

National Water Quality Inventory: Report to Congress

2004 Reporting Cycle

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List of Acronyms

ATTAINS	Assessment TMDL Tracking And Implementation System (Water Quality Assessment and TMDL Information)
BEACH Act	Beaches Environmental Assessment and Coastal Health Act of 2000
DIN	dissolved inorganic nitrogen
DIP	dissolved inorganic phosphorus
EPA	U.S. Environmental Protection Agency
FWS	U.S. Fish and Wildlife Service
IBI	Index of Biotic Integrity
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
TMDL	total maximum daily load
USGS	U.S. Geological Survey

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Executive Summary

This *National Water Quality Inventory: 2004 Report to Congress*, prepared under section 305(b) of the Clean Water Act, summarizes water quality reports submitted electronically by 44 states, 2 territories, and the District of Columbia to the U.S. Environmental Protection Agency (EPA) for the 2004 reporting cycle. These state water quality assessment findings are contained in EPA's Water Quality Assessment and Total Maximum Daily Load (TMDL) Information database and website, known as ATTAINS (Assessment TMDL Tracking And Implementation System), for the 2004 reporting cycle. The ATTAINS database is available online at the website <http://www.epa.gov/waters/ir>.

Summary findings of the 2004 state water quality reports are presented below. It is important to note that this information is for a relatively small subset of the nation's total waters which may not be representative of the waters that were not assessed. Because many states target their limited monitoring resources to waters that they suspect are impaired, there may be a lower percentage of impaired waters among the non-assessed (and total) waters than among the assessed waters. Information about specific sources and causes of impairment is incomplete because the states do not always report the cause or source of pollution affecting every impaired waterbody. In some cases, states may recognize that water quality does not fully support a designated use; however, they may not have adequate data to document the specific pollutant or source responsible for the impairment. EPA also made changes in how specific causes and sources are categorized for 2004, and these changes in some cases affect how the findings of causes and sources of impairment compare to findings of previous years. Readers are urged to consult the ATTAINS website for detailed listings of the causes and sources of impairment reported by states.

EPA developed the **Assessment TMDL Tracking And Implementation System (ATTAINS)** database and website to combine two formerly separate sites — the National Assessment Database (for 305(b) water quality assessment information) and the National Total Maximum Daily Loads (TMDL) Tracking System (for 303(d) impaired waters information). The ATTAINS database/website includes state-reported assessment decisions on the support of designated uses (such as recreation) in assessed waters; the waters that are impaired; the causes of impairment (such as pathogens); the sources of impairment (such as agriculture); and the status of actions (TMDLs) to help restore impaired waters.

ATTAINS contains this information for each waterbody assessed by the states and summarizes key waterbody information by state, by region, and nationally. If a state did not provide waterbody-specific information electronically to EPA by the reporting deadline, it was not included in this report. EPA worked extensively with the states to assist in data submittal.

Rivers and Streams

This report includes states' assessments of 16% of the nation's 3.5 million miles of rivers and streams for the 2004 reporting cycle. Of these waterbodies, 44% were reported as impaired or not clean enough to support their designated uses, such as fishing and swimming. States found the remaining 56% to be fully supporting all assessed uses. Pathogens, habitat alterations, and organic enrichment/oxygen depletion were cited as the leading causes of impairment in rivers and streams, and top sources of impairment included agricultural activities, hydrologic modifications (such as water diversions and channelization), and unknown/unspecified sources.

Lakes and Reservoirs

This report includes states' assessments of 39% of the nation's 41.7 million acres of lakes, ponds, and reservoirs during the 2004 reporting cycle. Of these waterbodies, 64% were reported as impaired and 36% were fully supporting all assessed uses. Mercury, polychlorinated biphenyls (PCBs), and nutrients were cited as the leading causes of impairment in lakes. Top sources of pollutants to lakes, ponds, and reservoirs included atmospheric deposition, unknown/unspecified sources, and agriculture.

Bays and Estuaries

This report includes states' assessments of 29% of the nation's 87,791 square miles of bays and estuaries for the 2004 reporting cycle. Of these assessed waterbodies, 30% were reported as impaired, and the remaining 70% fully supported all assessed uses. Pathogens, organic enrichment/oxygen depletion, and mercury were reported as the leading causes of impairment in bays and estuaries. Top sources of impairment to bays and estuaries included atmospheric deposition, unknown/unspecified sources, and municipal discharges/sewage.

Probability Studies of Water Quality

EPA and states have embarked on a series of probability-based surveys that are discussed later in this report. Probability-based surveys complement more traditional targeted monitoring and assessment programs and add substantially to our understanding of state, regional, and national water quality conditions. These studies select sites at random to provide estimates of the condition of a population of waters throughout a state, region, or the nation. They describe the percent of waters in a state or region supporting Clean Water Act goals and the percent of waters affected by the stressors that are included in the study design, which can inform protection and restoration priorities. Probabilistic surveys are a cost-effective approach for tracking changes in condition and stressors across the population of waters of the United States. As more states adopt probabilistic monitoring, EPA will be able to more accurately report on water quality trends. This effort will also help inform water quality policy and ensure resources are appropriately targeted. As of 2008, 30 states were participating in probabilistic water quality surveys, and EPA has set a goal of having participation by all 50 states by 2011. To date, EPA has provided \$65 million in additional section 106 grant monitoring funds to help states improve water quality monitoring programs and implement probabilistic survey designs.

Future Reporting

States are working to strengthen their water monitoring and assessment programs by developing long-term monitoring strategies that identify the specific actions needed to move toward more comprehensive and consistent reporting of water quality conditions. These actions include implementing probability-based surveys in combination with more traditional monitoring targeted to waters of interest. In addition, states and EPA have streamlined water quality assessment and reporting by integrating various Clean Water Act reporting requirements and facilitating and improving electronic reporting of water data. The results of these efforts will be

more comprehensive and valid information that can be easily accessed by water quality managers and the public in a timely fashion and used to describe water quality on a state, regional, or national scale.

I. Background

Under section 305(b)(1)(A) of the Clean Water Act, states, territories, and other jurisdictions of the United States are required to submit reports on the quality of their waters to the U.S. Environmental Protection Agency (EPA) every 2 years. Historically, states submitted these reports in hardcopy format, and EPA prepared a national hardcopy report that summarized their findings (see <http://www.epa.gov/305b/>). Under section 303(d) of the Clean Water Act, states also biennially provide a separate prioritized list of those waters that are impaired and require the development of pollution controls (to learn more about section 303(d) reporting, visit <http://www.epa.gov/owow/tmdl/>).

Beginning with the 2002 reporting cycle, EPA urged states to combine sections 305(b) and 303(d) reporting requirements into one integrated report and to submit these reports electronically. EPA has encouraged states to combine these reports for several reasons. Integrating these reports merges environmental data from a variety of water quality programs, increases the consistency of this information, benefits the public by providing a more informed summary of the quality of assessed state waters, and provides decision makers with better information on the actions necessary to protect and restore these waterbodies. The integrated report also streamlines state reporting burdens by eliminating the need for two separate reports.

For the 2004 reporting cycle, 16 of the 44 water quality reports submitted by the states were fully integrated. Progress toward full integration is expected in coming years. Data for both integrated and non-integrated state reports are available on EPA's new Water Quality Assessment and Total Maximum Daily Load (TMDL) Information database and website, known as ATTAINS (Assessment TMDL Tracking and ImplementatioN System). To facilitate the states' efforts to improve integrated reporting, EPA published reporting guidance in 2005 and a series of clarifying memoranda in subsequent years. For more information on integrated reporting, visit <http://www.epa.gov/owow/tmdl/guidance.html#tmdl>.

About the Water Quality Assessment and TMDL Information Database (ATTAINS)

The Water Quality Assessment and TMDL Information database, known as ATTAINS (for Assessment TMDL Tracking and ImplementatioN System), presents electronic water quality information submitted since 2002 by the states, territories, and the District of Columbia. ATTAINS allows the user to view, via the Internet, dynamic tables and charts that summarize state-reported data for the nation as a whole, for individual states, for individual waters, and for the ten EPA regions. It shows which waters have been assessed, which are impaired, and which have plans (e.g., TMDLs) completed to help restore them. By displaying data in one location, ATTAINS allows for a more informed summary of the quality of state waters that have been assessed and provides decision makers with better information on the actions necessary to protect and restore assessed waters of the U.S.

To view ATTAINS, go to <http://www.epa.gov/waters/ir> and click on the map to find summary information and assessment results for specific states, EPA regions, watersheds, and waterbodies of interest. You can select information for a specific biennial reporting cycle (e.g., 2002, 2004, etc) or the most recent available information across multiple cycles. A series of tables and charts also summarize the status of assessed waters across the nation.

For this report, EPA has included ATTAINS data from 44 states, the District of Columbia, the U.S. Virgin Islands and Puerto Rico. Pennsylvania, Maryland, Florida, Oregon, Idaho, Hawaii, the tribal nations, and the island territories of the Pacific did not provide data electronically that could be used for the 2004 reporting cycle. Although Pennsylvania, Florida, and Oregon did publish hard copy section 305(b) water quality reports, EPA relies on the electronic submittal by states of assessment information as the source of the water quality findings in this report. Maryland and Hawaii submitted only impaired waters lists under section 303(d) in 2004 and did not provide information on assessed waters that were not impaired. Idaho is submitting a combined 2004/2006/2008 integrated report in 2008. Although only 2004 reporting cycle data were used for this report, it is important to note that the ATTAINS database contains all available waterbody-specific data reported by the states and territories from 2002 on.

About half the states conduct their own probability-based surveys (based on statistical random sampling design) to complement this information and to draw state-wide conclusions about the state's water resources. EPA fully supports these state efforts to provide more complete assessments of their waters and to increase their percentage of assessed waters. Because state-level probabilistic monitoring efforts are in their initial stages in many states, the results of these state-scale probability surveys for the most part are not included in the 2004 ATTAINS database. We expect that the 2008 version of the database will begin to do so, and that we will be able to move toward water quality reports that assess all the states' waters, providing a valuable complement to current knowledge on the subset of waters with targeted monitoring.

Comparability of Water Quality Data

Although the information in ATTAINS provides a picture of state assessment results, these data should not be used to compare water quality conditions between states, identify trends in statewide or national water quality, or compare the impacts of specific causes or sources of impairment over time. The following are reasons for this lack of comparability:

- The methods states use to monitor and assess their waters, including what and how they monitor and how they report their findings to EPA, vary from state to state and within individual states over time. Many states target their limited monitoring resources to waters they suspect are impaired, or to address local priorities and concerns; therefore, the small percentage of waters assessed may not reflect statewide conditions. States may monitor a different set of waters from one reporting cycle to another, or may monitor fewer waters when state budgets are limited. It is also important to note that six states did not provide electronic data for the 2004 reporting cycle, and that the lack of data from these states affects the summary statistics.
- The science of monitoring and assessment varies over time, and many states are better able to identify problems as their monitoring and analytical methods improve. For example, states are conducting more fish tissue sampling than in previous years. The use of improved assessment methods to collect better information may result in more extensive and protective fish consumption advisories, even though water quality conditions themselves may not have changed.
- For the 2004 reporting cycle, EPA re-evaluated how it grouped sources and causes reported by the states into larger overall categories (such as municipal discharges/sewage or metals other than mercury) for national reporting purposes. The purpose of this re-evaluation was to more accurately categorize the source and cause information reported by the states. Some overall source and cause categories were renamed, and some state-reported sub-categories were moved into different overall categories compared to the 2002 reporting cycle. (See the section *Sources of Impairment* in this report for more information.)
- Under the Clean Water Act, each state has the authority to set its own water quality standards; therefore, a state's definition of its designated uses (for example, Warm Water Fishery or Livestock Watering) may differ from definitions used by other states, along with the criteria against which states determine impairments. (See the section *Assessing Water Quality*, below, for more information.)

