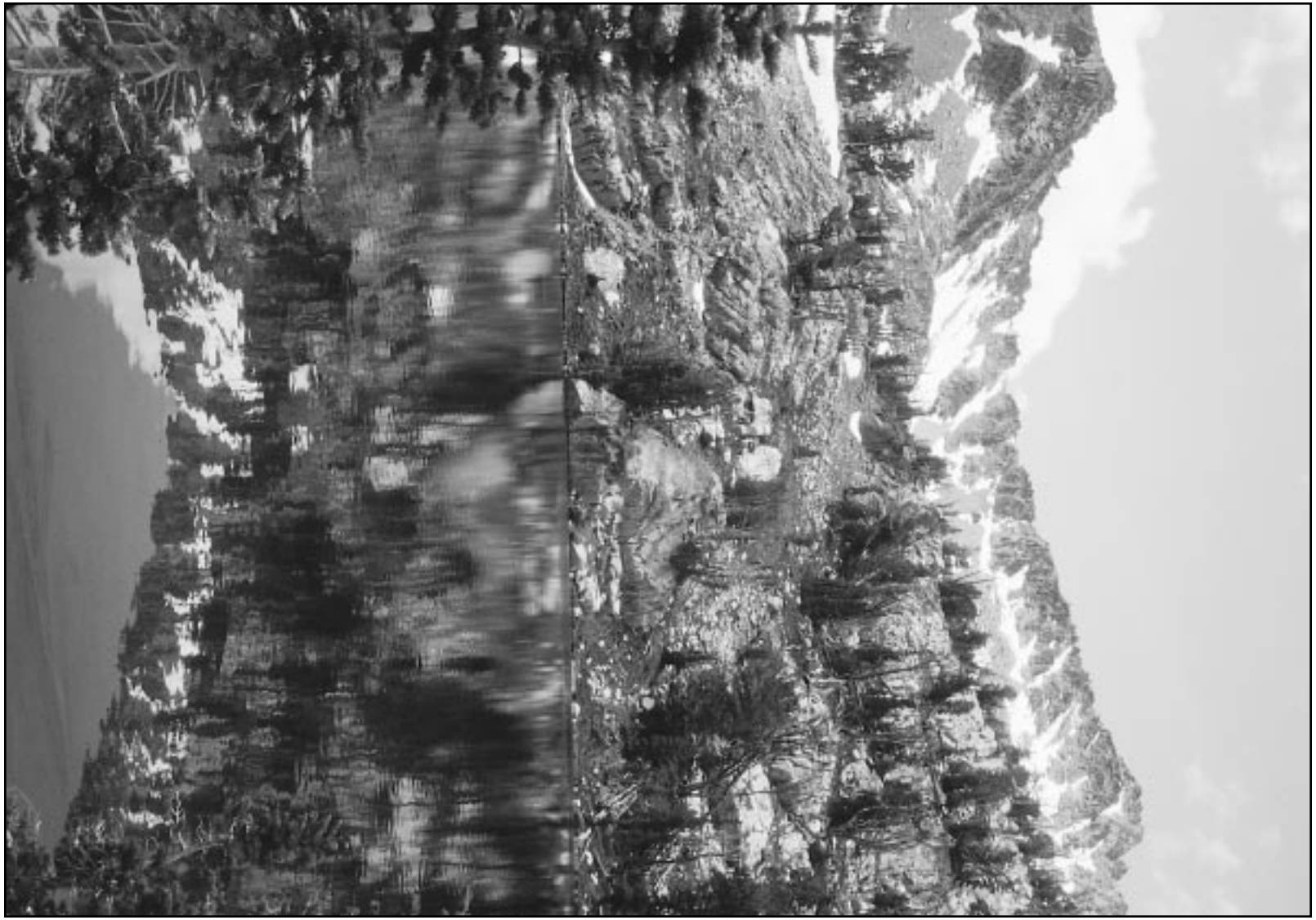
Greg Despopoulos, Raleigh, NC



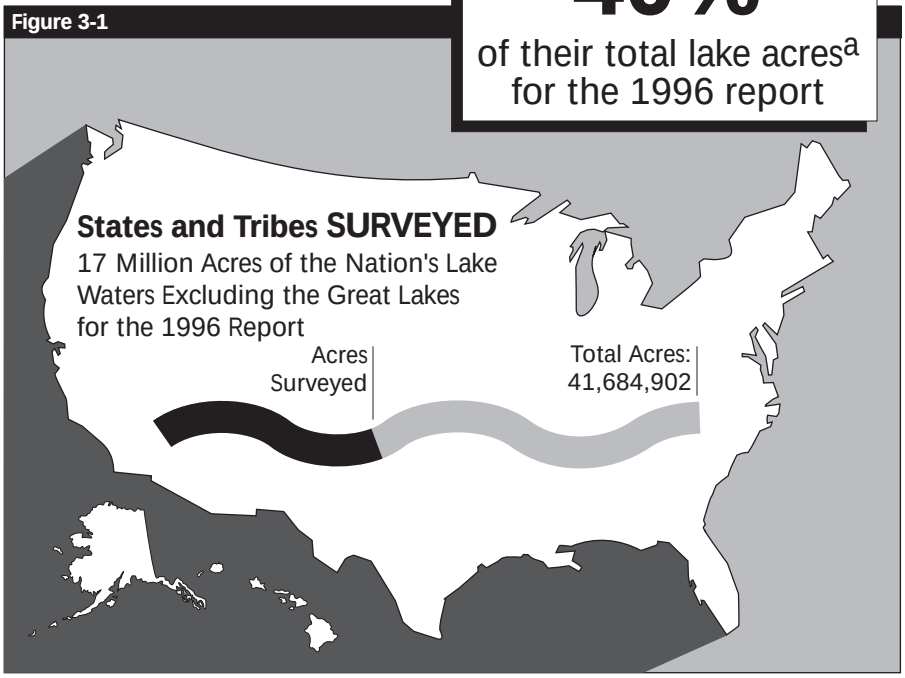
Lakes, Reservoirs, and Ponds

THE STATES SURVEYED nearly 17 million acres of lakes for 1996.

Forty-five States, Puerto Rico, and the District of Columbia (hereafter collectively referred to as States), and one Tribe rated lake water quality in their 1996 Section 305(b) reports (see Appendix B, Table B-1, for individual State and Tribal data). These States and Tribes surveyed over 16.8 million acres of lakes, reservoirs, and ponds, which equals 40% of the 41.7 million acres of lakes in the Nation (Figure 3-1). The States and Tribes based 74% of their survey on monitored data and evaluated 20% of the surveyed lake acres with qualitative information (including best professional judgment by water quality managers). The States did not specify whether the remaining 7% of the surveyed lake acres were monitored or evaluated.[a]

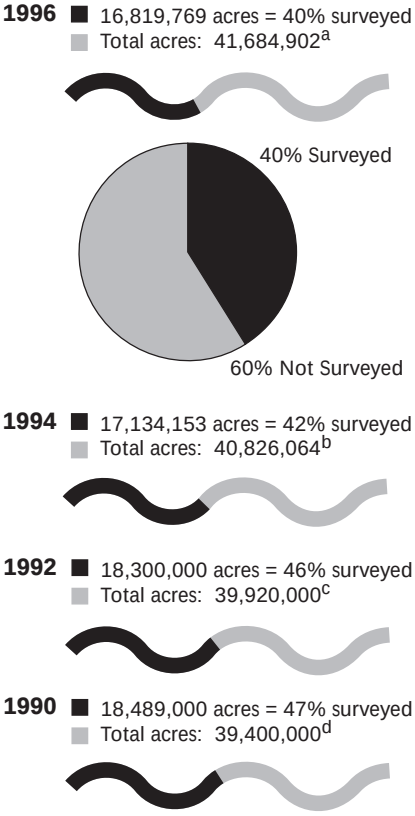
The number of surveyed lake acres declined from 17.1 million acres to 16.8 million acres between 1994 and 1996. Although California surveyed almost 300,000 additional lake acres in 1996 due to refined lake size estimates and new monitoring, a number of States, including Nevada, Washington, and Wisconsin, surveyed significantly fewer lakes. Funding issues forced Nevada to limit lake sampling to

Figure 3-1



Based on data contained in Appendix B, Table B-1.

Lake, Reservoir, and Pond Acres Surveyed by the States and Tribes



[a]Source: 1996 State and Tribal Section 305(b) reports.
[b]Source: 1994 State and Tribal Section 305(b) reports.
[c]Source: 1992 State and Tribal Section 305(b) reports.
[d]Source: *National Water Quality Inventory: 1990 Report to Congress*, U.S. EPA, 1992.

Note: Figures do not add to 100% due to the rounding of individual numbers.

