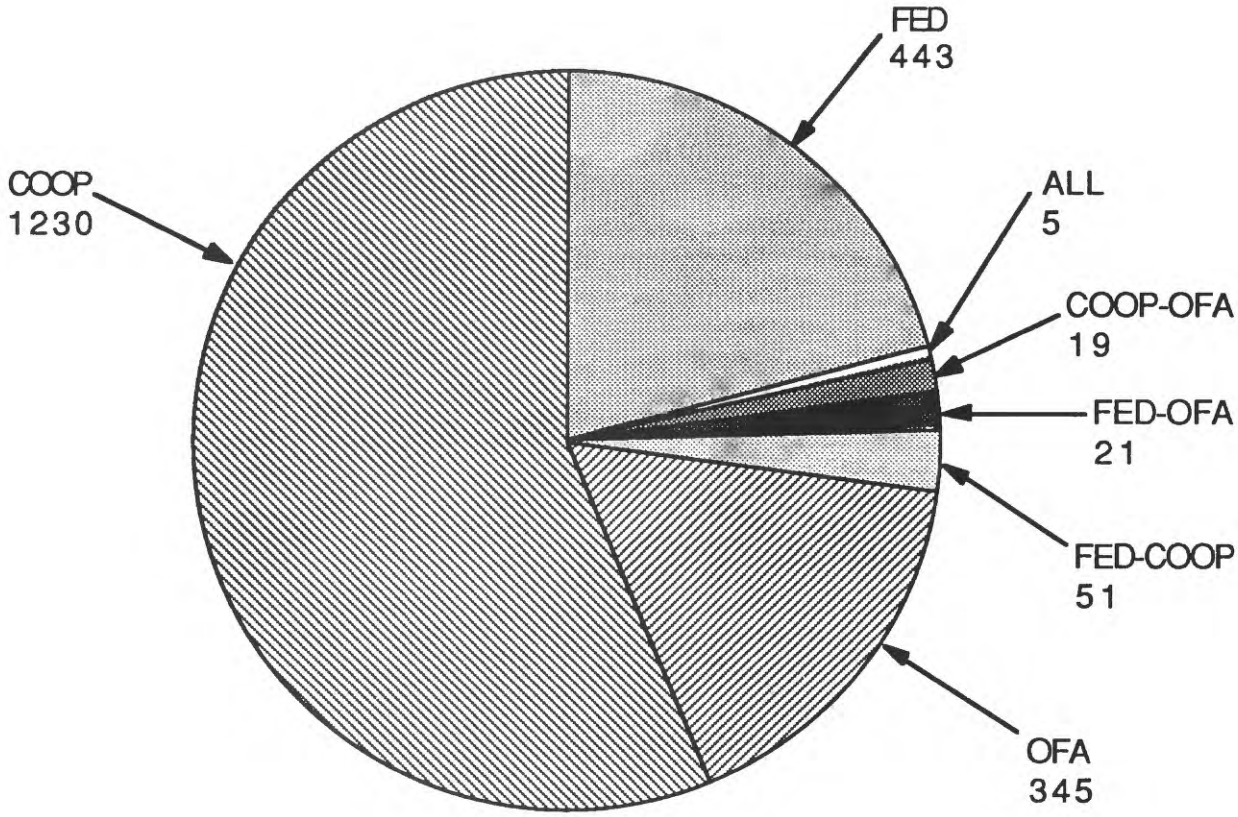
SINGLE PROGRAM SUPPORT

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 1993.



EXPLANATION

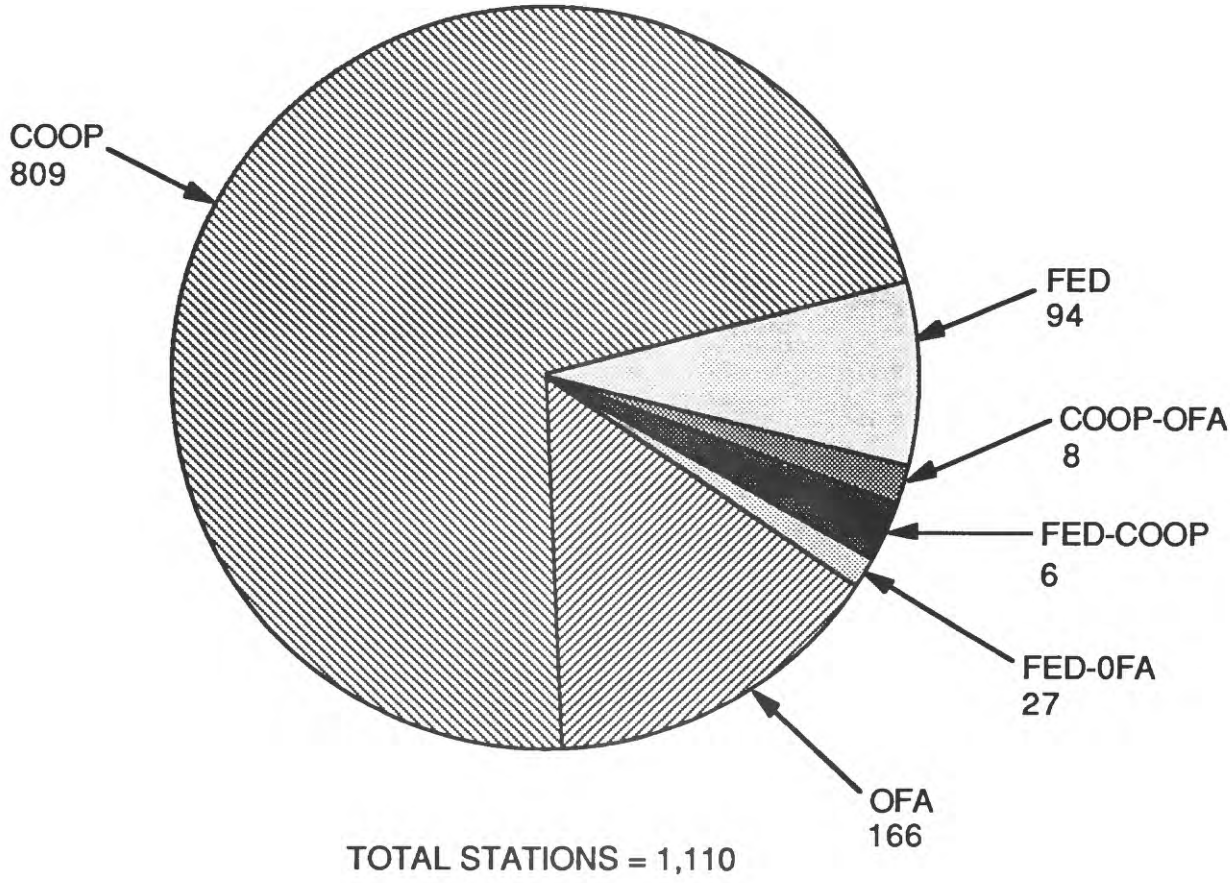
SINGLE PROGRAM SUPPORT

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 1993.

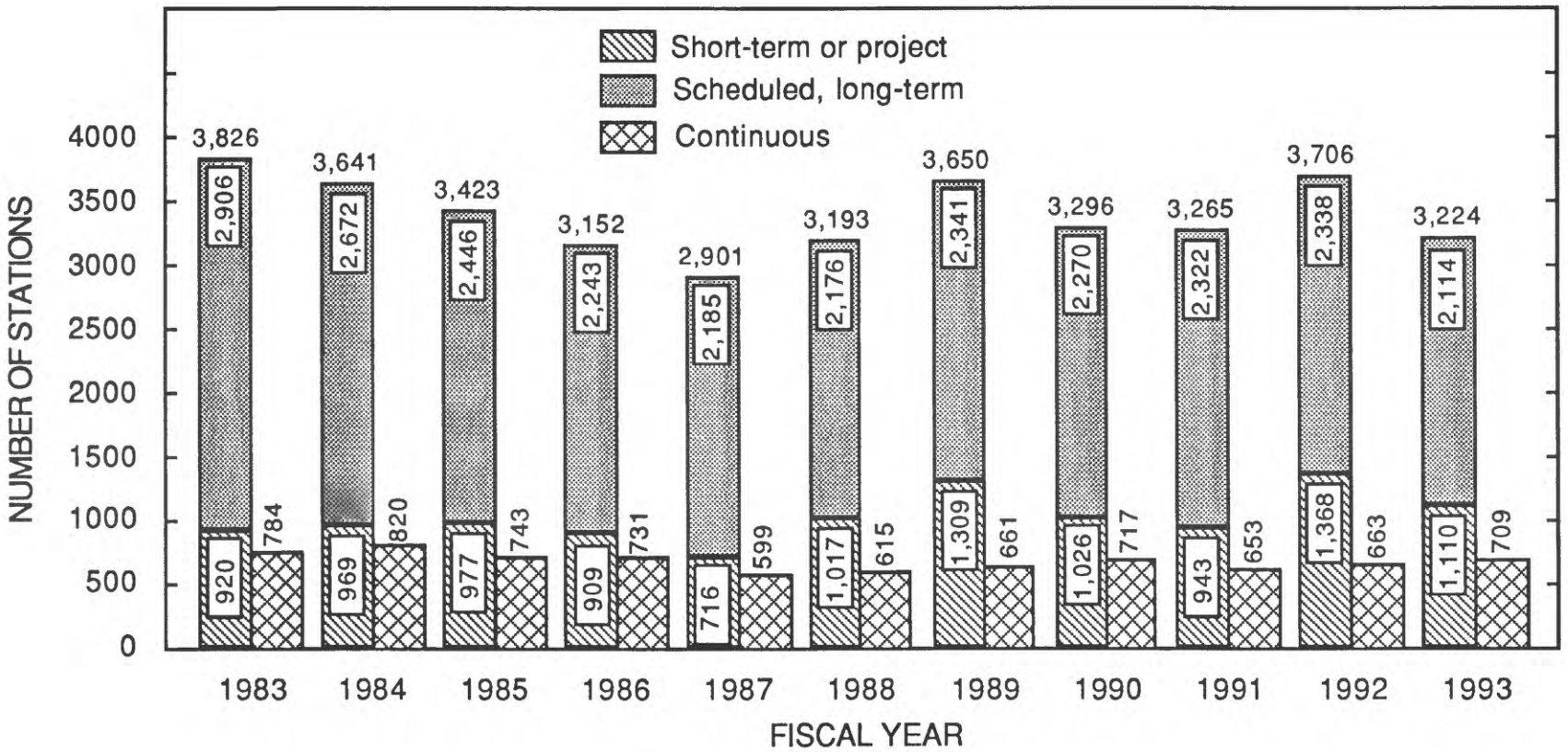


EXPLANATION

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 17.--Number of short-term or project surface-water quality stations, and sources of funding support, fiscal year 1993.



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 fiscal year 1993.