Assessing Water Quality

States assess the quality of their waters based on water quality standards they develop in accordance with the Clean Water Act. Water quality standards may differ from state to state, but must meet minimum requirements. EPA must approve these standards before they become effective under the Clean Water Act.

Designated Use Categories in this Report

The states have different names for the various uses they have designated for their waters. For example, one state might designate as Class A those waters that are capable of supporting fish species of commercial and recreational value (e.g., salmon, trout), whereas another state might classify similar waters as Cold Water Fishery waters. The ATTAINS database groups state-reported uses according to the following overall categories:

- **Fish, Shellfish, and Wildlife Protection and Propagation** – Is water quality good enough to support a healthy, balanced community of aquatic organisms?
- **Recreation** – Can people safely swim or enjoy other recreational activities in and on the water?
- **Public Water Supply** – Does the waterbody safely supply water for drinking after standard treatment?
- **Aquatic Life Harvesting** – Can people safely eat fish caught in the waterbody?
- **Agricultural** – Can the waterbody be used for irrigating fields and watering livestock?
- **Industrial** – Can the water be used for industrial processes?
- **Aesthetic Value** – Is the waterbody aesthetically appealing?
- **Exceptional Recreational or Ecological Significance** – Does the waterbody qualify as an outstanding natural resource or support rare or endangered species?

You can find out which state classifications fit under each of these categories by clicking on the individual use category name in the ATTAINS database.

Water quality standards consist of three elements: the **designated uses** assigned to waters (e.g., recreation, public water supply, the protection and propagation of aquatic life); the **criteria** or thresholds (expressed as numeric pollutant concentrations or narrative requirements) that are necessary to protect the designated uses; and the **anti-degradation** policy intended to prevent waters from deteriorating from their current condition. Waters may be designated for more than one use. To learn more about water quality standards, visit <http://www.epa.gov/waterscience/standards/>.

After setting water quality standards, states assess their waters to determine the degree to which the standards are being met. State water quality assessments are normally based on six broad types of monitoring data: biological integrity, chemical, physical, microbiological, habitat, and toxicity. (Examples of the different types of data used to determine a state's water quality are shown in the box below.) Each type of monitoring data yields an assessment that must be integrated with other data types for an overall assessment. Depending on the designated use, one data type may be more informative than others for making the final assessment.

Types of Monitoring Data

- **Biological integrity data:** Objective measurements of aquatic biological communities (usually aquatic insects, fish, or algae) used to evaluate the condition of an aquatic ecosystem. Biological data are best used when deciding whether waters support aquatic life uses.
- **Chemical data:** Measurements of key chemical constituents in water, sediments, and fish tissue. Examples of these constituents include metals, oils, pesticides, and nutrients such as nitrogen and phosphorus. Monitoring for specific chemicals helps states assess waters against numerical criteria, as well as identify and trace the source of the impairment.
- **Physical data:** Characteristics of water, such as temperature, flow, suspended solids, sediment, dissolved oxygen, and pH. These physical attributes are often useful indicators of potential problems and can have an effect on the impacts of pollution.
- **Microbiological data:** Measurements of pathogen indicators such as fecal and total coliform bacteria, *E.coli* and *Enterococci*. Monitoring of these indicators helps determine possible contamination by such things as untreated sewage, septic systems, and livestock or pet wastes, and is often used to determine if waters are safe for recreation and shellfish harvesting.
- **Habitat assessments:** Descriptions of sites and surrounding land uses; condition of streamside vegetation; and measurement of features, such as stream width, depth, flow, and substrate. These assessments are used to supplement and interpret other kinds of data.
- **Toxicity testing:** Measurements of mortality of a test population of selected organisms, such as fathead minnows or *Daphnia* ("water fleas"). These organisms are exposed to known dilutions of water taken from the sampling location. The resulting toxicity data indicate whether an aquatic life use is being attained. These tests can help determine whether poor water quality results from toxins or from habitat degradation.

States, tribes, and other jurisdictions monitor for a variety of pollutants, or causes of impairment. Table 1 provides a list of major causes of impairment cited in this report.

Table 1. Major Impairment Cause Categories Used in this Report

Category	Examples
Cause Unknown – Impaired Biota	Impairment or degradation of the biological community (e.g. fish, macroinvertebrates) due to unknown/unidentified cause
Dioxins	Highly toxic, carcinogenic, petroleum-derived chemicals that are persistent in the environment and may be found in fish tissue, water column, or sediments
Flow Alterations	Changes in stream flow due to human activity; includes water diversions for purposes such as irrigation
Habitat Alterations	Modifications to substrate, streambanks, fish habitat; barriers
Metals	Substances identified only as "metals;" also, selenium, lead, copper, arsenic, manganese, others (Note: may, in some cases, include mercury)
Mercury	A toxic metal with neurological and developmental impacts; found in fish tissue, water column, or sediments
Nuisance Exotic Species	Non-native fish, animals, or plants such as Eurasian milfoil, <i>Hydrilla</i> , or zebra mussels, which choke out native species and alter the ecological balance of waters
Nutrients	Primarily nitrogen and phosphorus; in excess amounts, these nutrients overstimulate the growth of weeds and algae and can lead to oxygen depletion
Organic Enrichment/ Oxygen Depletion	Low levels of dissolved oxygen; high levels of biochemical oxygen demanding substances (e.g., organic materials such as plant matter, food processing waste, sewage) that use up dissolved oxygen in water when they degrade

Category	Examples
Pathogens	Bacteria and pathogen indicators <i>E.coli</i> , total coliforms, fecal coliforms, <i>Enterococci</i> ; used as indicators of possible contamination by sewage, livestock runoff, and septic tanks
Polychlorinated biphenyls (PCBs)	A toxic mixture of chlorinated chemicals that are no longer used, but are persistent in the environment; used originally in industry and electrical equipment; primarily found in fish tissue or sediments
Pesticides	Substances identified only as “pesticides;” also, chlordane, atrazine, carbofuran, and others; many older pesticides are persistent in the environment
Sediment	Excess sediments, siltation; affects aquatic communities by altering and suffocating habitat and clogging fish gills
Toxic Organics	Chemicals identified only as “toxic organics;” also, priority organic compounds, non-priority organic compounds, polycyclic aromatic hydrocarbons (PAH), and others; often persistent in the environment

Where possible, states, tribes, and other jurisdictions identify the sources of those pollutants associated with water quality impairment. **Point sources** discharge pollutants directly into surface waters from a conveyance, such as a pipe. Point sources include industrial facilities, municipal sewage treatment plants, combined sewer overflows, and storm sewers. **Nonpoint sources** deliver pollutants to surface waters from diffuse origins, such as fields and streets. Nonpoint sources include urban runoff that is not captured in a storm sewer; agricultural runoff from cropland and grazing areas; leaking septic tanks; and deposition of contaminants in the atmosphere due to air pollution. Habitat alterations, dams, channelization, dredging, and stream bank destabilization are also significant sources of water quality degradation. See Table 2 for more information on source categories used in this report.

For 2004 reporting, EPA reorganized many source categories compared to previous reporting cycles; therefore, apparent significant increases or decreases in individual categories (e.g., Municipal Discharges/Sewage) may be attributable to these reporting changes rather than to actual changes in the impact of an individual source category.

Table 2. Major Pollutant Source Categories Used in this Report

Category	Examples
Agriculture	Crop production, feedlots (including concentrated animal feeding operations), grazing, manure runoff
Atmospheric Deposition	Airborne pollution from many diverse sources (such as factory and automobile emissions and pesticide applications) that settles to land or water
Construction	Residential development, bridge and road construction, land development
Habitat Alterations (Not Directly Related to Hydromodification)	Riparian and in-stream habitat modification and loss, filling and draining of wetlands, removal of riparian vegetation, streambank erosion
Hydromodification	Pond construction, channelization, dam construction, dredging, flow alterations from water diversions, flow regulation, hydropower generation, streambank destabilization and modification, upstream impoundments
Industrial	Factories, industrial and commercial areas, cooling water intake structures, mill tailings

Category	Examples
Land Application/Waste Sites/Tanks	Salt storage piles, land application of biosolids, land disposal, landfills, leaking underground storage tanks
Legacy/Historical Pollutants	Brownfield sites, contaminated sediments, in-place contaminants
Municipal Discharges/Sewage	Septic systems, sewage treatment plants, domestic sewage lagoons, sanitary sewer overflows, municipal dry and wet weather discharges, unpermitted discharges of domestic wastes, combined sewer overflows, septage disposal
Natural/Wildlife	Flooding, drought-related impacts, waterfowl
Recreation and Tourism	Golf courses, marinas, turf management, boat maintenance
Resource Extraction	Abandoned mining, acid mine drainage, coal mining, dredge mining, mountaintop mining, petroleum/natural gas activities, surface mining
Silviculture (Forestry)	Forest management, forest fire suppression, forest roads, reforestation, woodlot site clearance
Spills/Dumping	Accidental releases/spills, pipeline breaks
Unknown	Source of impairment is unknown
Unspecified Nonpoint Source	Source of impairment is identified as nonpoint, but no further information available
Urban-Related Runoff/Stormwater	Discharges from municipal separate storm sewers (MS4), parking lot and impervious surfaces runoff, highway and road runoff, storm sewers, urban runoff, permitted stormwater discharges

Hundreds of organizations in the United States conduct water quality monitoring. Monitoring organizations include state, interstate, tribal, and local water quality agencies; research organizations such as universities; industries and sewage and water treatment plants; and citizen volunteer programs. EPA, the U.S. Geological Survey (USGS), the National Park Service (NPS), and the National Oceanic and Atmospheric Administration (NOAA) are among the many federal agencies that collect water quality monitoring data. Monitoring organizations collect water quality data for their specific purposes, and many share their data with other users, including government decision makers. States evaluate and use much of these data when preparing their water quality reports.

The states, territories, and tribes maintain monitoring programs to support several objectives, including assessing whether water is safe for drinking, swimming, and fishing. States also use monitoring data to review and revise water quality standards, identify impaired and threatened waters under Clean Water Act section 303(d), develop pollutant-specific TMDLs, determine the effectiveness of control programs, adjust drinking water treatment requirements, measure progress toward clean-water goals, and respond to citizen complaints or events such as spills and fish kills.

Nationally consistent probability surveys are an efficient way to get a good understanding of national water quality conditions and trends. Probability surveys are scientifically based studies designed to sample water quality conditions at randomly selected sites that are statistically representative of the population of waters across the United States. EPA and its monitoring partners have used this methodology to develop a series of *National Coastal Condition Reports* (<http://www.epa.gov/nccr/>). These reports summarize the findings of the National Coastal Assessment, a probability-based study. Another probability-based project

currently underway is the National Study of Chemical Residues in Lake Fish Tissue (www.epa.gov/waterscience/fishstudy), which is the first national freshwater fish contamination survey to have statistically selected sampling sites. EPA also partnered with states to conduct a probability-based Wadeable Streams Assessment (www.epa.gov/owow/streamsurvey) to determine the biological condition of small streams in the United States. The Wadeable Streams Assessment was completed in 2006.

To learn more about the water quality monitoring, assessment, and reporting practices of a specific state, visit the state's water quality Internet site and read the explanatory and programmatic information included in most reports.