61% OF SURVEYED lake acres have good water quality.

only those lakes near routine sampling locations on rivers and streams. Due to staffing concerns, Washington State was only able to use water quality data collected internally at the Department of Ecology. In previous years the State incorporated data from other agencies into their 305(b) reports. Wisconsin now surveys its lakes as part of the State's 5-year basin planning cycle. Although the number of lakes assessed varies from year to year, Wisconsin surveys almost all the lakes in its monitoring program over the 5-year cycle.

Differences in State survey methods undermine comparisons of lake information submitted by individual States. Lake data should not be compared among States, which devote varying resources to monitoring biological integrity, water chemistry, and toxic pollutants in fish tissues. The discrepancies in State monitoring and survey methods, rather than actual differences in water quality, often account for the wide range in water quality ratings reported by the States.

The summary information presented in this chapter applies strictly to the portion of the Nation's lakes surveyed by the States and Tribes. EPA cannot make generalizations about the health of all of our Nation's lakes based on data extracted from the 305(b) reports because most States and Tribes rate their waters with information obtained from water monitoring programs designed to detect degraded waterbodies. Very few States or Tribes randomly select water sampling sites to represent a cross section of water quality conditions in their jurisdiction. Instead, many States and Tribes direct their limited monitoring resources toward waters with suspected problems. As a result, the surveyed lakes probably contain a higher percentage of polluted waters than all of the Nation's lakes.

