Prepared in cooperation with the Missouri Department of Natural Resources

Quality of Surface Water in Missouri, Water Year 2011

Data Series 734

U.S. Department of the Interior
U.S. Geological Survey

Front cover. U.S. Geological Survey hydrologic technicians collecting water-quality samples.

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By Miya N. Barr

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U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8\times°C)+32$$

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

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By Miya N. Barr

Abstract

The U.S. Geological Survey, in cooperation with the Missouri Department of Natural Resources, designed and operates a series of monitoring stations on streams throughout Missouri known as the Ambient Water-Quality Monitoring Network. During the 2011 water year (October 1, 2010, through September 30, 2011), data were collected at 75 stations—72 Ambient Water-Quality Monitoring Network stations, 2 U.S. Geological Survey National Stream Quality Accounting Network stations, and 1 spring sampled in cooperation with the U.S. Forest Service. Dissolved oxygen, specific conductance, water temperature, suspended solids, suspended sediment, fecal coliform bacteria, *Escherichia coli* bacteria, dissolved nitrate plus nitrite, total phosphorus, dissolved and total recoverable lead and zinc, and select pesticide compound summaries are presented for 72 of these stations. The stations primarily have been classified into groups corresponding to the physiography of the State, primary land use, or unique station types. In addition, a summary of hydrologic conditions in the State including peak discharges, monthly mean discharges, and 7-day low flow is presented.

Introduction

The U.S. Geological Survey (USGS), in cooperation with the Missouri Department of Natural Resources (MDNR), collects water-quality data pertaining to Missouri's water resources each water year (October 1 through September 30). These data, stored and maintained in the USGS National Water Information System (NWIS) database, are collected as part of the Missouri Ambient Water-Quality Monitoring Network (AWQMN) and constitute a source of reliable, impartial, and timely information for developing an enhanced understanding of the State's water resources. To make this information readily available, these data were published annually in the Water-Data Report series from water years 1964 through 2005 (U.S. Geological Survey, 1964–2005). Published data for the 2006 through 2010 water years can be accessed at *http://wdr.water.usgs.gov* (U.S. Geological Survey, 2006–2010). Beginning in the 2011 water year, discrete water-quality data are no longer published annually, but can be accessed on the National Water Information System Web Interface (NWISWeb) at *http://nwis.waterdata.usgs.gov/mo/nwis/qwdata*.

The MDNR is responsible for the implementation of the Federal Clean Water Act (CWA) in Missouri. Section 305(b) of the CWA requires that each State develop a water-quality monitoring program and periodically report the status of its water quality (U.S. Environmental Protection Agency, 1997). Water-quality status is described in terms of the suitability of the water for various uses, such as drinking, fishing, swimming, and support of aquatic life; these uses formally are defined as "designated uses" in State and Federal Regulations. Section 303(d) of the CWA requires certain waters that do not meet applicable water-quality standards be identified, and total maximum daily loads (TMDLs) be determined for these waters (U.S. Environmental Protection Agency, 1997). TMDLs establish the maximum amount of an impairing substance that a waterbody can assimilate and still meet the water-quality standards. A TMDL addresses a single pollutant for each waterbody.

Missouri has an area of approximately 69,000 square miles (mi^2) and an estimated population of 6 million people (U.S. Census Bureau, 2011). Within Missouri, there are 22,708 miles (mi) of classified streams that support a variety of uses including wildlife, recreation, agriculture, industry, transportation, and public utilities. An estimated 11,646 mi of streams are adversely affected (impaired) by various physical changes or chemical contaminants to the point that criteria for at least one of the designated uses no longer can be met (Missouri Department of Natural Resources, 2010). The impairment of about 3,772 mi of assessed streams has been documented by data that meet the requirements of Missouri's 303(d) Listing Methodology. There also are about 7,874 mi of classified, unassessed streams suspected of nonsupport, for which some data have been collected but the data are not of sufficient quality or quantity to officially rate the stream as impaired. Many of the unassessed streams suspected of non-support have been affected or modified by agriculture (Missouri Department of Natural Resources, 2010).

The purpose of this report is to summarize surface-water quality data collected by the USGS in cooperation with the MDNR and other Federal and local entities for water year 2011. The annual summary of select constituents provides MDNR with current information to assess the quality of surface water within the State and to ensure the objectives of the AWQMN are being met. This report is one in a series of annual summaries (Otero-Benitez and Davis, 2009a, 2009b; Barr, 2010, 2011). Data on the physical characteristics and water-quality constituents in samples collected at 72 surface-water stations are presented in figures and tables. These 72 stations primarily were classified into groups corresponding to the physiography of the State, primary land use, or unique station types.

The Ambient Water-Quality Monitoring Network

The USGS, in cooperation with the MDNR, designed and operates the cooperative AWQMN, which is a series of monitoring stations on streams and springs throughout Missouri. Constituent concentration data from the AWQMN have been used to determine statewide water-quality status and long-term trends (Barr and Davis, 2010) to meet information needs of State agencies involved in water-quality planning and management. The data collected also provide support for the design, implementation, and evaluation of preventive and remediation programs.

The objectives of the AWQMN are to obtain data on the quality and quantity of surface water within the State; provide a historical database of water-quality information that can be used by the State planning and management agencies to make informed decisions about anthropogenic effects (agriculture, mining, urban) on the State's surface waters; and provide for consistent methodology in data collection, laboratory analysis, and data reporting.

The MDNR and the USGS established a fixed-station AWQMN in 1964 with 18 stations, 5 of which are still currently (2012) being sampled. During the 2011 water year, the program consisted of 72 stations. In addition to the AWQMN stations, water samples are collected by the USGS at two USGS National Stream Quality Accounting Network (NASQAN; a national water-quality sampling network operated by the USGS) stations, and one spring sampled in cooperation with the U.S. Forest Service. From these 75 stations, 72 are included in this report. Three stations from the AWQMN did not fit in the groups (classes) defined for this report and were not included. The three excluded stations were Cuivre River near Troy (05514500) and Lamine River near Pilot Grove (06907300), both located in the Ozark Plateaus border, and Lake Taneycomo at Branson (07053700). Sampling frequency (table 1) is determined by a number of factors, including drainage basin size, potential effects from anthropogenic activities (such as agriculture, mining, and urban), history of chemical change, need for short-term data, and cost. Each of the streams in the AWQMN is classified for one or more designated uses. For specific information on the designated uses applicable to the stations in the AWQMN, refer to Missouri Department of Natural Resources (2012).

The unique eight-digit number used by the USGS to identify each surface-water station is assigned when a station first is established. The complete eight-digit number for each station includes a two-digit prefix that designates the major river system (05 is the Upper Mississippi River, 06 is the Missouri River, and 07 is the Lower Mississippi River) plus a six-digit downstream-order number. For example, the station number 05587455 indicates the station is located on the Upper Mississippi River ("05") while the remaining six digits ("587455") locate the station in downstream order. In this system, the station numbers increase downstream along the main stem. A station on a tributary that enters between two main stem stations is assigned a station number between them.

Methods used for collecting and processing representative water-quality samples are presented in detail in the USGS "National Field Manual for the Collection of Water-Quality Data" (U.S. Geological Survey, variously dated). Onsite measurements of dissolved oxygen (DO), specific conductance, and water temperature were taken at each station according to procedures described in Wilde (chapter sections variously dated). Samples were collected and analyzed for indicator bacteria [*Escherichia coli (E. coli)* and fecal coliform] using the membrane filtration procedure described in Myers and others (2007). Methods used by the USGS for collecting and processing representative samples for nutrients, major chemical constituents, trace elements, suspended solids, suspended sediment, and pesticide analysis are presented in detail in U.S. Geological Survey (2006), Guy (1969), and Wilde and others (2004). All chemical analyses were done by the USGS National Water Quality Laboratory (NWQL) in Lakewood, Colorado, according to procedures described in Fishman and Friedman (1989), Fishman (1993), and Zaugg and others (1995).

Laboratory Reporting Conventions

The NWQL uses method reporting conventions (Childress and others, 1999) to establish the minimum concentration for more than which a quantitative measurement can be made. These reporting conventions are the method reporting level (MRL) and the laboratory reporting level (LRL). The MRL is defined by the NWQL as the smallest measured concentration of a substance that can be measured reliably using a given analytical method. The method detection level (MDL) is the minimum concentration of a substance that can be measured and reported with 99-percent confidence that the concentration is greater than zero. A long-term method detection level (LT-MDL) is a detection level obtained by determining the standard deviation of 20 or more MDL spiked-sample measurements conducted for an extended period of time. The LRL is computed as twice the LT-MDL.

Table 1. U.S. Geological Survey (USGS) station number, name, drainage area, and sampling frequency of 72 selected stations in Missouri, water year 2011.