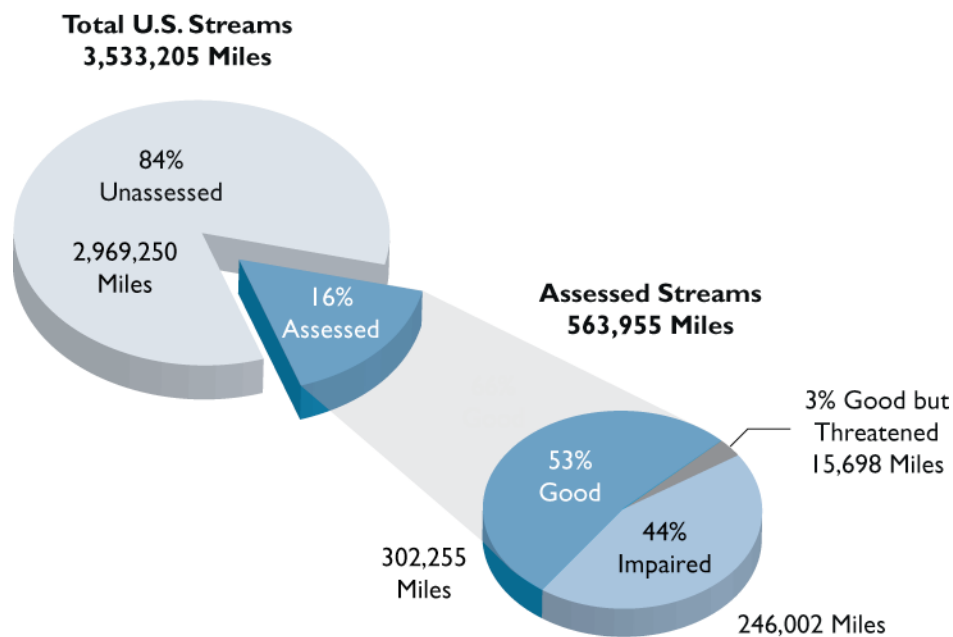
II. Findings

Rivers and Streams

The 2004 ATTAINS database summarizes river and stream designated use support information reported by the states by overall use support and by individual categories of uses. Waters are rated for overall use support as follows:

- Good if they fully support all their designated uses
- Threatened if they fully support all uses, but exhibit a deteriorating trend
- Impaired if they are not supporting one or more designated uses.

This report includes states' 2004 assessments of 563,955 miles of rivers and streams, or 16% of the nation's 3.5 million stream miles (Figure 1). Because six states did not provide specific waterbody data electronically in 2004, the findings of this report address about 130,000 fewer stream miles than were reported in 2002. States identified 44% of the assessed miles as being impaired, or not supporting one or more of their designated uses. The remaining 56% of assessed miles fully supported all uses, and of these, 3% were considered threatened (i.e., water quality supported uses, but exhibited a deteriorating trend).



*Total U.S. river and stream miles based on state 2004 Integrated Reports.
Percents may not add up to 100 because of rounding.

Figure 1. Water quality in assessed river and stream miles.

Individual use support assessments also provide important details about the nature of water quality problems in rivers and streams. Table 3 shows the top five assessed uses in rivers and streams. States evaluated support of the Fish, Shellfish, and Wildlife Protection and Propagation use most frequently, assessing a total of 466,617 stream miles (or 13% of U.S.

stream miles) and reporting that 36% of assessed stream miles were impaired for this use. States assessed 303,317 stream miles for Recreation uses (primary and secondary contact) and found recreation to be impaired in 28% of these waters.

Table 3. Individual Use Support in Assessed River and Stream Miles^a

Designated Use	Miles Assessed	Percentage of Total U.S. River Miles	Percentage of Waters Assessed		
			Good	Threatened	Impaired
Fish, Shellfish, and Wildlife Protection/Propagation	466,617	13	61	3	36
Recreation	303,317	9	69	3	28
Agricultural	200,817	6	90	<1	10
Aquatic Life Harvesting	154,746	4	56	4	40
Public Water Supply	144,245	4	79	3	18

^a Waterbodies can have multiple designated uses, resulting in an overlap of river and stream miles assessed.

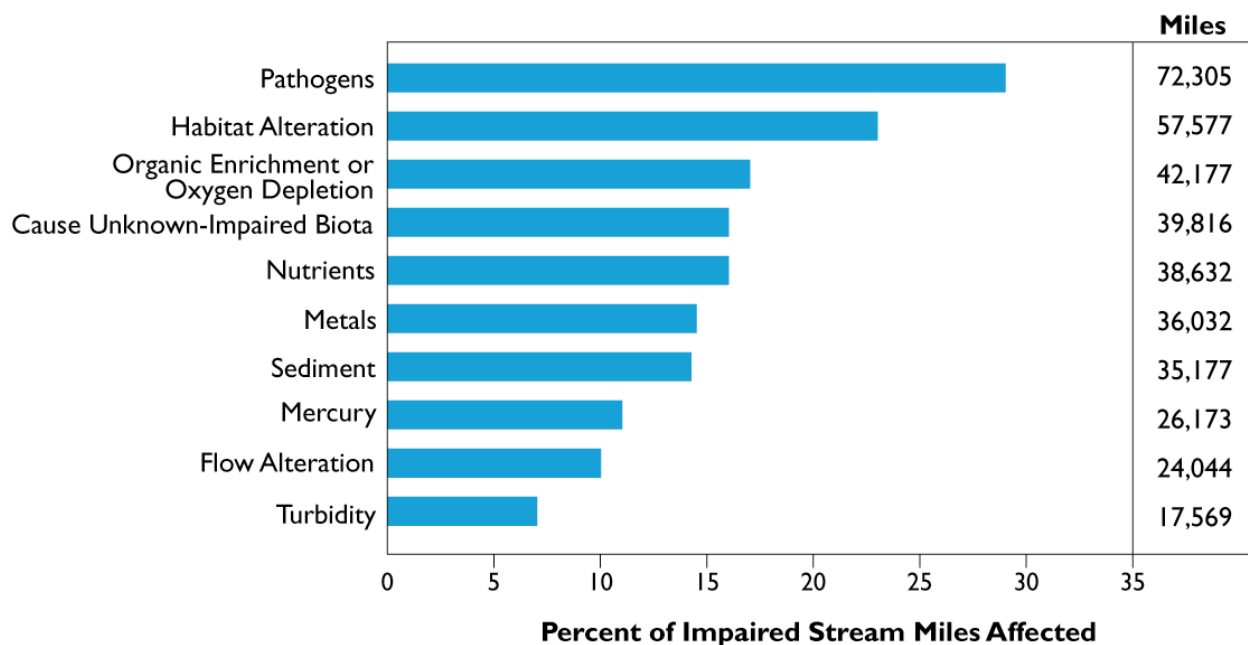
The ATTAINS database provides more detailed information about the sources and causes of impairments in rivers and streams, but it is important to note that the information about specific sources and causes of impairment is incomplete. States do not always report the pollutant or source of pollutants affecting every impaired river and stream. Although states may recognize that water quality does not fully support a designated use, they may not have adequate data in some cases to document the specific pollutant or source responsible for the impairment.

It is also important to note that—in an effort to provide clearer and more specific information—the actual categories of causes of impairment have changed since previous reporting cycles. For example, the cause of impairment category previously identified as Metals has now been divided into two cause categories: Metals and Mercury; however, some states may continue to report mercury under the Metals category.

Similar changes have occurred to the source categories used in this report. For example, a new source category—Unspecified Nonpoint Source—was created in 2004 to capture sources previously part of the Unspecified/Unknown category, but for which *some* information (i.e., their nonpoint source origins) had been identified; therefore, the Unknown/Unspecified category is somewhat smaller in 2004 than it was in 2002. Similarly, the 2002 source category Municipal Permitted Discharges has been renamed Municipal Discharges/Sewage and now captures combined and sanitary sewer overflows; therefore, it is larger than it was in 2002.

Figure 2 shows the top 10 reported causes of impairment in assessed rivers and streams. According to the states, the top causes of river and stream impairment regardless of designated use were the following:

- **Pathogens (bacteria)**, which indicate possible fecal contamination that may cause illness in people;
- **Habitat alteration**, such as disruption of stream beds and riparian areas; and
- **Organic enrichment/oxygen depletion**, or low levels of dissolved oxygen, often due to the decomposition of organic materials.



Note: Percents do not add up to 100% because more than one cause may impair a waterbody.

Figure 2. Top 10 causes of impairment in assessed rivers and streams.

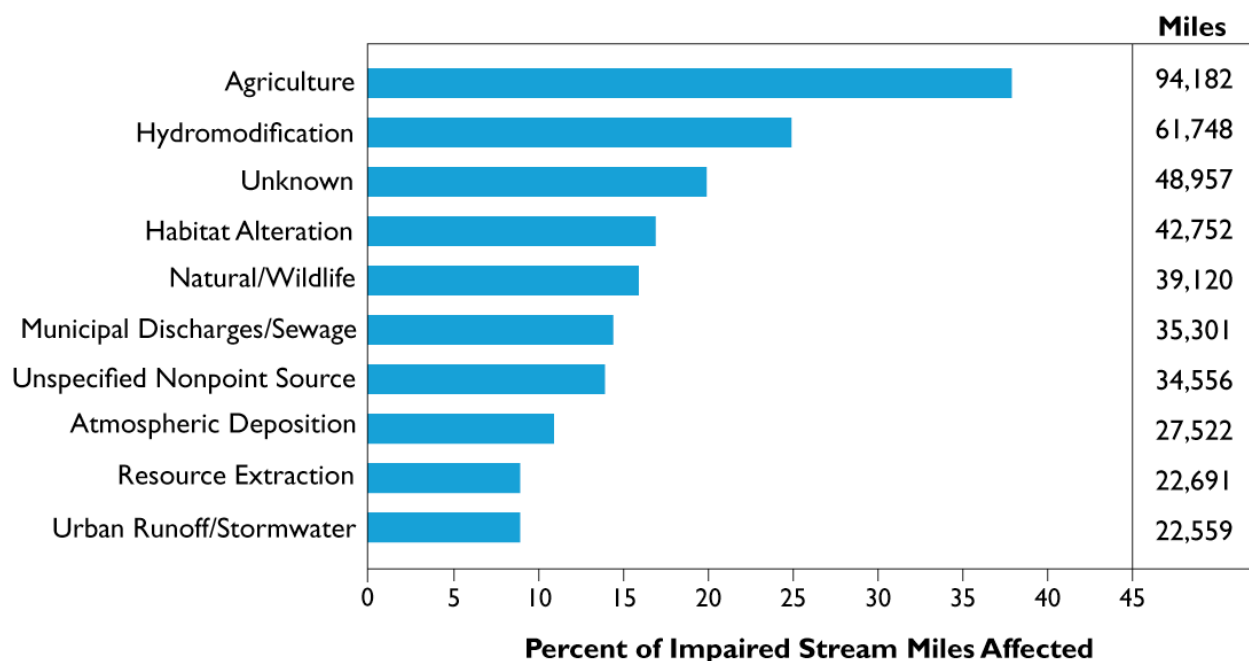
The listed top 10 causes of impairment (above) differ from those reported in 2002. This difference is more likely attributable to reporting changes (e.g., fewer river and stream miles assessed; improved reporting of the results of fish tissue monitoring; and administrative changes in cause category definitions, described above) than to actual changes in water quality.