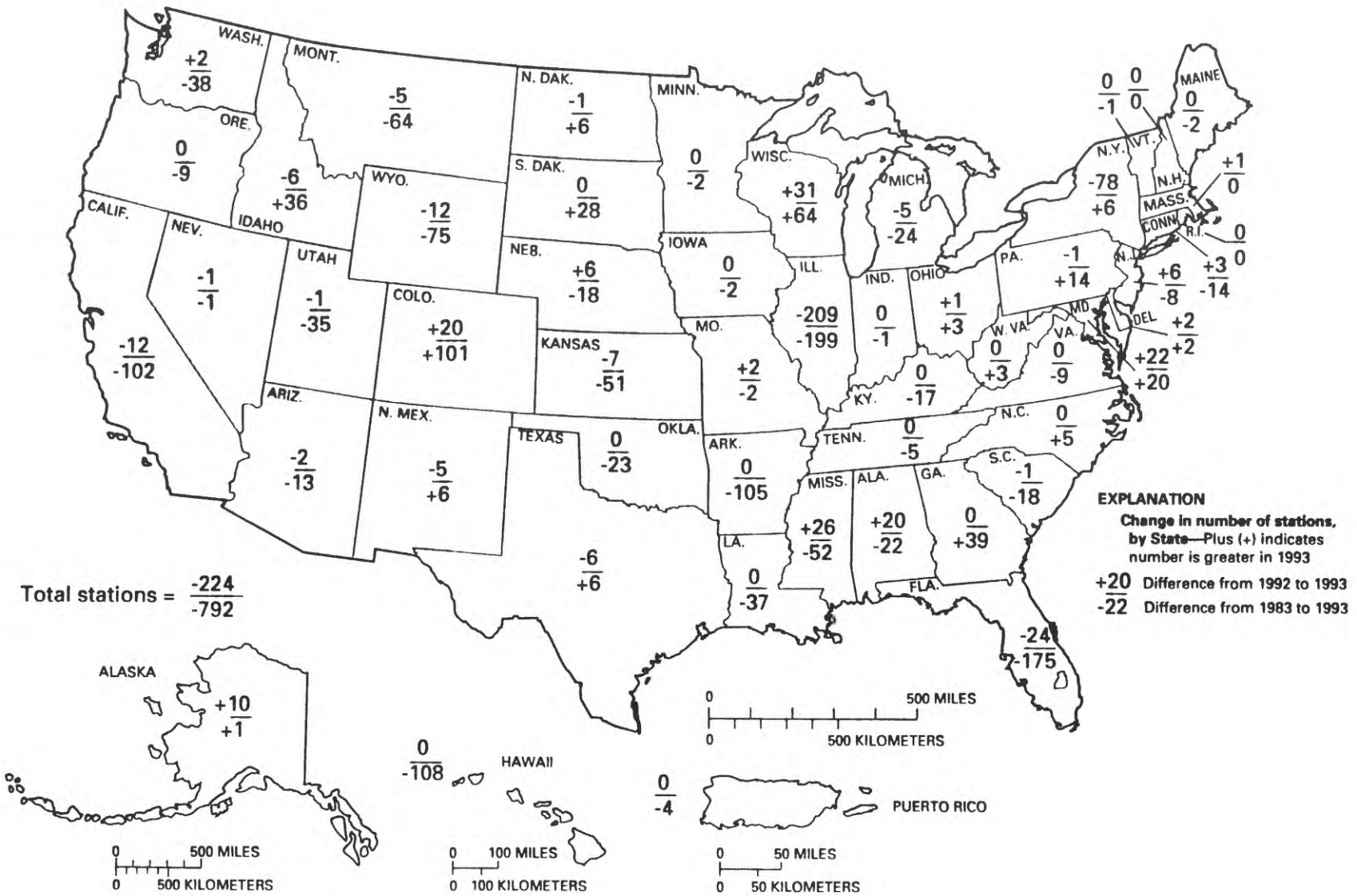


Figure 19.--Change in number of stations, by State, at which scheduled, long-term operation surface-water quality data were collected from fiscal year 1992 to fiscal year 1993, and from fiscal year 1983 to fiscal year 1993.

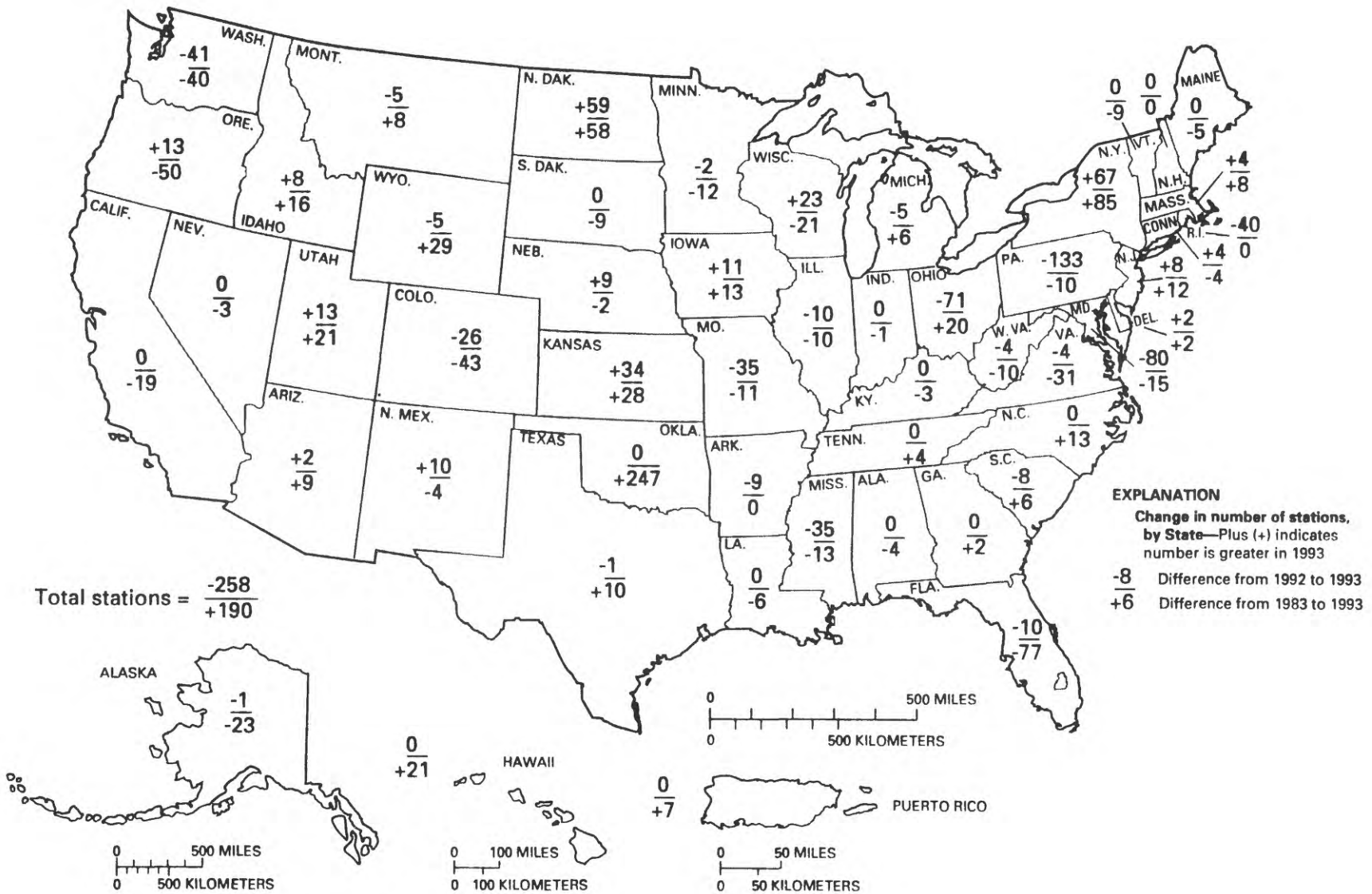


Figure 20.--Change in number of stations, by State, at which surface-water quality data were collected at short-term or project stations from fiscal year 1992 to fiscal year 1993, and from fiscal year 1983 to fiscal year 1993.

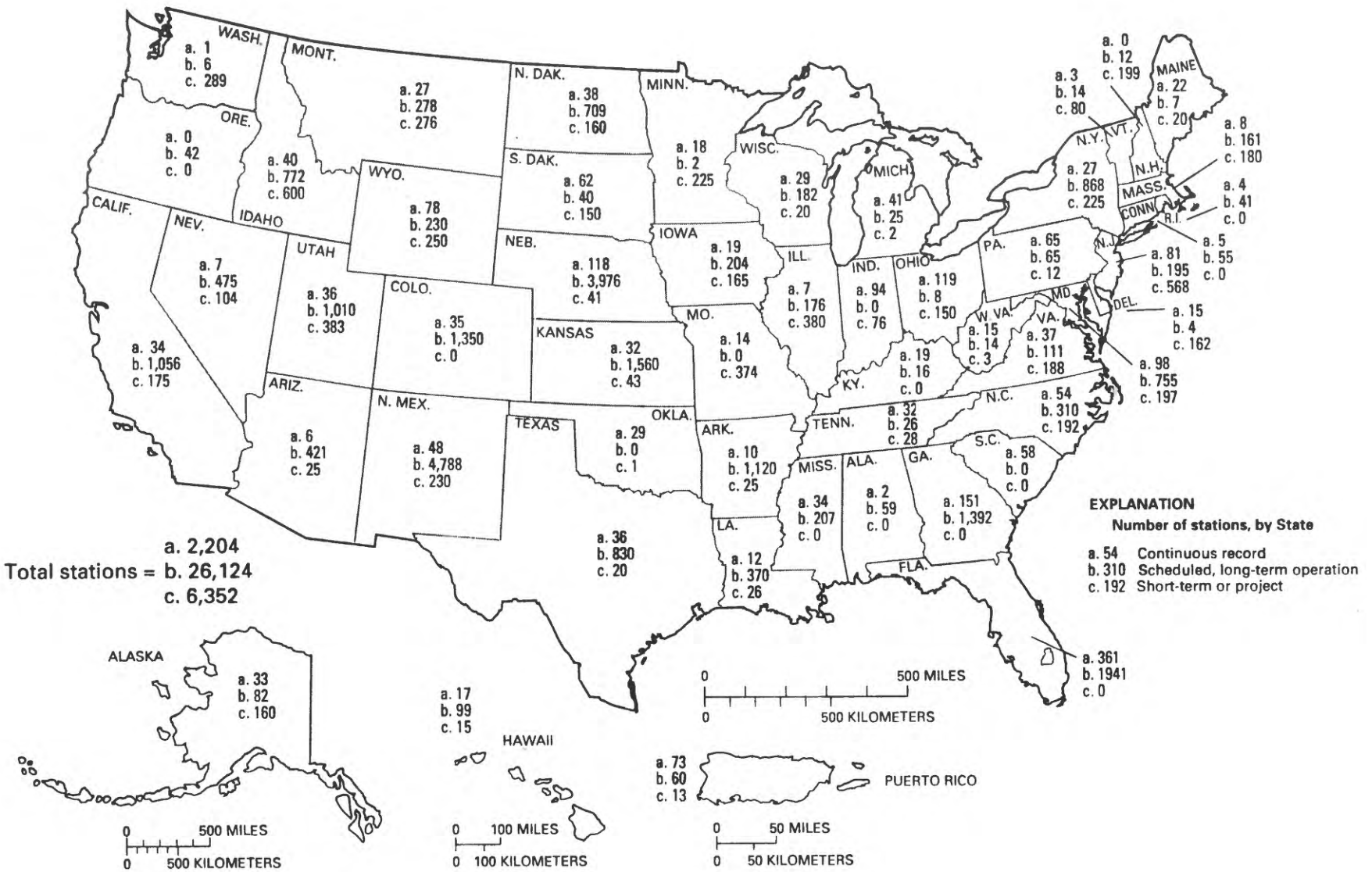
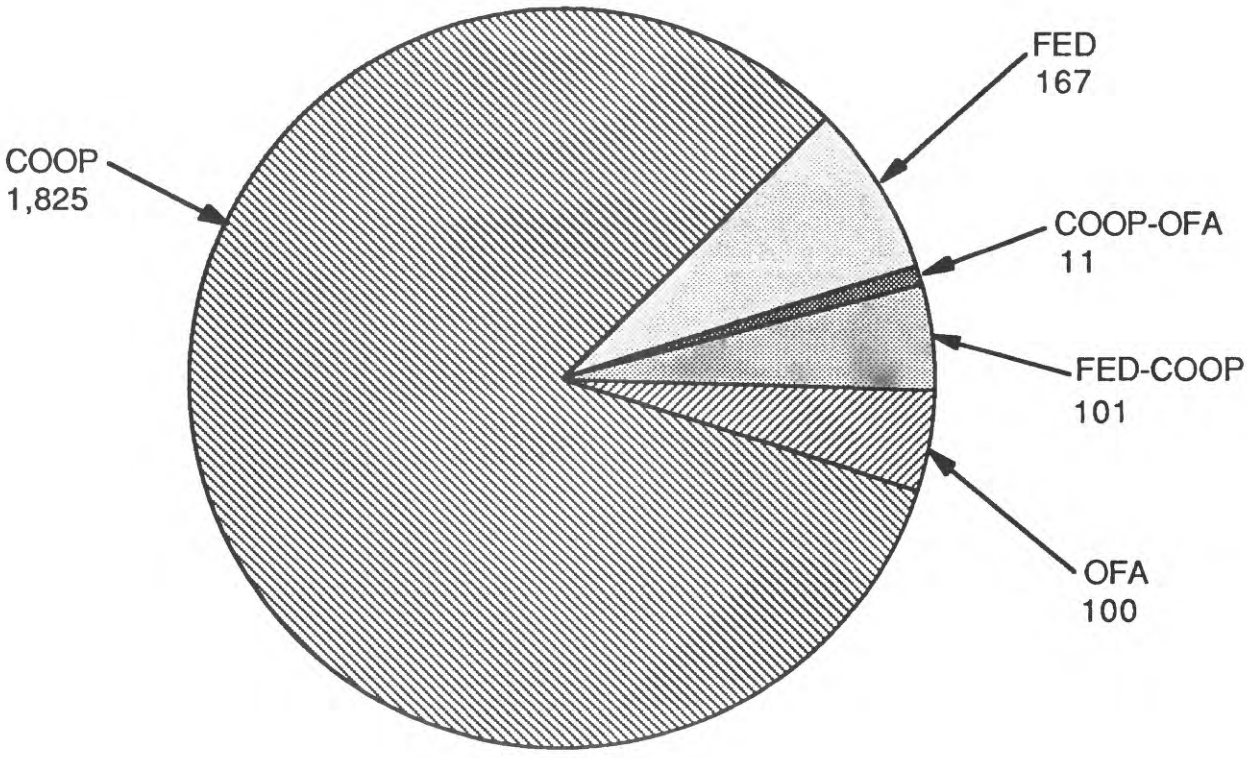


Figure 21.--Number of stations, by State, at which ground-water levels were collected in fiscal year 1993.