[mi^2, square mile; --, not applicable]

USGS station number	Station name	Contributing drainage area (mi^2)	Water year 2011 sampling frequency
05495000	Fox River at Wayland	400	6
05496000	Wyaconda River above Canton	393	6
05497150	North Fabius River near Ewing	471	6
05500000	South Fabius River near Taylor	620	12
[a]05587455	Mississippi River below Grafton, Illinois	171,300	12
06817700	Nodaway River near Graham	1,520	6
[a]06818000	Missouri River at St. Joseph	426,500	12
06821190	Platte River at Sharps Station	2,380	6
06894100	Missouri River at Sibley	426,500	12
06896187	Middle Fork Grand River near Grant City	82.4	6
06898100	Thompson River at Mount Moriah	891	6
06898800	Weldon River near Princeton	452	6
06899580	No Creek near Dunlap	34.0	12
06899950	Medicine Creek near Harris	192	12
06900100	Little Medicine Creek near Harris	66.5	12
06900900	Locust Creek near Unionville	77.5	12
06902000	Grand River near Sumner	6,880	12
06905500	Chariton River near Prairie Hill	1,870	6
06905725	Mussel Fork near Mystic	24.0	12
06906300	East Fork Little Chariton River near Huntsville	220	6
06917630	East Drywood Creek at Prairie State Park	3.38	4
06918070	Osage River above Schell City	5,410	6
06918600	Little Sac River near Walnut Grove	119	12
06919500	Cedar Creek near Pleasant View	420	12
06921070	Pomme de Terre River near Polk	276	9
06921590	South Grand River at Archie	356	6
06921720	Big Creek near Blairstown	414	12
06923700	Niangua River at Bennett Spring	441	6
06926510	Osage River below St. Thomas	14,580	6
06927850	Osage Fork of the Gasconade River near Lebanon	43.6	6
06928440	Roubidoux Spring at Waynesville	--	6
06930450	Big Piney River at Devil’s Elbow	746	9
06930800	Gasconade River above Jerome	2,570	12
[a,b]06934500	Missouri River at Hermann	522,500	16
07014000	Huzzah Creek near Steelville	259	6
07014200	Courtois Creek at Berryman	173	6
07014500	Meramec River near Sullivan	1,475	12
07016400	Bourbeuse River above Union	808	9
07018100	Big River near Richwoods	735	9
07019280	Meramec River at Paulina Hills	3,920	12
07020550	South Fork Saline Creek near Perryville	55.3	6

Table 1. U.S. Geological Survey (USGS) station number, name, drainage area, and sampling frequency of 72 selected stations in Missouri, water year 2011.—Continued

[mi^2, square mile; --, not applicable]

USGS station number	Station name	Contributing drainage area (mi^2)	Water year 2011 sampling frequency
07021020	Castor River at Greenbriar	423	6
[a,b]07022000	Mississippi River at Thebes, Illinois	713,200	12
07036100	St. Francis River near Saco	664	9
07037300	Big Creek at Sam A. Baker State Park	189	6
07042450	St. Johns Ditch at Henderson Mound	313	7
07046250	Little River Ditches near Rives	1,620	12
07050150	Roaring River Spring at Cassville	--	6
07052152	Wilson Creek near Brookline	51	12
07052250	James River near Boaz	462	7
07052345	Finley Creek below Riverdale	261	12
07052500	James River at Galena	987	12
07052820	Flat Creek below Jenkins	274	12
07053900	Swan Creek near Swan	148	6
07057500	North Fork River near Tecumseh	561	6
07057750	Bryant Creek below Evans	214	6
07061600	Black River below Annapolis	493	7
07066110	Jacks Fork above Two River	425	12
07067500	Big Spring near Van Buren	--	4
07068000	Current River at Doniphan	2,040	12
07068510	Little Black River below Fairdealing	194	6
[b]07071000	Greer Spring at Greer	--	4
07071500	Eleven Point River near Bardley	793	6
07185764	Spring River above Carthage	425	12
07186480	Center Creek near Smithfield	303	9
07186600	Turkey Creek near Joplin	41.8	9
07187000	Shoal Creek above Joplin	427	12
07188653	Big Sugar Creek near Powell	141	12
07188838	Little Sugar Creek near Pineville	195	12
07188885	Indian Creek near Lanagan	239	12
07189000	Elk River near Tiff City	872	12
07189100	Buffalo Creek at Tiff City	60.8	12

[a]Additional water temperature and suspended-sediment samples collected in cooperation with the U.S. Army Corps of Engineers.

[b]Stations 06934500, 07022000, and 07071000 are not part of the Ambient Water-Quality Monitoring Network, but were used in the report. Stations 06934500 and 07022000 are funded by the U.S. Geological Survey National Stream Quality Account Network; station 07071000 is funded by the U.S. Forest Service.

Data Analysis Methods

The distribution of select constituent data was graphically displayed using side-by-side boxplots (box and whiskers distributions; Helsel and Hirsch, 2002). The plots show the center of the data (median, the center line of the boxplot), the variation [interquartile range (25th to 75th percentiles) or the height of the box], the skewness (quartile skew, which is the relative size of the box halves), the spread (upper and lower adjacent values are the vertical lines or whiskers), and the presence or absence of unusual values, or outliers (upper and lower detached and outside values). If the median equals the 25th and 75th percentiles, the boxplot is represented by a single horizontal line. Censored concentration data reported less than the MRL, less than the LRL, or as estimated to be below the MRL or LRL were included in each distribution as a concentration value equal to the MRL or LRL. Boxplots with censored data were modified by making the lower limit of the box equal to the MRL or LRL.

Station Classification for Data Analysis

The stations primarily were classified in groups corresponding to the physiography of the State (fig. 1), primary land use (fig. 2), or unique station types (fig. 1; table 2). The physiography-based groups include the Dissected Till Plains (DTPL) in the north, the Osage Plains (OSPL) in the west, the Mississippi Alluvial Plain (MIALPL) in the southeast, and between them the Ozark Plateaus. The Ozark Plateaus (Fenneman, 1938) were further subdivided into two distinct groups based on physiographic location—the Salem Plateau (OZPLSA) and the Springfield Plateau (OZPLSP). Land-use groups include mining (MINING) and urban (URBAN) stations, whereas unique station classes refer to springs (SPRING) and the stations located on the big rivers [the Mississippi River (BRMIG and BRMIT) and the Missouri River (BRMOSJ, BRMOS and BRMOH)].

Some additional variability caused by differences in drainage area and land use was observed within physiographic regions; therefore, watershed size and land-use indicators were employed to develop a complete set of classes. The land-use indicator provides a subclassification for stations in similar regions with different land uses (fig. 1; table 2). The secondary land-use indicators are watershed indicator stations (wi), which are the most downstream stations in a large watershed, and are defined for the purposes of this report as a drainage area greater than 1,000 mi^2; forest (fo); agricultural (ag); and prairie (pr). Observations and analyses from watershed indicator stations can be interpreted as being representative of the general condition of the watershed. In some instances, the agricultural and forest secondary land uses were present; therefore, the convention was to mention them in predominant order. For example, an agriculture and forest (ag/fo) indicator implies that the primary land use of the watershed is agriculture, although a substantial part of the land use is forest.

Summary of Hydrologic Conditions

Surface-water streamflow varies seasonally in Missouri and tends to reflect precipitation patterns. The selection of streamflow-gaging stations (hereinafter referred to as streamgages) used to describe the variation in hydrologic conditions was based on their geographical distribution across the State and their long period of record. This summary of state-wide hydrologic condition data is a legacy of information that was previously provided in the annual Water-Data Reports (U.S. Geological Survey, 1964–2005). Stations used to provide hydrologic conditions that are not already identified as a surface-water quality sampling station on figure 1, are identified in figure 3.

Six streamgages across the State were selected to illustrate the 2011 water year monthly mean discharge and the long-term median of monthly mean discharge (fig. 4). Monthly mean discharge is the arithmetic mean of daily discharges for a given month. The median of the monthly mean discharges computed for the available period of record is used to represent the historical data for comparison to the current water year. Of these six stations, three (05495000, 06921590, and 07052500) are part of the AWQMN and the remaining four (06897500, 06921590, 06933500, and 07067000) are streamgages only and are not part of the AWQMN (figs. 1 and 3).

During the 2011 water year, the average annual precipitation of the conterminous United States was about 0.36 inches (in.) less than the long-term average of 29.35 in. (National Oceanic and Atmospheric Administration, 2012a). Missouri's precipitation ranked less than normal with 39.72 in. of total precipitation, whereas the long-term State average is 41.17 in. (National Oceanic and Atmospheric Administration, 2012b). Most stations had monthly mean discharges greater than or equal to the median of the monthly mean discharges for April through June 2011 except station 06921590 (South Grand River at Archie). Stations 06933500 (Gasconade River at Jerome) and 07067000 (Current River at Van Buren) had monthly mean discharges during March through September 2011 that were mostly greater than the long-term monthly mean discharges for their period of record. The largest differences can be observed at stations 05495000 (Fox River at Wayland) and 06921590 (fig. 3). Site 06921590, which is located in the west-central region of Missouri, exceeded the historical monthly mean discharges only in February 2011 (fig. 3).

Peak discharges for the 2011 water year and select periods of record are presented for nine streamgages (fig. 3; table 3). The peak discharges shown in table 3 were less than the peak discharges for the period of record at all stations. The 7-day low flow for the period of record, and the minimum daily mean flow for the 2011 water year are presented for selected stations in table 4.

Figure 1. Location and class of selected stations and physiographic regions of Missouri, water year 2011.