Summary of Use Support

The States and Tribes rate whether their water quality is good enough to fully support a healthy community of aquatic organisms and human activities, such as swimming, fishing, and drinking water use. The States and Tribes designate individual lakes for specific activities, termed "individual designated uses." EPA and the States use the following terminology to rate their water quality:

- **Good/Fully Supporting:** Good water quality supports a diverse community of fish, plants, and aquatic insects, as well as the array of human activities assigned to a lake by the State.

- **Good/Threatened:** Good water quality currently supports aquatic life and human activities in and on the lake, but changes in such factors as land use threaten water quality, or data indicate a trend of increasing pollution in the lake.

- **Fair/Partially Supporting:** Fair water quality supports aquatic communities with fewer species of fish, plants, and aquatic insects, and/or occasional pollution interferes with human activities. For example, runoff during severe thunderstorms may temporarily elevate fecal coliform bacteria densities and indicate that swimming is not

safe immediately following summer storms.

■ **Poor/Not Supporting:** Poor water quality does not support a healthy aquatic community and/or prevents some human activities on the lake. For example, lake waters may be devoid of fish for more than a month each summer because excessive nutrients from runoff initiate algal blooms that deplete oxygen concentrations.

■ **Not Attainable:** The State has performed a use-attainability analysis and demonstrated that use support of one or more designated beneficial uses is not attainable due to one of six specific biological, chemical, physical, or economic/social conditions (see Chapter 1 for additional information).

Most States and Tribes rate how well a lake supports individual uses (such as swimming and aquatic life) and then consolidate individual use ratings into a summary table. This table divides lake acres into those fully supporting all of their uses, those fully supporting all uses but threatened for one or more uses, and those impaired for one or more uses (see Chapter 1 for a complete discussion of use support).

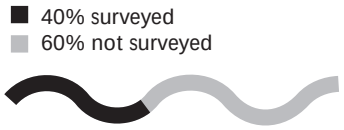
Forty-two States, one Tribe, Puerto Rico, and the District of Columbia reported summary use support status for lakes in their 1996 Section 305(b) reports (see Appendix B, Table B-2, for individual State and Tribal information). Another four States reported individual use support status but did not report summary use support status. In such cases, EPA used aquatic life use support status or swimming use support status to represent general water quality conditions in the State's lakes.

It is important to note that four States did not include the effects of statewide fish consumption advisories for mercury when calculating their summary use support status. New Hampshire, Michigan, South Carolina, and Vermont excluded the impairment associated with statewide mercury advisories in order to convey information that would have been otherwise masked by the fish consumption advisories. If these advisories had been included, all of the States' waters would receive an impaired rating. (See discussion of mercury in "Pollutants Impacting Lakes, Reservoirs, and Ponds" on page 55.)

The States and Tribes reported that 61% of their surveyed 16.8 million lake acres have good water quality (Figure 3-2). Waters with

Surveyed Waters

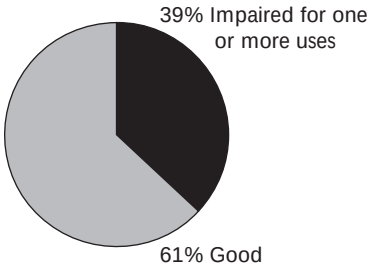
Total lakes = 41,684,902 acres[a]
Total surveyed = 16,819,769 acres[b]



Of the surveyed acres:[c]

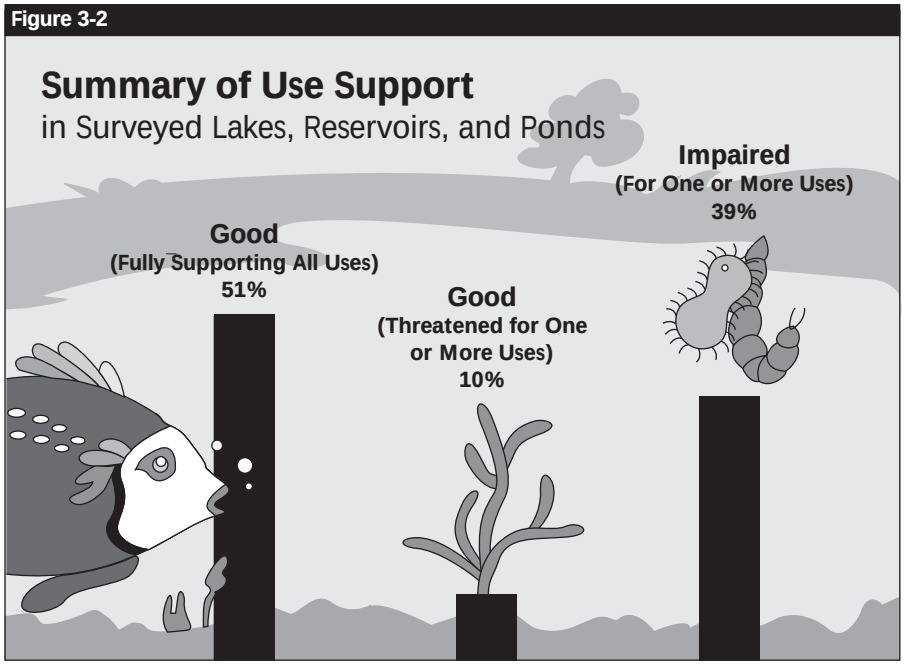
- 20% were monitored
- 74% were evaluated
- 7% were not specified

Surveyed Water Quality



[a]Source: 1996 State and Tribal Section 305(b) reports.
[b]Does not include acres assessed as not attainable (<0.01% of total lakes).
[c]Figures may not add to 100% due to rounding.