EXPLANATION

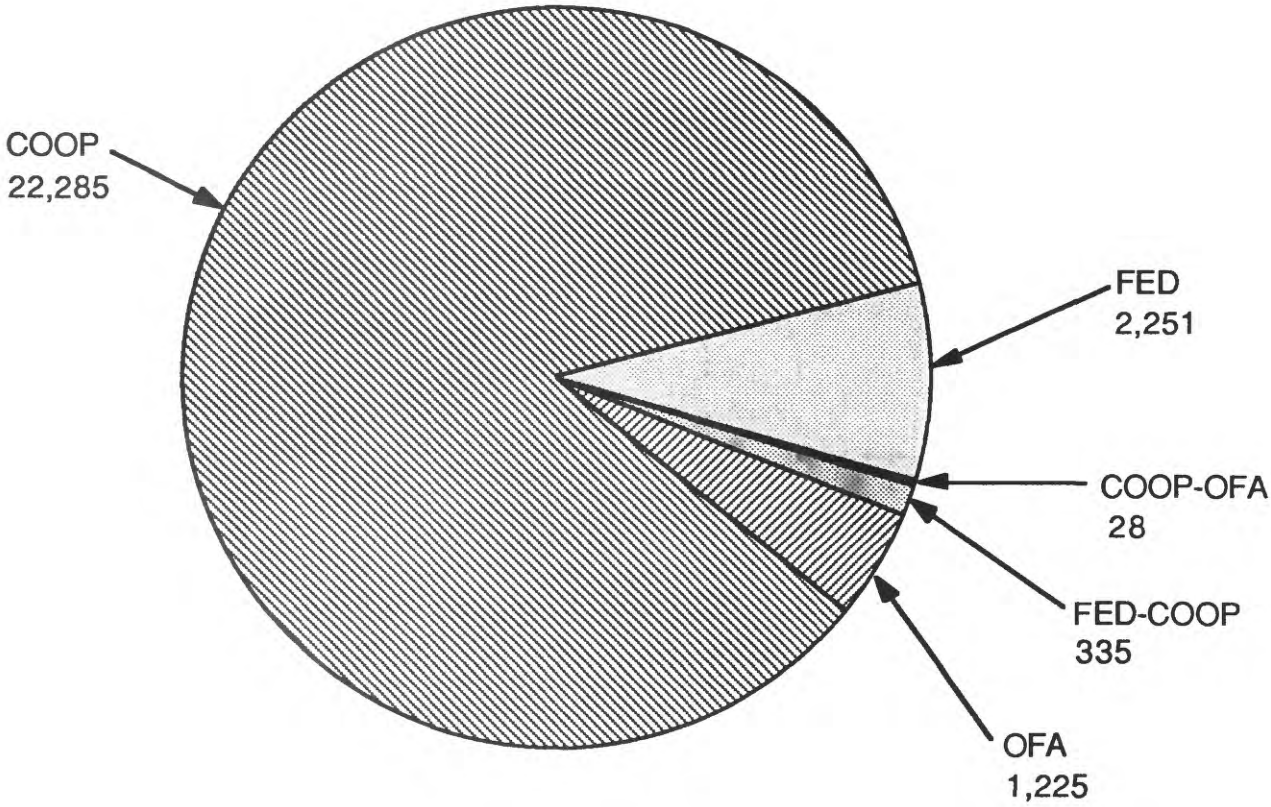
SINGLE PROGRAM SUPPORT

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 1993.



EXPLANATION

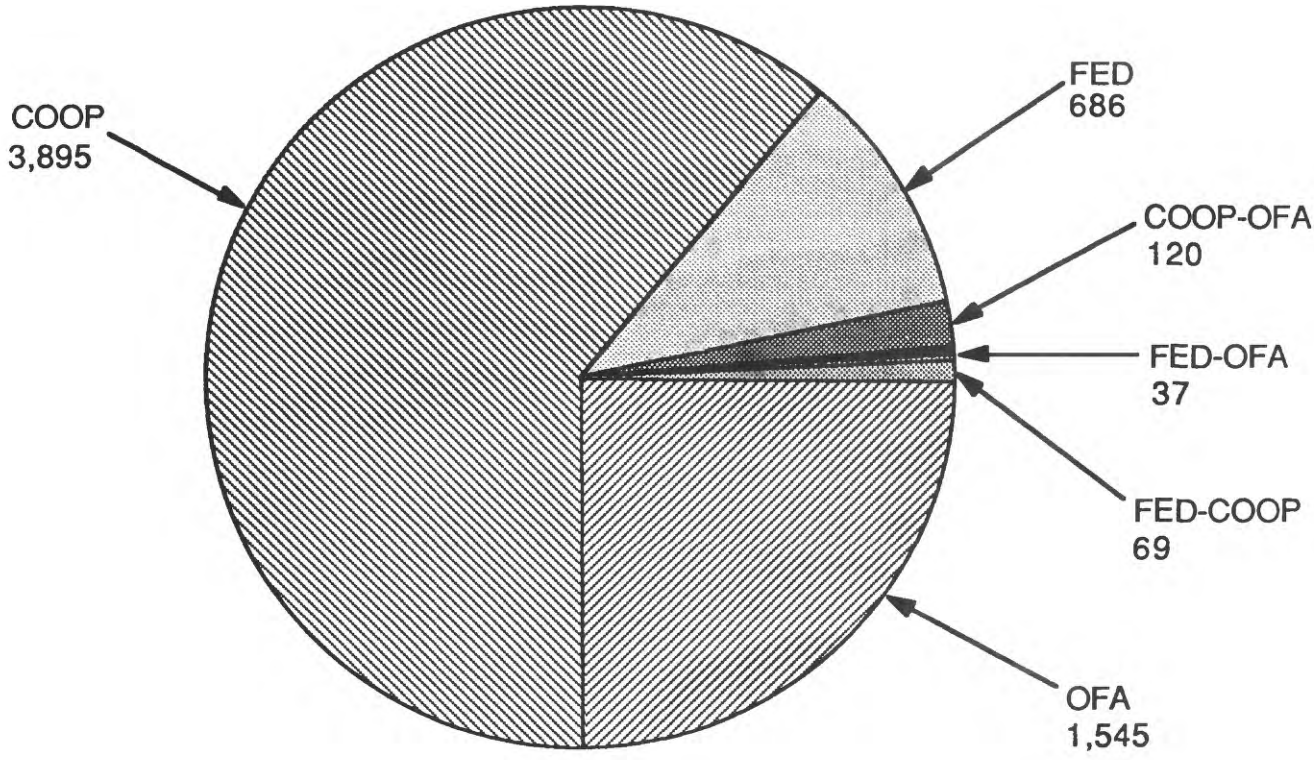
SINGLE PROGRAM SUPPORT

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 1993.



TOTAL STATIONS = 6,352

EXPLANATION

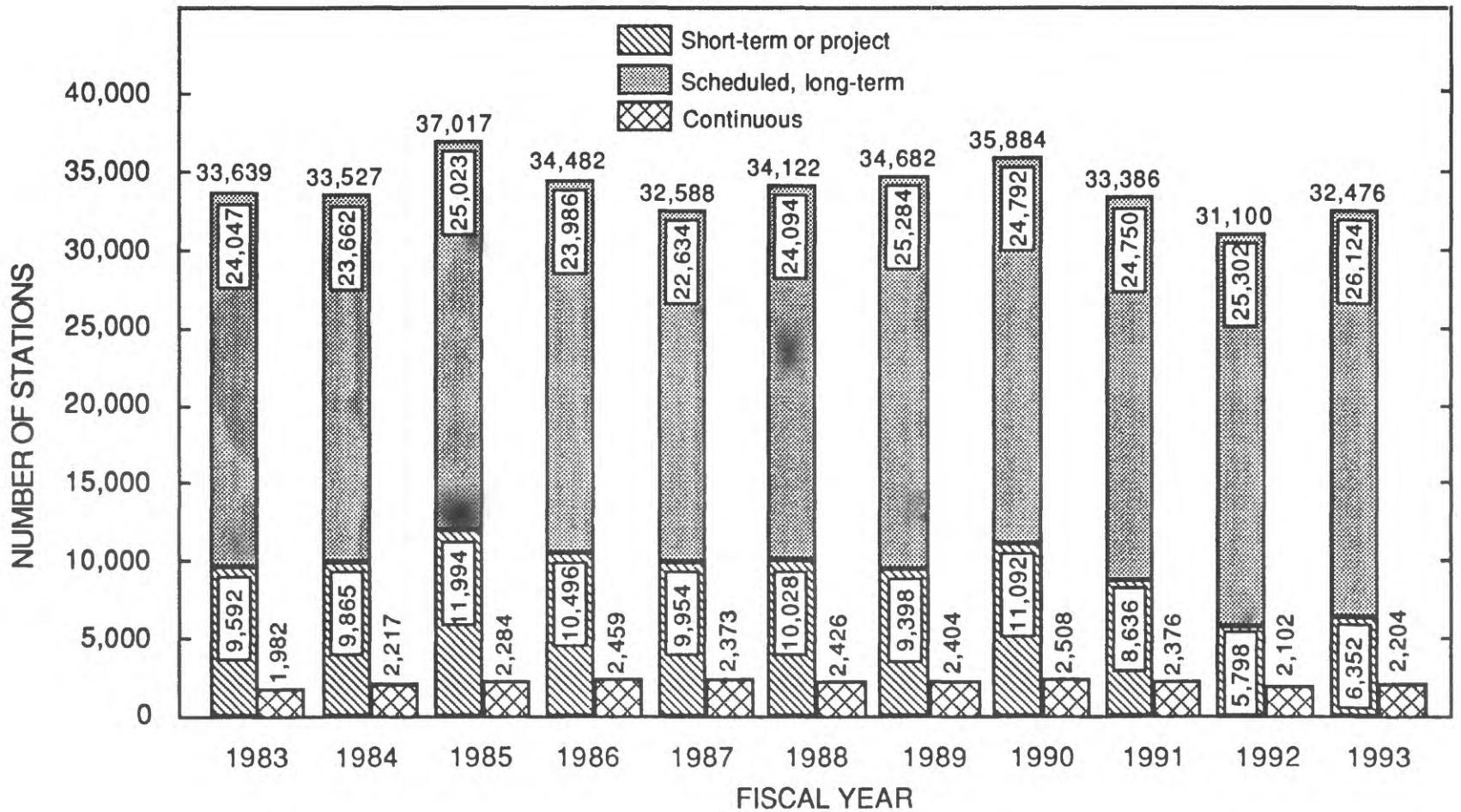
SINGLE PROGRAM SUPPORT

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 24.--Number of short-term or project ground-water level stations, and sources of funding support, fiscal year 1993.



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 1993.