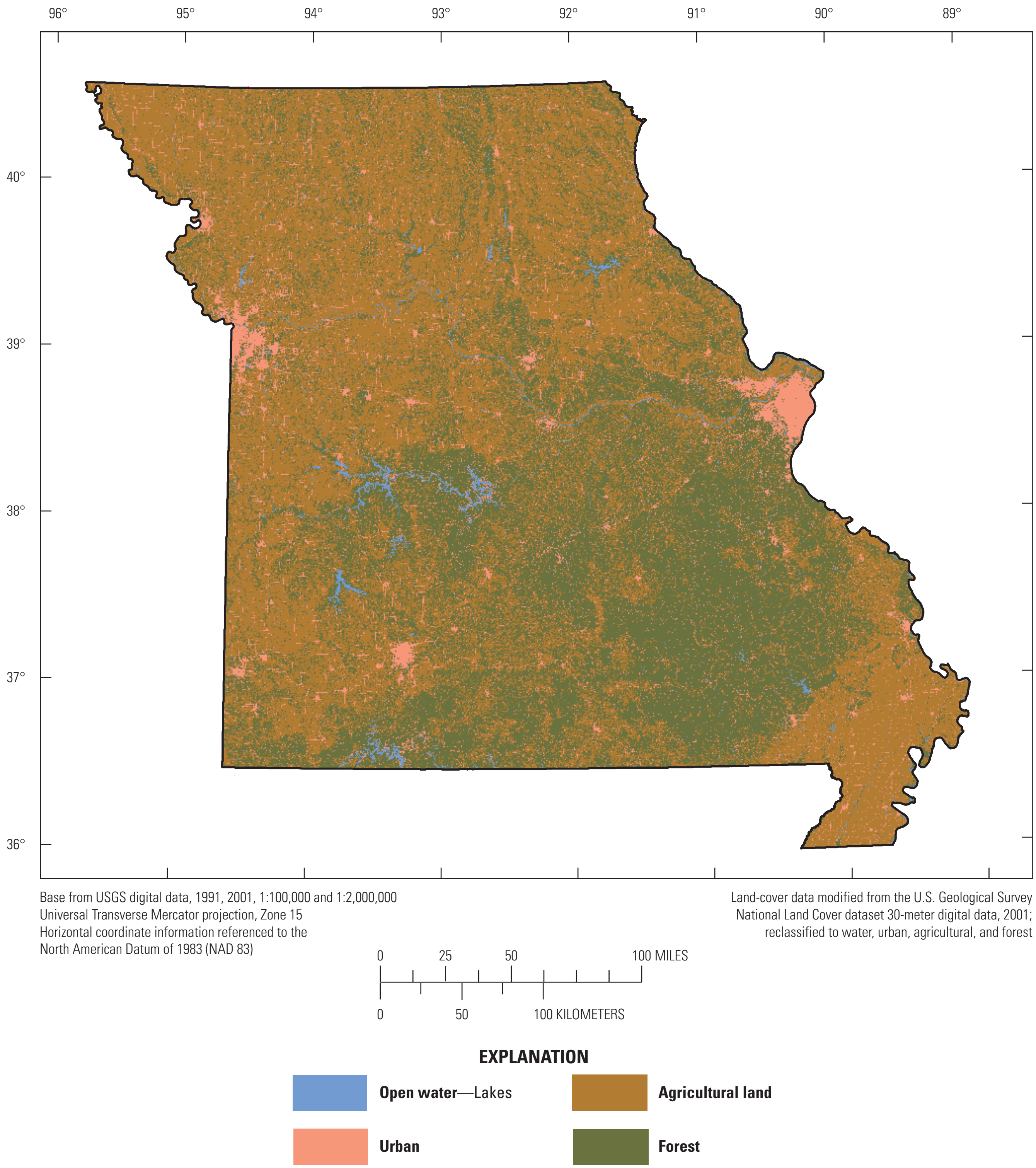


Figure 2. Land use in Missouri.

Table 2. Station classification system.

[Classification system is based on physiography of the State, primary and secondary land use, unique station type, and watershed size, as well as a station's representativeness to the general condition of the watershed]

Class (fig. 1)	Description	Number of stations
BRMIG	Big River—Mississippi River below Grafton, Illinois	1
BRMIT	Big River—Mississippi River at Thebes, Illinois	1
BRMOSJ	Big River—Missouri River at St. Joseph, Missouri	1
BRMOS	Big River—Missouri River at Sibley, Missouri	1
BRMOH	Big River—Missouri River at Hermann, Missouri	1
MIALPL	Mississippi Alluvial Plain	[a]2
OZPLSA fo/ag	Ozark Plateaus—Salem Plateau forest and agriculture	18
OZPLSA wi fo/ag	Ozark Plateaus—Salem Plateau watershed indicator, forest and agriculture	4
OZPLSP ag/fo	Ozark Plateaus—Springfield Plateau agriculture and forest	11
DTPL ag	Dissected Till Plains agriculture	12
DTPL wi ag	Dissected Till Plains watershed indicator, agriculture	4
OSPL ag	Osage Plains agriculture	2
OSPL wi ag	Osage Plains watershed indicator, agriculture	1
OSPL pr	Osage Plains prairie	1
SPRING	Springs	4
MINING	Mining	3
URBAN	Urban	4
URBAN wi	Urban watershed indicator	1

[a]One station in this class, Little River Ditches near Rives, Missouri (07046250), has a drainage area greater than 1,000 square miles but is not considered a watershed indicator station because the manmade canals and ditches within its drainage area are not hydrologically connected.

Distribution, Concentration, and Detection Frequency of Select Constituents

The analyses presented in this report include the following constituents: dissolved oxygen (DO), specific conductance, water temperature, suspended solids, suspended sediment, *E. coli* bacteria, fecal coliform bacteria, dissolved nitrate plus nitrite, total phosphorus, and dissolved and total recoverable lead and zinc. In addition, pesticide data were analyzed from eight stations. Of the 85 pesticide constituents analyzed during the water year, 15 were selected for presentation in this report: 2-chloro-4-isopropylamino-6-amino-s-triazine (CIAT; a degradation product of atrazine); 3,4-dichloroaniline, acetochlor; alachlor; atrazine; *cis*-propaconazole; metalaxyl; metoalachlor; metribuzin; pendimethalin; prometon; prometryn; simazine; terbuthylazine; and *trans*-propiconazole. The selection of these constituents and pesticides for presentation in this report was based on values or concentrations of the select constituents are characteristic of stream-water quality in the different physiographic areas, and values and concentrations of the select constituents and pesticides are more than background concentrations. Boxplots of measured constituents are presented for the different classes (figs. 5–7). Pesticide data are presented in figure 8. Missouri water-quality standards are not shown on the graphs because these standards are not applicable to all streams in the AWQMN network. For specific information on Missouri water-quality standards, refer to Missouri Department of Natural Resources (2012).

Distribution of Physical Properties, Suspended-Solids Concentration, Suspended-Sediment Concentration, and Indicator Bacteria Density

The physical properties analyzed for this report were DO, specific conductance, and water temperature. The median DO, in percent saturation, ranged from 71 to 111 percent (fig. 5). Samples from MIALPL, OSPL wi ag, and SPRING stations had the lowest median DO percent saturation values, whereas samples from URBAN stations had the highest (fig. 5). The range in DO percent saturation values was smallest at BRMIG. Median specific conductance values varied substantially among the station classes (fig. 5), ranging from 113 microsiemens per centimeter at 25 degrees Celsius at the OSPL pr station to 772 microsiemens per centimeter at 25 degrees Celsius at the BRMOSJ station. Median water temperature values ranged from 10.3 to 19.9 degrees Celsius, with the

