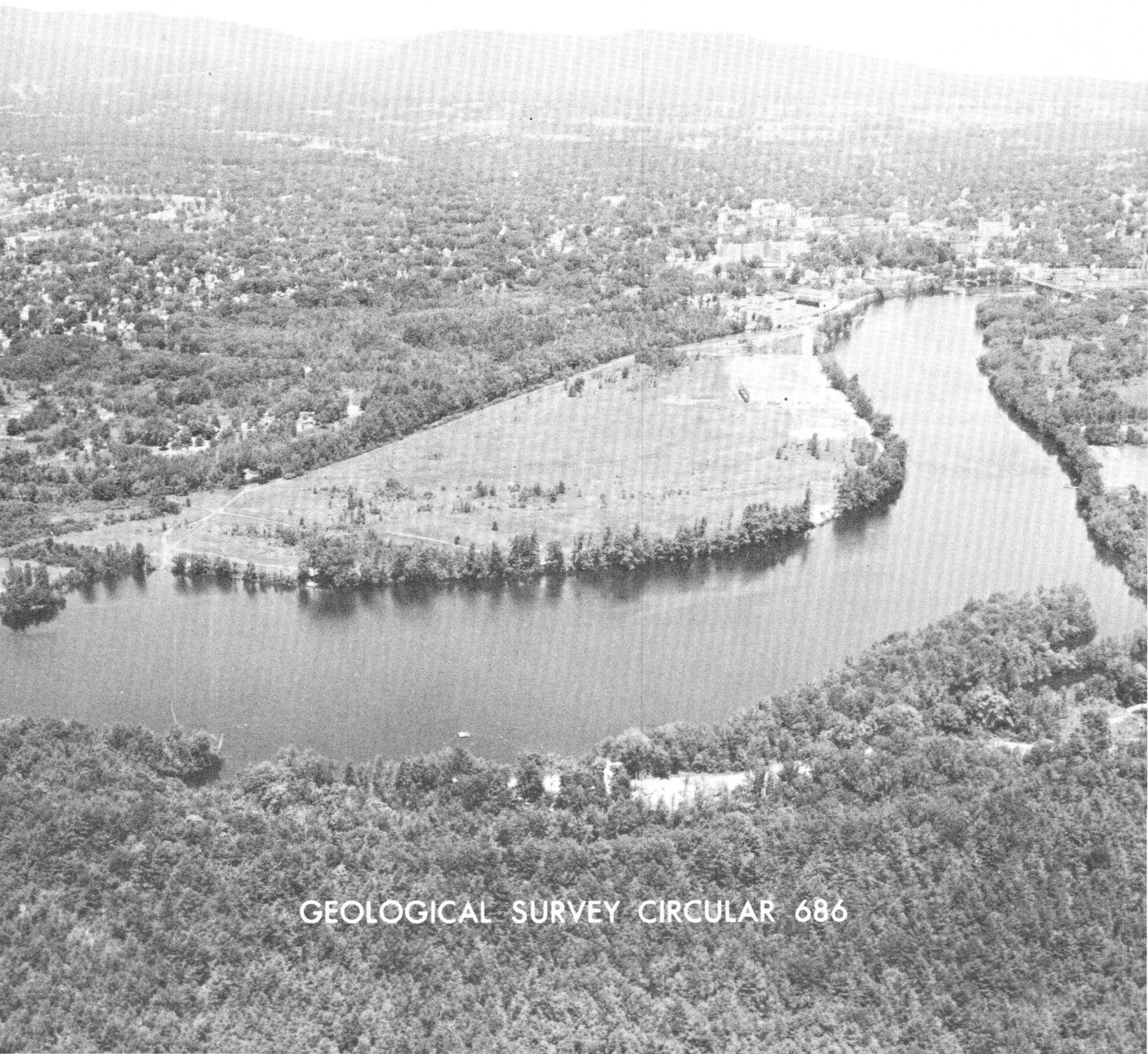
LARGE RIVERS OF THE UNITED STATES



GEOLOGICAL SURVEY CIRCULAR 686

Large Rivers of the United States

By Kathleen T. Iseri and W. B. Langbein

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ABSTRACT

Information on the flow of the 28 largest rivers in the United States is presented for the base periods 1931–60 and 1941–70. Drainage area, stream length, source, and mouth are included. Table 1 shows the average discharge at downstream gaging stations. Table 2 lists large rivers in order of average discharge at the mouth, based on the period 1941–70.