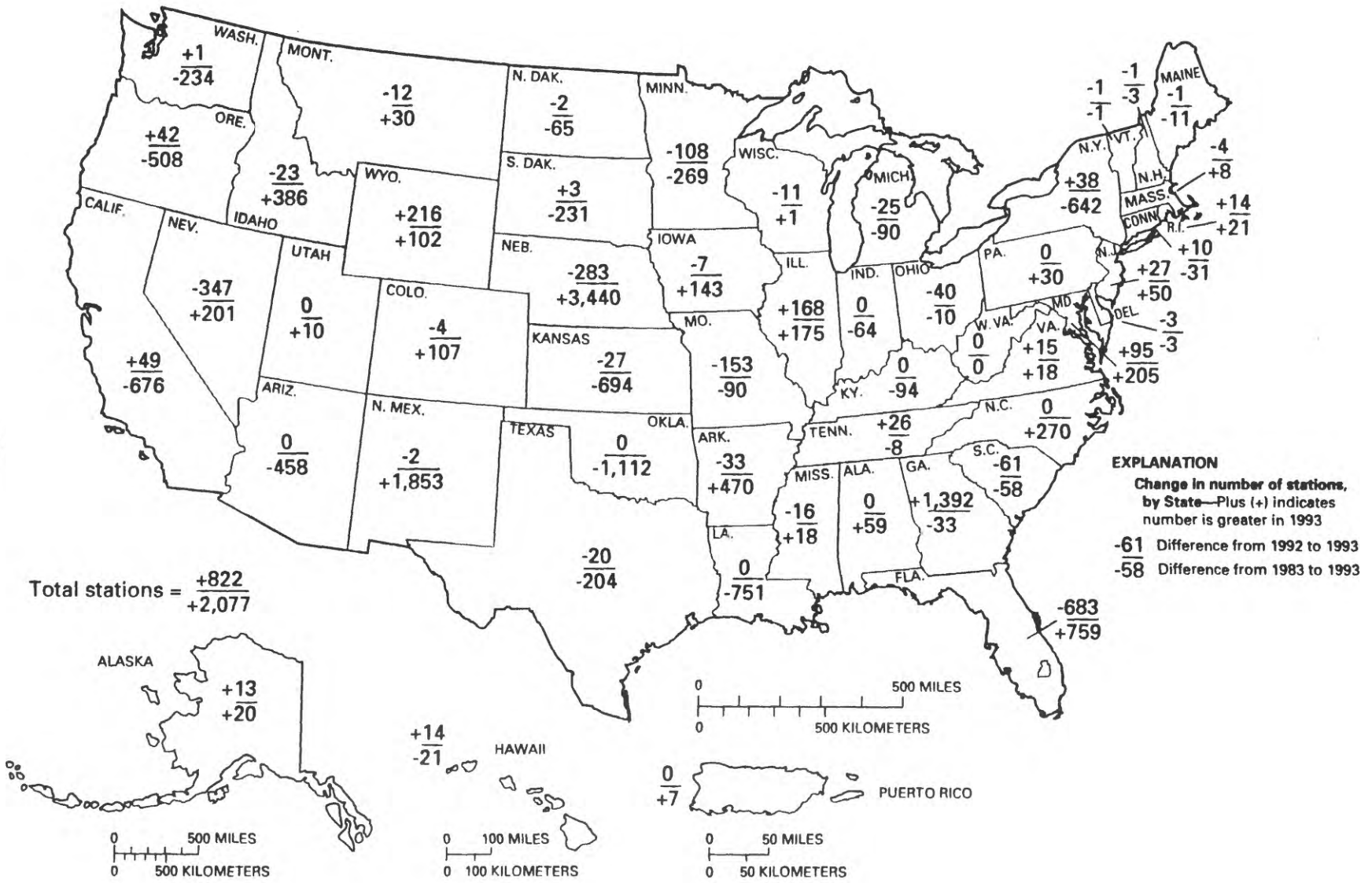


Figure 26.--Change in number of stations, by State, at which scheduled, long-term operation ground-water levels were collected from fiscal year 1992 to fiscal year 1993, and from fiscal year 1983 to fiscal year 1993.

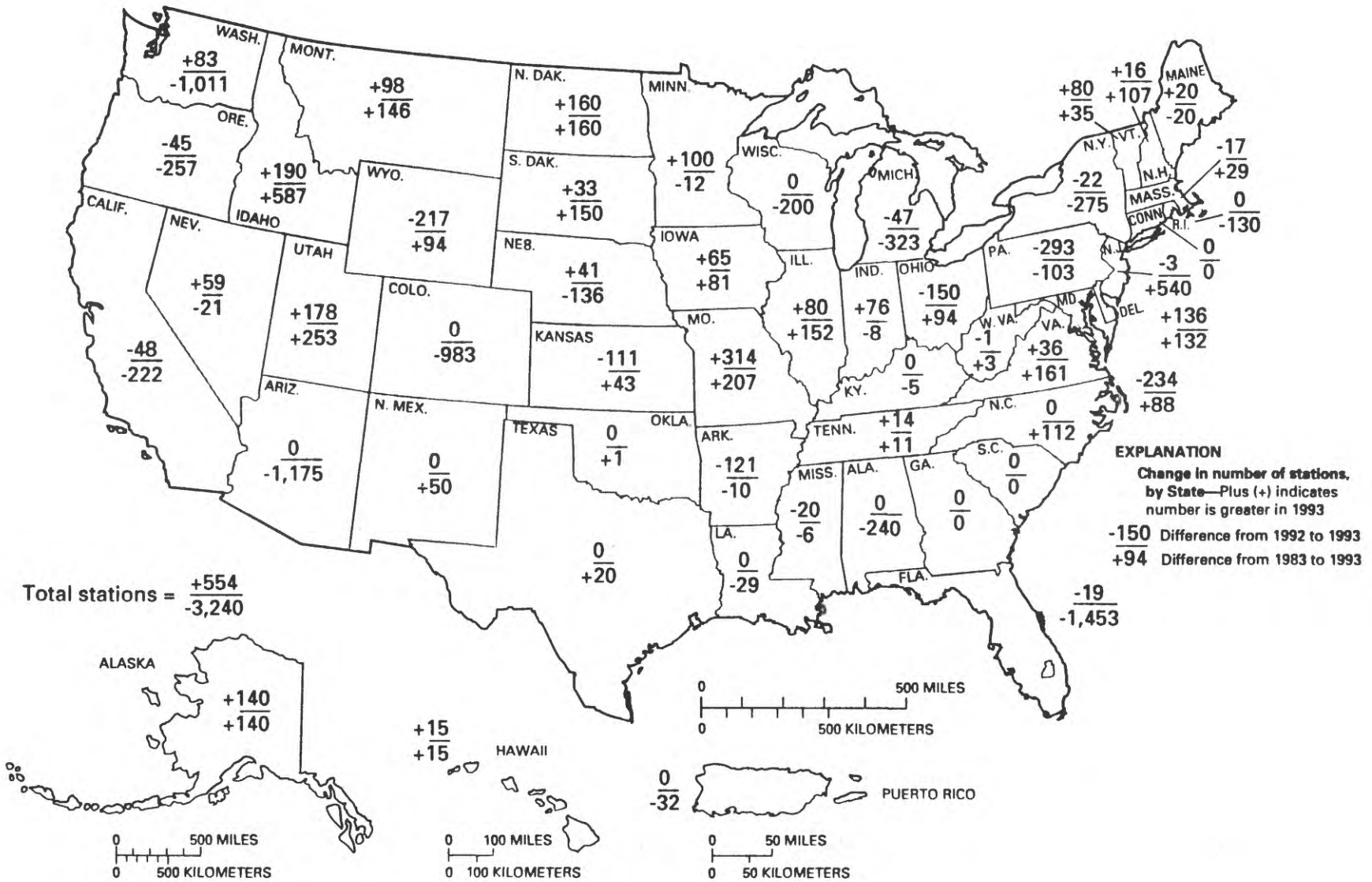


Figure 27.--Change in number of stations, by State, at which ground-water levels were collected at short-term or project stations from fiscal year 1992 to fiscal year 1993, and from fiscal year 1983 to fiscal year 1993.

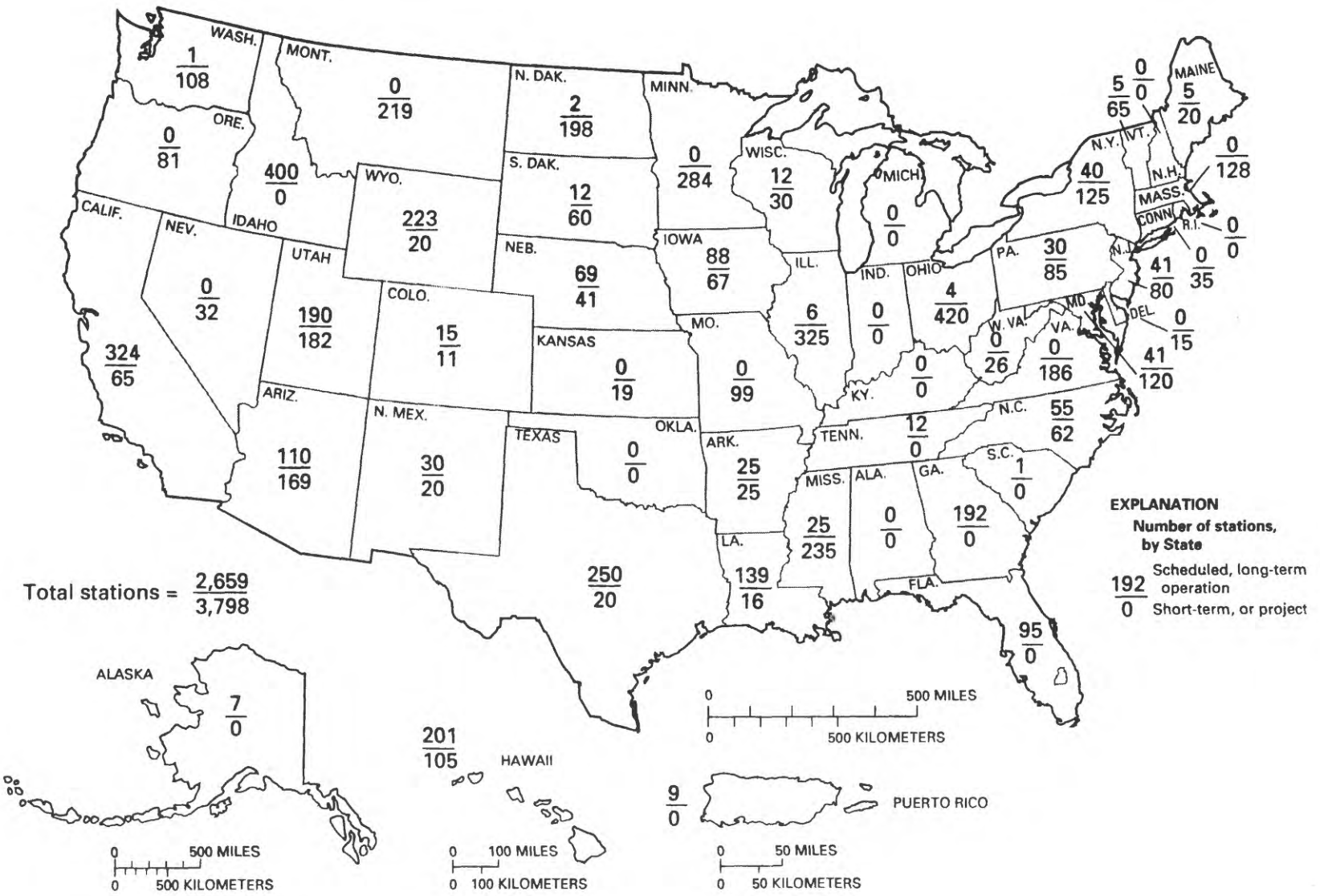
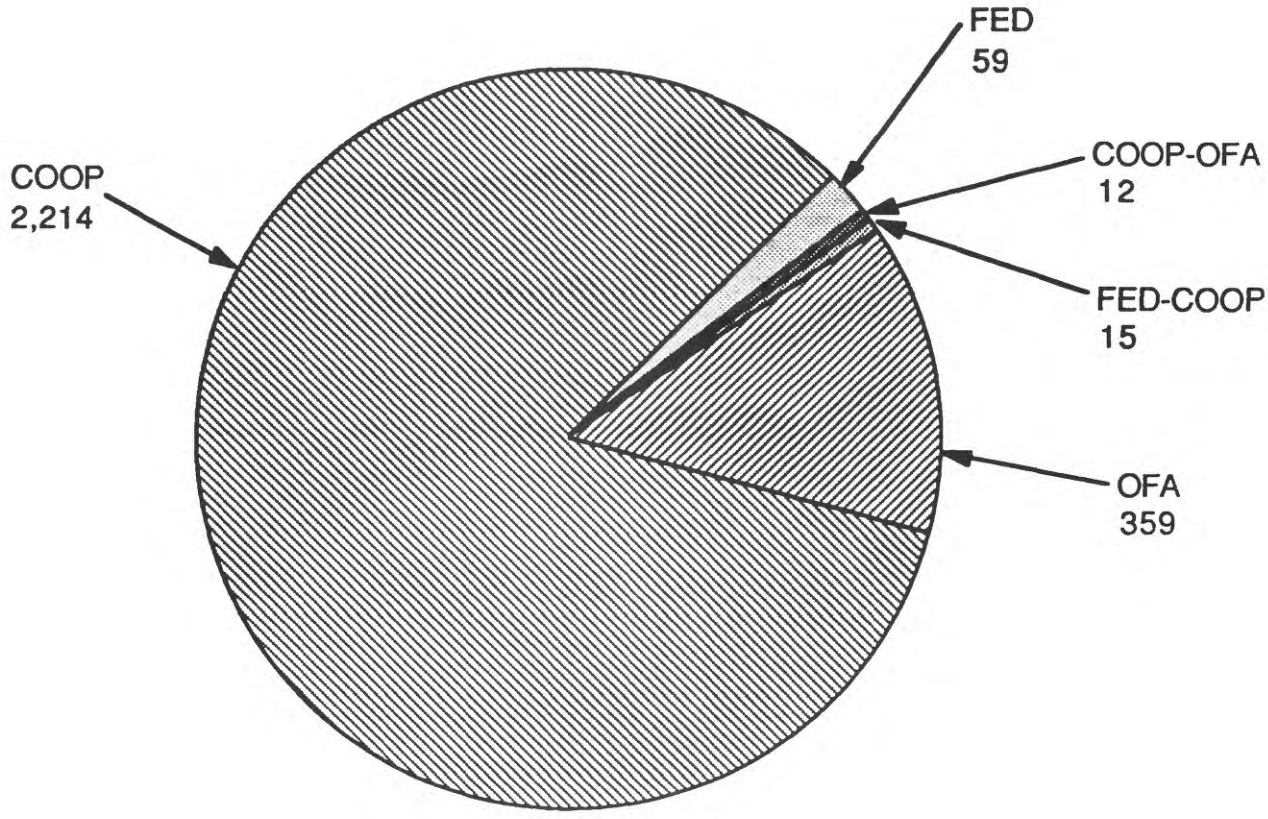