Figure 3-2



Based on data contained in Appendix B, Table B-2.

39% OF SURVEYED lake acres are impaired for one or more uses

good quality include 51% of the surveyed lake acres that fully support all uses and 10% of the surveyed lake acres that fully support all uses but are threatened for one or more uses and might deteriorate if we fail to manage potential sources of pollution. Some form of pollution or habitat degradation impairs the remaining 39% of the surveyed lake acres.

Individual Use Support

Individual use support information provides additional detail about water quality problems in our Nation's surface waters. The States and Tribes are responsible for designating their lakes for specific uses, but EPA requests that the States and Tribes rate how well their lakes support six standard uses so that EPA can summarize the State and Tribal data. The standard uses consist of aquatic life support, fish consumption, primary contact recreation (such as swimming and diving), secondary contact recreation (such as boating), drinking water supply, and agricultural use (see Chapter 1 for a description of each individual use).

Forty-two States, one Tribe, Puerto Rico, and the District of Columbia reported individual use support status of their lakes, reservoirs, and ponds (see Appendix B, Table B-3, for individual State and Tribal information). The reporting States and Tribes rated aquatic life use and swimming use in more lakes and identified more impacts on aquatic life use and swimming use than the other individual uses (Figure 3-3). These States and governments reported that fair or poor water quality impacts aquatic life in over 4.4 million lake acres (31% of the 14.2 million acres surveyed for aquatic life support), and swimming criteria violations impact 3.8 million lake acres (24% of the 15.4 million acres surveyed for swimming use support).

Many States and Tribes did not rate fish consumption use support because they have not codified fish consumption as a use in their standards. Some of these States consider fishing use as a component of aquatic life use–lakes that provide a healthy habitat for fish support fishing activities even though anglers may not be able to eat their catch in these States. EPA encourages the States to designate fish consumption as a separate use in their waterbodies to promote consistency in future reporting.

Water Quality Problems Identified in Lakes, Reservoirs, and Ponds

Figures 3-4 and 3-5 identify the pollutants/stressors and sources of pollutants that impair (i.e., prevent from fully supporting designated uses) the most acres of lakes, as reported by the States. The two figures are based on the same data (contained in Appendix B, Tables B-4 and B-5), but each figure provides a different perspective on the extent of impairment attributed to individual pollutants/stressors and sources. Figure 3-4 shows the relative impact of the leading pollutants/stressors and sources in all surveyed lakes. Figure 3-5 presents

the relative impact of the leading pollutants/stressors and sources in lakes with identified problems (i.e., impaired lakes), a subset of surveyed lakes.

The following sections describe the leading pollutants/stressors and sources of impairment identified in lakes. It is important to note that the information about pollutants/stressors and sources is incomplete because the States do not identify the pollutants/stressors or source of pollutants impairing every impaired lake. In some cases, a State may recognize that water quality does not fully support a designated use, but the State may not have adequate data to document that a specific pollutant or stressor is responsible for the impairment. Sources are even more difficult to identify than pollutants and stressors.

Pollutants Impacting Lakes, Reservoirs, and Ponds

Forty-one States, the District of Columbia, and Puerto Rico reported the number of lake acres impacted by individual pollutants and processes, such as invasions by noxious aquatic plants (see Appendix B, Table B-4, for individual State and Tribal information). EPA measures the impact of each pollutant or process by summing the total lake acres impaired (i.e., not fully supporting designated uses) by each pollutant or process. EPA ranks the pollutants and processes by the extent of their impacts on aquatic life and human activities rather than actual pollutant loads in lakes. This approach targets the pollutants and processes causing the most harm to aquatic life and public use of our waters rather than the most abundant pollutants in our lakes, reservoirs, and ponds.

The States, District of Columbia, and Puerto Rico identified more lake acres polluted by nutrients and metals than any other pollutants or processes (Figures 3-4 and 3-5). They

Figure 3-3

Individual Use Support in Lakes, Reservoirs, and Ponds

Designated Use	Acres Surveyed	Percent: Good (Fully Supporting)	Good (Threatened)	Fair (Partially Supporting)	Poor (Not Supporting)	Poor (Not Attainable)
Aquatic Life Support	14,200,153	55	14	25	6	<1
Fish Consumption	10,896,449	60	5	32	3	<1
Primary Contact – Swimming	15,369,354	63	12	21	4	<1
Secondary Contact	8,306,333	62	13	23	2	<1
Drinking Water Supply	8,466,958	81	10	7	1	0
Agriculture	4,712,268	84	5	10	1	0

Based on data contained in Appendix B, Table B-3.