More detailed information on state-reported causes and sources of impairment is available from the ATTAINS Water Quality Assessment and TMDL Information database at <http://www.epa.gov/ir>.

Figure 3 shows the top reported sources of impairment in assessed rivers and streams. According to the states, the top sources of river and stream impairment included the following:

- **Agricultural activities**, such as crop production, grazing, and animal feeding operations;
- **Hydromodifications**, such as water diversions, channelization, and dam construction; and
- **Unknown or unspecified sources** (i.e., the states could not identify specific sources).

Other leading sources of impairment in streams included habitat alteration (e.g., loss of streamside habitat), natural sources (e.g., floods, droughts, wildlife), municipal discharges/sewage (which includes sewage treatment plant discharges and combined sewer overflows), and unspecified nonpoint sources.



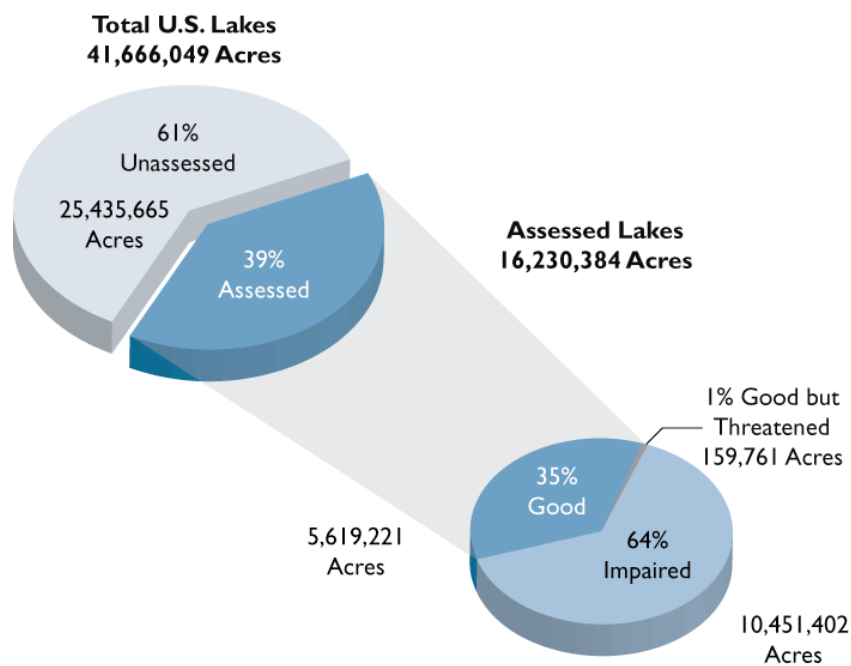
Note: Percents do not add up to 100% because more than one source may impair a waterbody.

Figure 3. Top 10 sources of impairment in assessed rivers and streams.

Lakes, Ponds, and Reservoirs

The 2004 ATTAINS Water Quality Assessment and TMDL Information database summarizes designated use support information reported by the states for lakes, ponds, and reservoirs (referred to hereafter as lakes) by overall use support and by individual categories of uses.

This report includes states' assessments of 16.2 million acres of lakes (excluding the Great Lakes), or 39% of the nation's total 41.7 million lake acres, for the 2004 reporting cycle (Figure 4). States identified 64% of assessed acres as impaired, or not supporting one or more of their designated uses (such as fishing or swimming). The remaining 36% of assessed acres fully supported all uses, and of these, 1% were considered threatened. It should be noted that 3.7 million impaired lake acres—about a third of all impaired lake acres—were reported by one state, Minnesota, due to increased fish tissue and water monitoring activities addressing mercury.



*Total U.S. lake acreage estimate based on 2004 state Integrated Reports.

Figure 4. Water quality in assessed lake acres.

Individual use support assessments provide important details about the nature of water quality problems in lakes and reservoirs. Table 4 shows the top five uses assessed in lakes, ponds, and reservoirs. States assessed 11.8 million lake acres for support of the Fish, Shellfish, and Wildlife Protection and Propagation use, of which 30% were found to be impaired. The Aquatic Life Harvesting use (primarily fish consumption) was assessed in 9.4 million acres; of these, 73% were impaired and 1% were considered threatened (i.e., water quality is deteriorating). This high percentage of lake, pond, and reservoir waters impaired for fish consumption is most likely related to changes in how states report on waters with statewide fish consumption advisories. For example, in previous cycles, some states may not have reported waters with fishing advisories as impaired. Recreational use (e.g., swimming, boating) was assessed in 8.1 million acres of lakes and found to be impaired in 26%.

Table 4. Individual Use Support in Assessed Lake, Reservoir, and Pond Acres^a

Designated Use	Acres Assessed	Percentage of Total U.S. Lake Acres	Percentage of Waters Assessed		
			Good	Threatened	Impaired
Fish, Shellfish, and Wildlife Protection/Propagation	11,770,370	28%	66%	4%	30%
Aquatic Life Harvesting	9,390,396	23%	26%	1%	73%
Recreation	8,069,018	19%	70%	4%	26%
Public Water Supply	6,427,687	15%	78%	1%	20%
Industrial	2,848,335	7%	82%	<1%	17%

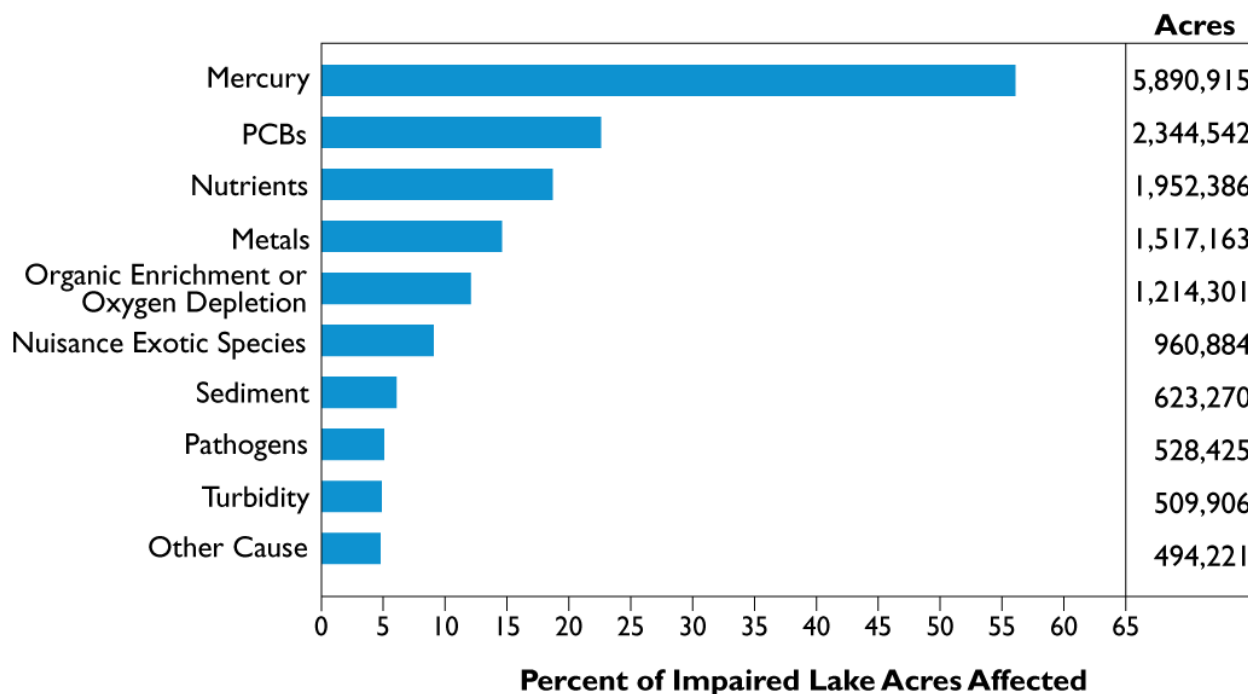
^a Waterbodies can have multiple designated uses, resulting in an overlap of acres assessed.

The ATTAINS database provides more detailed information on the sources and causes of impairments in lakes, but it is important to note that the information about specific sources and causes of impairment is incomplete. The states do not always report the pollutant or source of pollutants affecting every impaired lake, pond, and reservoir. In some cases, states may recognize that water quality does not fully support a designated use; however, they may not have adequate data to document the specific pollutant or source responsible for the impairment. The states may then simply report the cause or source of impairment as “unknown” or “unspecified.”

It is also important to note that, in some cases, groupings of causes and sources may have changed since previous reporting cycles. These changes were made to more accurately categorize the source and cause information reported by the states.

Figure 5 shows the top causes of impairment in assessed lakes, ponds, and reservoirs. According to the states, the top causes of lake impairment were the following:

- **Mercury**, which has been widely detected in fish tissue, where it may pose a health risk to people and animals who eat fish;
- **PCBs**, which are hazardous chemicals released via industrial and municipal waste disposal, spills, and leaks; and
- **Nutrients**, such as phosphorus and nitrogen, which disrupt lake ecosystems by stimulating growth of undesirable algae and aquatic weeds.



Note: Percents do not add up to 100% because more than one cause may impair a waterbody.

Figure 5. Top 10 causes of impairment in assessed lakes, ponds, and reservoirs.

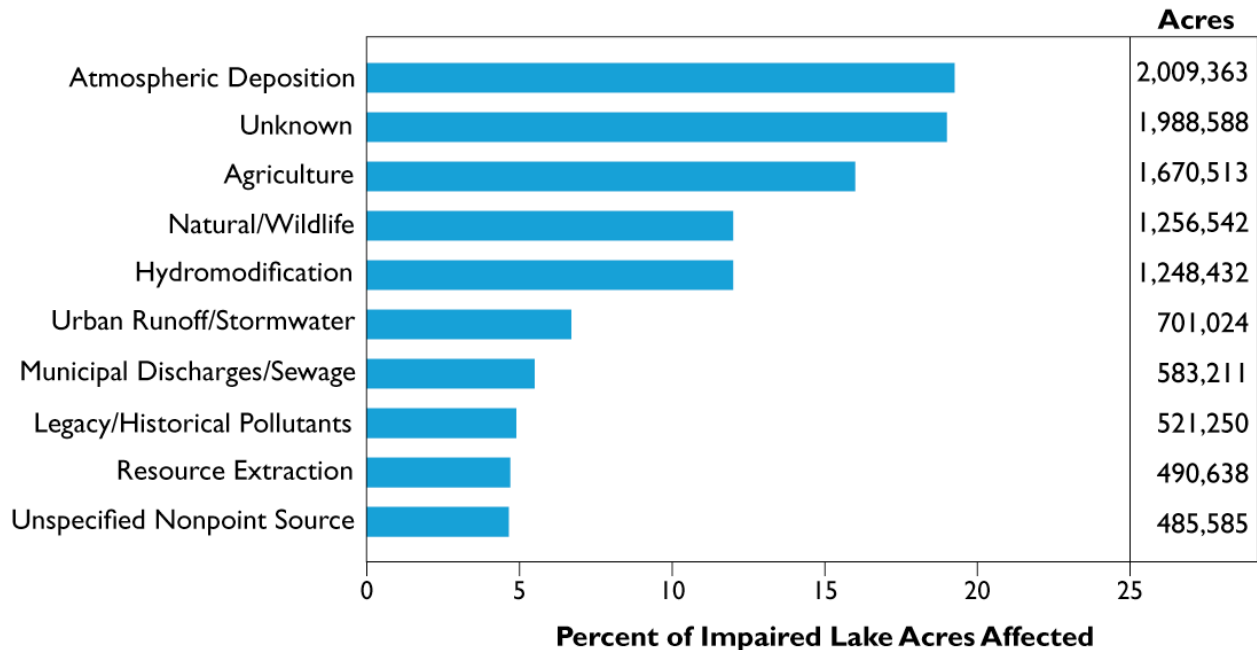
Heightened reporting of mercury, PCBs, and metals is largely the result of the reporting of broad-based fish consumption advisories due to these substances in fish tissue; some states have begun reporting the extent of waters affected by such advisories and bans. For example,

Minnesota reported 3.7 million acres impaired by mercury (representing 63% of the lake acres impaired by mercury in the United States) and 1.6 million acres impaired by PCBs (representing 70% of the lake acres impaired by PCBs in the United States). Other leading causes of impairments in lakes include organic enrichment/low dissolved oxygen, fish consumption advisory/pollutant unspecified, nuisance exotic species, sediment, turbidity, and pathogens.