INTRODUCTION

Everyone knows that the Mississippi River is the largest river in the United States. But what rivers are the second and third largest? To compare the size of rivers, one must know what is meant by large or small.

The simplest measurement to use, and the most common in our school geographies, is length. Length is most meaningful in comparing navigable rivers. The thousands of miles of navigation afforded by the Mississippi-Ohio-Missouri River system played a large and significant part in the development of the interior of our country. The great navigable length of the Missouri made it an important arterial trail to the West. It is interesting to consider the profound extent to which the settlement of the West might have been altered had the early Spanish settlers in Mexico been able to ascend the Colorado by boat.

Rivers may also be compared in relation to the size of the basin drained. Drainage area is a measure of the region contributory to a river, but is not so much a characteristic of the river itself.

It is the flow of water in the river that turns the wheels of industry, supplies water for cities and for innumerable industrial processes, and maintains navigable depths for shipping. Consequently, the flow of a river is perhaps the most significant index of its utility in a highly productive country. It tells us how much water the river can supply for development. Therefore, in this report, rivers are classified with respect to their flows. Their lengths and their drainage areas are listed for subsidiary classification.

MEASUREMENT OF DISCHARGE

Possibly the first effort to classify rivers on the basis of discharge was made in 1880 by H. B. Guppy,[1] a British naturalist. Dr. Guppy, who had made some measurements of the Yangtse River, the Yellow River, and the Pei-ho in China, using floats and sounding lines, was curious to know how his measurements compared with measurements on other rivers of the world. He was able to collect information as to the relative magnitude of the flow of 17 rivers. In 1880, facts on riverflow were obtained only by specially investigative-minded individuals like Dr. Guppy and published data were very limited—and still are in many parts of the world. About this time the U.S. Geological Survey began its river measurement work in the West to obtain needed streamflow information so that settlers and other water users might know how much water was available for irrigation and other purposes. Because water users in other parts of the country also needed streamflow information, the U.S. Geological Survey expanded its gaging station network and now collects stage and discharge data at about 16,000 sites, including those near the mouths of most of the large rivers of the United States.

The stream-gaging stations are maintained in cooperation with Federal, State, county, municipal, and other organizations. Collection of stage and discharge data at these stations is the foundation necessary for all types of water-resources investigations and research. This basic

[1] Guppy, H. B., 1880, Nature: v. 22, p. 486–488.

information is needed in studies in hydraulics and hydrology and in engineering studies related to design, construction, and operation of hydraulic structures. This information also is needed in making sound decisions concerning water-management and use, in determining the water rights of individuals and groups, in alleviating water shortages and pollution, in determining the magnitude and frequency of floods, and for many other purposes.

Various techniques and equipment are used to obtain streamflow measurements. At St. Louis, Mo., measurements of flow of the Mississippi River are made from a car suspended from a monorail beneath the bridge deck (fig. 1). At other bridge sites, measurements are obtained from instruments suspended from a crane mounted on a truck (fig. 2). On estuaries and large streams and especially during floods, river discharge measurements are made from moving boats (fig. 3).