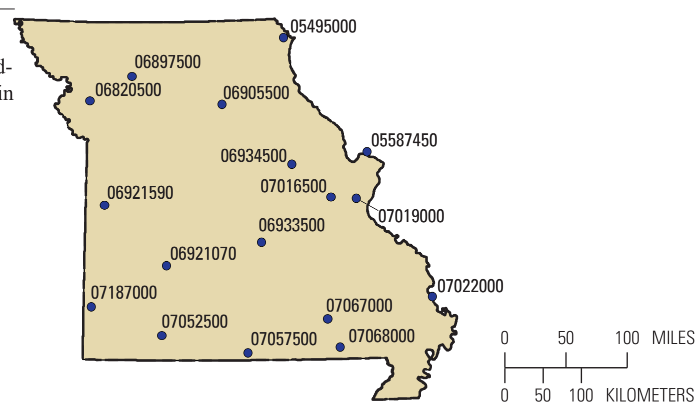
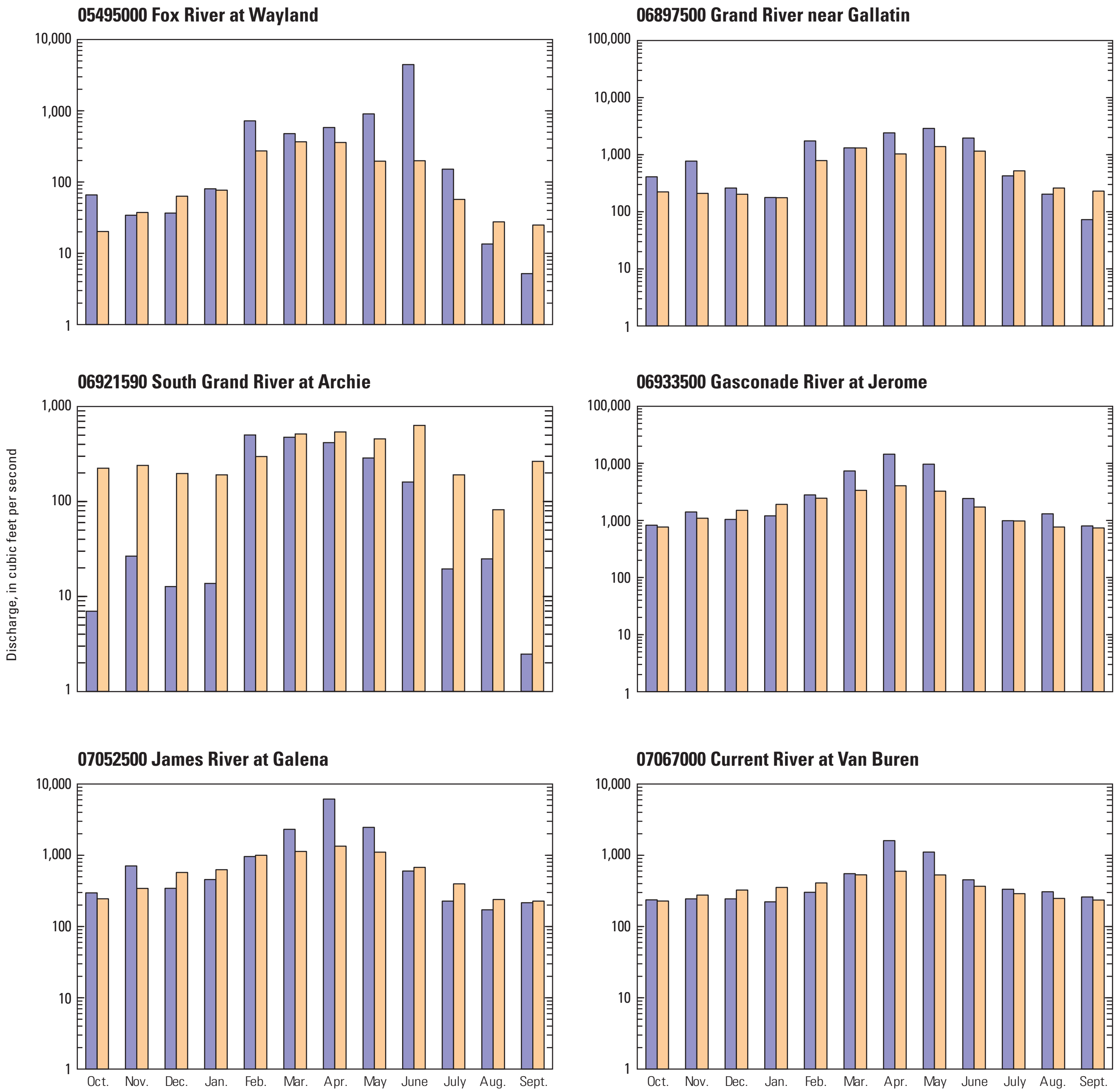
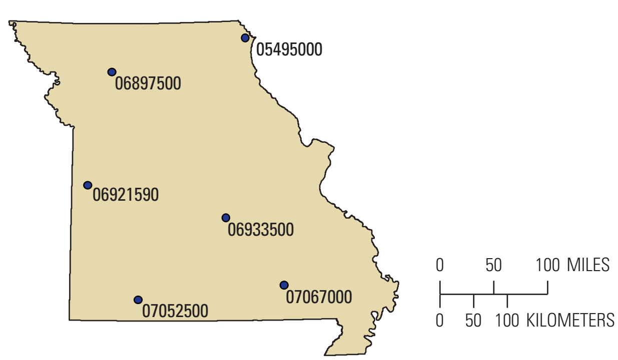


Figure 3. Location of streamflow-gaging stations used for the description of hydrologic conditions for Missouri, water year 2011.





EXPLANATION

- 2011 water year monthly mean discharge
- Median monthly mean discharge for period of record

Figure 4. The 2011 water year monthly mean discharge and long-term median of monthly mean discharges at six representative streamgages.

Table 3. Peak discharge for the 2011 water year and select periods of record for selected streamgages.

[Peak discharge in cubic feet per second]

U.S. Geological Survey station number[a]	Station name (period of record used for statistical summaries in water years)	2011 water year		Long-term period of record	
		Peak discharge	Date	Peak discharge	Date
05495000	Fox River at Wayland, Mo. (1922–2010)	26,200	June 15	26,400	Apr. 22, 1973
05587450	Mississippi River at Grafton, Ill. (1987–2010)	362,000	May 1, June 19	598,000	Aug. 1, 1993
06905500	Chariton River near Prairie Hill, Mo. (1929–2010)	22,900	June 28	38,400	July 27, 2008
06933500	Gasconade River at Jerome, Mo. (1903–2010)	85,100	Apr. 27	136,000	Dec. 5, 1982
06934500	Missouri River at Hermann, Mo. (1958–2010)	279,000	May 27	750,000	July 31, 1993
07019000	Meramec River near Eureka, Mo. (1904–2010)	60,600	Apr. 29	145,000	Dec. 6, 1982
07022000	Mississippi River at Thebes, Ill. (1933–2010)	876,000	May 2	996,000	Aug. 7, 1993
07057500	North Fork River near Tecumseh, Mo. (1945–2010)	81,000	Apr. 26	133,000	Nov. 19, 1985
07068000	Current River at Doniphan, Mo. (1921–2010)	90,100	Apr. 26	122,000	Dec. 3, 1982

[a]Stations 05587450, 06933500, and 07019000 are streamflow-gaging stations only and not part of the Ambient Water-Quality Monitoring Network (AWQMN).

Table 4. Seven-day low flow for water year 2011, period of record 7-day low flow, and period of record minimum daily mean flow for selected streamgages in Missouri.

[Flow in cubic feet per second]

U.S. Geological Survey station number[a]	Station name (period of record in water years)	7-day low flow		Minimum daily mean flow for period of record	
		2011	Period of record	Discharge	Date
05495000	Fox River at Wayland (1922–2011)	3.5	0	0	Several years
06820500	Platte River near Agency (1933–2011)	62	0	0	Several years
06921070	Pomme de Terre river near Polk (1969–2011)	5.8	0.34	0.30	Aug. 10, 1980
07016500	Bourbeuse River near Union (1921–2011)	62	13	12	Oct. 10, 1956
07067000	Current River at Van Buren (1912–2011)	809	479	476	Oct. 8, 1956
07187000	Shoal Creek above Joplin (1942–2011)	111	16	15	Sept. 7, 1954

[a]Stations 06820500, 07016500, and 07067000 are streamflow-gaging stations only and not part of the Ambient Water-Quality Monitoring Network (AWQMN).

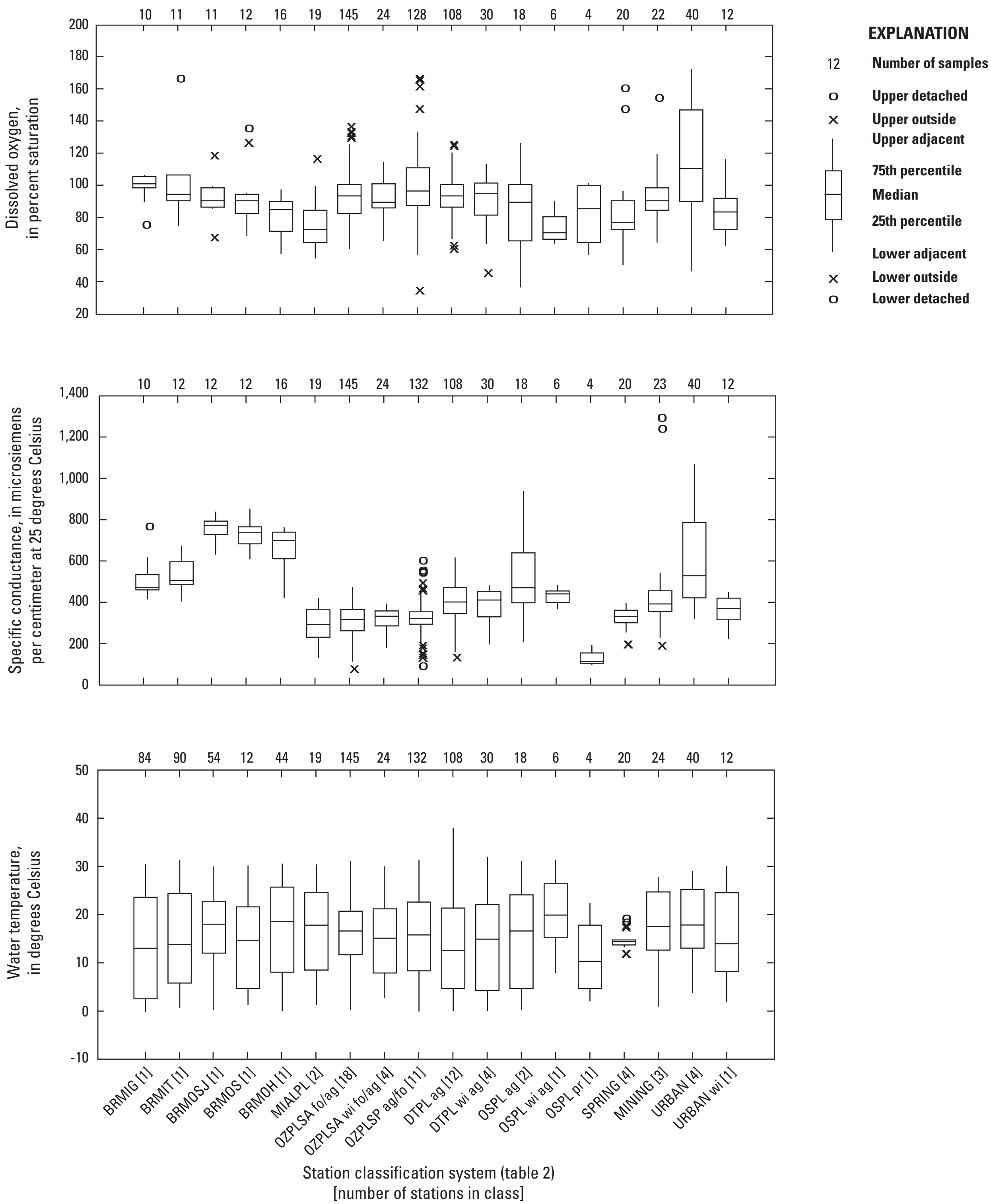


Figure 5. Distribution of physical properties, suspended-solids concentrations, suspended-sediment concentrations, and indicator bacteria densities in samples from 72 stations, water year 2011.