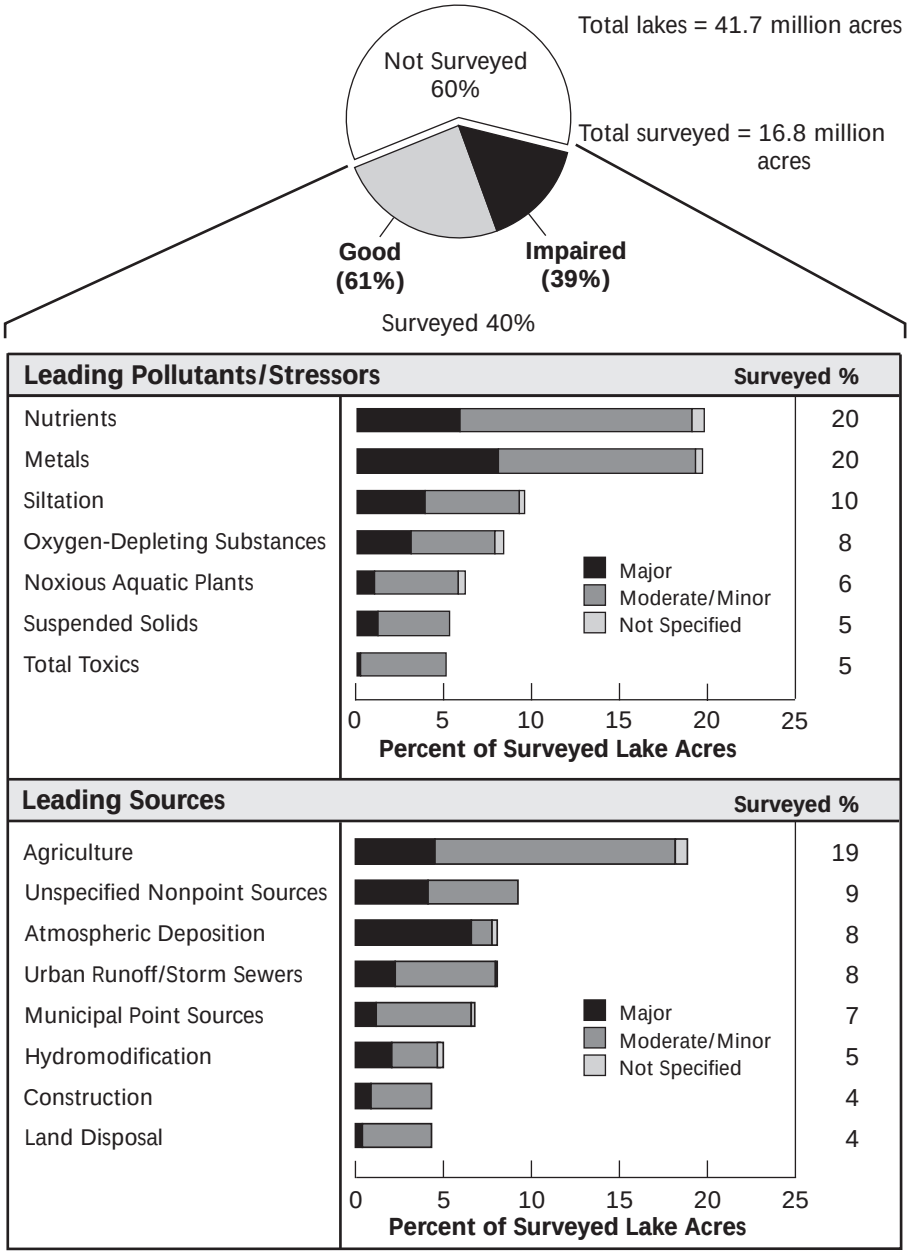
The pollutants/processes and sources shown here may not correspond directly to one another (i.e., the leading pollutant may not originate from the leading source). This may occur for a number of reasons, such as a major pollutant may be released from many minor sources or States may not have the information to determine all the sources of a particular pollutant/stressor.

AGRICULTURE is the leading source of pollution in surveyed lakes. According to the States, agricultural pollution problems

- affect 19% of all lakes surveyed, and
- contribute to 49% of all water quality problems identified (see Figure 3-5).