More information on state-reported causes and sources of impairment is available from the ATTAINS Water Quality Assessment and TMDL Information database at <http://www.epa.gov/waters/ir>.

Figure 6 shows the top sources of impairment in assessed lakes, ponds, and reservoirs. According to the states, the top sources of lake impairment were the following:

- **Atmospheric (or air) deposition**, primarily of toxic substances such as mercury, PCBs, and other metals, from both local and long-range sources;
- **Unknown or unspecified sources** (i.e., the states could not identify specific sources); and
- **Agricultural activities**, such as crop production and grazing.



Note: Percents do not add up to 100% because more than one source may impair a waterbody.

Figure 6. Top 10 sources of impairment in assessed lakes, ponds, and reservoirs.

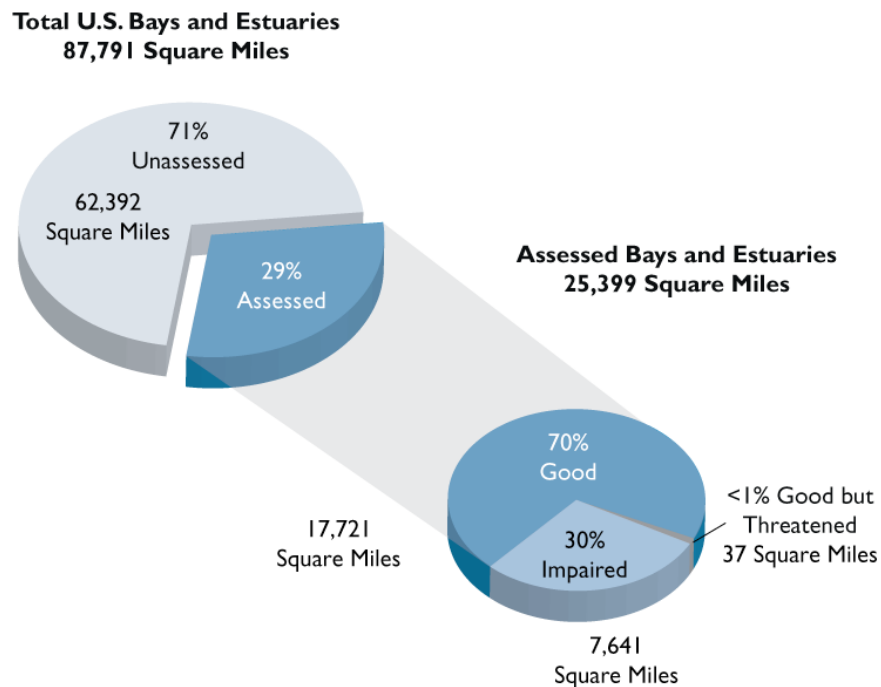
It should be noted that about one fourth (485,376 acres) of lake acres impaired by atmospheric deposition were reported by one state, Wisconsin. This is because Wisconsin reported that all its lake acres are under a fish consumption advisory due to mercury from atmospheric deposition sources. However, the total does not include lake acres that may be impaired by atmospheric deposition in Minnesota, which reported the largest number of impaired lake acres for mercury and PCBs, because Minnesota did not identify the source of these

impairments. It is likely that the majority of impairment by mercury and PCBs in Minnesota is from atmospheric deposition. Other leading sources of impairment include natural/wildlife sources (e.g., droughts, flooding, waterfowl), hydromodification, urban-related runoff/stormwater, municipal discharges/sewage, and legacy/historical pollutants (primarily in sediments).

Bays and Estuaries

The ATTAINS database summarizes state-reported designated use support information for bays and estuaries by overall use support and by individual categories of uses.

This report includes states' assessments of 25,399 square miles of bays and estuaries, or 29% of the nation's total estimated 87,791 square miles, for the 2004 reporting cycle (Figure 7). About 5,000 fewer estuarine square miles were assessed in 2004 than in 2002, at least in part because several coastal states did not provide electronic data in 2004. States identified 30% of assessed square miles as impaired, or not supporting one or more of their designated uses (e.g., swimming, fishing, shellfishing). The remaining 70% of assessed estuarine square miles were fully supporting all uses.



*Total U.S. estuarine square miles estimate based on 2004 state Integrated Reports.

Figure 7. Water quality in assessed bay and estuary square miles

Individual use support assessments provide important details about the nature of water quality problems in bays and estuaries. Table 5 shows the top three uses assessed in bays and estuaries. States assessed 24,338 estuarine square miles for support of the Fish, Shellfish, and Wildlife Protection and Propagation use and found that 27% were impaired; the Aquatic Life Harvesting use was assessed in 11,004 square miles and found to be impaired in 19% of assessed

waters; and 13% of the 9,322 square miles assessed for Recreation uses (e.g., swimming, boating) were reported as impaired.

Table 5. Individual Use Support in Assessed Bay and Estuary Square Miles ^a

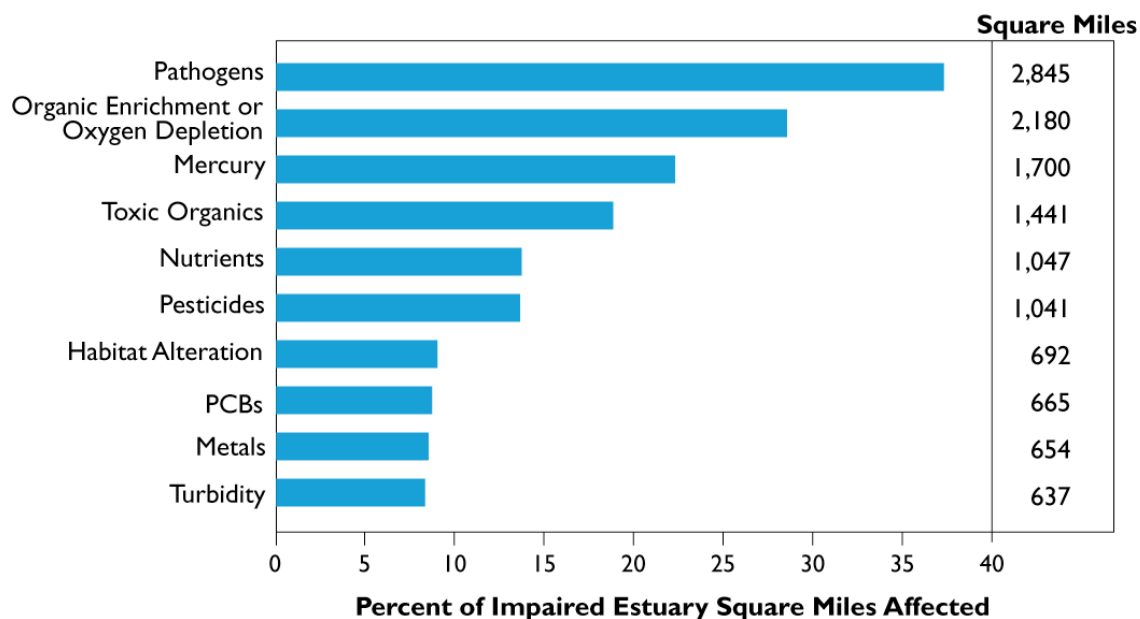
Designated Use	Square Miles Assessed	Percentage of Total U.S. Estuarine Miles	Percentage of Waters Assessed		
			Good	Threatened	Impaired
Fish, Shellfish, and Wildlife Protection/Propagation	24,338	28%	73%	<1%	27%
Aquatic Life Harvesting	11,004	13%	81%	<1%	19%
Recreation	9,322	11%	87%	<1%	13%

^a Waterbodies can have multiple designated uses, resulting in an overlap of square miles assessed.

State-reported information about specific sources and causes of impairment may be incomplete because the states do not always report the pollutant or source of pollutants affecting every impaired bay and estuary. In some cases, states may recognize that water quality does not fully support a designated use; however, they may not have adequate data to document the specific pollutant or source responsible for the impairment and report the cause or source as “unknown.”

Figure 8 shows the top causes of impairment in assessed bays and estuaries. According to the states, the top causes of estuarine impairment were the following:

- **Pathogens**, i.e., bacteria used as indicators of possible contamination by sewage, livestock runoff, and other sources;
- **Organic enrichment/oxygen depletion**, i.e., low levels of dissolved oxygen and/or high levels of oxygen-demanding substances such as organic waste; and
- **Mercury**, a toxic metal found in fish tissue, and, to a lesser extent, in the water column, often entering the aquatic environment via atmospheric deposition.



Note: Percents do not add up to 100% because more than one cause may affect a waterbody.

Figure 8. Top 10 causes of impairment in assessed bays and estuaries.

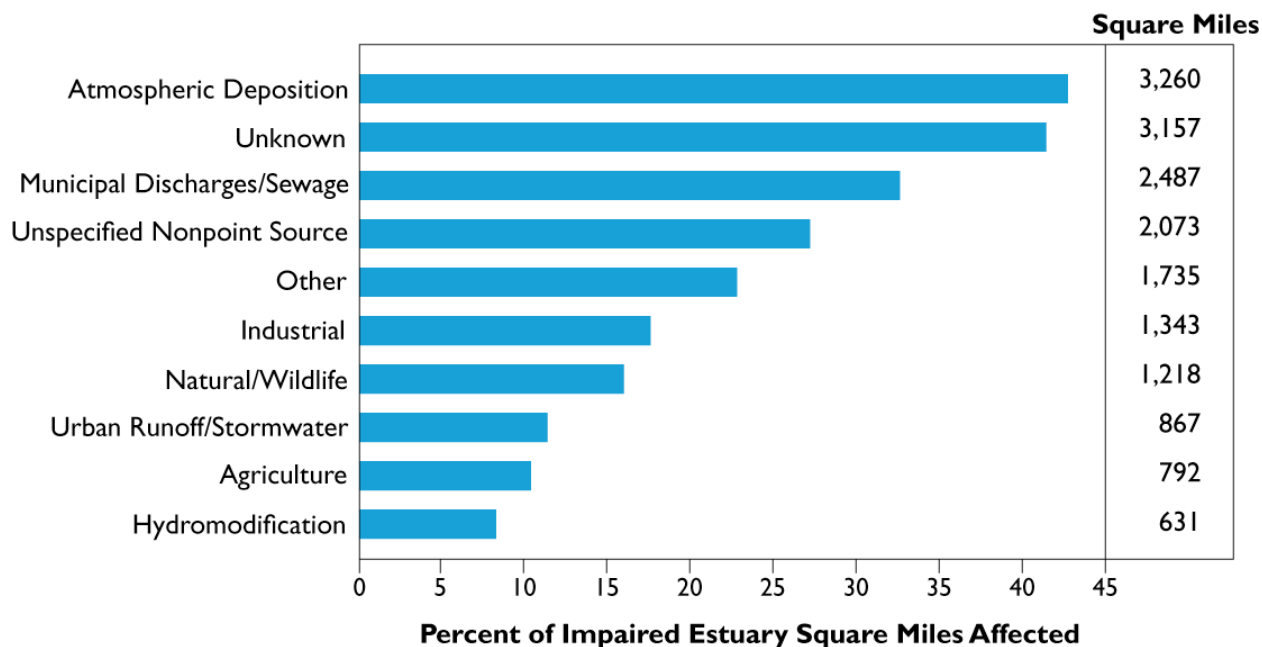
Toxic organics, nutrients, pesticides, and metals are also reported as top causes of impairment for estuarine waters.