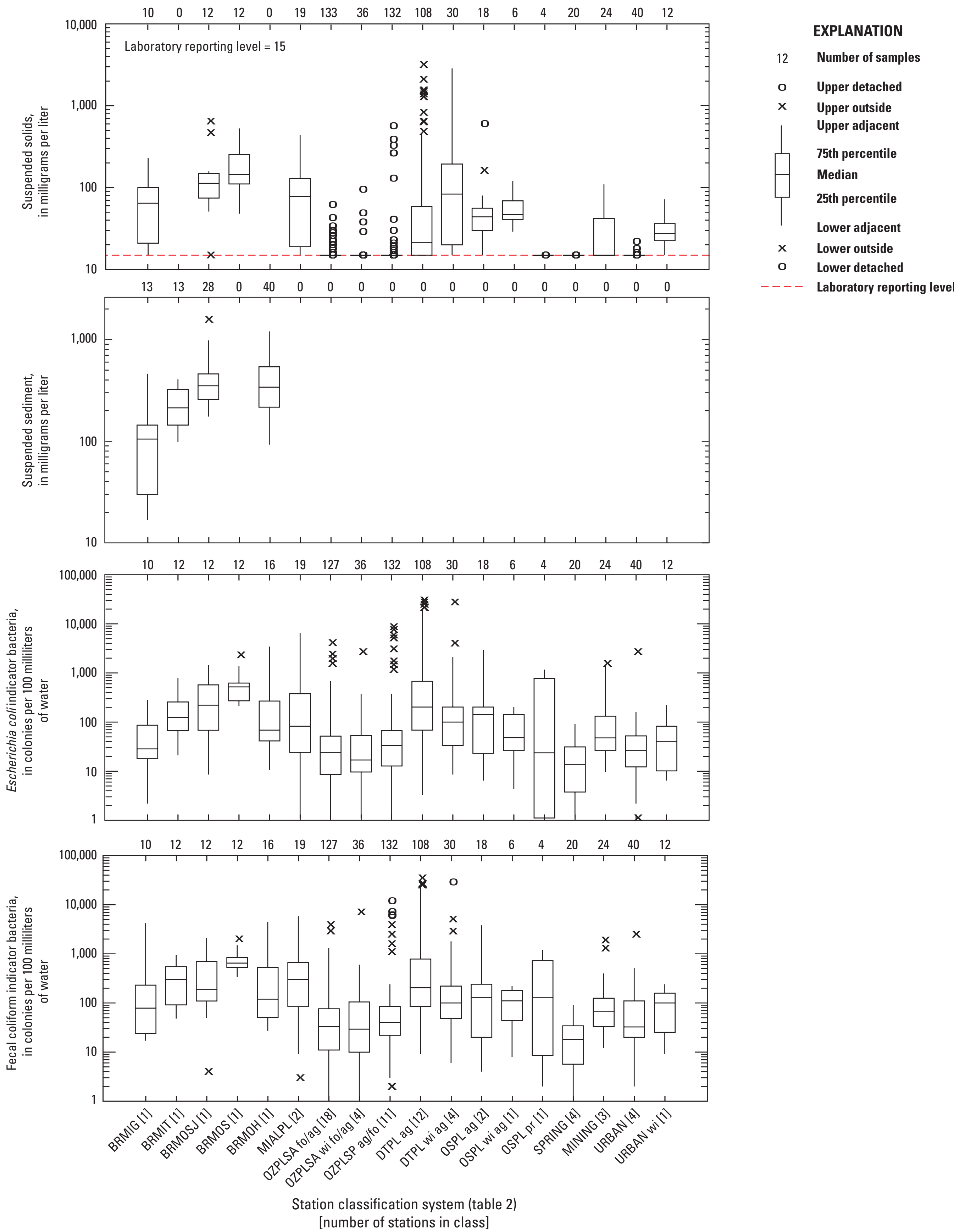


Figure 5. Distribution of physical properties, suspended-solids concentrations, suspended-sediment concentrations, and indicator bacteria densities in samples from 72 stations, water year 2011.—Continued

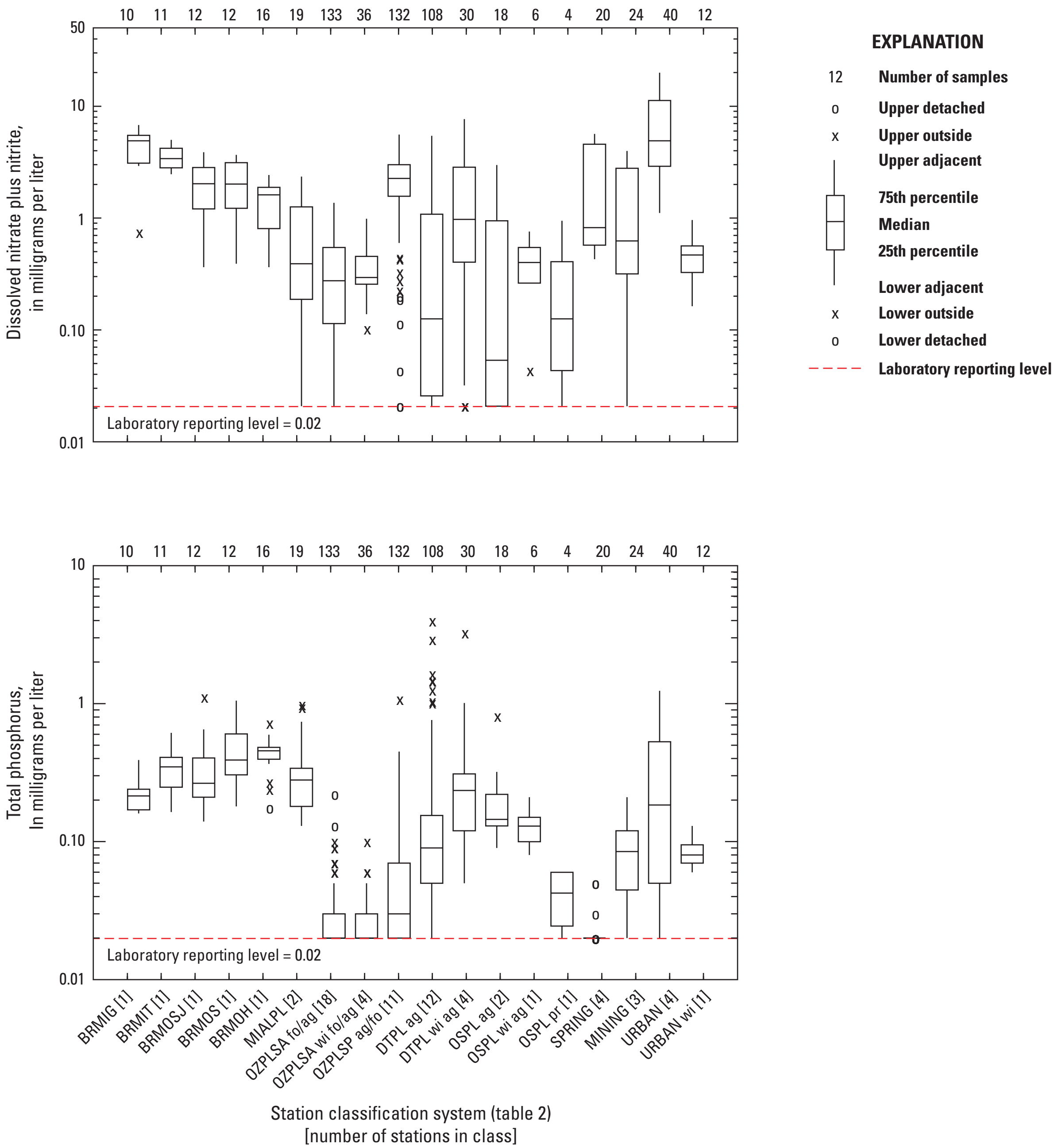


Figure 6. Distribution of dissolved nitrate plus nitrite and total phosphorus concentrations in samples from 72 stations, water year 2011.