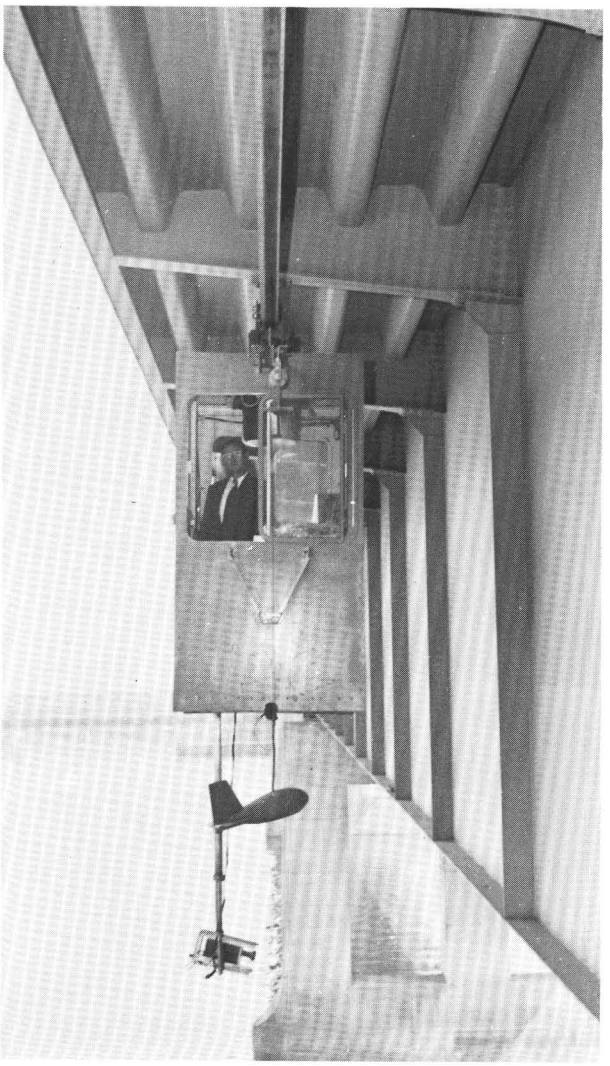

Figure 1.—Mississippi River at St. Louis, Mo. The flow of the Mississippi River at St. Louis is measured from a bridge. Depth and velocity are determined by use of current meter and sounding weight suspended from an electrically driven car, which travels along a monorail beneath the bridge deck. Waterway traffic is monitored with closed-circuit television camera. Photograph by Joseph C. Moore.

Figure 2.—At some bridge sites, streamflow measurements are obtained by use of current meter and sounding weight suspended from a crane mounted on a truck.

A list of the gaging stations maintained by the U.S. Geological Survey near the mouths of the large rivers of the United States is given in table 1. The list includes the drainage area above each gaging station and the average discharge in cubic feet per second (cfs) for two base periods—1931–60 and 1941–70.

For practical reasons, it is seldom feasible to operate gaging stations in the immediate vicinity of the mouth of a large river. Therefore, in order to determine the flow at the mouth, it becomes necessary to add the inflow to the river below the most downstream gaging station. For most rivers this additional flow is minor in comparison with that measured at the gaging station. Flows at the mouth in cubic feet per second, and for the same base periods as in table 1, are listed in table 2 for the 28 largest rivers in the country in order of volume of flow. The Mississippi River above the Missouri River is listed separately along with other major tributaries of the Mississippi, although it is a part of the Mississippi River listed at the head of table 2. No average figures of flow are shown for the Tennessee, Cumberland, Sacramento, and Colorado Rivers for 1941–70 because the

Figure 3.—The moving-boat method is used for obtaining measurements rapidly on large streams and estuaries where no fixed measurement facilities exist. This method is also used during floods when facilities are inaccessible or inundated.

unmeasured flow was so great in proportion to the total, or so uncertain, that no dependable estimate could be made for flow at the mouth. However, these rivers are listed in what is believed to be their proper rank in relation to others in the table. The information on discharge in tables 1 and 2 has been computed from basic data especially for this report. Data on lengths and drainage areas have been obtained from previously published sources. Lengths of rivers shown in table 2 are approximate. Changes in river channels may affect river lengths. Variations in techniques used to determine river lengths may also result in differences in river mileages. The locations of the rivers listed are shown in figure 4. The widths of the rivers represent their relative rates of flow.

MISSISSIPPI RIVER SYSTEM

The Mississippi, early named "Father of Waters," is the greatest river in the United States by all standards of comparison—flow, drainage area, and length. Of the tributaries or components of the Mississippi River system, 11 are included among the ranking 28 rivers in the United States. The Mississippi, together with a parallel distributary, the Atchafalaya, discharges water that drains from 40 percent of the land area of the conterminous United States.