Figure 28.--Number of stations, by State, at which ground-water quality data were collected in fiscal year 1993.



EXPLANATION

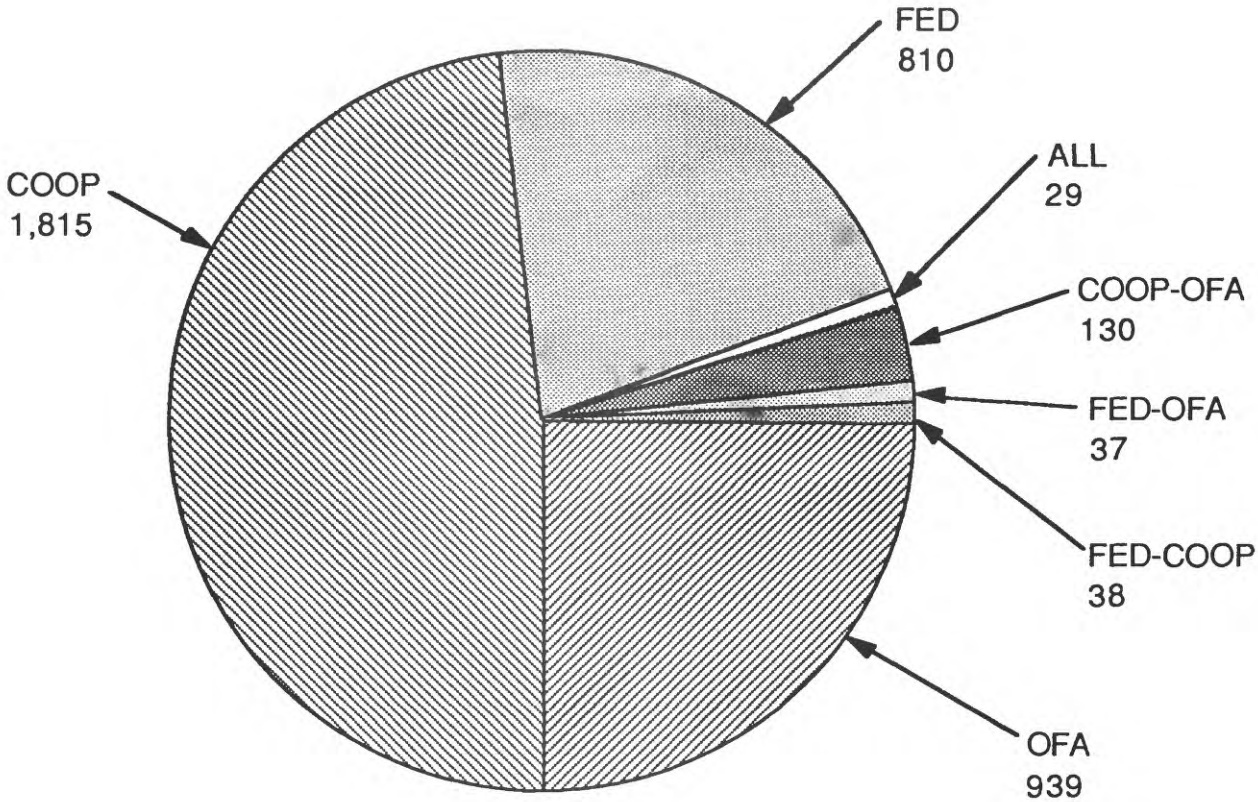
SINGLE PROGRAM SUPPORT

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 29.--Number of scheduled, long-term operation ground-water quality stations, and sources of funding support, fiscal year 1993.



TOTAL STATIONS = 3,798

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 30.--Number of short-term or project ground-water quality stations, and sources of funding support, fiscal year 1993.

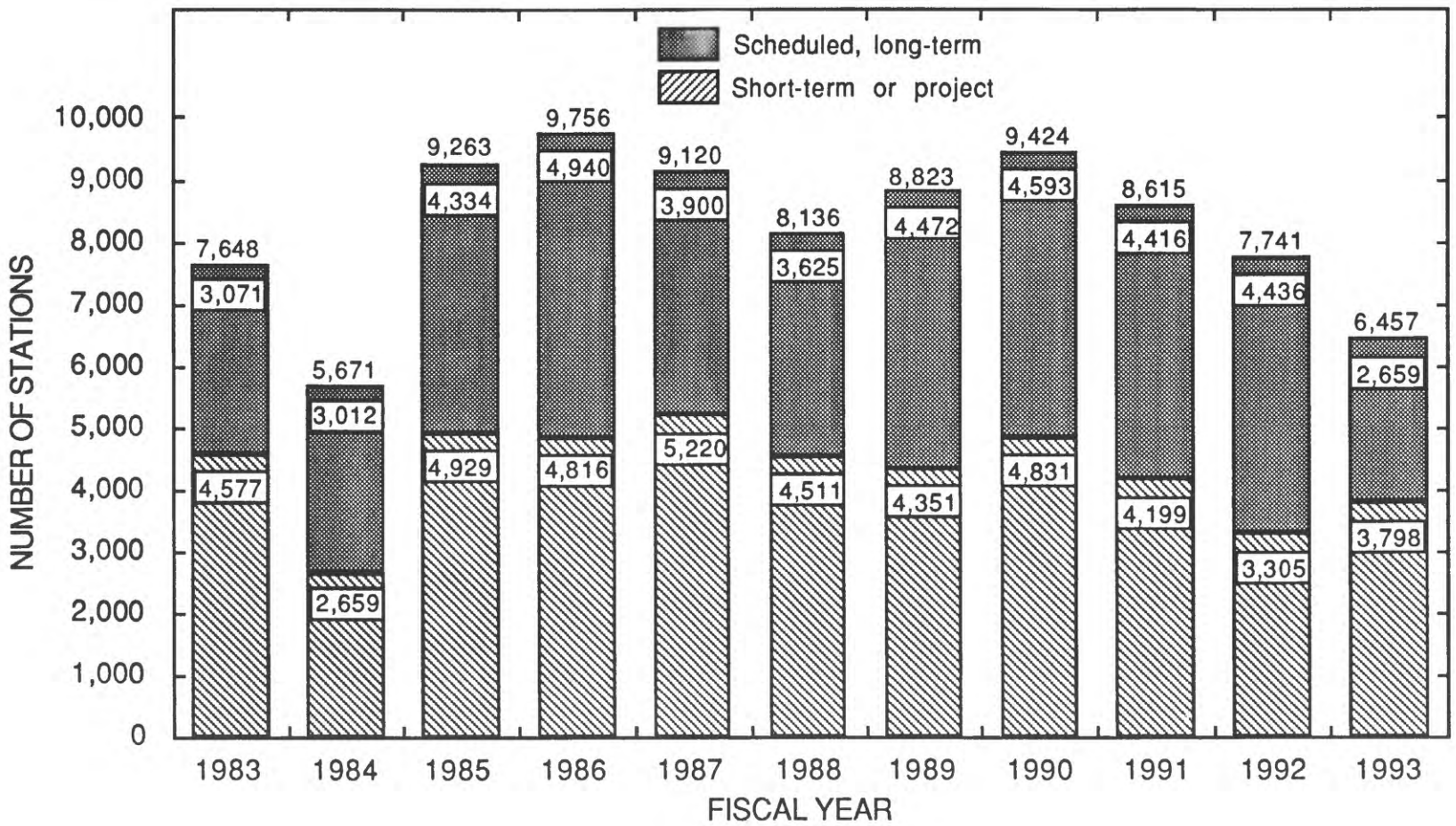


Figure 31.--Number of stations, by year, at which ground-water quality data were collected from fiscal year 1983 to fiscal year 1993.

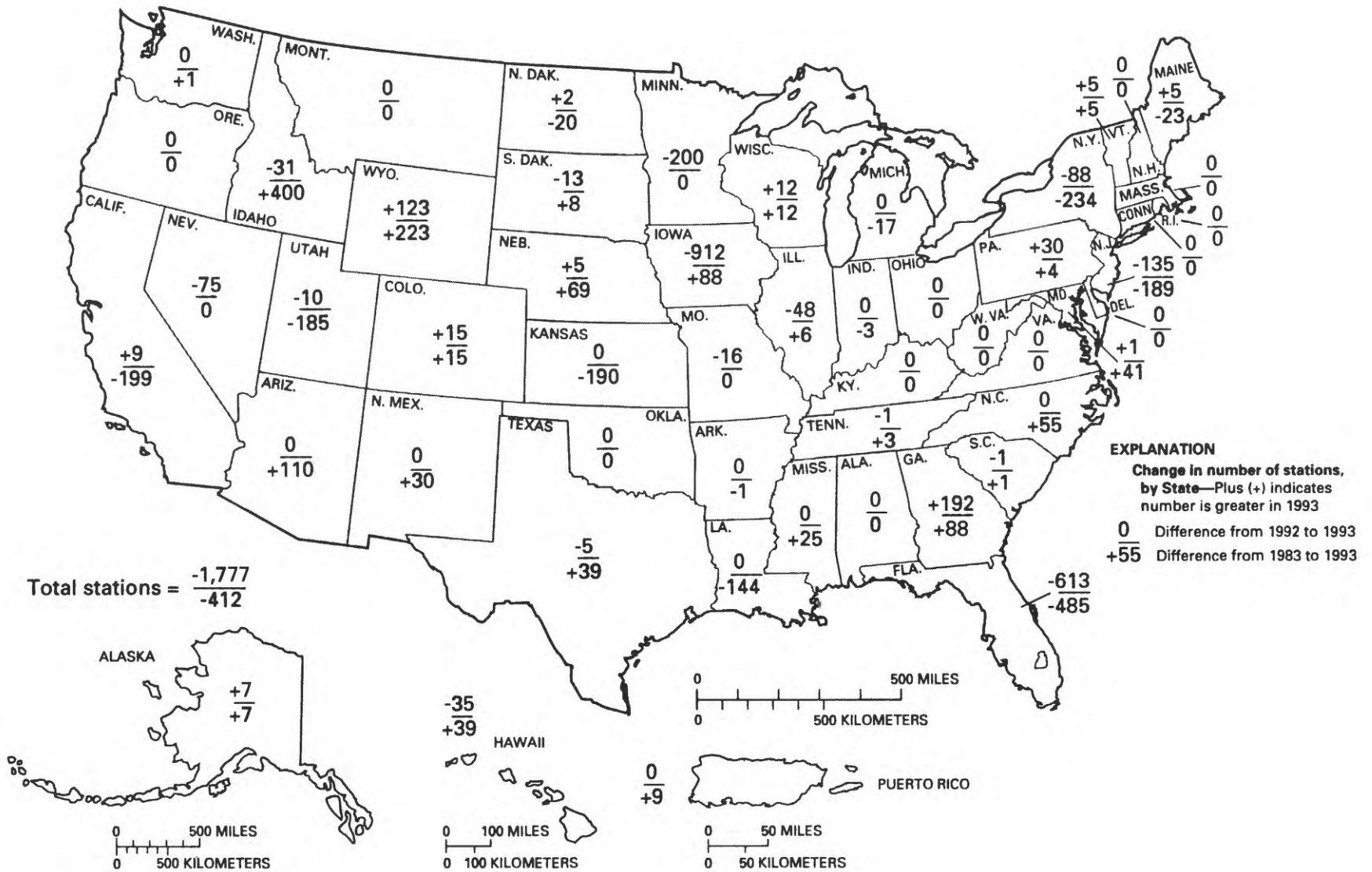


Figure 32.--Change in number of stations, by State, at which ground-water quality data were collected at scheduled, long-term stations from fiscal year 1992 to fiscal year 1993, and from fiscal year 1983 to fiscal year 1993.