Figure 9 shows the top sources of impairment in assessed bays and estuaries. According to the states, the top sources of estuarine impairment included the following:

- **Atmospheric (or air) deposition**, which can bring pollutants such as mercury from distant locations such as industrial centers;
- **Unknown/unspecified sources**, or sources that cannot be further identified by the states; and
- **Municipal discharges/sewage**, which includes septic systems, sewage treatment plants, and sanitary and combined sewer overflows.

More information on state-reported causes and sources of impairment is available from the ATTAINS Water Quality Assessment and TMDL Information database at <http://www.epa.gov/waters/ir>.

Other leading sources of impairment in bays and estuaries were unspecified nonpoint sources, other sources (such as sources outside state waters), and industrial sources.



Note: Percents do not add up to 100% because more than one source may impair a waterbody.

Figure 9. Top 10 sources of impairment in assessed bays and estuaries.

Other Waters

The 2004 ATAINS database also contains state-reported information on conditions in coastal shoreline waters, ocean waters, Great Lakes, and wetlands, although, in some cases, only a small percentage of these resources were assessed in the 2004 reporting cycle. These waters are discussed below.

Coastal Resources

Coastal resources are identified in the ATAINS database in two categories: coastal shorelines (the water immediately offshore, reported in miles) and ocean/near-coastal waters (i.e., the area of water extending into the ocean or gulf, range not specified, in square miles). Eight states assessed 1,859 miles of coastal shorelines, or about 3% of the nation's total 58,618 shoreline miles. The majority of assessed shoreline miles (68%) fully support their designated uses, with 12% of these miles classified as supporting uses, but threatened (i.e., water quality is deteriorating). In the 32% of shoreline miles not fully supporting their uses, metals (which could in some cases include mercury) and pathogens were the leading causes of impairment, and municipal discharges/sewage and industrial sources were listed as top sources of impairment.

To help protect the public at coastal recreation waters, Congress passed the Beaches Environmental Assessment and Coastal Health Act of 2000 (BEACH Act), requiring that coastal and Great Lakes states and territories report to EPA on beach monitoring and notifications to the public of potential health risks. Public notification may include issuing a beach advisory, warning people of possible risks of swimming due to water quality problems, or closing a beach to the public. The BEACH Act also requires EPA to maintain an electronic monitoring and notification database of those data.

For the 2004 swimming season, 28 of 30 coastal states and Puerto Rico reported public notification actions to EPA. Of the 3,574 beaches that were monitored in 2004, 942 (26%) had at least one advisory or closing. A total of 4,907 beach notification actions were reported. EPA calculates “beach days” (number of beaches multiplied by number of days in the swimming season) to get a better sense of the extent of the advisory and closure information. For the 2004 season, EPA determined that there were 584,150 beach days for all of the monitored beaches, and actions were reported about 4% of the time. EPA is continuing to work to improve the delivery of its beach advisory information to the public. Visit <http://www.epa.gov/beaches/> for more information on beach monitoring and notification.

A total of 5,544 square miles of oceans and near-coastal waters, or 10% of approximately 54,120 square miles of oceans and near-coastal waters in the United States, were assessed by 5 states in 2004. Of the assessed square miles, 88% were identified as impaired. Mercury was by far the most commonly reported cause of impairment, followed by organic enrichment/oxygen depletion. Atmospheric deposition was the predominant reported source of impairment in oceans and near-coastal waters. (It is important to note that Texas alone assessed nearly 3,879 square miles of oceans and near-coastal waters and reported that 100% of its assessed square miles are impaired due to mercury in fish tissue from atmospheric deposition.)

More information on state-reported causes and sources of impairment is available from the ATTAINS database information website at <http://www.epa.gov/waters/ir..>

Detailed information on U.S. coastal condition trends is available in the EPA’s *National Coastal Condition Report* series, which presents the findings of a collaborative effort between the states, EPA, and other federal agencies to characterize the condition of 100% of the nation’s coastal resources. Section III of this report summarizes key findings of the draft *National Coastal Condition Report III*.

Great Lakes

The Great Lakes—Superior, Michigan, Huron, Erie, and Ontario—are freshwater inland seas of vast importance for water consumption, recreation, fisheries, power, transportation, and many other uses. Of the eight states bordering the Great Lakes, six reported on the condition of their Great Lakes shoreline miles.

About 1,070 of 5,521 total Great Lakes shoreline miles were assessed in 2004, and of these, 93% were reported as impaired. The leading causes of impairment included PCBs, toxic organics, pesticides, and dioxins. Legacy or historical pollution—primarily contaminated sediment—were the leading source of shoreline impairment reported by the states, followed by municipal discharges/sewage.

Wetlands

Wetlands occur where water and land come together for a prolonged period of time and where saturation of the land with water is the dominant factor determining soil types and the plant and animal communities living in the soil and on the surface. Wetlands vary widely

because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance. Included among the many types of U.S. wetlands are marshes, bogs, swamps, wet meadows, vernal pools, playas, pocosins, sloughs, peat lands, prairie potholes, and fens.

Wetlands are a critically important resource due to the many benefits they provide to humans, aquatic life, wildlife, and the environment. Wetlands produce great quantities of food that attract a huge variety of animal species. They serve as nurseries and habitat for many game and commercial fish and wildlife species, and they help improve water quality by intercepting surface runoff and removing, retaining, or filtering out a broad range of substances (e.g., nutrients, sediments, organic wastes). By storing and slowly releasing water, wetlands help reduce the impacts of floods and erosion, as well as help replenish groundwater and stream flow during dry periods. Wetlands are also of great recreational value to bird watchers, hunters, fishermen, and nature lovers.

Only 10 states provided information on the support of designated uses for 1.8 million acres of wetlands assessed in their 2004 reports—a tiny portion of the nation's estimated 107 million acres. States identified 30% of these assessed acres as impaired. Organic enrichment/oxygen depletion, sediment, and turbidity were the leading causes of wetland degradation in these six states. Agriculture, unknown/unspecified sources, and atmospheric deposition were listed by the states as top contributors to impairment.

Section III of this report discusses plans for an upcoming National Wetland Condition Assessment.

III. Probability Surveys of Water Quality

EPA, other federal agencies, and the states have embarked on a cost-effective approach to assess status and track trends in the quality of the nation's waters: probability-based surveys that complement existing monitoring and assessment programs and add to our understanding of national, regional, and local water quality conditions. Probability surveys are designed to yield unbiased estimates of the condition of a whole resource (such as lakes or rivers and streams) based on a representative sample of waters. These surveys are designed to answer key questions asked by Congress, the public, and decision makers, such as

- Is water quality improving?
- What is the extent of waters that support healthy ecosystems, recreation, and fish consumption?
- How widespread are the most significant water quality problems?
- Are we investing in restoration and protection wisely?

Several national probability-based studies have already been completed, and several more are underway.

Understanding the Value of Probability-based Surveys and the National 305(b) Report

Although some of the findings of the national 305(b) report appear similar to the findings of the national, probability-based coastal and streams surveys, there are many differences in the scope of these reports and how they are best used to inform water quality management.

Probability surveys provide consistent environmental indicators of the condition of the nation's water resources, much as economic indicators report on the health of the nation's economy. Their design ensures that results represent the population of all waters of a certain type across the United States, and their consistent sampling methods ensure that results can be aggregated into regional and national indicators of the health of the resource. The survey results quantify, with documented confidence, how widespread water quality problems are across the country and estimate the extent of waters affected by key stressors. This helps set priorities for water resource protection and restoration. Nationally consistent surveys provide a standardized measure for tracking changes in the condition of the nation's waters over time and for evaluating, at a broad scale, progress in investments to protect and restore water quality.

In contrast to the probability surveys, this national 305(b) report summarizes information reported by states for only a portion of waters (approximately 16% of U.S. river and stream miles, 39% of lake acres, and 29% of bay and estuarine square miles). It tallies state findings based on data collected using a variety of sampling methods and parameters; water quality standards and interpretation methods; extrapolation methods; and time periods. The strength of the 305(b) report is that it provides useful information on the nature of water quality problems identified by state monitoring programs; documents the amount of waters assessed and unassessed; and supports the identification of specific waters not meeting water quality standards; therefore, it helps states set priorities for these waters.

National Coastal Assessment

The National Coastal Assessment surveys the condition of the nation's coastal resources. The results of these surveys have been compiled into the *National Coastal Condition Report*

series. The states, EPA, and partner agencies — NOAA, USGS, and the U.S. Fish and Wildlife Service (FWS) — issued the first three reports of the *National Coastal Condition Report* series in 2001, 2005, and 2008. These reports include evaluations of 100% of the nation’s estuaries in the contiguous 48 states and Puerto Rico. Federal, state, and local agencies collected samples using nationally consistent methods and a probability-based design to assess five key indices of coastal water health.

The *National Coastal Condition Report III* finds that the overall condition of the nation’s coastal waters is generally fair and has improved slightly since the 1990s. This rating is based on five indices of ecological condition: a water quality index (calculated based on ratings for dissolved oxygen, chlorophyll *a*, dissolved inorganic nitrogen, dissolved inorganic phosphorus, and water clarity), a sediment quality index (calculated based on ratings for sediment toxicity, sediment contaminants, and sediment total organic carbon), a benthic index, a coastal habitat index, and a fish tissue contaminants index. For each of these indicators, a score of good, fair, or poor was assigned to each coastal region of the United States. Ratings were then averaged to create the overall regional and national scores illustrated in Figure 10, which uses “traffic light” color scoring. Based on the findings of this survey, fifty-seven percent of the area of the nation’s estuaries and coastal embayments are in good condition for the water quality index, 6% are in poor condition, and 35% are in fair condition.

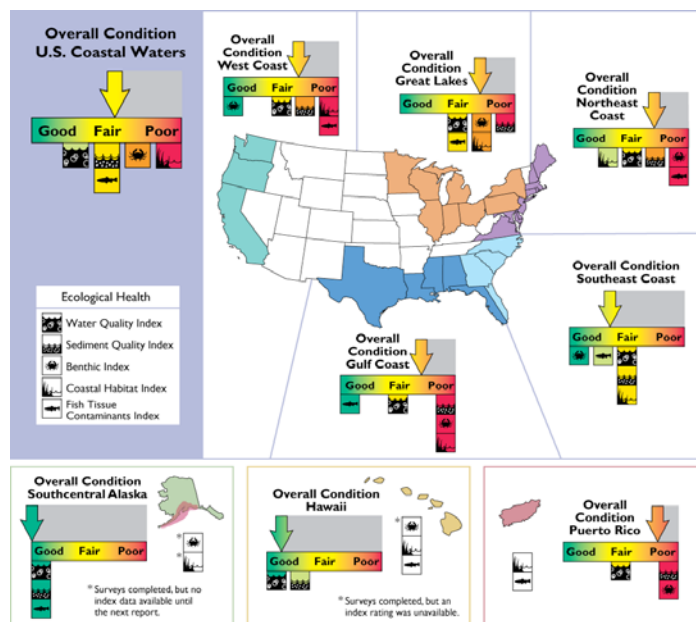


Figure 10. Findings of the *National Coastal Condition Report III* (U.S. EPA, 2008).