The Atchafalaya River is shown as a continuation of the Red River and as one of the 28 large rivers of the United States. The Old River control structure located in Concordia Parish, La., prevents flow of Red River from entering the Mississippi River. The structure was completed in 1963. The Red River flows into the Atchafalaya River, which continues directly to the Gulf of Mexico. About 25 percent of the Mississippi River flow is diverted into the Red River by means of the control structure. Hence, the Atchafalaya River flow includes the diversion from the Mississippi River and the entire flow from the Red River basin.

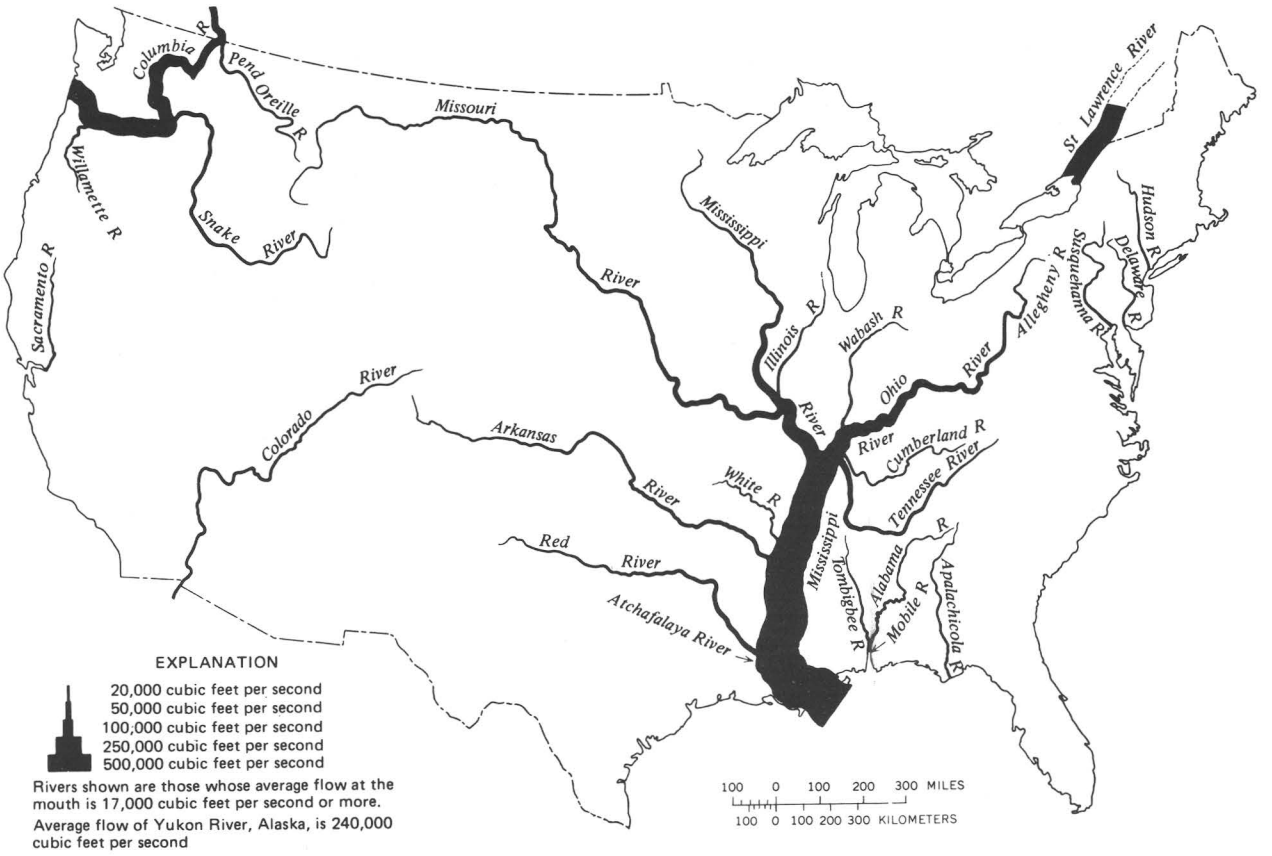

Figure 4.—Large rivers in the United States.