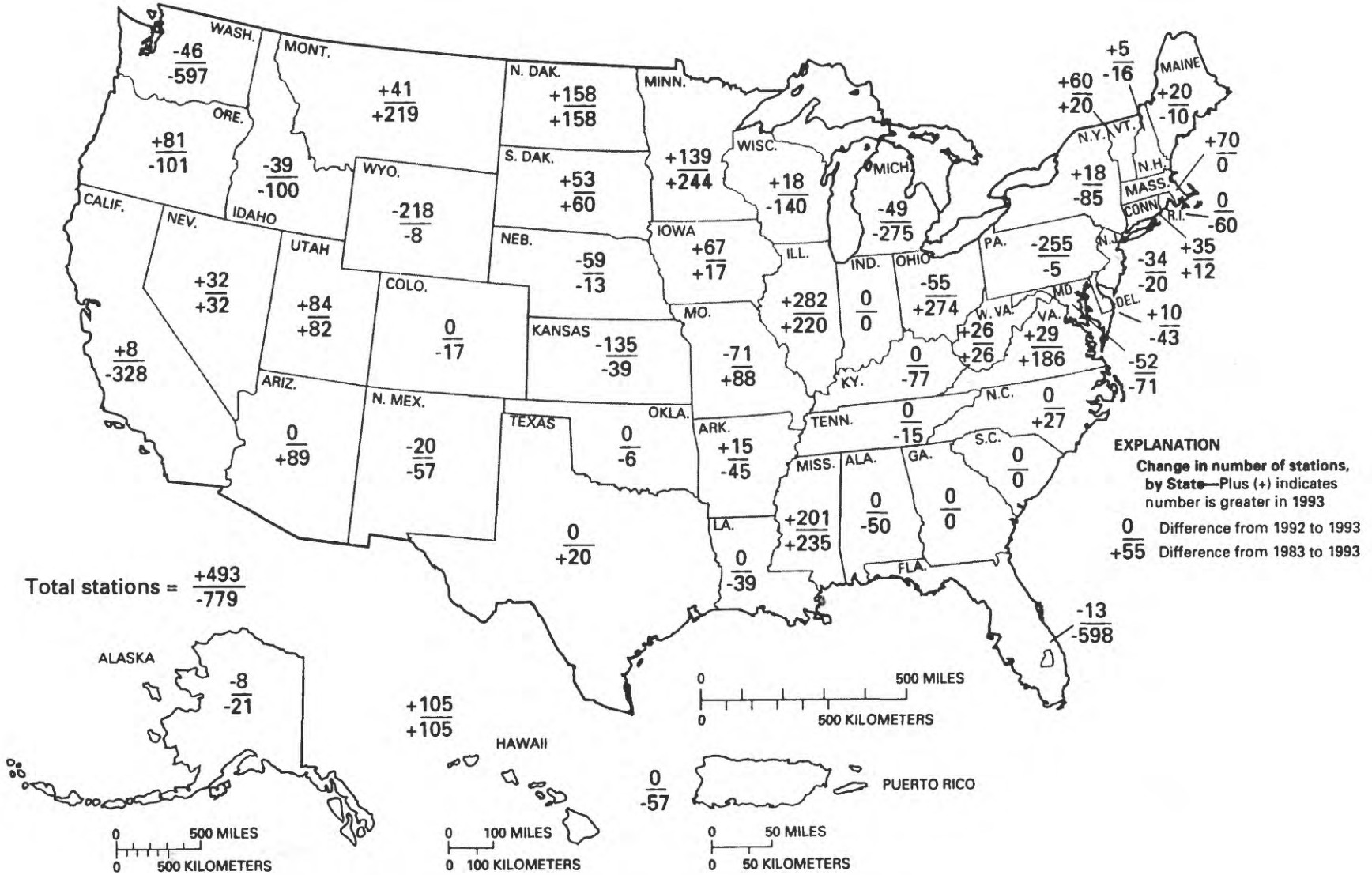


Figure 33.--Change in number of stations, by State, at which ground-water quality data were collected at short-term or project stations from fiscal year 1992 to fiscal year 1993 and from fiscal year 1983 to fiscal year 1993.

Figure 34.--Number of stations, by State, at which sediment data were collected in Fiscal Year 1993.

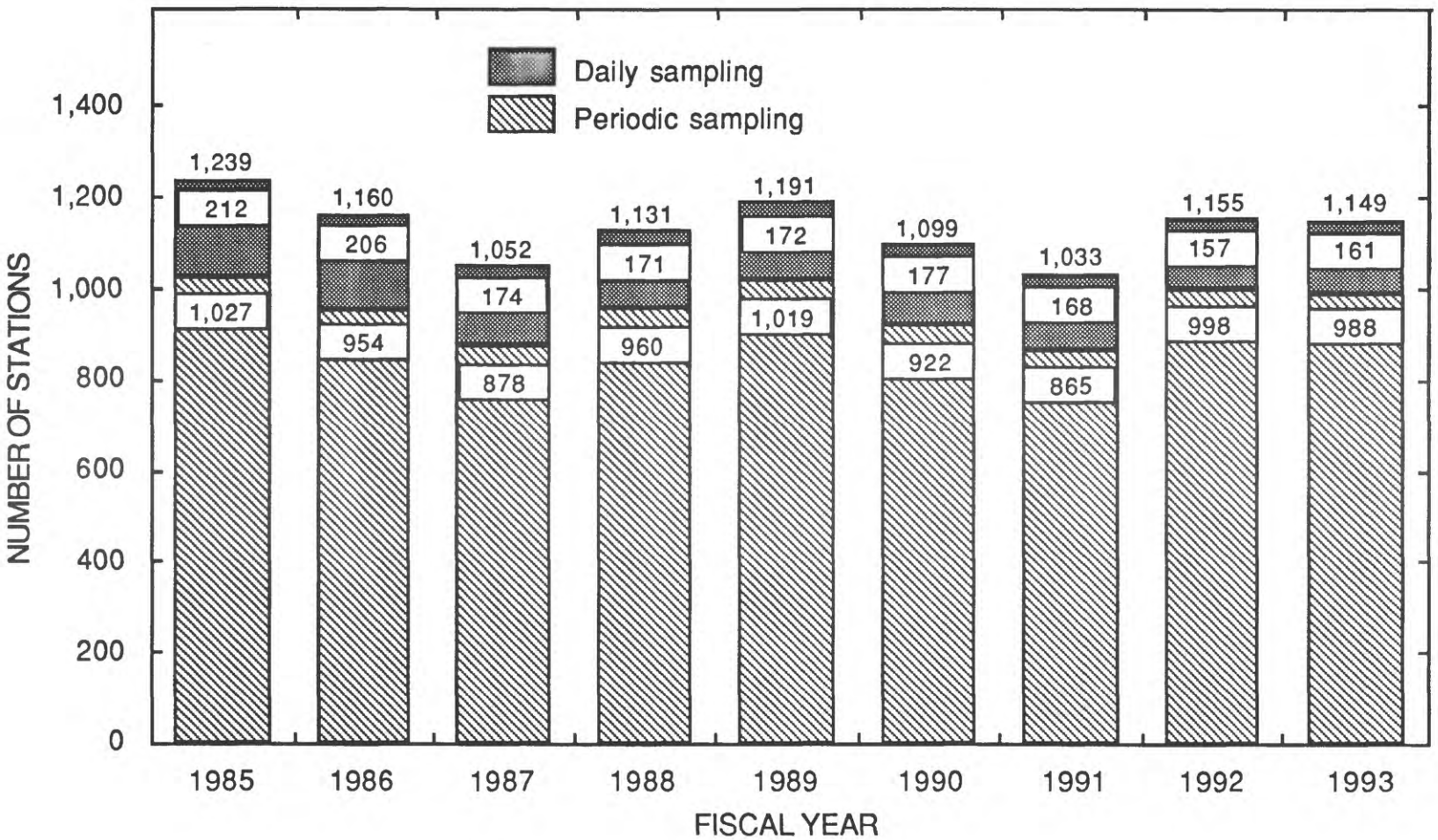
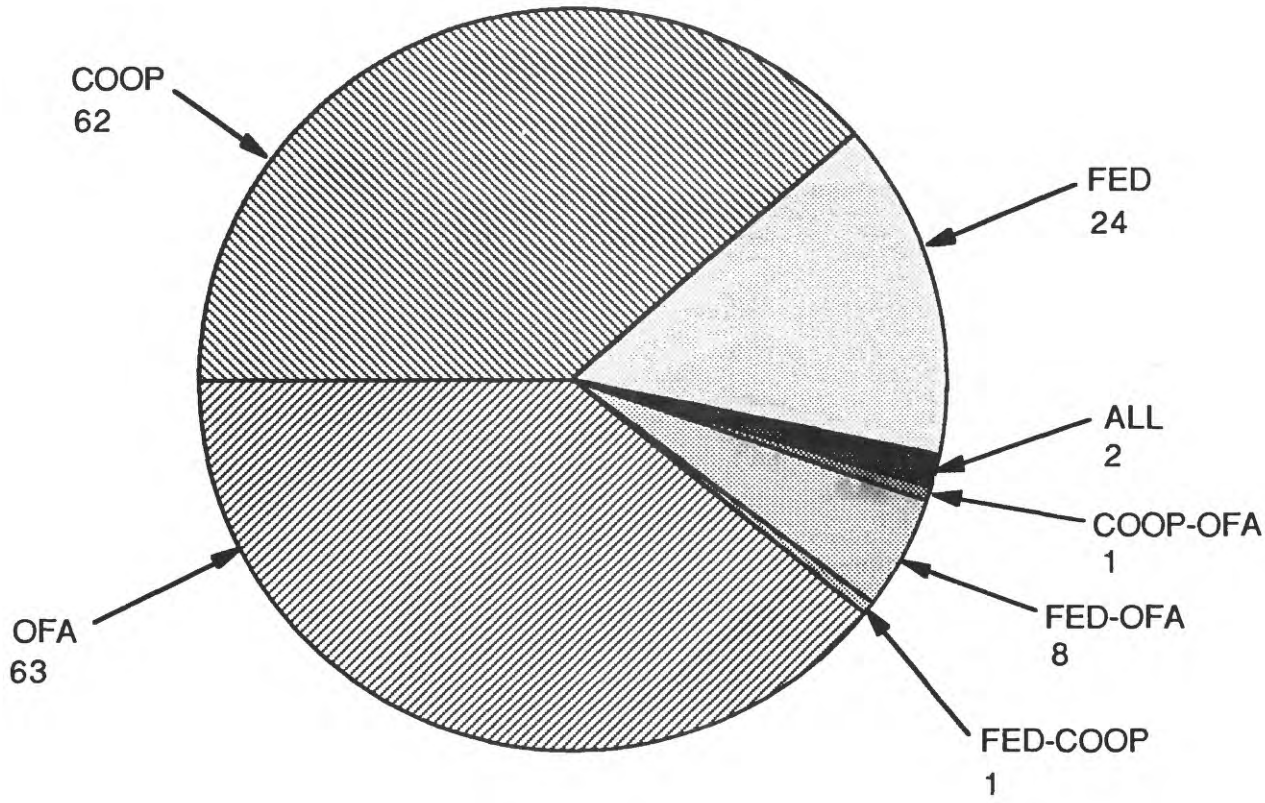


Figure 35.--Number of stations, by year, at which sediment data were collected from fiscal year 1985 to fiscal year 1993.