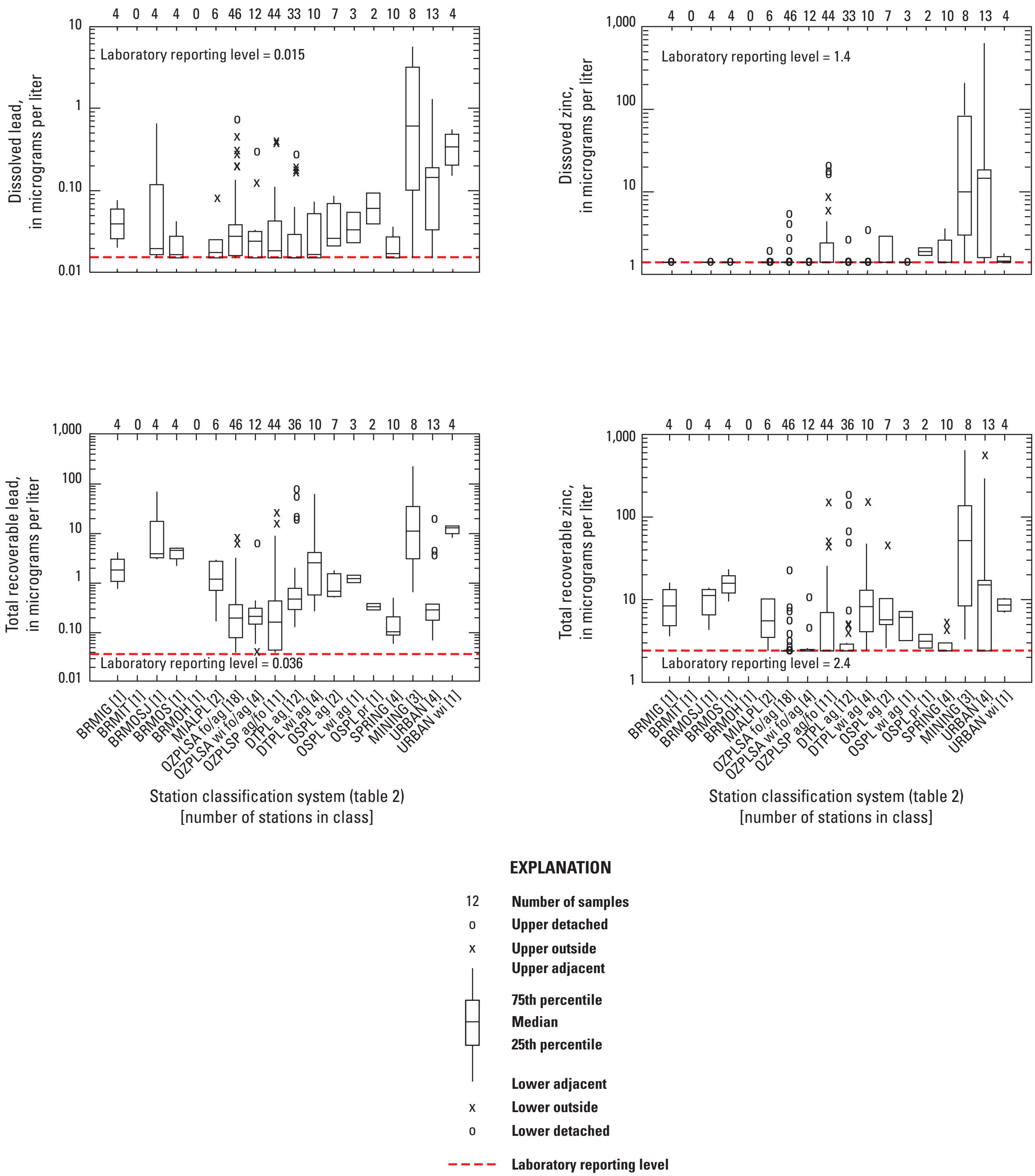


Figure 7. Distribution of dissolved and total recoverable lead and zinc concentrations from 72 stations, water year 2011.

smallest median measured at the OSPL pr station and the largest median measured at the OSPL wi ag station (fig. 5). The range in water temperature at the SPRING stations was much smaller than at any other station class.

Suspended solids and suspended sediment are measures of the solid material suspended in the water column. These two measures are not considered directly comparable because of differences in collection and analytical techniques. Suspended-solids concentrations were determined at all stations except BRMIT and BRMOH. Median suspended-solids concentrations varied considerably between all station classes, ranging from less than 15 to 145 milligrams per liter (mg/L). Samples collected at the the OZPL (SA fo/ag, SA wi fo/ag, and SP ag/fo), OSPL pr, SPRING, MINING, and URBAN stations had median concentrations less than the LRL, whereas the BRMOS station had the largest median suspended-solids concentrations. Suspended-sediment concentrations were determined only at four Big River stations. The suspended-sediment data used for this report consist of composited cross-sectional concentrations, average cross-sectional concentrations computed from five verticals within the cross-section, or from single vertical (also known as box sample) concentrations. Additional suspended-sediment concentrations from individual verticals within cross-sections are available on NWISWeb. Median suspended-sediment concentrations ranged from 115 mg/L at BRMIG to 397 mg/L at BRMOSJ (fig. 5).

Median *E. coli* bacteria densities ranged from 13 to 525 colonies per 100 milliliters (col/100mL) (fig. 5). The lowest median densities were in samples collected at SPRING stations, whereas the largest median densities were in samples collected at BRMOS (fig. 5). Median fecal coliform bacteria densities (fig. 5) ranged from 18 to 650 col/100mL. Similar to the median ranges of *E. coli* bacteria densities, the the smallest median densities were measured at SPRING stations and the largest median fecal coliform densities were in samples collected at the BRMOS station (fig. 5). Median *E. coli* and fecal coliform bacteria densities varied considerably between all station classes. The range of both fecal bacteria indicator densities at BRMOS were smaller than any other class.

Distribution of Dissolved Nitrate plus Nitrite and Total Phosphorus Concentrations

Samples were collected at all stations for the analysis of nutrients, including dissolved nitrate plus nitrite and total phosphorus. Median dissolved nitrate plus nitrite and total phosphorus concentrations varied considerably between all station classes (fig. 6), ranging from 0.05 to 3.5 mg/L nitrate plus nitrite as nitrogen and from less than 0.02 to 0.46 mg/L total phosphorus. The smallest median dissolved nitrate plus nitrite concentrations were detected at OSPL ag, and the largest concentrations were detected in samples collected at BRMIG and URBAN stations (fig. 6). The smallest median total phosphorus concentrations were detected at the OZPLSA (fo/ag and wi fo/ag) and SPRING stations, all of which had median values equal to the LRL, and the largest median concentrations were at the BRMOH station. (fig. 6).

Distribution of Dissolved and Total Recoverable Lead and Zinc Concentrations

Samples were collected for the analysis of dissolved and total recoverable trace elements, including lead and zinc. No dissolved or total recoverable lead and zinc samples were collected at BRMIT and BRMOH. Median concentration ranges of dissolved and total recoverable lead and zinc (fig. 7) were less than 0.015 to 0.63 micrograms per liter (µg/L) dissolved lead, 0.10 to 13.1 µg/L total recoverable lead, less than 1.4 to 14.6 µg/L dissolved zinc, and less than 2.4 to 54.3 µg/L total recoverable zinc. The smallest median concentrations of dissolved lead and dissolved and total recoverable zinc generally were detected in samples collected at all DTPL ag, OZPL (SA fo/ag, SA wi fo/ag, SP ag/fo), and SPRING stations (fig. 7). Median dissolved zinc concentrations were detected at or less than the LRL except for OSPL pr, MINING, URBAN and URBAN wi stations. Although large median concentrations of both dissolved and total recoverable lead and zinc were detected at the MINING stations, only median concentrations of dissolved lead and total recoverable zinc were the largest among all classes. Median total recoverable lead concentrations were largest at the URBAN wi station, and median dissolved zinc concentrations were largest in samples collected at URBAN stations.

Concentration and Detection Frequency of Select Pesticides from Selected Stations

Samples for the analysis of dissolved pesticides were collected at eight stations in the AWQMN, including three of the five Big River stations (BRMIG, BRMIT, and BRMOH), both stations in the MIALPL, one DTPL ag station, the OSPL wi ag station, and one URBAN station. The DTPL ag station is not routinely sampled for pesticides, but was sampled during the 2011 water year to compensate for the inability to access one of the MIALPL sites during the spring flooding conditions in the southeastern part of the State. Data from 15 compounds detected at concentrations greater than the LRL at 1 or more stations are presented graphically in this report (fig. 8). The most frequently detected pesticides were CIAT, acetochlor, alachlor, atrazine, metolachlor, and simazine. The concentrations detected at all stations for all pesticides were less than 1.00 µg/L except CIAT, atrazine, metalaxyl, and metolachlor. CIAT concentrations ranged from less than 0.006 to 1.29 µg/L. Atrazine concentrations ranged from less than 0.008 to 12.3 µg/L, with the largest concentrations detected at MIALPL stations. Metalaxyl concentrations ranged from an estimated 0.008 to 1.85 µg/L. Metolachlor concentrations ranged from an estimated 0.006 to 16.8 µg/L, with the largest concentrations detected at MIALPL stations (fig. 8).