BASE PERIODS

Rivers vary in flow from year to year. In order to standardize results and to minimize the effects of these variations on the comparisons, the flows of all rivers have been based on the averages during the 30-year periods, 1931–60 and 1941–70. The rank of the rivers listed in table 2 may depend partly on the period of record on which the flows are based. For example, in a previous edition of this circular the flow of the Columbia River during the period 1921–45 is shown as being less than that of the Ohio River, whereas in this edition the flow of the Columbia River during the period 1941–70 is shown as the greater. Other reversals, where order of rank is based on small differences in flow, might also occur if the flows were based on a period other than 1931–60 or 1941–70.

The flows of many western rivers, such as the Columbia, Snake, Missouri, and Colorado, are reduced or depleted by diversions for irrigation. These diversions have not been considered in preparing table 2, except on the Colorado River, where no entry for the flow is given, but the relative position was based on estimates of the virgin flow (that is, by adding the depletions for irrigation to the measured flow). In general these diversions would not greatly affect the relative position of the rivers listed.

NAMES OF RIVERS

Names of streams have little hydrologic significance, even though they may be of great historic and geographic interest. The rivers listed in table 2 bear the name of the stream at the mouth, because this is the point of greatest flow. The river lengths given in the table and shown in figure 4 represent not only the length of the stream bearing the given name, but the length of the river system, that is, distance from mouth to the most upstream source as measured along the watercourse. For the Mississippi River, the length listed is the distance along the stream from the Gulf of Mexico to the source of Red Rock River in the upper Missouri River basin in western Montana.

The Mobile River, the eleventh ranking river in table 2, is the name given to the meandering reach of river, about 45 miles long, which together with a parallel distributary, Tensaw River, carries the combined flow of the Alabama and Tombigbee Rivers to Mobile Bay.

Among the 28 large rivers listed in table 2, only 11 are independent; that is, rivers that discharge directly into

the ocean. The others, such as the Missouri and the Willamette, are tributary to larger streams included in the list and are therefore not independent. Some rivers, such as the Tennessee, are second-order tributaries; that is tributary to a tributary of a river that discharges into the ocean. Although it is common practice to follow accepted names in deciding which river is a tributary and which is the main river, it is largely a matter of historical accident which fork carries the name of the lower stream and which is separately named.

SUMMARY

The outflow of all streams from the conterminous United States into the oceans or across its boundaries is about 2,000,000 cubic feet per second. Of this total more than 75 percent is accounted for by the 11 independent streams that appear in table 2. The remaining 25 percent is discharged through a host of comparatively minor coastal streams.

We know only a little about rivers when we measure their lengths, drainage areas, and average flows. There is much to be learned about their range from flood to drought, about their sources, about their chemical and biological quality and about their load of sediment as well as other physical, hydraulic, and geomorphic characteristics. The topography, geology, climate, and vegetation growing in various parts of these river basins as well as human activities, greatly affect streamflows and the character of our rivers. All these things must be known if we are to make the most effective use of our rivers, large and small. Maps of all kinds, especially topographic maps which show elevations of all streams, mountains, and plains, are a valuable aid in studying our rivers.

ADDITIONAL INFORMATION

Information on these subjects is contained in the water-supply papers, hydrologic atlases, topographic maps, and other publications of the Geological Survey, available in major libraries. A list is available on request to the Director, U.S. Geological Survey, National Center, Reston, Va., 22092.

TABLES 1 and 2

Table 1.—*Average discharge at downstream gaging stations on large rivers of the United States, 1931–60, and 1941–70*