The indices that show the poorest condition are coastal habitat and benthic condition. Two of the individual component indicators of the water quality index generally show the best condition —dissolved oxygen and dissolved inorganic nitrogen.

In 2010, EPA and its partners expect to undertake a new survey of coastal waters and expect to report survey results in 2012. For more information on the *National Coastal Condition Report* series, go to <http://www.epa.gov/nccr/>.

The Wadeable Streams Assessment

The Wadeable Streams Assessment, a survey of the biological health of the nation’s wadeable streams, was launched by EPA and the states to provide a national baseline of stream water quality based on conditions at approximately 1,300 randomly selected sites across the conterminous United States. With support from EPA, state water quality agencies sampled

streams using the same methods at all sites. Crews collected macroinvertebrates to determine the biological condition of streams. They also measured key chemical and physical indicators that reveal stress or degradation of streams. The Wadeable Streams Assessment reports on four chemical indicators (i.e., phosphorus, nitrogen, salinity, and acidity) and four physical condition indicators (i.e., streambed sediments, in-stream fish habitat, riparian vegetative cover, and riparian disturbance).

The Wadeable Streams Assessment found that 42% of U.S. stream miles are in poor biological condition compared to best-available reference sites in their ecological regions, 25% are in fair condition, and 28% are in good condition (Figure 11). The confidence level for these key findings of biological quality is $\pm 2.8\%$. Five percent of U.S. stream miles were not assessed because the New England states did not include first order streams in the sample design.

The study was designed to examine eight key stressors. The most widespread stressors observed across the country and in each of the three major regions are nitrogen, phosphorus, riparian disturbance, and streambed sediments (Figure 12).

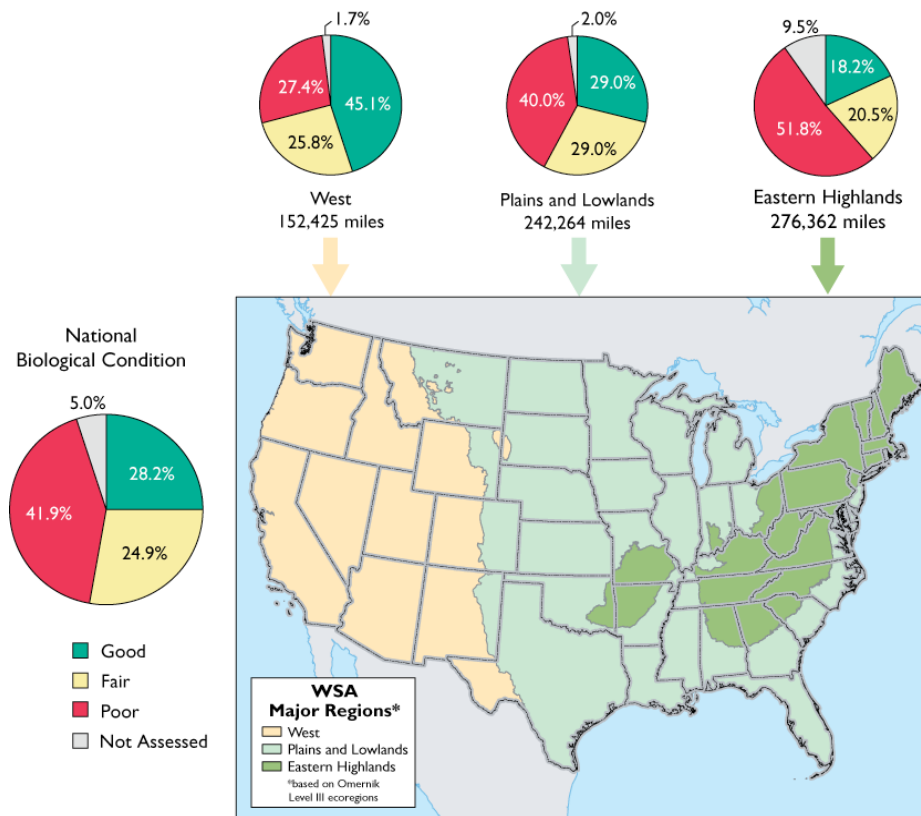


Figure 11. Biological quality of the nation's streams (U.S. EPA, 2006).

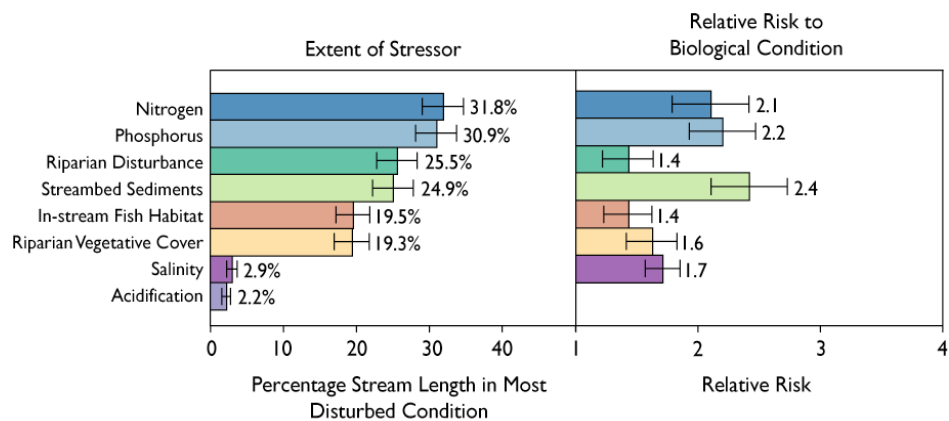


Figure 12. Extent of streams rated poor for aquatic stressors, and increase in risk of poor biology in streams rated poor over streams rated good for each stressor (U.S. EPA, 2006).

These stressors can degrade stream conditions for fish and other aquatic life. Nitrogen and phosphorus are nutrients that, when present in excess amounts, can increase the growth of algae, decrease levels of dissolved oxygen and water clarity, and degrade stream habitat. Excess streambed sediments can smother habitat for aquatic organisms. Riparian disturbance is evidence of human activity alongside streams, such as pipes, pavement, and pastures. The survey found that increases in nutrients and streambed sediments have the highest impact on biological condition, i.e., streams scoring poor for these stressors are twice as likely to have poor biological condition as streams that score in the good range for the same stressors. For more information on the Wadeable Streams Assessment, go to <http://www.epa.gov/owow/streamsurvey>.

Survey of the Nation's Lakes

In 2007, EPA and its state partners completed the field sampling season for the Survey of the Nation's Lakes, a baseline assessment of the condition of the nation's lakes, ponds, and reservoirs. More than 900 lakes were sampled over the course of a summer for this survey (see Figure 13). The population of lakes to be sampled was comprised of natural and man-made freshwater lakes, ponds, and reservoirs that were greater than 10 acres, at least one meter in depth, and located in the conterminous United States. The survey does not include the Great Lakes, the Great Salt Lake, natural saline systems, or treatment and disposal ponds. In order to examine potential trends in water quality, a representative subset of lakes from EPA's 1972 National Eutrophication Survey was included.



Figure 13. Sampling locations for the survey of the nation's lakes.

Key indicators sampled for the Survey of the Nation's Lakes included the following:

- Trophic indicators, such as *in situ* temperature and dissolved oxygen profiles, water chemical quality, nutrient concentrations, chlorophyll *a* levels, transparency measured by Secchi disk, turbidity, and color
- Ecological integrity indicators, such as sediment diatom abundance, diversity, and trends; phytoplankton abundance and diversity; zooplankton abundance and diversity; shoreline physical habitat conditions; and benthic macroinvertebrate abundance and diversity

- Recreational indicators, such as pathogen (*Enterococci*) concentrations, algal toxin (microcystins) levels, and sediment mercury concentrations.

Analysis of the survey's data is underway in 2008, and a report on the condition of the nation's lakes is planned for 2009.

National Rivers and Streams Assessment

EPA is undertaking a survey of the nation's rivers—including the “Great Rivers” of the United States—and intends to combine it with a second Wadeable Streams Assessment.

In 2008 and 2009, field crews expect to collect data on indicators of the following:

- Ecological condition, such as the abundance and diversity of periphyton, phytoplankton, benthic macroinvertebrates, and fish
- Recreational value, such, as fecal contaminant concentrations in water and contaminant residue in fish tissue
- Physical habitat condition, such as bank stability, channel alterations, and invasive species
- Water quality, such as basic water chemistry.

The focus will be on wadeable streams in the first year of monitoring and non-wadeable systems (e.g., rivers) in the second. Figure 14 shows the locations of the 1,350 new sites that will be sampled and the 450 sites from the 2006 Wadeable Streams Assessment will be re-sampled for this survey. A national report on rivers and streams is scheduled for 2011.

For more information on the National River and Streams Assessment, visit

<http://www.epa.gov/owow/riverssurvey/index.html>.

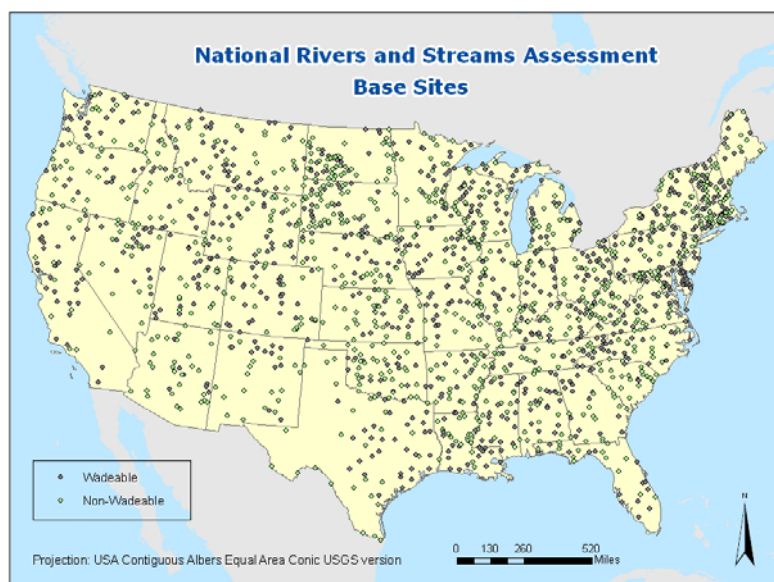


Figure 14. Sampling locations for the national rivers and streams assessment.

National Wetland Condition Assessment

In 2011, EPA and the states plan to conduct a survey (National Wetlands Condition Assessment) of the condition of the nation's wetlands, with a report planned for 2013. EPA and the states are working with the FWS to design the wetland assessment to ensure that it effectively

complements the FWS *Status and Trends* reports, which focus on the distribution of wetlands rather than their condition.

EPA is currently in the research phase of the National Wetland Condition Assessment and has identified several significant challenges to designing and implementing a wetland assessment on a national scale. These include designing the best sample frame and methods to support a national report; selecting efficient, scientifically valid indicators; ensuring that adequate resources are available; maintaining the resultant data; and building partnerships to most effectively use the information gleaned from the National Wetlands Condition Assessment.