Figure 3-4

SURVEYED Lake Acres: Pollutants and Sources

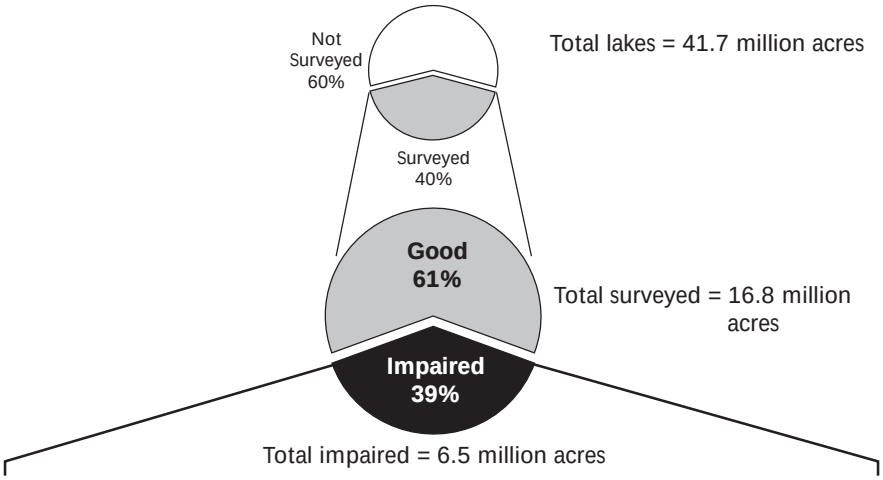


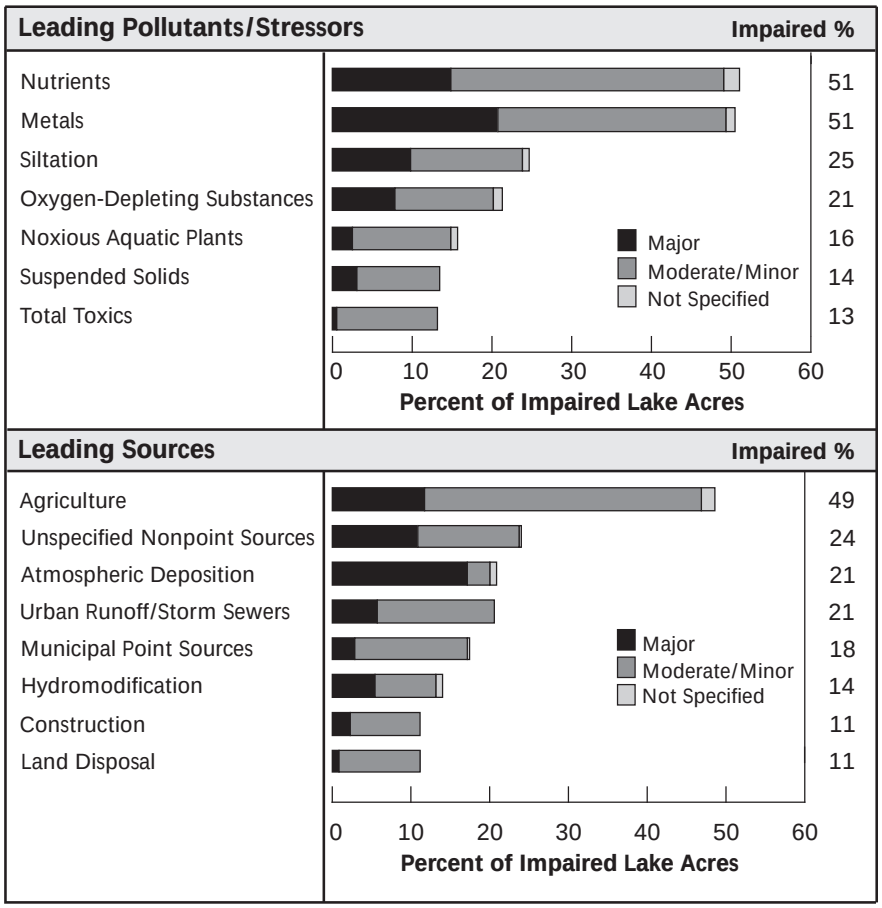
Based on data contained in Appendix B, Tables B-4 and B-5.

Note: Percentages do not add up to 100% because more than one pollutant or source may impair a lake.

Figure 3-5

IMPAIRED Lake Acres: Pollutants and Sources





Based on data contained in Appendix B, Tables B-4 and B-5.

NUTRIENTS AND METALS are the most common pollutants affecting surveyed lakes. Nutrients and metals

- are found in 20% of all lakes surveyed (see Figure 3-4), and
- contribute to 51% of all the water quality problems identified in lakes.