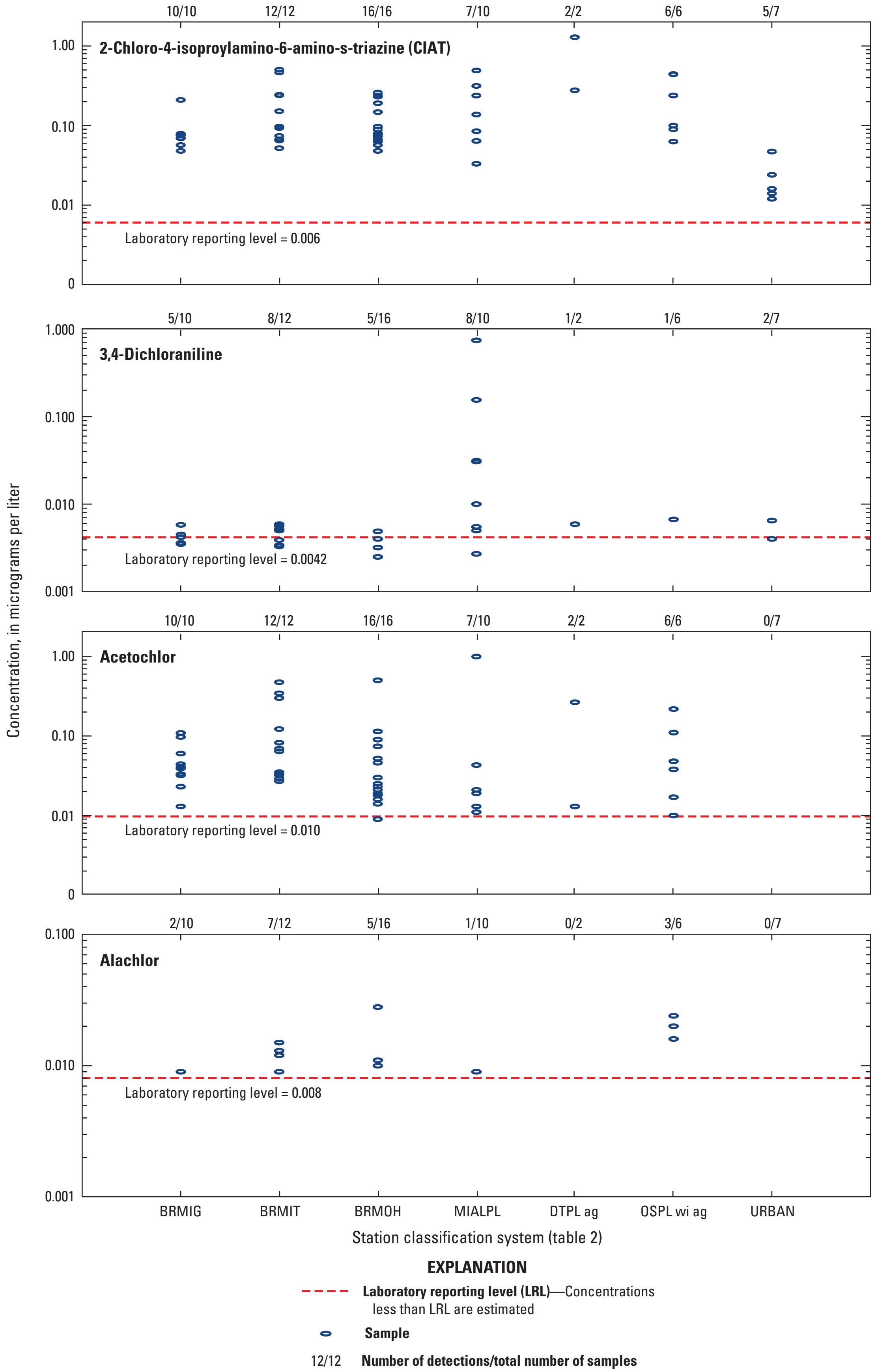


Figure 8. Detection of select pesticides from selected stations, water year 2011.

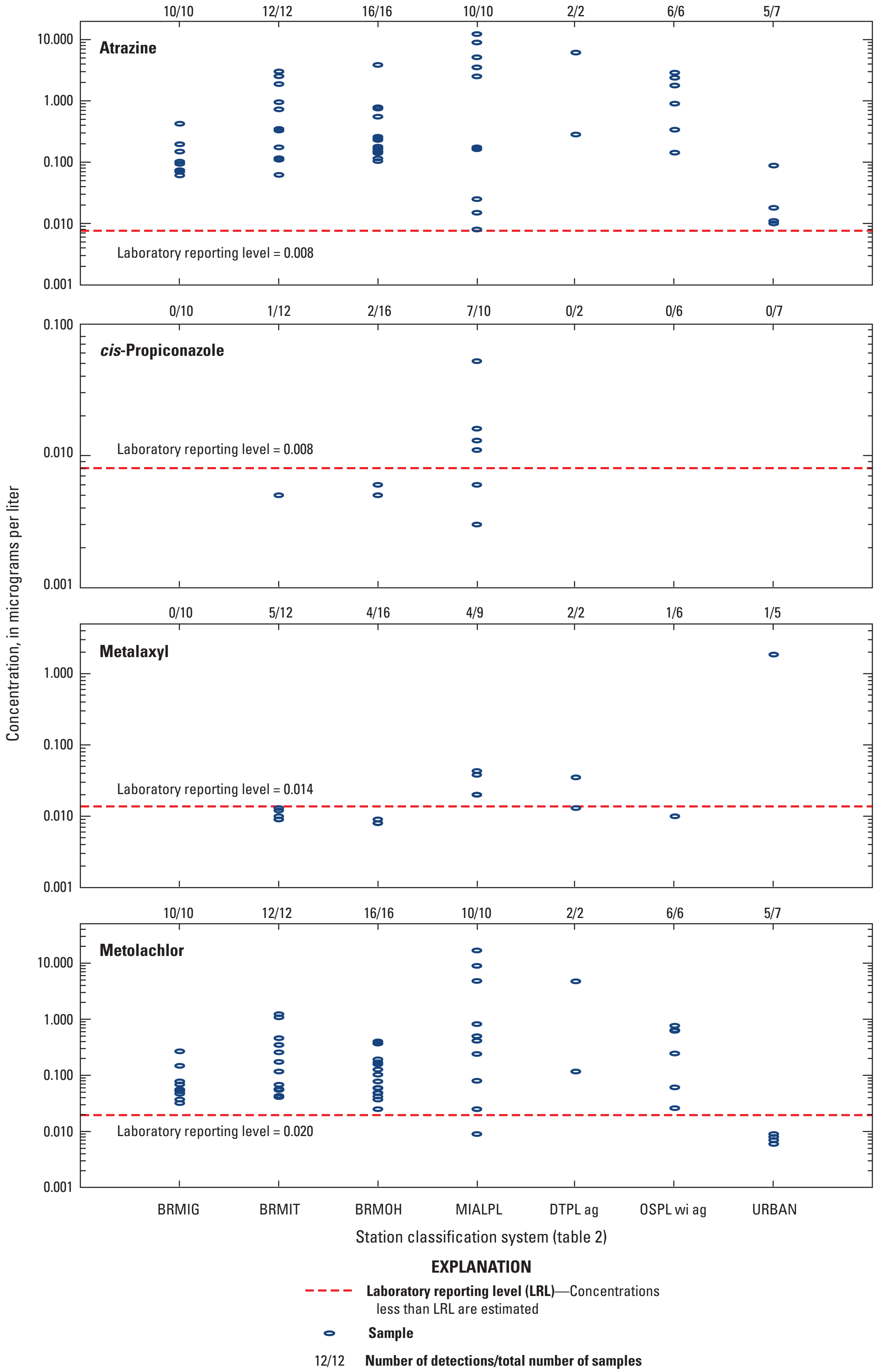


Figure 8. Detection of select pesticides from selected stations, water year 2011.—Continued