River	Gaging-station location	Drainage area (square miles)	Average discharge (1931–60) (cubic feet per second)	Average discharge (1941–70) (cubic feet per second)
Alabama	At Claiborne, Ala	22,000	31,140	31,510
Allegheny	At Natrona, Pa	11,410	19,200	18,810
Apalachicola	At Chattahoochee, Fla	17,200	20,700	21,700
Arkansas	At Little Rock, Ark	158,000	41,300	42,130
Atchafalaya[1]	At Krotz Springs, La	93,320	[2]160,800	[2]180,800
Colorado	Below Hoover Dam, Ariz.–Nev[3]	167,800	[4]14,580	14,530
Columbia	At The Dalles, Oreg	237,000	183,000	189,000
Cumberland	Near Grand Rivers, Ky	17,598	26,900	[5]28,030
Delaware	At Trenton, N.J[6]	9,397	16,100	[7]14,500
Hudson	At Green Island, N.Y	8,090	.....	[8]12,520
Illinois	At Merdosia, Ill	25,300	20,500	20,670
Mississippi	At Alton, Ill	171,500	91,300	98,300
Mississippi	At Vicksburg, Miss	1,144,500	554,000	565,300
Missouri	At Hermann, Mo	528,200	69,200	76,200
Ohio	At Metropolis, Ill	203,000	257,000	257,200
Pend Oreille	At international boundary	25,200	26,900	28,420
Red	At Alexandria, La	67,412	32,470	32,100
Sacramento	At Verona, Calif[9]	.....	25,700	27,200
St. Lawrence	At Cornwall, Ontario–near Massena, N.Y[10]	299,000	[11]233,000	[11]239,000
Snake	Near Clarkston, Wash	103,200	48,600	48,960
Susquehanna	At Marietta, Pa	25,990	36,100	35,060
Tennessee	Near Paducah, Ky	40,200	63,400	[5]64,050
Tombigbee	At Jackson Lock and Dam near Coffeeville, Ala.	18,500	25,200	25,130
Wabash	At Mount Carmel, Ill	28,600	26,400	26,600
White	At Clarendon, Ark	25,497	29,490	29,360
Willamette	At Salem, Oreg	7,280	23,870	24,780
Yukon	At Ruby, Alaska	259,000	.....	[12]170,000

[1] Continuation of Red River.

[2] Includes diversion from Mississippi River through Old River or Old River diversion channel.

[3] Very little tributary flow downstream. Downstream station located at Yuma, Ariz., drainage area 242,900 square miles. The greater part of the natural flow is diverted for irrigation and other uses in the basin above Yuma. Average flow at Yuma, 1963–70, is less than 1,000 cubic feet per second.

[4] For the period 1934–60.

[5] Interbasin diversion beginning June 1966 between Lake Barkley on Cumberland River and Lake Kentucky on Tennessee River through Barkley–Kentucky Canal.

[6] Five tributaries below Trenton have been added.

[7] Unadjusted for diversion by New York City reservoirs since 1954.

[8] October 1946 to September 1970 (24 years).

[9] American River and Yolo bypass have been added.

[10] Formerly at Ogdensburg, N.Y.

[11] Furnished by the U.S. Army Corps of Engineers through International St. Lawrence River Board of Control.

[12] Average is for 1957–70; station operated only since 1956.

Metric equivalents of measures used:

1 square mile = 2.590 square kilometers
1 cubic foot per second = 0.0283 cubic meter per second
1 mile = 1.6093 kilometers

Table 2.—*Large rivers in the United States in order of average discharge at mouth, 1931–60, 1941–70. Order based on average discharge for 1941–70*