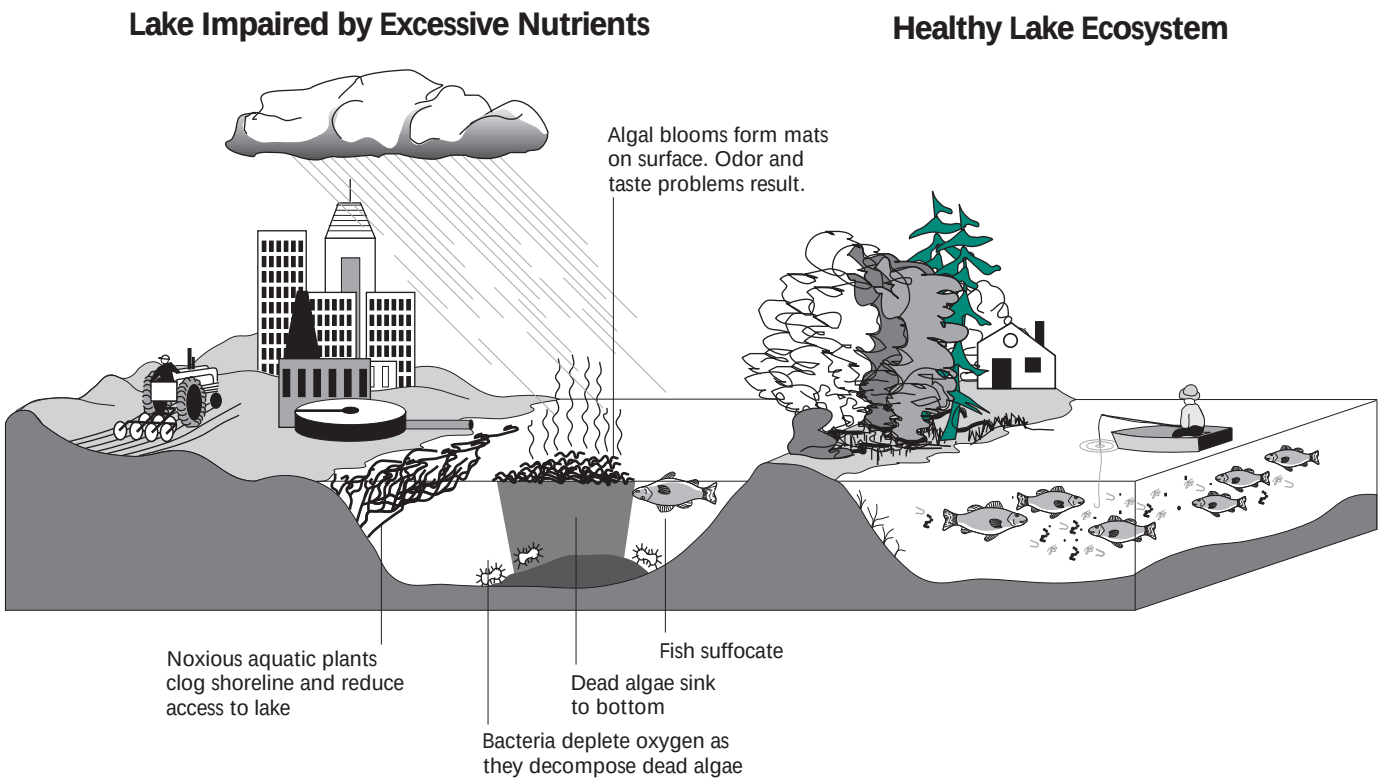
Note: Percentages do not add up to 100% because more than one pollutant or source may impair a lake.

reported that metals and excess nutrients pollute 3.3 million lake acres (which equals 20% of the surveyed lake acres and 51% of the impaired lake acres).

Healthy lake ecosystems contain nutrients in small quantities from natural sources, but extra inputs of nutrients (primarily nitrogen and phosphorus) unbalance lake ecosystems (Figure 3-6). When temperature and light conditions are favorable, excessive nutrients stimulate population explosions of undesirable algae and aquatic weeds. The algae sink to the lake bottom after they die, where bacteria consume the available dissolved oxygen as the bacteria decompose the algae. Fish kills and foul odors may result if dissolved oxygen is depleted.

States consistently report metals as a major cause of impairment to lakes. This is mainly due to the widespread detection of mercury in fish tissue samples. It is difficult to measure mercury in ambient water so most States rely on fish samples to indicate mercury contamination, since mercury bioaccumulates in tissue. States are

Figure 3-6



Nutrients cause nuisance overgrowth of algae as well as noxious aquatic plants, which leads to oxygen depletion via plant respiration and microbial decomposition of plant matter. If not properly managed and controlled, sources such as agriculture, industrial activities, municipal sewage, and atmospheric deposition can contribute to excessive nutrients in lakes.

actively studying the extent of the mercury problem, which is complex because it involves atmospheric transport from power-generating facilities and other sources.

In addition to nutrients and metals, the States, Puerto Rico, and the District of Columbia report that siltation pollutes 1.6 million lake acres (10% of the surveyed lake acres), enrichment by organic wastes that deplete oxygen impacts 1.4 million lake acres (8% of the surveyed lake acres), and noxious aquatic plants impact 1.0 million acres (6% of the surveyed lake acres).

Often, several pollutants and processes impact a single lake. For example, a process such as removal of shoreline vegetation may accelerate erosion of sediment and nutrients into a lake. In such cases, the States and Tribes count a single lake acre under each pollutant and process category that impacts the lake acre. Therefore, the lake acres impaired by each pollutant and process do not add up to 100% in Figures 3-4 and 3-5.

Most States and Tribes also rate pollutants and processes as major or moderate/minor contributors to impairment. A major pollutant or process is solely responsible for an impact or predominates over other pollutants and stressors. A moderate/minor pollutant or stressor is one of multiple pollutants and stressors that degrade aquatic life or interfere with human use of a lake. The States report that metals are the most widespread major cause of impairment in lakes.

Currently, EPA ranks pollutants and stressors by the geographic extent of their impacts (i.e., the number of lake acres impaired by each pollutant or process). However, less abundant pollutants or processes may have more severe impacts than the leading pollutants listed above. For example, extreme acidity (also known as low pH) can eliminate fish in isolated lakes, but acid impacts on lakes are concentrated in northeastern lakes and mining States and are not widespread across the country as a whole. The individual State 305(b) reports provide more detailed information about the severity of pollution in specific locations.