EXPLANATION

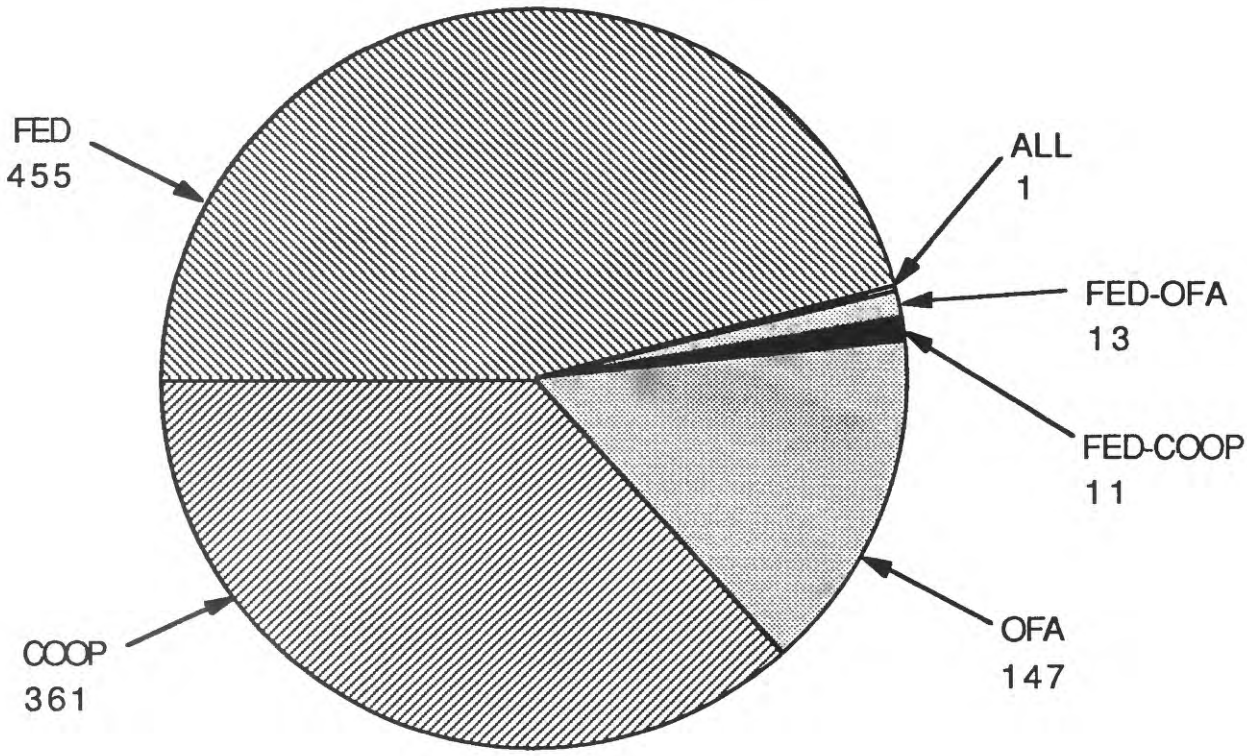
SINGLE PROGRAM SUPPORT

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 1993.



TOTAL STATIONS = 988

EXPLANATION

SINGLE PROGRAM SUPPORT

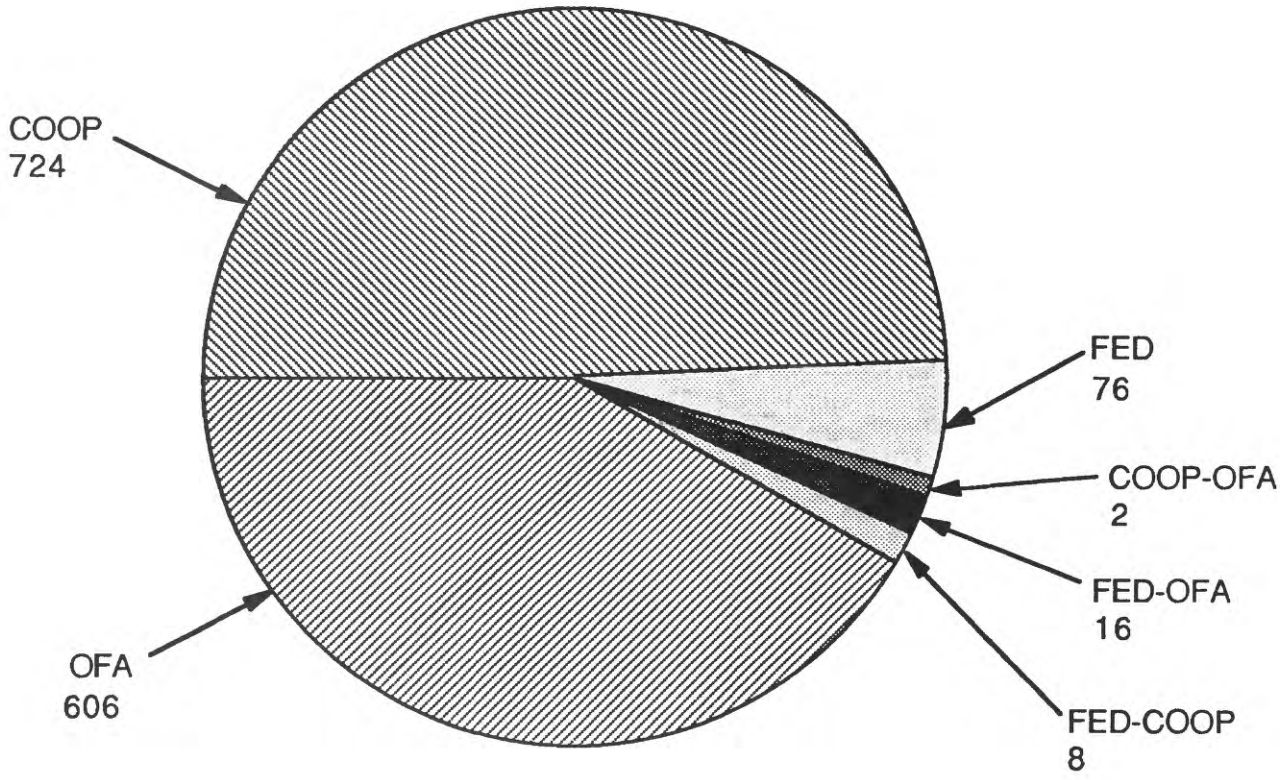
FED = Federal
OFA = Other Federal Agencies
COOP = Federal - State Cooperative Program

COMBINED PROGRAM SUPPORT

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

Figure 37.--Number of periodic sampling sediment stations, and sources of funding support, fiscal year 1993.

Figure 38.--Number of stations, by State, at which precipitation data were collected in fiscal year 1993.



TOTAL STATIONS = 1,432

EXPLANATION

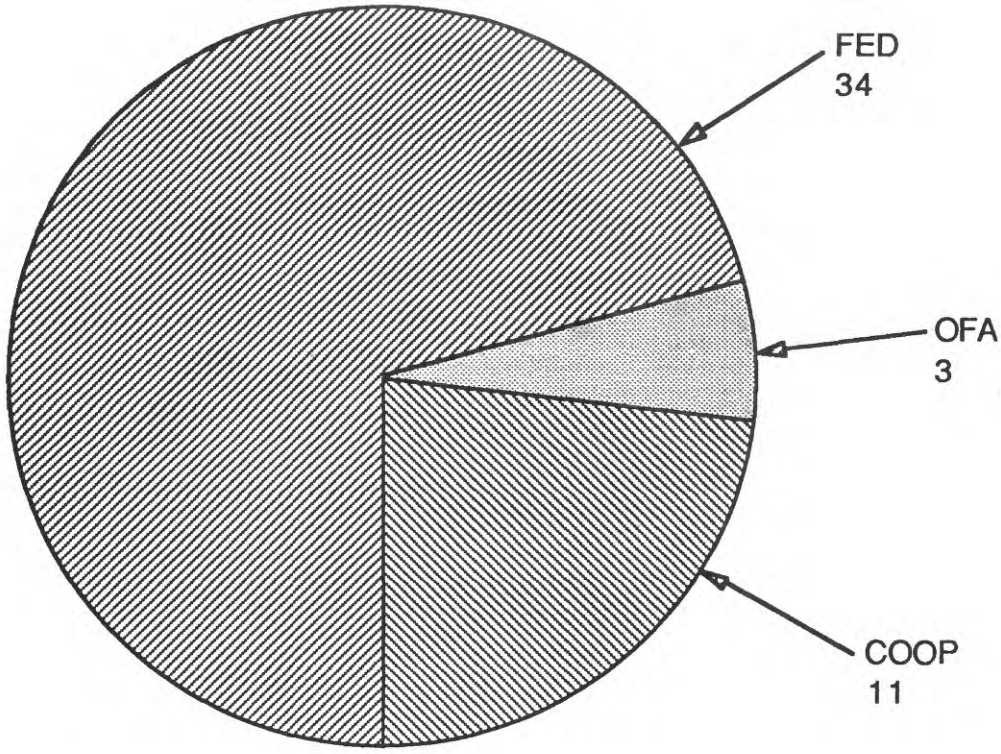
SINGLE PROGRAM SUPPORT

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 39.--Number of precipitation-quantity stations, and sources of funding support, fiscal year 1993.



TOTAL STATIONS = 48

EXPLANATION

SINGLE PROGRAM SUPPORT
FED = Federal
OFA = Other Federal Agencies
COOP = Federal - State Cooperative Program

Figure 40.--Number of precipitation-quality stations, and sources of funding support, fiscal year 1993.

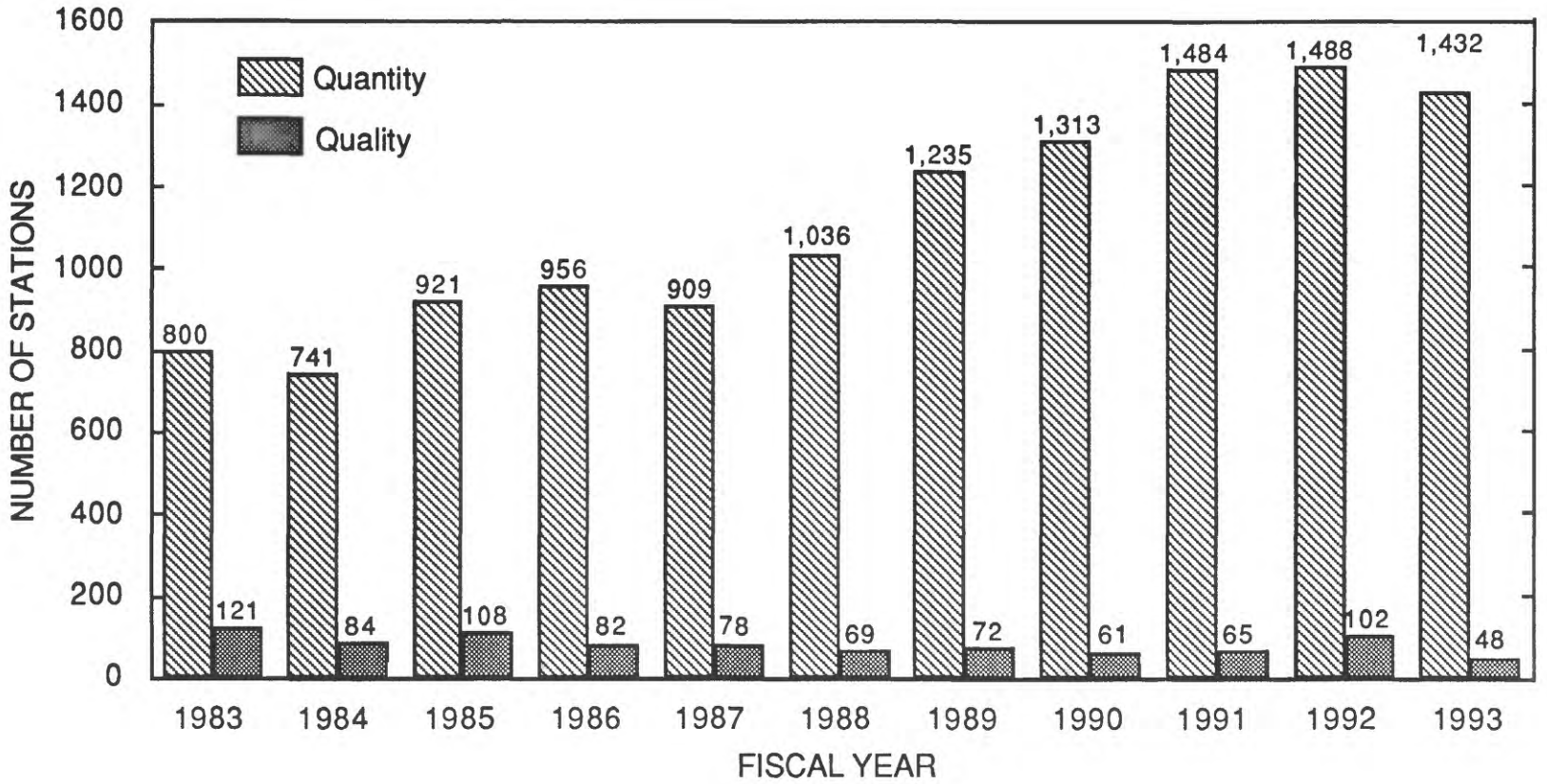


Figure 41.--Number of stations, by year, at which precipitation data were collected from fiscal year 1983 to fiscal year 1993.