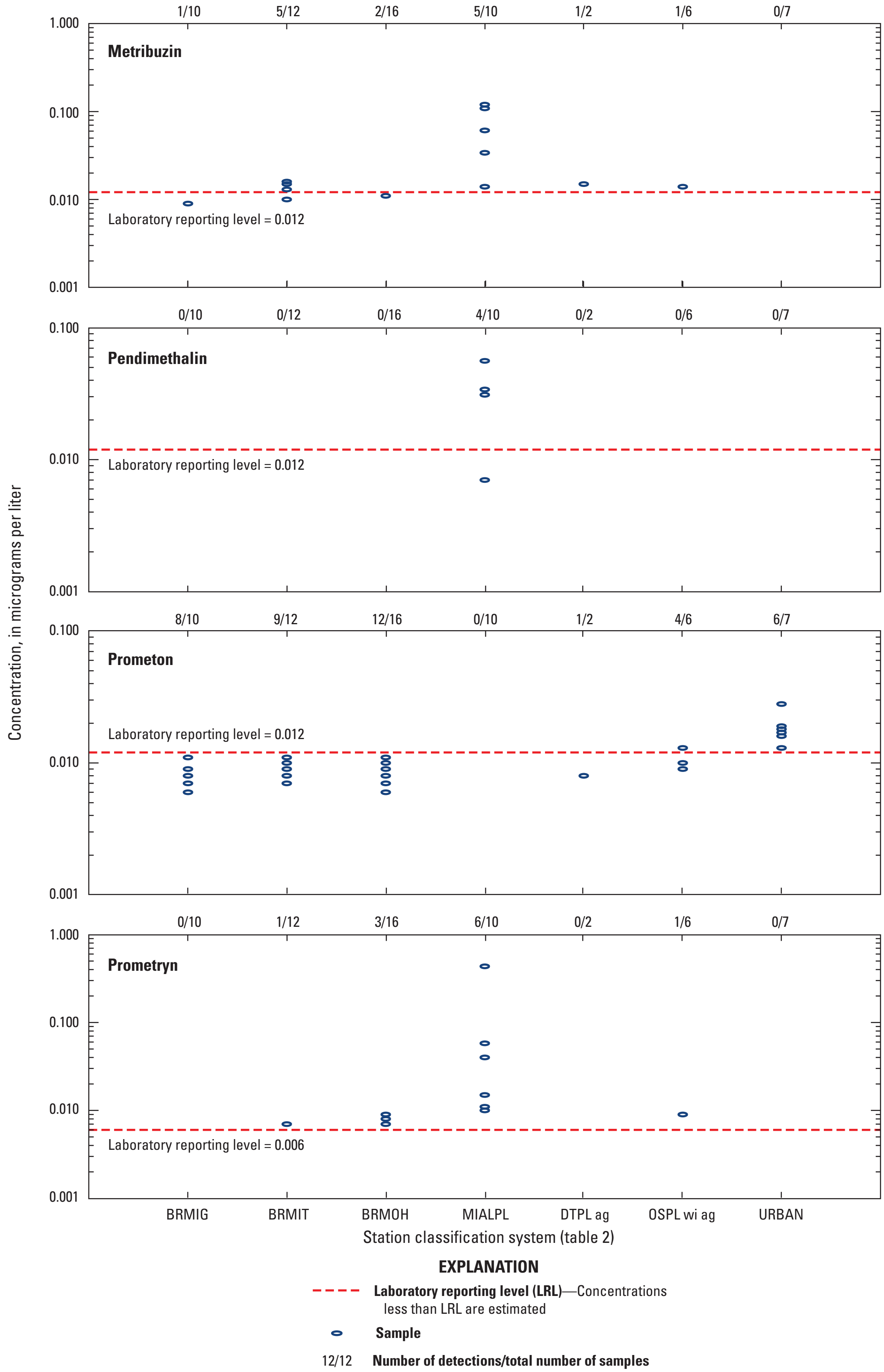


Figure 8. Detection of select pesticides from selected stations, water year 2011.—Continued

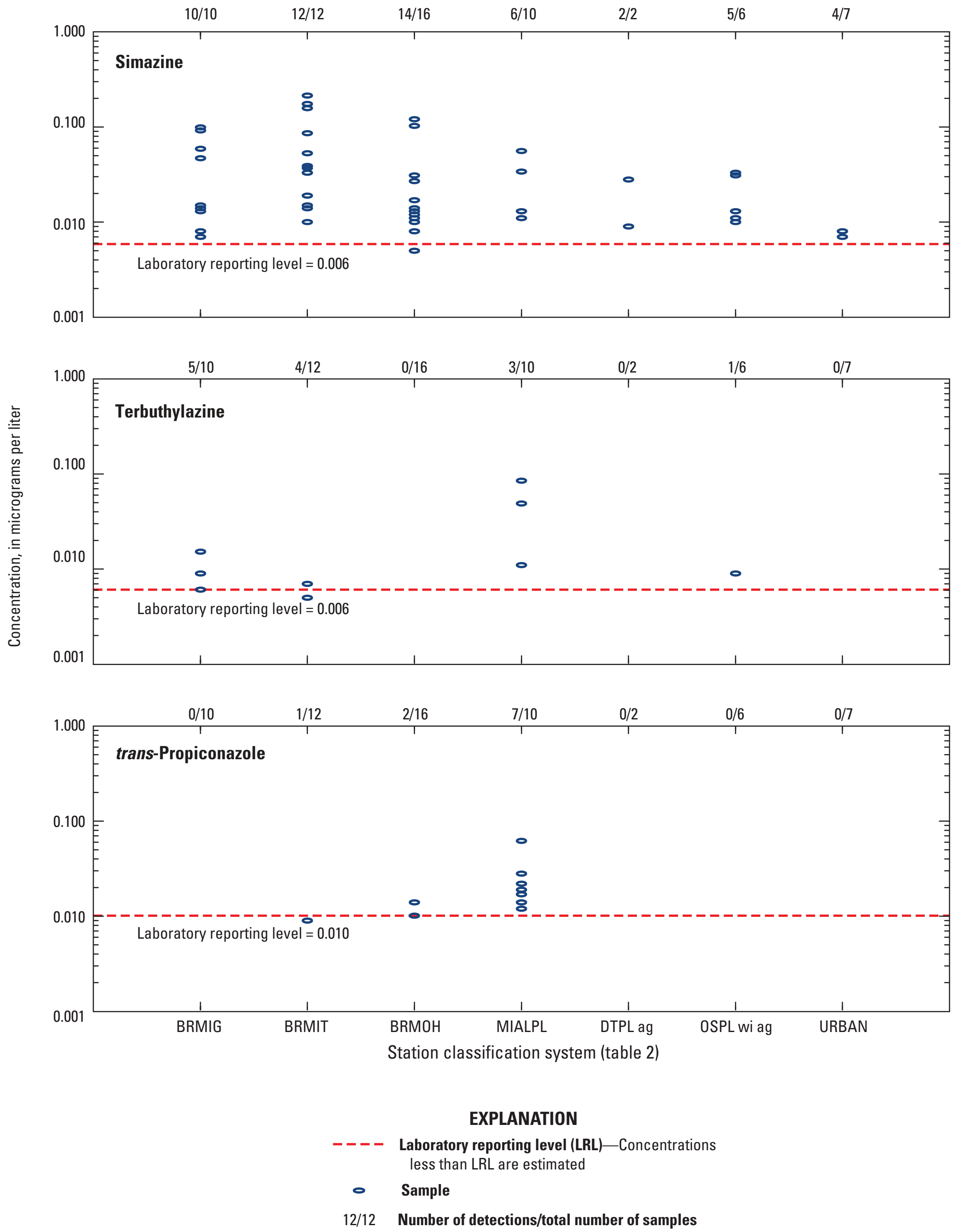


Figure 8. Detection of select pesticides from selected stations, water year 2011.—Continued

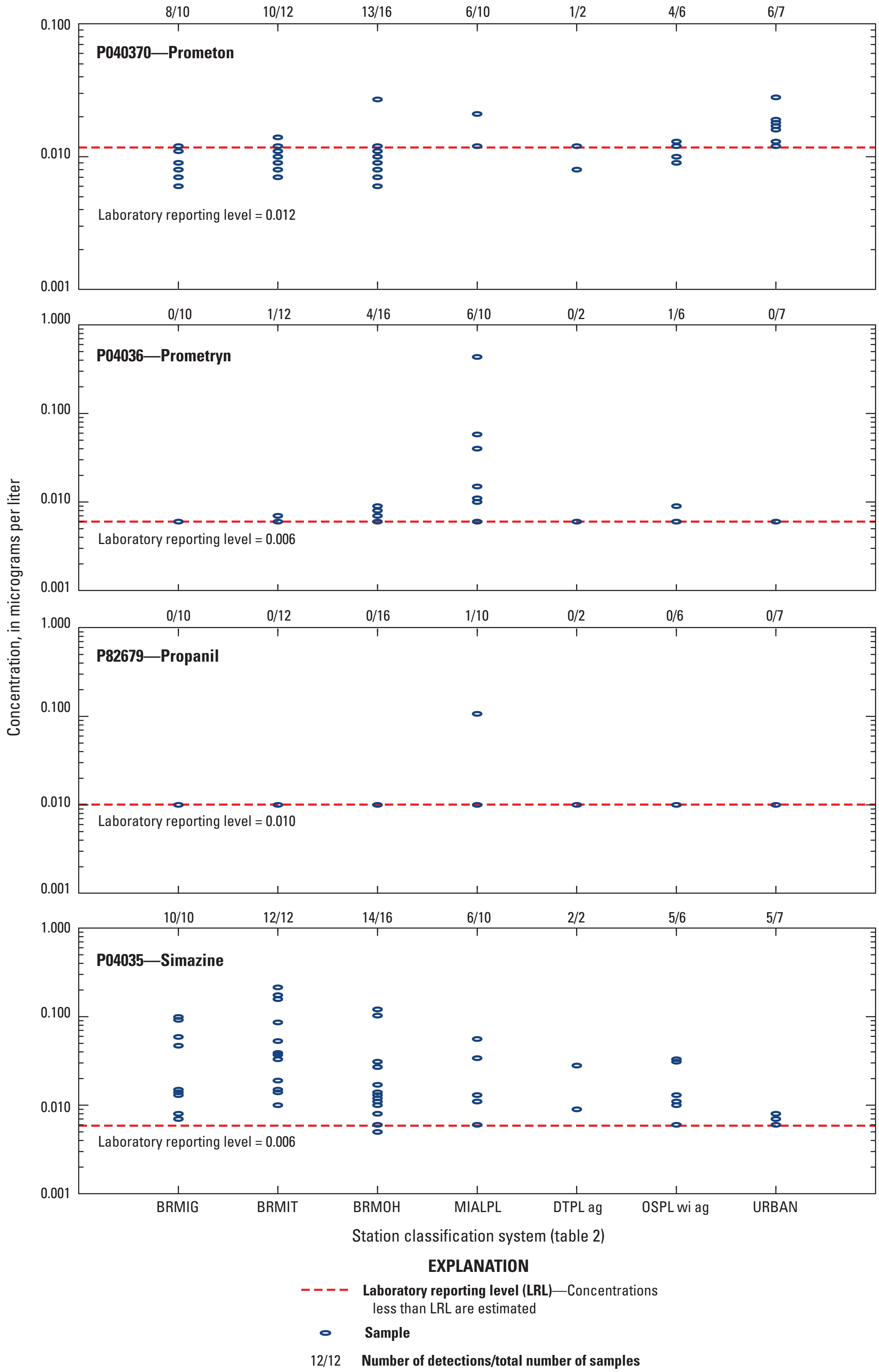


Figure 8. Detection of select pesticides from selected stations, water year 2011.—Continued

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