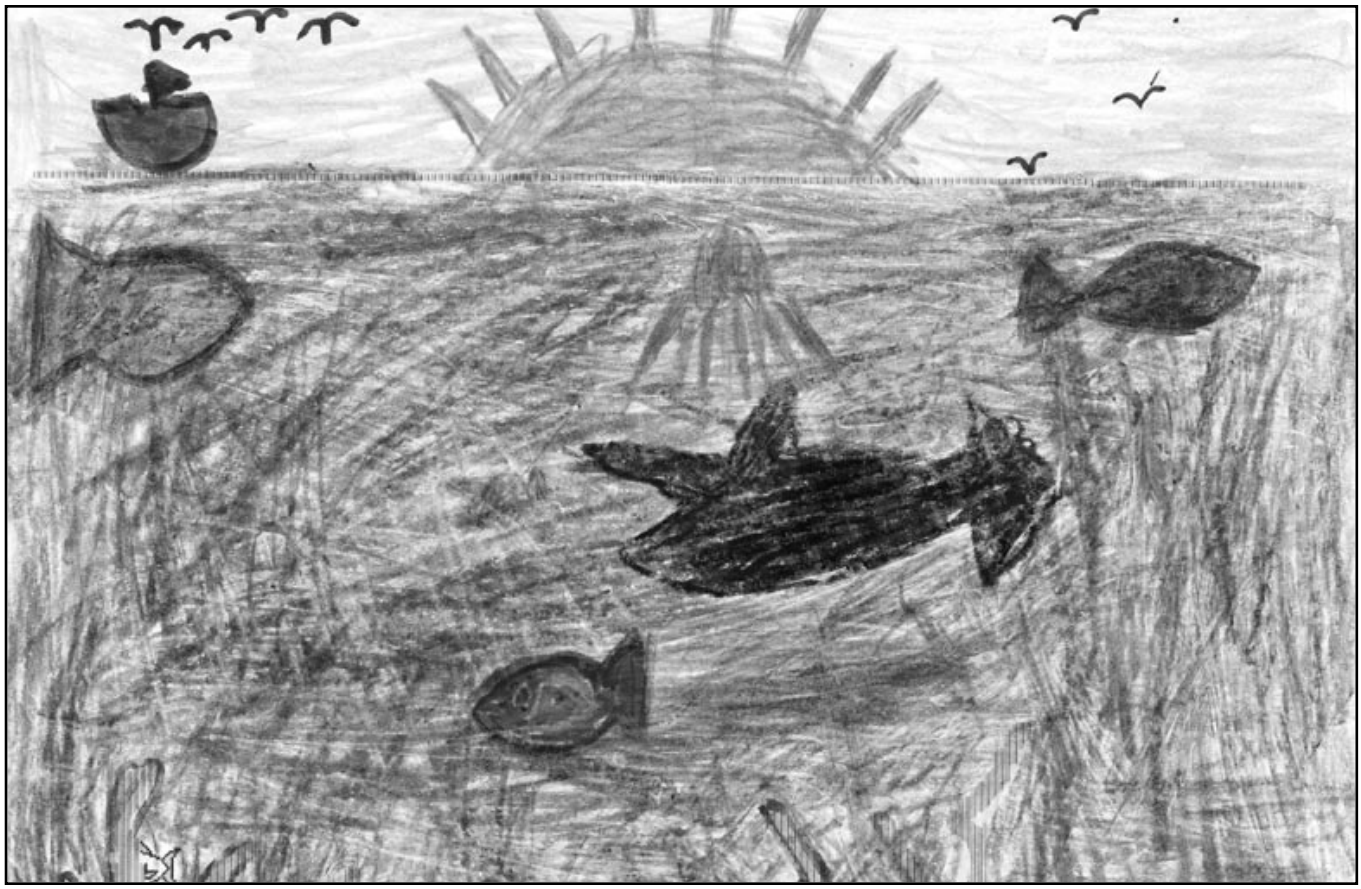
Sources of Pollutants Impacting Lakes, Reservoirs, and Ponds

Forty-one States, the District of Columbia, and Puerto Rico reported sources of pollution related to human activities that impact some of their lakes, reservoirs, and ponds (see Appendix B, Table B-5, for individual State information). These States and Puerto Rico reported that agriculture is the most widespread source of pollution in the Nation's surveyed lakes (Figures 3-4 and 3-5). Agriculture generates pollutants that degrade aquatic life or interfere with public use of 3.2 million lake acres (19% of the surveyed lake acres).

The States and Puerto Rico also reported that unspecified nonpoint sources pollute 1.6 million lake acres (9% of the surveyed lake acres), atmospheric deposition of pollutants impairs 1.4 million lake acres (8% of the surveyed lake acres), urban runoff and storm sewers pollute 1.4 million lake acres (8% of the surveyed lake acres), municipal sewage treatment plants pollute 1.2 million lake acres

(7% of the surveyed lake acres), and hydrologic modifications degrade 924,000 lake acres (6% of the surveyed lake acres). Many more States reported lake degradation from atmospheric deposition in 1996 than in past reporting cycles. This is due, in part, to a growing awareness of the magnitude of the atmospheric deposition problem. Researchers have found significant impacts to ecosystem and human health from atmospherically delivered pollutants. See the "Great Waters Program" section of Chapter 12 for additional information on atmospheric deposition.

The States, the District of Columbia, and Puerto Rico listed numerous sources that impact several hundred thousand lake acres, including construction, land disposal of wastes, industrial point sources, onsite wastewater systems (including septic tanks), forestry activities, habitat modification, flow regulation, contaminated sediments, highway maintenance and runoff, resource extraction, and combined sewer overflows.



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