EPA is coordinating a number of regional pilot projects with states, academics, and other federal agencies to test design approaches, field protocols, and indicators. EPA anticipates that in 2009, the project team will be making initial decisions on condition indicators and assessment methods that can apply across the nation's wide range of wetland types. For more information on the National Wetland Condition Assessment, visit <http://www.epa.gov/owow/wetlands/survey>.

Through the institution of regular probability surveys of all waterbody types, EPA and its partners in the states and other federal agencies expect to be able to cost-effectively assess 100% of the water resources of the United States and track trends in water quality over time. This scientifically based data will assist in the evaluation of the effectiveness of pollution-control activities and will greatly improve our ability to manage the nation's water resources.

State-Scale Statistical Surveys

More than half of the states have begun to implement state-scale statistical or probabilistic surveys to characterize the full population of a water resource type (e.g., streams, lakes). The majority of these surveys are of streams and rivers, although lakes, coastal waters, and wetlands are also surveyed.

States use probabilistic monitoring designs to develop estimates of water quality across the entire state, based on a representative sample, and to examine trends in water quality over time statewide. Probability surveys can eliminate the risk of generating a biased picture of water quality conditions; they provide information on changes in water quality over time statewide, and serve as a cost-effective benchmark of the effectiveness of the state's water quality program. Also as part of the probability assessment, a state can produce an estimate of the accuracy of its assessment results. The results also provide information on whether it would be useful to target certain waters for further assessment, or if limited resources for water quality assessment can be used more effectively in other ways.

States use targeted monitoring, on the other hand, to meet state management objectives such as identifying specific waters that are not meeting water quality standards, setting priorities for impaired waters, and tracking the restoration of individual waters. The two approaches are not expected to provide the same results because they are designed to achieve different objectives.

Comparing the results of the two monitoring designs is a useful evaluation tool for the state. For example, the statistical survey's overall description of the full population of waters

provides a useful benchmark for comparing the results of targeted monitoring activities and can help the state identify potential gaps in its targeted monitoring program.

The following are examples of how some states use probability assessments for water quality assessment reporting in 2004. It is important to note that for the 2004 reporting cycle, statewide probability assessments are still a fairly new development, and most states are only beginning to report their findings.

South Carolina

South Carolina's monitoring program includes a probability-based component to complement its targeted monitoring activities. Probability-based monitoring is conducted for streams, lakes/reservoirs, and estuaries. Each year, a new statewide set of probability-based random sites is selected for each waterbody type. These random sites are sampled on a monthly basis for one year. South Carolina's *2004 Integrated Report* (South Carolina DHEC, 2004) includes details on site selection.

South Carolina provides tables comparing assessment results from its traditional monitoring program and its probability-based assessment results for rivers and streams and for estuaries, including a discussion of the findings.

For rivers and streams, the traditional approach included data from 630 monitoring stations strategically located around the state, many of which include biological (macroinvertebrate) and chemistry data. Approximately 15,300 stream miles—or about half the state's total 29,794 stream miles—were assessed using the traditional 305(b) assessment approach.

South Carolina summarized data from a total of 58 randomly located stream sites for the probability-based assessment conclusions, 29 of which were sampled in 2001 and 29 of which were sampled in 2002 (Table 6). These sites represent the total stream miles in the state, weighted by stream size (i.e., based on the relative proportion of small headwater streams, second order or intermediate streams, and larger streams to the stream resource as a whole).

Table 6. Traditional vs. Probability-based Assessment Results for Rivers and Streams in South Carolina (South Carolina DHEC, 2004)

Use Support Category	Degree of Use Support	Percent of assessed miles in category -- traditional 305(b) approach	Estimated percent of total resource in category -- probability-based approach
Aquatic Life Use	Fully supporting	65.3%	79.0%
	Partially supporting	12.1%	5.9%
	Not supporting	22.5%	15.0%
Recreational Use	Fully supporting	59.3%	49.9%
	Partially supporting	21.5%	14.6%
	Not supporting	19.2%	35.5%

For its probability-based estuarine condition conclusions, the State summarized data from 60 randomly located estuary sites—30 sampled in 2001 and 30 sampled in 2002. These sites represent the total estuarine area in the state. Probability-based approach results were compared to the traditional approach, under which 221 square miles of South Carolina's total 401 square miles of estuaries were assessed (Table 7).

Table 7. Traditional vs. Probability-based Assessment Results for Estuaries in South Carolina (South Carolina DHEC, 2004)

Use Support Category	Degree of Use Support	Percent of assessed square miles in category -- traditional 305(b) approach	Estimated percent of total resource in category -- probability-based approach
Aquatic Life Use	Fully supporting	68.0%	75.3%
	Partially supporting	14.4%	3.0%
	Not supporting	17.6%	21.7%
Recreational Use	Fully supporting	94.1%	100%
	Partially supporting	4.5%	--
	Not supporting	1.4%	--

Indiana

In Indiana, probability-based representative samples are used to determine overall aquatic life use support, as part of the state's rotating basin approach (i.e., a plan for monitoring a subset of the state's watersheds on a rotating 5-year cycle, such that in 5 years, all watersheds have been cumulatively monitored). A stratified random sampling design is used to generate sampling sites and provide a representative sample set for each basin. A fish community Index of Biotic Integrity (IBI) is determined for each sampling location, and the results of each year's sample data are analyzed to estimate the percentage of stream miles supporting aquatic life use for each basin. This approach allows the state to make statistically valid estimates of aquatic life use support for a large geographic area (e.g., a basin) with a relatively small number of representative samples. For its 2004 *Integrated Report* (Indiana DEM, 2004), Indiana's probability-based program found that 22,157 stream miles in the state's major river basins

supported aquatic life and 13,168 miles did not support uses, for a total of 35,325 river and stream miles covered by the probabilistic assessment.

Indiana's probability-based sampling design, known as the Watershed Monitoring Program, allows the state to predict with reasonable certainty what percentage of its rivers and streams are impaired. An individual stream or stream reach is considered assessed only when sufficiently detailed monitoring data representative of that stream are available. According to the state, the principal advantage of the probabilistic monitoring approach is that it allows the agency to meet the goals of assessing all the waters of the state (in terms of the overall quality of each basin) while providing data that can also be used to make waterbody-specific assessments.

Florida

Florida uses a three-tiered approach to monitor surface water quality, ranging from the general to the specific. Tier 1, or probability monitoring, addresses statewide and regional questions and is used to develop statistical estimates of statewide water quality based on a representative sample. It allows the state to assess 100% of the waters of the state over a 5-year period. Tier 2 addresses basin-specific and stream-specific questions (e.g., to verify waterbody impairment), and Tier 3 addresses site-specific questions, such as those associated with permits and the development of TMDLs.

The first cycle of the statewide probability assessment through the Integrated Water Resource Monitoring Network began in 2000 and was completed in 2003. The results for each basin are aggregated by waterbody type and assessed against water quality targets to assess the overall health of that type of water in the basin. Florida assessed rivers and streams, large lakes, and small lakes using this approach (see Figure 15).

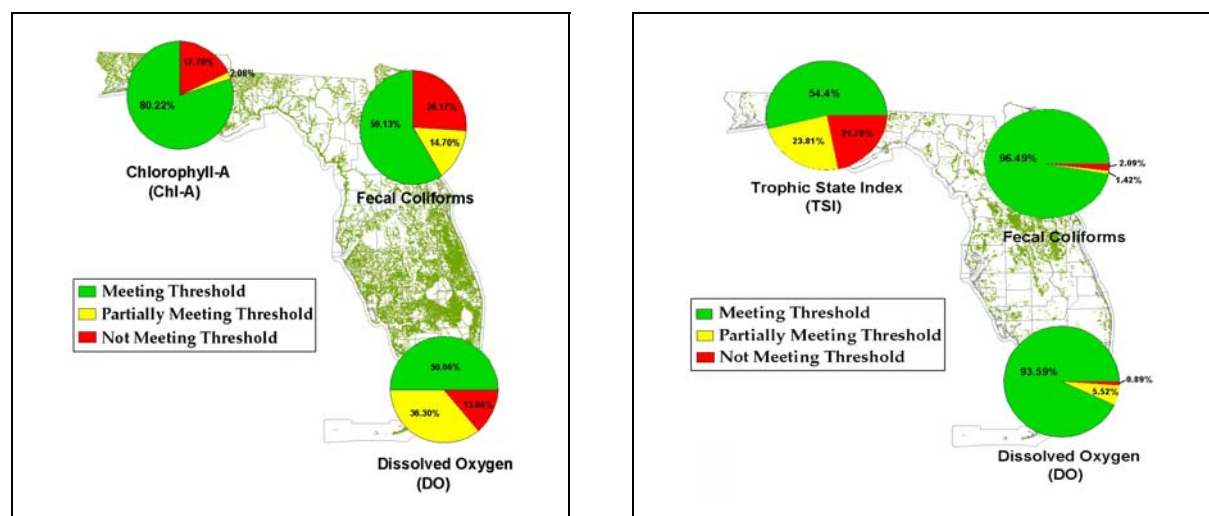


Figure 15. Summary of statewide condition for Florida rivers and streams (left) and large lakes (right) (Florida DEP, 2004).

Although the report (Florida DEP, 2004) presents preliminary results for the statewide probability assessment, it also notes the fundamental differences between this approach and the basin and stream assessments of Tier 2. Assessment targets, parameters monitored, and sample

sizes are different between the two types of assessments. The results of the probability network should be more representative of statewide conditions and may be able to shed light on any biases in the basin and stream assessments due to, for example, the location of monitoring stations. The State plans to make comparisons between both types of monitoring approaches as its probability network continues to evolve.

IV. Future Reporting

In March 2003, EPA issued guidance describing the basic elements of a state monitoring and assessment program. In response to this guidance, states have prepared long-term strategies that address comprehensive monitoring of all water types, including those for which little data currently exist. Along with the traditional, targeted monitoring approach, which describes the condition of individual waters of concern, probability surveys are an important component of comprehensive water monitoring programs, providing a cost-effective means of assessing and reporting on status and trends in overall populations of waters (e.g., streams and rivers, lakes). In the future, 305(b) reports will be able to provide statistically valid water quality data that is comparable across states.

The states and EPA are taking steps toward streamlining and improving water quality monitoring and assessment by integrating monitoring and reporting requirements under sections 305(b) and 303(d) of the Clean Water Act (see the section *Background, Integrated Water Quality Reporting* of this report). EPA has issued guidance to the states to clarify reporting requirements for the 2008 reporting cycle and has established a goal that all 50 states and 6 territories and jurisdictions use the integrated reporting format by 2008. EPA continues to promote this comprehensive assessment approach to improve the states' ability to track both programmatic and environmental goals of the Clean Water Act, and ideally, to increase the pace of achieving these important environmental goals. (See <http://www.epa.gov/owow/tmdl/> for more information on EPA's national water quality reporting guidance.)

Electronic reporting of water quality information is a continuing EPA priority and involves a significant commitment at the state and national levels. EPA and the states are working to ensure that each assessed watershed and waterbody is identified using a consistent national surface water locational system, the National Hydrography Dataset (see <http://nhd.usgs.gov/> for more information), and that electronic reporting continues to improve. EPA intends to continually adapt and improve the ATTAINS database to reflect new reporting requirements and the full range of state monitoring activities, including state-scale probability-based surveys, and will continue to fully support state efforts to adopt electronic reporting. This commitment to providing more comprehensive, easily shared water quality information will help managers and the public make more informed decisions about the future of our waters.

V. References

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