Rank	River	Drainage area (square miles)	Average discharge (1931–60) (cubic feet per second)	Average discharge (1941–70) (cubic feet per second)	Length (miles)	Most distant source	Mouth
1	Mississippi	[1]1,247,266	[2]650,000	[2,3]640,000	[4]3,710	Source of Red Rock River, Mont.	Gulf of Mexico.
2	Columbia	258,000	253,000	262,000	1,243	Columbia Lake, B.C	Pacific Ocean.
3	Ohio	203,900	258,000	258,000	1,306	Source of Allegheny River, Potter Co., Pa.	Mississippi River.
4	St. Lawrence	[5]302,000	[5]238,000	[5]243,000			
5	Yukon	327,600		[6]240,000	1,770	Coast Mountains, B.C	Bering Sea.
6	Atchafalaya[7]	95,105	161,000	183,000	135	Eastern edge of New Mexico.	Gulf of Mexico.
7	Mississippi above Missouri River.	171,600	91,400	98,400	1,170	Lake Itasca, Minn	Confluence with Missouri River.
8	Missouri	529,400	69,300	76,300	2,533	Source of Red Rock River, Mont.	Mississippi River.
9	Tennessee	40,910	64,000	(8)	900	Southwest Virginia, North Fork Holston River.	Ohio River.
10	Red	93,244	64,000	62,300	1,270	Eastern edge of New Mexico.	Atchafalaya River.
11	Mobile	[9]43,800	61,100	61,400	780	Northwest Georgia	Mobile Bay.
12	Snake	109,000	49,500	50,000	1,038	Ocean Plateau, Teton Co., Wyo.	Columbia River.
13	Arkansas	160,600	41,900	45,100	1,450	Lake Co., Colo	Mississippi River.
14	Susquehanna	27,570	38,200	37,190	444	Otsego Lake, Otsego Co., N.Y.	Chesapeake Bay.
15	Willamette	11,200	34,170	35,660	270	Tumblebug Creek, Douglas Co., Oreg.	Columbia River.
16	Alabama	22,600	32,000	32,400	735	Northwest Georgia	Mobile River.
17	White	28,000	32,300	32,100	720	Madison Co., Ark	Mississippi River.
18	Wabash	33,150	30,000	30,400	529	Darke Co., Ohio	Ohio River.
19	Pend Oreille	25,820	27,600	29,900	490	Near Butte, Mont	Columbia River.
20	Tombigbee	20,100	27,400	27,300	525	Northeast Mississippi	Mobile River.
21	Cumberland	18,080	26,900	(8)	720	Poor Fork, Letcher Co., Ky.	Ohio River.
22	Sacramento	27,100			377	Siskiyou Co., Calif	Suisun Bay.
23	Apalachicola	19,600	24,200	24,700	524	Source of Chattahoochee River, Towns Co., Ga.	Gulf of Mexico.
24	Illinois	27,900	22,600	22,800	420	Source of Kankakee River, St. Joseph Co., Ind.	Mississippi River.
25	Colorado	[10]242,900			[10]1,360	Rocky Mountain National Park, Colo.	Gulf of California.
26	Hudson	13,370	21,300	19,500	306	Essex Co., N.Y	Upper New York Bay.
27	Allegheny	11,700	19,800	19,290	325	Source of Allegheny River, Potter Co., Pa.	Ohio River.
28	Delaware	[11]11,440	[12]19,200	17,200	[11]390	Source of West Branch, Schoharie Co., N.Y.	Delaware Bay.

[1] At Baptiste Collette Bayou, La.

[2] About 25 percent of the flow of the Mississippi River system occurs in the Atchafalaya River.

[3] Combined flow of Mississippi and Atchafalaya Rivers is 640,000 cubic feet per second. Flow of Mississippi River channel at mouth is 453,000 cubic feet per second.

[4] Measured from the mouth of the Mississippi River and along its watercourse and that of the Missouri River to the source of Red Rock River in Montana. The length from mouth of Mississippi River to its source in *Minnesota* is 2,340 miles.

[5] At international boundary, lat. 45°. Includes flow of St. Regis River.

[6] Average is for 1957–70 period; station operated only since 1956.

[7] Continuation of Red River.

[8] Interbasin diversion beginning June 1966 between Lake Barkley on Cumberland River and Lake Kentucky on Tennessee River through Barkley-Kentucky Canal.

[9] At Bankhead Tunnel.

[10] At Arizona-Sonora boundary; natural flow not accurately known because of large depletions for irrigation.

[11] At Liston Point on Delaware Bay.

[12] Does not include flow of Chesapeake and Delaware canal.

The following rivers, mainly in the Southwest, have large drainage areas but relatively low average flows. They are listed according to drainage area, and are believed to discharge less than 10,000 cubic feet per second. Colorado River above its junction with Green River in Utah is believed to be the largest in the group on a flow basis.

	Square miles
Rio Grande	171,585
Platte River	90,000
Kansas River	61,300
Gila River	58,100
Brazos River	44,500
Green River (Utah–Wyo.)	44,400
Colorado River (Texas)	41,500
Red River of the North (at U.S.-Canadian boundary)	40,200
Pecos River	38,300
Canadian River	29,700
Colorado River (above Green River)	26,500

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