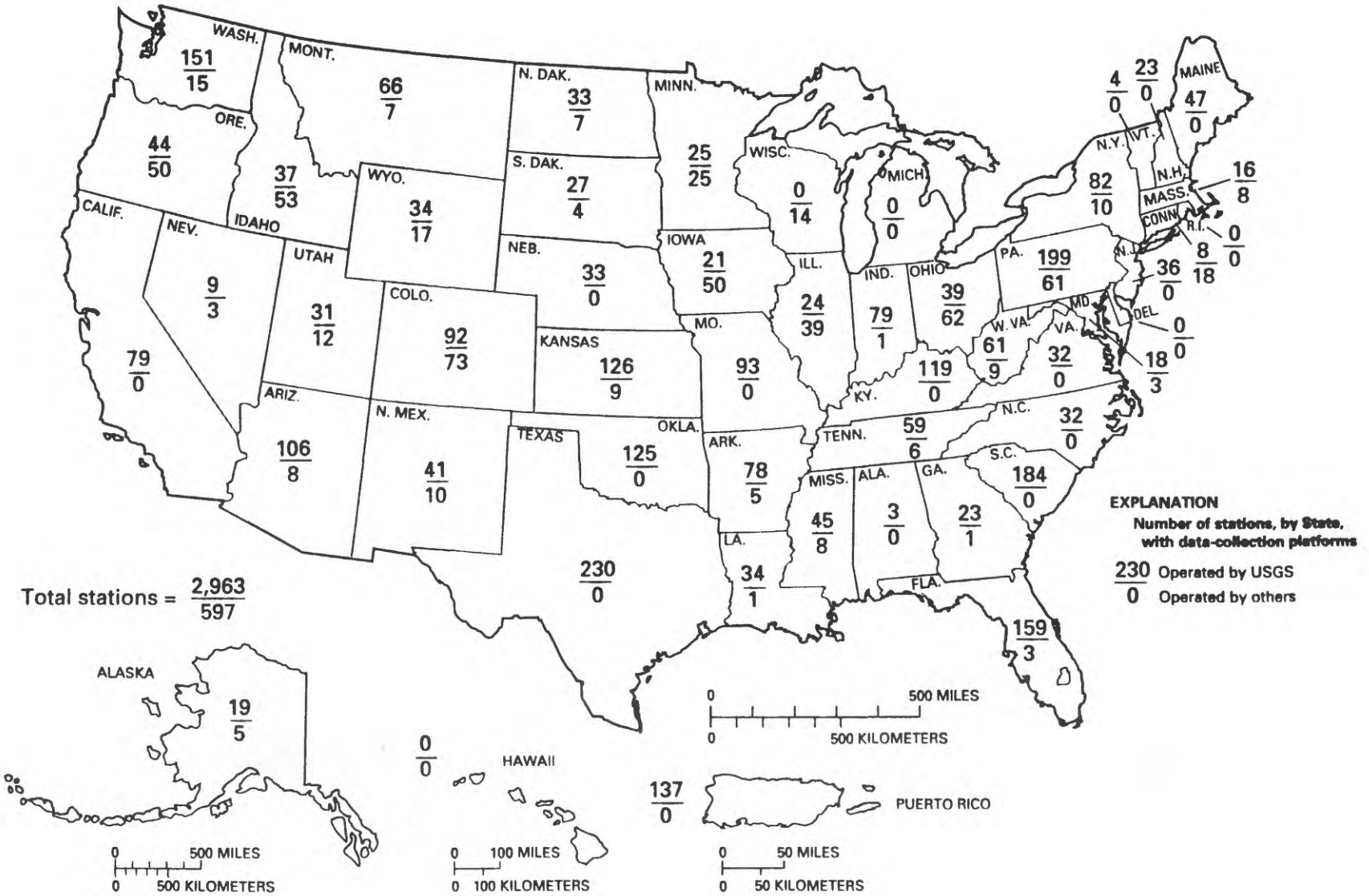
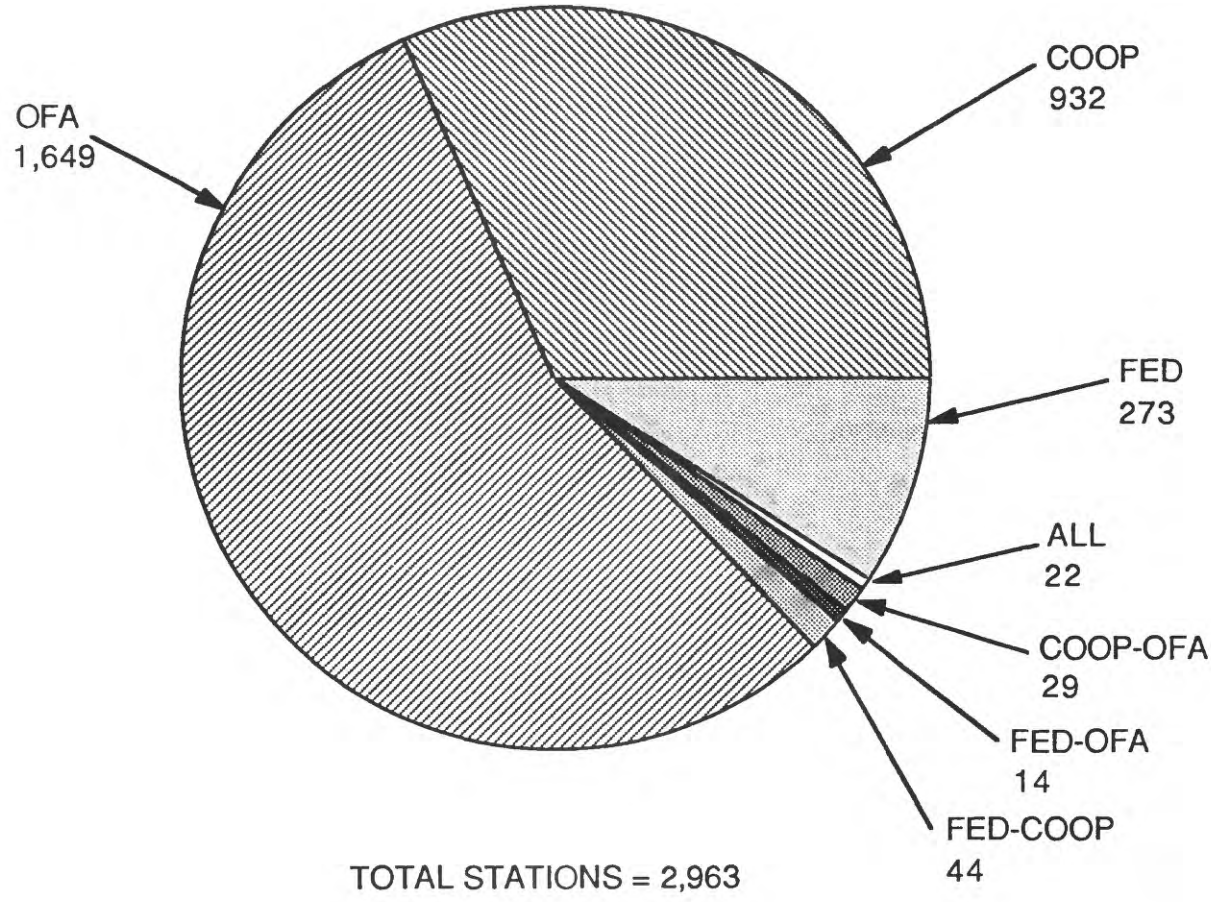


Figure 42.--Number of U.S. Geological Survey Stations, by State, at which data-collection platforms for satellite telemetry were operated in fiscal year 1993.



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 1993.

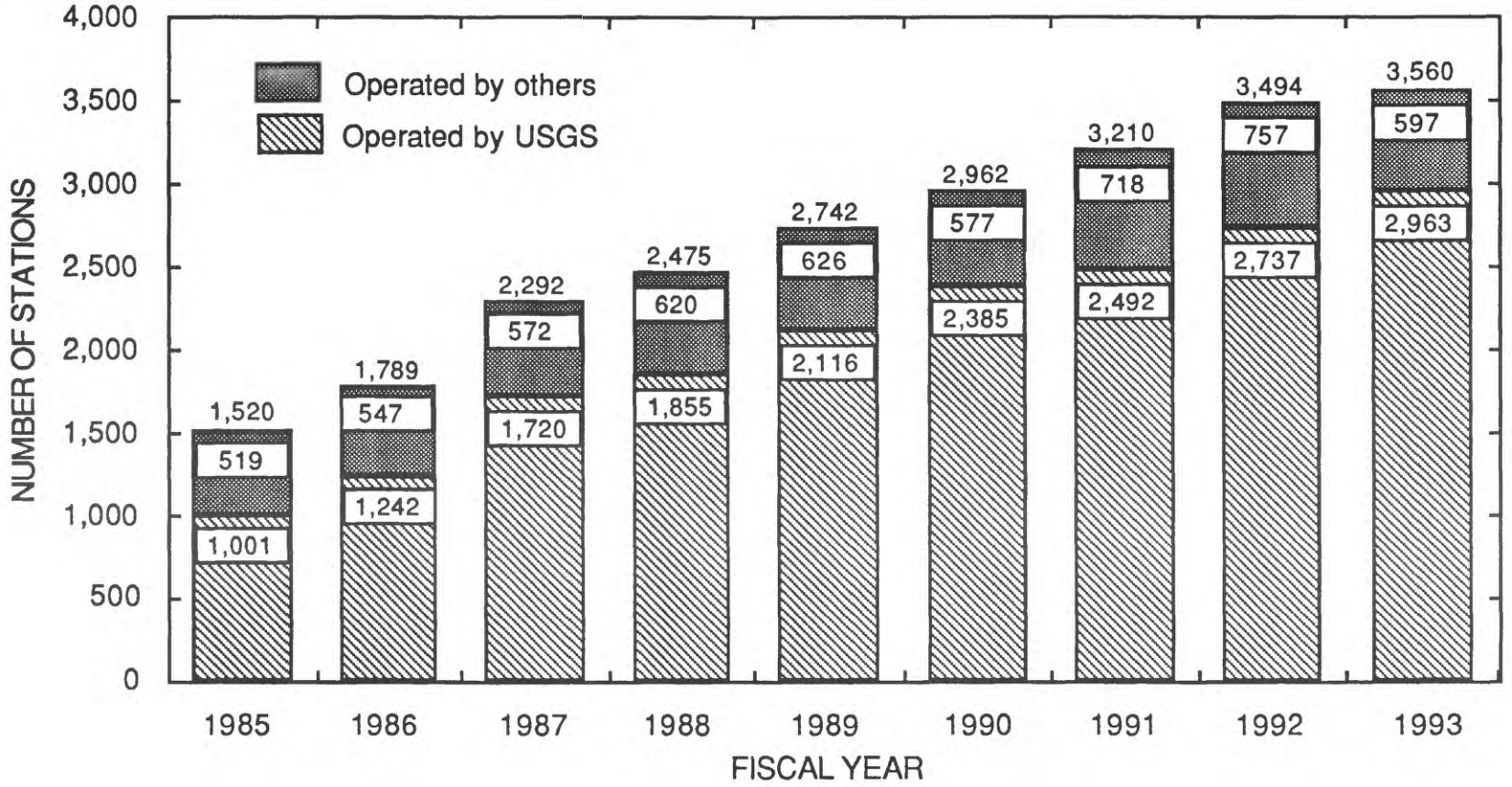


Figure 44.--Number of U. S. Geological Survey Stations, by year, at which data-collection platforms for satellite telemetry were operated from fiscal year 1985 to fiscal year 1993.

*U.S. G.P.O.:1994-301-077:80079